

Peroxide-Forming Chemicals

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 safe storage, handling, and disposal of peroxide-forming chemicals (PFCs).

Potential Hazards:

Under normal storage conditions, formed peroxides can accumulate in the chemical container and may explode when subjected to heat, friction, or mechanical shock.

- PFCs are a serious fire and explosion hazard.
- PFCs are irritating to the eyes, skin, and respiratory tract, and may cause drowsiness and dizziness.
- Opened and partially emptied containers accelerate formation of peroxides. However, peroxides may still form in unopened containers.
- Refrigeration will not prevent peroxide formation.
- The addition of inhibitors or stabilizers to PFCs helps to slow peroxide formation but doesn't stop peroxides from forming.

General Precautions:

The use of PFCs requires extreme care; if not stored, handled, and disposed of properly, these materials pose a serious threat to the health and safety of laboratory personnel, emergency responders, and waste handlers.

1. Training.

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

2. Peroxide Testing.

Chemicals that have been identified as a PFC with a peroxide former label should be tested and disposed according to the guidance listed on the peroxide former label.

3. Visual Inspection.

Peroxide-forming chemicals that exhibit unusual visual characteristics (e.g., discoloration, crystallization, formation of a surface crust) should be assumed to contain dangerous levels of peroxides. *Materials that do not pass a visual inspection should never be opened or moved.*

Classification:

The following represents a typical classification scheme for PFCs; consult the manufacturer's Safety Data Sheet to determine the peroxide-forming potential of the specific chemical(s) in use.

List	Classification	Description
A	Severe Peroxide Hazard	Spontaneously decompose and become explosive after exposure to air, even without concentration.
B	Concentration Hazard	Requires external energy for spontaneous decomposition. Form explosive peroxides when distilled, evaporated, or otherwise concentrated.
C	Shock & Heat Sensitive	Highly reactive and can autopolymerize from internal peroxide accumulation. Peroxides formed in these reactions are extremely shock and heat sensitive.

Labeling

PFC container(s) in packages will be labeled with a green PFC label at central receiving.

WARNING

MAY FORM EXPLOSIVE PEROXIDES

CLASS A Peroxide Former

Dispose of at **3 months** or manufacturer's expiration date

Date Received: _____

Date Opened: _____

Date Expires: _____

Contact EHSS at 315.443.4132 or ehss@syr.edu

WARNING

MAY FORM EXPLOSIVE PEROXIDES

Date Received: _____ Date Opened: _____

Date Expires: _____

Peroxide Former: **CLASS B** **CLASS C**

Dispose of at **12 months** or manufacturer's expiration date; tested every **3 months**

TEST DATE	RESULT	INITIALS

≥ 25 ppm: Recommended disposal
≥ 100 ppm: Required disposal

Contact EHSS at 315.443.4132 or ehss@syr.edu

Each class of PFC (A, B, C) has specific handling requirements. Class A PFCs are the most hazardous and have the strictest requirements.

- Date Container Received: This date is entered upon receipt at EHSS Chemical Receiving.
- Date Container Opened: The lab must enter this date when the container is opened.

Testing

Unexpired PFCs should be tested for peroxide content prior to use and at a minimum of what is recommended in the table below.

Class	Testing Frequency
A	Not required but recommended before use
B	Every 3 months and before concentrating
C	Every 3 months

Testing Instructions (Quantofix Peroxide Test Strips)

- Open the PFC container and dip the test strip into the PFC chemical for 1 second.

- Identify which color on the scale most closely matches the color on the test strip.
- Record the number (ppm) for the color that most closely matches the test strip on the green PFC label.

Evaluating Testing Results

- Results at **0-25 ppm** - Continue to use and periodically test the PFC according to the EHSS PFC label.
- Results at **>25 ppm** - Do not concentrate. Disposal is recommended.
- Results at **≥100 ppm** - Do not use. Contact EHSS for immediate disposal.

Disposal and Waste Management

Expired PFCs, containers of unknown age or history, and containers with visible abnormalities should be treated as potential explosives. Steel containers that have visible rust may also be extremely dangerous. Contact the EHSS Hazardous Waste Group at 315-443-6545 for assistance with any such containers.

The following table lists the recommended expiration dates for the different classes of PFCs:

Class	Expiration Date
A	Dispose of by the manufacturer's expiration date, or 3 months after the date received.
B	Dispose of by the manufacturer's expiration date, or 12 months after date received.
C	

Storage Considerations:

The rate of peroxide formation is dependent on the specific chemical, the amount of air exposure, and if the chemical contains a peroxide inhibitor.

- Procure and store only the smallest practical quantities for the experiment performed.
- Label PFC containers with the opened date.
- Store in airtight containers in a dark and dry area away from heat and sunlight.
- Do not store PFCs below the temperature at which the compound freezes or precipitates.
- Whenever possible, store PFCs from List A & B under inert gas to slow peroxide formation - consult the manufacturer's SDS for more information.

Best Practices for the Safe Handling of Peroxide-Forming Chemicals:

1. Review the Safety Data Sheet (SDS), laboratory standard operating procedure (SOP), and emergency procedures before starting any protocols requiring PFCs.
2. Post a hazard warning sign (*Appendix I*) in all storage and use areas.
3. Periodically test PFCs for peroxide accumulation as described in the Peroxide Testing section of this document. Record the date and peroxide content on the label.
4. Dispose of all PFCs by the expiration date.
5. If available, purchase PFCs that contain peroxide inhibitors or stabilizers added by the manufacturer.
6. Test for peroxides before evaporation or distillation.
7. Store in the original manufacturer's container whenever possible.
8. Inspect the container lid and contents for discoloration, crystals, or other solids before use.
9. Protect containers from heat, friction, and shock.
10. Never attempt to force open a rusted or stuck cap on a PFC container.
11. Replace caps promptly after use.

12. Never return unused quantities back to the container.

Personal Protective Equipment (PPE):

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

- ANSI certified (Z87+) impact-resistant splash goggles
- Full face shield
- Knee-length lab coat
- Chemically compatible gloves

First Aid:

The manufacturer'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.

References:

[National Institutes of Health Chemical Safety](#)

[Prudent Practices in the Laboratory](#)

[Bretherick's Handbook of Reactive Chemical Hazards](#)

[Management of time-sensitive chemicals \(II\): Their identification, chemistry and management \(CHAS\)](#)

[Peroxides and Peroxide Forming Compounds \(Clark\)](#)

Appendix I. Hazard Signage.

Post this warning sign at all storage and use areas.

