

# The Locomotive

## What You Think You Know About Industrial Fire Sprinkler Systems Really Can Hurt You

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### Introduction

There are many mistaken notions about fire damage and industrial fire suppression equipment. Many of these misconceptions involve the use and operation of fire sprinkler systems. When properly designed, installed and maintained, fire sprinkler systems are an effective means of protecting people, equipment and property. The real danger, in fact, is that these fallacies about sprinklers can lead to fire damage and even deaths that might have been prevented with proper fire protection steps.

### Five Common Myths About Sprinklers

In my years as a consulting engineer, I have often encountered confusion about fire damage and fire suppression equipment. What are the most common myths about fire sprinkler systems?

- Keep sprinklers away from electricity
- Don't use water on flammable liquid/oil fires
- Sprinklers do more damage than fire
- Sprinklers go off accidentally
- My plant has sprinklers, therefore I'm safe

### Get The Facts About Industrial Fire Protection

Most likely, you've heard one or more of these statements before. You may even believe it to be true. But you would be wrong. These statements are not based on fact. Fire sprinkler systems can be used to effectively control electrical and flammable liquid fires. Sprinklers can actually help limit damage. And there is only a very small chance that sprinklers can go off by accident. Yet, the installation of a fire sprinkler system is no excuse to relax other fire prevention efforts. Such a false sense of security can be costly — or even deadly.

Decisions about fire protection should not be based on myth or misunderstanding. Let's discuss each of these issues in more detail.

### Myth #1 — Keep Sprinklers Away from Electricity

Once a fire has started, the most critical objective is early control by preventing its spread. Electrical fires produce large amounts of dense, corrosive and toxic smoke that makes the use of portable extinguishers and other manual fire fighting efforts extremely difficult. But sprinklers can control most fires.



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As for damage, whatever gave off enough heat to melt a fusible sprinkler link is already on fire and will not likely be further harmed by water from sprinklers. Compare the large amounts of water damage from fire department hose streams to the relatively small volume of water discharged from sprinklers. Electrical equipment design usually incorporates protection against overload and ground faults. Electrical and electronic equipment exposed to sprinkler water can be cleaned, rinsed with deionized water and dried out.

### Smoke and Flames Can Be Deadly

What about personal safety? Fire protection laymen will almost always oppose installation of sprinklers in an electrical room because of misdirected concerns about the “personnel hazard.” Everyone should already have left the room long before a sprinkler actuates. After all, the hazard of the fire and its products of combustion are much greater than that of the water discharge and potential contact with a live electrical circuit.

Evacuation and the use of automatic fire protection equipment are always safer than attempting to use portable extinguishers or not having any fire suppression system and waiting until the spreading fire threatens the remaining building occupants. What if sprinklers actuate with a person in the room? There is a risk that a person could be rendered unconscious. But a person would have a better chance of surviving the water than deadly smoke and flames.

### Myth #2 — Don't Use Water on Flammable Liquid/Oil Fires

When I recommend sprinkler protection for a flammable liquid or oil hazard, someone is bound to argue that water should not be used on a flammable liquid fire. And while it is true that a straight stream of water applied to a pool fire can actually spread burning liquid, this is a poor reason to completely exclude the use of water. Water is an excellent fire suppression agent used to successfully control and extinguish flammable liquid fires if properly applied.

A brief look at the physics of burning liquids will help explain why. Every flammable/combustible liquid has a flash point — the temperature at which the liquid gives off a flammable vapor in sufficient concentration with ambient air to generate an ignitable mixture. It is not actually the liquid which burns but the vapor. The proper application of water to a flammable liquid fire has several effects:

It absorbs convective heat above the fire that can cause structural damage and ignite other nearby combustibles.

When applied to structural members, it provides a cooling effect to keep the materials from failing. Structural steel begins to weaken at 800 degrees F.

It extracts heat from the liquid itself. When the liquid is cooled to below its flash point the fire will self-extinguish.

### Water Application and Spill Containment

The method of water application is the key. Trained fire fighters use a spray or fog pattern from their hoses in order to accomplish the three objectives listed above. In fixed fire suppression systems the same purpose is achieved with sprinklers and water spray systems.

Another important aspect of flammable liquid fire control is proper spill containment. If a pool or “burning” liquid flows outside of a sprinkler-protected area, no sprinkler system will do the job. Containment areas should be limited to the areas protected by the fire suppression system and for ease of control should be subdivided into smaller areas. Only highly hazardous applications such as aircraft hangars, refineries and flammable liquid warehouses use foam-water sprinkler systems or three-dimensional expansion foam systems.

### Myth #3 — Sprinklers Do More Damage Than Fire

The sight of a commercial or industrial building burned to the ground dispels this notion. On the contrary, sprinkler systems can provide early control of a fire, which helps to improve safety and limit the damage. Insurance companies have known for a long time that the dollar amount of damage is much higher in buildings that don't have sprinklers.

It helps to understand how sprinkler systems function. With the exception of the deluge sprinkler/water spray system, which is only used for specific high hazard applications, sprinkler heads only operate when heat released by fire melts the fusible link that keeps the sprinkler closed. The open sprinklers can be expected directly above the fire seat. Every individual head must be triggered in that fashion.

### **Sprinklers Can Reduce Fire Losses**

The required water flow alarm notifies fire department and plant personnel so that sprinklers can be secured after the fire department has established the fire is out. In the majority of cases where sprinklers actuate during fires, the fire damage can be expected to be small, and water damage would be confined to approximately 400 square feet. Often, total damages due to sprinkler discharge are less than \$5,000 and go unreported. In contrast, fires can easily result in multimillion-dollar losses where sprinklers are absent.

According to a U.S. government fire loss history study through 1991, the average loss in computer rooms without a fire suppression system was about \$38,000. By comparison, the average loss due to fires controlled by sprinklers was about \$3,000. Fires extinguished by halon systems had an average loss of about \$6,000, including the replacement cost of the halon.

### **Myth #4 — Sprinklers Go Off Accidentally**

The failure rates for sprinkler heads are extremely small — approximately 1 in 16 million or a probability of  $6.25 \times 10^{-8}$ . Inadvertent discharge of sprinklers is extremely rare and is usually attributed to mechanical damage or poor system design. It is so rare, in fact, that there is not enough data to be more precise. It is estimated that 1 in 2.5 million installed sprinkler systems will discharge inadvertently (probability of  $4.0 \times 10^{-7}$ ).

To ensure reliability and performance, sprinkler system components, design and installation are meticulously controlled by the National Fire Protection Association standard NFPA 13, "Installation of Sprinkler Systems." It is the nation's foremost design and installation standard on sprinkler systems and has been adopted as a code by virtually all jurisdictions in the United States. The proper selection and location of sprinkler heads, and proper system design, will minimize the possibility of inadvertent discharges.

### **Myth #5 — My Plant Has Sprinklers, Therefore I'm Safe**

The mere presence of a sprinkler system does not mean that the sprinklers can adequately deal with a fire. This is especially true in industrial buildings and warehouses due to the higher and often changing hazards. Sprinkler systems are matched to the occupancy of a building. The higher the expected heat release of a fire, the more water a sprinkler system must be able to deliver.

The density, or water flow over a unit area, is a balance between the available water supply (flow and pressure) and friction resistance of the sprinkler piping. Engineering calculations are used in the sprinkler system layout and the pipe selection. A sprinkler system that was adequate 10 years ago may not necessarily offer adequate protection today.

### **Inspections Are Not Enough — Evaluate Your Current Needs**

For example: a building constructed as a metal assembly plant has a sprinkler system approved and installed to adequately protect this occupancy. The original company moves out and a plastics manufacturing company moves in. Their raw materials consist of thermoplastics stored in racks. The heat release of a fire involving plastics in a rack storage arrangement is many times higher than a fire involving metal production operations. The hazard has just been increased to the point where the existing sprinkler system would be ineffective.

This deficiency would not likely be picked up during a fire prevention inspection, nor would it be by the technician who performs the routine testing of the sprinkler system. The proper evaluation of a fire protection system necessitates information about the occupancy, the sprinkler system design and the water supply.

### Summary

Sprinklers have an excellent record of protecting people and buildings from fire. It is true that no amount of fire protection can guarantee absolute protection. But understanding the hazards, and the careful selection and application of sprinklers and other fire protection systems, can sharply reduce the potential for fire damage. Don't let myths and misconceptions keep you from including sprinklers as part of the fire protection system in your plant or facility.

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