Laboratory Specific Standard Operating Procedures

**TITLE: SOP for the safe use of Perchloric Acid**

Date: **7/20/18** Review: Date Revised:

Principal Investigator:

Authors (Names):

Department, Building, Room(s):

Contact Phone Number:

This SOP must be kept on file for all laboratory employee training and review.

**Section 1: (Check One)**
There are three methods that can be used to write SOPs. They are: by process (distillation, synthesis, chromatography, etc.); by individual hazardous chemical (benzene, phenol, arsenic, etc.); and by hazardous chemical class (flammable, corrosive, oxidizer, etc.).

_____ Process ___X__ Chemical _____Hazard Chemical Class

**Section 2: Describe Process, Hazardous Chemical or Hazard Class**
This SOP presents guidelines and procedures for the safe use of perchloric acid (CAS # 7601-90-3). In addition to use of this SOP, persons working with perchloric acid should be thoroughly familiar with general guidelines for high hazard chemicals identified in the High Hazard Chemical Policy (EHS 200.09) and all other applicable LSUHSC chemical safety policies. All current applicable Safety Data Sheets (SDSs) should be available and reviewed prior to use.

Perchloric acid has the formula of $HClO_4$ and is typically used to synthesize substances. It is a mineral acid that is typically found as an aqueous mixture. A very strong acid, it is useful for forming perchlorate salts. Perchloric is highly corrosive, is an oxidizer and can easily form potentially explosive compounds. Perchloric acid has use as a catalyst. Specific uses include separation of potassium, creation of explosives, with ammonium perchlorate being used for rocket fuel, and plating of metals with perchlorate salts. Other names for perchloric acid are: *chloric (VII) acid, hydronium perchlorate, dioxonium perchlorate, and hyperchloric acid*.

**Section 3: Potential Hazards**
Physical Hazards

- Clear odorless, liquid, appearing oily in nature.
- Strong oxidizer that can cause fire or an explosion.
- Very caustic, especially to metals.
- Incompatibilities & reactivities: excess heat, alcohols, metals, strong alkaline substances, ignition sources, dehydrating agents, organics, and incompatible materials (refer to SDS).

Health Hazards

- Primary routes of exposure are via inhalation and ingestion.
- Vapor exposure may cause conjunctivitis, scarring, and/or blindness.
- Contact of vapor with skin can cause dermatitis, and direct contact with the solid can lead to severe irritation and burns.
- Ingestion may be fatal.
- Inhalation may be fatal.
    - Irritation to the respiratory tract can occur with severe burns to the nose, throat, and lungs. Inhalation can also lead to coughing, shortness of breath, chest pain, and delayed pulmonary edema.
- Chronic exposure can lead to systemic toxic effects involving damage to the respiratory tract or sensitization dermatitis and destruction.
- Perchloric acid is regarded as a substance with poor warning properties.
- Perchloric acid has not been shown to be carcinogenic or to show reproductive or developmental toxicity in humans.

An employee demonstrating symptoms which might be a result of exposure to perchloric acid shall report immediately to supervisor who shall request an evaluation by EH&S.

**Section 4: Personal Protective Equipment**

- Proper Laboratory Attire - pants or dresses/shorts below the knees, sleeved shirt, close-toe shoes
- Eye/Face Protection
    - Chemical goggles or safety glasses with side shields are required for all circumstances of use.
    - Ordinary (street) prescription glasses do not provide adequate protection.
    - In addition, face shields are recommended in conjunction with chemical goggles or safety glasses.
- Skin Protection
    - A chemical resistant protective suit is recommended. Utilized in conjunction with rubber boots and gloves, there should not be potential for an exposure route to the skin.
    - Hand Protection
        - Utilize neoprene or polyethylene gloves to prevent exposure. Gloves should be changed frequently to minimize chance of exposure due to penetration or rupture.
    - Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.
- Respiratory Protection - EH&S (568-6585) should be contacted prior to initial use (and when processes of use change) of perchloric acid to evaluate exposures and need for respiratory protection.
    - Always guard against aspiration into the lungs. Utilize approved equipment when necessary.

Refer to EHS-400.03, Personal Protective Equipment for more information.

**Section 5: Engineering Controls**

- Substitute with a different chemical if practicable.
- Dilute perchloric acid as much as practicable.
- Exhaust ventilation or other engineering controls should be utilized to keep the airborne concentrations of vapors below their respective threshold limit value.
- **Perchloric acid must be utilized in chemical fume hoods certified and designed for its**

**use. Due to the nature of perchloric acid to form explosive mixtures, the fume hoods that are used to manipulate perchloric acid and its related compounds must have a wash-down capability to prevent oxidizers from accumulating inside of the duct work.**

- Remove all incompatibles within this work area.
- Use of a Biological Safety Cabinet is especially not appropriate for working with perchloric acid.
- Work at least 6" inside of fume hood and set sash at lowest possible position.
- The working surfaces of any fume hood for which perchloric acid is used should be protected with plastic backed absorbent pads to ensure containment of any spills. The side and back walls shall be covered to a minimum height of 12"
- Any fume hood for which perchloric acid is used shall be posted with a warning sign that identifies the hazards and necessary controls.

- If perchloric acid was used inappropriately, i.e. in a hood not certified for use with perchloric acid, notify EH&S **IMMEDIATELY**.
- Ensure an Emergency Wash Station is available for use.

**Section 6: Special Handling and Storage Requirements**

- If there are plans to utilize perchloric acid, then notify EH&S to assess the fume has wash down capabilities.
- Perchloric acid and concentrated solutions should be secured from unauthorized access.
- Store pure perchloric acid and its concentrated solutions in appropriate containers, with secondary containment if possible, preferably glass or porcelain. **Note** - metal containers should never be used. Label all containers, including secondary containment, with the chemical name and hazard warning.
- Perchloric acid shall be kept away from all incompatibles.
- Ensure the container is kept tightly sealed, kept upright, in a dry, away from heat and direct sunlight and well-ventilated place. Containers are to be carefully resealed.
- When moving perchloric acid to a chemical hood, do not remove it from the secondary containment until it is in the hood.
- Utilize the smallest amount necessary for procedures.
- Keep perchloric acid away from all heat and ignition sources. This includes direct sunlight.
- Wear appropriate PPE. Especially utilizing proper respiratory protection. Avoid breathing vapor. Ensure adequate ventilation.
- Prior to conducting any work with perchloric acid, the Principal Investigator must provide training to his/her laboratory personnel, specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures, to include review of this SOP and applicable SDS.
- If a container holding perchloric acid exhibits signs of concentration, such as crystal formation or becoming darker in color, there is an explosion hazard. Do not agitate the bottle. Ensure nearby personnel know to avoid contact with the container. Contact EH&S immediately.

**Section 7: Spill and Accident Procedures**

- The availability, location, and contents of chemical spill clean-up kits must be confirmed prior to handling or beginning any work with perchloric acid. All labs maintaining perchloric acid must have an inert absorbent material i.e. lime or soda ash available for spill-clean-up and neutralization.
- Immediately notify all lab personnel of spills (with the details of the spill and actions being taken) and regulate access to the area.
- Eliminate all ignition sources. Keep combustibles away from the spill.
- Ventilate the contaminated area.

- Do not let the product enter drains, sewers, waterways, basements, or confined areas.
- Personnel cleaning the spill shall, at minimum, wear the same PPE required for handling/use.
- **Combustible materials such as paper towels, sawdust, clothing, etc. shall not be used to clean perchloric acid due to perchloric acid being spontaneously combustible when dry.**
- Laboratory personnel should be prepared to respond to spills in accordance with the guidance provided in LSUHSC Chemical Spill Response Procedure (EHS 200.02).
- All spills of perchloric acid should have personnel contact University Police.
    - Small Spills – Perchloric acid is best disposed of when gradually stirring the waste product into enough cold water to make its concentration less than 0.1%, neutralizing it with aqueous sodium hydroxide and washing the solution down the drain with at least 50 times its volume of water.
    - Large Spills – Add a weak reducing agent such as ferrous salts to the waste perchloric acid. Then utilizing a non-metal tool, shovel the waste product into a large container of water, adding soda lime to neutralize.
        - Or absorb with dry earth, sand or other non-combustible material. Avoid getting water inside container. Keep substance damp using water spray and use a water spray curtain to divert vapor drift.
- Report all spills, regardless of size, to laboratory PI, who will report to LSUHSC EH&S.

Incident and accident reporting must be done electronically via the on-line fillable forms located on the EHS website. For more information about appropriate form selection, refer to EHS-400.06, Incident and Accident Reporting and Investigation Policy.

**Section 8: Decontamination Procedures**

- All exposed persons should seek immediate medical attention (subsequent to initial decontamination for skin contact).
- Where the eyes of any person may be exposed to perchloric acid, a safety shower/eye wash must be available for immediate use. Personnel must be aware of location of nearest Safety Shower/ Eye Wash and verify that a current certification of performance tag is present.
    - Personnel shall rinse eyes with copious amounts of cold water for at least 15 minutes. Obtain medical assistance immediately.
- Where the skin of any person may be exposed to perchloric acid, immediately wash the area exposed areas of skin with soap and water. Continue flushing and obtain medical assistance immediately.
- Whereas inhalation has occurred, transport the victim to a fresh air environment. If breathing ceases, administer oxygen. Obtain medical assistance immediately.
- Whereas ingestion has occurred, rinse mouth, but do not induce vomiting. Obtain medical assistance immediately.
- All equipment, materials and work surfaces that have/potentially have become contaminated with perchloric acid shall be thoroughly cleaned with soap and water solution prior to storage and re-use.

**Section 9: Waste Disposal Procedures**

Perchloric acid waste is considered hazardous and must be disposed of in accordance with LSUHSC Chemical Waste Management Procedures (EHS 200.04).

- Waste storage – Perchloric acid waste should be placed in a tightly sealed and labeled plastic container with the words “HAZARDOUS WASTE” clearly marked, the primary constituents of the waste, and the starting accumulation date.

- To schedule a waste pick-up by EH&S, use the bob.lsuhsc.edu service request system.

**Section 10: Laboratory Specific Protocol(s):**

Attach laboratory protocol for specific handling and operational practices.