

# Laboratory Standard Operating Procedure: Highly Reactive or Unstable Compounds

<b>I.</b>	<b>THIS STANDARD OPERATING PROCEDURE (SOP) IS FOR A:</b>
<p><input type="checkbox"/> <b>Specific laboratory procedure or experiment</b>  <i>Examples:</i> synthesis of chemiluminescent esters, folate functionalization of polymeric micelles, etc.</p> <p><input type="checkbox"/> <b>Generic laboratory procedure that covers several chemicals</b>  <i>Examples:</i> distillation, chromatography, etc.</p> <p><input checked="" type="checkbox"/> <b>Generic use of specific chemical or class of chemicals with similar hazards</b>  <i>Examples:</i> organic azides, mineral acids, etc.</p>	
<p><b>This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with highly reactive or unstable substances. This general use SOP only addresses safety issues specific to these substances. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., for perchloric acid, this general use SOP and the general use SOP for corrosives would apply). If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or the Chemical Environmental Health and Safety Coordinator [CEHSC] at (813) 842-3528.</b></p>	
<b>II.</b>	<b>CLASS OF HAZARDOUS CHEMICALS</b>
<p>Highly reactive or unstable materials are those that have the potential to vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, temperature, light, or contact with another material. Highly reactive chemicals may be explosives, peroxides, water-reactives, or pyrophorics.</p> <p><b><i>Examples:</i></b>  <u>Explosives:</u> Lead azide, Nitroglycerin  <u>Peroxide formers:</u> Isopropyl ether, Sodium amide, Ethyl ether, Styrene  <u>Water Reactives:</u> Alkali Metals (Lithium, sodium, potassium), Calcium carbide  <u>Ignitables:</u> Grignard Reagents (RMgX), Metal powders (e.g., Al, Co, Fe, Mg, Mn, Pd).</p>	
<b>III.</b>	<b>GENERAL HAZARD CONTROL</b>

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- 1) Minimize the quantity of reactive chemicals used or synthesized to the smallest amount needed.
- 2) Handle reactive chemicals with caution. Appropriate chemical-specific precautions must be taken for mixing even small quantities with other chemicals.
- 3) Chemical reactions conducted at temperatures or pressures above or below ambient conditions must be performed in a manner that minimizes risk of explosion or vigorous reaction.
- 4) Provide a mechanism for adequate temperature control and heat dissipation.
- 5) Utilize shields and barricades, and personal protective equipment (such as face shields with throat protectors and heavy gloves) whenever there is a possibility of explosion or vigorous chemical reaction.
- 6) Glass equipment operated under vacuum or pressure must be shielded, wrapped with tape, or otherwise set up to minimize damage in case the apparatus shatters.
- 7) Do not heat flammable chemicals with an open flame.

#### IV.

#### ENGINEERING & VENTILATION CONTROLS

These types of chemicals should be used in lab fume hoods or a well-ventilated area. If the process does not permit the handling of unstable or reactive agents in your fume hood, contact the CEHSC at 813-842-3528 to request ventilation review. Lab ventilation should have a minimum of 6 air changes per hour.

**NOTE:** Certain flammables that are also considered particularly hazardous substances (i.e., benzene) may require use of fume hood due to the toxicity potential.

#### Follow Safe Fume Hood Practices:

1. Ensure the fume hood's certification date is within a one-year period. Verify sufficient inward airflow before using a hood by checking the hood's airflow indicator. Report any problems to PI/Lab Supervisor and the CEHSC.
2. Maintain hood sash at or below the maximum height indicated by an arrow on the side of the fume hood.
3. Close the hood sash when not working in the hood.

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4. Avoid rapid movements at the face of the hood to avoid creating competing air currents that reduce the ability of the hood to contain air contaminants.
5. Equipment used in hoods should be placed securely on blocks to allow air to flow under and around the equipment.
6. Keep chemical sources and equipment at least six inches away from the face or rear of the hood.
7. Minimize equipment and chemical storage placed in the hood to avoid dead air spaces or eddies and to prevent blocking back baffles.

For operations involving heating or volatilizing perchloric acid:

Use perchloric acid fume hoods. These hoods contain water spray systems to wash down the interior of the hood, ducting, fan, and stack to prevent accumulation of explosive perchlorate crystalline material.

**V.**

### **PERSONAL PROTECTIVE EQUIPMENT**

☒ Lab Coat      ☒ Long pants      ☒ Close-toed shoes      ☒ Safety glasses

The above listed personal protective equipment should be worn when handling highly reactive or unstable substances. Additional protection may be required based upon additional experimental chemical agent(s) in use

Check all personal protective equipment [PPE] prior to use to ensure good undamaged condition. At a minimum:

1. Utilize shields and barricades along with PPE whenever there is a possibility of explosion or vigorous chemical reaction.
2. Protective gloves are to be worn and selected by reviewing the chemical Safety Data Sheet [SDS] and consulting with manufacturer's glove selection guidance documents;
3. A safety goggle with face shield is also recommended where potential for splash or spray exists; and
4. Additional protective clothing [i.e. face shield, apron or oversleeves] is appropriate

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when chemical contact is possible.	
<b>VI.</b>	<b>SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS</b>
<b>Safe Handling</b>	<ol style="list-style-type: none"> <li>1. Ensure secondary containment and segregation of incompatible chemicals per UT CHP guidance. Also, follow any substance-specific storage guidance provided in SDS.</li> <li>2. Ensure careful handling of handling materials that may be sensitive to shock, heat, friction, or light.</li> <li>3. Any chemicals with crystallization, visible discoloration, or liquid stratification potentially have undergone peroxidation and must not be used or otherwise disturbed.</li> </ol>
<b>Safe Storage</b>	<ol style="list-style-type: none"> <li>1. Label all chemicals with date received and date opened and if an appropriate expiration date does not exist, assign one to maintain fresh stock of peroxide forming chemicals.</li> </ol>
<b>VII.</b>	<b>DESIGNATED AREA</b>
<p>Establish a designated area if working with a particularly highly reactive or unstable compound where limited access, special procedures, knowledge, and work skills are required. A designated area can be the entire laboratory, a specific laboratory workbench, or a laboratory hood. Designated areas must be clearly marked with signs that identify the chemical hazard and include an appropriate warning; for example:</p> <p><b>WARNING! HIGHLY REACTIVE SUBSTANCE WORK AREA**AUTHORIZED PERSONNEL ONLY**</b></p>	
<b>VIII.</b>	<b>EMERGENCY SPILL AND ACCIDENT PROCEDURES</b>
<b>Health-</b>	<ol style="list-style-type: none"> <li>1. Call 911</li> </ol>

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<p><b>Threatening Emergencies</b></p> <p>Examples: Fire, explosion, health-threatening hazardous material spill or other Immediate Danger</p>	<ol style="list-style-type: none"> <li>2. Alert people in the vicinity to evacuate</li> <li>3. Activate the local alarm systems</li> <li>4. Call Campus Security at 813-257-7777 or xtn. 7777</li> <li>5. Remain nearby to provide arriving emergency responders information about chemicals</li> <li>6. Once personal safety is established, call the CEHSC at (813) 842-3528</li> </ol>
<p><b>Personnel Injury or Exposure</b></p>	<ol style="list-style-type: none"> <li>1. Remove the injured/exposed individual from the area if it is safe to do so because of the medical condition of the victim or the potential hazard to rescuers.</li> <li>2. Call 911</li> <li>3. Administer first aid as appropriate.</li> <li>4. FOR NON WATER REACTIVE COMPOUNDS ONLY: Flush contamination from eyes/skin using the nearest emergency eyewash/shower for a minimum of 15 minutes.</li> <li>5. Remove any contaminated clothing to prevent contaminants from continuing to absorb onto skin.</li> <li>6. Give medical responders copies of SDSs for all chemicals the victim was exposed to.</li> <li>7. Report the exposure to the CESHSC</li> </ol>
<p><b>Non-Health Threatening Emergencies</b></p>	<p>Call Security at 813-257-7777 or xtn. 7777 to report incident</p>
<p><b>Small Spill Clean-Up</b></p>	<p><b>Note: Only minor releases can be cleaned up by knowledgeable personnel using readily available equipment:</b></p> <ol style="list-style-type: none"> <li>1. Notify personnel in the area and restrict access. Eliminate all sources of ignition.</li> <li>2. Review the SDS for the spilled material, or use your knowledge of the hazards of the material to determine the appropriate level of protection.</li> <li>3. Wear gloves and protective eyewear.</li> <li>4. If it will take longer than 15 minutes for you to clean-up, immediately call Security (813) 257-7777 or xtn. 7777 to report the spill, and notify your supervisor.</li> <li>5. Submit waste pickup request to the CEHSC.</li> </ol>
<p><b>Incident Reporting</b></p>	<ol style="list-style-type: none"> <li>1. Report all occupational injuries or illness to laboratory supervisor as soon as practical.</li> <li>2. Laboratory personnel are encouraged to report "near misses" as they are considered a precursor to actual incidents.</li> </ol>

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	3. Laboratory supervisor is to conduct (or coordinate) an investigation of all incidents and "near misses." The goal of the investigation is to identify and address any deficiencies that may have contributed to the incident.
<b>Medical Consultation</b>	<p>Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:</p> <ol style="list-style-type: none"> <li>1. A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure); or</li> <li>2. Symptoms or signs of exposure to a hazardous chemical develop.</li> <li>3. Contact your CEHSC for more information or directions to medical services.</li> </ol>
<b>IX.</b>	<b>WASTE DISPOSAL</b>
Please call the CEHSC at (813) 842-3528 to coordinate with the collection of all waste highly reactive or unstable substances. Due to the specific hazard nature special handling or storage requirements may be warranted for your waste.	
<b>X.</b>	<b>DECONTAMINATION PROCEDURES</b>
Decontamination procedures vary depending on the material being handled. The toxicity of some materials can be neutralized with other reagents. All surfaces should be wiped with the appropriate cleaning agent following dispensing or handling. Waste materials generated should be treated as a hazardous waste.	
<b>XI.</b>	<b>TRAINING REQUIREMENTS</b>
<p><b>General Training</b> (check all that apply):</p> <p><input checked="" type="checkbox"/> General Safety &amp; Emergency Preparedness – Annual Orientation Training</p> <p><input checked="" type="checkbox"/> Review of SDS for other chemicals involved in process/experiment</p> <p><input checked="" type="checkbox"/> Review of this SOP</p> <p><input checked="" type="checkbox"/> Other: <u>Fire Extinguisher Use</u></p> <p>The University may require additional safety training depending on the hazardous materials and laboratory-specific processes – consult the PI for more information.</p>	