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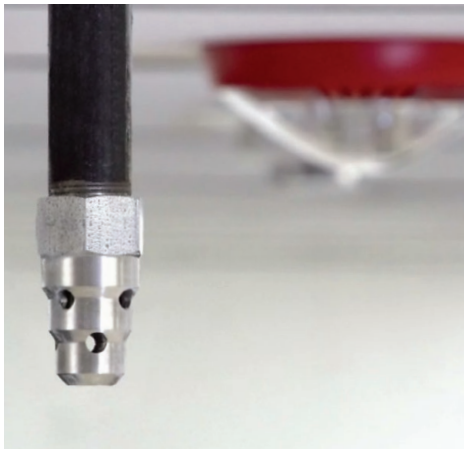
WHITE PAPER

Special hazard fire suppression best practices: What you need to know to protect critical assets and business continuity



Special hazard fire suppression technologies differ from fire sprinklers in how they mitigate damage from fire. These innovative solutions use gaseous or chemical agents to rapidly quell fires by absorbing heat or displacing required oxygen—but without catastrophic losses of building contents and business continuity. Facility designers, owners and managers should understand the best practices for special hazard fire suppression to protect facilities and assets.

Legislated by building codes in almost every locale, sprinkler systems have long been used to protect buildings and their occupants from fire. However, these systems are typically intended to protect structures, not building contents or the ongoing operations of the business inside a building. This is where special hazard fire suppression comes in. From power generation plants and data centers to art museums and historical churches, gaseous and chemical agent fire suppression technologies work quickly and, with no or minimal water, help prevent catastrophic damage.

From data centers and power generation plants to historic buildings and commercial kitchens, special hazard fire suppression can prevent catastrophic losses.

What is special hazard fire suppression?

Special hazard areas can be defined as:

- Any area containing equipment or processes of exceptionally high value
- Any area containing unique or irreplaceable assets (museums, archives, art galleries or records storage)
- Any area or process where the revenue produced or its function is of greater value than the equipment itself

Special hazard fire suppression can be installed in an entire building, an area, a room, or even for specific equipment or assets. For example, applications can range from computer racks at data centers and imaging equipment at healthcare facilities to range hoods in commercial kitchens. Special hazard fire protection systems include detection and control coupled with a fire suppression system. The fire suppression systems are designed to quickly and completely extinguish a fire without damaging building contents or endangering building occupants.

Matching fire suppression to applications

Not all types of fire suppression are ideal for every application. That's where the experts come in. Fire Protection Engineers (FPEs) and fire system integrators (usually a local distributor with specialized expertise) will research the specific application and requirements of each building. Before recommending the suppression type that

Fire is every building owner's nightmare. Special hazard fire suppression systems disperse agents to suppress a fire in its incipient stage, before reaching the flame/heat stage that activates a fire sprinkler system.

best fits a building's needs, they look at what is being protected and where—for example, there are very different needs for a hyperscale data center versus an office building with multiple data closets. The system designers will also consider room location, volume and ventilation.

When it comes to fire code, the Authority Having Jurisdiction (commonly known as AHJ) plays a vital role in certifying that the fire and life safety systems in your building are up to date and meet the National Fire Protection Agency (NFPA) codes and standards. Since local application codes and standards can vary by geography, experts such as FPEs will help navigate these requirements as well.

Once an area or building is identified as a special hazard requiring additional protection, a multifaceted hazard analysis should be performed. Understanding types of potential fires and differentiating among Class A (combustible materials, such as paper or plastics), B (flammable liquids), and C (energized electrical equipment) ignition sources can aid in the selection of the most efficient detection and suppression technology for a building's specific hazards. A thorough review of potential ignition sources enables not only selection of an appropriate fire protection system, but the possible elimination of ignition sources.

Types of fire suppression

Automatic sprinkler systems are the most common type of fire protection required to meet building codes. In the event of a fire, these systems immediately discharge a high volume of water into the building. In addition to the sheer amount of water employed, the water used may be unclean or contaminated, risking further damage to a facility's critical assets.

In contrast, special hazard fire suppression systems are designed to detect and extinguish fires in locations where standard suppression systems are not appropriate or adequate. Using gases, chemicals or a water mist, these systems quickly extinguish a fire and protect the building and its valuable assets. For this purpose, it's vital to choose the right type of fire suppression system for each application. Below is a look at five special hazard fire suppression approaches, along with some best practice tips for each.

1. CLEAN AGENT SUPPRESSION

Clean agent fire suppression systems disperse inert or halocarbon gases to suppress a fire in its incipient stage, that is, before reaching the flame/heat stage that would activate a fire sprinkler system. In the event of a system discharge, the clean agent suppresses the fire in seconds without damaging equipment and property or endangering personnel.

The "clean" in fire suppression clean agents means the agents are electrically non-conducting and leave no residue upon evaporation. Because the agents do not impair breathing or obscure vision in an emergency situation, there is no health risk for building occupants.

"Clean agent suppression is a good option for building owners requiring sustainability, occupant safety and protection of assets."

With an ozone depletion potential of zero, a low atmospheric lifetime, and their rapid suppression performance, clean agents not only offer low environmental impact, but reduce the potentially devastating atmospheric pollutants of an uncontrolled fire.

Clean agents are removed from the hazard area by ventilation, meaning this suppression type allows a virtually immediate return to "business as usual"—without the interruption of a costly clean-up or the expense of damage to assets from residue.

The most common clean agents on the market today are FK-5-1-12, HFC-227ea and naturally occurring inert gases such as argon and nitrogen. Clean agents have been tested and found to be effective against the widest possible range of fires, including Class A surface (wood, paper and cloth), Class B (flammable liquids) and Class C (electrical) fires.

***Best practice tip*:** Clean agent suppression is a good option for building owners requiring sustainability, occupant safety and protection of delicate assets such as hard drives. The ideal system for special hazards like these would incorporate both a clean agent gas system and a pre-action water sprinkler system in the ambient space.

2. DRY CHEMICAL SUPPRESSION

While actions such as smothering, cooling and heat transfer shielding contribute to the fire extinguishment characteristics of dry chemical agents, studies indicate that this agent type's greatest fire extinguishment mechanism is through the breakdown of the combustion chain reaction.

Dry chemical suppression not only offers protection for local areas or specific pieces of equipment, but can also be used as a total flood system for enclosed rooms or spaces. These chemical agents are nonconductive and are used to protect a variety of fire hazards such as electrical transformers, flammable liquids and fuel truck loading racks.

The upside to dry chemical suppression is that it's fast and economical, while the downside is that the powder can be messy and will need to be cleaned up. Dry chemicals are primarily suited for surface fires and are not effective on deep-seated fires.

***Best practice tip*:** Apply NFPA 17: Standard for Dry Chemical Extinguishing Systems to ensure dry chemical extinguishing systems are ready to respond.

3. WET CHEMICAL SUPPRESSION

The wet chemical suppression system is what most people understand as the traditional commercial kitchen fire suppression system. Wet chemical extinguishing systems were introduced in the early 1980s as an enhancement to restaurant equipment fire protection. The suppressant is a liquid substance that, when sprayed onto the affected area (usually a cooking fire) cools the flames immediately.

The nozzles for the fire suppression system are installed in the kitchen hood exhaust, so the wet chemicals will be discharged directly over the source of the fire. When the liquid comes into contact with cooking oils and fats, it reacts to produce foam, subsequently cooling the affected area and preventing the fire from reigniting. Its effectiveness is due in part to its immediate response to fire. Generally, wet chemical extinguishing agents consist of a mixture of organic and inorganic salts in solution.

Ideal for long distances and complex piping networks, the Kidde Fire Systems ADS™ Clean Agent fire suppression system discharges the suppression agent into the hazard area, minimizing damage, repair costs and downtime.

With a wet chemical fire suppression system, after the fire is suppressed, the soapy or foamy compound can be cleaned simply by using a cloth to wipe the surfaces. Wet chemical suppression systems are required to comply with NFPA 17A (Standard for Wet Chemical Extinguishing Systems) and NFPA 96 (Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations).

***Best practice tip*:** NFPA 17A and 96 require maintenance of kitchen hood suppressions systems at least twice a year and after any activation. If the kitchen suppression system protects an area that is also served by a fire alarm system, the two systems must be connected so that any activation of the fire suppression system will also trigger a fire alarm.

4. CARBON DIOXIDE (CO_2) SUPPRESSION

Carbon dioxide fire suppression systems displace breathable air, depriving a fire of its fuel (oxygen). Because of the air displacement, this agent is not safe for use in occupied environments. To minimize the inherent health risk of CO_2 while at the same time providing effective fire protection, the NFPA 12 Standard on Carbon Dioxide Extinguishing Systems mandated that all new and existing CO_2 systems be updated to include the addition of sirens to give occupants advance warning of a CO_2 discharge and odorizers to make people aware upon re-entry that CO_2 has discharged within a space.

Carbon dioxide suppression has been in use for many years. Typical applications include printing presses, vaults, dip tanks, spray booths, engine rooms and flammable gas or liquid storage. Carbon dioxide suppression extinguishes flammable liquids and gas fires, as well as fires involving electrically energized equipment and some ordinary combustibles. Suitable for local application and total flooding systems, there is no residue left behind after discharge.

Carbon dioxide supplies its own pressurization for discharge from a storage container, eliminating the need for superpressurization, and provides three-dimensional protection because it is a gas under ambient conditions.

***Best practice tip*:** Discharge duration and agent flow rates need to be customized for the specific application and installation location in a facility.

Marioff HI-FOG® systems fight fires just as effectively as traditional sprinkler systems, but with significantly less water. Dispersing water as small droplets, a HI-FOG® system cools a fire and its surroundings, blocks the fire's radiant heat and eliminates oxygen from the seat of the fire.

5. WATER MIST SUPPRESSION

The activation of a water mist suppression system in a fire situation results in an efficient and rapid extinguishment using a very fine water spray with a fraction of the water that would be used in a conventional sprinkler system. Water mist consists of finely atomized water droplets of water, where 99% of the droplets are less than 1,000 microns in size. High-pressure water mist systems typically create water droplets in the range of 50 microns on average, where low-pressure water mist systems typically create water droplets 400 microns to 1,000 microns in size. The smaller water droplets found in high-pressure systems provide a larger surface area for heat transfer (when compared to low-pressure water mist systems or traditional sprinklers). This permits much of the water mist to be vaporized into steam and provides the radiant heat-blocking and cooling effects necessary for fire extinguishment.

Studies have shown that water mist systems can be effective at controlling a room's temperature, which allows for safe egress by occupants and also reduces potential damage through pre-wetting of combustibles ahead of the advancing fire. Activation of a water mist system is similar to that of a conventional sprinkler system, with either thermally actuated nozzles or open (deluge) nozzles. Nozzles must be carefully selected to provide the required flow and distribution pattern.

High-pressure water mist systems are highly efficient in fighting fires. They can take one droplet of water from a traditional sprinkler and turn it into 8,000 droplets, resulting

in faster vaporization and efficient absorption of heat from the fire. Because of this, water mist systems use 50–90% less water, and require smaller diameter (and lighter) piping than a standard sprinkler system.

This efficiency and low-weight installation advantage enables water mist systems to protect an array of hazards, from industrial fryers and data racks to heritage homes and passenger ships—including locations with limited water supplies, where municipal water pressure is low, or where the sheer amount of water discharged from a traditional sprinkler system is unacceptable to the application owners.

Facility executives who are considering pre-action sprinkler systems, which use a dual-sensor system designed to prevent water from moving into the piping above a protected area unless a fire is detected—thereby mitigating the potential for damage caused by leaks or false alarms—should also know that water mist systems can be arranged in a similar pre-action arrangement as well.

***Best practice tip*:** Water mist systems can be used in various special hazard applications. You should also consult your water mist system manufacturer to see what approvals (FM, UL, etc.) they carry, understand what additional fire tests they may have completed in addition to any approvals, and review any fire test summaries they can provide as a basis of the system design. These systems can be configured in total flood, local application, wet pipe, deluge and pre-action arrangements to meet the needs of the hazard classification being protected, such as Light Hazard (HC-1), Ordinary Hazard 1 (OH-1), Data Centers, Machinery Space, etc.

SUMMARY

After fire prevention, special hazard fire suppression is a facility's best strategy for protecting business continuity, specialized equipment or irreplaceable assets. To determine the fire suppression agent best for a specific building, facility managers and owners can look to the expertise of FPEs and fire system integrators, as well as the unbiased expertise of equipment manufacturers that offer a complete range of fire suppression solutions.

About Kidde Fire Systems and Marioff

Kidde Fire Systems products and services set the benchmark for special hazard fire suppression. For over 100 years, we've been trusted to protect people and property from the danger of fires. That trust is reinforced by the quality we instill in everything we do, from manufacturing fire and safety systems to providing system design and technical support.

Marioff North America is an affiliate of Marioff Corporation, supplying land-based HI-FOG® water mist fire protection for commercial buildings, heritage sites and industrial applications.

Together, we know fire suppression.

Resources

NFPA 12: Standard on Carbon Dioxide Extinguishing Systems — nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=12

NFPA 17: Standard for Dry Chemical Extinguishing Systems — nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=17

NFPA 17A: Standard for Wet Chemical Extinguishing Systems — nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=17A

NFPA 96: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations — nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=96

NFPA 750: Standard on Water Mist Fire Protection Systems — nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=750

NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems — nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=2001

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