

EHS Laboratory Guidance

Perchloric Acid [CAS No. 7601-90-3]

Purpose

Perchloric acid is a strong, oxidizing inorganic acid with the chemical formula HClO_4 . Reagents and other solutions containing perchloric acid in concentrations up to 70 percent are relatively safe if handled properly. Perchloric acid in concentrations of no more than 70% can be used in standard chemical fume hoods, provided it is not being heated and work follows the protocols presented in this guidance. However, anhydrous perchloric acid (i.e., perchloric acid in concentrations of greater than 72%) or a perchloric acid solution heated to its boiling point are extremely dangerous because they can spontaneously explode. Because of its inherent explosive hazards, all lab users at the University of Idaho using perchloric acid must review this document before using perchloric acid.

Users planning to heat perchloric acid must contact EHS with their plans **before** starting work. Heating perchloric acid can emit explosive anhydrous perchloric acid and perchlorate salts can accumulate in the ductwork of a standard fume hood, leading to a fire or an explosion. Therefore, all work involving heated perchloric acid must be done in a specially designed hood constructed for use with perchloric acid that includes a wash down system and is approved by EHS.

All waste containing perchloric acid solutions and reagents must be submitted to EHS for collection and disposal.

NOTE: Anhydrous perchloric acid is not allowed at the university because of its explosive properties.

Hazards



Strong oxidizer; may cause or intensify a fire when in contact with combustible materials and flammable liquids. Dry forms and concentrations over 85% can be explosive.



Prolonged or repeated exposure can damage the thyroid; harmful when swallowed.



Corrosive to metals and severely corrosive to skin and eyes; very strong mineral acid.

Incompatibilities: Strong bases, strong acids, amines, phosphorus halides, alcohols, organic materials, powdered metals, strong reducing agents (e.g., sulfuric acid), dimethyl sulfoxide.

Precautions

Before starting work:

- Determine if you can use a less hazardous substance in place of perchloric acid.
- Review manufacturer's Safety Data Sheet and any additional chemical information.
- Ensure that a written experimental protocol including safety information is available and that you understand the entire protocol.
- Be familiar with general lab emergency procedures on the EHS website (www.uidaho.edu/safety).
- Order the most dilute solutions available that will meet experimental needs, and only the quantity that you need.
- Identify the location of the nearest eyewash and shower and verify that they are accessible and working.
- Locate and verify that appropriate perchloric acid spill cleanup materials are available, including the following:
 - Universal Spill Neutralizer (solid) or an Acid Neutralizer/Solidifier (solid).
 - Dustpan and broom (do not use metal dust pans or brooms made from organic plant material).
- Never use organic material (e.g., paper towels) to clean up a perchloric acid spill.
- Ensure another person who knows perchloric acid emergency procedures is in the lab; never work alone.

During work:

Avoid inhalation!

- Perform all operations in a certified chemical fume hood with the sash lowered.
- Always work at least 6 inches into the fume hood.
- If heating perchloric acid, use a fume hood designed for such work (i.e., a washdown hood specifically designed and built to work with perchloric acid) to prevent the buildup of shock-sensitive perchlorates in the exhaust system. Contact EHS for more information.

Avoid contact! Use appropriate personal protective equipment (PPE):

- Wear a lab coat, acid resistant apron, long pants and shirt, and closed-toed shoes.
- Chemically protective goggles (safety glasses are not adequate); additionally, a face shield is recommended.
- Nitrile gloves worn doubled is suggested for extra protection. When splash potential is high, neoprene gloves are recommended; always review the Safety Data Sheet for proper glove selection.
- Gloves must be thoroughly inspected prior to each use; do not use damaged gloves.
- Change gloves (outer and inner) at least once an hour and immediately whenever you suspect perchloric acid has contacted your gloves.

- Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with perchloric acid.
- Wash hands and forearms thoroughly with soap and water each time gloves are removed.
- Always work behind fume hood sash.
- Use materials and containers appropriate for perchloric acid use and know the potential incompatibilities. Glass, ceramic, polyethylene or propylene work well with perchloric acid. Do not use metal.
- Keep all containers tightly closed when not in use and during transport.

After completing the work:

- Dispose of perchloric acid waste following the EHS Hazardous Waste Procedures.
 - Hazardous Waste Classification: Corrosive, Oxidizer
- Return container to storage area:
 - Storage Group (Inorganic Acids).
- Store in original containers or other appropriate containers.
- Store primary containers in dedicated secondary containers (glass, ceramic, polyethylene or polypropylene). Do not use metal containers.
- Do not store in the same cabinet with organic chemicals, including organic acids.
- Wash hands and forearms thoroughly with soap and water before leaving the lab.

Emergency Procedures



First Aid

All exposures require immediate medical attention. Call 911 for medical assistance and EHS at 208-885-6524.

- Skin Contact
 - Wash with plenty of tepid water for at least 15 minutes using the closest available sink, safety shower or drench hose.
 - Remove any contaminated clothing and any jewelry that may be trapping perchloric acid.
- Eye Contact
 - Using eyewash, flush eyes while holding eyelids open.
 - Continue flushing eyes with water until emergency medical personnel arrive.
- Inhalation

- If perchloric acid is inhaled, immediately move outside the building to get fresh air.
- Ingestion
 - Do not induce vomiting.
 - Clean mouth with water.

Spill Response

Important! Do not use organic materials (e.g., paper towels or nonaggressive absorbents) on a perchloric acid spill.

Outside fume hood or other ventilated enclosure:

- Alert others; evacuate to a safe distance; prevent entry.
- Contact EHS at 208-885-6524.
- Remain in a safe location until EHS or other response personnel arrive.

Inside fume hood or ventilated enclosure (< 500 ml):

- Contact EHS at 208-885-6524.
- If trained and confident, you may assist in the clean-up effort of small amounts, wearing PPE described above and using appropriate spill supplies:
 - Apply an appropriate spill neutralizer (listed on first page of this guidance)
 - Once neutralizer is applied/mixed in, check the pH of the residual material to ensure a neutral pH (if there is broken glass, once neutralized, safely pick up using tongs and place into a rigid container)
 - Collect all other neutralized spill material using a compatible dustpan and broom. Place all material into a rigid container.
 - Label container with appropriately completed hazardous waste tag and leave in your SAA.
 - Request a waste pickup through the EHS website.
- If you are not trained and confident, close the fume hood sash and contact EHS for support.