



## Perchloric Acid



*Corrosives - Strong Oxidizing Agents (SOA), Strong Acids (SA) & Potentially Explosive Compound (PEC)*

**Areas with blue text indicate that information must be provided or modified by researcher prior to the SOP approval.**

**This SOP is not a substitute for hands-on training.**

Print a copy and insert into your laboratory SOP binder.

Department:	Chemistry
Date SOP was written:	Monday, October 24, 2016
Date SOP was approved by PI/lab supervisor:	
Principal Investigator:	Name: R. Sarpong Signature: _____
Internal Lab Safety Coordinator or Lab Manager:	Name: Rebecca Johnson/Melissa Hardy Lab Phone: 978-886-5808/406-696-1225 Office Phone: 510-642-6312
Emergency Contact:	Name: Rebecca Johnson/Melissa Hardy Phone Number: 978-886-5808/406-696-1225
Location(s) covered by this SOP:	Latimer Hall 831,832,834,836,837,838,839,842,844,847,849

### 1 - Purpose

This SOP covers the precautions and safe handling procedures for the use of Perchloric Acid.

***If you have questions concerning the applicability of any recommendation or requirement listed in this procedure, contact the Principal Investigator/Laboratory Supervisor or the campus Chemical Hygiene Officer at [ucbcho@berkeley.edu](mailto:ucbcho@berkeley.edu).***

### 2 - Physical & Chemical Properties/Definition of Chemical Group

CAS#: 7601-90-3

Molecular Formula: HClO<sub>4</sub>

Form: Liquid

Color: colorless

Melting point/freezing point: -18 °C (0 °F)

Density: 1.664 g/mL at 25 °C (77 °F)

Flash point: 113 °C (235 °F) - closed cup

Lower explosion limit: no data available

Upper explosion limit: no data available

Odor: no data available



Boiling Point: 203 °C (397 °F)

Odor threshold: no data available

Vapor pressure: 9.1 hPa (6.8 mmHg) at 25 °C (77 °F)

Perchloric acid is the inorganic compound with the formula HClO<sub>4</sub>. Usually encountered as an aqueous solution, this colorless compound is a strong acid comparable in strength to sulfuric acid and nitric acid. It is a powerful oxidizer, but its aqueous solutions up to 70% are remarkably inert, only showing strong acid properties and no other oxidizing properties. Above concentrations of approx. 70% the speed of oxidizing reactions rapidly increases with increasing acid concentration. The oxidizing power also greatly increases as the temperature is increased. It is useful for preparing perchlorate salts, especially ammonium perchlorate, an important rocket fuel. Perchloric acid is also dangerously corrosive and readily forms explosive mixtures.

### 3 - Potential Hazards/Toxicity

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) designates perchloric acid by the following pictograms, H codes, and precautionary statements:

#### GHS Pictograms and H codes, including precautionary statements



Pictogram

Signal word

Danger

Hazard statement(s)

H271

May cause fire or explosion; strong oxidizer.

H302

Harmful if swallowed.

H314

Causes severe skin burns and eye damage.

Precautionary statement(s)

P220

Keep/Store away from clothing/ combustible materials.

P280

Wear protective gloves/ protective clothing/ eye protection/ face protection.

P305 + P351 + P338

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310

Immediately call a POISON CENTER or doctor/ physician.

Please, review the SDS of any chemical before use (see Section 11 – SDS Location).

### 4 - Engineering Controls

Use the engineering controls listed below unless other lab-specific information is included in Section 12 - Protocol/Procedure.

- Work with Perchloric Acid – the work must be conducted in a fume hood unless other controls are designated in the lab-specific Protocol/Procedure section. Sash height must be kept as low as possible to avoid escaping fumes and provide a physical barrier.



- Laboratories and rooms where Perchloric Acid is used must have general room ventilation that is negative pressure with respect to the corridors and external environment. The laboratory/room door must be kept closed at all times.

## 5 - Personal Protective Equipment

At a minimum, the following PPE must be worn at all times.

### Eye and Face Protection

- ANSI Z87.1-compliant safety glasses with side shields, or chemical splash goggles.
  - Ordinary prescription glasses will NOT provide adequate protection unless they also meet ANSI standard and have compliant side shields.
- If the potential for explosion/splashing exists, and adequate coverage is not provided by the hood sash, a face shield must be worn.

### Skin and Body Protection

- Gloves are required when handling hazardous chemicals.
  - Refer to specific chemical SDS for information on glove selection.
  - For additional information on glove selection, go to:  
<http://ehs.berkeley.edu/hs/63-laboratory-safety/94-glove-selection-and-usage.html>
- Lab coats are required when handling hazardous chemicals in the lab. Select the type of lab coat according to the substances at the specific workplace.
- Long pants, closed-toe/closed-heel shoes, covered legs, and ankles.

## 6 - First Aid Procedures and Medical Emergencies

*In the event of an injury, notify your supervisor immediately and EH&S within 8 hours.*



***Go to the Occupational Health Facility (Tang Health Center, on campus); if after hours, go to the nearest emergency room (Alta Bates, 2450 Ashby Ave in Berkeley); or***



***Call 911 (from a cell phone: 510-642-3333) if:***

- *it is a life threatening emergency; or*
- *you are not confident in your ability to fully assess the conditions of the environment and/or the condition of the contaminated/injured person, or you cannot be assured of your own safety; or*
- *the contaminated/injured person is not breathing or is unconscious.*

***Please remember to provide a copy of the appropriate manufacturer SDS (if available) to the emergency responders or physician. At a minimum, be ready to provide the identity/name of any hazardous materials involved.***

### In case of skin contact

If skin contact occurs, and/or skin or clothing are on fire, immediately drench in the safety shower with copious amounts of water for no less than 15 minutes to remove any remaining contaminants. If possible to do so without further injury, remove any remaining jewelry or clothing.

### In case of eye contact

Rinse thoroughly with plenty of water using an eyewash station for at least 15 minutes, occasionally lifting the upper and lower eyelids. Remove contact lenses if possible.



### If swallowed

Do NOT induce vomiting unless directed otherwise by the SDS. Never give anything by mouth to an unconscious person. Rinse mouth with water.

### If inhaled

Move into fresh air.

### Needle stick/puncture exposure

Wash the affected area with antiseptic soap and warm water for 15 minutes.

## 7 - Special Handling and Storage Requirements

Lab-specific information on handling and storage may be included in the Protocol/Procedure section.

### Precautions for safe handling

- **Perchloric acid mist and vapor can condense in ventilation systems to form metallic perchlorates, which can be explosive. If you are planning on heating perchloric acid, contact EH&S.**
- Eliminate or substitute for a less hazardous material when possible.
- Design your experiment to use the least amount of material possible to achieve the desired result.
- Do not exceed the scale of procedures specified in Protocol/Procedure section without approval of the PI.
- Verify your experimental set-up and procedure prior to use.
- Know the location of the nearest eyewash, safety shower and fire extinguisher before beginning work.
- Upon leaving the work area, remove any personal protective equipment worn and wash hands.
- At the end of each project, thoroughly decontaminate the work area according to the material being handled.

### Conditions for safe storage

- Perchloric Acid must be stored separately from flammables and reducing agents in an approved acid or corrosives safety cabinet. If no corrosive cabinet available, use secondary container to store Perchloric Acid.
- Store in a cool, dry, well-ventilated area away from incompatible substances.

### Disposal

- Waste materials generated must be treated as a hazardous waste.
- The empty container must be rinsed three times with a COMPATIBLE solvent; leave it open in the back of the hood overnight. Solvent rinses and water rinse must be disposed of as hazardous waste.
- As an alternative, unrinsed empty containers can be disposed of through EH&S as hazardous waste. The unrinsed empty containers must be capped.
- Do not mix with incompatible waste streams.
- Decontamination of the empty container in order to use it for other purposes is not permitted.

## 8 - Chemical Spill

**Spill** – Assess the extent of danger; if necessary request help by calling **911** (from a cell phone: **510-642-3333**) for emergency assistance or 510-642-3073 for non-life threatening situations. If you cannot assess the conditions of the environment well enough to be sure of your own safety, do not enter the area. If



possible help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors from spill. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

- **Minor Spill** – In the event of a minor spill, if there is no potential for hazardous chemical exposure, report the spill to 510-642-3073. Remove all sources of ignition. If you are trained, proceed to clean it. Use appropriate personal protective equipment and clean-up material for chemical spilled. Absorb spill using an absorbent, non-combustible material such as sand. Do not use combustible materials such as sawdust. **Wet area to prevent drying out.** Use only non-sparking tools and equipment. Double bag spill waste in clear plastic bags, label and request pick-up.
- **Major Spill** – Any hazardous chemical spill that involves chemical exposure, any chemical spill that due to size and/or hazard requires capabilities beyond your training, or any chemical spill that gives the perception (because of odor, for example) that there has been a hazardous release. Call **911** or 510-642-3073 for assistance.

## 9. Cleaning and Decontamination

Lab-specific information on decontamination may be included in Section 12 - Protocol/Procedure.

- Wearing proper PPE, laboratory work surfaces must be cleaned at the conclusion of each procedure and at the end of each work day.
- Decontaminate all equipment before removing from a designated area.

## 10. Hazardous Waste Disposal

Label Waste

- Label all waste containers. See the EH&S Fact Sheet, “Hazardous Waste Management” for general instructions on procedures for disposing of hazardous waste.

Dispose of Waste

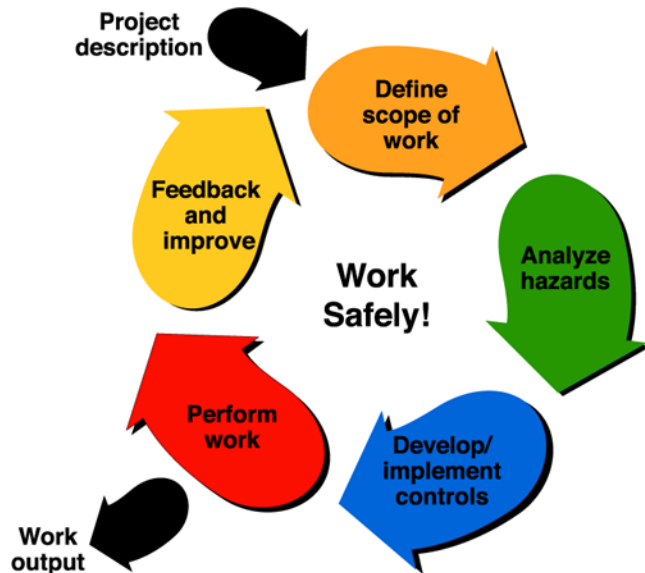
- Dispose of regularly generated chemical waste within 6 months.
- Contact EH&S at 642-3073 if you need assistance.

## 11. Safety Data Sheet (SDS) Location

SDS can be accessed online at <http://ucsdgs.com>



# -Take Ownership of Your Safety-



**Before starting any work, ask yourself:**

- 1- **What will I be doing?**
- 2- **Do I know what the hazards are?**
- 3- **Do I have everything I need to do the job safely?**
- 4- **Am I doing the job safely?**
- 5- **What can we do better?**



## 12 - Protocol/Procedure – Perchloric Acid

Section 12 must be customized to your specific needs. Delete any procedure that does not apply to your laboratory.

Procedure/Use	Scale	Engineering Controls/Equipment	PPE (eye, face, gloves, clothing)	Procedure Steps and Precautions
1. Preparation of dilute solutions (typically 1-5M).	Up to 10 ml of concentrated perchloric acid as supplied in the reagent bottle per dilution.  <span style="color: red;">Remember to obtain PI approval if higher scale is necessary.</span>	All reactions using these materials must be performed in a properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox.	<p><b>Eye protection:</b> Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields.</p> <p><b>Face Protection:</b> Face shields are to be used when there is no protection from the hood sash.</p> <p><b>Hand protection:</b> Confirm compatibility of glove material with chemical being used. General guidance (unless otherwise specified in the specific SDS): Inspect gloves prior to use. For dilute solutions (less than 3M) use standard nitrile; up to 6M acid use Viton or thicker nitrile or double glove; for more concentrated solutions to concentrated commercial grade use laminate film material, neoprene, or polyvinyl chloride gloves. If the acid at any time contacts the gloves being worn, change the gloves immediately. Wash and dry hands after use.</p> <p><b>Clothing:</b> Wear lab coat, full length pants or equivalent; and close-toed closed heeled shoes. Wear an acid resistant apron when handling the chemical as supply in the reagent bottle or when there is the potential for splashing.</p>	<p>Always add acid slowly to the bulk water component. <b>Do not add the water to the acid.</b></p> <p>A pipettor, or other means can be used to control the flow of acid, to slowly add the acid into a container of water until the acid has been diluted.</p> <p>Note: if temperature becomes too warm, stop addition immediately. Wait for the solution to cool down before proceeding with addition.</p>
<b>Notes</b>	Any deviation from this SOP requires approval from PI.			



Procedure/Use	Scale	Engineering Controls/Equipment	PPE (eye, face, gloves, clothing)	Procedure Steps and Precautions
<a href="#">2. Use as reactant.</a>	<p>Up to 1mL of concentrated perchloric acid as supplied in the reagent bottle.</p> <p>Up to 10 mL of dilute solution</p> <p style="color: red;">Remember to obtain PI approval if higher scale is necessary.</p>	<p>All reactions using these materials must be performed in a properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox.</p>	<p><b>Eye protection:</b> Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields.</p> <p><b>Face Protection:</b> Face shields are to be used when there is no protection from the hood sash.</p> <p><b>Hand protection:</b> Confirm compatibility of glove material with chemical being used. General guidance (unless otherwise specified in the specific SDS): Inspect gloves prior to use. For dilute solutions (less than 3M) use standard nitrile; up to 6M acid use Viton or thicker nitrile or double glove; for more concentrated solutions to concentrated commercial grade use laminate film material, neoprene, or polyvinyl chloride gloves. If the acid at any time contacts the gloves being worn, change the gloves immediately. Wash and dry hands after use.</p> <p><b>Clothing:</b> Wear lab coat, full length pants or equivalent; and close-toed closed heeled shoes. Wear an acid resistant apron when handling the chemical as supply in the reagent bottle or when there is the potential for splashing.</p>	<p>A pipettor, or other means can be used to control the flow of acid, to slowly add the acid into the reaction mixture until the acid has been diluted.</p> <p>Note: if temperature becomes too warm, stop addition immediately. Wait for the solution to cool down before proceeding with addition.</p>
<b>Notes</b>	Any deviation from this SOP requires approval from PI.			





**13 - Documentation of Training (signature of all users is required)**

- Prior to conducting any work with Perchloric Acid, designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
  
- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.

I have read and understand the content of this SOP:

Name	Signature	Identifier	Date