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Laboratory Chemicals of Concern and Storage

The Chemical Safety Specialist has attempted to provide “lists” of chemicals that are grouped according to their associated hazard. While these lists are comprehensive they are by no means exhaustive. The chemical and physical properties of every chemical encountered in the field needs to be fully understood prior to any manipulation or handling. These documents contain only the names of the compounds and elements by reactivity class. This should insure that users of this information should be compelled to seek more information from the body of available scientific literature. Lists such as those that follow are intended to assist workers who have to obtain a reasonable understanding of the risks that a chemical inventory may present. Perhaps the best approach to accomplishing this is to communicate the chemical categories that present risks so that the potential to “miss” a hazard is minimized. These lists represents chemicals that we believe you will find in chemical inventories, but not every chemical that could be encountered in a chemical inventory and exhibit the properties of concern are present in these lists. Instead at the beginning of each of the attached tables we have incorporated the general categories of chemicals that fit into the respective category of risk.

The presence Shock Sensitive or Pyrophoric Chemicals on one of these lists is not an endorsement or authorization to “blow up” the chemical. For example, Picric Acid is present on these lists but a chemical approach is recommended for its ultimate disposition rather than detonation. The Wyoming DEQ Solid Waste Management Program Regulations found in Chapter 1,(h)(3)(C) authorizes the Department to issue and terminate (for cause) Emergency Permits when there is a finding of imminent and substantial endangerment to human health or the environment. This authority may be given orally or in written form. In order to approve an Emergency Permit it must first be requested.

There are no easy answers in this arena. Be wary of those who believe that anyone with such information can safely deal with the chemistry and physics displayed by these types of chemicals. There is no substitution for good information, relevant experience and caution. Firefighters, hazardous materials workers, police and EHS staff who have to contend with emergency situations involving these materials should attempt to secure the best information obtainable through any resource available. Obtain guidance from reputable chemical specialists if available and use conservative operations to protect yourselves, the public’s health and the environment. The materials of greatest concern are those materials that are wastes and have absolutely no value. These valueless wastes are being handled by humans of infinite value and sometimes, at great personal risk.

For the most part responses involving these chemicals are entirely preventable. Persons who have chemicals found on these lists should be acutely aware of safe storage requirements, safe handling procedures, maximum shelf lives and the synergies that may be found in chemicals that populate a laboratory. Persons who have these chemicals need to translate that awareness into preventative measures, inventory control and good chemical hygiene. Realistically in this modern world new workers are constantly moving from employer to employer and older workers retire. These chemicals are left behind through generations of workers until an incident occurs or a level of awareness is obtained.

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Compatibility Concerns in Chemical Storage

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

Proper storage information can usually be obtained from the Safety Data Sheet (SDS), label or other chemical reference material. An SDS must be on hand for every chemical in your workplace. The SDS and chemical label can be consulted for information on special storage requirements. The SDS can also answer questions such as:

- Is the chemical a flammable or combustible?
- Is the chemical a corrosive?
- Does the chemical need to be stored at other than 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. A physical barrier 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. However, it is recommended that hydrochloric acid not be stored in any metal cabinet. Some other acids and bases may damage the painted surfaces of a cabinet if a spill occurs. Also, Perchloric acid should not be stored in a wooden cabinet.

There are cabinets available specifically for flammable and combustible materials. It is important to be aware of maximum allowable container size and maximum quantities for storage in cabinets based on the class of the flammable. The class of a flammable or combustible is determined by its flash point and boiling point.

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.

Chemical Storage Plan for Laboratories

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When certain hazardous chemicals are stored or mixed together, violent reactions may occur because the chemicals are unsuitable for mixing, or are incompatible. Classes of incompatible chemicals should be segregated from each other during storage, according to hazard class.

- Chemicals should be stored according to hazard class (ex. flammables, oxidizers, health hazards/toxins, corrosives, etc.).
- Store chemicals away from direct sunlight or localized heat.
- All chemical containers should be properly labeled, dated upon receipt, and dated upon opening.
- Store hazardous chemicals below shoulder height of the shortest person working in the lab.
- Shelves should be painted or covered with chemical-resistant paint or chemical-resistant coating.
- Shelves should be secure and strong enough to hold chemicals being stored on them. Do not overload shelves.
- Personnel should be aware of the hazards associated with all hazardous materials.
- Separate solids from liquids.

Below are examples of chemical groups that can be used to categorize storage. Use these groups as examples when separating chemicals for compatibility. Please note: reactive chemicals must be more closely analyzed since they have a greater potential for violent reactions. Contact EHS, Chemical Safety Specialist (766-3277), if you have any questions concerning chemical storage.

Acids:

- Make sure that all acids are stored by compatibility (ex. separate inorganics from organics).
- Store concentrated acids on lower shelves in chemical-resistant trays or in a corrosives cabinet. This will temporarily contain spills or leaks and protect shelving from residue.
- Separate acids from incompatible materials such as bases, active metals (ex. sodium, magnesium, potassium) and from chemicals, which can generate toxic gases when combined (ex. sodium cyanide and iron sulfide).

Bases:

- Store bases away from acids.
- Store concentrated bases on lower shelves in chemical-resistant trays or in a corrosives cabinet. This will temporarily contain spills or leaks and protect shelving from residue.

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Flammables:

- Approved flammable storage cabinets should be used for flammable liquid storage.
- You may store 20 gallons of flammable liquids per 100 sq.ft. in a properly fire separated lab. The maximum allowable quantity for flammable liquid storage in any size lab is not to exceed 120 gallons.
- You may store up to 10 gallons of flammable liquids outside of approved flammable storage cabinets.
- An additional 25 gallons may be stored outside of an approved storage cabinet if it is stored in approved safety cans not to exceed 2 gallons in size.
- Use only explosion-proof or intrinsically safe refrigerators and freezers for storing flammable liquids.
- University of Wyoming guidelines for flammable storage follow NFPA 30, 45 and the UW Safety Manual.

Peroxide-Forming Chemicals:

- Peroxide-forming chemicals should be stored in airtight containers in a dark, cool, and dry place.
- Unstable chemicals such as peroxide-formers must always be labeled with date received, date opened, and disposal/expiration date.
- Peroxide-forming chemicals should be properly disposed of before the date of expected peroxide formation (typically 6-12 months after opening).
- Suspicion of peroxide contamination should be immediately investigated. Contact Chemical Safety Specialist for procedures.

Water-Reactive Chemicals:

- Water reactive chemicals should be stored in a cool, dry place.
- Do not store water reactive chemicals under sinks or near water baths.
- Class D fire extinguishers for the specific water reactive chemical being stored should be made available.

Oxidizers:

- Make sure that all oxidizers are stored by compatibility.
- Store oxidizers away from flammables, combustibles, and reducing agents.

Toxins:

- Toxic compounds should be stored according to the nature of the chemical, with appropriate security employed when necessary.
- A "Poison Control Network" telephone number should be posted in the laboratory where toxins are stored (800-222-1222).

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Color Coded Labeling Systems That May Be Found In Your Lab:

Hazard	Color Code
Flammables	Red
Health Hazards/Toxins	Blue
Reactives/Oxidizers	Yellow
Contact Hazards	White
General Storage	Gray, Green, Orange

Please Note: Chemicals with labels that are colored and striped may react with other chemicals in the same hazard class. See SDS for more information. Chemical containers, which are not color-coded, should have hazard information on the label. Read the label carefully and store accordingly.

Suggested storage plan of inorganics and organics, Figure 1

National Safety Council Storage Arrangement of chemicals by family and compatible groups.

List of chemical families and specific chemicals: that are incompatible with each other, Chemical Incompatibility.

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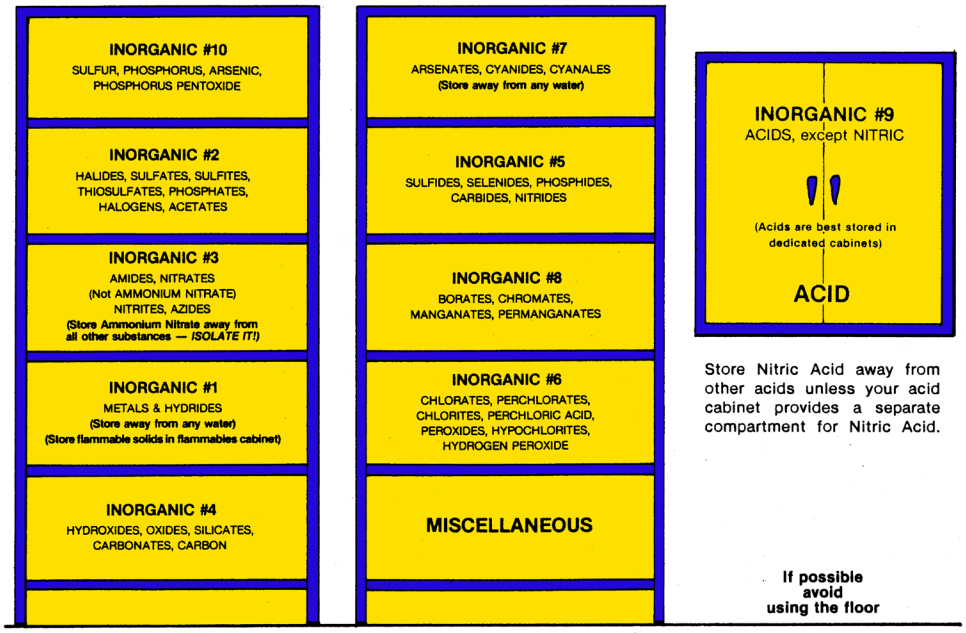
Figure 1

SUGGESTED SHELF STORAGE PATTERN — INORGANIC



SUGGESTED SHELF STORAGE PATERN — ORGANIC

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National Safety Council Storage Arrangement of chemicals by family and compatible groups.

Inorganic Family

- Metal hydrides
- Halides, sulfates, sulfites, thiosulfates, phosphates, halogens
- Amides, nitrates (e.g. Ammonium nitrate), nitrites, azides
- Hydroxides, oxides, silicates, carbonates, carbon
- Sulfides, selenides, phosphides, carbides, nitrides
- Chlorates, perchlorates, perchloric acid, chlorites, hypochlorites, peroxides
- Arsenates, cyanides, cyanates
- Borates, chromates, manganates, permanganates
- Nitric acid and other inorganic acids

Organic Family

- Acids, anhydrides, peracids
- Alcohols, glycol, amines, amides, imines, imides
- Hydrocarbons, esters, aldehydes
- Epoxy compounds, isocyanates
- Peroxides, hydroperoxides, azides
- Sulfides, polysulfides, sulfoxides, nitrites
- Phenols, cresols

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Chemical Incompatibility

A	Incompatible with	B
Alkali and Alkaline earth metals		Water
Carbides		Acids
Hydrides		Halogenated organics
Hydroxides		Halogenating reagents
Metals		Oxidizing agents
Peroxides		Oxidizing agents
Azides (inorganic)		Acids, Heavy metals, Oxidizing agents
Cyanides (inorganic)		Acids, Strong bases
Nitrates (inorganic)		Acids, Reducing agents
Nitrites (inorganic)		Acids, Oxidizing agents
Organic compounds		Oxidizing agents
Organic acyl halides and Organic anhydrides		Bases, Organic hydroxides and amino
Organic halogens		Group IA and IIA Metals, aluminum
Organic nitro compounds		Strong bases

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A Incompatible with B

Oxidizing agents	**Reducing agents**
Chlorates	Ammonia, anhydrous and aqueous
Chromates	Carbon
Chromium trioxide	Metals
Dichromates	Metal hydrides
Halogens	Nitrites
Halogenating agents	Organic compounds
Hydrogen peroxide	Phosphorus
Nitric acid	Silicon
Perchlorates	Sulfur
Peroxides	
Permanganate	
Persulfates	

A Incompatible with B

Reducing agents	**Oxidizing agents**
	Arsenates
	Arsenites
	Phosphorus
	Selenites
	Selenates
	Tellurium salts and oxides
Sulfides, inorganic	**Acids**

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Specific Incompatible Chemicals

Acetic Acid	Chromic acid, nitric acid, peroxides, permanganates
Acetic anhydride	Water, hydroxyl containing compounds (glycols), perchloric acid
Acetone	Nitric acid, sulfuric acid mixtures, hydrogen peroxide
Acetylene	Chlorine, bromine, copper, silver, fluorine, mercury
Alkali / alkaline earth metals	Carbon dioxide, chlorinated hydrocarbons, water
Ammonia (anhydrous)	Mercury, chlorine, hypochlorites, Iodine, bromine, hydrogen fluoride
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, combustibles
Aniline	Nitric acid, hydrogen peroxide
Bromine	Ammonia, acetylene, butadiene, petroleum gases, carbides, organics, powdered metals
Calcium oxide	Water
Carbon, activated	Oxidants
Chlorates	Ammonium salts, acids, metal powders, organics, combustibles
Chromic acid chromium trioxide	Acetic acid, flammable liquids, combustibles
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Fluorine	Isolate from everything
Hydrazine	Oxidizers
Hydrocarbons	Halogens, oxidizers
Hydrocyanic acid	Acids, and strong alkalis
Hydrofluoric acid-Hydrogen fluoride	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Most metals and their salts, flammables and combustibles, aniline, nitromethane
Hydrogen sulfide	Acids, oxidizers
Iodine	Acetylene, ammonia (aqueous or anhydrous)
Mercury	Acetylene, nitric acid-ethanol mixtures, ammonia
Nitric acid (conc.)	Combustible acids (acetic and phosphoric), flammables, nitratable substances, aniline, hydrogen cyanide, hydrogen sulfide, chromic acid
Nitroparaffins	Inorganic bases, amines

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Oxalic acid	Silver, mercury and their salts
Oxygen	Hydrogen, oils, grease, flammables
Perchloric acid	Organics, metals and their salts
Peroxides, organic	Acids (organic and mineral), store cold, avoid friction
Phosphorus, white	Air, oxygen
Phosphorus pentoxide	Alcohols, strong bases, water
Potassium chlorate	Acids (see Chlorates)
Potassium perchlorate	Acids (see perchloric acid)
Potassium permanganate	Glycerol, glycols, benzaldehyde, sulfuric acid
Silver and silver salts	Acetylene, oxalic acid, tartaric acid, nitric acid-ethanol mixtures, ammonium compounds
Sodium	See alkali metals
Sodium nitrite	Ammonium nitrate and ammonium salts
Sodium peroxide	Oxidizable substances, water
Sulfuric acid	Chlorates, perchlorates, permanganates

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