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Chemical Storage Compatibility Guidelines

Quick Tips #181

Chemicals play an important role in many workplace applications. The inherent hazards of chemicals can be reduced by minimizing the quantity of chemicals on hand. However, when chemicals must be in-house, proper storage and handling can reduce or eliminate some of the associated risks.

Proper storage information can be obtained from Section 7 of the Safety Data Sheet (SDS). As required by 29 Code of Federal Regulations (CFR) 1910.1200, an SDS must be on hand for every hazardous chemical in your workplace. Sections 7, 9, and 10 of the SDS can also answer questions such as:

- Is the chemical a flammable?
- Is the chemical a corrosive?
- Does the chemical need to be stored other than at ambient temperature?
- Is the chemical an oxidizer or reducer?
- Is the chemical light sensitive?
- Does the chemical require any special handling procedures?

Typical storage considerations may include temperature, ignition control, ventilation, segregation and identification. Proper segregation is necessary to prevent incompatible materials from inadvertently coming into contact. If incompatible materials were to come into contact, fire, explosion, violent reactions or toxic gases could result.

When segregating chemicals, acids should not be stored with bases, and oxidizers should not be stored with organic materials or reducing agents. Physical barriers and/or distance are effective for proper segregation.

If cabinets are used to segregate chemicals, consider the compatibility of the chemicals with the cabinet. For example, corrosives, like strong acids and caustics, will corrode most metal cabinets. Non-metallic or epoxy-painted cabinets are available and will provide a better service life with these types of chemicals. Some acids and bases may damage the epoxy-painted surfaces of a cabinet if a spill occurs. Also, perchloric acid should not be stored in a wooden cabinet.

There are cabinets designed specifically to store flammable liquids. It is important to be aware of the maximum allowable container size and maximum quantities for storage in cabinets based on the category of the flammable. The category of a flammable is determined by its flash point and boiling point. The Occupational Safety and Health Administration (OSHA) has defined a flammable liquid as any liquid having a flash point of not more than 93° C or 199.4° F (29CFR 1910.106(a) (19)). OSHA further classifies flammables into four categories. 29 CFR 1910.106(a)(19)(i-v) and Table B.6.1 of 29 CFR 1910.1200 Appendix B provides the criteria for the four flammable liquid categories:

Category	Criteria
1	Flash point < 73.4 °F and initial boiling point ≤ 95 °F
2	Flash point < 73.4 °F and initial boiling point > 95 °F
3	Flash point > 73.4 °F and ≤ 140 °F
4	Flash point > 140 °F and ≤ 199.4 °F

The following chart lists the maximum volume of flammables that can be stored in a single container type:

Maximum Allowable Size of Containers and Portable Tanks

Related Categories

[Shelf Trays](#)[Storage Cabinets](#)

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[Storage and Handling Checklist](#)[Quick Tips 257: Outdoor Chemical Storage Buildings](#)[Quick Tips 180: NFPA 30 Flammable and Combustible Liquids](#)[Quick Tips 215: Ventilation Guidelines for Flammable and Chemical Storage Cabinets](#)

Maximum Allowable Size of Containers and Portable Tanks				
Container Type	Category 1	Category 2	Category 3	Category 4
Glass or approved plastic	1 pint	1 quart	1 gallon	1 gallon
Metal (other than DOT drums)	1 gallon	5 gallons	5 gallons	5 gallons
Safety Cans	2 gallons	5 gallons	5 gallons	5 gallons
Metal Drums (DOT spec.)	60 gallons	60 gallons	60 gallons	60 gallons
Approved Portable Tanks	660 gallons	660 gallons	660 gallons	660 gallons

The following chart lists the maximum volume of flammables that can be stored in a single flammable storage cabinet.

Maximum Storage Quantities for Cabinets	
Liquid Class	Maximum Storage Capacity
Category 1	60 Gallons
Category 2	60 Gallons
Category 3	60 Gallons
Category 4	120 Gallons*

*Not more than 60 gallons may be Category 1, 2, or 3 liquids. No more than 120 gallons of Category 4 liquids may be stored in a storage cabinet, according to OSHA 29 CFR 1910.106(d)(3)(i).

For ease of locating chemicals, many storerooms organize chemicals alphabetically. However, chemical storage based upon an alphabetical arrangement of chemicals may inadvertently locate incompatible materials in close proximity to one another. A few examples of this potentially dangerous storage method are demonstrated by the following pairs of incompatible materials:

Chemical	Reaction
Acetic acid and acetaldehyde	Polymerization of acetaldehyde
Copper (II) sulfide and cadmium chlorate	Explosive reaction
Hydrogen peroxide and iron (II) sulfide	Reacts vigorously
Sodium nitrite and sodium thiosulfate	Explosive when heated

Other common examples of incompatible chemicals:

Chemical	Is Incompatible and Should Not Be Mixed or Stored With
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent

Azides	Acids
Bromine	See Chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Everything
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxide, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid

Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

General Incompatibilities by Chemical Groups	
Acids	Alkalines, Combustibles, Flammables, Cyanides, Nitrates and Reactive Sulfides
Oxidizers	Organics
Nitrates	Acids
Ammoniated Compounds	Hypochlorites / Bleach
Organics Nitrates	Perchlorates / Oxidizers / Metals

In addition to chemical compatibility concerns, safe chemical handling requires regular inspections of chemical storage areas and maintenance of stringent inventory control.

Commonly Asked Questions

Q. What are some things to look for when inspecting a chemical storage area?

- A. All chemicals should be properly labeled. Chemicals should have their caps secured at all times. No chemicals should be stored on bench tops, fume hoods, on the floor or extending into traffic aisles. Chemical shelves should not be over crowded. Chemicals should not be stored above eye level.

Q. What should we do if we have old, unlabeled chemicals in house?

- A. Hire a hazardous waste contractor to come in and evaluate the situation and properly dispose of the materials.

Q. What emergency equipment should be located near the chemical storage area?

- A. First aid supplies, emergency phone numbers, eyewash and shower facilities, fire extinguishers, spill cleanup supplies and personal protective equipment should be readily available.

Sources

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[29 CFR 1910.106](#), Flammable Liquids

29 CFR 1910.1200 Hazard Communication

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