



# Quenching of Self-Heating Substances and Mixtures

Hazardous Operation SOP

Berkeley EH&S

## Quenching of Self-Heating Substances and Mixtures

H251 H252



Examples: magnesium ethoxide, sodium ethoxide, sodium tert-butoxide, potassium methoxide, titanium sulfide

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:	11/22/16
Date SOP was approved by PI/lab supervisor:	
Principal Investigator:	Name: Richmond 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:	831,832,834,836,837,838,839,842,844,847,849

### 1. Purpose

This SOP covers the precautions and safe handling procedures for the Quenching of Self-Heating Substances and Mixtures.

All materials mentioned in your laboratory “Self-Heating Substances and Mixtures” Class SOP are covered by this hazardous operating SOP.

Also, this SOP covers any material synthesized using Self-Heating Substances.

***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

For physical and chemical properties on Self-Heating Substances and Mixtures, please refer to your laboratory “Self-Heating Substances and Mixtures” and to specific Safety Data Sheets (SDS) of chemicals in use (See Section 11 – SDS Location).

## 3. Potential Hazards/Toxicity

When quenching Self-Heating Substances, the hazards of the mixture, the Self-Heating Substance chemical and the solvent, must be considered together and procedures for safe quenching must reflect the hazard properties of both solvent and solute.

As defined by the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), Self-Heating Substances and Mixtures are designated by one or more of the following H codes:

**H251** Self-heating; may catch fire

**H252** Self-heating in large quantities; may catch fire

It is the Principal Investigator’s responsibility to ensure activity-specific laboratory procedures and/or processes are taken into account when using this Hazardous Operation SOP.

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

## 4. Engineering Controls

The following is the set of engineering controls required when quenching Self-Heating Substances and Mixtures:

- Work with Self-Heating Substances – 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.
- Remove any flammables (squirt bottles, solvents, oil bath) and combustibles (Kimwipes, paper towels) from the work area.
- Laboratories and rooms where Self-Heating Substances are 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 Protection

- A. 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.
- B. If the potential for explosion/splashing exists, and adequate coverage is not provided by the hood sash, a face shield must be worn.

### Skin Protection

- A. Flame-resistant lab coat (Nomex IIIA, NFPA 2112) must be worn when working with WR.
- B. A combination of fire resistant (FR) liners, covered with a pair of chemical-resistant disposable gloves (e.g. nitrile gloves or those specified in the specific SDS), must be worn AT ALL TIMES.



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The following products are Approved FR Liners: Ansell Kevlar® Goldknit® Lightweight 70-200 and Hanz Extremity Wear Nomex® Utility Liners.

- C. 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 not are 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

Self-Heating Substances chemicals can be handled and stored safely as long as all exposure to moisture or other incompatible chemicals is minimized. Never leave a container with a residue of a Self-Heating Substance material open to the atmosphere.

Lab-specific information on handling and storage may be included in Section 12 - Protocol/Procedure section.

#### **Precautions for safe handling**

- Only use if the area is properly equipped with a properly operating eye wash/safety shower within ten seconds of travel.



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- Work away from any water sources or where there is the potential of water splash.
- 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

- Keep container tightly closed in a dry and well-ventilated place.
- Store in a location separated from bases, oxidizing and other incompatible materials.
- Never allow product to get in contact with water or water-based compounds during storage. Keep in a dry place free of moisture/humidity and away from sources of heat.
- Do not leave the container near a lab sink, emergency eyewash, or safety shower or on the bench top - even momentarily.

### Disposal

- If you have large quantities of unreacted Self-Heating Substances, contact EH&S for guidance on disposal options.
- 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.
- The empty container, solvent rinses and water rinse must be disposed of as hazardous waste.
- Do not mix with incompatible waste streams.
- Decontamination of containers in order to use them for other purposes is not permitted.

## 8. Chemical Spill and Managing Any Subsequent Fire

### Self-Heating Substances Spill Response

- In the case of a spill, announce the situation loudly in the immediate area and have any nearby persons move to a safe location.
- Immediately eliminate/remove all nearby ignition sources.
- If spill occurs in a fume hood, cover with Met-L-X, dry sand, or other non-combustible material, close the hood sash and if present, press the red purge button.
- If a spill occurs outside a fume hood, cover with Met-L-X, dry sand, or other non-combustible material, and stand away from the spill.
- Locate and have a proper fire extinguisher (dry chemical-based) ready in case of ignition/fire.
- Use clean, non-sparking tools to collect absorbed material and place into loosely-covered metal or plastic containers ready for disposal.
- If you cannot assess the situation well enough to be sure of your own safety, do not approach the spill.
- Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).



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- Report the spill to 510-642-3073.

## Self-Heating Substances Fire Response

- Call **911** (from a cell phone: **510-642-3333**) for assistance with all fires, even if extinguished.
- If the spill ignites, and if you are trained and you feel comfortable to do so, consider extinguishing the fire with an appropriate fire extinguisher. Use only dry chemical fire extinguishers (classes ABC or D).
- A can of Met-L-X or **dry** sand in the work area, within arm's reach, might be helpful to extinguish any small fire as it can smother the flames.
- Do not use water to extinguish a Self-Heating Substance fire as it may enhance the intensity of the fire. An exception to this would be in the case of skin contact or ignited clothing/skin. In these cases rinsing any unreacted chemical off is of primary importance.

## 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

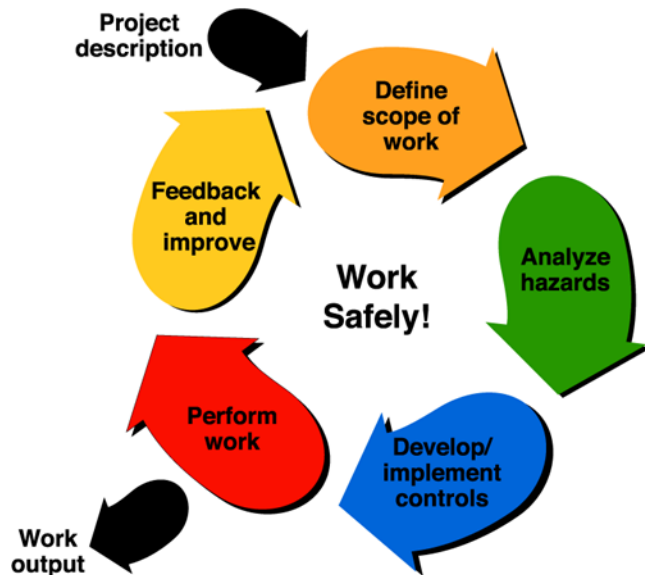
- Dispose of regularly generated chemical waste within 6 months.
- Call EH&S with questions.

## 11. Safety Data Sheet (SDS) Location

SDS can be accessed online at <http://ucsd.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?**



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### 12. Protocol/Procedure - Quenching of Self-Heating Substances and Mixtures

**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 Special Precautions for this Procedure
1. Quenching of Self-Heating Substances.	<p>Up to 10 g of material or Up to 1 L of solution in carrier solvent.</p> <p>Minimal quantities will be left after reactions carried out at scales listed in your laboratory specific "Self-Heating Substances and Mixtures" Class SOP.</p> <p>Larger quantities of Self-Heating Substances can be disposed of as hazardous waste.</p> <p>Obtain PI approval if higher scale is</p>	<p>Conduct in a clean and properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox.</p>	<p><b>Eye Protection:</b> Wear 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 or when the hood sash is in open position.</p> <p><b>Hand Protection:</b> Confirm compatibility of glove material with chemical being used. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p><b>General guidance:</b> For indirect contact (closed-system procedures such as transfers via syringe or cannula) AND direct contact (open system procedures such as spill handling, wiping of residual pyrophorics) with pyrophoric material - a combination of fire resistant (FR) liners, covered with a pair of chemical-resistant disposable gloves (e.g. nitrile gloves or those specified in the specific SDS), must be worn AT ALL TIMES. The following products are Approved FR Liners: Ansell Kevlar® Goldknit® Lightweight 70-200 and Hanz</p>	<p><u>General Procedure:</u></p> <p>Quenching procedures usually involve the reaction of the Self-Heating Substance with a reagent that has a reactive hydroxyl group.</p> <p>Any reaction or suspension containing these reagents MUST be quenched carefully!</p> <p>Addition of materials must be done SLOWLY and ensure adequate stirring/mixing.</p> <p>Whenever quenching be sure that it is <u>not</u> done in a sealed vessel as pressure will build up.</p> <p>If you're quenching in a RB flask or any floating vessel in a bath, <b>clamp it</b>.</p> <p>Typically, a suspension of less than 20 wt% of Self-Heating Substance in an inert solvent (such as hexane or toluene) is created, followed by the <b>slow</b> addition of isopropanol, under adequate stirring until no more bubbling is observed.</p> <p>To avoid vigorous bubbling and any signs of overheating during the quenching process, keep the solution cool by controlling the feed rate of the alcohol. If the solution begins to warm up, stop and allow it cool down before continuing the addition of the quenching agent.</p> <p>Repeat with methanol, and then repeat with water.</p> <p><b>Be Very Careful with the addition of WATER!</b> Even after methanol has been added, the Self-Heating Substance can still react violently with water, especially if there hasn't been sufficient mechanical</p>



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	<p>necessary.</p>		<p><b>Extremity Wear Nomex® Utility Liners.</b></p> <p><b>Clothing:</b> Wear Nomex IIIA (NFPA 2112) lab coat; full length pants or equivalent; and close-toed and close-heeled shoes.</p>	<p>stirring of the solution. So add in small aliquots. Stir for an additional 2 hours before disposing of the aqueous organic waste.</p> <p><i>If you are filtering out a solid residue containing a Self-Heating Substance, be sure there is no active residue on the filter paper before disposing of it in the solid waste. Wash the solid residue with some methanol to quench any remaining Self-Heating Substance.</i></p>
<p><b>Notes</b></p>		<p><b>Any deviation from this SOP requires approval from PI.</b></p>		



