General Use Standard Operating Procedure (SOP)

Oxidizers

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*Globally Harmonized System (GHS) Hazard Class: Oxidizing liquids, solids, and gases*

*Examples: oxygen, nitrous oxide, nitric acid, perchloric acid, halogens (e.g., bromine, chlorine, and fluorine), hydrogen peroxide, bromates, perchlorates, chlorates, chlorites, hypochlorite, nitrates, nitrites, dichromate, persulfates periodates, permanganates and peroxides.*

**Note**: This SOP is intended to provide general guidance on how to safely work with oxidizers and only addresses safety issues specific to oxidizers. 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 oxidizer is a chemical that brings about an oxidation reaction. In an oxidation reaction, the oxidizer may provide oxygen to the substance being oxidized (in which case the oxidizer has to be oxygen or contain oxygen), or it may receive electrons being transferred from the substance undergoing oxidation (e.g., chlorine is a good oxidizer for electron-transfer purposes, even though it contains no oxygen).

Oxidizing liquid or solid – while in itself is not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. Spontaneously evolve oxygen at room temperature or with slight heating.

Oxidizing gas – any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does. This includes pure gases or gas mixtures with an oxidizing power greater than 23.5%.

See Safety Data Sheet (SDS) for chemical specific hazard information.

Physical Hazards

* These substances will accelerate burning when involved in a fire.
	+ May ignite combustibles (wood, paper, oil, clothing, etc.)
* Some may decompose explosively when heated or involved in a fire.
* Some oxidizing solids may present explosion hazards under certain conditions (e.g. when stored in large quantities).
* Some oxidizers may react vigorously and/or explosively with water.
* May explode from heat or contamination (mixed with combustible, organic or reducing materials).
* Some will react explosively with hydrocarbons (fuels).
* May ignite combustibles (wood, paper, oil, clothing, etc.).
* Containers may explode when heated.
* Runoff may create fire or explosion hazard

Health Hazards

* Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns or death.
* Fire may produce irritating, corrosive and/or toxic gases.

# **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.
* Do not use strong oxidizer chemicals if less-hazardous alternatives are possible
* Purchase the smallest containers at the lowest concentration practical.
* Minimize the quantities of oxidizers used and stored in the laboratory.
* Mixing smaller quantities may reduce generation of heat and help control the reaction.
* Keep containers of oxidizers tightly closed, to avoid spillage or contamination of the container contents.
* Never return "used" or unused oxidizers to original containers of uncontaminated material. Trace amounts of contaminant might cause a dangerous decomposition.
* Keep oxidizing materials away from heat,
* If procedures require use of strong oxidizers or mixing oxidizers with flammable or combustible materials, do not work alone.

# **Engineering/Ventilation Controls**

* Work in a chemical fume hood when:
	+ Performing procedures that may generate heat, gases, or toxic or irritating aerosols/fumes.
	+ When using perchloric acid or perchloric salts, if the possibility of the release of perchloric acid fumes exists, the process must be done in a chemical fume hood designed for perchloric acid use.

# **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.

# **Special Handling Procedures and Storage Requirements**

* Store away from organics, flammables, reducing agents, combustible materials, and any other materials that may be chemically incompatible.
* It is a best practice to segregate oxidizers from all other chemical classes because of their high reactivity potential with a broad range of chemicals.
* Store in a cool, dry location.
* Store below eye level but not on the floor.
* DO NOT use corks or rubber stoppers.
* DO NOT store on wooden shelves or in wooden cabinets.
* Oxidizing acids are highly reactive, and may react with each other. Provide separate secondary containment for each type of oxidizing acids (e.g. perchloric, nitric, Hydrobromic, iodic and chromic acid). Do not store different types of oxidizing acids in the same secondary container.
* Transport oxidizers in a bottle carrier.
* Oxidizing gas cylinders must be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures not to exceed 52 °C (125 °F).
* Oxidizing gas cylinders must be stored at least 20 feet away from flammable gas cylinders, or separated by a barrier.
* Follow any substance-specific storage guidance provided in SDS documentation.

# **Decontamination Procedures**

* Ensure adequate ventilation.
* Use non-combustible materials (**not** paper towels) for decontamination.
* Place decontamination materials in suitable, closed containers for disposal as hazardous waste.
* Once any standing material has been wiped away, clean contaminated surfaces with soap and water.

# **Waste Disposal**

Waste of oxidizing chemicals should be collected in compatible waste containers (i.e. plastic 5 gallon pails or carboys) and segregated from incompatible chemicals.

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**

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 (313) 577-1200 to report the exposure to OEHS 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:

University Health Center (UHC)

Monday-Friday 7:00 am – 4:30 pm

4201 St. Antoine Blvd, UHC 4K, Detroit, MI 48201

Phone: 313 745-4522

If University Health Center is closed or for serious injuries, visit:

Emergency Department - Detroit Receiving Hospital

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.

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| **Name** | **Signature** | **Date** |
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