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# Storage of Idle Combustible Pallets

The storage of idle combustible pallets presents a significant fire hazard, both in indoor and outdoor storage. A fire involving even a modest number of idle pallets inside a building can rapidly overtax a fire sprinkler system. This report outlines the fire hazards and control measures associated with the storage of idle pallets, with a primary focus on wood pallets.

Although most often associated with warehouses, pallets can be found in nearly every industrial and commercial facility. Wherever pallets are used, the potential exists for the accumulation of excess or idle pallets that are awaiting use. While, initially, these accumulations may be thought to be “temporary,” the number of idle pallets can increase over time. To better utilize space, idle pallets are typically stacked in piles. A pallet pile is generally cube-shaped and about 4 ft. (1.2 m) high.

A fire involving even a modest number of idle pallets inside a building can rapidly overtax a fire sprinkler system. Careful control and management of idle pallets is required to prevent accumulations from becoming a significant fire exposure.

This report outlines the fire hazards and control measures associated with the storage of idle pallets, with a primary focus on wood pallets.

## Pallet Types

Pallet design is not universal. Various countries and industries have their own design standards for pallets. In North

America the most common pallet size is 48 in. x 40 in. (1.2 m x 1.0 m). For fire protection purposes, NFPA 13, Standard for the Installation of Sprinkler Systems, published by the National Fire Protection Association (NFPA), differentiates between wood and plastic pallets. Wood pallets are probably the most common type encountered, but the use of plastic pallets is increasing. Pallets may also be made from metal, cardboard, or recycled paper; however, it is rare to find these types. Metal pallets (i.e., skids) are not considered a fire hazard due to their non-combustible makeup.

## Wood Pallets

Wood pallets are typically constructed from various types of hardwoods (e.g., oak, yellow poplar, and alder) and softwoods (e.g., pine). Pallets may have slatted or solid tops and bottoms or a combination. While wood pallet designs vary from manufacturer to manufacturer, the basic structure remains consistent. A wood pallet will have three primary supports that are parallel to each other (i.e., two sides and a mid support). The actual dimensions of these supports will vary, but are roughly 2 in. (5 cm) wide and 4-in. (10.1 cm) high. Thin wood slats are then nailed or stapled, at right angles, to the tops and bottoms of these supports.

The slats will be run from one side support across the center support and terminate at the other side support. A space is maintained between each slat to reduce overall weight. In some cases, plywood may be placed across the tops of the supports when a solid-surface pallet is required.

### **Plastic Pallets**

Pallets may be manufactured from various types of plastic. One of the more common types of plastic pallet is the non-expanded, high-density polyethylene (HDPE) solid-deck pallet. Plastic pallets are typically injection-molded, one-piece designs. Similar in overall appearance to wood pallets, plastic pallets are more resistant to weather, oil, and chemical attack, and damage from rough handling.

### **Cardboard Pallets**

Wood fiber, cardboard, and recycled paper pallets are manufactured using a molding process. Typically, these pallets are used in environments that are not subject to dampness or temperature changes. For fire protection purposes, these pallets are treated in the same manner as wood pallets.

## **Fire Hazard**

The fire hazard of idle pallet storage is a function of the type of pallet material, pallet geometry, and the storage arrangement. The intense heat generated from a pallet fire can cause the structural steel of a building to quickly fail. Further, the fire and smoke generated, and water usage for firefighting, will be significant, which can create an exposure for neighboring occupancies.

### **Pallet Material**

The conventional pallet is typically made from wood. As wood loses its moisture content, it becomes easier to ignite. In addition, as wood pallets dry out, their edges tend to become frayed and splintered. In this condition, a small ignition source can easily ignite them.

Plastic pallets burn as hot as wood and for a longer time. When burning, plastic pallets may melt, drip, and form pools of liquid plastic on floors. Burning pools of plastic can flow and spread fire to other areas of a facility. The combustion of plastic may produce large quantities of smoke.

### **Pallet Geometry**

The geometry of a pallet also contributes to burning conditions. When pallets are stood on edge, they create a vertical flue space that allows for rapid burning. A vertical configuration provides the greatest amount of surface area for combustion. A fire occurring at the base of a pallet will spread upward as the rising gases preheat the thin slats above it. This preheating and high airflow leads to a rapid fire spread throughout the pallet pile.

Flat stacking of pallets provides less surface area for combustion. When one pallet is placed on the next, the thin slats typically cover each other, limiting the available surface area. However, the open area between slats provides a large vertical flue space for fire spread. Arranging flat-stacked pallets at right angles to each other will limit the flue space in the pallet pile, but does not afford easy handling of the pallets.

Of the two configurations, flat stacking is the most effective approach to idle pallet storage from both a fire protection and materials handling standpoint.

### **Storage Arrangement**

Floor stacking of idle pallets in pile groups of four stacks will provide easy access to material handling equipment and limit the amount of airflow through the pile. Many facilities opt to store idle pallets in racks to reduce clutter. While this storage arrangement may provide for better materials handling, it does present a significant fire risk. Pallets stored in racks have unrestricted airflow that will rapidly accelerate a fire. While the likelihood of a fire igniting in rack-stored pallets is less than that of floor storage, the flame propagation will be much faster. Further, the high heat produced by

burning pallets may lead to a failure of the rack assembly as the metal becomes fatigued.

Outside storage of idle pallets is the preferred method from a fire protection standpoint. By locating pallets outside, away from buildings and other exposures, property loss from a pallet fire will be restricted to the pallets. Outside storage of idle pallets does present several concerns, including premature aging of the pallet material and environmental damage if pallets have been exposed to hazardous materials. Additionally, the outside storage of wood pallets makes them susceptible to theft and arson-related fires.

## Hazard Control

Since accumulation of idle pallets can occur in any occupancy, it is important to monitor the number of pallets and storage arrangement on an ongoing basis. Generally, it is advisable to store pallets outdoors, in a separate building(s) intended for such storage.

### Outside Storage

Section 34.10 of NFPA 1, *Uniform Fire Code*, provides general requirements for the outside storage of idle pallets. These requirements include:

- Pallet piles should be separated from other storage by at least 20 ft. (6 m) for piles of less than 50 pallets; 30 ft. (9 m) for piles of 50–200 pallets; and 50 ft. (15 m) for piles of greater than 200 pallets.
- Pallet piles should not exceed 15 ft. (4.6 m) in height and should not exceed 400 ft.<sup>2</sup> (37 m<sup>2</sup>) in area.
- At least 8-ft. (2.4-m) clearance should be maintained between pallet piles and adjacent property lines.

Additionally, a pallet pile should be separated from buildings by clear spaces to prevent the spread of fire from the pile to a structure. Section 34.10 of NFPA 1 also provides minimum separations of pallet piles from buildings, as follows:

- Piles of 200 or less pallets may be stored with no minimum separation from buildings with masonry walls having no openings. However, experts recommend a minimum separation of at least 10 ft. (3.1 m).
- Piles of 200 or more pallets may be stored with a 15-ft. (4.6-m) separation from buildings with masonry walls having no openings.
- Piles of 50 or less pallets should have at least a 20-ft. (6.1-m) separation from buildings with wood frame or similar walls (e.g., iron-clad metal). This clearance should be increased to 30 ft. (9.1 m) for 50 to 200 pallets and 50 ft. (15.2 m) for storage of more than 200 pallets. These distances may be reduced when outside sprinklers are provided.

Table 34.10.3(b) of NFPA 1 provides a number of other separation requirements based on wall construction and the types of wall openings present. Additionally, Factory Mutual (FM) Property Loss Prevention Data Sheet 8-24 “Idle Pallet Storage” provide slightly different separation distances, often more restrictive, than NFPA 1. For example, pallet piles exceeding 200 pallets could have a separation distance that varies from 3 feet to 90 feet (1 m to 27 m), depending on building construction.

### Inside Storage

The intense heat generated by a fire in an idle pallet storage area could quickly weaken structural steel and lead to the collapse of a building. Steel columns that are surrounded by storage may be vulnerable depending on the amount of storage and fire protection available. Likewise, overhead steel framework will be exposed to the heat in a fire plume.

Section 12.12 of NFPA 13 provides requirements for the sprinkler protection of idle pallets based on the pallet material (i.e., wood or plastic) and the storage arrangement.

**Wood Pallets** NFPA 13 currently requires the indoor storage of idle wood pallets be protected by automatic sprinkler systems. This represents a change from earlier revisions (e.g., 2002 and earlier) of the standard. The current standard

requires that the indoor storage of wood pallets be protected using one of the following:

- Control mode density/area sprinkler protection as specified in Table 12.12.1.2(a), which limits storage to 20 ft. (6.1 m) in height.
- Control Mode Specific Application (CMSA) Sprinkler protection in accordance with Table 12.12.1.2(b), which limits storage to 20 ft. (6.1 m) in height.
- Early Suppression Fast-Response (ESFR) Sprinkler protection in accordance with Table 12.12.1.2(c), which limits storage for a pendent head orientation to 35 ft. (10.7 m) in height and 20 ft. (6.1 m) for upright head orientation.

The section also provides protection requirements for pallets that are stored no higher than 6 ft. (1.8 m) in height, with stacks (of four pallet groups) separated by at least 8 ft. (1.4 m) and having a clear space of 25 ft. (7.6 m). This arrangement previously (prior to the 2007 edition) did not require sprinkler protection. The 2007 and later revisions of NFPA 13 require that such an arrangement be protected in accordance with the OH2 density curve of Figure 13.2.1, *Miscellaneous Storage 12 ft. (3.7 m) or Less in Height—Design Curves*.

**Plastic Pallets** Section 12.12.2 of NFPA 13 limits the indoor storage of idle plastic pallets to floor storage not exceeding 10 ft. (3 m) in height when the pallets are protected by an automatic sprinkler system with a sprinkler density of at least 0.6 gpm/ft.<sup>2</sup> (24.5 mm/min) over 2,000 ft.<sup>2</sup> (186 m<sup>2</sup>), and a K factor of at least 16.8.

Additional allowances include:

- Plastic pallets can be stored up to 12 ft. (3.7 m) high in cutoff rooms when the room is protected by three-hour fire-rated walls and a sprinkler system with a density of at least 0.6 gpm/ft.<sup>2</sup> (24.5 mm/min) or a ESFR system with a K factor of 14. In addition, all steel columns are required to be protected by a one-hour fire rated covering or protected by a sidewall sprinkler.

- Storage of plastic pallets outside of cutoff rooms is limited to 4 ft. (1.2 m) in height and stacks (of two pallet groups) separated by at least 8 ft. (1.4 m) and protected by sprinklers using an OH2 design and having a high temperature rating.
- The in-rack storage of plastic pallets is allowed when the racks are protected by an ESFR sprinkler system meeting the design requirements of Table 12.12.2.2.3.

## Summary

An accumulation of idle pallets presents such a significant fire risk to a facility that it should be closely monitored. Idle pallet storage should be limited to the minimum needed to meet production demands and without exceeding the storage requirements outlined by NFPA. Storage of idle pallets in an outside, secured location, where sufficient clearances from exposures are maintained, is the most effective method of loss control. Additionally, outside pallet storage should be located away from any air intakes, ducts, or building openings that could allow smoke from burning pallets to enter the building. Pallets should not be stored next to walkways, driveways, or similar locations that may expose people or property in the event of a fire.

The National Wooden Pallet & Container Association provides a number of useful references for pallet users on their website at <http://www.nwpc.com>.

## References

1. Factory Mutual Engineering Corp. "Idle Pallet Storage." *Property Loss Prevention Data Sheet 8-24*. Norwood, MA: FM Global, 2015.
2. National Fire Protection Association (NFPA). *Fire Protection Handbook*. 20th ed. Quincy, MA: NFPA, 2008.
3. —. *Standard for the Installation of Sprinkler Systems*. NFPA 13. Quincy, MA: NFPA, 2013.
4. —. *Uniform Fire Code*. NFPA 1. Quincy, MA: NFPA, 2015.

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