

CHEMICAL STORAGE

INTRODUCTION

Because of the diverse nature of chemicals and their use, the "science" of storage has become increasingly important.

Ideal hazardous chemical storage would be complete isolation of each class and even isolation of some materials within a class. Practically, such isolation is not economically feasible, and it is necessary to group items so that the available space is used in the safest way.

THE HAZARD OF NON-CLASSIFIED STORAGE

In general, the storage of flammable solvents near reactive chemicals is a potential source of fire. The breakage of a bottle of corrosive liquid (i.e., H_2SO_4) in a storage area containing toxicants could lead to poisonous fumes escaping to the atmosphere. Substances that give off flammable vapors (solvents, substances slowly liberating H_2) can cause build-up of such vapors in pockets --potential fire or explosion hazards.

FLAMMABLE SOLVENTS

Storage conditions: Store in areas cool enough to prevent ignition even if vapors mix with air. Locate storage area away from areas of fire hazard. Eliminate all ignition sources. Allow no smoking in flammable storage areas. Storage areas shall have on site spill cleanup materials and automatic fire detection equipment nearby.

Inspect areas for deficiencies periodically. Provide adequate ventilation to prevent vapor build-up.

Isolate Flammable Solvents from:

- Oxidizers
- Chemicals capable of spontaneous heating
- Explosives
- Materials reacting with air or moisture to liberate heat
- Ignition sources

CORROSIVE CHEMICALS

Storage conditions: Store in cool, dry, well-ventilated areas away from sunlight. Store only in approved containers under approved conditions. An automatic water spray device shall be immediately available. Segregate acids from bases. Fire-fighting equipment shall be on hand. Treatment agents for the neutralization of spills shall be available. Storage area shall not be subject to rapid temperature changes. Structural materials shall be non-corroding or metal covered with acid-fume resistant paint. Inspect periodically for deficiencies.

Isolate Corrosives from:

- Toxic materials
- Substances that may release corrosive, toxic or flammable fumes on reaction
- Organic materials
- Flammable substances
- Uncoated structural materials

TOXIC CHEMICALS

Storage conditions: Store in cool, dry, well-ventilated areas. Store away from heat and moisture and out of sunlight. Area shall be protected from contamination by acid fumes. Toxic chemicals shall be stored away from fire hazard areas. Storage area shall not contain drain to which toxicants could be flushed. Containers shall be sealed as tightly as possible. Inspect periodically for deficiencies. Storage area shall maintain integrity in event of disaster.

Isolate Toxicants from:

Acids and acid fumes

Other corrosives

ASBESTOS

The public is often confused about asbestos. Asbestos is a mineral rock mined from the earth in much the same ways as other minerals such as iron, lead, and copper however, instead of crushing up into dust particles, asbestos divides into millions of fibers. These fibers come in three common varieties: chrysotile, amosite, and crocidolite.

All three varieties exhibit substantial resistance to heat and chemicals and thus have been used for many commercial and industrial purposes. In fact, asbestos has been used in more than 3,000 products.

While the asbestos industry started in the 1870s, it became more prevalent in the U.S. in the 1940s, where it was widely used in ships during World War II. After the war, asbestos use expanded to include use for acoustical and decorative purposes, especially in buildings. Additionally, it was sprayed or trowled on steel members of buildings as a fire proofing material.

More than half of the multi-story buildings constructed during the 1950 period contain some form of asbestos material within.

It has been apparent for some time that asbestos fibers can cause lung disease.

Accordingly, the Environmental Protection Agency (EPA) and subsequently the Louisiana Department of Environmental Quality (DEQ) have developed strict regulations regarding the use, removal, and disposal of asbestos and asbestos containing material.

Removal and disposal of asbestos and/or asbestos containing material is a very exacting process and must be done only by individuals who have been specially trained and certified to perform such tasks.

Presently, Louisiana Tech University Physical Plant has the trained and certified personnel to perform such work. Anticipated work that might involve asbestos or asbestos-containing material shall be coordinated through Physical Plant or the Environmental Health and Safety Department. The above is true even if it is only suspected that asbestos could be involved.

Removal of materials such as floor tiles, acoustical ceiling tiles, ceiling and wall plaster, insulated pipes, or removal of insulation from pipes or any sprayed or trowled on material within a building is not acceptable unless done by Physical Plant's trained and certified workers.

If a building occupant suspects asbestos problems, i.e. dust or fallen material on floors, exposed pipe insulation, etc., he or she shall report it to Physical Plant or Environmental Health and Safety Department.

The presence of asbestos-containing materials does not mean the health of building occupants is endangered. If asbestos-containing materials remain in good condition and are unlikely to be disturbed, exposure will be negligible. However, when fibers are released, they can create a potential hazard for building occupants.

Remember, indoor levels of airborne asbestos fibers are 10,000 to 100,000 times lower than levels in asbestos industry workplaces where asbestos related diseases have been well documented.

(OXIDIZING AND REDUCING SUBSTANCES) REACTIVE CHEMICALS

Storage conditions: Store in cool, dry, well-ventilated area out of direct sunlight. Buildings shall be fireproof and provided with an automatic sprinkler system (except where materials are water sensitive). Protect from extremes of temperatures and rapid temperature changes. Containers shall be tightly sealed and good ventilation provided.

Isolate Reactive Chemicals from:

- Organic materials
- Flammable solvents
- Corrosives
- Toxicants
- Heat
- Strong sunlight

NOTE: Many normal fire-fighting procedures are not particularly effective with oxidizers, as they provide their own oxygen for combustion.

(WATER AND AIR SENSITIVE MATERIALS) REACTIVE CHEMICALS

Storage conditions: Store in cool, dry area conforming to requirements for storing hydrogen. Building shall be waterproof. No sprinkler system shall be in building. The building shall be located on high ground and remote from other storage areas. Inspect periodically for deficiencies. Automatic detectors for flammable gases and smoke shall be provided. Ventilate well to protect from flammable gas build-up. Eliminate all ignition sources.

Isolate Reactive Chemicals from:

- Reactive chemicals
- Fire hazards
- Heat
- Moisture

HANDLING TOXIC AND CORROSIVE CHEMICALS

Because of the special dangers involved with toxic and corrosive chemicals (both of which may be related), some advice is warranted.

1. Handle carefully. (The life you save may be your own.)

2. Leaky containers:
 - a. Don protective gear: gloves, goggles, gas-masks, air-packs, boots, aprons, whatever necessary.
 - b. Isolate leak area. (Danger signs)
 - c. Report immediately:
What is leaking?
Where?
What or Who has been contaminated?
3. Wear adequate protective gear when using these substances.
4. Use fume hoods or other exhaust systems.
5. Wash thoroughly after using.
6. Get periodic medical checkups for insidious contamination.

REACTIVE CHEMICALS (EXPLOSIVES)

Storage conditions: Store in cool, dry areas protected from shock, elevated temperatures, rapid temperature changes. Storage sites shall be remote from all other storage, industrial, or residential areas. Magazines shall be heavily constructed, taking advantage of natural barriers. Do not store unnecessary quantities of explosives.

Isolate Reactive chemicals from:
 Water and water solutions
 Moist air
 Aqueous acids and bases
 Flammable storage areas
 Reactive chemicals

Special Precautions:

1. Keep containers well sealed.
2. Store under inert, non-flammable solvent where possible.
3. Store pyrophors under (always) non-flammable, inert solvents.

REACTIVE CHEMICALS (OTHERS)

Special organics. Store in cool, dry area away from extremes in temperature. Store away from corrosives and reactive chemicals. Provide adequate ventilation. Many of these substances fall into classes already discussed and shall be treated accordingly.

Acid or acid fume sensitive materials. Isolate from acid storage and from areas using acid. Provide adequate ventilation. Protect structured materials by coating with acid-resistant finish.

Compressed gases. Store in cool area out of sunlight. Store upright, chained in place. Building shall be fireproof. Care shall be taken to avoid damaging valves. Avoid drastic temperature changes and high temperatures. Do not store large quantities of compressed gases in work areas.

REMEMBER:

Isolation of hazardous materials is the safest means of storage. Isolate according to class where possible.

Because many compounds overlap the various classes, some doubt as to the needed storage conditions may exist.

Have adequate means available to deal with spills and to safely dispose of hazardous materials.

INCOMPATIBLE CHEMICALS PARTIAL LISTING

Chemical	Incompatible Chemicals
Acetic acid	Chromic acid, ethylene glycol, hydroxyl-containing compounds, nitric acid, perchloric acid, permanganates, and peroxides
Acetone	Bromine, chlorine, nitric acid, and sulfuric acid
Alkaline and alkaline earth metals such as powdered calcium, cesium, lithium, magnesium, potassium, sodium, aluminum, etc.	Bromine, chlorine, copper, fluorine, mercury, and silver
Aluminum and its alloys (particularly powders)	Acid or alkaline solutions, ammonium persulfate, water chlorates, chlorinated compounds, nitrates, and organic compounds in nitrate/nitrite salt baths
Ammonia (anhydrous)	Bromine, calcium hypochlorite, chlorine, hydrofluoric acid, iodine, mercury, and silver
Ammonium nitrate	Acids, chlorates, chlorides, lead, metallic nitrates, metal powders, finely divided organics or combustibles, sulfur, and zinc
Ammonium perchlorate, permanganate, or persulfate	Combustible materials, oxidizing materials such as acid, chlorates, and nitrates
Aniline	Hydrogen peroxide or nitric acid
Barium peroxide	Combustible organics, oxidizing materials, water, and reducing agents
Bismuth and its alloys	Perchloric acid
Bromine	Acetone, acetylene, ammonia, benzene, butadiene, butane and other petroleum gases, hydrogen, finely divided metals, sodium carbide, and turpentine
Calcium or sodium carbide	Moisture in air or water
Calcium hypochlorite	(Activated) ammonia or carbon containing materials

INCOMPATIBLE CHEMICALS PARTIAL LISTING (cont.)

Chemicals	Incompatible Chemicals
Carbon, activated	Calcium hypochlorite and all oxidizing agents
Chlorates or perchlorates	Acids, aluminum, ammonium salts, cyanides, phosphorous, metal powders, finely divided organics or other combustibles, sugar, sulfides, and sulfur
Chlorine	Same as bromine
Chlorine dioxide	Ammonia, hydrogen, sulfide, methane, phosphine, and organic materials
Chromic acid	Acetic acid (glacial), acetic anhydride, alcohols, combustible materials, flammable liquids, glycerine, naphthalene, nitric acid, sulfur, turpentine, reducing agents, and oxidizing materials
Copper	Acetylene, hydrogen peroxide, sodium azide
Cumene hydroperoxide	Acids (mineral or organic)
Cyanides	Acids or alkalies
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, and the halogens
Fluorine	Most materials
Hydrocarbons such as benzene, butane, gasoline, propane, turpentine, etc.	Bromine, chlorine, chromic acid, fluorine, hydrogen peroxide, and sodium peroxide
Hydrofluoric acid or anhydrous cyanide	Ammonia (anhydrous or aqueous)
Hydrocyanic acid or hydrogen cyanide	Alkalies, nitric acid, oxidizers
Hydrogen peroxide 3%	Chromium, copper, iron most metals or their salts
Hydrogen peroxide 30% to 90%	Same as 3% hydrogen peroxide plus aniline, and flammable liquids, combustible materials, nitromethane, and all other organic matter including alcohols

INCOMPATIBLE CHEMICALS PARTIAL LISTING (cont.)

Chemicals	Incompatible Chemicals
Hydrogen sulfide	Fuming nitric acid or oxidizing gases
Iodine	Acetylene, ammonia (anhydrous or aqueous), and hydrogen reducing materials
Lithium	Acids, moisture in air, water oxidizers
Lithium aluminum hydride	Acids, chlorinated hydrocarbons, carbon dioxide, ethyl acetate, and water-powered limestone and extinguishing agent
Magnesium (particularly powder)	Carbonates, chlorates, heavy metal oxalates or oxides, nitrates, perchlorates, peroxides, phosphates, and sulfates
Mercuric oxide	Sulfur, reducing agents
Mercury	Acetylene, alkali metals, ammonia, nitric acid with ethanol, oxalic acid, azides
Nitrates	Combustible and flammable materials, esters, phosphorous, sodium acetate, stannous chloride, water, and zinc powder
Nitric acid (concentrate)	Acetic acid, aniline, chromic acid, flammable gases and liquids, hydrocyanic acid, and hydrogen sulfide
Nitric acid	Alcohols and other oxidizable organic material, hydriodic acid (hydrogen iodide), magnesium or other metals, phosphorous, and thiophene
Nitrates	Potassium or sodium cyanide, reducing agents
Oxylic acid	Mercury or silver
Oxygen (liquid or enriched air)	Flammable gases, liquids, or solids such as acetone, acetylene, grease, hydrogen, oils, and phosphorous
Perchloric acid	Acetic anhydrides, alcohols, bismuth and its alloys, grease, oils or any organic materials, reducing agents, paper wood

INCOMPATIBLE CHEMICALS PARTIAL LISTING (cont.)

Chemicals	Incompatible Chemicals
Peroxides (organic)	Acids (mineral or organic), reducing agents
Phosphorous	Chlorates and perchlorates, nitrates and nitric acid, organic materials, reducing agents, white phosphorous, air or oxygen in addition to others
Phosphorous pentoxide	Organic compounds, water, reducing agents
Picric acid	Ammonia heated with oxides or salts of heavy metals (particularly copper, lead, zinc) and friction with oxidizing agents and reducing agents
Potassium	Air (Moisture and/or oxygen), water, carbon dioxide, carbon tetrachloride
Potassium chlorate or perchlorate	Acids or their vapors, combustible materials, especially organic solvents, phosphorous, and sulfur
Potassium permanganate	Benzaldehyde, ethylene glycol, glycerine, and sulfuric acid
Silver	Acetylene, ammonium compounds, nitric acid with ethanol, oxalic acid, tartaric acid, fulminic acid, azides
Sodium	Carbon tetrachloride, carbon dioxide, and water
Sodium amide	Air (moisture and oxygen), water, oxidizers
Sodium chlorate	Acids, ammonium salts, oxidizable materials, and sulphur
Sodium hydrosulfite	Air (moisture) or combustible materials
Sodium nitrate	Ammonia compounds, ammonium nitrate or other ammonium salts, organic materials, friction

INCOMPATIBLE CHEMICALS PARTIAL LISTING (cont.)

Chemicals	Incompatible Chemicals
Sodium peroxide	Acetic acid (glacial, acetic anhydride, alcohols, benzaldehyde, carbon disulfide, ethyl acetate, ethylene glycol, furfural, glycerine, methyl acetate, and other oxidizable substances, powdered metals, water acids, organic materials)
Sulfur	Any oxidizing material
Sulfuric acid	Chlorates, perchlorates, permanganates, combustibles
Water	Acetylene chloride, carbides, chromic acid, phosphorous, oxychloride, phosphorous pentachloride, sulfuric acid, and sulfur trioxide
Zinc chlorate	Acids or organic materials
Zinc (particularly powder)	Acids or water
Zirconium (particularly in powder form)	Carbon tetrachloride and other halogenated hydrocarbons, peroxides, sodium bicarbonate, water, and air

STORAGE OF FLAMMABLE LIQUIDS CLASSES IA IB ICPurpose

This Louisiana Tech University Operational Safety Standard establishes consistent safety practices within Louisiana Tech University for the Storage of Flammable Liquids--Classes IA, IB, and IC.

Scope

This Safety Standard shall apply to all users of Class IA, IB, and IC Flammable Liquids in the performance of any task on University property or under the auspices of the University.

Definitions

1. **FLAMMABLE LIQUID** shall mean a liquid having a flash point below 100°F (37.8°C), having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100°F (37.8°C), and shall be known as Class I liquid.

For the purpose of this standard, Class I liquids shall be subdivided as follows:

CLASS IA--includes all liquids having flash points below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C).

CLASS IB--includes all liquids having flash points below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C).

CLASS IC--includes all liquids having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).

2. **COMBUSTIBLE LIQUID** shall mean a liquid having a flash point at or above 100°F (37.8°C).

For the purpose of this standard, combustible liquids shall be subdivided as follows:

CLASS II--includes liquids having flash points at or above 100°F (37.8°C) and below 140°F (60°C).

CLASS IIIA--includes liquids having flash points at or above 140°F (60°C) and below 200°F (93.4°C).

CLASS IIIB--includes liquids having flash points at or above 200°F (93.4°C).

3. **SAFETY CAN** shall mean an approved container of not more than five gallon capacity having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure.

Storage shall be limited to that required for operation of office equipment, maintenance, demonstration, treatment, and laboratory work. All liquids in laboratories and other points of use shall meet the following storage requirements:

- a. No container for Class I or II liquids shall exceed one gallon, except safety cans, which may be of two gallon capacity.

- b. No more than 10 gallons of Class I and II liquids combined shall be stored outside of a storage cabinet or storage room, except in Safety Cans.
- c. No more than 25 gallons of Class I and II liquids combined shall be stored in Safety Cans outside of a storage room or storage cabinet.
- d. No more than 60 gallons of Class IIIA liquids shall be stored outside of a storage room or storage cabinet.
- e. Quantities of liquids in excess of those set forth in this Safety Standard shall be stored in an approved inside or outside storage room.

MAXIMUM ALLOWABLE SIZE OF CONTAINER

CONTAINER TYPE	FLAMMABLE LIQUIDS		COMBUSTIBLE LIQUIDS		
	Class IA	Class IB	Class IC	Class II	Class III
Glass	1 pint	1 quart	1 gallon	1 gallon	5 gallon
Metal (other than D.O.T drums or approved plastic)	1 gallon	5 gallon	5 gallon	5 gallon	5 gallon
Safety Cans	2 gallon	5 gallon	5 gallon	5 gallon	5 gallon
Metal Drums (D.O.T. Spec.)	60 gallon	60 gallon	60 gallon	60 gallon	60 gallon

NOTE: Class IA and Class IB liquids may be stored in glass containers of not more than 1 gallon capacity if the required liquid purity (such as ACS Analytical Reagent grade or higher) would be affected by storage in metal containers or if liquid would cause excessive corrosion of the metal container only upon written approval of the Office of Environmental Health and Safety.

- 4. Flame-proof storage cabinets shall be in accordance with National Fire Protection Association (NFPA) 30, Chapter 4.

Quantity and classification of liquids which can be stored:

- a. Not more than 120 gallons of Class I, Class II, or Class IIIA liquids.
 - b. Of the above total, not more than 60 gallons may be of Class I and Class II liquids.
 - c. No more than three cabinets can be located in a single room unless every group of three is separated by 100 feet or more.
- 5. Tank Storage of flammable or combustible liquids, above or below ground and in any quantity, shall meet NFPA 30, chapter 2 through chapter 9 and all codes set forth by the local authority having jurisdiction.

The Office of Environmental Health and Safety shall be contacted when any storage tank is being considered for campus use.

**FLAMMABLE LIQUIDS
CLASS IA**

CLASS IA: Flash point less than 73°F and boiling point less than 100°F.

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Acetaldehyde	-36	365	69	2	4	2
Amylene	28	523	86	1	4	0
1,3-Butadiene	<20	804	23	2	4	2
n-Butane	-76	761	31	1	4	0
1-Butene	-24	723	21	1	4	0
In Pentane	-40	588	97			
Diborane	-130	293	-135	3	4	3
Dimethylamine	-58	755	45	3	4	0
Dimethyl Propane	20	842	49		4	0
Dimethyl Sulfide	0	403	99	4	4	0
1,2-Epoxy-Propane	-35		93	2	4	2
Ethanethiol	<81	570	99	2	4	0
Ethylamine	0	723	63	3	4	0
Ethyl Chlorine	-58	966	54	2	4	0
Ethylene Oxide	<0	804	51	2	4	3
Ethyl Ether	-49	356	94	2	4	1
Ethyl Nitrite	-30	194	63	2	4	4
Ethyl Vinyl Ether	<-50	395	97	2	4	2
Furan	<32		90	1	4	1
Gasoline	-45	536-853	100-400	1	3	0
Hydrocyanic Acid	0	1000	79	4	4	2
Isoprene	-65	428	93	2	4	1
2-Methyl-2-Butene	<20	100		2	3	0
3-Methyl-1-Butene	<20	689	68	2	4	0
Methyl Ether	-42	662	-11	3	4	0
Methyl Ethyl Ether	-35	374	52	2	4	1
Methyl Formate	-2	853	90	2	4	0
Methyl Mercaptan	<0		45	2	4	0

**FLAMMABLE LIQUIDS
CLASS 1A
(cont.)**

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Methyl Vinyl Ether	-60		46	2	4	2
Monomethylamine	14	806	21	3	4	0
n-Pentane	-56	588	97	1	4	0
Iso-Pentane	-60	788	82	1	4	0
Petroleum Ethers	-70	550	86-140	1	4	0
Propane	-156	874	-49	1	4	0
Iso-Propylamine	-35	756	90	3	4	0
Propylene	-162	860	4	1	4	1
Trimethyl Amine	8-18	374	39	3	4	0
Vinyl Chloride	-108	882	7	2	4	2
Vinylidene Chlorine 5	856		99	2	4	2

**FLAMMABLE LIQUIDS
CLASS 1B**

CLASS 1B: Flash point less than 73⁰F and boiling point at or above 100⁰F.

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Acetal	-5	446	215	2	3	0
Acetone	0	1000	134	1	3	0
Acetonitrile	42		179	3	3	0
Acetyl Chloride	40	734	124	3	3	2
Acetylene Dichloride	39		140	2	3	2
Acetylene Dichloridetrans	36		119	2	3	2
Acrolein	0	532	125	3	3	3
Acrylonitrile	32	898	171	4	3	2
Allyl Alcohol	70	713	206	3	3	1
Allylamine	-20	705	128	3	3	1
Allyl Bromide	30	563	160	3	3	1
Allyl Chloride	-25	737	113	3	3	1
Allyl Ether	-20		203		3	0
Amyl Alcohol-Teriso	67	819	215	1	3	0
Amylamine	45		210	3	3	0
Amylamine-Sec	20		198	3	3	0
Amyl Chloride	55	650	223	1	3	0
Amyl Chloride-Ter		649	187	1	3	0
Amyl Chlorides-mixed	38		185-228	1	3	0
Amyl Mercaptans	65		176-257	2	3	0
Benzol Benzene	12	1044	176	2	3	0
Benzol Dilvent	-25	450	140-210	2	3	0
Benzotrifluoride	54		216	4	3	0
Butadiene Monoxide	-58		151	2	3	2
2-3 Butanediol		756	363	1	1	0
Butyl Acetate	72	790	260	1	3	0

**FLAMMABLE LIQUIDS
CLASS 1B
(cont.)**

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Butyl Acetate-iso	64	793	244	1	3	0
Butyl Acetate-Ter	52	892	181	1	3	0
Butylamine-N	45	594	172	3	3	0
Butylamine-iso	15	712	150	3	3	0
Butyl Bromide-N	65	509	215	2	3	0
Butyl Chloride-N	15	860	170	2	3	0
Butyl Formate-N	64	612	225	2	3	0
Butyl Peroxide	64		176	1	3	3
Butyraldehyde	20	446	169	2	3	
Butyraldehyde-iso	-40	490	142	2	3	
Carbon Disulfide	-22	212	115	2	3	0
Cellulose Nitrate	55			1	3	3
Chlorobutadiene	-4		138		3	
Chlorobutene	-3		143-159	2	3	0
Crotonaldehyde	55	450	216	3	3	2
Cyclohexane	-4	500	179	1	3	0
Cyclohexene	20		181	1	3	0
Cyclopentane	20		121	1	3	0
Denatured Alcohol	60	750	175	0	3	0
Di-Ter-Butyl Peroxide	65		231	2	3	4
Dichloroethylene-1,2	43		141	2	3	2
Diethylamine		594	134	3	3	0
Diethyl Ketone	55	846	217	1	3	0
Di-Iso Propylamine	30		183	2	1	0
Dimethyl Butane	-54	797	122	1	3	0
1,3-Dimethyl-butylamine	55		223-228	2	3	0

**FLAMMABLE LIQUIDS
CLASS 1B
(cont.)**

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
1,4-Dimethyl-cyclohexane	55		248	1	3	0
2,5-Dimethyl Furan	45		200	2	3	0
Dimethyl Hexane-2,3	45	820	237		3	0
Dimethyl Hexane-2,4	50		229		3	0
Dimethylhydrazine (unsym)	5	480	145			
Dimethyl Pentane-2,3	20	639	194		3	0
Dimethyl Pentane-2,4	50		229		3	0
Dioxane-1,4	54	356	214	2	3	1
Dioxolane	35		165	2	3	2
Dipropyl Amine	63		229			
Divinyl Ether	-22	680	102	2	3	2
Ethoxyacetylene	20		124			
Ethyl Acetate	24	800	171	1	3	0
Ethyl Acrylate	60		211	2	3	
Ethyl Alcohol	55	793	173	0	3	0
(with 96% water)	62					
95%	63					
80%	68					
70%	70					
60%	72					
Ethyl Benzene	59	810	277	2	3	0
Ethyl Borate	52		233	2	3	
Ethyl Bromide		952	100	2	3	0
Ethylbutyl-amine-N	64		232			
Ethyln-Butyl Ether	40		198	2	3	0

**FLAMMABLE LIQUIDS
CLASS IB
(cont.)**

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
2-Ethylbutyraldehyde	70		242	2	3	1
Ethyl Chloroformate	61		201		3	1
Ethyl Crotonate	36		282	2	3	0
Ethylene Dichloride	56	775	183	2	3	0
Ethyl Formate	-4	851	130	2	3	0
Ethylidene Dichloride	22		135-138	2	3	0
Ethyl Methacrylate	68		239-248	2	3	0
Ethyl Nitrate	50		190		3	4
Ethyl 1-Propenyl Ether	19		158	2	3	1
Ethyl Propionate	54	890	210		3	0
Ethyltrichloro Silane	72		208	3	3	0
Heptane-N	25	433	209	1	3	0
Heptane-iso	0		176-195	1	3	0
Hexadiene-1,4	-6		151			
Hexane-N	-7	502	156	1	3	0
Hexane-iso	-20		134-142	1	3	0
Hexene-1	20		146	1	3	0
Hexene-2	20		155	1	3	0
Lacquer Divent 12		450-550	190-225		3	0
Methallyl Chloride	11		162		3	
Methyl Acetate	14		140	1	3	0
Methyl Acrylate	27		176	2	3	2
Methylal	0	459	111	2	3	2
Methyl Alcohol	52	867	147	1	3	0
*Methyl Borate	80		156	2	3	1
2-Methyl Butene-2	20		101		3	0

**FLAMMABLE LIQUIDS
CLASS IB
(cont.)**

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Methylbutyl-amine-N	55		196			
Methyl, iso Butyl Ketone	73	860	244	2	3	0
Methyl Butyrate	57		215		3	0
Methyl Carbonate	66		192		3	1
Methyl Cyclohexane	25	545	214		3	0
4, Methylcyclo- hexane-1	30		217		3	0
Methylcyclo- pentane	20		161		3	0
Methyl Ethyl Ketone	21	960	176	1	3	0
2-Methyl Furan	-22		144-147		3	1
Methyl Hydrazine	80		190			
Methyl Methacrylate	50		212	2	3	2
Methyl Pentadiene	-30		168		3	
Methylpentaldehyde	68		243	2	3	1
2-Methyl Pentane 20		583	140	1	3	0
3-Methyl Pentane 20		146		1	3	0
2-Methyl Pentene-1	20		143	1	3	0
4-Methyl Pentene-1	20		129	1	3	0
2-Methyl Pentene-2	20		153	1	3	0
4-Methyl Pentene-2	20		133-137	1	3	0
2-Methyl-2-pro- panethiol	-20		149-153		3	0
2-Methylpropenal	35		154	3	3	2
Methyl Propionate	28	876	175	1	3	0
Methyl-N-Paopyl Ketone	45	941	216	2	3	0
Methyl Pyrrole	61		234		3	
Methyl Pyrrolidine	7		180		3	

**FLAMMABLE LIQUIDS
CLASS IB
(cont.)**

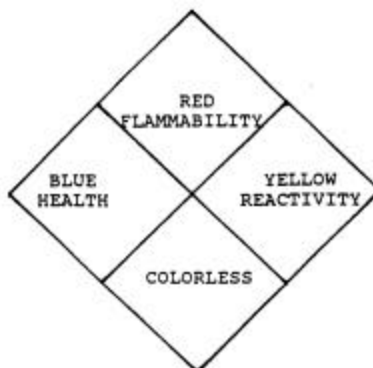
HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Methyltetrahydro-furan	12		176			
Methyl Vinyl Ketone	20		177	2	3	2
Naphtha V.M.&P. (regular)	28	450	212-320	1	3	0
Octane	56	428	258	0	3	0
Octene-1	70		250	1	3	0
Octene-2	70		257	1	3	0
Pentamethylene Oxide	-4		178		3	1
Petroleum Ether	0	550	95-140	1	4	0
Piperidine	61		223	2	3	3
Propanal	15-19		120	2	3	1
Propenyl Acetate-iso	60		207	2	3	
Propenyl Ethyl Ether	20		158		3	
Propionyl Chloride	54		176	3	3	1
Propyl Acetate-N	58	842	215	1	3	0
Propyl Acetate-iso	40	860	194	1	3	0
Propyl Alcohol-iso	53	750	181	1	3	0
Propylamine-N	-35	604	120	3	3	0
Propyl Chloride	0		115	2	3	0
Propylene Dichloride	60	1035	205	2	3	0
Propyl Ether-iso	-18	830	156	2	3	0
Propyl Formate-N	27	851	178	2	3	1
Propyl Formate-iso	22	905	153	2	3	
Propyl Nitrate-N	68	350	231	2	3	3
Pyridine	68	900	239	2	3	0
Pyrrolidine	37		186-189	2	3	1

**FLAMMABLE LIQUIDS
CLASS IB
(cont.)**

HAZARD IDENTIFICATION

CHEMICAL	FLASH POINT	IGNITION TEMP	BOILING POINT	HEALTH	FLAMMABILITY	REACTIVITY
Tetrahydrofuran	6	610	151	2	3	1
Thiophene	30		184			
Tolvol	40	997	231	2	3	0
Triethylamine	20		193	2	3	0
Trimethylhexane-2,2,5	55		255	2	3	0
2,2,4-Trimethyl-pentane	10	784	211		3	0
2,2,4-Trimethyl-pentene-1	20		214		3	0
2,2,4-Trimethyl-pentene	35		221		3	0
Valeraldehyde	54		217			
Vinyl Acetate	18	800	161	2	3	2
Vinyl Allyl Ether	68		153	2	3	2
Vinyl Butyl Ether	15		202	2	3	2
Vinyl Butyl Ether-iso	20		181	2	3	2
Vinyl Butyrate	68		242	2	3	2
4 Vinyl Cyclohexene	61		266		3	2
Vinyl Isobutyl Ether	15		182	2	3	2
Vinyl Propionate	34		203	2	3	2

NFPA HAZARD IDENTIFICATION SYSTEM

The diamond-shaped diagram shows the inherent hazards of the chemical and the order of severity of these hazards under emergency conditions. The Hazard Identification System is not intended to identify the non-emergency health hazards of chemicals.

The diamond-shaped diagram identifies the "Health," "Flammability," "Reactivity," and "Unusual Hazards" of a chemical. A numeral grading system, four(4) being high and zero (0) being low, indicates the order of severity of each hazard. The unusual hazard space is used to identify special reactive material.

Health Hazard--Code Color Blue:

A health hazard is any property of a material that either directly or indirectly can cause injury or incapacitation from exposure by contact, inhalation, or ingestion.

- 4 -- A few whiffs of the gas or vapor could cause death; liquid penetration could be fatal.
- 3 -- Material is extremely dangerous but area can be entered if fully protected.
- 2 -- Material is hazardous to health but area can be entered freely if SCBA is used.
- 1 -- Material is only slightly hazardous to health.
- 0 -- Material offers no health hazard.

Flammability Hazard--Code Color Red:

Flammability hazard deals with the degree of susceptibility of materials to burning.

- 4 -- Very flammable gases and very volatile flammable liquids and materials in the form of dusts or mists readily form explosive mixtures when dispersed into the air.
- 3 -- Liquids which can be ignited under almost all normal temperatures (low flashpoint). Solids which form dusts or solids in shredded or fibrous form. Solids that burn rapidly because they create their own oxygen. Any material that ignites spontaneously at normal temperature.
- 2 -- Liquids which must be moderately heated before ignition will occur and solids that readily give off flammable vapors. (Water can cool them off usually.)
- 1 -- Materials that must be preheated before ignition can occur.
- 0 -- Materials that will not burn.

Reactivity Hazard--Code Color Yellow:

Reactive hazard incorporates those materials that can enter into a chemical reaction with other materials.

- 4 -- Materials which, in themselves, are readily capable of detonation or explosive decomposition at normal temperatures. This includes materials sensitive to mechanical or thermal shock.
- 3 -- Materials which, in themselves, are capable of detonation or explosive decomposition but requiring a strong initiation source or must be heated before initiation under confinement. Includes materials that are shock sensitive at elevated temperatures or pressures. (These materials can react with water.)
- 2 -- Materials which, in themselves, are normally unstable and readily undergo violent chemical change but do not detonate. Includes materials that can undergo chemical change with rapid release of energy at normal temperatures or pressures. (These materials can react with water.)
- 1 -- Materials which, in themselves, are normally stable, but may become unstable at elevated pressures and temperatures. (These materials may react with water but not violently.)
- 0 -- Materials that are stable even under fire conditions and are not reactive to water.

Unusual Hazard--Code Color Colorless:

Unusual hazard space is primarily used to identify chemicals with unusual reactivity with water, radioactive, or is an oxidizing chemical.

Special reactive materials are:

OXY Oxidizers



Radiation

W Water

FIRE EXTINGUISHERSTypes of Fires:

- Class A-- Ordinary combustibles such as wood, paper, cloth, some rubbers, and plastics.
- Class B-- Flammable liquids such as gasoline, oils, grease, tars, lacquer, and oil-based paints.
- Class C-- Energized electrical equipment such as fuse boxes, electrical outlets, circuit breakers, wiring appliances, and other machinery.
- Class D-- Combustible metals such as fires involving titanium, magnesium, lithium, potassium, or sodium.

Types of Fire Extinguishers:

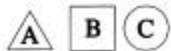
Fire extinguishers come in various shapes, sizes, colors, and types. They shall only be used on the type of fire for which they are rated. Before an emergency arises, it is recommended that all employees/students read and understand the directions of the fire extinguisher(s) in their area.



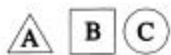
A WATER extinguisher is designated by an "A" inside a GREEN TRIANGLE on the label and is easily recognized by its silver container. This extinguisher is only to be used on Class A type fires. CAUTION: Do not use on electrical fires.



A CO₂ extinguisher is designated by a "B" in a RED SQUARE and a "C" in a BLUE CIRCLE on the label and is easily recognized by the large black discharge horn. This type of extinguisher is only to be used on Class B and/or C type fires. CAUTION: Do not use in a confined space.



MULTI-PURPOSE and ORDINARY DRY CHEMICAL extinguishers are designated by an "A" inside a GREEN TRIANGLE, a "B" inside a RED SQUARE, and a "C" inside a BLUE CIRCLE on the label respectively. It is easily recognized by its red container and/or piggy back cartridge. This type of extinguisher is only to be used on Class B and/or C type fires, while multi-purpose dry chemical can also be used on Class A type fires. CAUTION: Respiratory irritant, if inhaled.



HALON 1211 extinguishers are labeled by the same designations as a multi-purpose dry chemical extinguisher, "ABC." Halon is usually packaged in a red container similar to a dry chemical extinguisher, but it is usually not recognizable until the label is read. This extinguisher is for use on Class A, B, and C type fires. CAUTION: Do not use in a confined space.

NOTE: A Halon 1211 or CO₂ fire extinguisher is recommended for use in computer rooms or in areas where electronic equipment is located. Dry chemical and water extinguishers are not.



A COMBUSTIBLE METAL fire extinguisher is designated by a "D" inside a YELLOW STAR on the label. This extinguisher is only for use on Class D type fires.

How to Use a Fire Extinguisher:

The method described below is a standard application for how to use a fire extinguisher; however, it is highly recommended that all employees/students read and understand the directions on the fire extinguisher(s) in their area. This method does not apply to all portable extinguishers.

To use extinguisher, remember P A S S.

Pull the pin. (Some may require pressing a puncture lever or releasing a lock hatch.)

Aim the extinguisher nozzle or cone at the base of the fire.

Squeeze or press the handle.

Sweep from side to side at the base of the fire until it appears to be out. With a water extinguisher, place your finger over the nozzle to create a mist. Stop the extinguisher, check the fire area, and (if necessary) continue your extinguishment efforts. Always back away from a fire so you will not be caught off guard.