

Chemical Segregation and Storage Table

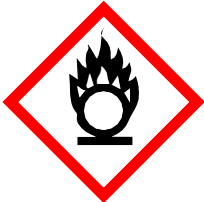
Chemical Segregation

Class of Chemicals	Common Chemical Examples	Additional Concerns and Storage Recommendations	Common Incompatible Chemical Types	Possible Reaction if Mixed/Health Concerns
Corrosive Acids-Organic 	- Acetic Acid - Butyric Acid - Trifluoroacetic Acid - Propionic Acid - Formic Acid - Carbonic Acid - Benzoic Acid	- Store in ventilated corrosives cabinet on protected shelving using secondary containment, keep away from incompatible chemicals - Do not store under the sink - Do not store acids on metal shelving - See compatibility chart for storage	- Flammable Liquids - Flammable Solids - Bases - Oxidizers - Inorganic Acids - Cyanides - Sulphides - Poisons/Toxins	- Heat - Gas Generation - Violent Reaction - DO NOT POUR WATER INTO ACID - Causes skin burn Respiratory distress - Use NIOSH approved gloves, eye protection, face shield & apron
Corrosive Acids-Inorganic 	- Nitric Acid - Sulfuric Acid - Phosphoric Acid - Hydrochloric Acid - Hydrofluoric Acid	- Store concentrated Nitric acid ($\geq 68\%$) and Sulfuric acid ($\geq 93\%$) in a secondary container Store in a corrosive cabinet labeled "Acid" or on shelving using a secondary containment - Do not store under the sink - Do not store acids on metal shelving - Hydrofluoric acid should be handled only by trained personnel. Requires extra handling precaution and stored in a secondary container (this chemical is a bone decalcifier)	- Flammable Liquids - Flammable Solids - Bases - Oxidizers - Organic Acids - Cyanides - Sulphides - Poisons/Toxins	- Heat - Gas Generation - Violent Reaction - DO NOT POUR WATER INTO ACID - Hydrofluoric acid can result in skin irritation and causes burn Respiratory distress - Use NIOSH approved gloves, eye protection, face shield & apron
Corrosive Bases-Organic/Caustic 	- Hydroxylamine - Tetramethylethylamine - Diamine - Triethylamine - Propylenediamine - Cuprietylenediamine Solution - Dicyclohexylamine	Store in separate cabinet, preferably with ventilation, corrosive cabinet or storage area with a spill tray, away from potential water sources (DO NOT store under the sink)	- Acids - Oxidizers - Flammable Liquids/Solids - Inorganic Bases - Poisons/Toxins - Amines are generally incompatible with Isocyanates, halogenated organics, peroxides, acidic phenols, epoxides, anhydrides, & acid halides	- Heat - Gas Generation - Violent Reaction - Causes skin irritation and burn - Respiratory distress - Foul odor - Use NIOSH approved gloves, eye protection, face shield & apron
Corrosive Bases-Inorganic/Caustics 	- Ammonium Hydroxide - Potassium Hydroxide - Sodium Hydroxide - Calcium Hydroxide - Sodium Hypochlorite Solution (Bleach) - Magnesium Hydroxide	- Store in separate cabinet, preferably with ventilation, corrosive cabinet or storage area with a spill tray, away from potential water sources (DO NOT store under the sink) - Store solutions of inorganic hydroxides in labeled polyethylene containers	- Acids - Oxidizers - Flammable Liquids - Flammable Solids - Organic Bases - Poisons/Toxins	- Heat - Gas Generation - Violent Reaction - Causes skin burn and irritation - Respiratory distress - Use NIOSH approved gloves, eye protection, face shield & apron

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Flammable Solids 	• Paraformaldehyde • Phosphorus • Magnesium • Sulfur • Potassium Sulphide • Naphthalene • Camphor	• Keep in a dry, cool area away from oxidizers and corrosives • Follow specific safety procedures • Conduct work on small scale if possible • Keep amounts on-hand to a minimum • Keep away from other flammables	• Acids • Bases • Oxidizers • Poisons/Toxins	• Fire Hazard • Violent Reaction • Generates toxic fumes • Respiratory distress • Keep away from ignition & sparks • Ignites readily, burn fiercely • Use NIOSH approved gloves, eye protection, face shield & apron
Flammable Liquids 	• Ethanol • Ethyl Acetate • Methanol • Acetone • Benzene • Xylene • Toluene • Diethyl Ether • Tetrahydrofuran • Acetonitrile • Propanol • Gasoline	• Flammable storage cabinet or refrigerator rated for flammable/hazardous storage/explosion proof • Peroxide-forming chemicals must be dated upon delivery and opening (two dates) ie: Di-ethyl Ether, Tetrahydrofuran, Furan, Methyl Butanol, Methyl Acetylene, Heptanol, Dioxanes, Diglyme • Please consult NIH Chemical Hygiene Plan Peroxide Formers	• Oxidizers • Acids • Bases • Reactives • Poisons/Toxins	• Fire Hazard • Heat • Violent Reaction • Watch for vapor mist • Causes eye and skin irritation • Keep away from ignition or sparks • Use NIOSH approved gloves, eye protection, face shield & apron
Toxic 	•Chloroform •Cyanides •Heavy metal compounds (e.g. Cadmium, Mercury, Osmium, Arsenic, Barium) •Formamide •Phenol •Carbon Tetrachloride •2-Mercaptoethanol •Acrylamide •Ethidium Bromide •Sodium Azide Solution	• Store in a dark, dry, ventilated, cool area in an unbreakable chemically resistant secondary container (polyethylene) • Store volatile toxic materials with evaporation rate above 1.0 - (ether =1.0) in flammable cabinet • Store non-volatile liquid poisons in a refrigerator or cabinet; amounts less than 1 liter can be stored in a cabinet above bench level, ONLY if the cabinet has sliding doors (not swinging) • Sodium Azide, must be kept refrigerated	• Flammable liquids • Acids • Bases • Reactives • Oxidizers • Corrosives • Please consult Division of Environmental Protection (DEP) for assistance	• Generation of Toxic and Flammable Gas • Combustible • Heat • Fire Hazard • Explosion Hazard • Violent Reaction • Chloroform explosively reacts with chemically-reactive metals (e.g., Aluminum or Magnesium powder, Sodium, and Lithium), Strong Oxidizers, Strong Caustics (e.g., Alkalis), and decomposes in sunlight • Some toxins are mutagenic and carcinogenic. • Review your SDS before working with toxic material • Use NIOSH approved gloves, eye protection, face shield & apron
Explosives 	• Picric Acid (Dry) • Ammonium Nitrate • Nitro Urea • Trinitroaniline • Benzoyl Peroxide (Dry) • Trinitrobenzene • Trinitrobenzoic Acid • Trinitrotoluene • Urea Nitrate • Diazoisbutylnitrile • Sodium Azide (Solid)	• Store in a secure location away from other chemicals; store in an area away from friction or shock • Store Picric Acid in cool location or in a hazard rated fridge to prevent explosive crystallization • Storage regulations DO NOT apply to binary explosives until mixed. Consult Explosive Expert of DEP	• Please consult the SDS and the DEP • Explosives must be stored as "STAND ALONE". It must never be stored with any chemicals of any kind	• Explosion Hazard • Violent Reaction • Heat • Shock Sensitive • Avoid Friction • Regular Inspection maybe required, to check for deposits or crystallization • Use spark proof tools • Use NIOSH approved gloves, eye protection, face shield & apron

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Oxidizers 	- Peroxides - Nitrates - Perchlorates - Permanganates - Sodium Hypochlorite (Solid) - Potassium Dichromate - Chlorates - Chlorites - Chromates - Bromates - Superoxides	- Store in secondary containment separately from combustibles and flammable materials - May explosively decompose on shock, friction, or concussion. - May EXPLODE ON HEATING, to form irritating toxic fumes and gases of Benzoic Acid and Carbon Monoxide. It's a strong oxidant and reacts violently with combustible, organic and inorganic acids, and reducing materials, causing fire and explosion hazard. Attacks some forms of plastics, rubber or coatings	- Combustibles - Flammables - Organic Materials - Reducing Agents	- Fire Hazard - Gas Generation - Toxic Gas - Explosion Hazard - Forms irritating toxic fumes - Use NIOSH approved gloves, eye protection, face shield & apron
Peroxide Formers 	- Acrylonitrile - Isopropyl Alcohol Ethers (e.g. Diethyl ether, Isopropyl Ether) - Acetals and Ketals, especially Cyclic Ethers and those with primary and/or secondary Alkyl groups Aldehydes (e.g. Acetaldehyde, Benzaldehyde) - Vinyl and Vinylidene compounds - Dienes - Tetrahydrofuran - Dioxane - Butylated Hydroxytoluene (BHT)	- Store in airtight bottles, away from light and heat in a dark, cool dry area; avoid using containers with loose-fitting lids and ground glass stoppers; crystallization, discoloration, and formation or deposition of layers are signs a peroxide former may have become shock sensitive; do not use or move such containers: contact DEP - All bottles of peroxide-forming chemicals must have the received date marked on the container; when the bottle is first opened, the container must be marked with the date opened	Always consult the Safety Data Sheet (SDS) and the Division of Environmental Protection (DEP)	- Explosion Hazard - Violent Reaction - Shock Sensitive - Combustion (Exothermic Reaction) - If an old or expired container of a peroxide-forming chemical or reactive is found, do not move it. Contact the DEP at 301-496-4710 for assistance in disposing of the container - Use proper PPE - Use NIOSH approved gloves, eye protection, face shield & apron
Water Reactive 	- Sodium Metals - Lithium Metals - Potassium Metals - Sodium Borohydride - Alkali Metal Hydrides - Cesium metal	- Store in a dry, cool area away from potential spray from fire sprinklers and other water sources (DO NOT store under the sink) - Label this area for water-reactive storage - Do not store with any other chemicals	- Aqueous solutions - Oxidizers - Please consult the Safety Data Sheet (SDS) and the Division of Environmental Protection (DEP)	- Heat Evolution - Violent Reaction when mix with water - Liberates hydrogen gas with water - Reacts violently with water - Use NIOSH approved gloves, eye protection, face shield & apron

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Flammable Compressed Gases 	• Methane • Acetylene • Butane • Propane • Hydrogen • Silane • Ethane • Arsine • Germane	• Handle flammable compressed gases in a chemical fume hood • Store in well-ventilated areas; store away from oxidizers, open flames, sparks, and other sources of heat ignition; post NO SMOKING signs around storage area(s) or entrance(s) to storage room(s); flammable gases stored outdoors where ambient temperatures exceed 125 deg F (51.7 deg C) shall be protected from direct sunlight • Must be secured in upright position, bonded or chained against the wall • Use a spark proof wrench to attach regulators and make other connections; install a flame/flash arrestor at the regulator outlet flow valve	• Oxidizers • Toxic Compressed Gases	• Fire Hazard • Explosion Hazard • Use NIOSH approved gloves, eye protection, face shield & apron • Wear safety shoes
Oxidizing Compressed Gases 	• Oxygen • Chlorine • Fluorine • Nitrogen Oxides • Gas mixtures containing Oxygen higher than atmospheric concentrations (above 23%)	• Store oxidizers separately from flammable gas containers or combustible materials; minimum separation requirement from these materials is 20 ft or a 5 ft noncombustible barrier with a fire resistance rating of at least 30 minutes • Must be secured in upright position, bonded or chained against the wall • Clean equipment used for oxygen and nitrous oxide with oxygen-compatible materials free from oils, greases, and other contaminants • Fluorine shall be handled in specially passivated containers and associated equipment	• FlammableCompressed Gases • Toxic Compressed Gases	• Fire Hazard • Explosion Hazard • Use NIOSH approved gloves, eye protection, face shield & apron • Wear safety shoes
Toxic Compressed Gases 	• Carbon Monoxide • Hydrogen Sulfide • Nitrogen Dioxide • Arsenic • Pentafluoride • Boron Tribromide • Bromine • Chlorine • Fluorine • Chloropicrin • Cyanogen	• Handle toxic compressed gases in a chemical fume hood • Must be secured in upright position, bonded or chained against the wall • Indoor storage or use of toxic compressed gases shall be provided with a gas cabinet, exhausted enclosure, or gas room • Refer to the SDS information for additional guidance on storage and compatibility requirements • Contact DOHS to determine if a fail-safe valve and/or continuous monitoring for toxic gas may be required during use	• Flammable Compressed Gases • Oxidizing Compressed Gases • Please consult the specific SDS and DEP	• Release of Toxic Gas • Hydrogen Sulfide is a colorless, flammable, extremely hazardous gas with a “rotten egg” smell; • Prolonged exposure may cause nausea, tearing of the eyes, headaches or loss of sleep, airway problems (bronchial constriction) in some asthma patients; • Possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness and slight conjunctivitis to name a few symptoms and effects • Use NIOSH approved gloves, eye protection face shield & apron • Wear safety shoes

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Carcinogens 	• Benzene • Benzadine • Methylene Chloride • Carbon Tetrachloride • Cadmium & Compounds • Arsenic & Compounds • Asbestos • Alfatoxins • Beryllium & Compounds	• Label all containers as "Cancer Suspect Agents" or the equivalent • Store according to the hazardous nature of the chemical, using appropriate security when necessary	• Please consult the specific SDS and DEP	• Please consult the specific SDS and DEP • Use NIOSH approved gloves, eye protection, face shield & apron
Teratogens 	• Tegretol • Aminopterin • Chlorobiphenyls • Coumarins • Tetracycline • Tapazole • Propylthiouracil (PTU)	• Label all containers as "Suspect Reproductive Hazard" or "Reproductive Effector" • Store according to the hazardous nature of the chemical, using appropriate security when necessary	• Aniline incompatible with Nitric Acid and Hydrogen Peroxide • Please consult the specific SDS and DEP	• Please consult the specific SDS and DEP • Use NIOSH approved gloves, eye protection, face shield & apron
Flammable Aerosols Cans 	Pressurized Aerosol Cans containing flammable liquid not limited to: • Acetone • Thinner • Toluene • Petroleum Distillates • Butyl Cellusolve • Xylenes • Methanol	Content under pressure: • Store at room temperature; or store above 120F; • Do not use near heat, sparks and open flames; • Always use secondary containers when storing with other chemicals	• See incompatibles for flammable liquids; • Do not store with acids, oxidizer, toxic and reactive chemicals; • Use secondary container with flat surface for stability	• Keep away from children reach; • Read instructions and usage as directed; • Review SDS prior to use; • Use NIOSH approve gloves or PPE rinse skin thoroughly with soup and water; • Consult your medical emergency for severe skin or eye contact; • Use fire extinguisher in case of fire or dial 911
Non-Flammable-Corrosive-Toxic Aerosols Cans	Pressurized Aerosol cans NOT containing flammable liquid but not limited to Corrosive or Toxic carrier: • Ammonia • Sodium Hydroxide • Sodium Hypochlorite • Amines	Content under pressure: • Store at room temperature; or store above 120F; • Do not use near heat, sparks and open flames; • Always use secondary containers when storing with other chemicals	• See incompatibles for corrosive acid, base and toxic items above; Use secondary container with flat surface for stability	• Keep away from children reach; • Read instructions and usage as directed; • Review SDS prior to use; • Use NIOSH approve gloves or PPE rinse skin thoroughly with soup and water; • Consult your medical emergency for severe skin or eye contact; • Use fire extinguisher in case of fire or dial 911

Adapted from Prudent Practices in the Laboratory: Handling and Disposal of Chemicals, National Research Council, 1995, University of Texas/Health Science at Houston and Boston University Environmental Health & Safety.