University of Colorado at Denver and Health Sciences Center

Environmental Health and Safety Department

Guidance Note: Potentially Explosive Compounds

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This information is for your internal use and as a way of providing consistent information. There is no response required.

Potentially Explosive Compounds

Researchers need to be aware that certain chemical compounds may become potentially explosive as they age. Potentially explosive compounds should be inspected regularly for water content or age and discarded before they become a significant safety hazard. The UCDHSC Environmental Health & Safety Department (EH&S) recommends that you check your chemical inventory for any of the potentially explosive compounds listed below or compounds which have warnings regarding storage on the label. **If an unstable chemical compound has exceeded its recommended shelf life or shows signs that it may be becoming unstable (discoloration, crystallization or layering visible), please call EH&S to arrange for immediate disposal (303 724-0345).**

Some chemical compounds are high-explosives due to their unstable chemical structure. **Picric acid** (trinitrophenol) has been commonly used in laboratories as a tissue fixative, however, when it becomes dry, it is also a high-explosive. Its chemical structure is very similar to TNT (trinitrotoluene). Solid picric acid is shipped from the manufacturer with 30% water added in order to minimize its potential to detonate. As long as picric acid remains wet it cannot explode. Picric acid also forms shock sensitive explosives on contact with metals, therefore a container with a metal lid may explode when disturbed. **Sodium azide** forms shock-sensitive explosives on contact with metals as well.

Ethyl ether and other peroxidizable solvents may form shock-sensitive explosive peroxide compounds on exposure to atmospheric oxygen, and the process is accelerated by exposure to light or heat. Organic peroxides are among the most hazardous substances handled in the laboratory due to their instability and shock-sensitive nature. For example, **isopropyl ether** containers have exploded when personnel attempted to to open them.

The manufacturer usually marks ethyl ether containers with an expiration date. Peroxidizable solvents should be dated by laboratory personnel when received and when the container is opened. Ethyl ether should be discarded within a year after being opened and isopropyl ether within three months. All unopened containers of peroxidizable chemicals should be discarded within 18 months of being purchased.

Laboratory personnel should use the following procedure prior to sorting through their chemical inventory for expired or outdated chemical reagents:

1. Never work alone. Don't involve employees who lack prior laboratory experience. Use appropriate personnel protective equipment (eye protection, gloves, lab coat). Identify the location of nearby emergency showers and eye washes and insure that they are operational. Know who to call for help if needed (dial 911).

2. Do not touch an old chemical container which holds a peroxidizable solvent, if there are any traces of solid crystals around the lid or if solid crystals are visible inside the container. Solid peroxide crystals are usually shock and friction sensitive and touching them may set off a violent explosion.

3. Handle every old or suspected peroxidizable solvent container (ethers, etc.) with extreme care and avoid unnecessary motion or bumping of the containers because peroxide crystals are very unstable. Ethyl ether is usually stored inside metal containers, so the liquid cannot be visibly inspected for the presence of peroxide crystals.

4. Do not attempt to open an old, outdated container of peroxidizable solvents because they may explode if peroxide crystals are present in sufficient concentration (above 1%), especially inside the threads of the lid.

5. Do not touch a container of picric acid (trinitrophenol) or sodium azide if they are stored inside a metal container or inside a container with a metal lid. Heavy metal salts of either picric acid or sodium azide are extremely shock-sensitive and disturbing a metal container may cause an explosion. Picric acid also forms explosively unstable compounds when it reacts with amines.

6. Contact EH&S immediately (303-724-0345) if you discover a peroxidizable solvent that has visible crystals present or if the container is over five years old. Contact EH&S if you discover a potentially explosive compound stored inside a metal can or inside a container with a metal lid.

7. For most potentially explosive chemicals which are not an immediate explosive hazard and are no longer needed, complete the regular UCDHSC Chemical Waste Request for Disposal Form for your appropriate campus and send it to EH&S through the campus mail. We will remove these compounds within the next 5–10 business days.

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Additional Examples of Potentially Explosive Compounds

Potentially Explosive Solid Compounds (partial listing)
benzoyl peroxide (dry), 2,4-dinitrophenol, 2,4-dinitrophenyl hydrazine, hexanitrodiphenylamine (dipicrylamine), 1-methyl-3-nitro-1-nitrosoguanidine, nitrogen trichloride, nitrocellulose, pyroxylin, solid picric acid (dry) or trinitrophenol, picramide, picryl chloride (trinitrochlorobenzene), picrylsulfonic acid (trinitrobenzenesulfonic acid), trinitrobenzene, sodium amide, potassium metal (old)

Potentially Explosive Organic Solvents, (partial listing)
acetaldehyde, diazald, dioxane, ether, ethyl ether, furan, isopropyl ether, N-methyl-N-nitroso-p-toluenesulfonamide, tetrahydrofuran (THF), vinyl ethers