TechTip G11 – Fire Suppression for Spray Rigs

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During the past decade, there has been an increasing number of spray foam rig fires. Many of these fires result in a total loss of the rig, putting them out of commission while they are repaired and replaced. In some cases, these fires result damage to customers property and unfortunately can result in severe injuries and fatalities.

The first step in preventing rig fires is good housekeeping, including:

- Keep the rig clear of excess combustibles (paper, cardboard, rags, foam scraps)
- Safeguard flammable solvents and generator fuels and use safe refueling procedures
- Inspect equipment and wiring for overheating
- Check generator for fuel leaks

Even with good housekeeping, fires can occasionally occur. While it is not always practical or cost-effective to have a person man the rig throughout the entire day on fire watch, there are devices that can help monitor and minimize the damage from fires starting in your rig. This TechTip discusses the pros and cons of three fire suppression systems:

- Fire Extinguishing Balls
- Clean Agent Fire Suppression Systems
- Dry Chemical Fire Suppression Systems

Fire Extinguishing Balls

The first and perhaps the most economical means to monitor and suppress fires in a spray foam rig is the use of a self-activating device called a fire extinguishing ball. These devices are typically packaged as a 6” diameter thin-walled plastic ball filled with about 3 pounds of dry fire extinguishing powder (monoammonium phosphate, used for Class ABC fire extinguishers). Some manufacturers make smaller diameter balls to cover small areas such as under the hood of a car or inside electrical panels.

Figure 1 – Single and Multiple Fire Extinguishing Balls for Fire Suppression. (Single ball shown in an SPF rig)

As a passive protection system these balls can be mounted on the wall or ceiling near or over a potential source of fire. If a fire starts, the flame and heat released will cause the ball to rupture, spreading dry powder in all directions, falling on the flame, suppressing the fire and depriving it of oxygen – removing oxygen from the 'fire-triangle'. Likewise, fire extinguishing balls may be used to actively suppress a fire by throwing them at the fire source.

For use in a spray foam rig, several of these fire extinguishing balls would be required and strategically placed over generators, compressors, workbenches, chemical lockers and electrical panels to provide protection.

It is not known how many of these devices nor the optimal placement of these devices to ensure complete fire protection of a spray rig. In addition, none of these devices are rated or certified under voluntary US standards that include UL 299 Dry Chemical Fire Extinguishers, UL 711 Rating and Fire Testing of Fire Extinguishers, and NFPA 10 Standard for Portable Fire Extinguishers.

Fire suppression balls are relatively inexpensive, with costs ranging from $40 to $120 apiece for a 3-pound device. While the efficacy of these devices is relatively unknown, videos show they are effective in extinguishing small fires. At such a low cost, they are certainly better than having no passive fire suppression. All these fire ball devices are made in different parts of Asia, so their effectiveness and quality may be questionable. The $120 Elide device does have several international quality certifications and is reportedly working on a US certification. Additionally, the US Consumer Products Safety Commission announced a recall in June 2023 for a list of fire ball devices mostly sold through Amazon, citing issues with unsafe and unpredictable detonation.

With a reported Class ABC rating, dry powder from these devices should not affect the electronics of your proportioner and other equipment, but detonation will result in some

downtime to clean. There is little data showing these devices can take the daily vibrations from a mobile spray rig, so accidental detonation may also be a concern.

The advantages of fire ball devices are their low cost and reported 5-year lifetime without regular maintenance. The disadvantages are their lack of third-party performance testing and certification, quality control programs (for certain manufacturers), durability in a mobile environment, and cleanup required after detonation. It would also require several of these devices to properly protect a spray rig. Considering these disadvantages, these devices may not be a good option.

Clean Agent Fire Suppression Systems
(also called Gaseous Fire Suppression Systems)

Another type of fire suppression system involves the use of a phase change reaction to rapidly remove heat from the fire triangle. These systems are based on the rapid transition of a liquid under pressure to a gaseous phase when released to atmospheric pressures. This change of phase from a liquid to gas creates an endothermic reaction (opposite of an exothermic reaction), which removes heat from the surroundings. A common example is aerosol dusters: Inside the can is liquid chemical under pressure; when released to the atmosphere, it exits the can as a cold gas.

This endothermic reaction is used for clean agent (i.e., no powder/residue) fire suppression systems. Chemours makes a product called FM-200, which is a liquid when pressurized, but a gas at room temperature. FM-200 is HFC-227ea, which can be blended with HFC-365mfa and used as a closed-cell SPF blowing agent. FM-200, which is a replacement for halon gas, is commonly used in a wide range of fire suppression systems that employ pressurized tanks, piping and targeted delivery areas.

One company, Proteng, has developed a clean fire suppression device called THIA using FM-200 for vehicles, including cars, trucks, buses and small aircraft. This system loads a small diameter tube with FM-200 liquid pressurized to 72 psi. The heat from a fire event increases the internal pressure to about 300 psi, rupturing the tube. This releases the liquid FM-200 to atmospheric pressure and vaporization occurs. This significantly reduces the surrounding air temperature, which extinguishes the fire.

Videos of the THIA device in action show examples where the device is protecting engine compartments in several different types of vehicles. These videos show that the THIA device works best in small, confined volumes. SPFA contacted Proteng and they inspected a typical spray foam rig. They stated that a system with 300 gm of FM-200 would be required to protect a typical rig generator room of 300 ft^3. The maximum estimated cost for this size of system is

$6,000, which can be reduced by enclosing the generator (reducing generator compartment volume) and by volume purchasing.

The main advantage of the clean agent fire protection system like Proteng's THIA is that there is no cleanup required after release. The FM-200 suppression system does not leave any corrosive residue that can harm equipment. The downside of this type of system is that it becomes prohibitively expensive to protect large volumes, including the entire spray foam rig. Another concern is the use of FM-200 (an HFC) – a compound that contributes to global warming and could be potentially banned under state PFAS regulations.

Figure 2 – Example of a small THIA device to protect small volumes like electrical panes or chemical storage cabinets.

Dry Chemical Fire Suppression Systems

Another type of fire suppression system to consider is a dry chemical system. These types of systems are designed for use on large, off-road type construction and mining equipment, underground mining equipment and specialty vehicles.

They consist of a pressurized tank containing a dry powder, detection sensors to release the pressurized powder, and a piping and nozzle system to distribute and apply the powder to a targeted area. The dry chemical powder is typically monoammonium phosphate. These dry powder systems are suitable for extinguishing Class A, B and C fires.

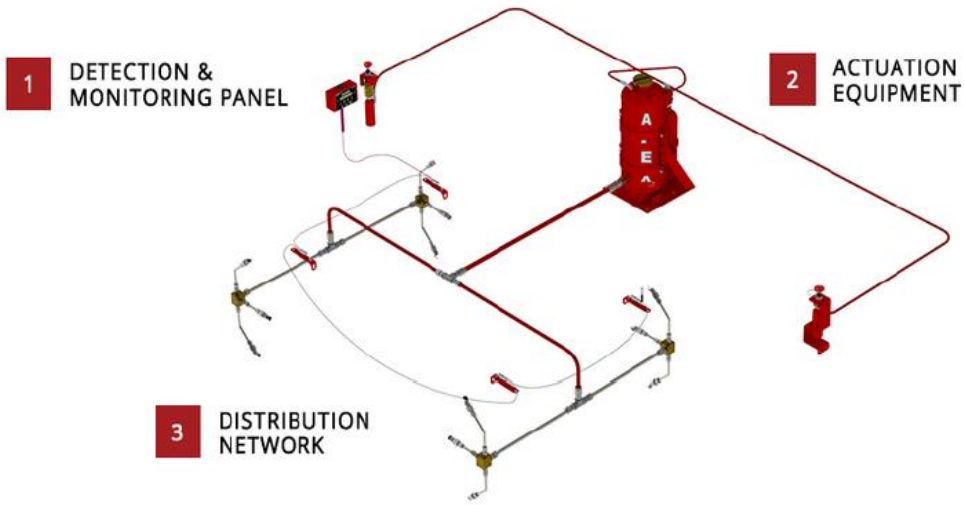

Figure 3 – Typical Dry Powder Suppression System used for Vehicles.

There are several manufacturers of these systems, including Ansul and AFEX. SPFA has contacted both manufacturers to get an estimated, installed cost for these systems to fully protect an entire rig. The system from AFEX, using a 60-pound tank of dry powder, would be on the order of $12,000-$15,000, including a generator engine shutdown system. This system will provide protection for the entire rig. AFEX also provided an estimate to protect the generator compartment only, on the order of $8,000. With these engineered systems, the entire rig is effectively protected by an automated 60-pound Class ABC fire extinguisher.

The advantage of a dry chemical system is that it would protect all areas of the rig and that these systems are ruggedly designed for mobile equipment use. The downside of these systems would be clean up and the potential for damage to some sensitive equipment inside the rig. In addition, these systems, like portable fire extinguishers, would need to be inspected serviced every 6-12 months to ensure continuous protection.

Conclusions

While most rig fires can be prevented with proper housekeeping, having a passive fire protection system can be a positive measure to reduce loss of downtime, equipment replacement cost as well as injury or death. Spray foam contractors should consider possible solutions to onboard fire suppression for spray foam rigs. Several options have been presented in this TechTip, each providing different levels of cost and protection.

ABOUT THE SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

Founded in 1987, the Spray Polyurethane Foam Alliance (SPFA) is the voice, educational and technical resource, for the spray polyurethane foam industry. A 501(c)6 trade association, the alliance is composed of contractors; manufacturers and distributors of polyurethane foam, related equipment and protective coatings; and consultants who provide inspections and other services. The organization supports the best practices and the growth of the industry through several core initiatives, which include educational programs and events, the SPFA Professional Installer Certification Program, technical literature and guidelines, legislative advocacy, research, and networking opportunities. For more information, please use the contact information and links provided in this document.

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