General Use Standard Operating Procedure (SOP)

Explosives



*Globally Harmonized System Hazard Class: Explosives*

*Examples: acetylides, azides, organic nitrates, nitro compounds and organic peroxides*

**Note**: This SOP is intended to provide general guidance on how to safely work with explosive chemicals and only addresses safety issues specific to explosive 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

An explosive chemical is a solid or liquid substance (or mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. This rapid chemical change can occur when a chemical or mixture is subjected to heat, impact, friction, detonation, or other suitable initiation. The term applies to materials that either detonate or deflagrate. May explode and throw fragments which can cause physical damage. Fire may produce irritating, corrosive and/or toxic gases.

*(OSHA 1910.1200 App B Physical Criteria) [Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (section 4.D.3.1 Explosive Hazards) The National Academies Press: Washington, DC, 2011]*

# Control of Hazards - General

* Do not use explosive chemicals if less-hazardous alternatives are possible.
* Purchase, dispense, and use the smallest quantity of explosive chemicals possible.
* Purchase the lowest concentration of explosive chemicals that will meet your research needs.
* Limit your inventory of explosive chemicals.,
* The scale of work is critical. It should be done at the smallest scale possible and scaled up only with the authorization of the Principle Investigator/Supervisor.
* Keep away from heat, sparks, open flames and hot surfaces.
* Avoid the use of metal spatulas and needles when working with compounds for which metal ions may catalyze explosive decomposition reactions.
* Avoid the use of ground-glass joints when working with compounds for which friction or mechanical shock may trigger explosion.
* Do not subject the chemical to crushing, grinding, shock or friction.
* Do not scrape explosives from surfaces.
* Identify and eliminate sources of static discharge since this can be an initiating force for some explosives. Sources of static include clothing, use of plastic, and transfer of materials between containers. If the explosive is electrostatically sensitive, ground/bond the container and receiving equipment
* Consult SDS and lab specific SOPs developed for the specific explosive used. Do not handle explosive chemicals until all safety precautions have been read and understood.
* If drying out increases the explosion hazard of a chemical, keep the chemical wetted.
* Immediately request disposal of any organic compounds that are prone to peroxidation (e.g. secondary alcohols) due to contamination.
* Do not handle explosive chemicals when working alone. Work within sight and/or hearing of at least one other person who is familiar with the hazards and written procedures.
* Notify other lab occupants when you will be actively working with potentially explosive compounds.
* Post a sign on the fume hood when it contains a process involving potentially explosive compounds.
* Immediately close all containers of explosive chemicals after use and return them to their designated storage location.
* Remove all other chemicals and hazardous materials from the work area.
* Keep the work area, tools and equipment scrupulously clean. Ensure the threads of explosive containers are free of chemical residues and clean. Do not allow explosives to build up.
* Be aware of nearby processes and other conditions that may affect the stability of the explosive chemicals. Examples are adjacent sources of heat or light, which may increase the likelihood of uncontrolled chemical reactions.
* Do not return unused portions of potentially explosive chemicals to their original container. Dispose as waste.
* Conduct a hazard assessment to identify proper use and handling techniques, fire safety, storage, and waste disposal issues specific to the chemical being used.
* Conduct a dry run of the experiment to help identify and correct potential hazardous contributing factors.

# Engineering/Ventilation Controls

* Explosive chemicals should be used in a chemical fume hood or other ventilated enclosures (e.g. glove box) whenever possible.
* Safety shields (i.e. blast-protective shields) must be used when:
	+ a reaction is attempted for the first time (small quantities should be used to minimize hazards),
	+ a familiar reaction is carried out on a significantly larger scale than usual (e.g. 5-10 times more material), or
	+ operations are carried out at increased temperature and/or pressure.
* Safety shields must be placed so all laboratory workers in the area are protected from the explosion hazard.
* Use an anti-static mat and anti-static gun when handling explosives.
* Ground equipment and containers.

# 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)
* 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

* Store explosive chemicals away from incompatible materials, including flammable materials and oxidizers, ideally in separate cabinets. If space is limited, store all compatible explosives in sealed secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as incompatible chemicals is acceptable. Use a separate shelf for explosives if stored in the same cabinet as incompatible chemicals.
* Never store on open shelves or lab benches.
* Transport and handle explosive chemicals as little as possible.
* Consult SDS for more specific information on compatibility and storage requirements.
* Record the receipt date, opening date and the date the chemical should be discarded on the label of explosive chemicals or chemicals that may degrade to become potentially explosive.

# Decontamination Procedures

Refer to SDS for compatible solvent and materials to use for decontamination.

# Waste Disposal

* Dispose of explosive chemicals as soon as possible. Explosive waste should not be allowed to accumulate.
* Where possible dilute explosive wastes in a safe solvent, since many explosives are more stable when dilute.
* Store explosive wastes separate from other wastes.

**IF YOU FIND A REACTIVE OR EXPLOSIVE 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. CONTACT OEHS IMMEDIATELY!**

Do not dispose of waste by dumping down a drain or discarding in regular trash containers, unless authorized 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

**In the case of a spill of explosive chemicals, do not attempt to clean the spill yourself. Evacuate the area and follow the Emergency Procedures outlined below.**

# 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 |
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