GENERAL WRITTEN SOP – Oxidizers

The OSHA Laboratory Standard explicitly requires "standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals." If the general SOP in this section do not fulfill this requirement, you must amend and append in some manner so as to comply.

Special Precautions for Working with Oxidizers: *Oxidizers are materials which readily yield oxygen or another oxidizing gas, or that readily react to promote or initiate combustion of flammable/combustible materials. This reaction may be spontaneous at either room temperature or may occur under slight heating. Oxidizing liquids and solids can be severe fire and explosion hazards. The most common strong oxidizers in campus laboratories are nitric acid and perchloric acid. These have* ***separate*** *SOPs within The Citadel Chemistry Department CHP and should be adopted by labs if those materials are used.*

Oxidation reactions are a frequent cause of chemical accidents. *Observe these precautions to reduce risk when storing or handling oxidizers.*

1. Never work alone with serious hazards. At least one other person must be present in the vicinity when any work involving strong oxidizers is carried out.
2. Know the reactivity of the materials involved in experiment or process. Make sure that there are no extraneous materials in the area which could become involved in a reaction.
3. Always use strong oxidizers in a certified chemical fume hood to minimize the potential for the spread of a fire if one should occur. It is recommended to avoid the use of Class 4 oxidizers. If no alternative can be found, then operations MUST be carried out in a fume hood with the addition of a blast shield. No part of the body (for example, hands) should ever be directly exposed to these materials when they are mixed with other chemicals.
4. Eliminate or substitute a less hazardous material when possible.
5. Use the minimum amounts necessary for the procedure. Do not keep excessive amounts of the material in the vicinity of the process.
6. It is essential that all strong oxidizers be stored separately from all chemicals with which they may react. Ensure secondary containment and segregation of incompatible chemicals. Also, follow any substance-specific storage guidance provided in Safety Data Sheet (SDS) documentation.
7. Perchloric acid has a notorious history of causing unanticipated explosions. Perchloric acid should be used only in specially-designed perchloric acid fume hoods equipped with wash-down systems to prevent deposition of shock-sensitive perchlorates in the ductwork and machinery. Spills should be immediately and thoroughly cleaned up. This fume hood shall be prominently marked for use with perchloric acid. Before purchasing perchloric acid, the laboratory supervisor should seek approval from the Laboratory Safety Manager, the Department Head and arrange for use of an approved perchloric acid hood and consult with EHS (953-4816).

NOTE: The Citadel does not have laboratories using perchloric acid at this time. **There is a perchloric acid fume hood located in Byrd 308.**

The National Fire Protection Association "Code for the Storage of Liquid and Solid Oxidizers" provides many examples of typical oxidizing materials.

NFPA Class 1 Oxidizers - Slightly increase the burning rate of combustible materials. Do not cause spontaneous ignition when they come in contact with them.
Examples:

- Aluminum nitrate
- Ammonium persulfate
- Barium peroxide
- Hydrogen peroxide solutions (8% to 27.5% by weight)
- Magnesium nitrate
- m-Chloroperoxybenzoic acid
- Nitric acid (40% concentration or less)
- Peracetic acid
- Perchloric acid solutions (less than 50% by weight)
- Potassium dichromate
- Potassium nitrate
- Silver nitrate
- Sodium dichloroisocyanurate dihydrate
- Sodium dichromate
- Sodium nitrate
- Sodium nitrite
- Sodium perborate (and its monohydrate)
- Sodium persulfate
- Strontium nitrate
- Strontium peroxide
- Trichloroisocyanuric acid
- Zinc peroxide

NFPA Class 2 Oxidizers - Increase the burning rate of combustible materials moderately with which they come in contact. May cause spontaneous ignition when in contact with a combustible material.
Examples:

- calcium chlorate
- calcium hypochlorite (50% or less by weight)
- chromic acid (chromium trioxide)
- 1,3-dichloro-5,5-dimethylhydantoin
- hydrogen peroxide (27.5 to 52% by weight)
- magnesium perchlorate
- nitric acid (concentration greater than 40% but less than 86%)
- potassium permanganate
- sodium permanganate
- sodium chlorite (40% or less by weight)
- sodium perchlorate (and its monohydrate)
- sodium peroxide

NFPA Class 3 Oxidizers - Severely increase the burning rate of combustible materials with which they come in contact. Will cause sustained and vigorous decomposition if contaminated with a combustible material or if exposed to sufficient heat.
Examples:

- Ammonium dichromate
- Hydrogen peroxide (52 to 91% by weight)
- Nitric acid, fuming (concentration greater than 86%)
- Perchloric acid solutions (60 to 72% by weight)
- Potassium bromate
- Potassium chlorate
- Potassium dichloroisocyanurate
- Sodium chlorate
- Sodium chlorite (greater than 40% by weight)
- Sodium dichloroisocyanurate

NFPA Class 4 Oxidizers - Can explode when in contact with certain contaminants. Can explode if exposed to slight heat, shock, or friction. Will increase the burning rate of combustibles. Can cause combustibles to ignite spontaneously.
Examples:

- Ammonium perchlorate (particle size greater than 15 microns)
- Ammonium permanganate
- Hydrogen peroxide (greater than 91% by weight)
- Perchloric acid solutions (greater than 72.5% by weight)
- Tetranitromethane

The other classification scheme for oxidizers is the Globally Harmonized System (GHS) which identifies 3 classes of solid/liquid oxidizers. Newer chemical containers will have this general symbol for oxidizers: The other classification scheme for oxidizers is the Globally Harmonized System (GHS) which identifies 3 classes of solid/liquid oxidizers. Newer chemical containers will have this general symbol for oxidizers:

ENGINEERING/VENTILATION CONTROLS

All chemicals should be transferred and used in an annually certified laboratory chemical fume hood with the sash at the certified position or lower. The hood flow alarm should be checked to be operating correctly prior to using the hood.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

The following administrative controls must be followed:

- It is better to do multiple transfers of small volumes than attempt to handle larger quantities. Finely divided solids must be transferred under an inert atmosphere in a glove box. Liquids may be safely transferred without a glovebox by employing certain syringe techniques and equipment. Before transferring, make sure that the material is at room temperature.
- Consult with the Laboratory Safety Officer and EHS if work involves large quantities.

SPILL AND INCIDENT PROCEDURES

See directions under the "Chemical Spill Clean-Up Procedures" and "Emergency Response" sections of the CHP. Incident Report forms should already be present in all laboratories.

WASTE DISPOSAL

See "Waste Disposal" in Section II of *The Citadel Chemistry Department Chemical Hygiene Plan*.