Lab PM 031 **April 2015**

VA MARYLAND HEALTH CARE SYSTEM
BALTIMORE, MARYLAND
RESEARCH AND DEVELOPMENT SERVICE
PROCESS MODULE

Management of Reactive/Explosive Hazardous Chemicals

PURPOSE: To assure the safe management of potentially reactive/explosive hazardous chemicals.

A number of relatively common chemicals and reagents can become explosive when stored or handled improperly. The following policy provides a list of the most common potentially reactive/explosive hazardous chemicals and provides information on how to prevent explosive hazards.

1. Peroxide Forming Chemicals

Certain chemicals can form dangerous peroxides on exposure to air and light. Peroxides can form even though the container has not been opened. Peroxides may detonate with extreme violence when concentrated by evaporation or distillation, when combined with other compounds, or when disturbed by unusual heat, shock or friction. Formation of peroxides in ethers is accelerated in opened and partially emptied containers. Refrigeration will not prevent peroxide formation and stabilizers will only retard formation.
Peroxide formation may be detected by visual inspection for crystalline solids or viscous liquids, or by using chemical methods or specialized kits for quantitative or qualitative analysis. If you suspect that peroxides have formed, do not open the container since peroxides deposited on the threads of the cap could detonate.

<u>Recommended Work Practices</u>

The following recommendations should be followed to control the hazards of peroxides.

- Know the properties and hazards of all chemicals you are using through adequate research and study, including reading the label and SDS.
- Inventory all chemical storage at least twice a year to detect forgotten items, leaking containers, and those that need to be discarded.
- Identify chemicals that form peroxides or otherwise deteriorate or become more hazardous with age or exposure to air. Label containers with dates of receipt and opening.
- Materials should be stored in tightly sealed containers away from light and heat. Do not store ethers at or below the temperature at which the peroxide freezes or the solution precipitates.
- Purchase in limited quantities to ensure use of the entire contents within a short period of time.
- Visually or chemically check container for peroxides before use.
- Clean up spills immediately. The safest method is to absorb the material onto Universal Spill kit absorbent.

- When working with peroxidizable compounds wear impact-resistant safety eyewear and face shields.
- Do not use solutions of peroxides in volatile solvents under conditions in which the solvent might be vaporized. This could increase the concentration of peroxide in the solution.
- Do not use metal spatulas or magnetic stirring bars (which may leach out iron) with peroxide forming compounds, since contamination with metals can lead to explosive decomposition. Ceramic, Teflon or wooden spatulas and stirring blades are usually safe to use.

Detection of Peroxides

If there is any suspicion that peroxide is present, do not open the container or otherwise disturb the contents. Call VAMC Industrial Hygienist for disposal. The container and its contents must be handled with extreme care. If solids, especially crystals, for example, are observed either in the liquid or around the cap, peroxides are most likely present.

Disposal of Peroxides

Disposal of any peroxide forming compounds in the sanitary sewer (sink) is not permitted. For disposal contact VAMC Industrial Hygienist.

The following table is composed of potentially reactive/explosive peroxide forming materials and storage time limits.

Manufacturers often state warnings on their peroxide forming chemicals. In this case, the chemicals should be dated and disposed of in accordance with manufacturers recommendations if more restrictive that the disposal limit set in the table below.

Materials other than those listed below may also form peroxides.

MOST DANGEROUS: Discard after 3 months Peroxide formation hazard during storage.	
Chemical	**Synonyms**
Divinyl acetylene	
Isopropyl ether	Diisopropyl ether, Diisopropyl oxide
Potassium metal	Potassium
Sodium amide	Sodamide
Vinylidene chloride	1,1,-dichloroethylene, 1,1,-dichloroethane
DANGEROUS: Discard after 1 year Peroxide formation hazard during storage and on concentration (i.e., distillation) of compound.	
Acetal	1,1 diethoxyethane, diethyl acetal
Acetaldehyde	Ethanal, Ethyl aldehyde
Cumene	Isopropyl benzene

Cyclohexene	1,2,3,4 Tetrahydrobenzene
Cyclopentene	
Diacetylene (gas)	Beacetylene
Dicyclopentadiene	
1, 4 Dioxane	p-Dioxane, Diethylene dioxide
Ethyl ether	Ether, Ethyl oxide, Diethyl ether
Ethylene glycol dimethyl ether	1,2, Dimetoxy ethane, Glyme, Monoglyme
Methyl acetylene	Allylene, Propyne
Methyl cyclopentane	
Methyl isobutyl ketone	
Tetrahydrofuran	1,4-epoxybutane, butylene oxide, diethylene oxide
Tetrahydronaphtalene	Tetraline
Vinyl ethers	Ethyl vinyl ether, Methyl vinyl ether, Divinyl ether
DANGEROUS: Discard after 1 year * Peroxide formation causes initiation of hazardous polymerization.	
Acrylic acid	
Acrylonitryle	
1,3-Butadiene	Vinylethylene, divinyl
2-Butanol	Sec-butanol, S-butyl alcohol, Methyl-ethyl carbinol
Chloroprene	Chlorobutadiene
Chlorotrifluoroethylene (gas)	Trifluorochloroethylene, Genetone 1113
Methyl methacrylate	
Styrene	Isopropyl alcohol, Dimethylcarbinol, 2-Hydroxypropane, Sec-propanol
Tetrafluoroethylene	
Vinyl acetate	Perfluoroethylene
Vinyl acetylene	
Vinyl chloride	Buten-3-yne
Vinyl Pyridine	Chloroethylene, Ethylene monochloride

* Under storage conditions in the liquid state the peroxide-forming potential increases and certain of these monomers (especially butadiene, chloroprene, and tetrafluoroethylene) should be discarded after three months.

2. Picric Acid and other Polynitroaromatic Compounds

These compounds are considered potentially explosive or shock sensitive under various conditions (e.g., dry, contaminated, etc.)
Picric Acid (Trinitrophenol) and Picrylsulfonic Acid (Trinitrobenzenesulfonic Acid) are commonly used in labs and are relatively safe in the form which they are sold. However, these compounds can become explosive when allowed to dry out or when they form certain metal salts. For handling and storage detail please follow VAMC Picric Acid S.O.P.

3. Azide compounds

Azide compounds (RN3) are derivatives of hydrogen azide (HN3). There are both inorganic and organic derivatives. They vary widely in their stability and some members of both classes are unstable and potentially explosive. Azide compounds also display significant human toxicity.

Commonly used Sodium Azide may form highly explosive heavy metal azides if contaminated or used improperly. Sodium Azide should never be heated rapidly or stored in containers with metal components. Disposal of sodium azide solutions to the sanitary sewer may cause the formation of lead or copper azide in the plumbing which could potentially cause a serious explosion. Therefore, disposal of any sodium azide-containing solutions in the sanitary sewer (sink) is not permitted. For disposal contact VAMC Industrial Hygienist.

4. Perchloric Acid

Perchloric acid ($HCLO_4$) is highly corrosive and oxidizing material. It is also a highly reactive material if in contact with incompatibilities. Perchloric acid can explode on contact with many organics and can form potentially explosive metal perchlorates if mixed with metals.
For handling and storage detail please follow VAMC Perchloric Acid S.O.P.

The above document was prepared based on several sources and approved by VAMC Industrial Hygienist.
Sources:
UMB web page http://www.ehs.umaryland.edu/Waste/reactive.cfm
Princeton University web page **http://web.princeton.edu/sites/ehs/labsafetymanual/sec7c.htm**
Clean Harbors Environmental Services web page
www.himnrbehs.com/himnrbehs/pdf/Unstable.**Materials**.List.pdf