NJIT New Jersey Institute of Technology

STRONG OXIDIZING AGENTS

STANDARD OPERATING PROCEDURE

Type of SOP: ☐ Process ☐ Hazardous Chemical ☐ Hazard Class

Department: _____ **Building:** _____ **Room #:**_____

Principal Investigator: _____ **Phone #:**_____

Prepared By: _____ **Email:** _____ **Date:** _____

1. HAZARD OVERVIEW

Oxidizing materials are liquids or solids that readily give off oxygen or other oxidizing substances such as bromine, chlorine, or fluorine. **They are materials that react chemically to oxidize combustible (burnable) materials; this means that oxygen combines chemically with the other material in a way that increases the chance of a fire or explosion.** 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.

The National Fire Protection Association (NFPA) "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.

- 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

Reference: University of California, Santa Barbara - Environmental Health & Safety

- 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.

- 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.

- 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:

Reference: University of California, Santa Barbara - Environmental Health & Safety

- 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

2. PERSONAL PROTECTIVE EQUIPMENT (PPE)

At minimum, safety glasses, lab coats, and gloves are required. Additional or more protective PPE may be required. Please refer to the NJIT Chemical Hygiene Guide and Hazard Assessment Form to determine the proper PPE for handling corrosive materials.

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3. 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. The following is a general plan for all strong oxidizers:

- Always use strong oxidizers in a certified chemical fume hood to minimize the potential 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 *(e.g., hands)* should ever be directly exposed to these materials when they are mixed with other chemicals.
- Perchloric acid has a notorious history of causing unanticipated explosions. Perchloric acid can form explosive salts almost anywhere, including in the exhaust ducts of fume hoods and even laboratory benches where other materials have been spilled in the past. Many perchlorate salts are shock sensitive and can lay dormant for very long periods.
- For these reasons, it is imperative that perchloric acid only be used in a designated fume hood. In some cases, to avoid an explosive condition, this hood must be a special type with a built-in water wash-down feature.
- This fume hood shall be prominently marked for use with perchloric acid. The EHS Department should be contacted for proper signage and approvals.

Please review the NJIT Chemical Hygiene Guide and the Safe Chemical Fume Hood Use Guide for information on the proper use of a chemical fume hood and criteria for implementing engineering controls.

☐ Chemical Fume Hood ☐ Glovebox ☐ Biological Safety Cabinet ☐ Other _____

Room Location of Unit(s): _____

Reference: University of California, Santa Barbara - Environmental Health & Safety

4. SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

The following administrative controls must be followed:

- 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.
- Eliminate or substitute a less hazardous material when possible.
- Design your experiment to use the least amount of material possible to achieve the desired result.
- 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 Faculty/PI and EHS if work involves large quantities.
- 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.
- Wash hands thoroughly after handling. **Do not** ingest or inhale nor get in eyes, skin or clothing.
- Store in a tightly closed, labeled container and in a cool, dry well-ventilated area. Segregate from incompatible materials. Secondary containers must be labeled clearly. Follow any substance-specific storage guidance provided in Safety Data Sheet.

5. INCIDENTS AND ACCIDENTS

Spills should be immediately and thoroughly cleaned up. Please review the SDS, verify with the manufacturer, or contact EHS for proper spill cleanup.

Laboratory personnel are to report all occupational injuries or illnesses to Faculty/PI as soon as practical. The Faculty/PI and laboratory personnel must submit the required paperwork to NJIT EHS Department. See the the Emergency Response Guidelines posted in the laboratory or Emergency Procedures section of the NJIT CHG for proper procedures involving an injury, exposure, fire, or release/spill of a hazardous material.

In the event of an emergency, DIAL 9-1-1 to activate emergency response personnel.

6. SPILL AND DECONTAMINATION

Wear proper PPE. Please review the SDS, verify with the manufacturer, or contact EHS for proper decontamination procedures. Dispose of all used contaminated disposables in the appropriate waste stream following the Waste Disposal Section of the NJIT CHG.

Decontamination Solution(s): _____

Additional Spill / Decontamination Requirements:

Reference: University of California, Santa Barbara - Environmental Health & Safety

7. WASTE DISPOSAL

Follow the practices and procedures in accordance with the NJIT Laboratory Waste Management Program to properly dispose of waste.

Additional Waste Disposal Requirements:

8. PRIOR APPROVAL/REVIEW

9. DESIGNATED USE AREA

Designated Use Area Location(s): _____

10. SAFETY DATA SHEETS

Location of SDS: _____

11. LAB-SPECIFIC INFORMATION (required) *(Examples of appropriate content)*

Reference: University of California, Santa Barbara - Environmental Health & Safety