¹Guidelines for Working with Perchloric Acid

¹University of Georgia

**Introduction**

Perchloric acid (HClO4) is a colorless, odorless, fuming liquid that is miscible with water, extremely corrosive and a strong oxidizer. If your lab inventory includes perchloric acid, follow these guidelines to protect yourself from injury.

Persons working with perchloric acid should be thoroughly familiar with general guidelines for the safe handling of hazardous chemicals supplemented by additional precautions particular for this chemical.

**Storage and Handling**

* Perchloric acid should be used only in standard analytical procedures from well recognized analytical texts. Work with > 85% perchloric acid requires special precautions and should be carried out only by specially trained personnel.
* As a minimum, splash goggles, nitrile gloves, and a lab coat should be worn when handling perchloric acid.
* Always transfer perchloric acid over a chemical resistant catch tray in order to catch any spills and afford a ready means of disposal.
* Precautions should be taken to prevent the buildup of explosive perchlorates. Light, mechanical shock, heat and certain catalysts can be initiators of explosive reactions with the perchlorates that may be formed from perchloric acid. Anhydrous acid which may be formed with strong dehydrating agents decomposes at ordinary temperatures and explodes on contact with most organic materials. Perchloric acid containers should be kept open no longer than 15 minutes per experiment.
* Perchloric acid should be stored in well-ventilated locations separated from organic substances and other combustible materials. Do not store perchloric acid in a refrigerator or other dehydrating atmosphere.
* Keep incompatible chemicals away from perchloric acid and the area in which perchloric acid will be used. Those chemicals that are incompatible with perchloric acid include oxidizable organic compounds such as alcohols, ketones, aldehydes, ethers, and dialkyl sulfoxides; strong acids such as sulfuric acid; dehydrating agents; anhydrous phosphorous pentoxide; formaldehyde; antimony or bismuth; and reducing agents. Seventy percent perchloric acid may react with cellulose materials such as wood, paper, and cotton. Preventing contact with incompatible chemicals during storage may be accomplished by placing perchloric acid containers in nonbreakable, chemical resistant containers which are capable of holding the entire contents of the container.

**Fume Hoods**

**Heating of perchloric acid or perchloric acid reactions that involve heat shall *NOT* be conducted in a general purpose fume hood.** A special perchloric acid hood is needed for these experiments.

Use of perchloric acid (<72%) at ambient temperature may be conducted in a general purpose fume hood if the following procedures are followed:

* Only small quantities are used on an infrequent basis.
* Easily accessible areas in the fume hood, which are exposed to perchloric acid, are immediately wet wiped or rinsed with a squirt bottle of distilled water after use. This procedure prevents the buildup of explosive perchlorates. Periodic methylene blue tests should be conducted after each perchloric acid use for the presence of any perchlorates.

***Perchloric acid fume hoods***

Perchloric acid hoods are specifically designed for the use of perchloric acid and other material that can deposit shock sensitive crystalline materials in the hood and exhaust system. Only those chemicals for which the hood is specifically designed should be used in a perchloric acid hood.

*Special precautions involving heated perchloric acid*

* Anhydrous perchloric acid is a powerful oxidizer that may explode if it comes in contact with organic materials. Anhydrous perchloric acid can be produced when heating perchloric acid, during the evaporation of perchloric acid, or during reactions involving dehydrating agents.
* Chemicals that are incompatible with anhydrous or hot concentrated perchloric acid include acetic anhydride, acetic acid, aniline, carbon (wood charcoal & carbon black), paper, wood, fiber, or sawdust.
* Procedures involving heated perchloric acid, reactions involving dehydrating agents, or routine use of perchloric acid must be conducted in a perchloric acid fume hood equipped with a water wash-down system. The wash down system should be turned on immediately after perchloric acid has been heated in the hood or after general use of the fume hood. Step by step instructions should be written on how to operate the wash-down for perchloric acid hoods.
* Tests shall be conducted for explosive perchlorates before any inspection, cleaning, maintenance, or other work performed on the exhaust system or hood interior.

**In the event of exposure**

* In the event of skin contact, immediately wash with soap and water and remove contaminated clothing. Seek medical attention immediately. In case of eye contact, promptly wash with copious amounts of water for a minimum of 15 minutes (lifting upper and lower lids occasionally) and obtain medical attention. If perchloric acid is ingested, obtain medical attention immediately. If large amounts of this compound are inhaled, move the person to fresh air and seek medical attention at once.

**Spills**

* Spill control materials should be available to control the release of perchloric acid. Appropriate protective equipment for clean-up should be worn (i.e., lab coats, protective gloves, protective rubber boots).

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* Perchloric acid spilled on the floor or bench top represents a hazard since the evaporation of the spill may lead to the formation of more dangerous concentrations of the acid. It should **not** be mopped up, **nor** should it be soaked up with dry combustibles.
* Remove all combustibles from the surrounding area (i.e., wood, paper, oils). A water spray may be used to help reduce vapors and keep the area wet. Measures should be taken to keep the material or spill area

from drying. Neutralize the spill with a dilute solution of sodium bicarbonate and then use absorbent material such as universal pads or absorbent clay to absorb it. Place the material in closed flammable waste disposal can.

* The area of the spill should be thoroughly rinsed once again and tested for the presence of perchlorates. You may want to neutralize this area also.

**Hazardous waste disposal**

Excess perchloric acid and waste material containing perchloric acid should be placed in a glass reagent container and labeled as Hazardous Waste.