COMMON FIRE HAZARDS

TERMINAL OBJECTIVES

The students will be able to:

1. *Recognize the presence of fire hazards in structures.*
2. *Recognize the presence of hazardous materials or processes.*

ENABLING OBJECTIVES

The students will:

1. *Define fire hazard.*
2. *Identify types of hazards.*
3. *Recognize common ignition sources.*
4. *Recognize and categorize hazardous materials.*

HAZARDS

A hazard is something that poses danger, peril, risk, or difficulty. On the golf course a lake can be a hazard. A wet floor can be a slipping hazard. This module covers three other types of hazards: common fire hazards, special fire hazards, and hazardous materials. Part of this module covers fire hazards and part hazardous materials.

The term fire hazard is used by both fire professionals and the lay public. What does it mean? Any actions, materials, or conditions that might increase the size or severity of a fire or that might cause a fire to start are called fire hazards. The hazard might be a fuel that is easy to ignite or a heat source like a defective appliance. The hazard could be an action like thawing a pipe with a torch or an omission like failing to have a wood stove chimney cleaned.

Common fire hazards are found in most occupancies and are not associated with any special occupancy. Smoking, trash, electrical appliances, storage, and heating are common to most occupancy types. However, smoke-free workplaces are making smoking a less common problem. Special fire hazards are linked to some specific process or activity in particular occupancies. Chemicals, spray painting, welding, combustible dusts, and flammable liquids are examples of special fire hazards.

The first part of the module starts with ignition sources, covers the heat hazards, and finishes with the fuel hazards. The handling and storage of combustibles and use or misuse of ignition sources create a nearly infinite variety of hazardous conditions. The inspector is responsible for recognizing those conditions and taking proper action.

IGNITION SOURCE--ELECTRICAL HAZARDS

Electrical problems are a major cause of fires. Electrical service is present in almost all structures. By observing a common toaster, you can see easily that there is plenty of energy available to cause a fire. However, if properly designed, installed, and maintained, electrical systems are both convenient and safe; otherwise they may be responsible for both fire and injury. When an electric circuit carrying current is interrupted intentionally or unintentionally, arcing or heating is produced. Fire protection standards attempt to prevent arcing and heating, and accidental contact which may cause electric shock.

Electrical Fires

Electrical fires can be divided into three categories. The first category consists of fires started by worn-out or "tired" electrical equipment. These cause the largest percentage of electrical fires. Examples include worn-out or dirty electric motors and deteriorated insulation.

The second category of electrical fires is caused by improper use of approved equipment. The most commonly misused electrical equipment includes electric motors, overloaded cords, and improper use of heating appliances.

The third cause of electrical fires is an accidental occurrence or operator error such as clothes left in contact with lamps, items dropped into electric equipment, heating equipment left on, or defective installations.

What to Look For

As you inspect existing buildings, be conscious of older pieces of electrical equipment and check their cords carefully. Wiring of any sort to any piece of equipment must be replaced whenever it is worn, frayed, or cracked. You also should check how each piece of equipment is wired.

Ask whether it is hard wired, i.e., connected directly to an electrical source without a plug. Is it directly plugged into an outlet? Does it have a special plug and outlet? Has a special adapter been used to connect it, such as a multiple plug adapter? Is an extension cord being used? Remember that extension cords are for temporary use only. Generally, by code, temporary wiring is permitted during construction projects, which, of course, includes remodeling.

Another example of temporary wiring may be that used for audiovisual equipment within a classroom. An example of wiring that is a violation is a typewriter that is plugged into an extension cord along with a copier and a fan or heater. Remember that multiple-plug adapters are generally not permitted by any of the codes. This is because it becomes too easy to overload circuits. The question often is raised as to the acceptance of heavy-duty cords with multiple plug ends that are equipped with built-in circuit breakers. The codes are silent about these so you must decide for yourself after taking the conditions of use into full consideration.

Consider the overall condition of the fixed installation. Check that covers on boxes, conduits, and raceways are not corroded. Are the electric panels accessible? Look for overcurrent protection that does not show signs of tampering. When inspecting equipment, look at how clean it is and, if you find dirty or dusty equipment, check the motor carefully. Motors overheat and start fires when they get dirty and ventilation is inhibited.

Areas where hazardous materials are used may require very specialized electrical equipment to prevent fires and explosions.

IGNITION SOURCE--HEATING

Heat-producing appliances and associated equipment are also a prevalent accidental cause of fire. Heat-producing appliances normally operate at temperatures above the ignition temperature of many common materials. Installation, use, and maintenance of heating systems must be considered fully.

Issues include proper maintenance, clearance to combustibles, fuels and fuel storage, fuel controls, proper chimneys or vents, and available air for combustion. Commercial cooking equipment must be properly installed, vented, and protected with a suppression system. Wood-burning equipment requires regular cleaning of the chimney to prevent buildup of residue that can be ignited as a flue fire. Installation and venting of solid-fuel heating equipment (wood stoves, fireplaces, inserts) are very critical. Installation must satisfy code requirements and the manufacturer's instructions.

OPEN FLAME IGNITION SOURCES

Welding and cutting with torches are also common ignition sources for fires and many times occur some time after the welding or cutting operation is over. Sparks or hot slag on a combustible surface may smolder for some time before igniting into open flame. The little globules of hot metal can fly or roll some distance and get into crevices or fall into unseen areas. Demolition operations are especially vulnerable to fire from cutting torches.

Any situation where open-flame devices are used must be controlled to avoid contact with combustible materials. Portable torches, candles, tar

kettles, open burning, and fuel fire space heaters (salamanders) are potential fire starters. Some, like open burning and candles in certain occupancies, require permits in many codes. Others have specific code requirements and safeguards. In some cases there are reasonable alternatives to open flame devices or safe ways to handle open flame situations. Electric heat guns are much safer than torches for thawing pipes or removing paint.

OTHER IGNITION SOURCES

Smoking

The recent discussions related to health issues surrounding tobacco smoking may cloud the fact that smoking is still a serious fire issue. Smoking now is banned in some facilities, but it is still permitted in many occupancies. Hazardous areas need "no-smoking" policies. Fire-related no-smoking policies need to be strictly enforced. Safe, properly designed smoking areas need to be provided to keep people from sneaking smokes in improper locations. Residue from smoking must be collected in proper ash receptacles and disposed of properly.

Static Electricity

Static electricity is formed when materials that do not conduct electricity move. Paper moving through a high-speed press, a rubber conveyer belt, or flammable liquid through a hose all generate static electricity. The transfer of fuels, whether it be as simple as gasoline into a lawn mower, or from a tanker truck into an underground tank at a service station, is a dangerous situation. You must be certain that all of the proper precautions are taken to ensure that incidents are not caused by carelessness. Static electricity is a real concern with the transfer of fuels from tanker trucks. Bonding and grounding must be done to mitigate the possible problems.

Grain elevators, because of the chutes and lifts, create static electricity problems. The grain dusts which accumulate also create explosive atmospheres which can be countered only by keeping the elevators properly cleaned.

This section would not be complete without a brief comment on the problem of arson. Obviously, we in prevention cannot eliminate this threat, but, through conscientious efforts of code enforcement, we can

minimize the effects of arson on a structure. Vigorous investigation and prosecution of arson can help to deter would-be firesetters.

HAZARDS OF HANDLING, USING, AND STORING MATERIALS

People must be educated about fire and our environment so that they will, on their own, make the change from hazard to safety in all they do. For instance, weeds, rubbish, and combustibles must not be permitted to become fire hazards. This can be done simply by creating an active building site and keeping it clean. Good housekeeping generally indicates a safer property. Materials should not block important facilities like the gas meter or electrical disconnects. One needs to provide drip pans to contain leaks, and metal storage containers for clean and dirty rags. Remember that combustibles not properly stored become litter.

Trash Containers

One of the more common types of fires occurs in trash containers. A good example occurred in the small city of Grantsville, Utah, a few years ago. One evening an individual set fire to two dumpsters, one at a middle school and the other at a large high school. The dumpster at the middle school was positioned about 60 feet away from the building and burned itself out. The high school was a different story. The dumpster was located right next to the building. The flames reached the eaves of the building, found a good fuel source, and were off and running. The entire building was lost. This was a case of the dumpster causing a major disaster. Note also that plastic lids on dumpsters can double the temperature of any fire in them.

Storage

Storage within warehouses must be kept away from the exterior walls by an aisle, to provide fire department access and to keep material from swelling with water and pushing out the wall. Storage also must be kept 24 inches away from ceilings. None of the codes permit storage in attic spaces or in boiler rooms, for obvious reasons.

Where business processes create litter or combustible wastes, containers should be supplied and these should be properly disposed of at least once each day.

Vacant Buildings

Buildings which have been left vacant must be properly secured against vagrants or vandals. They also must have all waste and rubbish removed. This type of building seems to attract the individuals who, through carelessness or by design, cause fires, resulting many times in large property loss. All of the codes address what must be done with these buildings and even go so far as to tell what must be done if the vacancy is temporary or long-term. If the vacancy is for an extended period, the codes say the building could be declared a public nuisance and torn down. This isn't done very frequently unless it is really a building in very poor condition.

If you have a building like this you should consult with your superior and the owner of the property and together reach a mutually beneficial decision as to its disposition. Remember that all such decisions on any fire safety problem must be followed up within time limits prescribed in the agreements reached. If you do not follow up properly, the courts will not support you and you could lose your professional and expert status.

Flammable Liquids

All of the codes require careful control of flammable liquids. Misused flammable materials are very dangerous. All of the fire codes give allowable limits of flammable liquids permitted to be within buildings. Become familiar with these limits and with the recommended safe practices for proper storage. Flammable liquids, for the most part, must be properly stored, as in a "flammable liquid storage cabinet."

Under no conditions are flammable liquids permitted in a boiler room or in an environment where sources of ignition are prevalent. Where flammable liquids must be used, they must be used with care and be stored in safety cans, proper cabinets, or flammable liquid storage rooms properly designed by code for the purpose.

Miscellaneous Problems

As you make your inspections be aware of decorative materials that are being used. In many cases they must be treated to render them flame retardant.

A common problem, especially in shops, is pressure cylinders of gases that are not properly secured in the upright position. Reactive gases also must be separated, and all flammables or gases which may be toxic must be stored properly.

File storage rooms become a concern due to the excessive amount of combustibles contained therein. The good part about these rooms is that they are usually neat and orderly and frequently the files are in filing cabinets. The rolling shelf type storage rooms have shelving tightly packed so that even though there are many combustibles they would be hard to ignite and slow to burn.

Mechanical air plenums such as those above ceiling spaces for return air must be free of all combustible materials, including the wiring which must be of the type approved for use in plenum spaces.

Gasoline-operated equipment is not to be stored inside buildings except within rooms designed especially for this type of hazard. As an inspector you should not permit any such equipment to remain anywhere except in properly designed and constructed storage rooms.

Custodial closets are a source of fire problems. These closets can become "catch-alls" for everything, and usually contain many flammable materials. Doors to custodial closets may be held open with wedges or other materials.

Spontaneous heating frequently results from slow oxidation of agricultural products, animal oils, vegetable oils, and other organic products. Spontaneous ignition in buildings occurs most frequently when a bundle of oily rags has spontaneously heated and the mass of the pile holds the heat until it ignites.

SPECIAL MATERIALS REQUIREMENTS

Overview of Flammable and Combustible Liquids

The use of flammable and combustible liquids produced by chemical and petrochemical companies is increasing rapidly. These liquids can be found daily in all types of occupancies. With the recent conservation and shortage of energy sources, alternate sources are being developed or used by both industry and the general public, which has caused an even larger increase in their use. Gasoline and fuel oil are the most common and widely used examples of flammable and combustible liquids. There are many other flammable and combustible liquids, some of which have names that give no indication of the hazard or characteristics of the liquid. In association with the flammable hazard, some liquids also may have additional hazards, such as being unstable (reactive) or toxic. The storage and handling of these types of liquids will require special attention and precautions.

The general principles for controlling fire hazards associated with flammable and combustible liquids are containing the liquid and vapors, and minimizing the exposure of the liquid to air.

Flammable and combustible liquid fire and explosion prevention measures embrace one or more of the following techniques:

- exclusion of sources of ignition;
- exclusion of air;
- keeping the liquid in closed containers or systems;
- ventilation to prevent the accumulation of vapors within the flammable range; and
- use of an atmosphere of inert gas instead of air.

Of all the hazardous materials, flammable and combustible liquids are probably of the greatest concern. They are not more dangerous than explosives or toxic gases, but they are found more frequently in a wider variety of occupancies and comprise more of the emergency calls received by the fire department. Fire codes address in more detail the requirements for the safe storage, handling, and use of these liquids. We need to dwell on these a bit more.

Flammable Liquids

Flammable liquid is a term used to designate any liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psi (2068.6mm) at 100°F.

Flammable liquids are further classified as follows.

Class I--Liquids having flash points below 100°F and subdivided as follows:

- Class IA--flash point below 73°F (22.8°C) and a boiling point below 100°F. An example is ethyl chloride.
- Class IB--flash point below 73°F and a boiling point at or above 100°F. An example is gasoline.
- Class IC--flash point at or above 73°F and below 100°F. An example is butyl alcohol.

	Flash Point	Boiling Point
Class IA	< 73°F	< 100°F
Class IB	< 73°F	> 100°F
Class IC	73°F to < 100°F	

Figure 1
Flammable Liquids

Combustible Liquids

Combustible liquid is a term used to designate any liquid having a flash point at or above 100°F.

This classification is subdivided as follows:

- Class II--Liquids having a flash point at or above 100°F and below 140°F (60°C) such as kerosene.
- Class IIIA--Liquids having a flash point at or above 140°F and below 200°F (93.4°C) such as fuel oil #6.
- Class IIIB--Liquids having a flash point at or above 200°F such as fish oil.

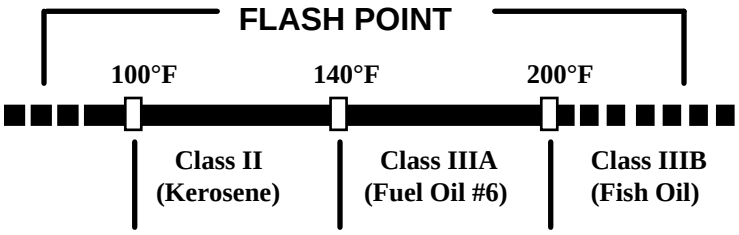

Figure 2
Combustible Liquids

Many chemicals are solids at 100°F or above and therefore are classified as solids. These solids include paste waxes and polishes. When heated the solids become liquids, giving off flammable vapors, and flash points can be determined. When in a liquid state these solids should be treated as liquids with similar flash points. The flash point and amount of liquid in the material will determine the degree of hazard.

The concept behind the above classification system is to divide liquids that burn into three categories. It is anticipated that in most areas the indoor temperature could reach 100°F at some time during the year; therefore, all liquids with flash points below 100°F are called Class I liquids. In some areas the ambient temperature could exceed 100°F, so only a moderate degree of heating would be required to heat the liquid to its flash point. Based on this, an arbitrary division of 100°F to 140°F was established for liquids with this flash point. These are known as Class II liquids. Liquids with flash points above 140°F would require considerable heating from a source other than ambient temperature before ignition could occur, and they have been identified as Class III liquids.

All the model fire codes use this classification except the Standard Fire Prevention Code. This code does not separate Class III liquids into the Class IIIA and IIIB. Only the Class III designation is used and is defined as a liquid with a flash point at or above 140°F and below 200°F. In determining fire prevention code requirements, it is important to remember that it is the vapor of a flammable or combustible liquid, rather than the liquid itself, that will burn or explode.

The violence of flammable vapor explosions also varies. It will depend on the concentration and nature of the vapor, as well as the quantity of the vapor-air mixture and type of enclosure containing the mixture.

Flash point, commonly accepted as one of the most important measures of the relative hazard of flammable and combustible liquids, is by no means the only factor in evaluating the hazard. The ignition temperature, flammable range, rate of evaporation, reactivity when contaminated or exposed to heat, density, and rate of diffusion of the vapor also have a bearing. The flash point and other factors which determine the relative susceptibility of a flammable or combustible liquid to ignition have comparatively little influence on its burning characteristics after the fire has burned for a short time.

In determining the physical and fire characteristics of a liquid, the following material is helpful:

- NFPA 321, *Standard on Basic Classification of Flammable and Combustible Liquids.*

- NFPA 325M, *Manual on Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids.*

Most of the violations concerning flammable and combustible liquids will occur with improper storage. This includes storage of excessive quantities, improper or unsafe storage containers, and improper handling or misuse of the liquid.

Permits

Usually the codes require a permit for the storage, handling, or use of flammable and combustible liquids exceeding a stated amount. The permit is used to control where, when, and by whom liquids are stored, handled, and used.

Storage Tanks

The codes address construction and fabrication requirements for atmospheric, low pressure, and pressure vessels.

They specify requirements for aboveground tanks (outside) which include minimum distance from property lines, public ways, nearest important building, and spacing between tanks and water. The type of tank and protection are conditions that affect the distance requirements.

Venting

Normal and emergency relief venting for fire exposure requirements are noted to prevent the development of a vacuum or overpressurization during the filling or unloading of tanks. Venting also is required for tanks to prevent the excessive internal pressure caused by exposure fires.

Dikes and drainage requirements are noted for tanks that may endanger important facilities, adjoining property, or waterways by accidentally discharging their liquids. Either drainage areas or firewalls can be provided to meet those requirements. Tanks in diked areas also are required to be subdivided by drainage channels or intermediate curbs to prevent spills from endangering adjacent tanks within the diked area.

Requirements for the location of underground tanks in regard to the nearest building foundation and property line are noted in the codes. Also the depth and cover, corrosion protection, and venting installations are noted.

Codes also note requirements for tanks that are permitted inside buildings under special conditions. They also note special venting, fire protection, piping arrangements, and control valves. Similarly, codes note special requirements for supports, foundations, and anchorage for tanks, and fire prevention or fire protection requirements for tanks that are supported above the foundation.

The codes list special requirements for anchoring of tanks that may be subject to flooding. In locations where flammable vapors may be present, precautions must be taken to eliminate or control ignition sources.

Container and Portable Tank Storage

The codes specify requirements for the construction and venting of portable containers, maximum allowable sizes for containers and portable tanks, and requirements for capacity and construction of storage cabinets.

Codes also indicate special requirements for the rooms used for storage. These include requirements for maximum amounts of materials stored depending on the fire-resistive enclosure, fixed fire protection systems in the room, doorsill heights, ventilation, and electrical wiring and

equipment. Also, limited amounts of the liquids may be permitted outside of a storage cabinet or room depending on the type of occupancies. Requirements for outside storage locations, drainage, maximum amount of liquid in each pile, and distances between piles, property lines, and public ways are noted.

Loading and Unloading

Codes specify requirements for the method of transfer, as well as drainage and ventilation requirements and bonding. They include requirements for the location and distances from tanks, property lines, and buildings. Special fire control equipment is also required. Requirements for electrical bonding and grounding also are noted, along with filling controls, ignition sources, and drainage requirements.

Electrical Equipment

Codes list requirements for proper type of explosive-proof equipment, fixtures, and wiring. The class of liquid, location, and distance from the activity determine the requirements.

Fuel Dispensing

Codes also list requirements for the type of nozzles, dispensing units, dispensing locations, special controls, emergency shutoffs, attendance, or supervision of dispensing.

Paint Booths

Paint booths, rooms, or areas are notorious as environmental problems for fire safety. Each of the fire codes addresses this issue, calling out minimum requirements for safe spraying operations. One of the most universal requirements is that the operation be protected by a sprinkler system. In all cases, filter banks should be required with the proper flow of air being designed for safe use. Along with the draw of air, makeup air must be provided. As you inspect spray operations be sure that proper cleaning is being carried out, with the filters being replaced as necessary. Another thing often overlooked is where the discharged air goes. You must be certain that the discharge does not create a problem.

Wood Shops

Wood shops generally are classified as hazardous operations due to the dust produced. All dust-producing equipment must be connected to a sawdust collection system. Even though a collection system is used, it does not completely eliminate the dust problem, and shops would have a rigorous cleanup program to minimize the potentially serious problem. A dirty, dusty wood shop is an accident waiting to happen.

Like wood shops, shops that use flammable materials, e.g., auto shops, need to be inspected carefully. Again, a dirty shop is an indication that you should look more closely at how the operations of the shop are being handled. A frequently found problem is the open waste-oil container, usually a cut-off 55-gallon drum. Another is cleaning tanks with flammable solvents, with the lids wired open or disconnected. Occasional welding is carried on carelessly in close proximity to flammable atmospheres.

Another important shop is the manufacturing plant which uses resins to cast cultured marble items. These need proper protection and ventilation.

Gases

Most fire inspectors will run into gases that are considered hazardous materials. Gases in themselves are not dangerous. It is their use and handling that determine whether or not that gas is hazardous. Used improperly, gases can cause major disasters. Chemical properties of a gas are a primary fire protection concern as they determine the ability of a gas to react chemically with other materials (or with itself) and can produce potentially hazardous quantities of heat or reaction products. Furthermore, there is the production of physiological effects hazardous to humans. The hazards of gases confined in their containers basically reflect their tendency to expand when heated. When a confined gas is heated there is an increase in pressure which can result in gas release or cause container failure. Containers also can fail from contact with flames from an exposing fire due to loss in strength of the material from which the container is fabricated.

Generally the principles of controlling the fire hazards associated with gases involve storing in the proper type of container, minimizing the

exposure of the liquid to air, knowing the chemical and physical properties of the gas, and limiting the gas/air mixture accumulation in a structure.

Fire and explosion prevention measures for gases embrace one or more of the following techniques:

- use of containers, fitting regulators, valves, and piping that have been approved for use with a given gas;
- preventing the overpressurization of the storage container, regulator, valves, and piping;
- preventing the storage container from overheating;
- limiting the amount of storage at a given location;
- segregation of storage to prevent interreaction among gases;
- ventilation to prevent the accumulation of vapors;
- exclusion of ignition sources;
- proper training for persons employed in handling gases; and
- installation of systems, regulated as to qualification of installers.

In order to deal effectively with the many, varied gases in commerce or the environment, it helps to establish certain classifications for gases. These various classifications recognize certain "common denominators" reflecting the chemical and physical properties of gases and their primary uses. Compressed gases may be toxic, flammable, corrosive, oxidizing, etc. Release of a gas for any reason may have a detrimental effect on life and property.

Definitions

Gas is a term applied only to substances which exist in the gaseous state at so-called "normal" temperature and pressure (NTP) conditions (approximately 70°F (21.1°C) and 14.7 psia). Gases are further grouped as follows:

- **Compressed gas**--a gas at normal temperature inside its container which exists solely in the gaseous state under pressure (hydrogen).

- **Liquefied gas**--a gas at normal temperature inside its container partly in the liquid state and partly in the gaseous state and under pressure as long as any liquid remains in the container (liquefied petroleum gas).

- **Cryogenic gas**--a liquefied gas which exists in its container at temperatures far below normal atmospheric temperatures, usually slightly above its boiling point at NTP (liquid oxygen).

These four gases can appear in a different grouping.

- **Flammable gas**--any gas that will burn in normal concentrations of oxygen in the air (acetylene).

- **Nonflammable gas**--any gas that will not burn in any concentration of air or oxygen (nitrogen). Some nonflammable gases will support combustion and are referred to as "oxidizers" (oxygen).

- **Reactive gas**--any gas that will react with other material or by itself with the production of potentially hazardous quantities of heat or reaction products (fluorine).

- **Toxic gas**--any gas that presents a serious life hazard if released into the atmosphere, such as gases that are poisonous or irritating when inhaled or contacted (chlorine).

Another classification of gases exists according to principal use.

- **Fuel gases**--flammable gases used for heating.

- **Industrial gases**--gases used for welding and cutting, chemical processing, refrigeration, etc.

- **Medical gases**--gases used for medical purposes such as anesthesia and respiratory therapy.

The model fire codes address requirements for gases from three angles: compressed gases; liquefied petroleum gases; and cryogenics.

The model fire prevention codes have sections on gases and liquefied petroleum gases, and some of the model codes have a section on cryogenic gases.

Most of the model codes reference the following NFPA standards for code requirements.

- NFPA 43C, *Code for the Storage of Gaseous Oxidizing Materials.*
- NFPA 50, *Standard for Bulk Oxygen Systems at Consumer Sites.*
- NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites.*
- NFPA 50B, *Standard for Liquefied Hydrogen Systems at Consumer Sites.*
- NFPA 56F, *Standard for Nonflammable Medical Gas Systems.*
- NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases.*
- NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas.*
- NFPA 99, *Standard for Health Care Facilities.*

Chemicals

Chemicals are hazardous because of properties other than combustibility. Although many chemicals possess more than one hazardous property, it is customary to classify each by its predominant hazard. The danger of such a procedure, of course, is that an unmentioned hazardous property may be overlooked.

As was pointed out earlier, in dealing with chemicals it is wise to refer to chemical dictionaries, data sheets, hazardous chemical data, and manufacturers' information.

Hazardous chemicals like flammable and combustible liquids exist and are used in all types of occupancies. This may or may not be obvious to the inspecting authority. Dangerous reactions can occur when certain chemicals are mixed. Some chemicals mixed with a combustible material increase the ease of ignition or the intensity of burning of the combustible material. In order to recognize the innumerable combinations of so-called incompatible chemicals, it is necessary to have a knowledge of the potentially dangerous reactions of individual chemicals. NFPA 491M, *Manual of Hazardous Chemical Reactions*, contains more than 3,400 dangerous reactions that have been reported in chemical literature.

Generally the principles of controlling the fire hazards associated with chemicals include safe storage and handling, education and training, knowledge of the toxicity of the chemical for control of the chemicals, isolation and separation, and keeping storage quantities to a minimum.

Chemical fire and reaction prevention measures embrace one or more of the following techniques:

- Knowing the hazardous properties of the chemicals to be stored or handled.
- Educating persons in the area where the chemical is handled as to its hazard, precautionary procedures, danger signals, and proper steps to take in case of an emergency.
- Providing reference sources, knowing where to look for help in finding the answers to problems beyond your area of knowledge, and knowing how experts can be contacted.
- Regulating by permit the use and storage quantities permitted.
- When possible, substituting a less toxic chemical that should be a suitable replacement.
- Controlling and confining the chemical so that the toxic material cannot be contacted, swallowed, or inhaled in dangerous quantities during normal operations.
- Providing automatic toxic gas indicators and alarms.
- Providing natural or mechanical exhaust ventilation systems.
- Keeping combustible materials and packaging away from the storage area.
- Providing a storage building of noncombustible or resistive construction.
- Using good housekeeping techniques.

- Cleaning up spilled material immediately in accordance with safe practices.
- Removing defective containers which permit leakage or spillage, in accordance with recognized safe practices.
- Controlling all sources of ignition such as open flames and smoking.
- Providing for storage of flammable liquids, gases, two percent explosives, and blasting agents stored in the same building or in close proximity to chemicals that are unstable (reactive).
- Keeping storage containers away from all sources of heat, including direct exposure to sunlight.
- Removing all opened containers from the storage area.

Definitions

Chemicals are classified as oxidizers, combustible chemicals, unstable chemicals, water- and air-reactive chemicals, corrosive chemicals, radioactive materials, and toxic chemicals.

Oxidizers

Oxidizers provide oxygen for combustion. In most cases the oxidizing chemicals themselves are not combustible. If you increase the ease of ignition of a combustible material, you invariably increase the intensity of burning. Oxidizing agents, such as some of the organic peroxides, are themselves combustible. Examples are nitrates, nitrites, chlorates, chlorides, peroxides, perchlorates, and "per" acids.

Oxidizers are used in rocket fuels, in fertilizers, and in the plastics industry to initiate polymerization of a monomer to form plastics out of certain substances.

Those agents give off toxic gases when heated. They also are highly flammable and explosive when exposed to combustible materials. They need no outside source of oxygen as they form the oxygen side of the fire triangle.

Combustible Chemicals

Combustible chemicals burn readily and include carbon black, lamp black, sulfide, sulfur, and organic peroxides. All organic peroxides are combustible and some are explosive when confined.

Unstable Chemicals

Unstable chemicals are chemicals that spontaneously polymerize, decompose, or otherwise react with themselves in the presence of a catalytic material, or even when pure, such as hydrogen cyanide, or organic peroxides.

Unstable organic peroxides deserve special attention in storage and handling. Unstable chemicals can be decomposed by heat, shock, or friction. The rate of decomposition depends on the particular chemical and temperature.

Water- and Air-Reactive Chemicals

Water- and air-reactive chemicals comprise a group of chemicals that, when exposed to air or water, react and produce significant quantities of heat. If the chemical itself is combustible, it is capable of self-ignition. If noncombustible, the heat reaction may be sufficient to ignite nearby combustible materials. Examples include alkalies (caustics), anhydrides, carbides, phosphorus, charcoal, coal, hydrides, quicklime, sodium, and corrosive chemicals. Corrosive chemicals have a destructive effect on living tissues. They are usually strong oxidizing agents but are separately classified as corrosive chemicals to emphasize their injurious effects on contact or inhalation.

For example, there are inorganic acids like hydrochloric acid, hydrofluoric acid, nitric acid, and sulfuric acid. Then there are the halogens: bromine, chlorine, and fluorine.

Radioactives

Radioactive materials have fire and explosion hazards identical to those of the same material when not radioactive. An additional hazard is introduced by the various types of radiation emitted. The possibility of accidental release of radioactive materials because of a fire or explosion is a strong argument for careful attention to methods of fire prevention and control in occupancies handling radioactive materials. There are three types of radiation released: alpha, beta, and gamma.

Radioactive chemicals may be found in hospitals and include Cobalt 60, Radium 226, Iodine 131, and X-rays.

Examples of radioactive chemicals in industry include X-rays, Krypton 85, Plutonium 238, and Uranium 238.

Toxic Chemicals

Toxic chemicals are materials that in the event of fire would present a hazard to life. They are defined as those materials that when inhaled, ingested, or absorbed through the skin in small quantities can cause serious injury or death. Toxic chemicals can be further divided into the following classes:

- Alkaloids--This group exists for medical purposes (cocaine and quinine).
- Antimony compounds--These occur in printing operations involving type metal.
- Aromatic hydrocarbons--These help fabric-coating operations, particularly rubber spreading (benzene).
- Arsenate and arsenites--These occur in the manufacturing of insecticides and pesticides.
- Cyanides and fluorides.
- Fumigants (insecticides and pesticides).

Fire Prevention

The key to hazardous material fire prevention is proper handling and storage. The hazard is generally a container and dispensing problem. Hazardous materials must be separated from incompatibles to avoid a chemical reaction. As an example, oxidizers must not be stored with combustibles. The oxidizer in contact with a combustible can "complete" the fire triangle without any outside help. Research is essential in determining what fire prevention techniques to employ. One

cannot trust to memory the tremendous number, variety, and potentially lethal mixes of hazardous materials.

The fire inspector is not expected to make on-the-spot decisions about hazardous materials (other than in an emergency situation). Consult reference books and other experts. The decision on how to abate the hazard properly does not have to be made in ten minutes. If there are some situations where some type of immediate action is necessary, follow this decision with more indepth research.

Code Requirements and Chemicals

The National Fire Codes (NFPA) and the model fire codes lump hazardous chemicals into one chapter. They use several standards to cover those materials.

The code requirements are primarily to prevent mixing of incompatible substances, to eliminate ignition sources, to prevent storage of excessive amounts of hazardous chemicals, etc. Those are basically common-sense requirements. Below is a list of codes that may be helpful to the inspector in addition to the requirements as noted in the model fire codes.

- NFPA 43A, *Code for the Storage of Liquid and Solid Oxidizing Materials*.
- NFPA 43C, *Code for the Storage of Gaseous Oxidizing Materials*.
- NFPA 43D, *Code for the Storage of Pesticides in Portable Containers*.
- NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*.
- NFPA 49, *Hazardous Chemicals Data*.
- NFPA 325M, *Manual on Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids*.
- NFPA 490, *Code for the Storage of Ammonium Nitrate*.
- NFPA 491M, *Manual of Hazardous Chemical Reactions*.
- NFPA 704, *Standard System for Identification of the Fire Hazards of Materials*.

Explosives

The hazardous nature of explosives has long been recognized. The rapid increase in their production and use makes it necessary to point out those properties that contribute most to the inherent dangers of these very important industrial and military products. As early as 1972, the industrial field alone used almost 2.67 billion pounds of explosives and blasting agents. Of this total, 82 percent were for mining. The remainder was used principally in construction operations. Accidents with explosives are not frequent because normally great care is used in handling these materials. Despite the detailed regulations governing explosives, their potential hazard is so great that it would be dangerous to assume that there will never be an accident or a failure to live up to basic safety precautions. An understanding of the nature of explosive materials is essential before one can understand the fire and explosion potential and evaluate the hazard.

For this reason, inspectors should understand some basic precautions and have access to applicable regulations for the explosives and operations involved. Fire is a principal cause of accidents involving explosive materials. Explosives and blasting agents vary in their sensitivity to fire conditions. All such materials are liable to produce a disastrous explosion when exposed to fire.

Generally the principles of controlling the fire and hazards associated with explosives include the following.

- Providing protection for such materials from their surroundings.
- Training persons to handle such materials safely.
- Eliminating sources of fire.
- Providing proper storage facilities and sites.
- Controlling storage and use.

Explosive fire prevention measures embrace one or more of the following techniques.

- Identifying substances correctly.
- Handling by qualified personnel.
- Providing special remote and isolated storage and manufacturing sites.
- Separating different explosive materials in storage.
- Eliminating all ignition sources.

- Protecting materials from accidents, shock, heat, etc.
- Securing from theft and saboteurs.
- Protecting the industrial worker involved and the general public in the vicinity of storage or use.
- Training employees to provide maximum attainable safety.
- Regulating the manufacture, distribution, and storage by the Bureau of Alcohol, Tobacco, and Firearms (BATF).
- Regulating the user and use location.
- Informing firefighters of the location of such materials (storage/use).
- Providing proper fire protection systems.

Definitions

An explosive is a substance, a mixture of substances, or a chemical compound whose primary use is to function by explosion. Examples include dynamite, black powder, detonators, and detonating (det) cord.

A blasting agent is a material or mixture consisting of a fuel and an oxidizer used for the purpose of blasting operations, or a substance that cannot be detonated by a Number 8 blasting cap when unconfined. "Explosive material" is defined as explosives, blasting agents, water gels, and detonators. There are deflagrations (rapid burning) and detonations (explosions) associated with different types of "explosive material." The DOT divides commercial explosives into separate classes for transportation, labeling, and placarding purposes. They regulate the transportation of explosives.

Divisions

The DOT has seven divisions for explosives. Industry generally has accepted this classification system, since it corresponds roughly to the procedures for handling, storage, and transportation. The divisions are listed in order of decreasing sensitivity.

The DOT classes for explosives are

Division 1.1: Explosives for which the major hazard is mass explosion. It includes, but is not limited to, detonating materials, since some substances, such as black powder, deflagrate violently. This division corresponds closely to the old Class A. Examples include dynamite, sensitized nitroglycerin, lead azide, mercury fulminate, and black powder.

Division 1.2: Explosives for which the major hazard is dangerous projections, such as fragments. This division has no clear-cut equivalent in the traditional U.S. classification scheme. Examples include certain types of ammunition and explosive components and devices.

Division 1.3: Explosives for which the major hazard is radiant heat or violent burning, but for which there is no blast or projection hazard. This division corresponds closely to the old Class B. Examples include propellants such as smokeless powder.

Division 1.4: Low hazard explosives with no mass explosion hazard and no projection of fragments with appreciable size or range. This division corresponds closely to the old Class C. It includes articles containing Division 1.1, or 1.3, or both, and materials in limited quantities, such as small arms ammunition.

Division 1.5: A detonable explosive material with acceptably low sensitivity to shock, heating under confinement, fire, and incendiary sparks. This division corresponds closely to the old blasting agent classification.

Division 1.6: Explosive articles containing extremely insensitive explosive substances. This division has no clear-cut equivalent in the traditional U.S. classification system. It includes certain specialized ordnance items.

Forbidden explosives: Explosives for which transportation is forbidden because of instability, high sensitivity to various stimuli, incompatibility of components, or other reasons. It also includes any explosive, regardless of properties, that has not been approved by DOT for transportation.

The DOT has a list of forbidden explosives. These cannot be transported by interstate commerce and include

- liquid nitroglycerin;
- dynamite (except gelatin dynamite) containing over 60 percent liquid explosive;
- nitrocellulose in a dry, uncompressed condition, and greater than ten pounds in one package; and
- dry fulminate of mercury.

There are two chief codes and standards.

- NFPA 495, *Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.*

- NFPA 498, *Standard for Explosives Motor Vehicle Terminals*.

Role of the Inspector

The area of explosives and blasting agents is very specialized and normally, for the most part, the beginning inspector will not have to deal with it. However, the beginning inspector should have a basic knowledge of the requirements for explosives and an understanding of the nature and terminology of explosives in order to evaluate the hazard. When inspecting an occupancy containing explosives, you should know or be able to determine

- the contents of the package;
- its classification;
- the code requirements pertaining to it; and
- conditions that may need further inspection by more knowledgeable persons in authority.

INDICATIONS OF HAZARDOUS MATERIALS

History of Hazardous Materials Development

Explosives, which were developed by the Chinese, were the first hazardous materials. Explosives remained essentially the only bulk hazardous material until the discovery of oil, natural gas, and alcohols. The period from 1880 through 1940 produced some remarkable developments in "miracle" materials, including rubber, nylon, rayon, crude plastic, gasoline, heavy fuel oils, city gas, electricity, radio waves, vacuum tubes, high explosives, acids, corrosives, and combustible metals. From 1940 to the present a technological explosion of useful new hazardous substances was developed for modern society.

Perceiving the Presence of Hazardous Materials

One of the problems for the basic-level fire prevention inspector is identifying the presence of hazardous materials. Hazardous materials are common in the "normal" environment of a routine inspection. You expect to find hazardous materials at a chemical manufacturer but you also must be aware of their possible presence in many of your more routine inspection environments. Here are some examples.

- Swimming pool supply stores will carry chlorine, and a sewer plant also uses chlorine.
- There are cryogenic materials and radiation sources in a doctor's office.
- Hospitals also have radiation sources as well as chemicals.
- Hardware and lawn supply stores, railroad yards, truck terminals, and manufacturing plants all handle hazardous materials.

Life Cycle of Hazardous Materials

Hazardous materials are processed, stored, handled, and transported. At each step in the life cycle of these materials different hazards are created.

First the material is manufactured. Then hazardous materials often are shipped or transferred to a facility closer to their point of end use. Here they can be stored or transferred to a smaller container for distribution and sale. Finally, hazardous materials may be totally consumed, or waste may be generated for disposal (used motor oil, nuclear fuel core). This clearly illustrates the need for code enforcement initiatives at various levels in your community. The following list separates code actions into functional areas:

- manufacturing of hazardous materials;
- transfer and storage;
- distribution and/or retail sales; and
- end-user.

Responsibilities of the Inspector

You must be able to perceive the hazard from these materials in various settings within the community. In order to determine the hazard you will need to identify the nature of the material and the occupancy classification of the structure.

What questions should you answer when dealing with a hazardous material? Some examples might be the following.

- How much gasoline can be stored in a single-family dwelling, or garden apartment storage room?
- How much "white" gas can be stored and displayed in a mercantile occupancy?
- Can cryogenic materials be stored and used in a doctor's office? If so, how much?
- Are there any requirements for the storage or sale of fertilizers and pesticides?
- Does a hardware store need a magazine for the storage of black powder and munitions?

Before you can work methodically toward the solution of the problem by using the proper code requirement, you must be able to recognize that a hazard exists. Your jurisdiction may not have code requirements for some of the hazardous materials. Become totally familiar with your jurisdiction's codes and with what types of materials the codes address.

No community is immune to the use of a hazardous material or the threat such use may present. You must become familiar with the basic requirement each code addresses, and know where to look to find the correct detail requirements that would apply to the condition noted.

SARA Title III

On October 17, 1986, the President signed into law the Superfund Amendments and Reauthorization Act of 1986 (SARA) [Pub. L. 99-499] which included provisions for community right-to-know, and worker right-to-know (OSHA). Furthermore, Material Safety Data Sheets (MSDS) must be provided for emergency response agencies. MSDSs contain this information:

- name, address, and telephone number;
- chemical and trade name;
- health and hazard data;
- hazardous ingredients;
- fire and explosive information;
- precautions and protection information;
- physical and reactivity data; and
- environmental information.

Manufacturers must submit copies of MSDSs to the local emergency planning committee (LEPC), the state emergency response commission (SERC), and the local fire department.

Emergency response planning also is required at the local, regional, and state levels. A plan must include these elements:

- identification of facilities and extremely hazardous substances transportation routes;
- emergency response procedures, on site and off site;
- designation of a community coordinator and facility coordinator(s) to implement the plan;
- emergency notification procedures;
- methods for determining the occurrence of a release and the probable affected area and population;
- description of community and industry emergency equipment and facilities and the identity of persons responsible for them;
- evacuation plans;
- description and schedules of a training program for emergency response personnel; and
- methods and schedules for exercising emergency response plans.

Any facility that produces, uses, or stores any of the listed chemicals in quantities greater than its listed threshold is subject to emergency planning.

The plan also must provide for emergency notification. This includes sharing information on the extremely hazardous substances at the facility. This information includes the following items:

- the chemical name;
- an indication of whether the substance is extremely hazardous;

- an estimate of the quantity released into the environment;
- the time and duration of the release;
- the medium into which the release occurred;
- any known or anticipated acute or chronic health risks associated with the emergency and, where appropriate, advice regarding medical attention necessary for exposed individuals;
- proper precautions, such as evacuation; and
- name and telephone number of contact person.

An emergency response plan shall be developed and implemented to handle anticipated onsite emergencies prior to the commencement of hazardous waste operations. Emergency response activities to all other hazardous waste operations shall follow an emergency response plan meeting the requirements of this section.

The employer shall develop an emergency response plan for on-site and offsite emergencies which shall address, as a minimum, the following:

- pre-emergency planning;
- personnel roles, lines of authority, training, and communication;
- emergency recognition and prevention;
- safe distances and places of refuge;
- site security and control;
- evacuation routes and procedures;
- decontamination;
- emergency medical treatment and first aid;
- emergency alerting and response procedures;
- critique of response and followup; and
- personal protective equipment (PPE) and emergency equipment.

Additional information on SARA is included in the Appendix at the end of the Student Manual.

Tasks Faced by Inspector

Identification of hazardous materials is one of the most difficult tasks the inspector will encounter. Often very little information is available. The owner or employee of an occupancy containing hazardous materials may not be of much help.

Initial Information

The initial information must include the name of the substance. This may be more difficult than one may think. The name may be a trade name only, which doesn't tell you anything about the hazard, or the name may be the chemical name only. It is very important to record the correct spelling of the chemical name. Some of the spellings will be very similar but there can be a big difference in the hazard or in the way that the material reacts.

In order to determine the classification, consult the MSDS. However, even these can be inexact or incomplete. An invaluable source of information for classification is the *Code of Federal Regulations--Title 49 Transportation Parts 100-177.* Virtually every chemical is listed in paragraph 172.101. The hazard class is listed in the column beside the name. The DOT label is required on the container or package.

Additional Information Needed

It is not enough to know that a substance is a flammable or combustible liquid; its class also must be determined. Additional information needed may include boiling point, vapor density, flammable limits, and flash point.

There are several sources for obtaining this information:

- *Fire Protection Guide on Hazardous Material* (NFPA).
- *Flammable Hazardous Materials* (James H. Meidle).
- *Chemistry of Hazardous Materials* (Eugene Meyer).
- *Fire Protection Handbook,* 17th Edition (NFPA).
- NFPA 321, *Standard on Basic Classification of Flammable and Combustible Liquids*.
- NFPA 325M, *Manual on Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids*.

There are also several chemical dictionaries on the market which may be helpful. More and more hazardous materials response teams have one or more of these resources.

Manufacturers' special information also may offer assistance. This includes the following sources.

- Chemical Hazard Response Information System (CHRIS) Manual.
- Chemical Emergency Transportation Center (CHEMTREC), a service provided by the Chemical Manufacturers Association.
- Hazardous Materials *1993 Emergency Response Guidebook* DOT-P 5800.6.

Marking Systems for Special Hazard Materials

The U.S. Department of Transportation (DOT) labeling system is used for materials involved in interstate shipping. The system identifies only the general hazardous characteristics of the material labeled. In some categories, such as explosives and poisonous materials, there are different classifications within the general category. If the material has more than one hazard classification, the shipper should attach the appropriate label for each significant hazard.

The DOT system requires that placards be displayed on the transporting vehicle itself and labels displayed on the containers or packages that are being carried inside the transporting vehicle. The system requires the displaying of a four-digit ID number on the placard or orange panel display. You can locate the ID number in the DOT *Emergency Response Guidebook*.

After locating the number in the book, you will find a guide number listed. Even with the labeling aids provided for interstate transportation of hazardous materials, you still must identify other characteristics of the material when you encounter it in use. Again--you have to do your homework. **Remember: Just because a product doesn't have a label doesn't mean it is not hazardous.**

NFPA 704M, *Degree of Fire Hazards of Materials* establishes a marking system when materials are stored, handled, or used. It applies only to stationary facilities, **not transportation.** The system can be used for buildings, tanks, and piping that handle the material. This is the best marking system of hazardous materials available, both from a prevention and from a firefighting point of view. It is a complete system that identifies the three characteristics that are most important for safety:

- fire hazard (flammability);
- health hazard (toxicity, irritability); and
- chemical reaction hazard (reactivity).

In each square, a number from 0 to 4 indicates hazard level; 0 means no hazards, 4 means a major hazard.

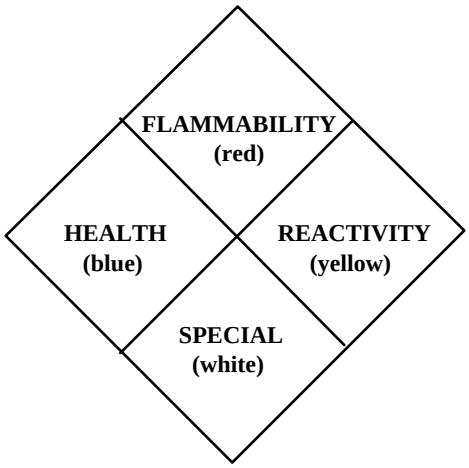

Figure 3
NFPA 704 Hazard System

In addition, a portion of the sign will identify such other special hazards as radioactivity and water reactivity.

Use of a combination of colors and numbers allows someone who is familiar with the system to identify easily the relative hazard of the materials involved in all important safety categories. The numbers used indicate the relative hazard within each main category: 0 indicates no special hazard, and 4 indicates a severe hazard. Unfortunately this system is not yet widely used because it is difficult to get everyone to agree to a national system. Some model fire codes require facilities that store, handle, or use hazardous materials to post the 704 signs.

Another color code system available is the Compressed Gas Association's system for color coding compressed gas cylinders. This system is not used at all times and may be unreliable.

Remember, the DOT label doesn't identify the complete hazard that a given material may pose, but it does provide the inspector a good starting point.

Gas	Color
oxygen	green
nitrous oxide	blue
helium	brown
ethylene	red
cyclopropane	orange
carbon dioxide	gray

Color combinations--used for gas mixtures of certain percentages.

Figure 4
Coding for Compound Gas Cylinders
(Compressed Gas Association)

Common Hazards by Occupancy

The following are hazards you may frequently find in particular occupancies. Note that these lists include both fire hazards discussed in this module and life safety hazards discussed in the Life Safety Features module.

Multi-unit Residences

- Blocked exits.
- Unserviced or missing extinguishers.
- Excessive storage in basement.
- Cluttered attic, garage, under stairs, heating room.
- Lack of (and/or not visible) exit signs.
- Accumulation of dust and lint in laundry room.
- Combustibles next to water heater.
- Transoms in old buildings (window over door).
- Faulty fire escapes or escapes blocked at ground level.
- Faulty, untested standpipes.
- Penetrations in fire separations.
- Incomplete or missing evacuation plans.
- Stairway doors blocked open.

Assembly Occupancies

- Blocked exits (constant problem).
- No exit signs; exit lights out.
- Doors locked during hours of occupancy.
- Extinguishers not serviced or nonexistent.

- Overcrowding, no occupant load sign.
- Aisles not adequate.
- Candles on tables in unsafe holders.
- Extension cords and other electrical problems.
- Decorations (combustible or flammable type).
- Non-flame-retardant drapes.
- Smoking problems.
- Heating hazards.

Restaurants

- Grease accumulation on filters and in ducts.
- Hood system not serviced, nonexistent, or improperly installed.
- Exiting problems the same as assembly.
- Decoration problems the same as assembly.
- Smoking problems.
- Cluttered storeroom.
- Electrical hazards.
- Heating hazards.
- Extension cords.

Warehouses

- Fire protection equipment not in service.
- Overhead doors obstructed by stock.
- Exits obstructed.
- Electrical machinery hazards.
- Extension cords.
- Flammable liquid storage.
- Oily rags, etc.
- Trash and debris.
- Poor storage practices.
- Poor smoking practices.
- Stock obstructing sprinklers.
- Fire separations violated.
- Propane- or gasoline-operated lift trucks.
- Separation and isolation of hazardous materials.

Hospitals

- Fire protection equipment not in service.
  - Sprinklers.
  - Alarms.
  - Extinguishers.
- Extension cords.

- Concealed smoking by patients.
- Cafeteria hazards.
- Exits locked and blocked.
- Fire separations and doors blocked open.
- Excessive storage of combustibles.
- Emergency generator not tested.
- Sterilizer room cluttered with combustibles.
- Employees smoking in linen storage room.
- Improper storage of gases.
- Improper storage, handling, and use of anesthetics.
- Combustibles next to heating equipment.
- Lack of proper maintenance of heating equipment.
- Evacuation plan outdated, inadequate, or not posted.

Office Buildings

- Exiting problems.
- Extension cords.
- Extinguishers not serviced or missing.
- Poor record storage.
- Wastepaper handling.
- Smoking hazards.
- Heating equipment near combustibles.
- Fire escape maintenance and obstruction.
- Lack of proper maintenance and testing of fire protection systems.

Manufacturing

- Electrical machinery.
- Misuse of extension cords.
- Improper use and storage of flammable liquids.
- Faulty use and storage of chemicals.
- Improper use and storage of gases.
- Blocked and obstructed exterior doors, fire doors, etc.
- Improper storage of fire protection equipment.
- Improper maintenance of fire separations.
- Cluttered storerooms.
- Unsafe smoking practices.
- Inadequate aisles and exits.
- Cluttered storage of business records.
- Heating equipment problems.
- Combustibles too close to heating equipment.
- Spontaneous ignition.
- Paint spraying operations.
- Dip tanks with faulty lids, etc.

- Paint and chemical storage.
- Inherently hazardous processes.
- Sparks from welding.
- Inadequate exhausting of vapors, dust, etc.
- Disposal of trash, sawdust, fires, debris.

Schools

- Blocked exits.
- Chained exits.
- Exit lights not functioning.
- Fire protection equipment not maintained.
- Unsafe chemistry lab (storage and equipment).
- Flammable liquids such as solvents, paints, cleaners, and duplicating fluids stored in offices, shops, and classrooms.
- Shop hazards same as "manufacturing."
- Excessive storage.
- Lack of fire drills.
- Non-flame-retardant drapes in auditorium.
- Extension cords and octopus connections.
- Combustibles near heating equipment.
- Improper, older electrical equipment.
- Chlorine and acid storage for pool.
- Hazards caused by lab experiments.
- Spray painting in shops and illegal/unapproved booths.
- Dip tanks.
- Oily rags.
- Welding hazards.

SUMMARY

Take your time during the inspection and be observant. Ask to see all areas of the occupancy. Be methodical and accurate. You don't want to miss any vital details or facts.

If a situation doesn't look right, check into it to determine its safety. Common sense and good judgment must be used in inspecting existing occupancies. Use the code as a guide. Remember that the purpose of the inspection is to enforce code compliance and leave the place safer than when you first entered it. Report all violations in writing and keep file copies. When identifying a hazard, also identify ways of correcting it according to code.

Some hazards must be corrected immediately. Others can be corrected within a prescribed timeframe. Remember that you cannot memorize all the codes but you can make sure that reasonable fire and life safety conditions exist.

Activity 2

Hazard Recognition

Purpose

To examine conditions and determine if a hazard exists.

Directions

Examine the conditions shown on the slides. If you observe any fire hazard, note on this worksheet. Note "no hazard observed" if you find no violations on the slide.

Slide 1

Slide 2

Slide 3

Slide 4

Slide 5

Slide 6

Slide 7

Slide 8

Slide 9

Slide 10

Slide 11

Slide 12