

**STUDY MATERIAL FOR
CONSOLIDATED EXAMINATION C-98 FOR:**

**C-12 SUPERVISE THE MANUFACTURE OF FLAMMABLE
MIXTURES**

**C-13 SUPERVISE WHOLESALE DRUGSTORES, AND DRUG AND
CHEMICAL SUPPLY HOUSES**

**C-16 SUPERVISE THE MANUFACTURE OF COMBUSTIBLE
MIXTURES**

**C-23 SUPERVISE THE OPERATION OF DRY CLEANING AND DRY
DYEING ESTABLISHMENTS**

C-25 SUPERVISE TECHNICAL ESTABLISHMENTS

**C-26 STORAGE AND USE OF FLAMMABLE AND/OR COMBUSTIBLE
LIQUIDS**

About these study materials

These study materials will help you prepare for the written examination for the certificate of fitness for the handling and storage of flammable and combustible liquids and other hazardous materials (chemicals). The study materials include information taken from the Fire Prevention Code, NFPA Standards, and the Rules of the City of New York, NYFD. The study materials *do not* contain all the information you need to know in order to handle and store flammable/combustible liquids and other hazardous chemicals or materials safely and efficiently. It is your responsibility to become familiar with all applicable rules and regulations of the City of New York, even if they are not covered in this material. You must be familiar with §§27-4085 through 27-4089 and §§27-4232 through 27-4248 of the Fire Code, and 3RCNY §§13-01; 20-04, 05, 06, 07; 21-04, 17; 27-01; 28-04 in order to pass 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 option is correct for each question. If you do not answer a question, or if you mark more than one option, your answer will be scored as incorrect. Read each question carefully before marking your answer. There is no penalty for guessing.

Sample Questions

1. The first President of the United States was?
(A) George Washington.
(B) George Jefferson.
(C) Bill Clinton.
(D) George Pataki

The correct answer is "A". You would mark "A" on your answer sheet.

2. The city known as the Big Apple is?
(A) Albany.
(B) Los Angeles.
(C) Salt Lake City.
(D) New York.

The correct answer is "D". You would mark "D" on your answer sheet.

Introduction

This document outlines New York City Fire Department regulations for the safe handling and storage of flammable/combustible liquids and other hazardous chemicals or materials. 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. Some of the regulations related to storage dictate that all bulk storage tanks must be designed to meet American Standards for Mechanical Engineers (ASME) design specifications and that all storage and shipping containers must meet the US Department of Transportation (DOT) design specifications.

Basic Definitions

Several terms frequently used to describe characteristics of flammable and combustible liquids and other hazardous materials are described below.

Flammable Liquid

Any liquid mixture, substance or compound which will emit a flammable vapor at a temperature below 100 degrees Fahrenheit when tested in a Tagliabue open cup tester. (e.g., acetone and ethyl alcohol.)

Volatile Inflammable Oil

Any oil or liquid that will generate a flammable vapor at a temperature below 100 degrees Fahrenheit when tested in a Tagliabue open cup tester. This refers to liquid products of coal tar, shale oil and petroleum. (e.g., benzene, xylol, gasoline, and naphtha.)

Combustible Liquid

Any liquid, solid mixture, substance, or compound which emits a flammable vapor at temperatures between 100 degrees Fahrenheit and 300 degrees Fahrenheit when tested in a Tangliabue open cup tester. (e.g., fuel oil.)

Flammable Gas

A gas that will form an explosive mixture upon concentration with air or that will ignite in air. Utility gases piped into laboratories are not considered to be flammable for the purpose of classification under Fire Department regulations.

Flammable Solid

A solid substance other than one classified as an explosive which is liable to cause a fire through friction, absorption of moisture, spontaneous chemical changes, or as a result of retained heat from manufacturing or processing (e.g., white phosphorous, nitrocellulose, metallic sodium and potassium, and zirconium powder.)

Oxidizing Material

A substance that readily yields oxygen readily to support combustion. (e.g., potassium permanganates, sodium nitrate, and hydrogen peroxide.)

Unstable (Reactive) Chemical

A substance, other than one classified as an explosive or blasting agent, that will vigorously and energetically react, is potentially explosive, will polymerize or decompose instantaneously, will undergo uncontrollable auto-reaction, or can be exploded by heat shock, pressure or combinations thereof. (e.g., organic peroxides, nitromethane, and ammonium nitrate.)

Explosive Material

Any quantity of Class A, Class B or Class C explosive as classified by the DOT and any other chemical compounds or mixtures thereof used as the propelling or exploding material in any cartridge or other explosive device.

Flashpoint

The minimum temperature of a liquid at which sufficient vapor is produced to form an ignitable mixture in the air near the surface of the liquid. Flashpoint is an indication of the ability of a flammable/combustible liquid to produce flammable vapors - i.e., the lower the flash point, the greater the vapor production, and the greater the fire hazard. It is important to note that it is the vapors produced by the liquid that can ignite and explode, not the liquid itself.

Ignition Temperature

The ignition temperature of a solid, liquid, or gas, is the minimum temperature to which it must be heated for it to ignite.

Material Safety Data Sheet (MSDS)

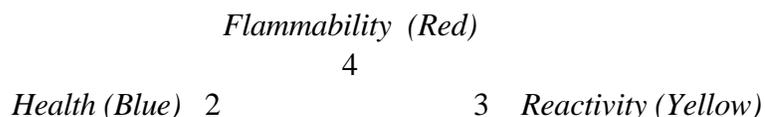
The material safety data sheet (MSDS) contains specific information about the health and physical hazards of the material used, as well as safe work practices and required protective equipment. It may also describe the material's physical characteristics and procedures that should be followed in case 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.

Hazard Signal Arrangements

Flammable and combustible liquids are highly hazardous and require special handling. Fire and explosion are the hazards most commonly associated with flammable and combustible liquids. These hazards can occur when the vapors released from these liquids ignite. There are also acute and chronic health effects that can develop if flammable liquids come in contact with human tissue or are inhaled or ingested.

A simple classification system has been developed by the National Fire Protection Association (NFPA) that allows the flammability, reactivity, and health hazards associated with a material to be quickly identified. The classification system is referred to as the Hazard Signal Arrangement. This system uses the term "material" to represent all liquids, gases and solids. Under the classification system, each material is given three ratings that represent the material's health, flammability, and reactivity hazards (in that order). Each rating ranges from 0 to 4. The higher the hazard signal number, the greater the degree of hazard associated with the material. The hazard signals are also color coded: red for flammability, blue for health, and yellow for reactivity. A hazard classification sign may be posted on containers used to ship or store these materials. The classification numbers are always arranged in triangular fashion as shown in the diagram below.



Flammability Hazard

The flammability signal describes the conditions under which the material will burn. Brief descriptions of the degrees of flammability hazard are given below.

- 4 Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or which are readily dispersed in air and will burn readily.
- 3 Materials that can be ignited under almost all ambient temperature conditions.
- 2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.
- 1 Materials that must be preheated before ignition can occur.
- 0 Materials that will not burn.

Health Hazard

The health hazard signal indicates the property of a material to cause direct or indirect injury; or incapacitation by contact, inhalation, or ingestion. The health hazards arise out of the inherent properties of the material and the toxic products created by the material's combustion or decomposition. The hazard signal is assigned based on the greatest hazard that could exist under fire or other emergency conditions. In general, the health hazard in fire fighting or other emergency conditions is that of a single exposure which may vary from a few seconds up to an hour. The physical exertion demanded in fire fighting or other emergency conditions might intensify the effects of exposure to hazardous liquids. Types of exposure and the associated health hazards that can occur as a result are described below.

Inhalation - nausea, headaches, muscular weakness, and drowsiness.

Skin contact - irritation, cracking, and rashes.

Eye contact - burning and irritation.

Ingestion - irritation of mouth, throat, and digestive tract.

The common health hazards from the burning of ordinary combustible materials are not included in the hazard signal arrangement. For example, injury caused by the heat from a fire or force of an explosion is not included. Brief descriptions of the degrees of health hazard are given below.

- 4** Extremely hazardous materials that may, on very short exposure, cause death or major residual injury even when prompt medical treatment is given. These materials must not be approached without specialized protective clothing and a self-contained breathing apparatus because they can penetrate the standard protective, rubber clothing. No skin surface should be exposed to these materials.
- 3** Materials which on short exposure can cause serious temporary or residual injury even if prompt medical treatment is given. Full standard, protective clothing and a self-contained breathing apparatus must be worn when handling these materials. No skin surface should be exposed.
- 2** Materials which on intense or continued exposure can cause temporary incapacitation or possible residual injury unless prompt medical treatment is given. A self-contained breathing apparatus must be worn when handling these materials.
- 1** Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given. It is recommended that a self-contained apparatus must be worn when handling these materials.

- 0 Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material. No protective equipment is required when handling these materials.

Reactivity Hazard

This hazard signal deals with the degree of susceptibility of materials to release energy by themselves or in combination with other materials. Some materials are capable of rapid release of energy by themselves through self-reaction or polymerization. Other materials can undergo violent eruptive or explosive reactions if contacted with water, extinguishing agents, or certain other materials. The violence of these reactions or decompositions of materials may be increased by heat, pressure, or mixture with certain other materials.

Because of the wide variations of accidental combinations possible in fire or other emergencies, these extraneous hazard factors (except for the effect of water) cannot be applied in the hazard signal classification system. Extraneous factors must be considered on an individual basis in order to establish safe handling and storage procedures for the materials. Guidance for making these decisions is included in NFPA 49 and Hazardous Chemicals Data. This information should also be included in the material's MSDS. Brief descriptions of the degrees of reactivity hazard are given below.

- 4 Materials which in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
- 3 Materials which in themselves are capable of detonation or explosive reaction but require a strong initiating source, or which must be heated under confinement before initiation. Also materials which react explosively with water.
- 2 Materials which in themselves are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form potentially explosive mixtures with water.
- 1 Materials which in themselves are normally stable, but which can become unstable at elevated temperatures and pressures. And also materials which may react with water with some release of energy but not violently.
- 0 Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.

Flammable Liquids

The following paragraphs give a brief overview of the safety precautions, rules, guidelines, work practices, and emergency procedures for the handling and storage of flammable and combustible liquids that are commonly used in cleaning applications, manufacturing, and chemical experiments. The name of each flammable liquid is followed by its hazard signal classification for flammability, reactivity, and

health. The Certificate of Fitness holder must know the properties of each of these flammable liquids and their handling and storage requirements. He or she must also know the procedures that must be followed when dealing with fire or spill emergencies for these flammable liquids.

It is recommended that the Certificate of Fitness holder wear rubber safety gloves, chemical safety goggles, and a self-contained breathing apparatus when handling the flammable liquids described below. When a person is exposed to the liquids or their irritating vapors and breathing is affected, he or she should be moved to a location where there is fresh air, and a physician must be contacted. When breathing is difficult or stopped, oxygen or artificial respiration must be given immediately.

Ethyl Alcohol (*Hazard Signal: 0 Health 3 Flammability 0 Reactivity*)

Ethyl alcohol is a colorless, flammable liquid with a sweet odor and the consistency water. In the field, it is also referred to as ethanol, alcohol, grain alcohol, denatured alcohol, and cologne spirit. Denatured alcohol may have an unpleasant odor. When in a liquid state, ethyl alcohol is not harmful; however, when mixed with water, an irritating flammable vapor is produced. If the water content is less than 30%, it is classified as flammable. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazards

Exposure to the liquid's vapor can cause headache and drowsiness and temporary irritation of the eyes, nose and throat. Intoxication may occur when the liquid is ingested.

Acetone (*Hazard Signal: 1 Health 3 Flammability 0 Reactivity*)

Acetone is a colorless, flammable liquid with a sweet odor and the consistency of water. It is also referred to as imethyl ketone, propanone, and 2-propanone. When mixed with water, an irritating flammable vapor is produced. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazards

When inhaled, the vapor is irritating to eyes and mucous membranes, and in very high concentrations it acts as an anesthetic. Acetone has a low degree of toxicity, but it is very irritating to mucous membranes when ingested. Although acetone is practically harmless to the skin, prolonged and/or excessive contact causes defatting of the skin, which can lead to dermatitis.

When acetone is ingested in large amounts, vomiting should be induced. When the eyes or skin are splashed with the liquid, they must be flushed with water immediately for at least fifteen minutes.

Methyl Alcohol (*Hazard Signal: 1 Health 3 Flammability 0 Reactivity*)

Methyl alcohol is a colorless, flammable liquid with a sweet odor and the consistency water. It is also referred to as methanol, wood alcohol, wood spirit, pyroxic spirit, colonial spirit, and columbian spirit. Methyl alcohol in a liquid state is poisonous if ingested. It is irritating to the skin and eyes. When mixed

with water, an irritating flammable vapor is produced. Methyl alcohol is shipped and stored in a liquid state at ambient temperatures. If the water content is less than 30%, it is classified as flammable. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazards

Exposure to excessive vapor can cause eye irritation, headache, fatigue, and drowsiness. High concentrations can produce central nervous system depression and optic nerve damage. Exposure to high concentrations of methyl alcohol vapors (50,000 parts per million) for one to two hours can cause death. Methyl alcohol can also be absorbed through the skin, and when ingested it may cause death or severe eye damage. Contaminated clothing and shoes must be removed and the affected area must be flushed with water. When the liquid is ingested, vomiting should be induced, and then two spoons of baking soda in a glass of water should be administered to the victim.

Ether (*Hazard Signal: 2 Health 4 Flammability 1 Reactivity*)

Ether is a colorless, flammable liquid with a sweet odor and the consistency of water. In the field, it is also referred to as anesthetic ether, diether, diethyl oxide, anesthesia ether, and ethoxyethane. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazards

Contact with liquid ether and its vapors must be avoided. When inhaled, the vapors will cause nausea, vomiting, headache, or loss of consciousness. Liquid ether also irritates the skin, causing burns. Ingestion is also harmful. Ether is used as a medical anesthetic and low concentrations of vapor in air rapidly causes unconsciousness. Clothing wet with ether may cause skin burns. Contaminated clothing and shoes must be removed and the affected area must be flushed with water.

Formaldehyde Solution (*Hazard Signal: 1 Health 3 Flammability 0 Reactivity*)

Formaldehyde is a colorless liquid with a pungent odor and the consistency of water. In field settings, it is also referred to as fomalith, fyde, formalin, formic aldehyde solution, and methanol solution. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazards

When inhaled, its vapors will cause coughing, chest pain, nausea, and vomiting. When ingested, formaldehyde will cause nausea, vomiting, abdominal pain, and collapse. Contact with the skin and eyes can cause irritation. Contaminated clothing and shoes must be removed and the affected area must be flushed with water. If ingested, vomiting must be induced until the vomit is clear.

Benzene (*Hazard Signal: 2 Health 3 Flammability 0 Reactivity*)

Benzene is a colorless liquid with an aromatic odor. It is insoluble in water. Its vapors are explosive when mixed with air, and they may travel considerable distances to a source of ignition. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures

Health Hazard

Benzene irritates the skin and eyes. Repeated inhalation of low concentrations may result in severe or fatal anemia. When the eyes or skin are splashed with the liquid, they must be flushed with water immediately.

Toluene (*Hazard Signal: 1 Health 3 Flammability 0 Reactivity*)

Toluene is a colorless liquid with an aromatic odor. It is insoluble in water. Its vapors are explosive when mixed with air and they may travel considerable distance to an ignition source. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazard

Toluene is an eye and respiratory irritant. Extreme inhalation of vapors may cause death by paralysis of the respiratory center. When eyes are exposed to toluene, they must be flushed with water. Ingestion of high concentrations of toluene may cause acute poisoning and death.

Xylene (*Hazard Signal: 2 Health 3 Flammability 0 Reactivity*)

Xylene is a colorless, toxic, flammable liquid that is insoluble in water. Its vapors are explosive when mixed with air and they may travel a considerable distance to an ignition source. This flammable liquid is shipped and stored inside glass bottles or cans, steel drums, and storage tanks at ambient temperatures.

Health Hazard

Xylene's vapors, when inhaled in high concentrations, are anesthetic. Xylene is an irritant to skin, eyes, and the upper respiratory system. Ingestion in high concentration may cause acute poisoning and death. When the eyes or skin are splashed with the liquid, they must be flushed with water immediately.

Fire Department Regulations

The Certificate of Fitness holder must understand the characteristics of each flammable and combustible liquid used under his or her supervision. He or she must make sure that these liquids are handled and stored in a manner that is consistent with all Fire Department regulations. When these regulations are not obeyed, a violation may be issued against the Certificate of Fitness holder and the owner of the building. The violation may include fines and the revocation of the certificate of fitness. Some of the Fire Department regulations related to the handling, storage and use of flammable and combustible liquids in factories, warehouses, manufacturing plants, and other locations are described below.

Requirements

No permit shall be issued for the manufacture of flammable mixtures in any premises which are not equipped with an approved storage system for containing and handling of volatile flammable oils used in such manufacture. All premises used for manufacture of flammable mixtures will be under the care and supervision of one or more persons, each holding a certificate of fitness as superintendent or manager. The required number of persons holding such certification will be determined by the Fire Commissioner and stated in the permit.

Containers

Flammable and combustible mixtures for commercial or business use in New York city must be packed and shipped in cans of a capacity not exceeding five gallons each, or steel barrels or drums of a capacity not exceeding 55 gallons each. Such mixtures may also be stored in bottles or other glass containers when there is a concern about maintaining the purity of the liquid or when the liquid would cause metal to corrode. The maximum capacity of these glass containers is one gallon.

For shipment outside of the city, containers must conform to the regulations of the Interstate Commerce Commission. When used for domestic or household applications, flammable and combustible mixtures must be shipped and stored in glass bottles of a capacity not exceeding 32 ounces or in cans of a capacity not exceeding two gallons. All bottles and cans should be fitted with an airtight and replaceable top, cap, or other sealing device.

Each can, bottle, or container should bear a label giving the name and address of the manufacturer or agent. The New York City Fire Department requires that all bottles or containers must have a label with a caution statement on the front of the container/bottle, immediately above the manufacture's directions for use. Two samples of acceptable labels are shown below.

<p>CAUTION--COMBUSTIBLE MIXTURE N.Y.F.D. of A. No.0000</p> <p>PRODUCT NAME</p> <p>Name & address of manufacturer</p>
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CAUTION--COMBUSTIBLE MIXTURE	
	PRODUCT NAME
DIRECTION FOR USE:	

	Name & address of manufacturer

If the mixture is manufactured within the City of New York, a manufacturing permit is required.

Storage

Flammable and combustible liquid containers must be stored in Fire Department approved storage areas only. The storage of flammable and combustible liquids is prohibited in a building's basement or other subgrade areas. Where more than five gallons of corrosive acids or five gallons of flammable liquids are stored or used, suitable facilities for the quick drenching of the body (e.g., fixed overhead or flexible hand held showers), shall be provided within 25 feet of the entrance to the area. The Certificate of Fitness holder must make sure that the drenching facilities are kept unobstructed and accessible at all times.

Storage Cabinets

Storage cabinets constructed of metal may be used to store flammable liquids (i.e. raw materials such as acetone vegetable and essential oils) in quantities of 55 gallons or less. All cabinets must be approved by the Fire Department and meet OSHA's General Industry Standards for flammable and combustible liquids. The cabinets must be against an outside building wall and remote from possible ignition sources. Each cabinet must be provided with top and bottom ventilation to outer air.

Storage Rooms

Flammable liquids (i.e. raw materials, such as acetone, vegetable and essential oils) storage rooms must be approved by the Fire Department and the New York City Department of Buildings. They must be used when flammable and combustible liquids are stored in quantities greater than 55 gallons. Storage rooms must be separated from the remainder of the premises by at least a 4-hour, fire-retardant partition and a 3-hour fire rated door. The floor and ceiling should be of non-combustible construction

and designed with sufficient strength and customary safety factors to sustain maximum imposed loads. The storage room shall be provided with a sprinkler system that provides at least one sprinkler head every 90 feet. Dry chemical or CO₂ type fire extinguishers must be installed such that there is at least one fire extinguisher within 50 feet of any given area inside the storage rooms. Each room must have a sill at each doorway to prevent spills from leaking into adjacent rooms. Drip pans should be provided under the faucets, and waste cans must be provided for the safe disposal of dirty rags. A natural or mechanical exhaust system which provides at least two air changes per hour must be installed in each storage room. All lights, switches, and other electrical apparatus shall be explosion-proof. The use of portable extension lights is forbidden. Where drums on racks are used for dispensing flammable liquids, the racks, drums, receiving containers, and any rotating equipment used must be effectively grounded and non-sparking tools must be used. If flammable liquids are stored in a refrigerator, the refrigerator must be of an explosion proof type. The use of drum pumps listed by underwriters laboratories is recommended in handling small quantities. If draw-off faucets are used, they must be of the self closing type. All machinery must be grounded and a sufficient number of "NO SMOKING" signs must be posted throughout the facility. All plans and specifications for the construction of storage rooms must be filed and approved by the Department of Buildings.

***NOTE:** When the quantity of acetone exceeds 275 gallons, a buried storage system shall be required.

Outdoor Storage Area

When outdoor storage is used the location of the storage area should provide the drums and containers with protection against physical damage and exposure to ignition sources. The storage area must also provide adequate ventilation, keep the containers dry, and protect them from vandalism. Not more than one drum of acetone shall be allowed in a wood frame building. A minimum distance of 5 feet between the piles or racks of stored drums must be maintained in storage areas. Containers with a storage capacity greater than 30 gallons must be stacked one container high only. The maximum height of container storage must not exceed 12 feet. A minimum distance of at least 50 feet must be kept between the storage area and any street, alley, or public way.

Signage

Signs indicating that open flames and smoking are prohibited must be posted inside storage areas as well as outside the entrances to these areas.

All bottles, containers and cabinets containing flammable/combustible liquids must be properly labeled to indicate their exact contents. These labels should indicate special conditions under which the materials should be stored. The Certificate of Fitness holder must periodically check the labels to make sure that they are still legible. When the label on a container is not legible and its contents cannot be identified, the Certificate of Fitness holder must treat its contents as hazardous. The Certificate of Fitness holder must then make arrangements to have the contents of the container disposed of in a safe and legal manner.

Warning placards indicating the type and nature of hazardous materials used or stored in an area must be posted at the entrances to such areas. For example, warning placards must be posted at the entrance of a facility where flammable, reactive, or poisonous materials are used or stored.

Storage areas must be clearly marked with illuminated exit signs. The Certificate of Fitness holder must make sure that these signs are clearly visible and that exits are kept free of obstructions at all times.

Handling and Dispensing

All flammable liquids must be stored in Fire Department and USDOT approved containers, except for flammable liquids stored in glass containers with less than a one-gallon capacity. These glass containers require Fire Department approval only. Drums must be equipped with a flame arrestor and a drip-proof, self-closing faucet or a flame arrestor and a safety pump. A flame arrestor is designed to rapidly dissipate heat to prevent fire from reaching the contents of the drum. A safety relief device, designed to prevent the build up of a vacuum by opening and venting into the atmosphere when the pressure inside the drum reaches dangerous levels, is also required. Either pressure build-up or the creation of a vacuum can cause the failure of a drum. A drip pan must be positioned underneath the dispensing faucet to catch excess liquids.

Bonding During Pouring Operations

The build up of static electricity is a potential source of ignition and must be avoided when transferring a flammable liquid from one metal container to another. Bonding is achieved by running a metal wire from one container to the other. The entire operation should be grounded by running a metal wire from the drum/tank to a grounding source (e.g., a cold water pipe or a grounding rod). Both the grounding and bonding connections must be made on clean metal surfaces. It is also advisable to reduce static electricity build-up when transferring some liquids to or from a glass container (e.g., polar solvents). In this situation, the static electricity build-up may be limited by reducing the free fall distance of the liquid during the transfer. This is achieved by pouring the liquid through a funnel during the transfer. The funnel should be long enough so that it reaches the bottom of the glass container. As an added precaution, it is recommended that this type of transfer be done under controlled ventilation or in a fume hood when possible. The Certificate of Fitness holder must make sure that only one container is open at any given time during dispensing operations. All sources of ignition within 25 feet of the dispensing station must be extinguished. When a flammable liquid is pumped into or onto a motor vehicle, its engines must be shut off.

When an electrical transfer pump is used to discharge the liquids, a remote emergency shutoff switch must be installed. The Certificate of Fitness holder must make sure that this switch is free of obstruction and accessible at all times.

Incompatible Chemicals

Incompatible materials should not be allowed to come into contact with each other. Contact between incompatible chemicals can produce poisonous or flammable gases, explosions, or spontaneous ignition.

Some examples of incompatible chemicals are shown in the table below. The materials in the right column should not be allowed to come in contact the materials in the left column.

Acetone	Concentrated acids, nitric acids, perchloric acid, sulphuric acid, peroxides, and permanganates
Acetylene	Chlorine, bromine, copper, silver, fluorine, and mercury
Hydrogen Peroxide	Copper, chromium, iron, most metals or their salts, any flammable liquid, combustible materials, aniline, or nitromethane
Ether	Liquified air, chlorine permanganates, sulfuric acid, perchloric acid
Formaldehyde	Nitrogen dioxide
Benzene	Chlorine, oxygen, perchlorates, permanganates and sulfuric acid, sodium peroxide
Methyl Alcohol	Perchloric acid, chromic and hydride, lead perchlorate
Toluene	Silver perchlorate, nitric acid plus sulfuric acid
Nitric Acid	Acetic acid, aniline, concentrated caustics, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids and gases, and nitritable substances
Oxygen	Oils, grease, hydrogen, flammable liquids, and gases, flammable solids

Organic Peroxides [Unstable (Reactive) Chemicals]

These chemicals are hazardous because of their *extreme* sensitivity to shock, sparks, or other forms of accidental ignition. Some examples of organic peroxides are ethers, aldehydes, and ketones. The presence of peroxides can be easily detected using Merkoquant Peroxide test strips. The manufacturer's recommendations must be followed when storing and handling peroxides. Generally, peroxides should be stored at the lowest possible temperature consistent with solubility or freezing point. Never store a peroxide below its freezing point as its shock sensitivity will be increased. The peroxides must be stored in a location that will protect them from friction, grinding, and all forms of impact. This is especially important for solid peroxides.

Use only the amounts of peroxides required to complete the task. Do not return the unused peroxides to the container. Caution must be used when mixing the peroxides. A ceramic or wooden spatula should

be used during mixing. A metal spatula must never be used. Smoking, open flames, or other sources of ignition are not permitted near peroxides. Flammable and combustible materials must never be stored next to organic peroxides.

Fume Hoods and Exhaust Systems

Approved fume hoods and exhaust systems which are vented to the atmosphere must be installed to extract noxious odors, flammable and poisonous gases and radioactive materials from storage areas and laboratory units. In locations where perchloric acids, strong oxidizing agents, or highly reactive chemicals are used, the fume hood must be served by an independent duct. This system must vent to the atmosphere without coming into contact with the vapors and gases extracted using the other fume hoods. Washdown provisions are required in fume hoods in which perchloric acids are heated above room temperature. The Certificate of Fitness holder must make sure that these systems are maintained in good working order. The hoods are designed for use when working with hazardous material and must not be used for the storage of these materials.

Fire Prevention and Protection Systems

Fire protection and fire prevention systems are required in all storage areas and laboratories. The Certificate of Fitness holder must make sure that these systems are maintained in good working order at all times. Some of these systems are briefly described below.

Fire Alarms

Generally, smoke and/or heat detectors are used as fire alarm devices. They are designed to automatically sound the alarm when a fire is detected. An alarm will sound on the premises and a signal may also be sent to a central monitoring station. The personnel at the central monitoring station will then notify the Fire Department. The smoke and heat detectors must be tested annually. These inspections must be conducted by person holding a certificate of fitness for the maintenance and testing of smoke and heat detectors.

During these inspections, the Certificate of Fitness holder will calibrate the smoke and heat detectors where necessary. Any defective detectors that are discovered must be replaced immediately.

Sprinklers

Sprinkler systems are designed such that water is automatically discharged when a fire occurs. The system consists of an arrangement of piping connected to a reliable water supply. Sprinkler heads are installed at intervals along the piping. Under normal conditions, the sprinkler heads are kept in the closed position by a fusible link. The fusible link is designed to melt when the temperature in the room reaches an unsafe level. When the fusible link melts, water is forcefully discharged at a controlled rate onto the fire. The discharge of the water suppresses the fire and prevents it from spreading.

Standpipe Systems

Generally a standpipe system is installed in or close to the laboratory or storage area. This system consists of a series of pipes and hoses that may be used to discharge water in case of a fire emergency. The Certificate of Fitness holder must know how to operate the standpipe system in case of an emergency.

Fire Extinguishers

Fire extinguishers must be provided in each chemical storage and use area. These extinguishers must be positioned such that there is at least one within fifty feet of any location. Generally, dry-chemical or CO₂ extinguishers are installed in these areas.

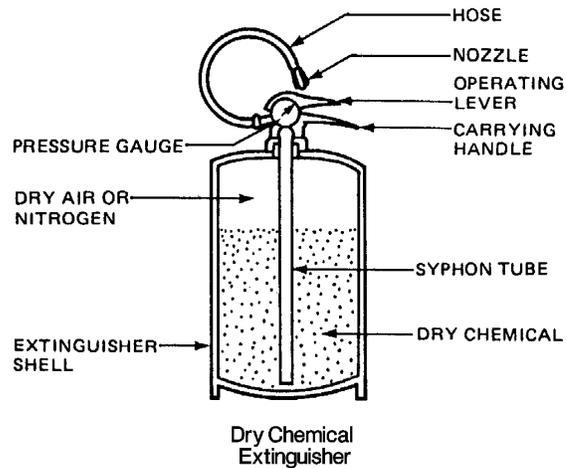
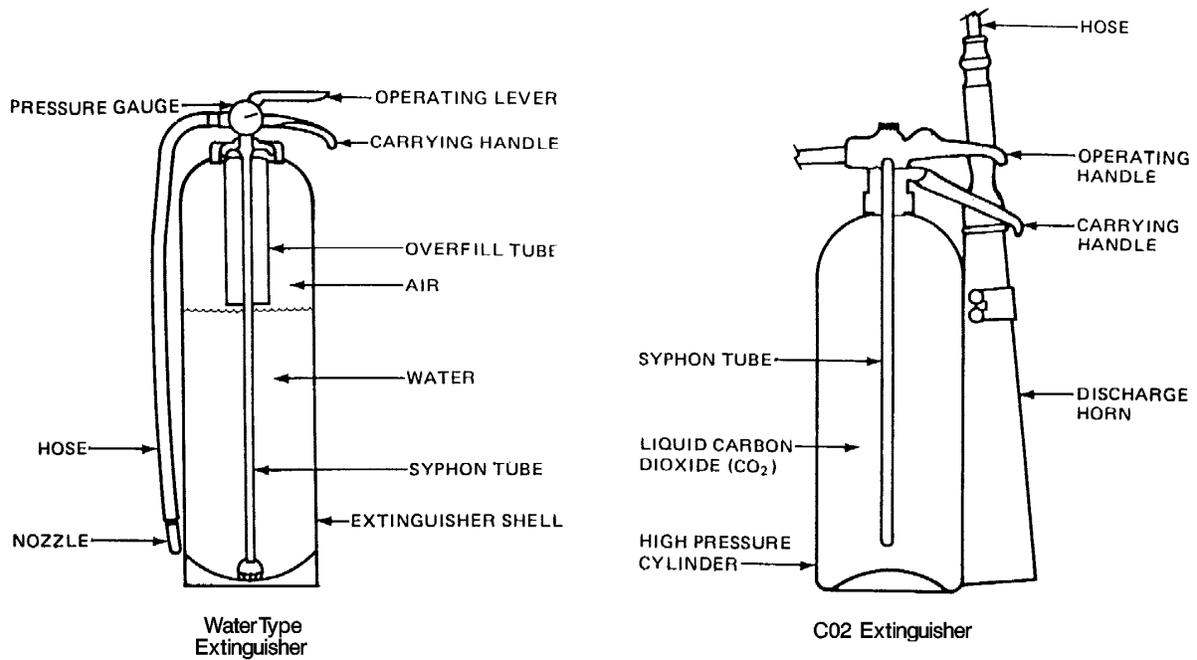
Extinguishers are most effective when they are discharged at the base of the fire. However, the Fire Commissioner may require other types of extinguishers depending on the nature of the chemicals used in the laboratory. The Certificate of Fitness holder must know how and when to operate all fire extinguishers installed in the facility. Three classes of fires and the appropriate extinguishers are described below.

Class A fires occur when ordinary combustible materials are ignited. For example, wood and paper fires are class A fires. Water type extinguishers should be used to extinguish these fires because they cool the fire while quenching the flame.

Class B fires occur when flammable liquids, gases or greases are ignited. These fires must be extinguished by smothering the flame. The flame may be smothered using carbon dioxide, dry chemical or foam extinguishers. Water type extinguishers will not effectively extinguish class B fires.

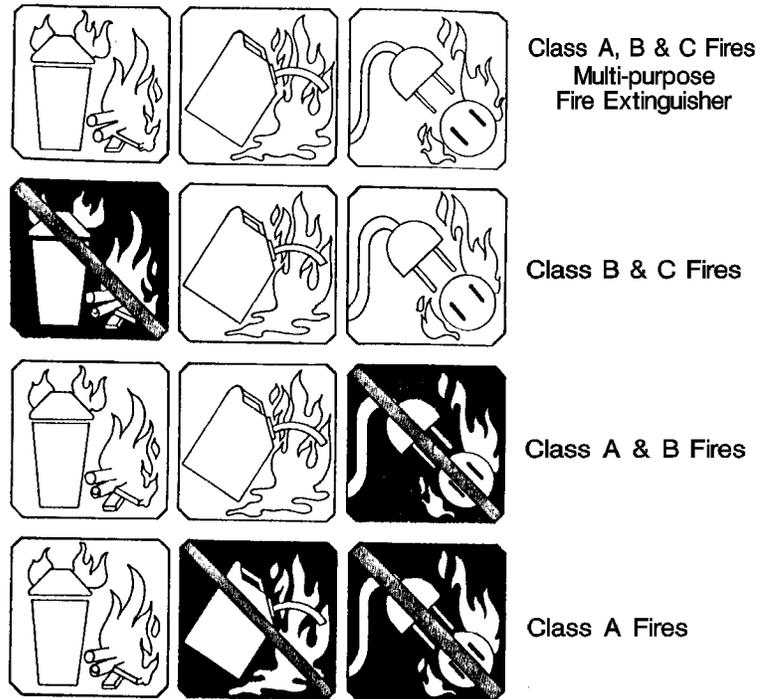
Class C fires occur when electrical equipment catches fire. These fires must be fought with fire extinguishers that do not conduct electricity. Carbon dioxide and dry chemical extinguishers must be used to extinguish electrical fires. Foam and water type extinguishers *must* not be used to extinguish electrical fires.

Examples of water type, carbon dioxide and dry chemical extinguishers are shown on the following page.



Fire Extinguishers

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



Symbols Painted on Fire Extinguishers

A symbol with a shaded background and a slash indicates that the extinguisher must not be used for that type of fire. The Certificate of Fitness holder must understand these symbols and must make sure that the fire extinguishers are kept in good working order at all times.

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.



Operation Instructions for a Fire Extinguisher

Water spray or fog can be effective on fires involving flammable liquids and volatile solids when it is used to knock down the vapors released by the flammable liquids. It can also be used to cool down storage containers and materials positioned close to the fire. Automatic sprinklers are similar to water

spray systems in extinguishing effectiveness. Their principal value is in absorbing the heat from the fire and keeping the surroundings cool until the flammable liquid fire either burns out or is extinguished by other means. Automatic sprinklers have a good record of fire control in garages, in paint and oil rooms, and in storage areas where liquids are kept in closed containers. In some industries that use water-soluble liquids, such as the distilled spirits industry, sprinkler systems have been used to achieve protection and extinguishment with excellent results.

The selection of the extinguishing method used should be made with some degree of caution. Flowing fires, such as may be caused by a leaking overhead pipe, with burning liquid on the ground, are always difficult to extinguish. The size and type of fire anticipated must be taken into consideration when selecting an extinguishing agent and its rate and method of application. The Certificate of Fitness holder must contact the manufacturer when there is some doubt about the type of extinguishing agent that should be used.

The chemical and physical properties of the material involved must also be considered when choosing an extinguishing agent. For example, standard fire fighting foam should not be used on fires involving water-soluble flammable liquids because the liquid destroys the foam blanket.

Fire Blankets

Fire blankets may be provided in chemical storage and use areas. They are usually located in a metal case mounted on the wall. When clothing catches fire the blanket may be used to smother the flames. However, the blanket can also be used to smother small fires when there are no extinguishers available. The Certificate of Fitness holder must make sure that the fire blanket is easily accessible at all times.

Emergency Procedures

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 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) 999-2222
Bronx	(212) 999-3333
Brooklyn	(718) 999-4444
Queens	(718) 999-5555
Staten Island	(718) 999-6666

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 Certificate of Fitness holder must answer any questions asked by the firefighters 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.

Spills

When a spill occurs the Certificate of Fitness holder must evacuate the area when the situation warrants such an action. For example, the area may need to be evacuated when a benzene spill occurs. Drains and other possible escape routes must be blocked or covered to prevent the flammable liquid from leaking into the water table or sewer system. The Certificate of Fitness holder must make sure that all spills are cleaned up promptly with absorbent materials and then sealed in one or more 55 gallon drums. These drums must be marked and handled as hazardous waste and arrangements must be made to have the drums disposed of in a manner consistent with New York City, New York State and federal regulations. Never dispose of the liquids by pouring them down a drain or sink because they may contaminate the water table and/or the sewer system. These actions can cause extensive damage to the environment and they may present life-threatening dangers to you, and other workers downstream. When leaked into water supplies, rivers, lakes, and so on, the Certificate of Fitness holder must notify local health and wildlife officials and/or the operators of nearby water intakes.

Fires and Explosions

When a fire or an explosion occurs the Certificate of Fitness holder should stop dispensing operations and shut off the ignition source if possible. Unauthorized persons must be kept away from the fire and/or spill area. Evacuation of the area must be conducted when the situation warrants such an action. Typically, carbon dioxide or dry chemical fire extinguishing agents may be used to extinguish a fire. The Certificate of Fitness holder must stay upwind of the fire and use the extinguishing agent to "knock down" the released vapor. Water spray may be used to flush spills that have not been ignited away from personnel and buildings during an emergency. Containers exposed to the fire should be cooled with water to prevent ignition and/or explosion. The local health and pollution control agencies must be contacted to arrange clean-up operations.

The Certificate of Fitness holder must know how to respond when an individual's clothing has caught fire. The correct procedure is to immediately roll the person on the floor to smother the flames. The flames will quickly extinguish. Fire blankets, showers, and fire extinguishers should only be used when they are immediately at hand.

Evacuation Plan

An evacuation plan should be established for each facility. The Certificate of Fitness holder should take great care to make sure that copies of the evacuation plan are posted in appropriate locations throughout the facility. The plans must include a drawing of the building, show all emergency exits, and describe the evacuation procedures that must be followed in case of an emergency. Evacuation plans must take into consideration the hazardous nature of the chemicals stored and used in the building. The evacuation plan should be submitted to the Fire Department for review. Typically, several employees are required to supervise the evacuation operations. Fire drills may be conducted in some locations to ensure that all personnel know and understand the emergency evacuation plan.

INSPECTIONS

Fire Department inspections

Fire Department inspectors will conduct periodic inspections of the premises under the supervision of the Certificate of Fitness holder to make sure that all Fire Department regulations are obeyed. Enforcement actions may be taken against the Certificate of Fitness holder and the building owner when Fire Department regulations are not obeyed. These actions may include fines and the revocation of the certificate of fitness.

Storage systems must be hydrostatically tested at least once every ten years; however, the Fire Department may order a test at any time for the purpose of locating defective underground storage systems. These tests must be witnessed by an authorized representative of the Fire Department.

Fire Extinguisher Inspections

The extinguishers must be inspected by a qualified technician at least once a year. Generally, the inspections are conducted by a representative of the company who holds the maintenance contract for the fire extinguishers. The Certificate of Fitness holder should record the testing date and the technician's name in the inspection log. All inspections must also be recorded on a tag attached to the extinguisher.

In addition, the Certificate of Fitness holder should visually inspect the fire extinguishers monthly. He or she should make sure that they are positioned in the correct locations and are clearly visible. When a damaged extinguisher is discovered, it should be repaired or replaced immediately. The Certificate of Fitness holder should check to make sure that the fire extinguisher is fully charged. The condition of the extinguisher is checked by looking at the gauge connected to the top of the extinguisher. A needle that indicates the extinguisher's condition is positioned inside the gauge. When the needle points to the green area, the extinguisher is fully charged. When the needle points to the red area, the extinguisher needs to be recharged. When extinguishers need to be recharged, the Certificate of Fitness holder must make the arrangements.

Recommended Inspection Procedures

The Certificate of Fitness holder is required to make regular inspections and patrols of the assigned area of responsibility to make sure that fire protection systems, storage containers, and related equipment are in good condition. Defective components (e.g., leaking faucets) should be replaced promptly. The Certificate of Fitness holder must notify the Fire Department and his or her supervisor when major defects are discovered (e.g., when the sprinkler system is inoperative). Violations may be issued and enforcement action taken against the Certificate of Fitness holder when major defects are not reported. Although the inspections will vary depending on the location, the following general guidelines will apply for all locations.

- The entire premises must be checked daily for potential ignition sources. Any potential ignition sources that are discovered must be corrected or removed immediately. For example, frayed electrical wires and defective electronic components must be either repaired or removed.
- Trash and garbage must not be allowed to accumulate anywhere inside the storage areas. Accumulated trash is a fire hazard because it may be easily ignited by a stray spark. All trash and garbage must be removed from the premises.
- Interior fire alarm systems, when installed, must be tested daily by a Certificate of Fitness holder. It is not necessary to test all fire alarm boxes. Instead, one fire alarm box of each type should be tested daily.

Log

The Certificate of Fitness holder must keep a comprehensive log of all hazardous materials (e.g., flammable liquid, oxidizing materials) stored on the premises. This log must include the expiration date/shelf life of the materials, the condition of containers and related equipment, and the fire protection systems. The log must be made available to Fire Department representatives upon request.

Permits

A permit is required to maintain a chemical storage room or area in which any of the following: flammable gases, solids and liquids; explosive materials, oxidizing materials, or reactive materials are used in testing, research, or experimental work. This permit will be issued by the Fire Commissioner after the location has been inspected and approved as acceptable for such practices. No permits will be granted for flammable liquids/mixtures used as stove polish, metal polish, insecticide or cleaning fluid that emit a flammable vapor below 80° Fahrenheit when tested in a Tagliabue open cup tester or dry cleaning fluids that emit a flammable vapor below 138° Fahrenheit when tested in a Tagliabue open cup tester. The Certificate of Fitness holder is responsible for determining the required permits for his/her facility and for making sure that they are secured and posted in a visible location. Ten gallons or more of a combustible liquid mixture requires a permit. Five gallons or more of a flammable liquid requires a permit. Permits are valid for a period of one year from the date of issue.