

**EHS**

**Environmental Health and Safety**

**Handling Perchloric acid (≤ 70%)**

**Standard Operating Procedure**

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**These guidelines present information on how to handle and store perchloric acid safely**

**1.0 Hazards Associated with Perchloric acid:**

**May cause fire or explosion. Strong oxidizer.**

Perchloric acid is the [inorganic compound](http://en.wikipedia.org/wiki/Inorganic_compound) with the formula HClO4. Usually encountered as an aqueous solution, this colorless compound is a [strong acid](http://en.wikipedia.org/wiki/Strong_acid) comparable in strength to [sulfuric](http://en.wikipedia.org/wiki/Sulfuric_acid) acid and [nitric acid](http://en.wikipedia.org/wiki/Nitric_acid). It is a powerful [oxidizer](http://en.wikipedia.org/wiki/Oxidizer), but its aqueous solutions up to 70% are remarkably inert, only showing strong acid properties and no other oxidizing properties. At concentrations above 72% or when heated (at any concentrations), perchloric acid becomes a strong oxidizer. It is useful for preparing [perchlorate](http://en.wikipedia.org/wiki/Perchlorate) salts, especially [ammonium perchlorate](http://en.wikipedia.org/wiki/Ammonium_perchlorate), an important rocket fuel. Perchloric acid is also dangerously corrosive and readily forms explosive mixtures. Metal and non-organic salts formed from oxidization are shock sensitive and pose a great fire and explosion hazard.

**2.0 Controls:**

**2.1 Engineering Control:**

* Utilize a fume hood with the sash closed as much as possible
* A blast shield should be used for potentially explosive materials.

**2.2 Administrative Controls:**

* Do not work alone in the lab. Implement the buddy system.
* Substitute for a less hazardous material when feasible. Use dilute solutions (less than 60%) whenever possible.
* Attend baseline laboratory safety training (required annually). The training schedule is located at the following link - <http://www.uml.edu/ehs/Training_Schedule.html>.
* Attend laboratory-specific training on handling perchloric acid.
  + Document this training in section 8 of the Chemical Hygiene Plan Notebook.
* Know the location of the emergency shower and eyewash station.
* Review this SOP and applicable safety data sheets as part of your laboratory-specific training on handling perchloric acid.
* Keep a hard copy of the safety data sheet (SDS) for perchloric acid in section 6 of the CHP Notebook.
* Place the perchloric acid SOP in section 7 of the CHP Notebook.
* Purchase only enough material needed to complete an experiment.
* Wash hands thoroughly with soap and water after removing gloves.

**2.3 Personal Protective Equipment:**

* Safety goggles
* Face shield
* Fire resistant lab coat
* Acid Resistant Apron
* PVC or Neoprene
* Closed toe shoes and pants

**3.0 Procedure:**

**Using Perchloric Acid (< 72%) at Room Temperature**

At room temperature, perchloric acid up to concentrations of 72% has properties similar to other strong mineral acids. It is a highly corrosive substance and causes severe burns on contact with the eyes, skin, and mucous membranes. When used under these conditions, perchloric acid reacts as a strong non-oxidizing acid. The following precautions should be taken when using perchloric acid under these conditions:

* Substitute with less hazardous chemicals when appropriate.
* Use dilute solutions (< 60%) whenever possible.
* Conduct operations involving cold perchloric acid in a properly functioning chemical fume hood with current EHS certification. If operations are conducted frequently or in large quantities contact EHS to determine if a specially designed fume hood dedicated to perchloric acid use is required.
* **Processes involving heating perchloric acid (any concentrations) or using highly concentrated (73 –85 %) or anhydrous perchloric acid (> 85%) is not permitted in labs at UMass Lowell since specifically designed laboratory fume hood for only perchloric acid operations are required**.

**4.0 Precautions:**

* When using or storing even dilute perchloric acid solutions avoid contact with strong dehydrating agents (concentrated sulfuric acid, anhydrous phosphorous pentoxide, etc.). These chemicals may concentrate the perchloric acid and make it unstable.
* Always transfer perchloric acid over a chemical resistant spill tray in order to catch any spills.
* Avoid contact with cellulose materials such as wood, paper and cotton. Perchloric acid may become concentrated and cause a fire or explosion.
* Avoid contact with eyes and skin.
* Avoid inhalation of vapor or mist.
* Examples of perchloric acid incompatible material:

1. Plastics such as polyamide (nylon) and polyester (Dacron)

2. Metals such as copper and copper alloys, aluminum, and nickel alloys

3. Glycerin-lead oxide (letharge)

4. Strong dehydrating agents such as concentrated sulfuric acid and anhydrous phosphorous pentoxide

5. Organic material such as cotton, wool, grease, and wood

**5.0 Storage:**

The quantities of perchloric acid kept in storage should be kept to a minimum and stored in a well-ventilated location. Perchloric acid should be stored in its original container within compatible secondary containment, preferably glass or porcelain. Glass trays should be wiped periodically. It should be separate from other chemicals, but may be stored with other inorganic acids, preferably in a corrosive storage cabinet. Perchloric acid must be stored away from organic chemicals, flammable or combustible materials and strong dehydrating agents such as sulfuric acid and anhydrous phosphorus pentoxide.

**If a bottle containing perchloric acid has turned dark and has crystals forming around the bottom of the bottle, there is a potential explosion hazard. Do NOT move the bottle; instead, contact EHS at 42543 for immediate assistance or 44911 after hours.**

**6.0 Disposal:**

Place the UMass Lowell Hazardous Waste Label on the container and fill out the label. Full and/or dated containers of hazardous waste are picked up by EHS during the weekly inspection checks for satellite accumulation areas or upon request by calling 42543. Remember, the container must be picked up within 3 days after the container is full or dated.

Empty containers that once contained perchloric acid must be disposed of as hazardous waste. Please properly label the empty container with a hazardous waste label.

**7.0 Emergency Procedures:**

**7.1 Spills**

Evacuate the lab, post a restriction on the lab door and call UMass Lowell Police at extension 44911.

Stay close by to answer questions when EHS and emergency response personnel arrive.

**7.3 First Aid**

For eyes

* Irrigate the eyes for 15 minutes, holding eyelids apart.
* Call extension 44911 or 978-934-4911 from a cell phone to seek medical assistance and then can keep track of the length of time eyes are being irrigated.

For skin

* For full body exposure, remove contaminated clothing and go under the emergency shower for 15 minutes. If bare hands and/or arms are contaminated, rinse area with soap and water for 15 minutes.
* Call extension 44911 or 978-934-4911 from your cell phone immediately to seek medical assistance.

For inhalation

* Remove to fresh air. Seek medical attention immediately. Call extension 44911 or 978-934-4911 from a cell phone.

**7.4 Fire:**

* Evacuate the lab, pull the nearest fire alarm pull station and then go to a safe area and call extension 44911 or 978-934-4911 from a cell phone. Follow the fire safety evacuation plan.

**NOTE:** All work-related injuries must be reported immediately to Human Resources (HR) by calling extension 43560. (HR has some forms that will need to be filled out within 48 hours after the incident.) An Incident/Injury Report Form is available on-line at <http://www.uml.edu/ehs>. Please double click on the link located in the middle of the webpage.

*\*The buddy, supervisor, or Principal Investigator may fill out the Incident/Injury Report Form while the injured employee follows first aid procedures and seeks medical attention.*