SUPPRESSION

Dousing doubts

Stationary extinguishing systems: do they work as well as we think? By Dick van Roosmalen, advisor Kappetijn Safety Specialists

On June 13, 2022, a fire at a Dutch warehouse containing fire starters challenged the efficacy of fire protection systems after a high-expansion foam system failed to extinguish the blaze. The incident at the Oisterwijk company, which had prior nuisance complaints and fire incidents, prompted an investigation shared with the municipal council. Findings indicated that fire suppression systems have intrinsic limitations, underscoring the need for expert management and preparedness.

However, the fire persisted, leading to the question: do fire protection systems actually work as well as we think?

Investigation results

The investigation of the permit status and incident history found that the warehouse had a high-expansion foam system which should have extinguished any fire. Despite this, fire did spread inside the warehouse. Fortunately the fire brigade prevented the fire from spreading beyond the warehouse, which was a complete loss.

The investigation additionally revealed the building's insurer's prior concerns regarding safety due to the history of incidents, leading to the mandate for a sophisticated high-expansion foam system with roof-mounted foam generators and a sensitive aspiration system for early smoke detection.

In the event of an incipient fire, the system's roof domes would open and draw in fresh outside air to make foam. Foam would fill the space and extinguish the fire. The operating principle is based on the displacing oxygen by foam bubbles and isolating the seat of the fire.

Ultimately, the modern installation was ineffective due to two main factors. Initially, the system was not delivered completely ready for operation. The system's roof domes open pneumatically, but the required CO2 gas cylinders had not been installed. The system as installed was therefore able to produce some foam, but not nearly as much high-expansion foam as it intended to fill the space completely and extinguish fires effectively.

It is noteworthy that all required tests were performed in accordance with national protocols and that required certificates were formally and correctly issued. The manufacturer of the foam generators prescribes in its documentation that the roof domes must be tested monthly. The installer failed to include this procedure in the weekly test protocol, which the building owner had diligently followed. Given the experiences in this case, such tests are not a bad idea, although an annual test may be sufficient to identify shortcomings after installation.

The second reason that the installation proved to be ineffective was that no risk analysis or normative scenario was described in the Principles Document (UPD).

> "THE INVESTIGATION REVEALED THAT EACH EXTINGUISHING SYSTEM DEPLOYED HAS INHERENT WEAKNESSES, REQUIRING EXPERTISE FOR PROPER PREPARATION."

The assessed as most likely cause of the fire on June 13 was over-heating.

However, a smouldering fire can be interrupted only by physically pulling the materials apart, then extinguishing the fire and cooling the materials with water. This type of smouldering fire could therefore not have been extinguished using the high-expansion foam installation, which only temporarily isolated the fire with foam bubbles.

Examples of extinguishing gas systems

Other extinguishing systems are not without their drawbacks. One example is extinguishing gas. A well-known major incident occurred in 2008 in a German paint factory equipped with an extinguishing gas system. The system was triggered by a fire and, due to a defect, continued operating for much longer than it was programmed to.

Due to the weather conditions, the released CO2 extinguishing gas lingered as a cloud in the valley where the factory was located. As a result, more than 100 people became unwell, including factory staff, firefighters and local residents. Of those, more than 10 required hospital treatment. Some fifty houses in the area required ventilation and air quality tests before the homes were considered safe.

Studies and research indicate that the impact of extinguishing gas systems are much greater than even knowledgeable users think or estimate. In 2000, the United States Environmental Protection Agency researched risks of CO2 extinguishing systems. They found that since 1975, there have been 51 incidents, with a total of 72 fatalities and 145 injuries.

Most casualties occurred during maintenance or testing of the installation, resulting in the unintentional release of extinguishing gas. In two cases, fire ▸

extinguishing gas was deliberately tested and casualties still occurred because people were unaware of the test and safety procedures were not fully followed. In one case, more CO2 was released than intended because a main valve was not closed properly.

Extinguishing systems in hangars

A report by Aviation International News in 2020 cited that from 2004 to 2020 there have been at least 137 incidents in which foam extinguishing systems in aircraft hangars were accidentally activated. That is an average of one every six weeks. The average direct damage per case is about a million dollars.

> **ENSURE THAT EXPERTISE IS AVAILABLE TO RECORD CONSIDERATIONS AND AGREEMENTS IN A REALISTIC AND COORDINATED EMERGENCY PLAN.**

Interestingly, the NFPA (National Fire Protection Association) established the standard for hangar protection more than 70 years ago: a sprinkler system was required. At that time, a hangar was more expensive than the aircraft it housed. The situation is now reversed: if there are several business jets in a hangar, the aircraft are worth more than 10 times the building. From 1984, the standards reflected the understanding that the defining scenario in a hangar was not the building on fire, but a pool of burning liquid under the aircraft.

Therefore, the updated standard no longer prescribed a sprinkler with water as the extinguishing agent, but a foam extinguishing system. A foam extinguishing system should quickly extinguish a pool fire under an aircraft, thus limiting damage to the aircraft.

Action perspective for the fire brigade

An important consideration for extinguishing systems is the operational strategy for the responding fire brigade. After a space-filling fire-fighting foam system has been activated, people cannot enter the building. Visual inspection inside the space often becomes impossible, especially with foam systems. This makes it difficult, or impossible, to determine what happened and whether the extinguishing system functioned effectively. The realistic perspective for action for the fire brigade is therefore very limited and requires specific knowledge. Was this a justified or unjustified report?

It is also often impossible to locate or rescue any victim who may be left behind. A comprehensive exploration and waiting interval to see whether a fire still breaks through is the remaining perspective in the absence of knowledge. After activation, all the extinguishing agent in the stationary system will have been used. If a fire has developed, large-scale action will still be necessary, and preventing fire spread becomes more difficult.

Selecting a system

When fire protection is mandatory for a building a permanent extinguishing system may seem a reliable solution. However, selection of the appropriate system requires specialised knowledge. A carefully chosen normative fire scenario and fitting extinguishing system must be properly documented as permitting conditions. Just as important are correct installation, careful periodic inspections and intensive system tests.

It is important to note that extinguishing systems may have negative aspects, such as significant risks to employees, the surroundings, and the environment. The system can also be activated accidentally, without being triggered by a relevant incident.

Therefore, ensure that expertise is available to record considerations and agreements in a realistic and coordinated emergency plan, so that there is as much certainty as possible that effective and safe action can be taken. ▪