



# Peroxide Forming Compounds

## Reference Guide

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### PURPOSE:

This reference guide aims to promote the safe storage, handling, and disposal of peroxide forming compounds.

### KEY CONSIDERATIONS:

- Peroxide forming chemicals are particularly dangerous compounds that react with oxygen in the air to form unstable peroxides.
- Once peroxides have formed, they can detonate when combined with other compounds or when disturbed by unusual heat, mechanical shock, impact or friction.
- If a peroxide former has crystals inside or around the cap, precipitation, or cloudiness, do not move or disturb the container! Immediately contact EH&S for assistance ([labsafety@ehs.msstate.edu](mailto:labsafety@ehs.msstate.edu); 662-325-0026).
- Since most peroxide forming chemicals are packaged in atmospheres containing air, even unopened bottles can produce peroxides.
- Refrigeration does not eliminate peroxide formation.
- Stabilizers, such as BHT, do not entirely prevent peroxide formation but reduce the rate of formation.
- Stringent adherence to dating, disposal, and/or testing criteria are essential to reduce opportunities for accumulation of unstable peroxides and prevent incidents.

### PEROXIDE FORMING COMPOUND CLASSIFICATIONS:

There are four classes of peroxide forming compounds as defined by the [American Chemical Society](#).

- Class A - Severe Peroxide Hazards:**
  - Spontaneously decompose and become explosive with exposure to air without concentration.
  - Class A peroxide forming compounds include, but are not limited to:

Acetaldehyde diethyl acetal (often referred to as acetal)	Potassium amide
Butadiene (Liquid)	Potassium metal
Chloroprene (Liquid) (2-chloro-1,3-butadiene)	Sodium amide (sodamide)
Diisopropyl ether (isopropyl ether)	Tetrafluoroethylene (Liquid) (TFE)
Divinylacetylene (DVA)	Vinylidene chloride (1,1-dichloroethylene)

□ **Class B** - Concentration Hazards:

- Form explosive peroxides when distilled, evaporated, or otherwise concentrated.
- Class B peroxide forming compounds include, but are not limited to:

2-Propanol	Cyclohexene
2-Butanol	Decahydronaphthalene (decalin)
2-Cyclohexen-1-ol	Diacetylene (butadiene, gas)
1-Phenylethanol	Diethyl Ether (ether)
2-Phenylethanol	Dioxanes
2-Heptanol	Diethylene glycol dimethyl ether (diglyme)
2-Hexanol	Ethylene glycol dimethyl ether (glyme)
2-Pentanol	Furan (compounds)
4-Penten-1-ol	Methylacetylene
Acetals	Methyl cyclopentane
Acetaldehyde	Methyl isobutyl ketone (MIBK)
Benzaldehyde	Tetrahydrofuran (THF)
Cumene	Tetrahydronaphthalene (tetralin)
Cyclohexanol	Vinyl ethers

□ **Class C** – Shock and Heat Sensitive:

- Chemicals that may autopolymerize as a result of peroxide formation.
- Class C peroxide forming compounds include, but are not limited to:

Acrylic acid	Styrene
Acrylonitrile	Tetrafluoroethylene (Gas)
Butadiene (Gas)	Vinyl acetate
Chloroprene	Vinyl acetylene
Chlorobutadiene	Vinyl chloride (Gas)
Chlorotrifluoroethylene (Gas)	Vinyl pyridine
Methyl methacrylate	Vinylidene chloride

□ **Class D** – Potential Peroxide Forming Chemicals:

- Chemicals that may produce explosive peroxides but are not overtly placed in the prior categories.
- Class D peroxide forming compounds include, but are not limited to:

Acrolein	p-Chlorophenetole	4,5-Hexadien-2-yn-1-ol
Allyl ether	Cyclooctene	n-Hexyl ether
Allyl ethyl ether	Cyclopropyl methyl ether	o,p-Iodophenetole
Allyl phenyl ether	Diallyl ether	Isoamyl benzyl ether
p-(n-Amyloxy)benzoyl chloride	p-Di-n-butoxybenzene	Isoamyl ether
n-Amyl ether	1,2-Dibenzoyloxyethane	Isobutyl vinyl ether
Benzyl n-butyl ether	p-Dibenzoyloxybenzene	Isophorone
Benzyl ether	1,2-Dichloroethyl ethyl ether	b-Isopropoxypropionitrile
Benzyl ethyl ether	2,4-Dichlorophenetole	Isopropyl-2,4,5-trichlorophenoxy acetate
Benzyl methyl ether	Diethoxymethane	n-Methylphenetole
Benzyl-1-naphthyl ether	2,2-Diethoxypropane	2-Methyltetrahydrofuran
1,2-Bis(2-chloroethoxy)ethane	Diethyl ethoxymethylenemalonate	3-Methoxy-1-butyl acetate
Bis(2-ethoxyethyl)ether	Diethyl fumarate	2-Methoxyethanol
Bis(2-(methoxyethoxy)ethyl) ether	Diethyl acetal	2-Methoxyethyl acetate
Bis(2-chloroethyl) ether	Diethylketene	3-Methoxybutyl acetate
Bis(2-ethoxyethyl) adipate	Diethoxybenzene (m-,o-,p-)	2-Methoxyethyl vinyl ether
Bis(2-methoxyethyl) carbonate	1,2-Diethoxyethane	Methoxy-1,3,5,7-cyclooctatetraene
Bis(2-methoxyethyl) ether	Dimethoxymethane	b-Methoxypropionitrile
Bis(2-methoxyethyl) phthalate	1,1-Dimethoxyethane	m-Nitrophenetole
Bis(2-methoxymethyl) adipate	Di(1-propynyl) ether	1-Octene
Bis(2-n-butoxyethyl) phthalate	Di(2-propynyl) ether	Oxybis(2-ethyl acetate)
Bis(2-phenoxyethyl)	Di-n-propoxymethane	Oxybis(2-ethyl benzoate)

ether		
Bis(4-chlorobutyl) ether	1,2-Epoxy-3-isopropoxypropane	b,b-Oxydipropionitrile
Bis(chloromethyl) ether	1,2-Epoxy-3-phenoxypropane	1-Pentene
2-Bromomethyl ethyl ether	p-Ethoxyacetophenone	Phenoxyacetyl chloride
beta-Bromophenetole	1-(2-Ethoxyethoxy)ethyl acetate	a-Phenoxypropionyl chloride
o-Bromophenetole	2-Ethoxyethyl acetate	Phenyl-o-propyl ether
p-Bromophenetole	(2-Ethoxyethyl)-a-benzoyl benzoate	p-Phenylphenetone
3-Bromopropyl phenyl ether	1-Ethoxynaphthalene	n-Propyl ether
tert-Butyl methyl ether	o,p-Ethoxyphenyl isocyanate	n-Propyl isopropyl ether
n-Butyl phenyl ether	1-Ethoxy-2-propyne	Sodium 8-11-14-eicosatetraenoate
n-Butyl vinyl ether	3-Ethoxypropionitrile	Sodium ethoxyacetylde
Chloroacetaldehyde diethylacetal	2-Ethylacrylaldehyde oxime	Tetrahydropyran
2-Chlorobutadiene	2-Ethylbutanol	Triethylene glycol diacetate
1-(2-Chloroethoxy)-2-phenoxyethane	Ethyl-b-ethoxypropionate	Triethylene glycol dipropionate
Chloroethylene	Ethylene glycol monomethyl ether	1,3,3-Trimethoxypropene
Chloromethyl methyl ether	2-Ethylhexanal	1,1,2,3-Tetrachloro-1,3-butadiene
beta-Chlorophenetole	Ethyl vinyl ether	4-Vinyl cyclohexene
o-Chlorophenol	2,5-Hexadiyn-1-ol	Vinylene carbonate

## PEROXIDE FORMING COMPOUND DATING AND DISPOSAL:

- Class A**
    - Date compounds when received.
    - Dispose of within 3 months of receipt, even if unopened.
  - Class B (unstabilized)**
    - Date when received **&** when opened.
    - Dispose within 6 months of opening **or** within 1 year of receipt.
  - Class B (stabilized)**
    - Date when received **&** when opened.
    - Dispose within 1 year of opening **or** within 2 years of receipt.
  - Class C**
    - Date when received **&** when opened.
    - Dispose within 6 months of opening **or** within 1 year of receipt.
  - Class D**
    - No institutional expiry dating requirements.
    - Adhere to manufacturer expiration dates.
  - Exceptions:**
    - As detailed in the subsequent section, compounds that are adequately tested to affirm peroxides are not accumulated to unsafe levels may be retained for extended durations.
    - Class B solvents that are maintained a solvent purification system that is sealed under nitrogen are excluded from institutional expiry criteria. Any dispensed materials must adhere to prescribed dating and disposal criteria. Bear in mind that solvents circulated through activated alumina columns strip stabilizers/inhibitors.
    - Paints and adhesives containing dilute amounts of Class B solvents are excluded from institutional expiry criteria.
    - Please reach out to EH&S ([labsafety@ehs.msstate.edu](mailto:labsafety@ehs.msstate.edu); 662-325-0026) if you would like to discuss unique exceptions.
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## PEROXIDE TESTING

- If applicable, peroxide testing may be completed for certain peroxide-forming chemicals instead of strictly adhering to the previously outlined disposal criteria.
  - ONLY** Class A and Class B liquids may be tested for peroxides. Chemicals falling into Class C and solutions containing reactive compounds (e.g., hydrogen chloride in ether) **CANNOT** be tested for peroxides.
  - Peroxide testing must be performed prior to the previously outlined expiration dates.
  - Peroxide testing is recommended when performing hazardous operations that may concentrate peroxides.
  - Compounds that maintain levels <30 PPM of peroxides are safe to retain beyond institutional expiry standards. Retained compounds must be retested for peroxides at least annually.
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