

FIRE DEPARTMENT • CITY OF NEW YORK



**STUDY MATERIAL FOR THE EXAMINATION FOR
CERTIFICATE OF FITNESS FOR
HAZARDOUS MATERIALS**

C-91

**(This study material also includes old C-24:
The Supervision of Bulk Acid Storage)**

NOTICE OF EXAMINATION

Title: Examination for Certificate of Fitness for Hazardous Materials (C-91)

Date of Test: Written tests are conducted Monday through Friday (except legal holidays) 9:00 AM to 2:30 PM

QUALIFICATION REQUIREMENTS

1. Applicants must be at least 18 years of age.
2. Applicants must have a reasonable understanding of the English language.
3. Applicant must present a letter of recommendation from his/her employer. The letter must be on official letterhead and must state the applicant's full name, character, physical condition, experience, and address of premises where applicant will be employed.
4. Applicant must provide two forms of government issued photo identification, such as a State-issued Drivers' License or Non Drivers License or a passport.

APPLICATION INFORMATION

Application Fees: \$25.00 for originals and \$15.00 for renewals. The fee may be paid by credit card (no debit), in cash, money order, or personal check payable to New York City Fire Department. The \$25.00 fee must be payable by all applicants prior to taking the Certificate of Fitness test. Application forms are available at the Public Certification Unit, 1st floor, 9 MetroTech Center, Brooklyn, NY 11201.

TEST INFORMATION

Test: The test will be of the written, multiple choice type. A passing score of at least 70% is required in order to secure a Certificate of Fitness. Call 718-999-1988 or 2504 for additional information and forms.

About the Study Material

These study materials will help you prepare for the written examination for the certificate of fitness for hazardous chemicals. The study materials include information taken from the Fire Code. The study material does not contain all the information you need to know in order to perform the responsibilities of storage, handling and use of organic peroxide, oxidizer, pyrophoric, pyroclastic, unstable (reactive) material, water-reactive, corrosive material, and toxic and highly toxic and flammable sold chemicals safely. It is your responsibility to become familiar with all applicable laws, rules and regulations of the federal, state and city agencies having jurisdiction, even though such requirements are not included in this study material. You need to be familiar with New Fire Code Chapters 31, 36, 37, 39, 40, 41, 42, 43 and 44, which regulate the storage, handling and use of the above chemicals in order to adequately prepare for the exam. ***It is critical that you read AND understand this booklet to help increase your chance of passing this exam.***

About the Test

You must pass a multiple choice test to qualify for the certificate of fitness. A score of 70% correct is required in order to pass the test. All questions have four answer options. Only **one** answer is correct for each question. If you do not answer a question, or if you mark more than one answer to a single question, your answer to that question will be scored as incorrect. Read each question carefully before marking your answer. There is no penalty for guessing.

Sample Questions

1. Who was the first president of the United States?

- (A) George Washington.
- (B) Madonna.
- (C) Abraham Lincoln.
- (D) Elvis Presley.

The correct answer is "**A**". You would mark "**A**" on your touch-screen terminal.

2. What sports team plays at Madison Square Garden?

- (A) Yankees.
- (B) Nets
- (C) Cardinals.
- (D) Knicks.

The correct answer is "**D**". You would mark "**D**" on your touch-screen terminal.

Introduction

This document outlines New York City Fire Department regulations for the safe handling and storage of hazardous chemicals. One primary regulation is that at least one Certificate of Fitness holder must be on duty at all times when these chemicals or materials are being used. The fire commissioner may require an additional Certificate of Fitness holder in some locations. The Certificate of Fitness holders are responsible for ensuring that all Fire Department regulations related to the safe handling and storage of hazardous chemicals or materials are obeyed on the premises.

The Certificate of Fitness holders are responsible for ensuring that all Fire Department regulations related to the safe storage, handling and use of hazardous materials at the work site are complied with. The booklet provides a brief overview of the safety precautions, rules, guidelines, work practices, and emergency procedures for the storage, handling and use of hazardous materials. The Certificate of Fitness holder must know the properties of each of these hazardous materials and the proper storage, handling and use requirements. S/he must also know the procedures that must be followed when dealing with fire or spill emergencies for this hazard.

This booklet consists of two parts: core requirements and specific descriptions of 10 chemical groups covered under the Fire Code. The test covers all of the material in this booklet. Therefore, if you are successful on the test, you will be authorized to handle any of these chemicals. You should become with the entire booklet.

The following hazardous materials are covered in this study guide and test:

- Corrosive materials systems and facilities: **[Fire Code Chapter 31]**
- Flammable solids systems and facilities: **[Fire Code Chapter 36]**
- Highly toxic and toxic materials systems and facilities: **[Fire Code Chapter 37]**
- Ozone gas generators **[Fire Code Chapter 37]**
- Organic peroxides storage and facilities: **[Fire Code Chapter 39]**
- Oxidizer systems and facilities: **[Fire Code Chapter 40]**
- Pyrophoric materials systems and facilities: **[Fire Code Chapter 41]**
- Pyroxylin plastics systems and facilities: **[Fire Code Chapter 42]**
- Unstable (Reactive) materials systems and facilities: **[Fire Code Chapter 43]**
- Water-reactive solids and liquids systems and facilities: **[Fire Code Chapter 44]**

These materials are NOT covered in this study guide as separate testing for these topics is required.

- Non-production chemical laboratories: **[Fire Code Section 2706]**
- Combustible fibers: **[Fire Code Chapter 29]**
- Compressed Gases: **[Fire Code Chapter 30]**
- Cryogenic fluids systems and facilities: **[Fire Code Chapter 32]**
- Explosives, Fireworks & Special Effects: **[Fire Code Chapter 33]**
- Flammable and combustible liquids: **[Fire Code Chapter 34]**
- Flammable gases: **[Fire Code Chapter 35]**
- Liquid Petroleum Gas (LPG): **[Fire Code Chapter 38]**

PART I

1. DEFINITIONS

BOILING POINT: The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch (psia) or 760 mm of mercury. Where a boiling point is unavailable for the material in question or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D 86 shall be used as the boiling point of the liquid.

CEILING LIMIT: The maximum concentration of an airborne contaminant to which one may be exposed shall be as established by the regulations of the United States Department of Labor, as set forth in 29 CFR Part 1910.1000, or if not listed therein, the ceiling Recommended Exposure Limit (REL-C) concentrations published by the U.S. National Institute for Occupational Safety and Health (NIOSH), the Threshold Limit Value — Ceiling (TLV-C) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), the ceiling Workplace Environmental Exposure Level (WEEL-Ceiling) Guides published by the American Industrial Hygiene Association (AIHA), or other approved standard.

CHEMICAL: An element, chemical compound or mixture of elements or compounds or both.

CHEMICAL NAME: The scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry, the Chemical Abstracts Service rules of nomenclature, or a name that will clearly identify a chemical for the purpose of conducting an evaluation.

CLOSED CONTAINER: A container sealed by means of a lid or other device capable of preventing the escape of liquid, vapor or dusts in the ordinary course of storage, handling or use.

CONTAINER: For solid and liquid hazardous materials, a vessel of 60 gallons or less in capacity used for storage or transportation. For compressed gases, a cylinder, pressure vessel or tank designed for pressures greater than one atmosphere at 68°F. Pipes, piping systems, engines and engine fuel tanks associated with solid or liquid hazardous materials or compressed gases, shall not be deemed to be containers if in active use.

CONTAINMENT SYSTEM: A gas-tight recovery system comprised of devices or equipment which, when placed over or around the portion of the compressed gas container that is leaking, stops or controls the escape of gas from the container.

CONTAINMENT VESSEL: A gas-tight vessel which, when installed or placed over or around a leaking compressed gas container, confines the container and the gas leaking there from.

CONTROL AREA: Spaces within a building that are enclosed and bounded by exterior walls, fire walls, fire barriers and roofs, or a combination thereof, where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, handled or used, including any dispensing.

DESIGN PRESSURE: The maximum gauge pressure that a pressure vessel, device, component or system is designed to withstand safely under the temperature and conditions of use.

DETACHED BUILDING: A separate single-story building, without a basement or crawl space, used for the storage, handling or use of hazardous materials and located an approved distance from other buildings or structures.

DISPENSING: The pouring or transferring by other means of any material from a container, tank or similar vessel, which would release dusts, fumes, mists, vapors or gases to the atmosphere, unless such release is prevented by a device, equipment or system designed for that purpose.

EXCESS FLOW CONTROL: A fail-safe system or other approved device, equipment or system designed to shut off flow caused by a rupture in a pressurized piping system.

EXHAUSTED ENCLOSURE: A device, typically consisting of a hood equipped with a fan that serves to capture and exhaust fumes, mist, vapors and gases generated at a workstation or other local environment. An exhausted enclosure does not include a room provided with general ventilation.

EXOTHERMIC: a process or reaction that releases energy usually in the form of heat, but also in form of light e.g. a spark, flame, or explosion.

EXPLOSION; An effect produced by the sudden violent expansion of gases, whether or not accompanied by a shock wave or disruption, of enclosing materials, including the effects of the following sources of explosion:

1. Chemical changes such as rapid oxidation, deflagration or detonation, decomposition of molecules and runaway polymerization (usually detonations).
2. Physical changes such as pressure tank ruptures.
3. Atomic changes (nuclear fission or fusion).

FLAMMABLE VAPORS OR FUMES: The concentration of flammable constituents in air that exceeds 25 percent of their lower flammable limit (LFL).

GAS CABINET: A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas containers in storage or use, including any doors and access ports for exchanging containers and accessing pressure-regulating controls.

GAS ROOM: A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

GENERAL SUPERVISION: Supervision by the holder of any certificate of fitness who is responsible for performing the duties set forth in the Fire Code but need not be personally present on the premises at all times. The **storage** of organic peroxides, oxidizers, highly toxic and toxic materials, pyrophoric materials, raw pyroxylin plastics, unstable (reactive) materials, water-reactive solids and liquids quantities requiring a permit or the storage of corrosive materials in quantities exceeding 550 gallons of liquid or 1,000 pounds of solid shall be under the **general** supervision of a certificate of fitness holder.

HANDLING: The movement of a material in its container, the removal of the material from its container, or any other action or process that may affect the material, other than its storage or use.

HAZARDOUS MATERIALS: Those chemicals or substances that are physical hazards or health hazards as defined and classified in this New Fire Code, whether the materials are in usable or waste condition.

HEALTH HAZARD: A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term “health hazard” includes chemicals that are toxic, highly toxic and corrosive.

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH): The concentration of airborne contaminants that poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment, as established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m³).

INCOMPATIBLE MATERIALS: Materials that, if mixed or combined, could explode, generate heat, gases or other byproducts, or react in a way hazardous to life or property.

LABORATORY CHEMICAL: A material with a health, flammability and/or instability hazard ranking of 2, 3 or 4 as defined in NFPA 704.

LABORATORY UNIT: An enclosed space of a minimum one-hour fire rated construction, designed or used as a non-production laboratory. Laboratory units may include one or more separate laboratory work areas, and accessory storage rooms or spaces within or contiguous with the laboratory unit, such as offices and lavatories.

LIQUID: A material having a melting point that is equal to or less than 68°F and a boiling point that is greater than 68°F at 14.7 psia. When not otherwise identified, the term “liquid” includes both flammable and combustible liquids.

LOWER EXPLOSIVE LIMIT (LEL): See “Lower flammable limit.”

LOWER FLAMMABLE LIMIT (LFL): The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as LEL or lower explosive limit.

MATERIAL SAFETY DATA SHEET (MSDS): A document prepared in accordance with the regulations of the United States Department of Labor, as set forth in 29 CFR Part 1910.1200 or a federally approved state OSHA plan which sets forth information concerning a hazardous material.

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA: The maximum amount of a hazardous material allowed to be stored, handled and/or used within a control area inside a building or structure or an outdoor control area. **The storage, handling and use MAQs are not additive;** that is, the maximum allowable quantity of any hazardous material stored, handled and/or used within a control area **shall not exceed** the maximum allowable quantity listed in the Fire Code for the **storage** of that particular hazardous material.

NON-PRODUCTION LABORATORY: A building or portion thereof wherein chemicals or gases are stored, handled or used on a non-production basis for testing, research, experimental, instructional or educational purposes.

NORMAL TEMPERATURE AND PRESSURE (NTP): A temperature of 70°F and a pressure of 1 atmosphere.

OUTDOOR CONTROL AREA: An outdoor area that contains hazardous materials in amounts not exceeding the maximum allowable quantities of Fire Code Tables 2703.1.1(3) or 2703.1.1(4).

PERMISSIBLE EXPOSURE LIMIT (PEL): The maximum permitted 8-hour time-weighted average concentration of an air-borne contaminant as established by the regulations of the United States Department of Labor, as set forth in 29 CFR Part 1910.1000, the Recommended Exposure Limit (REL) concentrations published by the U.S. National Institute for Occupational Safety and Health (NIOSH), the Threshold Limit Value-Time Weighted Average (TLV-TWA) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), the Workplace Environmental Exposure Level (WEEL) Guides published by the American Industrial Hygiene Association (AIHA), or other approved standard.

PERSONAL SUPERVISION: Supervision by the holder of any certificate of fitness who is required to be personally present on the premises, or other proximate location acceptable to the department, while performing the duties for which the certificate is required. For example, the **handling and use** of organic peroxides, highly toxic and toxic materials, pyrophoric materials, raw pyroxylin plastics, unstable (reactive) materials, water-reactive solids and liquids in quantities requiring a permit or the handling and use of corrosive materials in quantities exceeding 550 gallons of liquid or 1,000 pounds of solid shall be under the **personal** supervision of a certificate of fitness holder.

PHYSICAL HAZARD: A chemical for which there is evidence that it is a combustible or flammable liquid; a flammable solid or gas; an explosive; an organic peroxide; an oxidizer; a pyrophoric material; an unstable (reactive) material; a water-reactive solid or liquid; or a cryogenic fluid.

PILE: A grouping of materials (including a stack, group, or placement) for storage or staging. ("Containers in piles" "Piling containers: Containers . . . when piled one upon the other".)

REDUCED FLOW VALVE: A valve equipped with a restricted flow orifice and inserted into a compressed gas container that is designed to reduce the maximum flow from the valve under full-flow conditions. The maximum flow rate from the valve is determined with the valve allowed to flow to atmosphere with no other piping or fittings attached.


SAFETY CAN: An approved container with a capacity of not more than 5-gallons and equipped with a spring-closing lid and spout cover designed to relieve internal pressure when exposed to fire.

SECONDARY CONTAINMENT: A device, equipment or system designed to contain liquid or solid, that is external to and separate from the primary containment device, equipment or system.

SOLID: A material that has a melting point and decomposes or sublimates at a temperature greater than 68°F.

STANDARD CUBIC FEET (SCF): Cubic feet of gas at normal temperature and pressure (NTP).

2. GENERAL FIRE CODE REQUIREMENTS

FIRE DEPARTMENT, CITY OF NEW YORK				PERMIT		BUREAU OF FIRE PREVENTION					
ACCOUNT NUMBER	TYPE	A.P.	D.O.	ADM. CO.	ISSUANCE DATE	PERMIT EXPIRES					
88888888	10	R	27	E777	2/29/09	2/10					
PREMISES ADDRESS				ACCOUNT NAME							
LAUREN BLDG 111 ELM AVE QUEENS 11105-4950				BATTY'S BATCH OF CHEMICALS							
ITEM CODE	SUB CODE	QTY	DESCRIPTION		FLOOR NO.	FEE					
715	00	1	INFL MIX/LQ 1-10 UNITS		1	210.00					
110	00	1	ACIDS STR > 5 CARB EX PICRIC		1	50.00					
<table border="1"> <tr> <th>PERMIT TYPE</th> </tr> <tr> <td>1</td> </tr> </table>				PERMIT TYPE	1	<p>1=REGULAR 2=SUPPLEMENTAL 3=DUPLICATE</p>				<p>BATTY'S BATCH OF CHEMICALS 111 ELM AVE QUEENS 11105-4950</p>	
PERMIT TYPE											
1											
 <p>9002004592</p>				<p>BLEND METHANOL FROM 500-G TK W/ACETIC ACID FOR CLNG SOLN G-97 COF REQD</p>				<p>260.00</p>			
BY ORDER OF THE COMMISSIONER											

Sample of a Fire Department Permit

The certificate of fitness holder is responsible for ensuring that all required permits are secured and posted in visible locations. The holder is responsible for complying with the requirements of the Fire code.

Permits are valid for 12 months only. Enforcement action may be taken against the certificate of fitness holder when the required permits are not secured and posted. The enforcement actions may include fines and/or the revocation of the certificate of fitness.

An FDNY permit is required to manufacture, store, handle, use, sell or transport hazardous materials or combustible materials when required by the Fire Code.

Every permit or renewal shall require an inspection and shall expire after twelve months. Permits are not transferable and any change in occupancy, operation, tenancy or ownership shall require that a new permit be issued.

Current permits (or a legible copy) shall be posted in a conspicuous location on the premises and shall be readily available for inspection by any representative of the department.

In addition to the requirements of Fire Code, all applicants for a permit must meet the requirements of the Department of Buildings. Other agencies such as NYC DEP, NYS DEC, and USEPA may have additional requirements.

It shall be unlawful to obstruct or impede access to any required means of egress. All required means of egress, including each exit, exit access and exit discharge, shall be continuously maintained free from obstructions and impediments to immediate use in the event of fire or other emergency.

Hazardous materials reporting: The storage of hazardous materials shall be reported as required by the New York State General Municipal Law Section 209-u. The commissioner may require an application for a permit pursuant to this code to include a copy of the current filing pursuant to such New York State General Municipal Law for the facility or premises for which a permit is sought. **(See Addendum B of a “Hazardous Materials Report Form”)**

Duties: In addition to any other responsibilities specified in this code or the rules, a certificate holder shall be responsible for:

1. The safe manufacturing, storage, handling, use, operation, maintenance, inspection, testing, repair and/or supervision of the material, operation or facility for which the certificate is required, in accordance with this code, the rules, and any other applicable laws, rules and regulations.
2. Notifying the department of any explosion, fire, reportable leak or other release of hazardous material, or other emergency related to the duties of his or her certificate.
3. Keeping such certificate upon his or her person or otherwise readily available for inspection by any representative of the department, at all times while conducting or supervising the material, operation or facility for which the certificate is required.
4. When becoming aware that a required fire protection system for hazardous material is out of service, assure that immediate notification is made to the FDNY and the C of F holder for fire protection system.

Hazardous Materials Management Plan: The commissioner may require each application for a permit to include a Hazardous Materials Management Plan (HMMP). Such plan shall be drawn approximately to scale. The HMMP shall contain the following:

- Storage, handling and use areas.
- Maximum amount of each material stored, handled or used in each area.
- Type and size of containers to be used for storage.
- Location of valves and devices used to control and mitigate the accidental or unauthorized release of hazardous materials, and where such valves are of the self-indicating type, an illustration of their on and off position.
- Piping through which hazardous material liquids or gases are transferred, other than utility-owned natural gas lines and low-pressure natural gas lines subject to compliance with the requirements of the Plumbing Code.
- Storage plan showing the storage arrangement, including the location and dimensions of aisles.
- The location and type of emergency equipment.

- Such other information and documentation as the commissioner may prescribe.

HMMP when required shall be submitted to:
 Toxic Substance Unit
 Haz-Mat Battalion FDNY
 Division of Training, Building 8
 Randall's Island, NY 10035

3. GENERAL HOUSEKEEPING AND GOOD WORK PRACTICES

Poor housekeeping & work practices are one of the leading causes of hazardous material incidents, work place accidents and fires. Poor housekeeping can result in fire accidents, lost tools/supplies, damaged equipment and contribute to higher operating costs. Good housekeeping minimizes fire, accidents, reduces waste & disposal costs, increases efficiency and generally results in cheaper production costs. Areas kept in neat & organized condition provides a positive impression on inspectors. The following is some guidance on good practices.

General Housekeeping and Standards:

- Access doors, aisles and exit doors clear of obstructions. Keep storage of items out of hallways and stairwells. The Fire Code contains various requirements for aisle spacing depending upon stacking arrangements.
- Whenever feasible, outdoor storage areas should be covered to prevent contamination by the elements.
- Secure storage areas to minimize liability and hazards of intrusion or dumping.
- Be familiar with the use, limitations and location of emergency equipment such as emergency eyewashes, safety showers, fire alarms, exits and fire extinguishers.
- Be aware of Fire Code storage requirements for permit and certificates of fitness.
- Material Safety Data Sheet (MSDS) information should be readily available.

General Storage:

- Containers should be in good condition and closed when not in use.
- Defective containers shall be promptly removed from service or disposed of in approved manner.
- Chemicals should be stored per manufacturer's recommendations and in such a way to minimize the potential for tipping, tearing, puncture, or breakage.
- Flammable/combustible material must be stored away from open flame or other ignition sources.
- Do not store chemicals above eye level except for containers that are removed with mechanical equipment (e.g., fork-lift).
- Safety cans should be considered for storage of flammable solvents instead of glass containers.
- Do not store unprotected glass containers on the floor.
- Don't stack equipment against containers.
- Raise drums off floor to prevent corrosion from concrete "sweating" or storage in "wet" areas (i.e. pools).
- Segregate incompatible materials/wastes by hazard category to prevent reactions (e.g. acids and bases).

- Storage area should be checked periodically for container integrity, leaks, older stock, faded/missing labels etc.
- Know the characteristic of the material being stored and possible interaction with other material stored.
- Piles of chemicals should be stacked in a secure manner, properly labeled in closed containers.

Work Areas:

- Empty, but not clean, containers should be handled as having the same hazards as non-empty containers. In some cases the residual vapors are more dangerous than the liquids. (For example gasoline vapors are more flammable than liquid gasoline).
- Keep work areas clean and free of obstructions.
- Limit the amount of hazardous materials to the minimum needed for an operation and keep process containers covered when not being used.
- Clean surfaces (counter tops, bench tops, fume hoods and floors) of drips and residues.
- Clean spilled chemicals immediately and dispose of all wastes properly.
- Hazardous material in any quantity shall not be released into a sewer, water way, ground or atmosphere.
- Routinely inspect and address potential sources of leaks and spills including tanks, pipes, hoses and container storage areas. Spill control equipment & containment structures should be inspected periodically.
- Code required signage must be provided on all hazardous material containers and entrance to locations where hazardous material stored.
- Facilities conducting dust producing operations need to keep the accumulation of combustible dusts to a minimum by using collection equipment.

Outdoor Storage:

Outdoor control areas for hazardous materials shall be in compliance with the following requirements:

1. Outdoor control area shall be kept free from vegetation, rubbish and other combustible waste, and combustible materials not necessary to the storage. The area surrounding an outdoor control area shall be kept clear of such materials for a minimum of 15 feet.
2. Outdoor control areas shall be located at least 5 feet from a building opening and at least 15 feet from Assembly occupancies. Outdoor control areas shall be located at least 20 feet from a lot line, public street or private road.

Exception: A 2-hour fire-resistance-rated wall without openings extending not less than 30 inches above and to the sides of the storage area is allowed in lieu of such distances required from a building opening, lot line, public street or private road.

3. Where a property exceeds 10,000 square feet, there may be two outdoor control areas separated by a minimum distance of 50 feet, when approved.

4. Where a property exceeds 35,000 square feet, there may be multiple outdoor control areas, separated a minimum distance of 50 feet, when approved.

Separation of incompatible materials:

Incompatible materials, shall be separated while in storage or use except for stored materials in containers having a capacity of not more than 5 pounds or 0.5 gallon. Separation shall be accomplished by:

- Segregating incompatible materials in storage by a distance of not less than 20 feet.
- Isolating incompatible materials in storage by a noncombustible partition extending not less than 18 inches above and to the sides of the stored material.
- Storing liquid and solid materials in hazardous material storage cabinets. Materials that are incompatible shall not be stored in the same cabinet.
- Storing compressed gases in gas cabinets or exhausted enclosures in accordance with the Fire Code. Materials that are incompatible shall not be stored within the same cabinet or exhausted enclosure.

The following are general chemical segregation guidelines for some commonly encountered materials. The MSDS's should be consulted regarding specific incompatibilities. When diluting corrosives (especially concentrated strong corrosives) always add the corrosive material to water slowly while stirring; never the reverse. The exothermic reaction from the dilution can cause the water to flash to steam resulting in possible thermal and chemical burns due to splashing.

Flammable/combustible: Kept as far away from oxidizers and ignition sources as possible.

Oxidizers: Oxidizers stored to avoid contact with incompatible materials, such as flammable/combustible liquids. Solid oxidizers should not be stored directly beneath incompatible liquids. Gaseous oxidizing materials are highly reactive, and can react vigorously with finely divided metals, organic liquids, and other materials that are readily oxidizable. Spilled oxidizers should be placed in a clean, separate container and disposed of in a proper manner. Oxidizer materials should not be placed in the trash. Spilled materials should never be returned to the original container.

Compressed gas cylinders: Should be securely strapped or chained to a wall or bench top and capped when not in use. (Exception: nesting of compressed gas cylinders at container filling or servicing facilities not accessible to the general public).

Corrosives: Should never be stored with combustible or flammable materials. Mutually reactive items (such as sulfuric acid & sodium hydroxide) should be separated.





Water/Air reactive: Water- reactive chemicals should be protected from exposure to water. Air- reactive chemicals should be stored under inert gas whenever possible. Containers should be waterproof and/or sealed against air exposure, and inspected frequently.









GENERAL STORAGE CHEMICAL COMPATABILITY

General Chemical Storage Compatibility						
+ means these groups may be stored together in most cases			* means store these groups AWAY from water and water sources			
Group 1 +	Group 2+	Group 3 +*	Group 4 *	Group 5 *	Group 6 *	Group 7 *
Halogenated compounds	Ketones	Organic Acids	Aminies & Alkanolamines	Caustics	Oxidizers	Inorganic acids
Olefins	Saturated hydrocarbons	Acid Anhydrides	Ammonia	Hydroxides	Nitrates	Hydrochloric
Alcohols, glycols & glycol ethers	Aromatic hydrocarbons	Acetic Acid		Carbonates	Persulfates	Sulfuric
Phenol	Oils					Phosphoric
Chloroform	Aldehydes					Halogens
Dyes & Stains	Olefins					
Ethidium bromide	Esters					
	Formaldehyde					

4. GENERAL DOT INFORMATION

The USDOT regulates the transportation of hazardous materials and while these rules are not under the scope of the Fire Code certain portions of them can be a useful resource for material identification. In particular the shipping descriptions and hazard packaging labels. The following table summarizes the DOT hazard labels, typical shipping names/DOT classes and cross references to related Fire Code sections.

DOT LABELS	REFERENCE EXAMPLES	DOT LABELS	REFERENCE EXAMPLES
	Fire Code Chapter 33 Explosives Flares, aerial 1.3G Explosive blasting 1.1D		Fire Code Chapters 41, 43 44 Reactive Magnesium alkyls 4.2 Self-heating liquid, inorganic, n.o.s. 4.2
	Fire Code Chapter 35 Flammable Gas Methane 2.1 Compress Gas Flammable 2.1		Code Chapters 41, 43, 44 Water Reactives Water-reactive solid, n.o.s. 4.3 Calcium carbide 4.3 Lithium 4.3

	Fire Code Chapter 30 Compressed Gases		Fire Code Chapters 40 Oxidizers
	Nitrogen 2.2 Compressed Gas nos 2.2		Calcium permanganate 5.1 Oxidizing solid, n.o.s. 5.1
	Fire Code Chapter 37 Toxic Gases		Fire Code Chapter 39 Organic Peroxides
	Chlorine 2.3 Compressed Gas Toxic nos 2.3		Organic peroxide type B, liquid 5.2
	Fire Code Chapter 34 Flammable Liquids		Fire Code Chapter 37 Toxics
	Gasoline 3 Flammable liquids. 3		Cyanides, n.o.s. 6.1 Pesticides, liquid, toxic 6.1
	Fire Code Chapter 36 Flammable Solids		Fire Code Chapter 37 Corrosives
	Flammable solid, inorgan n.o.s. 4.1 Sulfur 4.1		Corrosive liquids, n.o.s. 8 Hydrochloric acid 8 Sulfuric acid, spent 8

Please note that this table is meant as an aid for material identification only as the Fire Code applicability requirements are not necessarily the same as DOT applicability requirements. For example DOT divides flammable liquids into two groups (flammable liquids and combustible liquids) while the Fire Code utilizes three different classes with sub groups, with each sub group having different Fire Code requirements. As another example the DOT definition of a toxic Class 6.1 material does not cover the full range of toxics covered under the Fire Code.

If a particular material meets the definition of more than one DOT hazard class or division, compliance with each hazard class shall be required. Where a material is both a physical hazard and a health hazard, compliance with the requirements for each hazard class shall be required. One example of this "multiple personality" is nitric acid (concentration greater than 35%), classified as both an oxidizer and a corrosive. A second example is concentrated acetic acid, which is classified as both a combustible and a corrosive.

Some hazard classes are assigned numerical designations based upon their hazard potential. For example, oxidizers and unstable (reactive) materials are classified as Class 1,

2, 3 or 4 materials, water –reactive solids and liquids are classified as Class 1, 2 or 3 materials while organic peroxides are classified as Class I, II, III IV and V materials. The following chart explains the severity of each class:

Arabic Numeral		Roman Numeral
4	HIGHEST HAZARD	I
3		II
2		III
1		IV
0	LOWEST HAZARD	V

Where more than one class of organic peroxide, oxidizer, unstable (reactive) material or water-reactive solid or liquid is stored in immediate proximity to one another, such area shall be provided with hazard identification signs for the most severe class present.

Where more than one class of organic peroxide, oxidizers, unstable (reactive) material or water-reactive solid or liquid is stored in the same control area, the maximum quantity allowed of each hazardous material shall be limited as follows:

The maximum quantity shall be reduced by multiplying the maximum allowable quantity for each such material by the proportional amount that such material bears to the total quantity of material stored in the control area. The total of the proportional amounts shall not exceed 100 percent.

Where the required organic peroxide or unstable (reactive) material storage temperature range, as specified by the manufacturer, extends beyond normal ambient temperatures, high or low temperature limit switches, as applicable, shall be provided in addition to normal temperature controls. These limit switches shall actuate an alarm in a supervised area to ensure reporting to the fire department.

5. NFPA HAZARD DIAMOND SIGN EXPLANATION

NFWA Rating Explanation Guide					
RATING NUMBER	HEALTH HAZARD	FLAMMABILITY HAZARD	INSTABILITY HAZARD	RATING SYMBOL	SPECIAL HAZARD
4	Can be lethal	Will vaporize and readily burn at normal temperatures	May explode at normal temperatures and pressures	ALK	Alkaline
3	Can cause serious or permanent injury	Can be ignited under almost all ambient temperatures	May explode at high temperature or shock	ACID	Acidic
2	Can cause temporary incapacitation or residual injury	Must be heated or high ambient temperature to burn	Violent chemical change at high temperatures or pressures	COR	Corrosive
1	Can cause significant irritation	Must be preheated before ignition can occur	Normally stable. High temperatures make unstable	OX	Oxidizing
0	No hazard	Will not burn	Stable	W	Reacts violently or explosively with water
				W OX	Reacts violently or explosively with water and oxidizing

This chart for reference only - For complete specifications consult the NFPA 704 Standard
NFPA-Chart_1 www.ComplianceSigns.com

Hazard Identification Signs: NFPA 704 Diamonds

The *transport* of hazardous materials is accompanied by the use of US DOT compliant placards and labels to assist identification of hazardous materials on the roadway, railway, waterway and in the air. In a similar manner the *storage, handling and use* of hazardous materials is accompanied in the Fire Code by a requirement for the use of consistent signage to alert people, including first responders, to the presence of hazardous materials in a facility. The intent of the signage is to provide an indication of both the *type* of hazardous material present and the relative *degree of harm* that the material may pose. This simplistic system uses symbols, colors and numbers to readily communicate these concerns in a visual manner, and recognizes the fact that a material may pose more than one type of hazard.

The basis of the system is a diamond-shaped sign that is divided into four color-coded quadrants (see Figure 1). The left-most quadrant is colored blue and represents the *health* hazard posed by the material. The upper quadrant is red in color and indicates the relative *fire* hazard. The right-most quadrant is yellow and conveys the relative potential for *reactivity* of the material. The last quadrant, at the bottom, is white in color and serves to convey “*special*” information such as “OX” for oxidizer and “W” for water-reactive material.



Blank NFPA Diamond Sign



Sign with Hazards Indicated

The diamond-shaped sign is required by the Fire Code to be conspicuously displayed at the entrance to locations where hazardous materials are stored, handled and used, and on stationary containers and aboveground tanks containing hazardous materials. Note that

the sign requirement also applies to locations at which a hazardous material is dispensed. The triggering amount for the sign requirement is the **amount required for a permit**.

The numbering system that is used to convey the hazards of a material uses a scale of 0 through 4 for each of the three hazard types (health, fire and reactivity). A number is placed in each box, specific to the material at hand. In each quadrant, a “0” represents the least concern and “4” represents the highest degree of hazard posed by a material. For instance, a “0” in the upper quadrant indicates a material that will not burn, while a “4” in the same quadrant indicates a gaseous material that will burn very readily (see Figure 2). Intermediate numbers represent increasing levels of hazard in all categories, such as the “3” that is present in the “health” quadrant of Figure 2. This is indicative of a material that can cause permanent or serious injury upon exposure.

6. FIRE EXTINGUISHERS

FIRE EXTINGUISHING DEVICES AND SYSTEMS:

The C-91 C of F holder must be familiar with the different types of fire extinguishers that are present on the premises. S/he must know how to operate the extinguishers in a safe and efficient manner. S/he must know the difference between the various types of extinguishers and when they should be used. A description of the four classes of fires and the appropriate extinguishers are described on the following page.

Class A fires involve ordinary combustible materials (such as wood, paper, and cloth), for which the quenching-cooling effect of quantities of water or solutions containing large percentages of water is most effective in reducing the temperature of the burning material below its ignition temperature.

Class B fires involve flammable petroleum products or other flammable liquids, greases, etc., for which the blanketing-smothering effect of oxygen-excluding media such as CO₂, dry chemical or foam is most effective.

Class C fires involve electrical equipment. The electrical non-conductivity of the extinguishing media is of first importance. These fires must be extinguished with non-conductive media such as CO₂ or dry chemical.

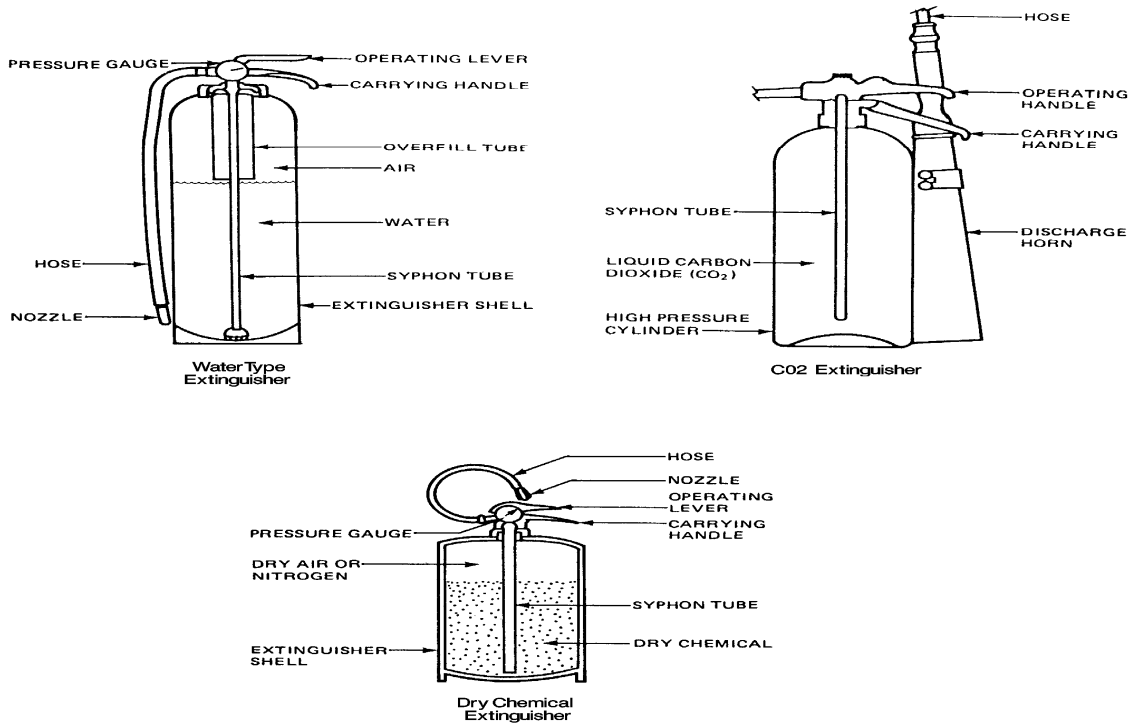
Class D fires involve ignitable metals, such as magnesium, titanium, and metallic sodium, or metals that are combustible under certain conditions, such as calcium, zinc, and aluminum. Generally, water should not be used to extinguish these fires.

Class K fires involve cooking.

A multi-purpose dry chemical fire extinguisher may be used to extinguish Class A, B, or C fires.

Examples of Water type, CO₂ and Dry Chemical extinguishers are shown below.

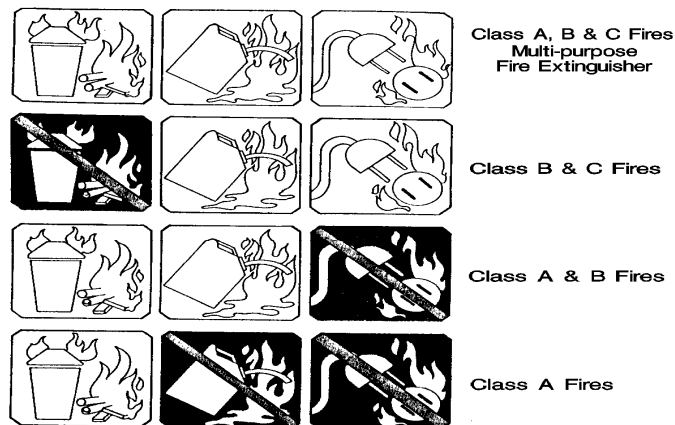
Typical Fire Extinguishers



Symbols may also be painted on the extinguisher. They indicate what kind of fires the extinguishers may be used on. Examples of these symbols are shown on the following page.

Typical Symbols Painted on Fire Extinguishers

The symbol with the shaded background and the slash indicate when the extinguisher must



not be used. The C of F holder must understand these symbols. The C of F holder must make sure that the fire extinguishers are kept in good working order at all times. Inspection is a "quick check" that a fire extinguisher is available and will operate. It is intended to give reasonable assurance that the fire extinguisher is fully charged and operable. This is done

by verifying that it is in its designated place, that it has not been actuated or tampered with, and that there is no obvious or physical damage or condition to prevent its operation.

Generally, operation instructions are clearly painted on the side of the fire extinguisher. They clearly describe how to use the extinguisher in case of an emergency. An example of these instructions is shown below.



7. LOCATION STORAGE RESTRICTIONS

Please note that the maximum allowable quantity (MAQ) of any hazardous material stored or used within an indoor control area is dependent on the floor location relative to the ground floor (the ground floor being the least restrictive location). The MAQ of any hazardous material in control areas located above the ground floor or below grade are strictly reduced by a fixed percentage as specified by the Fire Code. Furthermore, the number of control areas allowed on any specific floor is also dependent on floor location relative to the ground floor (the ground floor being the least restrictive location).

The indoor storage of any hazardous material in excess of the MAQ in any one control area shall require that the control area be classified as High Hazard occupancy.

DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	NUMBER OF CONTROL AREAS PER FLOOR	FIRE- RESISTANCE RATING FOR FIRE BARRIERS IN OURS
Above grade	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade	1	75	3	1
	2	50	2	1
	Lower	Not Allowed	Not Allowed	Not Allowed

	than 2			
--	--------	--	--	--

8. MATERIAL SAFETY DATA SHEETS (MSDS)

The material safety data sheet (MSDS) contains specific information about the health and physical hazards of the material used, as well as safe work practices and required protective equipment. It may also describe the material's physical characteristics and procedures that should be followed in case of an emergency. For example, the MSDS may list appropriate and inappropriate extinguishing agents. The Certificate of Fitness holder must refer to the MSDS when questions arise about how to handle, use, or store hazardous chemicals or materials. (*See Addendum A for a sample of a "Material Safety Data Sheet" at the end of the booklet*)

9. EXPOSURE HAZARDS

Inhalation, ingestion, skin and eye contact: The health hazards associated with any hazardous materials will vary depending upon the individual chemical's hazards, the manufacturers MSDS should be consulted for each chemical in use.

Chronic Exposure: Chronic exposure hazards associated with any hazardous materials will vary greatly. Consult the individual chemical's MSDS for specific chronic hazards.

First Aid: First aid measures will vary greatly based on the individual chemicals hazard properties. Consult the specific chemical's manufacturers MSDS and when necessary, a medical professional for the appropriate first aid procedures.

Exposure Limits: Exposure limits will vary based on individual chemical hazards, consult the manufacturers MSDS for established exposure limits.

Exposure Controls/Engineering Controls: Local exhaust ventilation or breathing protection is generally required. Depending upon the level of flammability involved with specific chemicals, engineering control requirements may increase (e.g., use of inert atmospheres, glove boxes, special detection and/or extinguishing systems, etc.). Consult the MSDS for hazardous properties.

Administrative Controls: Administrative controls will vary based on individual chemical hazards. Personnel working with the materials must receive detailed training on the hazards, safe use, and emergency procedures.

Personal Protective Equipment: Avoid breathing dusts, vapors or fumes. Follow individual chemical's MSDS recommendations for the appropriate PPE. In general, prevent skin/eye contact through the use of impervious gloves, clothing, boots, apron, and eye goggles or full face shield. If the airborne concentrations are elevated and engineering controls are not feasible wear a NIOSH-approved self-contained breathing apparatus with full face-piece operated in the pressure demand or other positive pressure mode

Disposal: In general, any hazardous materials are regulated as hazardous waste. Regulatory requirements will vary depending on the individual chemical.

Medical Monitoring (if applicable): Medical and exposure monitoring will vary depending on the individual chemical hazards. Consult the MSDS or industrial hygiene program manager for the appropriate monitoring for the chemical of concern.

10. EMERGENCY PROCEDURES

In the event of a significant release that poses a threat to employees and/or the environment, immediately evacuate the area and notify the emergency operator (911). The New York City Fire Department will respond. You are then required to notify your supervisor. Small spills can be cleaned up by properly trained employees with the appropriate spill response supplies.

The Certificate of Fitness holder must know the locations of and how to operate all fire extinguishing devices, control devices, and fire alarm stations installed at the facility. In case of a fire, explosion, major spill or emergency, the Certificate of Fitness (C of F) holder must notify the Fire Department by phone immediately. The Certificate of Fitness holder must know the telephone number of the Fire Department Borough Communication Office. The borough phone numbers are listed below. These phone numbers must be posted near the phones most likely to be used in case of an emergency.

Manhattan	212-570-4300
Bronx	718-430-0200
Brooklyn	718-965-8300
Queens	718-476-6200
Staten Island	718-494-4296

After notification by phone, the local fire alarm must be sounded. In some cases, the activation of the fire alarm will transmit a signal to the Fire Department via an approved central station company. The C of F holder shall initiate an orderly evacuation when required by the hazard presented by any release and take reasonable steps to isolate the hazard until the Fire dept arrives. The Certificate of Fitness holder must answer any questions asked by them when they arrive. For example, he or she must indicate the location of the fire, describe the type of fire protection devices available, and describe the materials stored on the fire floor. The Bureau of Fire Prevention must be notified as soon as possible after an explosion or fire has occurred. The Bureau of Fire Prevention may require a detailed report on the causes and the consequences of the explosion or fire. Generally, this report must be filed within ten days after the incident.

11. PENALTIES FOR NON-COMPLIANCE WITH FIRE CODE

All applicants and certificate holders are required to promptly notify the Department of any change in the applicant's or certificate holder's residence address, any change in work location when such location is required for and/or indicated on such certificate or permit and such other information as the Department may require. COF holders and permit holders must ensure that all requirements of the Fire Code and RCNY are met. Failure to comply with these provisions may subject C of F holder and/or permit holders to summonses, fines and other enforcement measures.

PART II

A. CORROSIVE MATERIALS [Fire Code Chapter 31]

DEFINITIONS

Corrosive Material: A material that causes full thickness destruction of human skin at the site of contact within a specified period of time when tested by methods set forth in Department of Transportation (DOT) regulations 49 CFR Sections 173.136 and 173.137, or a liquid that has a severe corrosion rate on steel or aluminum based on the criteria set forth in DOT regulations 49 CFR Section 173.137(c) (2).

In simpler terms, a corrosive material is a gas, liquid or solid that causes permanent injury (full thickness destruction) of intact human skin at the site of contact. Any liquid that can corrode 1/4 inch of bare steel (not stainless) or aluminum within a year is also classified as a corrosive material.

pH: The negative logarithm of the hydrogen ion (H⁺) concentration of a solution (in moles per liter or molarity).

Acid: A solution that has a pH less than 7.0.

Base: A solution that has a pH greater than 7.0. Basic materials or solutions are sometimes called caustic or alkaline

PERMITS AND CERTIFICATES OF FITNESS

Quantities requiring a permit

Gas	100 scf
Liquids	55 gallons
Solids	1000 pounds

Quantities requiring supervision by a C-91 certificate of fitness holder

Gas	100 scf
Liquids	550 gallons
Solids	1000 pounds

The **handling and use** of corrosive materials in quantities exceeding 550 gallons of liquid or 1,000 pounds of solid shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of corrosive materials in quantities exceeding 550 gallons of liquid or 1,000 pounds of solid shall be under the **general supervision** of a certificate of fitness holder.

MATERIAL DESCRIPTION

Corrosives act either directly, by chemically destroying the part or indirectly by causing inflammation. Acids and bases are common corrosive materials.

Information on pH can often be found in the MSDS. It is important to know the pH of substances because they may be corrosive or react with incompatible materials. For example acids and bases should not be stored or used near each other as their accidental combination could generate a huge amount of heat and energy, possibly resulting in an explosion.

It is also important to know the pH in case you get the material on your skin or in your eyes. Whenever a substance enters the eye, flush with water for 15 minutes and get prompt medical attention.

A general warning sign may appear like this:



The pH tells you whether a solution is acidic, basic or neutral. The corresponding ranges are:

- Acidic - the pH is between zero and 7.0
- Neutral - the pH is 7.0
- Basic (also called alkaline) - the pH is between 7.0 and 14.

For strong acids or bases, these values may actually be higher than 14 or lower than 0, but the 0-14 range is most commonly encountered. The pH scale is logarithmic. That means each change of one in pH value is 10 times more acidic. A substance with a pH of 2 is 1000 times more acidic than one with a pH of 5!

The pH values of some common substances are given in the table below.

Substance	Typical pH	[H ⁺], M
Stomach acid (gastric juices)	1.4	0.0398
Lemon juice	2.4	0.00398
Vinegar	3.0	1 x 10 ⁻³
Tomatoes	4.2	6.31 x 10 ⁻⁵
Water exposed to air	5.5	3.16 x 10 ⁻⁶
Pure water	7.0	1 x 10 ⁻⁷
Blood or tears	7.4	3.98 x 10 ⁻⁸
Baking soda	8.4	3.98 x 10 ⁻⁹
Household ammonia	11.5	3.16 x 10 ⁻¹²

Acids

Strong acids completely dissociate into ions and form H⁺ in aqueous (water) solution. For example:



Weak acids do not dissociate completely into ions. Examples of these include acetic acid (a 5% solution of acetic acid in water is called vinegar), formic acid, ammonium cation (NH₄⁺), and water itself. The strength of acids can be measured using the pH scale. A lower pH indicates the greater the acidity of a solution. Mineral/inorganic acids can be strong or weak.

A general warning sign may appear like this:



All of the following strong acids will cause severe and immediate burns upon skin contact. The following acids are all examples of inorganic acids, sometimes called mineral acids.

Formula	Name
HClO ₄	Perchloric acid
HI	Hydroiodic acid
HBr	Hydrobromic acid
HCl	Hydrochloric acid
H ₂ SO ₄	Sulfuric acid
HNO ₃	Nitric acid

Substances with names that end in "oic acid" or "ic acid" are organic acids called carboxylic acids. Two of the examples we just looked at, formic acid and acetic acid are carboxylic acids. Just because an acid is weak does not mean that it can't harm you. For example, HF, hydrofluoric acid, is a weak inorganic acid. When you spill it on your hand it doesn't burn but it migrates to the bones in your fingers and then begins to dissolve them from the inside out (a painful process; amputation may be required). In addition, systemic effects (referring to a disease, symptom, medication or injury) such as hypocalcemia can cause death.

Some common properties of acids are:

- They have a sour taste (tasting acids...or for that matter, any chemical, is not recommended!). For example, the citric acid in lemons and acetic acid in vinegar are responsible for the sour taste of each.
- They can react with metals such as magnesium, zinc or iron to corrode them and produce explosive hydrogen gas. Do not store acids in metal containers!
- Solutions of acids can conduct electricity.

The concentration of acids can be expressed in many different ways:

- Molarity (defined earlier)
- Percent by mass
- Degrees Baumé (indirectly) or specific gravity

Bases

Bases can be thought of as the chemical opposite of acids. A reaction between an acid and base is called neutralization. Bases react with acids to produce water and salts (or their solutions).

Some general properties of bases include:

- Slimy or soapy feel on fingers, due to saponification of the lipids in human skin.
- Concentrated or strong bases are caustic on organic matter and react violently with acidic substances.
- Aqueous solutions or molten bases dissociate into ions and conduct electricity.
- Reactions with indicators: bases turn litmus paper blue and phenolphthalein pink.

A general warning sign may appear like this:



The following are examples of strong bases, meaning that they completely dissociate into ions and form OH⁻ in aqueous (water) solution. All of these will cause severe burns upon skin contact. For example:



Formula	Name
NaOH	Sodium hydroxide
KOH	Potassium hydroxide
Ba(OH) ₂	Barium hydroxide
Ca(OH) ₂	Calcium hydroxide

Weak bases do not dissociate completely to form hydroxide (OH⁻) ions in water. Examples of these include ammonia (NH₃), amines, fluoride ion (F⁻), and acetate ion (CH₃COO⁻). Water can also act as a weak acid or base. Just because a base is weak does not mean that it can't harm you. For example, inhaling ammonia can be extremely irritating and cause severe burning of the lungs and potentially death.

STORAGE & USE REQUIREMENTS

Storage

Special care needs to be taken when storing acids. Minor spills and acid fumes can quickly corrode standard metal storage cabinets or soapstone countertops, for example. The best choice for storing acid containers is a chemically-resistant cabinet designed for that purpose, with polyethylene construction being the best choice. Polyethylene spill trays are also a very good idea, whether acids are stored on a bench top or in a cabinet.

Compressed gas containers and systems should not be exposed to corrosive chemicals or fumes that could damage containers, valves or valve-protective caps.

Handling and Use

Handling and use of corrosive materials shall be located in accordance with the distances and exposures noted for storage.

Piping and tubing shall be clearly identified to indicate the material conveyed. Readily accessible manual valves, or automatic remotely-activated fail-safe emergency shutoff valves, are required on supply piping and tubing at the point of use and at the source of supply. Emergency shutoff valves shall be clearly visible and readily accessible. A durable sign is to be conspicuously posted immediately adjacent to such valves that identify their purpose.

B. FLAMMABLE SOLID [Fire Code Chapter 36]

DEFINITIONS

Fire Code Definition

FLAMMABLE SOLID: A solid, other than a blasting agent or other explosive, whether in elemental or alloy form, that is capable of causing fire through friction, absorption of

moisture, spontaneous chemical change, or heat retained from manufacturing or processing, or which has an ignition temperature below 212°F or which burns so vigorously and persistently when ignited as to create a serious hazard. Examples include Aluminum powder, Camphor, Magnesium, Matches, Naphthalene, Nitrocellulose, Phosphorus, Sulfur and Picric Acid (wetted with not less than 10% water).

US DOT definition

The US Department of Transportation defines a flammable solid as falling under three broad classes:

1. Desensitized explosives such as those wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties.
2. Self-reactive materials that are thermally unstable and that can undergo a strongly exothermic (heat-evolving) decomposition even without the participation of oxygen (air).
3. Readily combustible solids, including solids which may cause a fire through friction and any metal powders that can be ignited.

PERMITS AND CERTIFICATES OF FITNESS

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

FORMS OF FLAMMABLE SOLID	INDOORS (pounds)	OUTDOORS (pounds)
Pigs, ingots, billets, heavy castings	1,000	100
Light castings, light metallic products	125	100
Scraps, shavings, powders, dusts	1	100

MATERIAL DESCRIPTION

Many flammable solids may react violently or explosively on contact with water including water applied for extinguishment purposes (i.e., water fire extinguishers). They may also be ignited by friction, heat, sparks or flame. Some of these materials will burn with intense heat. Dusts or fumes may form explosive mixtures in air. Containers may explode when heated. Materials may re-ignite after fire is extinguished.

Fires may produce irritating, corrosive and/or toxic gases. Some of these materials may also be pyrophoric – spontaneously reacting with oxygen in air to ignite. Many flammable solids are metals. Oxides from metallic fires are a severe health hazard, inhalation or contact with substance or decomposition products may cause severe injury or death. Cutting some flammable solids can initiate a fire. For example, using a torch to cut titanium tubing will generate sufficient heat to ignite the material.

SPECIAL FIRE EXTINGUISHER REQUIREMENTS

Many flammable solids react with water and cannot be extinguished with conventional dry chemical or carbon dioxide extinguishers. For metallic flammable solids (e.g., phosphorus, sodium, lithium, magnesium) do not use water, foam or carbon dioxide as a fire suppressant. Dousing metallic fires with water may generate hydrogen gas, an extremely dangerous explosion hazard, particularly if fire is in a confined environment.

Additionally, fires involving flammable metals (lithium, sodium, potassium etc.) or flammable metal compounds (butyllithium, diethylzinc etc.) can be fueled by using water or carbon dioxide fire extinguishers. You must have a class D extinguisher on hand if you are using these materials.

PS: Dry sand can usually be used to smother a fire involving flammable solids. Keep a container of sand near the work area.

C. HIGHLY TOXIC AND TOXIC MATERIALS [Fire Code Chapter 37]

DEFINITIONS

LD50: LD stands for "Lethal Dose". A LD50 value is the amount of a solid or liquid material that it takes to kill 50% of test animals (for example, mice or rats) in one dose. It is a standard measurement of the short-term poisoning potential (acute toxicity) of a solid or liquid material. LD50 values are expressed in terms of the tests and animal used (i.e. LD50 (oral, rat), LD50 (skin, mouse)) other animals (dogs, hamsters, cats, guinea-pigs, rabbits, and monkeys) are sometimes utilized but the Fire Code is very specific regarding test species (oral-rats and skin-rabbits). The LD50 value is expressed as the weight of chemical administered per kilogram body weight of the animal, the test animal used and route of exposure. So, the example "LD50 (oral, rat) 5 mg/kg" means that 5 milligrams of that chemical for every 1 kilogram body weight of the rat, when administered in one dose by mouth, causes the death of 50% of the test group.

LC50: LC stands for "Lethal Concentration". A LC50 value is the amount of a gas, dust or mists that it takes to kill 50% of test animals (for example, mice or rats) in one dose. Like LD50 various tests and animals may be utilized. In addition the duration of exposure may vary. For the purposes of the Fire Code this is a one hour test utilizing rats.

Highly Toxic Material: a chemical that is lethal at the following doses or concentration, including the following:

- A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each; or
- A chemical that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each; or
- A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for one hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Exception: For purposes of this code, chlorine is classified as a Highly Toxic Material.

Ozone Gas Generator: Equipment which produces ozone.

Toxic Material: A chemical that is lethal at the following doses or concentration:

- A chemical that has a median lethal dose (LD50) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each; or
- A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each; or
- A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Common Abbreviations: The following table lists some common abbreviations utilized in toxicology information.

gm	gram	mus	mouse
gpg	guinea pig	NOAE L	No Observed Adverse Effect Level
grb	gerbil	ppb	parts per billion (v/v)
ham	hamster	ppm	parts per million (v/v)
idr	intradermal	rat	rat
kg	kilogram	rbt	rabbit
L	liter	scu	subcutaneous
LC50	lethal concentration 50 percent kill	skn	administration onto skin
LCLo	lowest published lethal concentration	STEL	short term exposure limit
LD50	lethal dose 50 percent kill	TC	toxic concentration (other than lowest concentration)
LDlo	lowest published lethal dose	TCLo	lowest published toxic concentration
m3	cubic meter	TD	toxic dose (other than lowest toxic dose)
ug	microgram	TDL0	lowest published toxic dose
mg	milligram	TLV	Threshold Limit Value
mky	monkey	TWA	time weighted average
mL	milliliter		

PERMITS AND CERTIFICATES OF FITNESS

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

Toxic Gases	Any amount	Highly Toxic Gases	Any amount
Toxic Liquids	10 gallons	Highly Toxic Liquids	Any Amount
Toxic Solids	100 pounds	Highly Toxic Solids	Any Amount

The **handling and use** of highly toxic and toxic materials in quantities requiring a permit shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of highly toxic and toxic materials in quantities requiring a permit shall be under the **general supervision** of a certificate of fitness holder.

RESTRICTIONS

It shall be unlawful to store, handle or use highly toxic and toxic compressed gases within:

1. Assembly, Educational, Institutional, Residential or Utility occupancies.
2. Offices and areas accessible to the public located within Business, Factory, Mercantile or Storage occupancies.

The maximum number of containers located in a single gas cabinet shall not exceed three, except that cabinets containing containers not over 1 pound net contents are allowed to contain up to 100 containers.

MATERIAL DESCRIPTION

Toxic chemicals are chemicals that can produce injury or death when inhaled, ingested, or absorbed through the skin. While damage may be acute or chronic the Fire Code is only concerned with acute lethality. The extent of lethality depends on the dose and duration of exposure. Exposure may enter the body through three routes: inhalation, ingestion, or contact with the skin and eyes.

For the purposes of the Fire Code, Toxic & Highly Toxic Material are defined in terms of LD50 values as follows.

Summary Definitions Toxic & Highly Toxic

	Toxic	Highly Toxic
Oral LD50 (albino rats)	50-500 mg/kg	<50 mg/kg
Skin Contact LD50 (albino rabbits)	200-1000 mg/kg	<200 mg/kg
Inhalation LC50 (albino rats) gas	200-2000 ppmv/air	<200 ppmv/air
Inhalation LC50 (albino rats) mists/dust	2-20 mg/L	<2 mg/L

One of the best sources of information regarding toxicity is a MSDS. However the reporting of LD50/LC50 data on MSDS's is optional and there is no standard format when it is reported. Other reference materials are also available but care must be taken to ensure the relevance of the data. The following table is some examples on how this information is applied.

Caution: It is the permit holder's responsibility to be knowledgeable in the toxicological information and the appropriate relevance of Fire Code requirements. The lack of LD50/LC50 information on an MSDS does not imply such information does not exist or the Fire Code requirements for Toxic or Highly Toxic materials do not apply.

EXAMPLES of LD50 VALUES

Chemical	Category	Oral LD₅₀ in Rats (mg/kg)	Skin LD₅₀ in Rabbits (mg/kg)	Inhalation LD₅₀ in Rats (mg/L)(ppm)
sodium azide	Highly toxic solid	27	20	13.9
hydrogen cyanide	Highly toxic Gas			105
acrolein	Highly toxic Liquid	26	160	15-91
hydrogen sulfide	Toxic Gas			944
acrylonitrile	Toxic Liquid	78	63	364
phenol	Toxic solid	317	630	81
chlorine	Highly toxic Gas			293
Table data intended for examples. See specific MSDS's for specific values.				

It is important to recognize that LD50/LC50 values will vary by route of exposure and animal species tested as well as from study to study. Additionally these values will vary by concentration of pure material in mixtures and commercial products. For example the oral LD50 for pure warfarin is much less than the oral LD50 for 0.025% warfarin in rat bait.

As a result it is important to refer to the specific tests required by the Fire Code when determining the toxicity of a particular material. The following is one examples of how toxicological information can be presented on MSDS's

Example for Phenol

Section 11 - Toxicological Information LD50/LC50: CAS# 108-95-2:	
Draize test, rabbit, eye: 5 mg Severe; Draize test, rabbit, skin: 500 mg/24H Severe; Draize test, rabbit, skin: 100 mg Mild; Inhalation, mouse: LC50 = 177 mg/m ³ ; Inhalation, mouse: LC50 = 177 mg/m ³ /4H; Inhalation, rat: LC50 = 316 mg/m³	Oral, mouse: LD50 = 270 mg/kg; Oral, rat: LD50 = 317 mg/kg; Oral, rat: LD50 = 512 mg/kg; Skin, rabbit: LD50 = 630 mg/kg; Skin, rat: LD50 = 669 mg/kg; Skin, rat: LD50 = 1500 mg/kg;

For the purposes of Fire Code compliance, is it important to have supporting documentation regarding the toxicity of the specific materials being stored, handled or used. Generally this would be MSDS's. Care should be exercised when changing material vendors as the MSDS information may be different. It is the facility storing, handling or using these chemicals to know their toxicity and be able to demonstrate to an inspector that the appropriate classification and handling procedures are being used.

The level of toxicity of Highly Toxic and Toxic Materials may be reduced by diluting such materials with other materials, such as water, to a degree that the resulting mixture may no longer be Highly Toxic or Toxic.

For the purposes of Fire Code compliance, a mixture containing any amount of Highly Toxic and/or Toxic material is presumed to be a highly toxic or toxic material, as applicable, unless it is otherwise certified and labeled by the manufacturer.

The Fire Code is not designed to regulate industrial hygiene in work areas. Employers are encouraged to consult the OSHA or the American Conference of Governmental Industrial Hygienists (ACGIH) exposure standards regarding routine work site exposures and personal protection equipment (PPE's) recommendations. These standards are expressed in terms of Threshold Limit Values (TLV), Time Weighted Average (TWA), Short Term Exposure Limit (STEL), Ceiling Value, Immediately Dangerous to Life or Health (IDLH) and permissible exposure limits (PEL).

Highly Toxic and Toxic Materials that are compressed gases shall also comply with the compressed gases requirements of New Fire Code Chapter 30 [Compressed Gases] in addition to these requirements. Additionally Highly Toxic and Toxic Materials that meet the definition of other hazard classes shall comply with those requirements also including New Fire Code Chapters 35 (Flammable Gases), 37 (Highly Toxic and Toxic Materials), 40 (Oxidizers) and 41 (Pyrophoric), as applicable.

STORAGE & USE REQUIREMENTS

Indoor/Outdoor Storage, Handling & Use - Liquids/Solids

The indoor and outdoor storage, handling or use of Highly Toxic and Toxic solids or liquids in amounts that do not exceed the maximum allowable quantity per control area shall be in accordance with the general provisions for hazardous materials and with the general provisions for Highly Toxic & Toxic Materials.

OZONE GAS GENERATORS [Fire Code Chapter 37]

MATERIAL DESCRIPTION

Ozone (also known as trioxygen or O₃) is a **highly toxic** gas which can explode on contact with organic substances, especially strong reducing agents. Ozone is also a **powerful oxidizer**. Oxidation with ozone evolves more heat and usually starts at a lower temperature than oxidation with oxygen.

Ozone is an **unstable** gas which at normal temperatures decomposes to re-form oxygen and is a very effective bactericide. At elevated temperatures and in the presence of certain catalysts such as hydrogen, iron, copper and chromium, this decomposition may be explosive. An Ozone generator, which takes advantage of the bactericidal effect of ozone, produces the gas by one of two methods; passing air over an Ultra Violet light source and then mixing the gas with water OR by a process known as the "Corona Discharge Method" where air is passed through an electrically charged chamber which electrically converts oxygen into ozone.

PERMIT AND CERTIFICATE OF FITNESS

The operation of an ozone generator does not require a Fire Department permit or supervision by a certificate of fitness holder provided the ozone is not stored within a compressed gas cylinder.

STORAGE & USE

The operation of an ozone gas generator with a maximum ozone-generating capacity of 0.5 pound or more over a 24-hour period, [except ozone-generating equipment used in Group R-3 Residential occupancies] shall fully comply with the Fire Code as follows:

- Ozone gas generators shall be designed, manufactured and tested in accordance with NEMA 250 and located in approved cabinets or ozone generator rooms.
- Ozone cabinets shall be mechanically ventilated. Ozone gas/generator rooms shall be mechanically ventilated and equipped with a continuous gas detection system which will shut off the generator and sound a local audible and visible alarm when concentrations above the permissible exposure limit occur. Ozone gas-generator rooms shall not be normally occupied, kept free of combustible and hazardous material storage.
- Piping valves and fittings shall be welded stainless steel piping or tubing unless of double-walled construction or located in exhausted enclosures.
- Ozone gas generators shall be designed to shut down automatically under the following conditions:
 - When the dissolved ozone concentration in the water being treated is above saturation when measured at the point where the water is exposed to the atmosphere.
 - When the process using generated ozone is shut down.
 - When the gas detection system detects ozone.
 - Failure of the ventilation system for the cabinet or ozone-generator room.
 - Failure of the gas-detection system.
- Manual shutdown controls shall be provided at the ozone gas generator and, when the generator is in a room, within 10 feet of the main exit or exit access door.

Ozone piping, cabinets and access doors to ozone gas/generator rooms shall be provided with the following identifying signage:

OZONE GAS—HIGHLY TOXIC—OXIDIZER.

D. ORGANIC PEROXIDES & OXIDIZERS [Fire Code Chapters 39 & 40]

DEFINITIONS

Explosion: An effect produced by the sudden violent expansion of gases, whether or not accompanied by a shock wave or disruption, of enclosing materials including the effects of the following sources of explosion:

- Chemical changes such as rapid oxidation, deflagration or detonation, decomposition of molecules and runaway polymerization (usually detonations). This includes a

chemical reaction during which *oxygen* combines with a *fuel*. (The oxygen may be entirely or partially provided by an oxidizing material. The reaction takes place extremely rapidly with the release of light, heat, sound and a pressure wave.

- Physical changes such as pressure tank ruptures.
- Atomic changes (nuclear fission or fusion).

Deflagration: An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

Detonation: An exothermic reaction with explosive effect that utilizes shock compression as the principal heating mechanism and generates a shock wave in the material that establishes and maintains a reaction that progresses through the material at a rate greater than the velocity of sound.

Fire: a chemical reaction during which oxygen combines with a fuel in the presence of oxygen, or an oxidizer. A source of ignition energy is required. The reaction takes place at a moderate rate with a release of light, heat and sound.

FUEL: any material (solid, liquid or gas) that can undergo (rapid or moderate oxidation, or burning.) Burning is accomplished by materials which are combustible or flammable.

Organic Peroxide: An organic compound having a double oxygen or peroxy (-O-O-) in its chemical structure. Organic peroxides can present an explosion hazard (detonation or deflagration), can be shock sensitive, can be susceptible to decomposition into various unstable compounds over an extended period of time and are classified as follows based upon their hazardous properties:

- Class I. Organic peroxides that are capable of deflagration but not detonation.
- Class II. Organic peroxides that burn very rapidly and that pose a moderate reactivity hazard.
- Class III. Organic peroxides that burn rapidly and that pose a moderate reactivity hazard.
- Class IV. Organic peroxides that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.
- Class V. Organic peroxides that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.
- Unclassified detonable: Organic peroxides that are capable of detonation and pose an extremely high-explosion hazard through rapid explosive decomposition.

Oxidizer: A material that readily yields oxygen or other oxidizing gas, such as bromine, chlorine and fluorine, or that readily reacts to promote or initiate combustion of combustible materials, classified as follows:

- **Class 1.** An oxidizer whose primary hazard is that it slightly increases the burning rate but which does not cause spontaneous ignition when it comes in contact with combustible materials.
- **Class 2.** An oxidizer that will cause a moderate increase in the burning rate or that causes spontaneous ignition of combustible materials with which it comes in contact.

- **Class 3.** An oxidizer that will cause a severe increase in the burning rate of combustible materials with which it comes in contact or that will undergo vigorous self-sustained decomposition caused by contamination or exposure to heat.
- **Class 4.** An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and can cause spontaneous ignition of combustibles.

Oxidizing Gas: A gas that can support and accelerate combustion of other materials.

Oxidizing Material: Any material that can serve as an oxidizer in a chemical reaction.

Note: Oxidizers and organic peroxides are both considered “oxidizing materials” in that they provide oxygen to chemical and physical reactions.

PERMIT AND CERTIFICATE OF FITNESS

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

Organic Peroxides

Liquids		Solids	
Class I	Any Amount	Class I	Any Amount
Class II	Any Amount	Class II	Any Amount
Class III	1 gallon	Class III	10 pounds
Class IV	2 gallons	Class IV	20 pounds
Class V	No Permit Required	Class V	No Permit Required

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

Oxidizers

Gas	504 scf		
Liquids		Solids	
Class 4	Any Amount	Class 4	Any Amount
Class 3	1 gallon	Class 3	10 pounds
Class 2	10 gallons	Class 2	100 pounds
Class 1	55 gallons	Class 1	500 pounds

The **handling and use** of organic peroxides and oxidizers in quantities requiring a permit shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of organic peroxides and oxidizers in quantities requiring a permit shall be under the **general supervision** of a certificate of fitness holder.

RESTRICTIONS

It shall be unlawful to store, handle or use:

1. Class I organic peroxides and Class 4 oxidizers within Assembly, Educational, Institutional, Residential or Utility occupancies.
2. Class I organic peroxides and Class 4 liquid and solid oxidizers within offices, retail sales areas and areas accessible to the public located within Business, Factory, Mercantile or Storage occupancies.
3. Oxidizing gases in portable containers exceeding an individual capacity of 250 scf for maintenance purposes, patient care or operation of equipment in Assembly, Business, Educational, Institutional or Residential occupancies.

STORAGE REQUIREMENTS

It is important to understand that the conditions of acceptable storage for oxidizing materials are based upon their ability to cause combustible and flammable materials to ignite and burn, or explode. The fundamental and general rule is to keep fuels (including wood, paper, cardboard, flammable liquids and gases, metals, etc...) and sources of ignition away from the stored oxidizing materials. Furthermore, in the special case of organic peroxides, sources of contamination and heat production must be avoided in the area of storage.

Special attention must be paid to the class of oxidizer and organic peroxide that one is dealing with, a designation that may be found on the label accompanying the material, it's MSDS (Material Safety Data Sheet), or through a phone call 1-800-CHEMTREC or to the manufacturer. For instance, greater care must be used in the storage of Class 4 oxidizers than with Class 1 oxidizers. Similarly, greater care must be used in the storage of Class I organic peroxides than with Class IV organic peroxides.

HANDLING & USE

Solid oxidizers and solid organic peroxides are less likely to pose problems than liquids and gases due to their physical characteristics. However, great care must be used in the handling and use of all oxidizing materials. In some respects the hazard during handling may be significantly increased due to the potential absence of a suitable container. The use of these materials near potential fuels must be avoided. Fuels include paper, wood, and flammable liquids. Also of concern is the use of oxidizing materials near some acids, as a dangerous reaction may occur when these materials are mixed. All materials in the vicinity of oxidizers and organic peroxides should be investigated for compatibility, and segregated if necessary.

All potential sources of ignition must be removed from the vicinity of oxidizers in use. "No smoking" signs must be posted prominently and no open flames – such as those associated with boilers or water heaters – are permissible where oxidizers and organic peroxides are used or stored.

Many oxidizing materials possess other hazards such as flammability, corrosively and toxicity. Chlorine, for instance, is an oxidizer that is also both corrosive and toxic. All hazards should be investigated prior to use and handling and steps taken to reduce the potential for problems, in accordance with the Fire Code.

In the event of an uncontrolled spill or release of a liquid, solid or gaseous oxidizing material, the area should be evacuated and notification to 911 made as soon as possible.

In the event of a fire, personnel should be aware that many extinguishing agents – such as carbon dioxide and dry chemical agents - are likely to be ineffective against oxidizer-based fires. The principle upon which they operate is to deprive the fire of atmospheric oxygen. Oxidizers and organic peroxides are unique in that they provide their own oxygen to the fire, independent of the atmosphere. Water as an extinguishing agent can often effectively be used, in very large quantities, to cool the burning material below its ignition temperature and thereby extinguish the fire. Prior to the use of water, however, it must first be determined that the material is not water-reactive.

Oxidizers containing ammonium nitrate shall also comply with the requirements of NFPA 490.

Bulk oxygen systems shall also comply with the requirements of NFPA 50.

Bulk nitrous oxide systems shall also comply with the requirements of Compressed Gas Association Pamphlet G-8.1.

E. PYROPHORICS [Fire Code Chapter 41]

DEFINITIONS

Pyrophoric Material: A material that is so chemically unstable that it may ignite spontaneously at a temperature at or below 130°F.

Silane: A pyrophoric chemical compound, gaseous at standard temperatures and pressures, that is composed of one silicon atom and 4 hydrogen atoms (SiH₄).

PERMITS AND CERTIFICATES OF FITNESS

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

Gases	Any Amount
Liquids	Any Amount
Solids	Any Amount

The **handling and use** of pyrophoric materials in quantities requiring a permit shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of pyrophoric materials in quantities requiring a permit shall be under the **general supervision** of a certificate of fitness holder.

RESTRICTIONS

It shall be unlawful to:

1. Manufacture, store, handle and/or use detonable pyrophoric materials.
2. Compress any pyrophoric material that is a gas.

STORAGE & USE REQUIREMENTS

Handling and Use

The handling and use of pyrophoric materials near incompatibles such as heat sources and water must be avoided. Material must be kept away from any possible fuel sources. All pyrophorics should be managed under inert gases, solvent or in an inert atmosphere. Compressed pyrophoric gas systems shall have approved emergency shutoff valves that can be activated at each point of use and each source. Proper personal protective equipment must be worn at all times while handling these materials.

Many pyrophorics possess other hazards such as flammability, corrosivity and toxicity. Be sure to reference MSDS' or manufacturer's information for all materials prior to working with material. All hazards should be investigated prior to use and handling and steps taken to reduce the potential for problems, in accordance with the Fire Code.

Appropriate fire extinguishing equipment must be present in each in areas where these materials are handled. Extinguishing agents include a Class D fire extinguisher and Metal X for metal fires.

In the event of an uncontrolled spill or release of material, the area should be evacuated and notification made to 911 as soon as possible.

Manufacturing, storing, handling and/or using of detonable pyrophoric materials is prohibited in most cases. Always consult the Fire Code prior to conducting any activities with any of these materials.

Pyrophoric materials will often have very specific storage or handling requirements due to the volatile nature of the chemicals. It is important to consult the MSDS or to contact the chemical manufacture for specific guidelines. Some examples of pyrophoric materials include diethylaluminum chloride, lithium metal or silane gases.

F. PYROXYLIN PLASTICS (Fire Code Chapter 42)

DEFINITIONS

Finished Pyroxylin Plastic Products: Any product to which a pyroxylin plastic has been applied that does not require further manufacturing with respect to the application of such pyroxylin plastic or any further application of pyroxylin plastic.

Pyroxylin Plastic: Any plastic substance, material or compound, other than cellulose nitrate film, that has soluble cotton or similar cellulose nitrate as a base, by whatever name known, in the form of blocks, sheets, tubes or other fabricated shapes, including raw pyroxylin plastics and finished pyroxylin plastic products.

Raw Pyroxylin Plastic: Any pyroxylin plastic in the form of blocks, slabs, rods tubes or other shapes, that is to be used in a manufacturing process.

PERMITS AND CERTIFICATES OF FITNESS

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

1. Storage, handling, and/or use of more than 25 pounds of raw pyroxylin plastic.
2. Use of any amount of raw pyroxylin plastic for the assembly or manufacture of articles.

The **handling and use** of raw pyroxylin plastics in quantities requiring a permit shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of raw pyroxylin plastics in quantities requiring a permit shall be under the **general supervision** of a certificate of fitness holder.

RESTRICTIONS

It shall be unlawful to:

1. Manufacture raw pyroxylin plastics.
2. Store raw pyroxylin plastics, except accessory storage authorized by a special permit pursuant to Section 42-276 of the Zoning Resolution.

It shall be unlawful to store, handle or use raw pyroxylin plastics within:

1. Any building within 50 feet of the nearest wall of a school or hospital building or Assembly occupancy.
2. In any Residential occupancy.
3. In any building of combustible construction as defined by the NYC Building Code.

MATERIAL DESCRIPTION

Pyroxylin (nitrocellulose, cellulose nitrate) in raw form is generally a thin, transparent colorless to pale yellow solid. It is also used as filters/membrane in laboratory analysis. It is generally manufactured with a damping agent of water, alcohol or gelatinizing plasticizer agents. Industrial nitrocellulose is usually not sold in pure form but damped with water and/or organic solvents such as isopropyl alcohol, esters, ketones or glycol ethers. Damped nitrocellulose can be solid or liquid, depending on the amount of damping agent used.

Pyroxylin with damping agent concentrations of less than 25 wt% water/alcohol or 18 wt% plasticizer is considered an explosive. Solid pyroxylin with higher concentrations of damping agents is a flammable solid. At room temperature, pure nitrocellulose is a white-yellow solid with an ether-like odor and is stable under normal temperature and pressure. When the temperature is increased to 320F and above, it will spontaneously ignite without an external spark or flame.

Plasticized pyroxylin was a forerunner of modern plastics in such items as combs, collars and cuffs. Nitrocellulose in flat motion picture film is a form of pyroxylin plastic but is

covered under a separate code. Currently, pyroxylin is used in liquid printing inks, binders for wood coatings and other lacquers and artificial leathers.

Pyroxylin lacquers are made by dissolving pyroxylin in a mixture of volatile solvents and adding a plasticizer and a pigment or dye. Pyroxylin plastics are made by colliding pyroxylin with large amounts of a plasticizer such as camphor; such plastics (e.g., celluloid) are highly flammable.

When dry, pyroxylin presents an unusually severe fire hazard and can ignite readily and burn explosively. Unstabilized product decomposes generally at relatively low temperature. Decomposition is flameless, self-sustaining and accelerative with evolution of copious volumes of toxic and flammable gases, and rapid heat generation. For unstabilized dry material: an explosion may be initiated by sudden shock and/or by high temperature and can be sensitive to static charge. Prolonged storage can result in deterioration and decomposition. Fires are caused by ignition of residual nitrocellulose in the blending machine or by nitrocellulose stored on the factory premises.

Burning Characteristics

- Pyroxylin plastic is a flammable/combustible solid material and may be ignited by friction, heat, sparks or flames. Powders, dusts, shavings, borings, turnings or cuttings may explode or burn with explosive violence and may re-ignite after fire is extinguished.
- Old pyroxylin plastic articles have a tendency to lose their plasticizer agents (evaporation) and become more brittle and flammable.
- Pyroxylin (cellulose nitrate) contains sufficient oxygen to self-sustain burning even in oxygen-deficient atmospheres so prompt cooling with a large quantity of water is essential. Water applied through spray nozzles is effective if used quickly and in sufficient volume. For small fires of solutions or mixtures dry chemical, CO₂, sand, earth, water spray or regular foam should be used. For large fires a water spray or fog should be used.
- For fires of raw pyroxylin, water is preferable to reduce the potential of toxic gas (nitrous gases) evolution.

STORAGE & USE REQUIREMENTS

Storage

Pyroxylin plastics should never be stored for any time in any dry fibrous state. Check with the manufacturer for specific information. If you have to store nitrocellulose for a longer period, invert the container at regular intervals to prevent the damping medium from separating from the nitrocellulose and the nitrocellulose from drying out.

Because of the hazards associated with pyroxylin plastics good storage practices should include:

- Do not store pyroxylin (nitrocellulose) with incompatible substances, such as explosive substances, gases under pressure, flammable substances, oxidizing agents, acids, alkalis and amines.
- Store all unopened containers of pyroxylin (nitrocellulose) in a sealed and upright position.

- Inventory should be managed in a first in, first out order with the stock with the earliest production date being used first.
- Do not open or empty pyroxylin (nitrocellulose) into other containers. The pyroxylin (nitrocellulose) should be kept only in the original containers.

The storage & handling of pyroxylin plastics shall be in accordance with the following.

1. Finished pyroxylin plastic products displayed in areas to which the public has access shall be placed on tables or counters not more than 3 feet wide and 10 feet long. Tables and counters shall be spaced at least 3 feet apart. The space underneath tables shall be kept free from storage of any kind and table location shall not interfere with means of egress.
2. Lighting shall not be located directly above pyroxylin plastics, unless provided with a suitable guard to prevent heated particles or broken bulb elements from falling
3. The storage, handling or use of pyroxylin plastic in quantities exceeding 100 pounds shall be located in a building or part thereof protected throughout by a sprinkler system, except for storage exclusively of finished pyroxylin plastic products in a quantity not exceeding 6,000 pounds.
4. Rooms in which pyroxylin plastics are handled or stored shall be heated by low-pressure steam or hot water. Special spacing and construction requirements for heating systems radiators are addressed by the Fire Code.
5. Sources of ignition shall not be located in rooms in which pyroxylin plastics in excess of 25 pounds are stored, handled or used.
6. As dry pyroxylin (nitrocellulose) is sensitive to heat and impact, damped nitrocellulose must not be allowed to dry out. Tools should be non-ferrous (copper, brass, bronze or wood) when opening and closing containers of nitrocellulose. Plastic materials should not be used because they tend to produce static electricity. Protect all nitrocellulose mixing and processing equipment from static electricity by grounding all metal parts. Ground all containers before transferring nitrocellulose.

The storage, handling and use of pyroxylin plastics in Factory occupancies shall be in accordance with the following:

1. Where raw pyroxylin plastics in excess of 25 pounds are received in a building or fire area, an approved vented cabinet or approved vented vault protected by a sprinkler system shall be provided for that storage.
2. Storage in any one workroom shall not exceed 1,000 pounds of raw pyroxylin plastics. A storage cabinet shall not contain more than 500 pounds. Each compartment shall not contain more than 250 pounds. Materials in excess of these quantities shall be kept in vented vaults not exceeding 1,500-cubic-foot capacity of total vault space, and with construction, venting and sprinkler system protection approved by the commissioner.
3. Pyroxylin plastics shall not be stored within 2 feet of heat producing appliances, steam pipes, radiators or chimneys.
4. Work stations for manufacturing finished pyroxylin plastic products shall not be stationed closer together than 3 feet. The amount of material per operator shall not exceed one-shift's supply and shall be limited to the capacity of three tote boxes, including material awaiting removal or use.
5. Approved vented cabinets, vaults or storage rooms protected by a sprinkler system shall be provided to prevent accumulations of raw pyroxylin plastic and finished pyroxylin plastic products in workrooms where pyroxylin plastics are manufactured.

6. Waste pyroxylin plastics, such as shavings, chips, turnings, sawdust, edgings and trimmings, shall be kept under water in metal receptacles until removed from the premises. When the drums are empty, wash or wipe them with a damp rag. Clean the inside of the lid and the closure ring as well. Dispose of the used rags in the same manner as spilled nitrocellulose.

G. UNSTABLE REACTIVES [Fire Code Chapter 43]

DEFINITIONS

Unstable (Reactive) Material—A material, other than an explosive, that will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Classes 1 through 4, with increasing levels of hazard from Class 1 to Class 4.

In storing unstable reactive materials, care must be taken to ensure that the materials do not encounter any incompatible materials or conditions that could cause a reaction. Storage of temperature-sensitive materials requires the use of temperature controls. Whenever the chemical manufacturer or MSDS specifies a maximum/minimum storage temperature, the storage area must also have an emergency alarm that notifies personnel whenever the temperature falls below or exceeds the set point. These personnel must ensure notification to the fire department.

There are different storage considerations for “deflagrating” unstable reactives, as opposed to those for “non-deflagrating” unstable reactives. To determine whether or not a material is considered deflagrating, one must consult an MSDS or the chemical manufacturer.

Additionally, one must determine the class of unstable reactive by consulting an MSDS or by contacting the chemical manufacturer. The classes of unstable reactives are ordered in incrementally increasing hazard. A Class 4 unstable reactive, therefore, must be handled more carefully than a Class 1 unstable reactive. A basic description is listed below for each class.

- **Class 1-** Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure. Examples include Hydrogen Peroxide 35-52%, paraldehyde, tetrahydrofuran, and concentrated acetic acid.
- **Class 2-** Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressure, and that can undergo violent chemical change at elevated temperatures and pressures. Examples include Acrolein, Acrylic Acid, and hydrazine.
- **Class 3-** Materials those in themselves are capable of detonation or of explosive decomposition or of explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures. Examples include Hydrogen peroxide >52%, hydroxylamine, and perchloric acid.
- **Class 4-** Materials that in themselves are readily capable of detonation or of explosive decomposition or of explosive reaction at normal temperatures and pressures. This

class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures. Examples include Acetyl peroxide, dibutyl peroxide and ethyl nitrate.

PERMITS AND CERTIFICATES OF FITNESS

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

Gases	Any Amount		
Liquids		Solids	
Class 4	Any Amount	Class 4	Any Amount
Class 3	Any Amount	Class 3	Any Amount
Class 2	5 gallons	Class 2	50 pounds
Class 1	10 gallons	Class 1	100 pounds

The **handling and use** of unstable (reactive) materials in quantities requiring a permit shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of unstable (reactive) materials in quantities requiring a permit shall be under the **general supervision** of a certificate of fitness holder.

RESTRICTIONS

It shall be unlawful to store, handle or use Class 3 and 4 unstable (reactive) materials within:

1. Assembly, Educational, Institutional, Residential or Utility occupancies.
2. Offices and areas accessible to the public located within Business, Factory, Mercantile or Storage occupancies.

STORAGE & USE REQUIREMENTS

The storage and use of these materials near incompatibles such as heat sources must be avoided. Material must be kept away from any possible fuel sources. Proper personal protective equipment must be worn at all times while handling these materials.

Many unstable materials possess other hazards such as flammability, corrosivity, and toxicity. Be sure to reference MSDS's or manufacturer's information for all materials prior to working with material. All hazards should be investigated prior to use and handling and steps taken to reduce the potential for problems, in accordance with the Fire Code.

Appropriate fire extinguishing equipment must be present in each in areas where these materials are handled. Extinguishing agents may include a Class A, B, C or Class D fire extinguisher.

In the event of an uncontrolled spill or release of material, the area should be evacuated and notification made to 911 as soon as possible.

H. WATER-RACTIVE SOLIDS & LIQUIDS [Fire Code Chapter 44]

DEFINITIONS

Water-Reactive Material: A material (solid, liquid, or gas) that has a dangerous chemical reaction when reacting with water. Upon coming in contact with water, a water reactive material may explode, violently react, produce flammable, toxic, or other hazardous gases, and/or generate enough heat to cause ignition of the material or nearby materials.

PERMITS AND CERTIFICATES

Quantities requiring a permit AND Supervision by a C-91 certificate of fitness holder

Gases	Any Amount		
Liquids		Solids	
Class 3	Any Amount	Class 3	Any Amount
Class 2	5 gallons	Class 2	50 pounds
Class 1	55 gallons	Class 1	500 pounds

The **handling and use** of water-reactive solids and liquids in quantities requiring a permit shall be under the **personal supervision** of a certificate of fitness holder. The **storage** of water-reactive solids and liquids in quantities requiring a permit shall be under the **general supervision** of a certificate of fitness holder.

RESTRICTIONS

It shall be unlawful to store, handle or use Class 3 water-reactive solids and liquids:

1. In Assembly, Educational, Institutional, Residential or Utility occupancies.
2. In offices or in retail sales portions of Business, Factory, Mercantile or Storage occupancies.

MATERIAL DESCRIPTION

Water-Reactive chemicals react with the hydrogen and oxygen in water to create new combinations of chemicals and produce energy, resulting in an exothermic reaction. Water reactive materials often produce byproducts that may be ignited by the heat generated, thereby producing a flame or explosion. Water-reactive materials are often elemental metals in either whole or powder form. Examples include Potassium, calcium, and sodium.

The chemical equation below shows the reaction of elemental sodium with water. The heat generated by the reaction ignites the hydrogen gas, creating a bright flame.



Water-reactive materials are divided in to Classes 1 through 3, with increasing levels of hazard from Class 1 to Class 3. To determine the class of the water-reactive material, one should consult the MSDS or call the chemical manufacturer.

- **Class 1-** Materials that may react with water to release some energy, but not violently. Examples include Acetic Anhydride, Solid Sodium Hydroxide, and Sulfur Monochloride.

- **Class 2-** Materials that may form potentially explosive mixtures with water. Examples include Calcium carbide, Calcium metal, and potassium metal.
- **Class 3-** Materials that react explosively with water without requiring heat or confinement. Examples include Aluminum alkyls, bromine trifluoride, and diethyl zinc.

STORAGE & USE REQUIREMENTS

Storage

In storing water reactive materials, care must be taken to ensure that the materials do not come in to contact with any water or other incompatible materials.

Handling and Use

The hazards presented by these materials in storage also exist during the use of these materials. The use of these materials near incompatibles such as heat sources and water must be avoided. Material must be kept away from any possible fuel sources. All water reactives should be managed under solvent or in an inert atmosphere.

Many water reactive materials possess other hazards such as flammability, corrosivity and toxicity. Be sure to reference MSDS' or manufacturer's information for all materials prior to working with material. All hazards should be investigated prior to use and handling and steps taken to reduce the potential for problems, in accordance with the Fire Code.

Proper personal protective equipment must be worn at all times while handling these materials. Appropriate fire extinguishing equipment must be present in each in areas where these materials are handled. Extinguishing agents include a Class D agents and Metal X for metal fires.

Addendum A**Sample Material Safety Data Sheet (MSDS)****SECTION 1: PRODUCT IDENTIFICATION**

PRODUCT NAME: Arsenic Brew
MANUFACTURER: Batty's Batch of Chemicals
ADDRESS: 111 Elm Ave
Astoria, NY 11105
EMERGENCY PHONE: 1-800-555-5555

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT:
Cacodylic Acid 90%

CAS NO.
75-60-5
Trade Secret Inert Ingredients 10%

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Toxic if inhaled or swallowed. Cancer hazard. May cause irritation to eyes, skin, and/or respiratory tract.

ROUTES OF ENTRY: Inhalation, Ingestion, Absorption.

POTENTIAL HEALTH EFFECTS

EYES: May cause irritation

SKIN: May cause irritation

INGESTION: May cause irritation to digestive tract. Toxic if ingested.

INHALATION: May cause irritation. Toxic if inhaled.

ACUTE HEALTH HAZARDS: May cause death or severe health reactions within 24 hours of ingestion or inhalation of particles.

CHRONIC HEALTH HAZARDS: May cause cancer.

CARCINOGENICITY

ACGIH: Not listed **NTP:** Not listed **IARC:** Group 1 carcinogen

OTHER: Carcinogen in California

SECTION 4: FIRST AID MEASURES

EYES: Flush with water. Immediate medical aid.

SKIN: Remove any clothing and flush skin with water. Immediate medical aid.

INGESTION: Do NOT induce vomiting. Call poison control and get medical aid.

INHALATION: Remove from exposure and get medical aid immediately. If breathing is impeded, give oxygen. Do NOT administer mouth-to-mouth resuscitation when substance inhaled or ingested.

NOTES TO PHYSICIANS OR FIRST AID PROVIDERS: Treat symptomatically and supportively.

SECTION 5: FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable

AUTOIGNITION TEMPERATURE:
Not available

NFPA HAZARD CLASSIFICATION

HEALTH: 3 FLAMMABILITY: 1 REACTIVITY: 1

Note: ratings are estimated

HMIS HAZARD CLASSIFICATION

HEALTH: FLAMMABILITY: REACTIVITY:
PROTECTION:

EXTINGUISHING MEDIA: Use water spray, dry chemical, carbon dioxide, or chemical foam

SPECIAL FIRE FIGHTING PROCEDURES: None

General: Use self-contained breathing apparatus, or approved respiratory gear in the case of a fire.

SECTION 6: ACCIDENTAL RELEASE MEASURES

ACCIDENTAL RELEASE MEASURES: Promote proper ventilation, Vacuum or sweep and put in appropriate disposal container. Use appropriate PPE.

SECTION 7: HANDLING AND STORAGE

HANDLING AND STORAGE: Store in a cool, dry place in closed container. Do not get in eyes, skin, or clothing. Use only in a chemical fume hood.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Eyewash facility and safety shower. Use only in chemical fume hood.

RESPIRATORY PROTECTION: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

EYE PROTECTION: Wear appropriate safety eye protection per OSHA 29 CFR 1910.133

SKIN PROTECTION: Wear appropriate safety gloves.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Crystalline powder, white

ODOR: Not available

PHYSICAL STATE: solid

pH: Not available

BOILING POINT: Not available

MELTING POINT: not available

FREEZING POINT: not available

SPECIFIC GRAVITY (H₂O = 1): Not available

Molecular Formula: (Cacodylic acid) C₂H₇AsO₂

SECTION 10: STABILITY AND REACTIVITY

STABILITY: Hygroscopic

CONDITIONS TO AVOID (STABILITY): Incompatible materials, dust generation, excess heat, expo

INCOMPATIBILITY (MATERIAL TO AVOID): Strong oxidizing agents, strong bases

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: Carbon monoxide, carbon dioxide, oxides of arsenic.

HAZARDOUS POLYMERIZATION: Will not occur

SECTION 11: TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:

Oral, mouse: LD₅₀=1200 mg/kg

Oral, rat: LD₅₀=655 mg/kg

SECTION 12: ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION: Degrades in water and land through biodegradation. Dominant degradation leads to the formation of inorganic arsenate.

SECTION 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Consult federal and state regulations for proper disposal guidance.

SECTION 14: TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION

PROPER SHIPPING NAME: Cacodylic Acid (solutions)

HAZARD CLASS: 6.1

ID NUMBER: UN1572

PACKING GROUP: II

Addendum B



NEW YORK STATE DEPARTMENT OF STATE
OFFICE OF FIRE PREVENTION AND CONTROL

HAZARDOUS MATERIALS REPORT FORM
(General Municipal Law, § 209-u)

The information entered herein is essential to your local fire chief for the protection of your employees, the fire-fighters and citizens in the immediate area, and to reduce damage to your property in the event of a fire or an emergency.

Every fire insurance policyholder, engaged in commerce in this state, is required by law to report the presence of hazardous materials at their business address.

Failure to file in accordance with the provisions of section 209-u of the General Municipal Law could result in a fine. A separate report is required annually for each business address.

WHEN COMPLETED, THIS FORM MUST BE SENT TO YOUR LOCAL FIRE DEPARTMENT.

Hazardous Materials Location*

Firm Name _____	Street Add. Only _____
Bus. Add. _____	Bldg. Name or No. _____
City, State, Zip _____	City, State, Zip _____
Tel. No. _____	Policy Anniv. Date _____
Name Emergency Contact _____	Bus. Tel. _____ Home Tel. _____

(Signature and Title of Person Completing Form)

*It is suggested that a separate form be filled out for each building that contains hazardous materials.

EXEMPTIONS

Requests for exemptions from this law must be made in writing, attached to this form, and filed annually with your local fire department not later than the anniversary date of your policy.

All exemptions approved shall expire on the next policy anniversary date.

Exemptions denied shall require that the insured file a completed hazardous materials report form within 15 days of denial.

FOR FIRE DEPARTMENT USE ONLY

Exemptions: Approved _____ Denied _____ Additional Information Needed _____

(Date)

(Signature of Fire Chief)

(Fire Department Name and Address)

(Print Name of Fire Chief)

Instructions for Hazardous Material Listing

Identifying Symbol: This area identifies different classes of hazardous material. Most material will fall within one of these classes. If a particular material falls within two or more classes, it should be listed in each applicable class.

Two additional boxes are provided for material that does not fall within any class. These boxes may also be used if additional space is needed to further identify previously listed categories.

Amounts to be reported are shown in Table 1 below.


NOTE: SHIPPING AND PACKAGING LABELS MAY BE OF ASSISTANCE IN IDENTIFYING THE CLASS OF MATERIAL.

Hazardous Material Description and Proper Shipping Name

This area is reserved for the description and name of any hazardous material within a given class. If there is more than one material within a certain class, at a given location, then the most prevalent or most common should be used (indicate "most common").

Total Amount

List the total amount of reportable material within the given class. If the amounts vary from day to day, then the average amount should be listed.

Identifying Symbol	Hazardous Material Description and Proper Shipping Name	Total Amount
	Ethyl Chloride	60 gals.
	(most common)	

Special Considerations/Remarks

This area is reserved for the policyholder and the fire chief for making any notes or comments they feel are pertinent. Several examples are listed below:

1. Building has a sprinkler system.
2. Adjacent building is a school.
3. Guard dogs are on the premises from 6:00 p.m. to 6:00 a.m.
4. Hazardous material amounts may vary greatly from day to day.
5. Poor water supply.
6. Access to the building is poor.
7. Flammable liquid is stored in the same building as oxidizer.

Table 1

Amounts to be Reported

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Explosives and Blasting Agents - any amount 2. Poison Gas - any amount 3. Poison and Irritant - any amount 4. Flammable Liquid - over 5 gallons inside a building and over 10 gallons outside a building 5. Flammable Solid - any amount 6. Flammable Gas - over 2,000 cubic feet at normal temperature 7. Nonflammable Gas - over 6,000 cubic feet at normal temperature | <ol style="list-style-type: none"> 8. Oxidizer - over 50 pounds 9. Organic Peroxide - over 10 pounds 10. Combustible Liquid - over 25 gallons inside a building and over 60 gallons outside a building 11. Radioactive Material - any amount 12. Corrosive Material - over 55 gallons 13. Dangerous When Wet Material - any amount 14. Etiologic Material - any amount |
|--|---|

(OVER)

Hazardous Material Definitions

The following definitions have been abstracted from the Code of Federal Regulations, Title 49- Transportation, Parts 100 to 199. Refer to the referenced sections for complete details.

NOTE: Rulemaking proposals are outstanding or are contemplated concerning some of these definitions.

Hazardous Material - Means a substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property, when transported in commerce, and which has been so designated. (Sec. 171.8)

Multiple Hazards - A material meeting the definitions of more than one hazard class is classed according to the sequence given in Sec. 173.2.

HAZARD CLASS	DEFINITIONS
EXPLOSIVES	An Explosive - Any chemical compound, mixture or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture or device is otherwise specifically classified in Parts 170-189. (Sec. 173.50)
CLASS A EXPLOSIVE	Detonating or otherwise of maximum hazard. The nine types of Class A explosives are defined in Sec. 173.53.
CLASS B EXPLOSIVE	In general, function by rapid combustion rather than detonation and include some explosive devices such as special fireworks, flash powders, etc. Flammable hazard. (Sec. 173.88)
CLASS C EXPLOSIVE	Certain types of manufactured articles containing Class A or Class B explosives, or both, as components but in restricted quantities, and certain types of fireworks. Minimum hazard. (Sec. 173.100)
BLASTING AGENTS	A material designed for blasting which has been tested in accordance with Sec. 173.114a(b) and found to be so insensitive that there is very little probability of accidental initiation to explosion or of transition from deflagration to detonation (Sec. 173.114a(a))
COMBUSTIBLE LIQUID	Any liquid having a flash point above 100°F. and below 200°F. as determined by tests listed in Sec. 173.115(d). Exceptions to this are found in Sec. 173.115(b).
CORROSIVE MATERIAL	Any liquid or solid that causes visible destruction of human skin tissue or a liquid that has a severe corrosion rate on steel. See Sec. 173.240(a) and (b) for details.
FLAMMABLE LIQUID	Any liquid having a flash point below 100°F. as determined by tests listed in Sec. 173.115(d). Exceptions are listed in Sec. 173.115(a).
COMPRESSED GAS	Compressed Gas - Any material or mixture having in the container a pressure exceeding 40 psia at 70°F., or a pressure exceeding 104 psia at 130°F.; or any liquid flammable material having a vapor pressure exceeding 40 psia at 100°F. (Sec. 173.300(a))
FLAMMABLE GAS	Any compressed gas meeting the requirements for lower flammability limit, flammability limit range, flame projection, or flame propagation criteria as specified in Sec. 173.300(b).
NONFLAMMABLE GAS	Any compressed gas other than a flammable compressed gas.
FLAMMABLE SOLID	Any solid material, other than an explosive, which is liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious transportation hazard. (Sec. 173.150)
ORGANIC PEROXIDE	An organic compound containing the bivalent -O-O structure and which may be considered a derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by organic radicals must be classed as an organic peroxide unless... (See Sec. 173.151(a) for details)
OXIDIZER	A substance such as chlorate, permanganate, inorganic peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter. (See Sec. 173.151)
POISON A (Poison Gas)	Extremely Dangerous Poisons - Poisonous gases or liquids of such nature that a very small amount of the gas, or vapor of the liquid, mixed with air is dangerous to life. (Sec. 173.326)
POISON B (Poison)	Less Dangerous Poisons - Substances, liquids, or solids (including pastes and semi-solids), other than Class A or Irritating materials, which are known to be so toxic to man as to afford a hazard to health during transportation; or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man. (Sec. 173.343)
IRRITATING MATERIAL	A liquid or solid substance which upon contact with fire or when exposed to air gives off dangerous or intensely irritating fumes, but not including any poisonous material, Class A. (Sec. 173.381)
ETIOLOGIC AGENT	An "etiologic agent" means a viable micro-organism, or its toxin which causes or may cause human disease. (Sec. 173.386) (Refer to the Department of Health, Education and Welfare Regulations, Title 42, CFR, Sec. 72.25(c) for details.)
RADIOACTIVE MATERIAL	Any material, or combination of materials, that spontaneously emits ionizing radiation, and having a specific activity greater than 0.002 microcuries per gram. (Sec. 173.389) NOTE: See Sec. 173.389(a) through (1) for details.
WATER REACTIVE MATERIAL (SOLID)	Means any solid substance (including sludges and pastes) which, by interaction with water, is likely to become spontaneously flammable or to give off flammable or toxic gases in dangerous quantities.

PART III

HAZARDOUS MATERIAL SPECIFIC REQUIREMENTS

The **first two parts** of this study material dealt with the **general requirements** applicable to the storage, handling and/or use of hazardous materials **in quantities not exceeding** the maximum allowable quantity per control area for that material. This 3rd part is provided **FOR YOUR REFERENCE ONLY**.

In addition to compliance with all general requirements, hazardous materials in quantities **exceeding** the maximum allowable quantity per control area shall be stored, handled and used in accordance with the following hazardous material specific requirements:

- **CORROSIVE MATERIALS (FIRE CODE CHAPTER 31)**

Indoor storage of corrosive materials in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following.

Floors in storage areas for corrosive liquids shall be of liquid-tight construction.

Outdoor storage and use of corrosive materials in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

Aboveground outdoor storage tanks exceeding an aggregate quantity of 1,000 gallons of corrosive liquids shall be provided with secondary containment.

Outdoor storage of corrosive materials shall not be within 20 feet of buildings not associated with the manufacturing or distribution of such materials, lot lines, public streets, private roads or means of egress. A 2-hour fire barrier wall without openings or penetrations, and extending not less than 30 inches above and to the sides of the storage area, is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

Indoor use of corrosive materials in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following.

When corrosive materials are dispensed or used, mechanical exhaust ventilation shall be provided.

- **FLAMMABLE SOLIDS (FIRE CODE CHAPTER 36)**

Indoor storage in amounts exceeding the maximum allowable quantity per control area shall be in accordance with NFPA 484 and the following:

Flammable solids stored in quantities greater than 1,000 cubic feet shall be separated into piles each not larger than 1,000 cubic feet. Aisle widths between piles shall not be less than the height of the piles or 10 feet, whichever is greater. Flammable solids shall not be stored in basements or other below grade areas.

Outdoor storage in amounts exceeding the maximum allowable quantity per control area shall be in accordance with NFPA 484 and the following:

Outdoor storage of flammable solids shall not be located within 20 feet of a building, lot line, public street, private road or means of egress. A 2-hour fire barrier without openings or penetrations and extending 30 inches above and to the sides of the storage area is allowed in lieu of such distance. The fire barrier shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

Outdoor storage of flammable solids shall be separated into piles not larger than 5,000 cubic feet each. Piles shall be separated by aisles with a minimum width of not less than one-half the pile height or 10 feet, whichever is greater.

Combustible material and combustible waste, including packing materials and oily rags, shall not be stored in the same area as that where solid combustible metal scraps or powders are stored.

Indoor and outdoor handling and use of flammable solids in amounts exceeding the maximum allowable quantity per control area shall be in accordance with NFPA 484, and n amounts not exceeding the maximum allowable quantity per control area.

- **HIGHLY TOXIC AND TOXIC MATERIALS (FIRE CODE CHAPTER 37)**

Indoor storage, handling and use of highly toxic and toxic materials in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

Exhaust scrubbers or other systems for processing vapors of highly toxic liquids shall be provided where a spill or accidental release of such liquids can be expected to release highly toxic vapors at normal temperature and pressure.

Indoor storage of highly toxic and toxic materials in amounts exceeding the maximum allowable quantity per control area shall be additionally comply with the following:

Floors of storage areas shall be of liquid-tight construction.

Highly toxic solids and liquids in storage shall be located in approved hazardous material storage cabinets or isolated from other hazardous material storage by an approved storage room.

Indoor handling and use of highly toxic and toxic materials in amounts exceeding the maximum allowable quantity per control area shall be additionally comply with the following:

Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in open systems except for liquids or solids that do not generate highly toxic or toxic fumes, mists or vapors.

Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in closed systems except for liquids or solids that do not generate highly toxic or toxic fumes, mists or vapors.

Indoor storage, handling or use of highly toxic and toxic gases in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

Portable containers shall be located within gas cabinets, exhausted enclosures or gas rooms. All other containers shall be located within gas rooms or exhausted enclosures.

The room or other area in which gas cabinets or exhausted enclosures are located shall be provided with exhaust ventilation. Gas cabinets or exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

Except where containers are already located within gas cabinets or exhausted enclosures or where approved containment vessels or containment systems are provided, one or more spare gas cabinets or exhausted enclosures shall be available on the premises to capture the gas from leaking containers until such time as the leaking container can be removed from the premises and disposed of lawfully. These gas cabinets and exhausted enclosures shall be located in gas rooms and connected to an exhaust system.

Gas cabinets and exhausted enclosures shall be protected by a sprinkler system. Alternative fire extinguishing systems shall not be used in lieu of a sprinkler system.

A means of local exhaust shall be provided to capture leaks from portable containers. The local exhaust shall consist of portable ducts or collection systems designed to be applied to the site of a leak in a valve or fitting on the container. The local exhaust system shall be located in a gas room. Exhaust shall be directed to a treatment system.

Pressure relief devices shall be vented to a treatment system except that pressure relief devices on outdoor containers provided exclusively for relieving pressure due to fire exposure are not required to be vented to a treatment system provided that the material in the container is not flammable, the container is not located in a disked area with other containers containing combustible materials and the container is located not less than 30 feet from combustible materials or structures or is shielded by a 2-hour fire resistant barrier.

Filling or dispensing connections shall be provided with a means of local exhaust. Such exhaust shall be designed to capture fumes and vapors. The exhaust shall be directed to a treatment system. Stationary containers shall be provided with a means of excess flow control on all container inlet or outlet connections except for inlet connections are designed to prevent backflow and on pressure relief devices.

Gas rooms shall be protected throughout by a sprinkler system. Alternative fire extinguishing systems shall not be used in lieu of a sprinkler system. The exhaust ventilation from gas rooms shall be directed to an exhaust system.

The exhaust ventilation from gas cabinets, exhausted enclosures and gas rooms, and local exhaust systems shall be directed to a treatment system. The treatment system shall be utilized to handle the accidental release of gas and to process exhaust ventilation.

Exception:

- A treatment system is not required for highly toxic and toxic gases containers in storage when valve outlets are equipped with gas-tight outlet plugs or caps,

hand wheel-operated valves have handles secured to prevent movement and approved containment vessels or containment systems are provided

- Treatment systems are not required for toxic gases supplied by portable containers not exceeding 660 gallons liquid capacity when monitored by a gas detection system with a sensing interval not exceeding 5 minutes and an approved automatic-closing fail-safe valve located immediately adjacent to container valves, closing when gas is detected at the permissible exposure limit (PEL) monitoring the exhaust system at the point of discharge from the gas cabinet, exhausted enclosure, ventilated enclosure or gas room is provided.

Emergency power shall be provided where any ventilation, treatment, detection, control or alarm system is required except that emergency power is not required for mechanical exhaust ventilation, treatment systems and temperature control systems where approved fail-safe engineered systems are installed.

An approved automatic fire detection system shall be installed in rooms or areas where highly toxic compressed gases are stored or used. Activation of the detection system shall sound a local alarm.

A gas detection system shall be provided to detect the presence of gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is provided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the IDLH limit. The detection system is not required for toxic gases when the physiological warning properties for the gas are at a level below the accepted PEL for the gas.

The system shall initiate a local alarm and transmit a signal to a continuously attended control station on the premises whenever it detects the presence of the gas in the atmosphere. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where gas is detected.

Signal transmission to a continuously attended control station is not required where not more than one container of highly toxic or toxic gas is stored. A gas detection system is not required for toxic gases when the physiological warning properties for the gas are at a level below the accepted PEL for the gas.

The gas-detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected. Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic compressed gases where such reactors are operated at pressures less than 15 pounds per square inch gauge (psig), continuously attended and provided with readily accessible emergency shutoff valves.

When the gas-detection sampling point initiating the gas-detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close. Under all other circumstances, shutoff valves shall comply with the following automatic closure requirements:

1. When the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and compressed gas containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the container of specific gas detected supplying the manifold shall automatically close.

Outdoor storage, handling and use of highly toxic or toxic solids and liquids in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

Outdoor storage, handling or use of highly toxic or toxic solids and liquids shall not be located within 20 feet of lot lines, public streets, private roads, exit discharges or exterior wall openings. A 2-hour fire barrier wall without openings or penetrations extending not less than 30 inches above and to the sides of the storage is allowed in lieu of such distance. The fire barrier wall shall be either an independent structure or the exterior wall of the building adjacent to the storage area.

Outdoor storage piles of highly toxic and toxic solids and liquids shall be separated into piles not larger than 2,500 cubic feet. Aisle widths between piles shall not be less than one-half the height of the pile or 10 feet, whichever is greater.

Where overhead weather protection is provided for outdoor storage or use of highly toxic and toxic liquids or solids, and the weather protection is attached to a building or structure, the storage or use area shall either be protected throughout by a sprinkler system, or storage or use vessels shall be fire-resistance rated.

Outdoor storage, handling or use of highly toxic and toxic gases in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

Outdoor storage, handling or use of highly toxic or toxic compressed gases shall not be located within 75 feet of a lot line, public street, private road, exit discharge or building not associated with the manufacture or distribution of such gases, unless all of the following conditions are met:

1. Storage is shielded by a 2-hour fire-resistant barrier which interrupts the line of sight between the storage and the exposure.
2. The 2-hour fire-resistant barrier shall be located at least 5 feet from any exposure.
3. The 2-hour fire-resistant barrier shall not have more than two sides at approximately 90-degree directions, or three sides with connecting angles of approximately 135 degrees.

Exception: Compressed gases located in sprinklered gas cabinets located 5 feet or more from buildings and 25 feet or more from an exit discharge.

Where the storage, handling or use area is located closer than 75 feet to a building not associated with the manufacture or distribution of highly toxic or toxic compressed gases, openings into a building other than for piping are not allowed above the height of

the top of the 2-hour fire-resistant barrier or within 50 feet horizontally from the storage area whether or not shielded by a fire barrier.

Exception: Compressed gases located in sprinklered gas cabinets located 5 feet or more from buildings and 25 feet or more from an exit discharge.

Any area used for storage, handling or use shall not be located within 75 feet of air intakes.

Exception: Compressed gases located in sprinklered gas cabinets located 5 feet or more from buildings and 25 feet or more from an exit discharge.

Leaking containers. Same as that for indoor storage, handling or use. Gas cabinets and exhausted enclosures shall be located within or immediately adjacent to outdoor storage, handling or use areas.

Local exhaust for portable containers. Same as that for indoor storage, handling or use.

Piping and controls—stationary containers. Same as that for indoor storage, handling or use.

Treatment systems. Same as that for indoor storage, handling or use.

Emergency power. Same as that for indoor storage, handling or use.

Gas detection system. Same as that for indoor storage, handling or use.

Weather protection shall be provided for portable containers located outdoors and not within gas cabinets or exhausted enclosures. The storage area shall be protected throughout by a sprinkler system except when all materials under the weather protection structure, including hazardous materials and the containers in which they are stored, are noncombustible and the weather protection structure is located not less than 30 feet from combustible materials or structures or is separated from such materials or structures using a 2-hour fire resistant barrier.

Portable containers in outdoor use shall be located in gas cabinets or exhausted enclosures.

- **ORGANIC PEROXIDES (FIRE CODE CHAPTER 39)**

Indoor storage in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

When the storage of organic peroxides is required to be in a detached building, such building shall be located in accordance with Table 3904.1.2.

Floors of storage areas shall be of liquid-tight construction.

Electrical wiring and equipment in storage areas for Class I or II organic peroxides shall comply with the requirements of the Electrical Code for electrical Class I, Division 2 locations.

An approved supervised smoke detection system shall be provided in rooms or areas where Class I, II or III organic peroxides are stored except in detached buildings equipped throughout with a fire extinguishing system. Activation of the smoke detection system shall sound a local alarm.

Storage arrangements for organic peroxides shall be in accordance with Table 3904.2.4 and shall comply with the following requirements:

1. Containers and packages in storage areas shall be closed.
2. Bulk storage shall not be in piles or bins.
3. A minimum 2-foot clear space shall be maintained between storage and uninsulated metal walls.
4. Fifty-five-gallon drums shall not be stored more than one drum high.

**TABLE 3904.1.2
ORGANIC PEROXIDES—DISTANCE FROM DETACHED STORAGE BUILDINGS OR
OUTDOOR STORAGE AREAS TO EXPOSURES**

ORGANIC PEROXID E CLASS	MAXIMUM STORAGE QUANTITY (POUNDS) AT MINIMUM SEPARATION DISTANCE					
	Distance to buildings, lot lines, public streets, private roads or means of egress			Distance between individual detached storage buildings or individual outdoor storage areas		
	50 feet	100 feet	150 feet	20 feet	75 feet	100 feet
I	2,000	20,000	175,000	2,000	20,000	175,000
II	100,000	200,000	No Limit	100,000 ^a	No Limit	No Limit
III	200,000	No Limit	No Limit	200,000 ^a	No Limit	No Limit
IV	No Limit	No Limit	No Limit	No Limit	No Limit	No Limit
V	No Limit	No Limit	No Limit	No Limit	No Limit	No Limit

a. When the amount of organic peroxide stored exceeds this amount, the minimum separation shall be 50 feet.

The storage of Class I or II organic peroxides shall be on the ground floor. Class III organic peroxides shall not be stored in basements or other below grade areas.

Organic peroxides shall be stored in their original shipping containers. Organic peroxides shall be stored in a manner to prevent contamination.

Indoor storage rooms, areas and buildings containing Class I organic peroxides shall be provided with explosion control.

Emergency power shall be provided for storage areas of Class I organic peroxides.

Storage areas for Class I organic peroxides shall be provided with smoke and heat venting.

Outdoor storage in amounts exceeding the maximum allowable quantities per control area shall be in accordance with the following:

Outdoor storage areas for organic peroxides shall be located in accordance with Table 3904.1.2.

Electrical wiring and equipment in outdoor storage areas containing Class I or II organic peroxides shall comply with the requirements of the Electrical Code for electrical Class I, Division 2 locations.

Maximum allowable quantities of organic peroxides in outdoor storage shall be in accordance with Table 3904.1.2.

Storage arrangements shall be in accordance with Table 3904.2.4.

Outdoor storage areas for organic peroxides in amounts requiring detached storage shall be located a minimum distance of 50 feet from other hazardous material storage.

**TABLE 3904.2.4
STORAGE REQUIREMENTS FOR ORGANIC PEROXIDES**

ORGANIC PEROXIDE CLASS	PILE CONFIGURATION				MAXIMUM QUANTITY PER BUILDING
	Maximum width (feet)	Maximum height (feet)	Minimum distance to next pile (feet)	Minimum distance to walls (feet)	
I	6	8	4 ^a	4 ^b	Note c
II	10	8	4 ^a	4 ^b	Note c
III	10	8	4 ^a	4 ^b	Note c
IV	16	10	3 ^{a,d}	4 ^b	No Requirement
V	No Requirement	No Requirement	No Requirement	No Requirement	No Requirement

a. At least one main aisle with a minimum width of 8 feet shall divide the storage area.

b. Distance to noncombustible walls is allowed to be reduced to 2 feet.

c. For detached storage buildings or outdoor storage areas see Table 3904.1.2 for maximum quantities. For indoor storage, see Table 2703.8.2 for maximum quantities.

d. The distance shall not be less than one-half the pile height.

- **OXIDIZERS (FIRE CODE CHAPTER 40)**

Indoor storage in amounts exceeding the maximum allowable quantity per control area.

In addition to any other general Fire Code storage requirements, Class 4 oxidizer liquids and solids shall be separated from other hazardous materials by not less than a 1-hour fire barrier or stored in hazardous materials storage cabinets.

Outdoor storage in amounts exceeding the maximum allowable quantities per control area.

Outdoor storage areas for liquid and solid oxidizers shall be located in accordance with Table 4004.1.2.

**TABLE 4004.1.2
OXIDIZER (LIQUIDS AND SOLIDS) — DISTANCE FROM OUTDOOR STORAGE AREAS
TO EXPOSURES**

OXIDIZER CLASS	WEIGHT (pounds)	MINIMUM DISTANCE TO BUILDINGS, LOT LINES, PUBLIC STREETS, PRIVATE ROADS OR BUILDING EXITS (feet)
1	Note a	Not Required
2	Note a	35
3	Note a	50
	Up to 10	50
	greater than 10 up to 100	75
	greater than 100 up to 500	100
	greater than 500 up to 1,000	125
	greater than 1,000 up to 3,000	200
	greater than 3,000 up to 5,000	300
	greater than 5,000 up to 10,000	400
	over 10,000	As required by the commissioner

a. Any quantity over the outdoor maximum allowable quantity for outdoor control areas.

Storage configuration for liquid and solid oxidizers shall be in accordance with Tables 4004.1.7(1) through 4004.1.7(4).

**TABLE 4004.1.7(1)
STORAGE REQUIREMENTS FOR CLASS 1 OXIDIZER (LIQUIDS AND SOLIDS) IN
COMBUSTIBLE CONTAINERS^a**

STORAGE CONFIGURATION	LIMITS (feet)
Piles	
Maximum length	No Limit
Maximum width	50
Maximum height	20
Minimum distance to next pile	3
Minimum distance to walls	2
Maximum quantity per pile	No Limit
Maximum quantity per building	No Limit

a. Storage in noncombustible containers or in bulk in detached storage buildings is not limited as to quantity or arrangement.

TABLE 4004.1.7(2)
STORAGE REQUIREMENTS FOR CLASS 2 OXIDIZER (LIQUIDS AND SOLIDS)^{a,b}

STORAGE CONFIGURATION	LIMITS		
	Segregated storage	Cutoff storage rooms ^c	Detached building
Piles			
Maximum width	16 feet	25 feet	25 feet
Maximum height	10 feet	12 feet	12 feet
Minimum distance to next pile	Note d	Note d	Note d
Minimum distance to walls	2 feet	2 feet	2 feet
Maximum quantity per pile	20 tons	50 tons	200 tons
Maximum quantity per building	200 tons	500 tons	No Limit

- a. Storage in noncombustible containers is not limited as to quantity or arrangement, except that piles shall be at least 2 feet from walls in buildings protected throughout by a sprinkler system and 4 feet from walls in buildings not protected throughout by a sprinkler system; the distance between piles shall not be less than the pile height.
- b. Quantity limits shall be reduced by 50 percent in buildings or portions of buildings used for retail sales.
- c. Cutoff storage rooms shall be separated from the remainder of the building by 2-hour fire barriers.
- d. Aisle width shall not be less than the pile height.

TABLE 4004.1.7(3)
STORAGE REQUIREMENTS FOR CLASS 3 OXIDIZER (LIQUIDS AND SOLIDS)^{a,b}

STORAGE CONFIGURATION	LIMITS		
	Segregated storage	Cutoff storage rooms ^c	Detached building
Piles			
Maximum width	12 feet	16 feet	20 feet
Maximum height	8 feet	10 feet	10 feet
Minimum distance to next pile	Note d	Note d	Note d
Minimum distance to walls	4 feet	4 feet	4 feet
Maximum quantity per pile	20 tons	30 tons	150 tons
Maximum quantity per building	100 tons	500 tons	No Limit

- a. Storage in noncombustible containers is not limited as to quantity or arrangement, except that piles shall be at least 2 feet from walls in sprinklered buildings and 4 feet from walls in nonsprinklered buildings; the distance between piles shall not be less than the pile height.
- b. Quantity limits shall be reduced by 50 percent in buildings or portions of buildings used for retail sales.
- c. Cutoff storage rooms shall be separated from the remainder of the building by 2-hour fire barriers.
- d. Aisle width shall not be less than the pile height.

**TABLE 4004.1.7(4)
STORAGE REQUIREMENTS FOR CLASS 4 OXIDIZER (LIQUIDS AND SOLIDS)**

STORAGE CONFIGURATION	LIMITS (feet)
Piles	
Maximum length	10
Maximum width	4
Maximum height	8
Minimum distance to next pile	8
Maximum quantity per building	No Limit

• **PYROPHORIC MATERIALS (FIRE CODE CHAPTER 41)**

Indoor storage in amounts exceeding the maximum allowable quantity per control area.

Storage of pyrophoric solids and liquids shall be limited to a maximum area of 100 square feet per pile. Storage shall not exceed 5 feet in height. Individual containers shall not be stacked. Aisles between storage piles shall be a minimum of 10 feet in width. Individual tanks or containers shall not exceed 500 gallons in capacity.

Except when stored in approved hazardous materials storage cabinets, indoor storage of pyrophoric materials shall be isolated from incompatible hazardous materials by 1-hour fire barriers.

Outdoor storage in amounts exceeding the maximum allowable quantity per control area.

The separation of pyrophoric solids, liquids and gases from buildings, lot lines, public streets, private roads or means of egress shall be in accordance with the following:

1. Solids and liquids. Two times the separation required by Chapter 34 for Class IB flammable liquids.
2. Gases. The location and maximum amount of pyrophoric gas per storage area shall be in accordance with Table 4104.2.1.

**TABLE 4104.2.1
PYROPHORIC GASES—DISTANCE FROM STORAGE TO EXPOSURES^a**

MAXIMUM AMOUNT PER STORAGE AREA (cubic feet)	MINIMUM DISTANCE BETWEEN STORAGE AREAS (feet)	MINIMUM DISTANCE TO LOT LINES (feet)	MINIMUM DISTANCE TO PUBLIC STREETS AND PRIVATE ROADS (feet)	MINIMUM DISTANCE TO BUILDINGS ON THE SAME PROPERTY		
				Nonrated construction or openings within 25 feet	Two-hour construction and no openings within 25 feet	Four-hour construction and no openings within 25 feet
250	5	25	5	5	0	0
2,500	10	50	10	10	5	0
7,500	20	100	20	20	10	0

- a. The minimum required distances shall be reduced to 5 feet when protective structures having a minimum fire resistance of 2 hours interrupt the line of sight between the container and the exposure. The protective structure shall be at least 5 feet from the exposure. The configuration of the protective structure shall allow natural ventilation to prevent the accumulation of hazardous gas concentrations.

Silane Gas

The **storage, handling, and use** of silane gas and gaseous mixtures with at least 2% silane by volume in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

- In most cases, cylinders and tanks containing silane gas and silane gas mixtures must be equipped with reduced flow valves. A label that declares the presence of the restrictive flow orifice is required on the valve and on the cylinder, container, or tank.
- Container, cylinder, and tank valves shall be constructed of stainless steel or other approved materials.

The **indoor storage** of silane gas and gaseous mixtures with at least 2% silane by volume in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

When provided, exhausted enclosures and gas cabinets must comply with the following standards:

- Must be internally protected by a sprinkler system.
- Must meet the construction specifications for ventilation velocity as indicated in the Fire Code.
- The ventilation system must have an automatic emergency power source.

The **outdoor storage** of silane gas and gaseous mixtures with at least 2% silane by volume in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

- The maximum volume of each storage area must not exceed 10,000 cubic feet of gas.
- Storage shall be located a minimum of 25 feet from lot lines, public streets, private roads, means of egress and buildings
- The clear height of overhead construction for weather protection shall not be less than 12 feet.

The **indoor handling and use** of silane gas and gaseous mixtures with at least 2% silane by volume in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

- Remote manual shutdown must be provided outside of any exhausted enclosures.
- The ventilation system must have an automatic emergency power source.
- Automated purge panels shall be provided.
- When provided, exhausted enclosures and gas cabinets shall be internally protected by a sprinkler system; meet the construction specifications for ventilation velocity as indicated in the Fire Code; and the ventilation system shall have an automatic emergency power source.

The outdoor handling and use of silane gas and gaseous mixtures with at least 2% silane by volume in amounts exceeding the maximum allowable quantity per control area shall be in accordance with the following:

- When in sheltered construction, a fire extinguishing system must be provided.

- **PYROXYLIN PLASTICS (FIRE CODE CHAPTER 42)**

The regulations covering the indoor and outdoor storage, handling and use of pyroxylin plastics in amounts exceeding the maximum allowable quantity per control area are the same as those covering the indoor and outdoor storage, handling and use of pyroxylin plastics in amounts not exceeding the maximum allowable quantity per control area.

- **UNSTABLE (REACTIVE) MATERIALS (FIRE CODE CHAPTER 43)**

Indoor storage in amounts exceeding the maximum allowable quantity per control area.

Except for materials stored in tanks, materials stored in quantities greater than 500 cubic feet shall be separated into piles, each not larger than 500 cubic feet. Aisle width shall not be less than the height of the piles or 4 feet, whichever is greater.

Unstable (reactive) materials shall not be stored in basements or other below grade areas.

Outdoor storage of unstable (reactive) material that can deflagrate shall not be within 75 feet of buildings, lot lines, public streets, private roads or means of egress. Outdoor storage of nondeflagrating unstable (reactive) materials shall not be within 20 feet of buildings, lot lines, public streets, private roads or means of egress.

A 2-hour fire barrier wall without openings or penetrations extending not less than 30 inches above and to the sides of the storage is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

Piles of unstable (reactive) materials shall not exceed 1,000 cubic feet.

Aisle widths between piles shall not be less than one-half the height of the pile or 10 feet, whichever is greater.

- **WATER-REACTIVE SOLIDS AND LIQUIDS (FIRE CODE CHAPTER 44)**

Indoor storage in amounts exceeding the maximum allowable quantity per control area.

Except for water-reactive solids and liquids stored in tanks, water-reactive solids and liquids stored in quantities greater than 500 cubic feet shall be separated into piles, each not larger than 500 cubic feet. Aisle widths between piles shall not be less than the height of the pile or 4 feet, whichever is greater.

Class 2 water-reactive solids and liquids shall not be stored in basements or other areas below grade unless such materials are stored in closed water-tight containers or tanks.

Class 3 water-reactive solids and liquids shall not be stored in basements or other areas below grade.

Class 2 or Class 3 water-reactive solids and liquids shall not be stored with flammable liquids.

Outdoor storage in quantities exceeding the maximum allowable quantity per control area.

Outdoor storage of Class 3 water-reactive solids and liquids shall not be within 75 feet of buildings, lot lines, public streets, private roads or means of egress.

Outdoor storage of Class 1 and Class 2 water-reactive solids and liquids shall not be within 20 feet of buildings, lot lines, public streets, private roads or means of egress. A 2-hour fire barrier wall without openings or penetrations, and extending not less than 30 inches above and to the sides of the storage area, is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

Class 3 water-reactive solids and liquids shall be limited to piles not greater than 500 cubic feet.

Class 1 and Class 2 water-reactive solids and liquids shall be limited to piles not greater than 1,000 cubic feet.

Aisle widths between piles shall not be less than one-half the height of the pile or 10 feet, whichever is greater.