



# Self-Heating Substances and Mixtures

H251 H252



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

**Note:** Before handling any Self-Heating Substances, researchers must also read and sign the “Quenching of Self-Heating Substances and Mixtures” hazardous operation SOP

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:	Monday, October 24, 2016
Date SOP was approved by PI/lab supervisor:	
Principal Investigator:	Name: R. 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:	Latimer
	831,832,834,836,837,838,839,842,844,847,849
	Hall

## 1. Purpose

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

For a list of Self-Heating Substances and Mixtures covered by this SOP and their use(s), see the “List of Chemicals”. Procedures described in Section 12 apply to all materials covered in this SOP.

***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. Self-Heating Substances and Mixtures Information

A self-heating substance is defined as follows: a solid or liquid or mixture, other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat; this substance or mixture differs from a pyrophoric liquid or solid in that it will ignite only when large amount (kilograms) and after long periods of time (hours or days).

## 3. Potential Hazards/Toxicity

Self-heating of a substance or mixture is a process where the gradual reaction of that substance or mixture with oxygen in air generates heat. If the rate of heat production exceeds the rate of heat loss, then the temperature of the substance or mixture will rise which, after an induction time, may lead to self-ignition and combustion.

The fire hazard presented by self-heating substances is due to four inter-related factors:

- Volume of material present
- Rate at which the material self reacts
- Temperature of the surroundings/insulating factors
- Availability of oxygen/moisture

The GHS establishes two categories for self-heating substances or mixtures. Category 1 materials are more reactive and self heat more readily and in smaller amounts than category 2 materials.

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) designates self-heating substances and mixtures 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 Chemical Class 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 that are required when working with Self-Heating Substances:

- 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 (spray 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 Self-Heating Substances.
- B. Gloves are required when handling hazardous chemicals.
  - Refer to specific chemical SDS for information on glove selection.
  - For additional information on glove selection, go to:  
<http://ehs.berkeley.edu/hs/63-laboratory-safety/94-glove-selection-and-usage.html>
- 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 are not 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. For mucous membrane exposure such as eyes, mouth and/or nose, flush the affected area for 15 minutes using an eyewash station.

## 7. Special Handling, Storage, and Disposal 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.
- 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

- 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 (such as a desiccator or a dry box or glove box) 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.
- Ensure that a sufficient protective solvent, oil, kerosene, or inert gas remains in the container while the material is stored.

### Disposal

- Any unused or unwanted Self-Heating Substances must be destroyed by following the Quenching of Self-Heating Substances SOP. 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. Solvent rinses and water rinse must be disposed of as hazardous waste.



- As an alternative, unrinsed empty containers can be disposed of through EH&S as hazardous waste. The unrinsed empty containers must be capped.
- 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.).
- 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



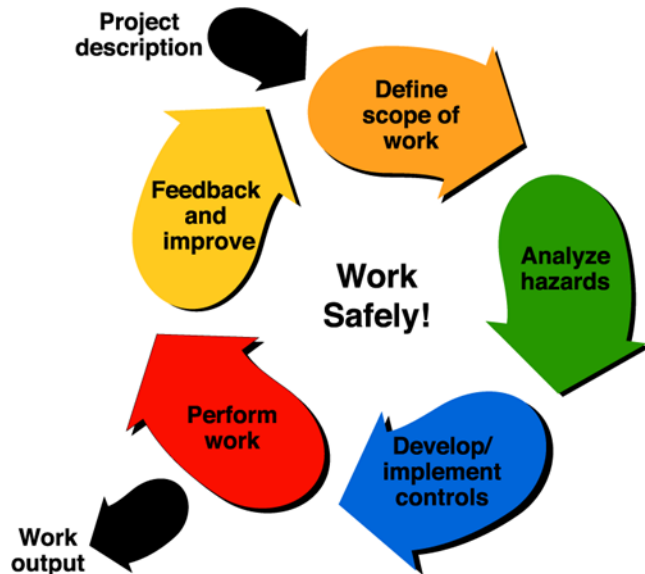
- Dispose of regularly generated chemical waste within 6 months.
- Contact EH&S at 642-3073 if you need assistance.

## 11. Safety Data Sheet (SDS) Location

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



## 12. Protocol/Procedure - 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. Using Self-Heating Substances as reactant.	Up to 20 g as supplied in the reagent bottle.  <b>Remember to obtain PI approval if higher scale is necessary.</b>	All reactions using these materials must be performed in a properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox.	<b>Eye Protection:</b> Wear tight-fitting safety goggles or safety glasses with side shields. <b>Face Protection:</b> Face shields are to be used when there is no protection from the hood sash. <b>Hand Protection:</b> Confirm compatibility of glove material with chemical being used. General guidance (unless otherwise specified in the specific SDS): Nitrile gloves must be used to prevent incidental contact. For spill handling or for potential contact with larger quantities, use double nitrile or heavier gauge nitrile or neoprene gloves. Gloves must be inspected prior to use. Wash and dry hands after use. <b>Clothing:</b> Wear Nomex IIIA (NFPA 2112) lab coat; full length pants or equivalent; and close-toed and close-heeled shoes.	<u>General Procedure:</u> Add these Self-Heating Substances reagents to reactions in a slow and controlled manner. Avoid vigorous or exothermic reactions and the buildup of pressure within a reaction vessel. Cool if necessary. Adequate ventilation (pressure bubbler on Schlenk manifold or an equilibrating balloon) has to be used to prevent dangerous over pressurization.  For quenching procedure, see “Quenching of Self-Heating Substances and Mixtures” SOP.
<b>Notes</b>	Any deviation from this SOP requires approval from PI.			





**13. Documentation of Training (signature of all users is required)**

- Prior to conducting any work with Self-Heating Substances designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with the substance(s), work area decontamination, and emergency procedures.
- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.

I have read and understand the content of this SOP:

Name	Signature	Identification	Date



# Self-Heating Substances and Mixtures

Chemical Class Standard Operating Procedure

Berkeley **EH&S**

## List of Chemicals

Chemical(s)	Chemical(s)	Chemical(s)
azidodicarboxamide	cobalt octacarbonyl	dicobalt octacarbonyl
lithium tert-butoxide	magnesium	potassium methoxide
sodium dithionite	sodium methoxide	sodium tert-butoxide
lithium methoxide		