Syracuse University

Laboratory Guidance Document

# Oxidizers

This Laboratory Guidance Document was created by Syracuse University Environmental Health & Safety Services (EHSS) to assist researchers in developing laboratory specific standard operating procedures for the storage, handling, and disposal of oxidizers.

## Properties

Oxidizers, oxidizing agents, and oxidants are chemicals that have the potential to spontaneously give off oxygen or other oxidizing substances at room temperature or at slightly elevated temperatures.

Oxidizers have the ability to:

- Speed up the development and make a fire more intense.
- Increase the flammability of substances including substances that do not normally burn in air.
- Causes materials that are combustible to burn spontaneously without the presence of obvious ignition sources.

There are four classes of oxidizers:

| Class | Description |
|---|---|
| 1 | Oxidizers that do not moderately increase or cause a slight increase in the burning rate of the combustible materials with which they come into contact. |
| 2 | Oxidizers that do moderately increase the burning rate of the combustible materials with which they come into contact. |
| 3 | Oxidizers that will cause a severe increase in the burning rate of the combustible materials with which they come into contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat. |
| 4 | Oxidizers that will cause a severe increase in the burning rate of the combustible materials with which they come into contact and will undergo an explosive reaction due to contamination or exposure to thermal or physical shock. |

Examples of oxidizers are oxygen, perchlorates, peroxides, chlorates, nitrates, and permanganates.

## Potential Hazards

1. Fire

A fire can be described by the fire triangle (Figure 1), where a fire can only burn with all three of the following: oxygen, heat, and fuel. As an oxidizer is burned, it decomposes and a product of that decomposition is an oxidant (typically oxygen). The increase in oxidant fuels the fire, increasing the burn rate.

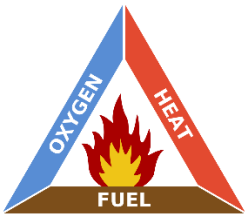

Figure 1. The fire triangle, each piece is required for a fire to burn.

The presence of an oxidizer widens the flammable range of a material, combustible or not-combustible, by lowering the flashpoint and the ignition temperature and allowing for easier ignition.

Oxidizers that are mixed with flammables have an increased risk of catching fire than if the oxidizer weren't

2. **Toxicity**

Oxidizers react with tissue, including skin, eyes, and lungs and oxidize the material they are in contact with. The effect of this reaction varies from oxidant to oxidant and can be minor or serious.

The by-products formed from the decomposition of an oxidizer that is being burned can react and can result in the formation of substances that are much more toxic than if the material was burned without the presence of the oxidizer.

## General Precautions:

Working with any oxidizer requires thorough planning and the consistent application of good work practices and skills to control the hazard while achieving the goal of the experiment.

1. **Training**

   The Principal Investigator is responsible for ensuring all personnel under their supervision are made aware of hazards of oxidizers, have received the appropriate hands-on training, adhere to the laboratory standard operating procedures, and are provided with the appropriate personal protective equipment.

2. **Awareness**

   The hazard of working with an oxidizer varies from oxidizer to oxidizer. Working with any oxidizer requires prior research of the chemical to determine the level of risk one will be exposed to while working with the chemical. This includes: the strength of the oxidizer, incompatibilities with other chemicals, and proper storage and handling.

## Personal Protective Equipment (PPE):

In addition to the standard laboratory attire (i.e., long pants and closed toe shoes), the following PPE is recommended:

- ANSI certified (Z87) chemical splash goggles
- Knee-length lab coat
  NOTE: A flame resistant (FR) lab coats should be worn when working with an oxidizer.

- Nitrile gloves

## Best Practices for the Working with Oxidizers:

- The SDS should be referenced to determine class of the oxidizer to assess the risk of the oxidizer.
- Procure and store only the smallest practical quantities for the experiment performed.
- When using solutions of oxidizers, use the most diluted solution that is practically possible for the experiment to reduce the hazard.
- Conduct work involving oxidizers within a fume hood.
- Remove all flammables, reducing agents, and combustible material from the work area prior to use.
- Combine oxidizers with all materials using well established procedures. For materials where no established procedures exist, a trial procedure should be conducted with the smallest practical amounts to assess the hazard.
- If an oxidizer will be used with a flammable or combustible material, add slowly and monitor to ensure heat generation is kept to a minimum.
- A hazard assessment with EHSS consultation should be conducted prior to any work with an oxidizer that is a class 3 or class 4 oxidizer. Experiments with these classes of oxidizers may be violent or explosive.
- A hazard assessment with EHSS consultation should be conducted prior to any work with perchloric acid or perchloric containing salts.
- Oxidizing gases (oxygen, chlorine) can react with metals and should only be used with the appropriate regulator for each gas.

## Storage Considerations:

- Store oxidizers away from organic, flammable, dehydrating, or reducing agents.
- Do not store oxidizers in wooden cabinets or on wooden shelves.

## Disposal:

- Oxidizers should be handled as hazardous waste.
- Oxidizers should be segregated from flammable waste and other hazardous waste.
- Place the waste container in the satellite accumulation area in secondary containment and notify the EHSS Hazardous Waste Group at 315.443.9132 for disposal.

## First Aid:

The chemical's SDS should be readily available and used as a reference for determining appropriate first aid measures. The following information provides typical first aid measures recommended for chemical exposures.

1. **Skin Contact:** Remove all contaminated clothing and rinse affected area with water for at least 15 minutes.
2. **Eye Contact:** Flush with water at an emergency eyewash station for at least 15 minutes.
3. **Ingestion:** Seek medical attention immediately.
4. **Inhalation:** Move to fresh air and seek medical attention immediately.

## Incident Response:

All laboratory emergencies must be reported to the Department of Public Safety at 315-443-2224.