Auburn University Risk Management and Safety Standard Operating Guideline	Effective Date: 6/16/2011		SOG Number: HM.1.5.2
	Supercedes: NA	Superceded: NA	Page: 1 of 3
Subject: **Peroxide-forming Materials**	Approval: Steve Nelson Associate Director, Environmental Health and Safety		

I. PURPOSE

This document provides standard procedures for managing chemicals which may form hazardous peroxides during storage.

II. OBJECTIVE

The purpose of the procedures is to prevent minimize hazards to personnel using these chemicals, and reduce disposal cost to the university for managing the chemicals.

III. SCOPE

The guideline shall apply to all AU faculty, staff and students.

IV. GENERAL GUIDELINES

Many commonly used chemicals; organic solvents in particular, can form shock, heat, or friction sensitive peroxides upon exposure to oxygen. Once peroxides have formed, an explosion can result during routine handling, such as twisting the cap off a bottle – if peroxides are formed in the threads of the cap. Explosions are more likely when concentrating, evaporating, or distilling these compounds if they contain peroxides.

When these compounds are improperly handled and stored, a serious fire and explosion hazard exists. A list of common peroxide forming chemicals is attached. In general chemicals from Table A, B, and C should be submitted for waste pick up after 18 months of receiving, even if unopened, unless you are following the additional storage requirements below. You will receive an email alert from Chematix to remind you to submit expired containers for waste pick up. Chemicals from List A should be discarded 3 months after opening. The table below is a summary of safe storage periods.

SAFE STORAGE PERIODS FOR PEROXIDE FORMERS	
Unopened chemicals from manufacturer:	18 months or (expiration date)
Opened containers:	
Chemicals in Table A	3 months unless in inert-atmosphere box
Chemicals in Tables B	12 months after negative peroxide test
Uninhibited chemicals in Table C	24 hours
Inhibited chemicals in Table C (Do not store under an inert atmosphere)	12 months after negative peroxide test

The following guidelines should be adhered to when using peroxide forming chemicals:

- Each peroxide forming chemical container MUST be dated when received and opened. Those compounds in Table A of the list should be kept in an inert-atmosphere box or disposed of within 3 months of opening. Those compounds in the listed in Tables B, and C should be disposed of within 12 months of opening or tested for peroxides annually. The results of the peroxide test and the test date must be marked on the outside of the container. You must send a list of the containers tested (bar code number) and the date tested to Abbie Beaty (butleaj@auburn.edu) to have the expiration date reset. If no test results are received and the 18 month expiration date arrives, the container must be submitted for waste pick up.

- Peroxide test strips can be purchased from a variety of safety supply vendors, such as VWR and Laboratory Safety Supply. An alternative to peroxide test strips is the KI (potassium iodide) test. References such as Prudent Practices in the Laboratory and the American Chemical Society booklet Safety in Academic Chemistry Laboratories

outline ways to test for peroxides and ways to remove them if discovered. When using the test strips, if the strip turns blue, then peroxides are present. Light blue test results may be acceptable for use if your procedure does not call for concentrating, evaporating or distilling. Containers with darker blue test results must be deactivated or disposed of. You can test older test strips for efficacy with a dilute solution of hydrogen peroxide.

- Due to sunlight's ability to promote formation of peroxides, all peroxidizable compounds should be stored away from heat and sunlight.

- Peroxide forming chemicals should not be refrigerated at or below the temperature at which the peroxide forming compound freezes or precipitates as these forms of peroxides are especially sensitive to shock and heat. Refrigeration does not prevent peroxide formation.

- As with any hazardous chemical, but particularly with peroxide forming chemicals, the amount of chemical purchased and stored should be kept to an absolute minimum. Only order the amount of chemical needed for the immediate experiment.

- Ensure containers of peroxide forming chemicals in class A and B are tightly sealed after each use and consider adding a blanket of an inert gas, such as Nitrogen, to the container to help slow peroxide formation. Inhibited class C chemicals require O_2 for proper stabilization.

- A number of peroxide forming chemicals can be purchased with inhibitors added. Unless absolutely necessary for the research, labs should never purchase uninhibited peroxide formers.

- Before distilling any peroxide forming chemicals, always test the chemical first with peroxide test strips to ensure there are no peroxides present. Never distill peroxide forming chemicals to dryness. Leave at least 10-20% still bottoms to help prevent possible explosions.

While no definitive amount of peroxide concentration is given in the literature, a concentration of 50 ppm should be considered dangerous and a concentration of >100 ppm must be disposed of immediately. In both cases, procedures should be followed for removing peroxides or the containers should be disposed of as hazardous waste.

Compounds that are suspected of having very high peroxide levels because of age, unusual viscosity, discoloration, or crystal formation should be considered extremely dangerous. If you discover a container that meets this description, DO NOT attempt to open or move the container. Notify other people in the lab about the potential explosion hazard and notify RMS Hazmat Personnel at 844-4870 immediately.

For those compounds that must be handled by a hazardous materials team, the expense for such an operation can result in significant cost per container to the University. However, if laboratory staff follow the guidelines listed above, the chances for requiring special handling for these types of containers or for an explosion to occur is greatly diminished.

The listing of common peroxide forming chemicals provided is not all-inclusive, there are numerous other chemicals that can form peroxides. Be sure to read chemical container labels, MSDSs, and other chemical references.

Classes of Chemicals That Can Form Peroxides

Table A: Chemicals that form explosive levels of peroxides without concentration

Isopropyl ether	Sodium amide (sodamide)
Butadiene	Tetrafluoroethylene
Chlorobutadiene (chloroprene)	Divinyl acetylene
Potassium amide	Vinylidene chloride
Potassium metal	

Table B: These chemicals are a peroxide hazard on concentration (distillation/evaporation). A test for peroxide should be performed if concentration is intended or suspected.

Acetal	Dioxane (*p*-dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan
Cyclooctene	Cyclopentene
Diacetylene	Methyl acetylene
Dicyclopentadiene	Methyl cyclopentane
Diethylene glycol dimethyl ether (diglyme)	Methyl-isobutyl ketone
Diethyl ether	Tetrahydrofuran
Tetrahydronaphthalene	Vinyl Ethers

Table C: Unsaturated monomers that may autopolymerize as a result of peroxide accumulation if inhibitors have been removed or are depleted.

Acrylic acid	Styrene
Butadiene	Vinyl acetate
Chlorotrifluoroethylene	Vinyl chloride
Ethyl acrylate	Vinyl pyridine
Methyl methacrylate	

References:

Prudent Practices in the Laboratory, updated edition, National Research Council, 2011.
"Review of Safety Guidelines for Peroxidizable Organic Chemicals," Chemical Health and Safety, September/October 1996.