



Investigation Guideline

Fire Sprinkler Systems Appendix 119 March 1999

Background Information

National fire loss data indicate that in 1996, there were an estimated 27,100 fires attended by fire departments in structures where sprinkler systems were reported to be installed. The fires occurred in locations such as public assembly (3,900), educational (1,900), institutional (4,500), residential (11,000), and commercial (stores, offices) structures (5,800). In 6,800 (25%) fires, the sprinkler system was reported to have operated properly and in 1,500 (6%) the sprinklers was reported to have failed to operate properly. In the remainder of the fires, the fire was insufficient to require the sprinkler system to activate. These 27,100 fires were responsible for over 376 million dollars in property damage.

Fire sprinklers are installed in many occupancies, and their presence in the residential market is growing as local authorities are adopting sprinkler ordinances throughout the United States. Some communities have required residential sprinkler systems by passing ordinances or laws, while other communities have offered incentive programs for installing sprinkler systems voluntarily. Recent Commission activities have raised concern regarding the performance of fire sprinklers. A major concern is the failure of sprinklers to operate under fire conditions. These failures are evident in the NFIRS fire data. Data on fire sprinklers are being collected to identify potential causes of failures of fire sprinklers and to develop recommendations for adoption in national fire codes and state and local building codes.

The National Fire Protection Association reports that between 1987 and 1996, the reduction of civilian deaths per thousand fires associated with automatic fire suppression equipment is 65% for home, including single family homes, apartment buildings, dormitories, and room/boardings houses and 83% for hotels and motels. NFPA has no record of a fire that killed more than two people in a completely sprinklered public assembly, educational, institutional, or residential structure where the system was operating properly.

Types of Fire Sprinklers

There are several types of fire sprinkler systems where each depends on the nature of the area being protected. The type of sprinkler system used in most residential structures is the wet pipe system.

Wet Pipe Systems are the most common, economical and effective systems for most locations. The piping contains water at all times to discharge as soon as a sprinkler is activated. The disadvantage of wet pipe systems is that they can't be exposed to freezing temperatures.

Dry Pipe Systems are used in parking garages, warehouses and other areas subject to freezing. Instead of water, the systems keep piping filled with pressurized air, usually supplied from an air compressor. The air holds the water back at a dry pipe valve. When a sprinkler opens, the air rushes out, followed by the water. There's a brief delay in the delivery of the water to the fire. To accommodate this, the designer must calculate the area of sprinkler operation to be 30 percent larger than it actually is, with a corresponding increase in water demand.

Preaction Systems use electronic heat or smoke detector operation to open a valve and allow water into the piping system. Even then, water will not discharge until heat opens a sprinkler. In large warehouses, these systems often are used instead of dry pipe systems. In the case of an accident-- such as a fork lift breaking sprinkler piping-- a dry pipe system could fill with water that could then freeze, causing severe damage.

Fire sprinklers are individually heat-activated by a fusible link or glass bulb and connected to a network of piping with water under pressure. When the heat of a fire causes the fusible link to melt or glass bulb to shatter in a sprinkler, that sprinkler head essentially becomes an open faucet releasing water directly over the source of heat.

Sprinkler Systems Safety Standards / Product Listings

Most sprinkler systems are listed to UL199 (Automatic Sprinklers for Fire-Protections Service) or UL1626 (Residential Sprinklers for Fire-Service Protection) and FM2000 (Automatic Sprinklers for Fire Protection).

Headquarters Contacts

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Investigation Instructions

These instructions pertain to all fire incidents where a sprinkler system was present, whether it activated properly, failed to control the fire, or failed to activate. The targeted cases are fires in public assembly, educational, residential, store, and office structures. The attached data record sheet will ensure a uniform approach for gathering data about these fire incidents.

Every completed field investigation should contain a completed data record sheet, in addition to the CPSC standard 182 form and standard narrative description of the pre-incident, incident, and post-incident. Photographs of the sprinkler heads involved in the incident should be included in the investigation along with a sample. A copy of the attending fire department's investigative report of the incident, a copy of the installation drawings of the sprinkler system, and any reports regarding testing or repairing of the sprinkler system should be obtained.

Free Text Summary

- Describe the sequence of events that led to the incident. Describe incident, including the type and age of structure where the fire occurred, the type of sprinkler system, the make and model of the sprinkler system, the date of manufacture of the sprinkler system, and whether the system was disconnected or turned off during the incident.
- In addition, describe the consumer product involved in fire, including manufacturer and model number.
- Describe any injuries and deaths involved in the incident and the nature of the injuries.
- Determine the date of installation of the system and who installed the sprinkler system.
- Determine the number of sprinkler heads in the room of fire origin and the number that operated or failed to operate. Describe the location of the sprinkler heads in relation to the fire origin.
- Determine whether the structure was ever remodeled or enlarged and whether the sprinkler system was extended to cover the enlarged area. If more than one manufacturer (or model) or type of sprinkler, determine all manufacturers and types.
- Determine whether the sprinkler system was ever tested (frequency of testing), serviced, or repaired and whether there were any prior incidents involving the sprinkler system, such as leaking water incidents.
- Determine whether the sprinkler system was subjected to freezing, overheating, mechanical damage, or apparent corrosion. Determine whether any of the sprinkler heads involved in the incident were ever painted over, had objects hanging from the heads, or were obstructed in any way.
- Determine the type of piping material (plastic, steel, copper) used in the system and whether there was any prior water damage apparent on the ceiling surrounding the sprinkler heads.
- Determine the point of origin of the fire, what item first ignited and estimate any property damage including flame spread damage (e.g., product, small area surrounding product, room, floor, entire structure, etc.), water damage, and property dollar loss.
- Describe any safety certification labels, such as UL, CSA, ETL or other certification, or conformance with specific standards.

- For data retrieval from the computer, please use the following key words in the free text summary as appropriate: **fire sprinkler system**.

Photographs of Incident Scene

- Photos of the products involved and diagrams describing the location of the incident should be included in the investigation report. **If possible**, please include photographs of the fire scene on-site.

Sample Collection Instructions

- If the fire incident involved sprinkler heads that failed to operate, collect five (or as many as are available) separate sprinkler heads directly above the fire's point of origin.
- If the fire incident involved sprinkler heads that operated properly, then collect five sprinkler heads (or as many as are available) from both directly above the fire's point of origin and in the general area surrounding the fire's point of origin.
- Place sample in air tight plastic bag.
- **Send all samples to the sample custodian at CSPC warehouse and notify Kim Ault in Directorate for Epidemiology and Health Sciences at 301- 504-0470 x1269.**

Instructions for Obtaining Documents

- Determine whether the fire department attended the incident and obtain copy of fire incident, casualty, and investigation reports.
- Obtain copies of any official report if fire department did not attend (e.g. police report, emergency response report, service/repair report, insurance report, etc.)
- Obtain the sprinkler system installation drawings from authority having jurisdiction.
- Obtain copies of any testing reports, repairs, service contracts, or upgrades to sprinkler system.

The following page contains some pictures of fire sprinklers.

Wet Pipe Systems



Dry Pipe Systems



**Investigation Guideline
Data Record Sheet for Sprinkler Systems**

| | |
|---|-------------------------------|
| Task Number | |
| Type of Structure | Mark "Y" to one choice |
| Public Assembly | |
| Educational | |
| Institutional | |
| Residential | |
| Store/Office | |
| Other | |
| Age of Structure (In Years) | |
| Type of Sprinkler System | Mark "Y" to one choice |
| Wet Pipe System | |
| Dry Pipe System | |
| Preaction Systems | |
| Unknown | |
| Date System Installed | |
| Installer of System | |
| Date Sprinkler Manufactured | |
| System Disconnected / Turned off at time of incident | Yes No Unknown |
| Number of Sprinkler Heads in Room of Origin | |
| Number of Sprinkler Heads Operated | |
| Number of Sprinkler Heads Failed | |
| Sprinkler System Enlarged | Yes No Unknown |
| Sprinkler System Tested | Yes No Unknown |
| Sprinkler System Repaired | Yes No Unknown |
| Sprinkler System Serviced | Yes No Unknown |
| Prior Problems with System | Yes No Unknown |
| If Prior Problems, Describe | |

| Type of Piping Material or System | Mark "Y" to one choice |
|--|-------------------------------|
| Plastic | |
| Steel | |
| Copper | |
| Other | |
| Unknown | |

| Sprinklers System Exposure Conditions | Mark "Y" to one choice |
|--|-------------------------------|
| Freezing | |
| Overheating | |
| Mechanical Damage | |
| Corrosion | |
| Painted | |
| Objects Hanging from Head | |
| Obstruction | |
| Other | |

| | |
|-------------------------------|--|
| Point of Origin | |
| Item First Ignited | |
| Estimated Dollar Loss | |
| Estimated Water Damage | |

| | |
|---------------------------|--|
| Number of Injuries | |
| Number of Deaths | |