Center for Career Advancement
Education for Your Competitive Edge

Warehouse Checklist

Recent NFPA statistics estimate that in 1998 approximately 36,000 fires occurred in structures used for storage, accounting for $687mm of damage (over 10% of total fire damage for 1998 and a 20% increase from 1997). Warehouses are unique in their characteristics and provide a large potential for catastrophic loss. Underwriting warehouses requires a full understanding of the risk and its protection. Following is a summary of things to keep in mind when underwriting General Storage Warehouses.

Warehouse Construction

Warehouses come in all shapes and sizes. Some are multi-story buildings built over 100 years ago that have been well maintained. Others are new, single story, cheaply built structures that would not contain a small fire or a heavy snow load on the roof. Non-combustible or fire resistive construction is most desirable for this type of risk. Additional considerations would include durability for wind and snow loads in the appropriate climates. The ideal warehouse would be one story without a basement because of the ease for fire-fighting, ventilation and salvage operations. Long, narrow buildings are more accessible than large square buildings.

Interior construction features should include dividing up large open spaces with fire walls which rise above the roof and are parapitted properly. If this situation is present, appropriate fire doors should be in place which segregate office and work areas. Within storage areas, proper divisions should exist for the storage of flammable liquids, aerosols and plastics. Interior divisions of this nature inhibit the spread of fire throughout the warehouse and minimize damage. Along exterior walls, emergency access openings should be present to help manual fire fighting. Play particular attention to buildings that are older or may not have been designed for the current warehouse occupancy, and whose interior protection may be inadequate to handle the new packaging techniques of the 90s, which contain a lot of plastic and make up a significantly higher combustible load.

Consideration should also be given to the physical site of the warehouse. Is the risk subject to any natural catastrophes which would damage the structure or prohibit access to the facility? Such conditions include bridges with width or weight restrictions, roads subject to flooding, drifting snow, wash out or other blockages, and low overhead clearings, railroad grade crossings and drawbridges.

Often overlooked is the proper valuation of the building. Costs per square foot can vary widely due to construction types, internal protection and the location of the risk.

Storage Arrangement

The two most important elements to assess when evaluating a warehouse exposure are its Commodity Classification and the manner in which the commodities are stored, which is commonly called a Storage Arrangement. Based on this information, it is possible to estimate the fire intensity and the proper internal protection required. Even though commodity classes change, storage configurations remain consistent regardless of the commodity. Arrangements are based on the way the commodity can best be stored, the type of building and the type of protection that is designed for the risk.

Storage arrangements in warehouses are classified as Bulk Storage, Solid Piling, Palletized Pile Storage and Rack Storage. Each configuration creates different air spaces or flues and will affect how quickly a fire spreads and its intensity.

Bulk Storage

A bulk storage arrangement consists of piles of unpackaged materials in a loose, free flowing condition. Examples of this are powder, granules, pellets, or flakes or items such as peanuts. Usually these goods will be found in silos, bins, tanks or in large piles on the floors of storage buildings. While this term should be familiar to someone who is underwriting warehouse risks, it is unlikely that you will see this type of storage configuration for General Warehouse Storage.

Solid Piling

This arrangement indicates boxes, cartons, bales and bags that are stacked on top of each other. There is minimal air or flue space, which decreases the opportunity for fire development. This type of storage arrangement is considered desirable compared with palletized and rack storage because there is less potential for fire development and water application has the most chance to be effective. It is important to note that piling in excess of 15 feet can present a sever hazard when the outer surfaces of the materials stored have rapid flame spread properties. Sprinkler requirements exist for goods stored in this manner based on commodity and height.

Palletized Storage

A palletized storage arrangement refers to unit loads or commodities mounted on pallets. The size of the unit is about 4 feet in height and is in the shape of a cube. Arrangement of the cube is such that additional units can be placed on top of each other without crushing one another. The actual pallet is approximately 4 inches high and is composed of wood, metal plastic, expanded plastic or cardboard. It is designed so the prongs of a forklift can pick up the pallet with its commodity load on top of it. Palletized storage usually reaches 30 feet in height. Limitations to this height are the stackability of the commodity.

Drawbacks of palletized storage are the many horizontal air spaces that are created by this type of arrangement by the actual pallets. The spread of fire is also assisted because the sprinklers cannot reach the interior of the storage. The entire storage pile is exposed because of the symmetrical arrangement of the pallets. Sprinkler requirements exist for goods stored in this manner based on commodity and height.

Another concern with pallets is *idle pallet storage*. This storage condition presents a sever fire exposure and can usually be found in most warehouse situations which employ this method of storage. When reviewing a risk of this nature, confirm that idle pallet storage is properly controlled. Proper controls would include limiting the pile heights of the idle pallets or keeping idle pallets out of the building. Special protection is needed for those risks which have a major idle pallet exposure.

Rack Storage

A rack storage arrangement includes any combination of vertical, horizontal and diagonal members that support stored materials. Some rack structures use solid shelves. Racks may be fixed, portable or movable. Loading may be either manual, using lift trucks, stacker cranes and hand placement, or automatic, using machine controlled storage and retrieval systems. Rack storage is referred to with the following terminology: single row racks, double row racks, multi-row racks, portable racks and movable racks. Usually, unit loads on pallets are placed on the racks.

Average rack storage height is 25 feet, although many rack storage configurations are higher. In some fully automated warehouses, rack storage reaches up to 100 feet in height. It is noted that aisle space in automated warehouses can be as narrow as 4 feet. A fire can easily jump aisles of this width. In addition, horizontal air spaces of about 1 foot are under each tier of supports which provide clearance for handling. Vertical flues or air spaces exist between unit loads. This type of spacing allows vertical fire spread as well as horizontal.

Fortunately, most rack storage arrangements are able to support sprinklers which, given the proper design, can effectively control a fire. Look for installation of in-rack sprinklers when storage is between 12 and 20 feet. Risks which are 20 feet and over should have in-rack sprinkler protection.

Commodity Classification

Each storage risk should be evaluated based on the commodity that is stored as well as the storage arrangements. Based on these criteria, it can then be determined if the proper protection is in place. Bear in mind that protection requirements are very general and cay vary from risk to risk.

Class I includes noncombustible foodstuffs and drinks, glass products and metal products in corrugated cartons.
Class II includes Class I products in slatted wooden crates, wooden boxes, multiple thickness, paperboard cartons or equivalent packaging.
Class III includes wood, paper, natural fiber cloth, Group C plastics and a limited amount of Group A or B plastics.
Class IV includes Class I, II or III products containing an appreciable amount of Group A plastics in ordinary corrugated cartons and Class I, II and III products in corrugated cartons with Group A plastic packing, with or without pallets.

Special Commodities

Plastics: 3 categories – A (fastest burning), B and C (slowest burning). Determine whether a plastic falls into a commodity group or should be treated as a special hazard.

Aerosols: Minimum amounts present a significant fire exposure and require special storage. Aerosols are found in many general storage warehouses such as grocery, hardware and department store warehouses. It is critical to inquire if these goods are present and how they should be stored. They should be kept in an area where, in the event of a fire, they would not be able to ignite and rocket across the warehouse igniting other areas.

Aerosols are classified into two groups: flammable and nonflammable, and in three levels:

Level I: Contain 75% water, nonflammable
Level II: Water miscible (to mix) products and products composed of 25% to 55% non-water-miscible flammable components.
Level III: Nonwater-miscible products which contain more than 55% of nonwater – miscible flammable component.

Flammable Liquid Storage

Flammable liquid storage presents the possibility of severe exposure. Limited quantities are permitted in general warehouse storage, but must be segregated. Class I, II and IIIA should be stored in a detached building 50 feet from premises.

Flammable liquid storage is classified as follows:

Class I: Flashpoints below 100 degrees F (alcohol, octane, turpentine)
Class II: Flashpoints at or above 100 degrees F/below 140 degrees F (kerosene and mineral spirits)
Class IIIA: Flashpoints at or above 140 degrees F and below 200 degrees F (nitrobenzene and pine oil)
Class IIIB: Flashpoints at or above 200 degrees F (animal and vegetable oils, ethylene glycol)

Storage Arrangement

Class I-IV Commodities can be stored in solid piles, on pallets and in racks. The safest method for solid piles is up to 15 feet. For rack storage in excess of 20 feet, in-rack sprinklers should be used. For storage up to 30 feet, NFPA guidelines apply. Items over this height require special consideration.

Protection

Automatic sprinkler protection should be part of every storage risk. A general idea of the sprinkler system water flow rate for Class I commodities would be 1500 gallons per minute/3500 square feet. This criteria is based on using 165 degree Fahrenheit wet sprinkler and contemplating 20 feet maximum storage height. The actual water pressure needed is a function of the sprinkler system design for each warehouse. Water supply duration should be 1 and ½ hours for Class I commodities stored up to 20 feet and 2 hours for commodities stored up to 30 feet. Each sprinkler system is designed for the commodity and storage arrangement at the individual warehouse. The numbers above increase significantly as the commodity class increases.

General water flow rates for each commodity are as follows (based on 165 degree wet sprinkler, 20 feet maximum storage height):

Class I Commodity: Water flow rate = 1500 gal. per minute/ 3500 sq. ft.
Duration = 1 ½ to 2 hours
Class II Commodity: Water flow rate = 1700 gal. per minute/ 3500 sq. ft.
Duration = 1 ½ to 2 hours
Class III Commodity: Water flow rate = 2100 gal. per minute/ 3500 sq. ft.
Duration = 1 ½ to 2 hours
Class IV Commodity: Water flow rate = 2900 gal. per minute/3500 sq. ft.
Duration = 2 to 2 ½ hours

Each sprinkler system is designed for the commodity and storage arrangement at the individual warehouse. It is important to have an inspection report to eavalute the sprinkler system for each risk. Verify that the public or private water supply is adequate to meet the sprinkler supply demand.

Additional protection includes alarm systems that are used to monitor both the heat and smoke detection system as well as the sprinkler system. These should be tied into a central station alarm so the fire department can be quickly notified. On premises, protection should also include portable fire extinguishers and standpipes and hose stations. This emergency equipment can be utilized by the in house fire brigade to help control the fire until the fire department arrives.

Passive protection includes assessing the number of fire divisions and proper smoke and heat venting. These features may plan an important role in containing and limiting the spread of fire.