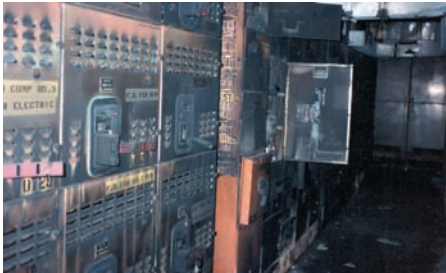
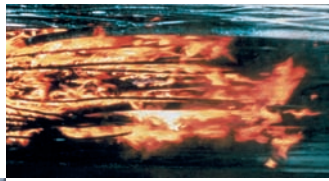


# Understanding the Hazard



## Fire in Electrical Equipment Rooms

### Understanding the Hazard

This series of publications is designed to help you understand the everyday hazards present at your company's facilities. For more information on how you can better understand the risks your business and operations face every day, contact your FM Global engineer.

#### UTH topic categories:

Construction

Equipment

**Fire Protection**

Human Factor

Natural Hazards

Process Hazards

### Hazard or Risk?

Fire in an electrical equipment room is a very serious hazard. Heat from the fire will damage the equipment inside the room, and smoke may cause nonthermal damage outside the room. Your FM Global engineer can help you understand and minimize your risk from this hazard.

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### The Hazard

In a recent 10-year period, 63 losses involving fire in electrical equipment rooms were reported to FM Global. The cost of these losses totaled more than US\$190 million. Twenty-one of the losses cost more than US\$1 million each, and five of the losses exceeded US\$10 million.

Fire is a hazard in electrical equipment rooms whenever combustible objects are present. Sometimes, the combustible objects can be removed from the room and, sometimes, they cannot. When they cannot be removed, steps must be taken to prevent and mitigate a possible fire or explosion.

### Science of the Hazard

Combustible objects are sometimes necessary for the operation of electrical equipment and cannot be eliminated from the room. For example, insulating oil is needed for oil-filled transformers or oil-filled switchgear. If a fire involving these combustible objects would likely be large enough to damage the electrical equipment, an automatic fire protection system is needed.

Cables are a common source of combustible material in electrical equipment rooms. The plastic used for the cable jacket or as insulation for conductors is combustible, and many types of cable insulation will continue to burn beyond the area of ignition. The type of insulation and the quality, quantity and arrangement of the cable (horizontal or vertical) all determine how rapidly a fire will spread and how much smoke will be generated. The use of good quality (non-fire-propagating) cable will reduce the chance of ignition and result in lower fire spread. Also, FM Approved cable coatings can be sprayed or brushed on to help protect cables. Sealing cable penetrations with fire-rated penetration seals will help prevent the spread of fire outside the electrical equipment room.

A leak in process equipment at a certain type of facility (for example, a chemical plant) can create a cloud of flammable gas that could enter an electrical equipment room, where it might cause an explosion. Pressurizing electrical equipment rooms can prevent flammable gas from entering. Pressuring the room also should be considered when combustible dust could enter.

## What You Can Do at Your Facility

### Now:

- Evaluate combustible loading in your electrical equipment room(s).
- Remove combustible storage from rooms containing energized electrical equipment.
- Determine if combustible loading warrants an automatic fire protection system.
- Seal cable and pipe penetrations with an FM Approved fire-rated material.
- Pressurize the room if it is in an area that can be exposed by flammable gas/vapor or combustible dust.
- Develop an emergency response plan that includes shutting off power to the electrical equipment room.
- Inspect rooms frequently to ensure they remain free of combustible storage.

### Soon:

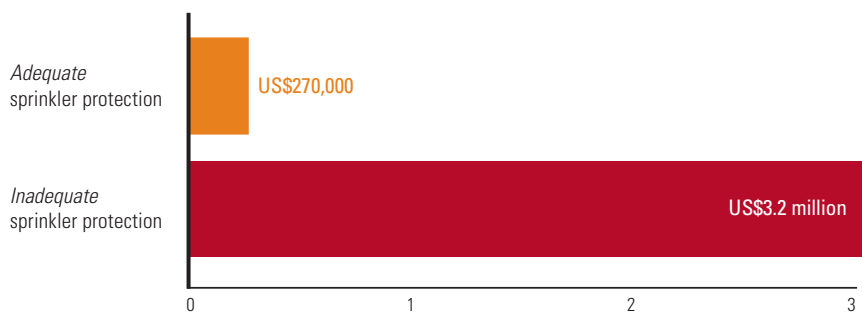
- Install a smoke-detection system for early warning, with an alarm system connected to a constantly attended location.
- If combustible loading warrants it, provide an automatic fire protection system. Or, where cable is the only exposure, provide an FM Approved cable coating.

Because electrical equipment rooms often are secured areas, they may seem like ideal places in which to store combustible items. This is a dangerous practice, however, and frequent inspections are needed to ensure these rooms remain free of storage.

## Loss Experience

During the 10-year period from 1996 to 2005, where automatic sprinkler protection systems were needed in electrical equipment rooms, but were not provided (or were inadequate), the average fire loss was US\$3.2 million. Where the automatic sprinkler protection was adequate, the average fire loss was US\$270,000 (indexed to 2007 dollars).

Average Fire Loss in Electrical Rooms (1996 – 2005)



## Loss Example:

### Delayed Discovery and Lack of Automatic Sprinkler Protection

A fire occurred at an indoor substation containing switchgear and distribution panels for facility equipment. It is believed the fire started due to overheating or a loose connection in one of the distribution panels. The fire spread to cable trays over the panels, and detection was delayed because there was no smoke-detection system in the room. The facility's fire brigade responded, but was not able to fight the fire due to heavy concentrations of smoke in the room. The public fire service managed to extinguish the fire two hours after detection.

All switchgear, distribution panels and cable in the substation were badly damaged, and replacement was necessary. Because this was a food-production facility, there was little salvageable material in process and a limited number of products in storage.

Smoke detection would likely have provided early warning, and automatic sprinkler protection would have controlled the fire, limiting damage to two or three distribution panels. As it was, the loss totaled more than US\$8.7 million (indexed to 2007 dollars).

## But What About . . .

### ...damage to electrical equipment from sprinklers?

A common misconception is that all sprinklers will function in a fire. Tests have shown that a cable fire will cause only one to three automatic sprinklers to operate. Switchgear can be protected from overhead sprinkler water by installing a drip cover (metal pan or plate) over the switchgear and extending it a few inches (centimeters) beyond the front and back of the switchgear. Cables can be run from the tray to below the top of the switchgear and then into the switchgear to prevent water entry. Without this protection, water from a limited number of operating sprinklers may damage some energized electrical equipment, but, in most cases, this is preferable to fire and corrosion damage to all the equipment in the room.

It also is important to bear in mind that firefighters will not attempt to extinguish a fire in a room containing energized electrical equipment until that equipment has been de-energized, which, depending on the situation, can take from several minutes to a few hours. They then may use hose streams to control and extinguish the fire, causing far more damage than would a few sprinklers. Lack of protection also may result in substantially greater nonthermal damage to sensitive electrical equipment.

Well-maintained gaseous-agent systems also provide acceptable protection for electrical equipment rooms, although they are less reliable than automatic sprinkler systems. A gaseous system will cause less damage than a water-based system if the power supply to the room is shut off early enough. If arcing occurs, however, the agent may decompose. Some agents can cause additional damage to equipment because their decomposition products are corrosive.

### ...the accidental operation of sprinklers?

Such an occurrence is extremely unlikely. FM Approved sprinklers are tested during the Approval process to verify they will not operate accidentally. If concerns about accidental operation remain, a preaction automatic sprinkler system can be used. This method requires the operation of two independent systems before water is discharged.

### ...local codes that do not allow sprinklers over electrical equipment?

If local laws prohibit the use of sprinklers over electrical equipment, consider another protection option, such as a gaseous-agent system or FM Approved cable coating.

### ...cable? How do I know if it needs automatic fire protection?

A number of flammability tests are used to classify cable. All tests involve simulating actual fire conditions. FM Approved Group 1 or plenum-rated cable does not require automatic fire protection.

## Loss Example: Oil-Filled Switches

A 30 x 50 ft. (9.1 x 15.2 m) central substation, curbed and with metal walls, contained five oil-filled switches and two silicone-fluid-insulated transformers. The facility was operating normally when a cast-iron pothead on the bottom of a 13.8 KV switch fractured. Approximately 200 gal. (757 L) of mineral oil drained from it and ignited. The local fire service was called and responded promptly, but was not able to fight the fire until after electricians isolated power to the substation. Eventually, they extinguished the fire using two small hose streams and a carbon dioxide extinguisher. There were no sprinklers inside the room, but the heat was so intense, it opened sprinklers outside the room.

The cost of the fire was approximately US\$2.8 million (indexed to 2007 dollars). After the fire, the oil-filled switches were replaced with air switches. Automatic sprinkler protection was not needed for the new switches due to the minimal fire loading.

## Need More Information?

Ask your FM Global engineer about the following:

- More loss examples
- Understanding the Hazard, *Grouped Cable* (P0218)

## Ordering Information

### For Understanding the Hazard

For additional copies of *Understanding the Hazard* publications, contact your FM Global engineer or client service team.

### For all other FM Global publications

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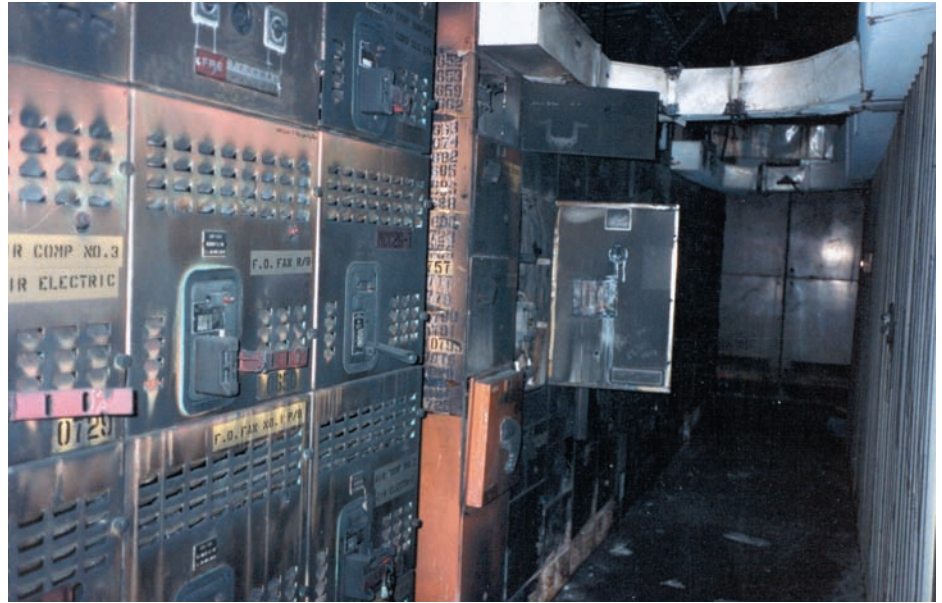
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## Don't Let This Happen To You



*Perhaps sprinkler protection would have prevented this complete switchgear burnout.*