HUNTER COLLEGE ehs www.hunter.cuny.edu/ehs

Office of Environmental Health and Safety

Handling and Disposal of Peroxidizable Chemicals (Peroxide-Formers)

Introduction:

It is very important to note that there are organic compounds in different physical phases - mostly liquid and few are gas that form peroxide even during storage. Formation of peroxides results by the reaction of the chemical with the oxygen from air which usually enters the container when it is opened for the first time. This process of peroxide-formation happens at varying rates and factors.

Organic peroxides are sensitive to heat, shock and friction to varying degrees. Some peroxides quickly build up to high levels that make them very explosive while others are only explosive on concentration (e.g. after distillation). Although there is no specific rule nor mandate on what level of peroxides pose a significant hazard, a good rule of thumb is “any peroxide formation below 10 ppm is “safe”. Any peroxide level detected above 10 ppm needs deperoxidation or immediate disposal as hazardous waste. ***Contact Environmental Health and Safety (EHS) office at (212) 772-4462 for hazardous wastes disposal of peroxide forming chemicals.***

Objective:

This program is aimed at providing information on proper handling and disposal of peroxide-forming chemicals found/used at Hunter College, particularly in the laboratories and classrooms.

Requirements:

In order to prevent potential explosion and unsafe conditions as a result of peroxidation of some chemicals, the following requirements must be observed and complied with:

I. Labeling of Containers

All peroxide-forming chemicals shall be labeled with "WARNING PEROXIDE FORMER or POTENTIAL EXPLOSIVE PEROXIDE" and the following information:

1. Date of Purchase/Receipt
2. Opening date (date when the container is first opened)
3. Required Disposal date (material must be disposed of by this date). Disposal dates of peroxide-formers vary by class or group. Please see table of Peroxide-formers under different group/class below.

Here's the official label to be placed on the container:

WARNING-PEROXIDE FORMER

This material will form explosive peroxides during storage and must not be kept for more than _____months after opening.
(see Peroxide Policy at
http://www.hunter.cuny.edu/ehs)

Date Received_____
Date Opened _____

Please call Environmental Health and Safety office (x 4462) for labels.

II. Storage Procedures

In order to safely manage chemicals that have the potential for forming heat and shock sensitive peroxides stored and handled in the laboratories, the following should be observed and followed:

- Order/Purchase the smallest possible container size for your needs, probably enough amounts of chemical to cover 3-6 months use.

- Store peroxide formers in sealed, air-impermeable containers such as dark amber glass with a tight-fitting cap.

- Use metal cans when storing diethyl ethers, as Iron inhibits the formation of peroxides in some materials. Ground glass stoppered bottles and plastic containers are not advisable, however, plastic squeeze bottles may be used for small quantities of some materials, such as 2-propanol, for immediate use.

- Store peroxide formers possible in a dark area.
- Purchase chemicals with inhibitors added when applicable.
- Test for existence of peroxides for any material prior to distillation. Most explosions recorded in a laboratory setting were related to peroxide-formers distilled to dry. Make sure to leave 10-20% bottoms when doing this process.

III. Disposal Procedure per Class

A. Class 1 (Autopolymerizers):

These chemicals may autopolymerize and react violently to possibly explode when considerable amount of peroxides are formed. Chemicals in this class used in the laboratories **should be inhibited** when ordered from vendors. Uninhibited chemicals in this class can only be stored for up to **48 hours**. If inhibited, chemicals can be stored for **12 months.** Inhibited autopolymerizers should not be stored in inert atmosphere after opening, because some inhibitors require a small amount of oxygen to work.

Chemicals in this class should be tested for peroxide formation or **discarded after 12 months from open date**. If test shows absence of, or any peroxide level below 10ppm, the discard date can be **reset to 12 months from test date**. For any questions or clarifications about peroxidizable chemical disposal and extension, please contact Environmental Health and Safety (x 4462).

List of Class 1 (Autopolymerizers)

- ***Discard or Test for peroxides 12 months after opening***
- ***Chemicals in this list should be ordered Inhibited***

Peroxide Formers Class 1 (Inhibited)	# of Months Storage prior Discard or Test for Peroxides (after Open Date)	If Peroxide Level is 0 - 10ppm; Disposal Date Reset/Extended for: (after Test Date)
1,3-butadiene (when stored as gas)	12 Months	12 Months
2-chloro-1, 3-butadiene	12 Months	12 Months
9,10-dihydroanthracene	12 Months	12 Months
acrylic acid	12 Months	12 Months
Acrylonitrile	12 Months	12 Months
chloroprene (when stored as gas)	12 Months	12 Months
dibenzocyclopentadiene	12 Months	12 Months
Indene	12 Months	12 Months
methyl methacrylate	12 Months	12 Months

Continuation for Class 1 list…		
Styrene	12 Months	12 Months
Tetrafluoroethylene (when stored as gas)	12 Months	12 Months
vinyl acetate	12 Months	12 Months
vinyl acetylene	12 Months	12 Months
vinyl chloride	12 Months	12 Months
vinyl pyridine	12 Months	12 Months
vinylidene chloride	12 Months	12 Months

B. Class 2 (Concentration Peroxides)

These peroxidizable chemicals listed below pose hazards when they evaporate from the container, which then concentrates any peroxide build up. This class of chemicals has a tendency to explode when used in experiment procedures such as distillation. Some very volatile chemicals like Diethyl ethers may evaporate if stored without a cap or with a cap but not sealed properly, and the resulting concentrated, peroxidized material may be shock sensitive.

Chemicals in this class should be tested for peroxide formation or **discarded after 12 months from open date**. If test shows peroxides are not present or any level below 10ppm, the discard date can **be reset to 6 months from test date**. For any questions or clarifications about peroxidizable chemical disposal and extension, please contact Environmental Health and Safety (x 4462).

List of Class 2 (Concentration Peroxide Formers)

- **Test for the Presence of Peroxides Prior to Distillation or Evaporation**
- **Discard or test for peroxides 12 months after opening**

Peroxide Formers (Class 2)	# of Months Storage prior Discard or Test for Peroxides (after Open Date)	If Peroxide Level is 0 - 10ppm; Disposal Date Reset/Extended for: (after Test Date)
1-Phenylethanol	12 Months	6 Months
2-Butanol	12 Months	6 Months
2-Cyclohexen-1-ol	12 Months	6 Months
2-Hexanol	12 Months	6 Months
2-Pentanol	12 Months	6 Months
2-Phenylethanol	12 Months	6 Months
2-Propanol	12 Months	6 Months
3-Methyl-1-butanol	12 Months	6 Months
4-Heptanol	12 Months	6 Months
4-Methyl-2-Pentanol	12 Months	6 Months
4-Methyl-2-Pentanone	12 Months	6 Months
4-Penten-1-ol	12 Months	6 Months

Continuation for Class 2 list…		
Acetal	12 Months	6 Months
Acetaldehyde	12 Months	6 Months
Benzyl alcohol	12 Months	6 Months
Butadiyne (butadiene)	12 Months	6 Months
Cellosolves	12 Months	6 Months
Chlorofluoroethylene	12 Months	6 Months
Cumene	12 Months	6 Months
Cyclohexanol	12 Months	6 Months
Cyclohexene	12 Months	6 Months
Cyclopentene	12 Months	6 Months
Decahydronaphthalene	12 Months	6 Months
Decalin	12 Months	6 Months
Diacetylene (butadiene)	12 Months	6 Months
Dicyclopentadiene	12 Months	6 Months
Diethyl ether	12 Months	6 Months
Diethylene glycol dimethyl ether	12 Months	6 Months
Diglyme	12 Months	6 Months
Dioxanes	12 Months	6 Months
Ethyl ether	12 Months	6 Months
Ethylene glycol dimethyl ether	12 Months	6 Months
Ethylene glycol ether acetate	12 Months	6 Months
Furan	12 Months	6 Months
Glyme	12 Months	6 Months
Isopropyl alcohol	12 Months	6 Months
Isopropyl benzene	12 Months	6 Months
Methyl acetylene	12 Months	6 Months
Methyl isobutyl ketone	12 Months	6 Months
Methylcyclopentane	12 Months	6 Months
Tetrahydrofuran	12 Months	6 Months
Tetrahydronaphthalene	12 Months	6 Months
Tetralin	12 Months	6 Months
Vinyl ethers	12 Months	6 Months

C. Class 3 (High Hazard Peroxide Formers)

The chemicals listed below pose severe hazard when potentially explosive levels of peroxides are formed. They can form peroxides spontaneously without concentration that will make the chemical shock or heat sensitive especially after exposure to air and prolonged storage.

Chemicals in this class should be tested for peroxide formation or **discarded after 3 months from open date**. If test shows peroxides are not present or any level below 10ppm, the discard date can be **reset to 3 months from test date**.

For any questions or clarifications about peroxidizable chemical disposal and extension, please contact Environmental Health and Safety (x 4462).

List of Class 3 (High Hazard Peroxide Formers)

- **Severe Peroxide Hazard on Storage with Exposure to Air**
- **Test within 3 months of opening**

Peroxide Formers (Class 3)	# of Months Storage prior Discard or Test for Peroxides (after Open Date)	If Peroxide Level is 0 - 10ppm; Disposal Date Reset/Extended for: (after Test Date)
butadiene *(when stored as a monomer)*	3 Months	3 Months
chloroprene (when stored as a monomer)	3 Months	3 Months
divinyl acetylene	3 Months	3 Months
isopropyl (diisopropyl) ether	3 Months	3 Months
potassium amide	3 Months	3 Months
potassium metal	3 Months	3 Months
sodium amide	3 Months	3 Months
tetrafluoroethylene (when stored as a monomer)	3 Months	3 Months
vinylidene chloride six	3 Months	3 Months

IV. Procedure for Peroxide Testing

Any peroxidizable chemical should be tested for presence of peroxide after its expiration date. If you determine the container is safe to open, test the peroxide-forming chemical with a commercial test strip. These strips can be purchased from most laboratory equipment supply vendors. Commercial test strips have a test range of 0.5 to 50 ppm (mg/L) or 3 to 100 ppm.

Any chemical tested with a peroxide level more than 10 ppm cannot be extended for use and needs to be disposed of promptly though EHS. However, chemicals that did not show any peroxides can be extended per expiration date extension requirements on its class e.g. 12 months for Class 1 chemicals, 6 months for Class 2, and 3 months for Class 3.