General Use Standard Operating Procedure (SOP)

Self-Reactive and Self-Heating Chemicals

**Explosives

Globally Harmonized System pictogram Indicating a chemical is an explosive hazard. Flammable

Globally Harmonized System pictogram Indicating a chemical is a flammable hazard.**

*Globally Harmonized System Hazard Class: Self-heating substances or mixtures; Self-reactive substances or mixtures*

*Examples: acrylonitrile, ammonium perchlorate, ethyl acrylate, vinyl acetate, azides, picric acid, nitrate esters*

**Note**: This SOP is intended to provide general guidance on how to safely work with self-reactive/self-heating chemicals and only addresses safety issues specific to self-reactive/self-heating chemicals. Other hazard classes may also apply. Review Safety Data Sheets (SDS) and refer to other general use SOPs relevant to the chemical you are working with. Contact the Principal Investigator/ Laboratory Supervisor or the WSU Chemical Hygiene Officer for questions concerning the applicability of any item listed in this SOP (OEHS: 313-577-1200).

**If the chemical of interest is a particularly hazardous substance or a high risk chemical a lab specific SOP is required.**

# Hazard Description

According to the Globally Harmonized System of Classification and Labeling of Chemicals (GHS):

* Self-reactive substances are thermally unstable liquid or solid substances or mixtures liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). This definition excludes substances or mixtures classified under the GHS as explosive, organic peroxides or as oxidizing.
* A self-heating substance is a solid or liquid substance, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat; this substance differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

Self-reactive or self-heating substances/mixtures may:

* Undergo vigorous polymerization, condensation or decomposition.
* Become self-reactive/self-heating under conditions of shock, light, increase in pressure/temperature or in contact with other materials such as water and air.
* React violently in an uncontrolled manner releasing heat, toxic gases, or causing explosion resulting in injuries or costly accidents.

# Control of Hazards – General

* Conduct a hazard assessment to identify proper use and handling techniques, fire safety, storage, and waste disposal issues specific to the chemical being used.
* Only trained personnel should work with highly reactive chemicals.
* Do not use self-reactive/self-heating chemicals if less-hazardous alternatives are possible.
* Purchase, dispense, and use the smallest quantity of highly reactive chemicals possible.
* Purchase the lowest concentration of chemicals that will meet your research needs.
* Purchase self-reactive/self-heating chemicals that include inhibitors when such products are available. Inhibitors are added to products to slow down or prevent an unwanted reaction such as polymerization.
* Minimize the quantity of self-reactive/self-heating chemicals used or synthesized to the smallest amount needed.
* Use material specific specialized procedures and control equipment when handling self-reactive/self-heating chemicals.
* Handle self-reactive/self-heating chemicals with caution. Appropriate chemical-specific precautions must be taken for mixing even small quantities with other chemicals.
* 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.
* Provide a mechanism for adequate temperature control and heat dissipation.
* Utilize blast 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.
* Glass equipment operated under vacuum or pressure must be shielded, wrapped with tape, or otherwise protected from shattering.
* Before conducting the actual procedure, always perform a dry run (without the highly reactive material) to identify and resolve possible safety hazards.
* Work with self-reactive/self-heating compounds in areas that you have designated especially for this work.
* Post a sign on the fume hood warning of the hazards inside when a process involving self-reactive/self-heating compounds is left unattended.
* Remove all other incompatible chemicals and hazardous materials from the work area.
* Be aware of nearby processes and other conditions that may affect the stability of the self-reactive/self-heating chemicals. Examples are adjacent sources of heat or light, which may increase the likelihood of uncontrolled chemical reactions.
* **Do not** work alone when using self-reactive/self-heating substances. Work within sight and/or hearing of at least one other person who is familiar with the hazards and written SOP.

# Engineering/Ventilation Controls

* As many reactive materials liberate combustible and/or toxic gas when exposed to water vapor or air, they should be used in a chemical fume hood to prevent hazardous buildup of gases and protect lab personnel.
* The chemical fume hood sash also acts as a blast shield in case of violent reactions. When actively working in the hood maintain the sash at the designated level for adequate air flow. Close sash when leaving reaction unattended.
* Use Glove boxes for working with self-reactive chemicals which require inert or dry atmospheres.

# Personal Protective Equipment

In addition to proper street clothing (long pants or equivalent that cover legs and ankles, close-toed non-perforated shoes that completely cover the feet), wear the following Personal Protective Equipment (PPE) when performing lab operations/tasks:

* Safety glasses (If splash potential exists, use goggles + face shield instead)
* Lab coat.
  + Hazard assessment of procedures may indicate the need for a flame resistant lab coat, such as Nomex.
* Appropriate chemical‐resistant gloves.
* Refer to Section 8 “Exposure controls/personal protection” of SDS or a glove selection guide (e.g. [Ansell Chemical Protection Guide](https://www.ansellguardianpartner.com/chemical/home#hp)) to identify appropriate glove type.
* Additional fire resistant gloves may be necessary depending on the task.

Additional PPE for potentially explosive substances or by-products:

* Heavyweight gloves (such as anti-static PVC gauntlets)

# Special Handling Procedures and Storage Requirements

* Ensure careful handling of materials that may be sensitive to shock, heat, friction, or light.
* Ensure secondary containment and segregation of incompatible chemicals.
* Ensure chemical containers are dry and tightly closed.
* Follow any substance-specific storage guidance provided in SDS documentation. Refer to the Chemical Segregation Flow Chart for additional assistance in segregation and storage.
* Label all chemicals with date received and date opened. Routinely check for expiration dates as some highly reactive chemicals require disposal on or before the expiration date.
* Any chemicals with crystallization, visible discoloration, or liquid stratification potentially have undergone peroxidation and must not be used or otherwise disturbed. Refer to the Fact Sheet on Peroxide Forming Chemicals.

# Decontamination Procedures

* Decontamination procedures vary depending on the material being handled. The reactivity 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.
* See the chemical Safety Data Sheet to determine an appropriate decontamination method.

# Waste Disposal

* Highly reactive/ unstable materials intended for disposal are considered hazardous wastes.
* Many reactive/unstable materials have a short shelf life. **If you find a reactive chemical container that is damaged, bulging, past-expiration, leaking or otherwise compromised in any way, do not handle the container. Move away from the area and prevent others from entering the area. Immediately contact OEHS to arrange safe disposal.**

Do not dispose of waste by dumping down a drain or discarding in regular trash containers, unless authorized in writing by OEHS. [Submit requests to OEHS](https://research.wayne.edu/oehs/forms/chem-waste) for waste containers, labels, and waste collection. Also, refer to the [OEHS Hazardous Waste Management web page](http://research.wayne.edu/oehs/hazardous/index.php) and [WSU Chemical Hygiene Plan](http://research.wayne.edu/oehs/pdf/chemical-hygiene-plan.pdf) for more information.

# Spill procedures

1. **Spills**

For hazardous material spills or releases which have impacted the environment (via the storm drain, soil, or air outside the building) or which cannot be cleaned up by local personnel due to size of spill, hazard level, or hazards are unknown:

* 1. Call WSU Police (313) 577-2222. Available 24 hours a day, 7 days a week.
  2. Evacuate the spill area
  3. Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering.
  4. Remain in the vicinity until emergency personnel arrive and provide them with information on the chemicals involved.

For additional information regarding spill response procedures, refer to the [OEHS chemical spill response guidelines](http://research.wayne.edu/oehs/chemical/spills), [WSU Chemical Hygiene Plan](http://research.wayne.edu/oehs/pdf/chemical-hygiene-plan.pdf) and [American Chemical Society (ACS) guide for chemical spill response](https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/publications/guide-for-chemical-spill-response.html).

1. **Small Spills**

**Note: Small spill cleanup procedures may vary based on the hazardous class type of the highly reactive chemical. Always refer to the chemical specific SDS and hazard class specific general SOPs relevant to the chemical spilled.**

In the event of a minor spill or release that can be safely cleaned up by local personnel using readily available equipment (e.g. absorbent materials) and appropriate PPE:

* 1. Alert personnel in the immediate area of spill and restrict access.
  2. Eliminate all sources of ignition.
  3. Increase ventilation in area of spill (turn on fume hood and open sash, open windows). Vent vapors to outside of building only.
  4. Review the SDS for the spilled material, or use your knowledge, to assess the hazards and to determine the appropriate level of protection.
     1. **DO NOT** clean up spills requiring respiratory protection. Contact OEHS for help (313-577-1200).
  5. Choose appropriate personal protective equipment (e.g. goggles, face shield, chemical resistant gloves, lab coat or apron).
  6. Protect floor drains, sinks or other potential avenues of environmental release as much as possible. Make a dike around the outside edges of the spill using absorbent materials.
  7. For solid spills: Use a scoop and brush or other suitable non-combustible items to collect spilled material. Minimize dust generation.
  8. For liquid spills: Cover the liquid with appropriate non-combustible absorbent material (NO paper towel), working from the spill's outer edges toward the center.
  9. Collect spill cleanup materials using a scoop or other suitable items and place in a tightly closed hazardous waste container.
  10. After spilled material is removed, decontaminate surfaces with water or other appropriate solvent.
  11. Place all contaminated materials, including contaminated items such as gloves, in the hazardous waste container.
  12. Label waste container with completed hazardous waste tag (available from OEHS).
  13. Submit online [waste pickup request](https://research.wayne.edu/oehs/hazardous/chemical-waste.php) to OEHS.

# Emergency Procedures

**\*\*If medical attention required, call WSU police (313-577-2222) immediately\*\***

* **Fire Extinguishers** – Refer to section 5 of the SDS for chemical specific firefighting measures. Both ABC dry powder and carbon dioxide extinguishers are appropriate for most fires.
* **Eyewash/Safety Showers** – Depending on the chemical hazard type, an ANSI approved eyewash station and safety shower may be required, easily accessed, and available within 10 seconds travel time for emergency use. Instruct personnel on the locations of eyewashes and safety showers, and how to activate them, prior to an emergency. Refer to [MIOSHA Fact Sheet: Eyewashes and Safety Showers](https://www.michigan.gov/documents/lara/lara_miosha_cet0199_628109_7.doc) to determine if an eyewash/safety shower is required for your specific chemical.

Please note: Additional hazards present in the laboratory may require that an eyewash or safety shower be present. This emergency equipment is required for treating exposures to workplace hazards such as chemical splashes, biological agents, welding sparks, metal shavings, or fine particulates like dust, dirt and sand.

1. **Health Threatening Emergencies**
   1. **Fire, explosion, health threatening hazardous material spill or release, compressed gas leak, or valve failure.**
      1. Call WSU Police (313) 577-2222.
      2. Alert people in the vicinity and activate the local alarm systems.
      3. Evacuate the area and go to your Emergency Assembly Point.
      4. Remain nearby to advise emergency responders.
      5. Once personal safety is established, call OEHS at (313) 577-1200.

Note: For compressed gas leaks, shut off gas supply only if this can be done safely, without risk to personnel.

* 1. **Injuries and Exposures:** 
     1. Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
     2. Call WSU Police (313) 577-2222.
     3. Administer first aid as appropriate.
        1. Eye contact: Promptly flush eyes with copious amounts of water for a prolonged period (at least 15 minutes). Seek medical attention.
        2. Ingestion: Seek medical attention IMMEDIATELY. See first aid section of chemical Safety Data Sheet.
        3. Skin contact: Remove any contaminated clothing. IMMEDIATELY flush contamination from skin using the nearest emergency shower for a minimum of 15 minutes. Seek medical attention.
        4. Inhalation: Get to a source of fresh air. Seek medical attention.
     4. Call OEHS (313) 577-1200, to report the exposure and complete [Report of Injury](https://risk.wayne.edu/files/rofi.pdf) form.
     5. Bring to the hospital copies of the Safety Data Sheets for all chemicals to which the victim was exposed.

1. **Non-Health Threatening Emergencies**
   1. **Injuries and Exposures**

For injuries and exposures that are not considered serious or a medical emergency, visit:

Henry Ford Occupational Health – Harbortown

3300 East Jefferson, Suite 100

Detroit MI 48207

(313) 656-1618

Monday – Friday 8:00 AM to 6:30 PM

If Henry Ford Occupational Health Center is closed or for serious injuries, visit:

Henry Ford Hospital – Emergency Room

2799 W. Grand Blvd.

Detroit MI 48202

(313) 916-8742

OR

Detroit Receiving Hospital - Emergency Room

4201 St. Antoine St, Detroit, MI 48201

Phone: (313) 745-3000

# Minimum Training Requirements

1. **General Training:**

* Online through the [Collaborative Institutional Training Initiative (CITI)](https://about.citiprogram.org/en/homepage/).
  + Laboratory Safety Training (general lab & chemical safety issues) and Hazard Communication
* [Fire Safety](https://risk.wayne.edu/fire-safety).

1. **Laboratory Specific Safety Training:**

* [Laboratory-Specific Safety Training](https://research.wayne.edu/oehs/docs/lab-safety-training-checklist.doc) checklist
* Review of SDS for chemicals involved in process/experiment.
* Review of this SOP.
* Review [WSU Hazardous Waste Management](https://research.wayne.edu/oehs/hazardous/chemical-waste) guidelines.
* Other: \_\_\_\_\_\_\_\_\_

# Laboratory Personnel Review

Prior to initiating work, lab personnel using these types of chemicals must complete the table below confirming that they have read and understood the above SOP and the associated hazards.

| Name | Signature | Date |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |