Dust Explosions
Isolation Vs. Suppression

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CONTENT

ABSTRACT

There are two common methods that can be implemented to subdue a dust explosion isolation and suppression. Isolation prevents the propagation of the flame, pressure, and ignition of dust cloud in a secondary enclosure. Suppression is a method that detects and eliminates an explosion in the early stages of development.

ISOLATION

USED TO PREVENT EXPLOSION PROPAGATION.[1]

- Prevent flame propagation and ignition of a secondary dust cloud.
- Prevent pressure piling through the system.
- Prevent deflagration to detonation transition in pipes.

Isolation without venting (Containment) can be used if the maximum pressure developed from the resulting explosion (Pmax) is less than the MAWP of the enclosure.[2]

Isolation is commonly used in conjunction with other mitigating technologies, such as explosion venting and suppression.[2]

Isolation systems can be passive or active.[1,2,3]

Active Isolation systems have detection components. (Sensor needs to detect pressure anomaly to activate isolation valve or chemical isolation system)

Passive isolation system activates on its own from deflagration. (float valves, flap valves, diverters)

Additional Passive and Active Options:[2]

- Isolation Flap/ Float Valve -Passive
- Chemical Isolation System- Active
- Fast Acting Mechanical Valve – Active
- Rotary Airlock – Passive

Isolation Video: https://youtu.be/w_TMHiXaiAw

Sources:

1. https://www.fike.com/knowledge-center/101/dust-explosion-propagation-and-isolation/
2. https://dustconsolutions.com/dust-explosion-mitigation/
3. https://core.ac.uk/reader/82740676

SUPPRESSION

USED TO DETECT EXPLOSION AT THE EARLY STAGES AND PREVENT IT FROM CAUSING DAMAGE.[1,2]

- Usually implemented when the explosion cannot be safely vented from the system.
- Isolation is commonly used with suppression technologies to isolate and suppress the developing explosion.
- Suppression typically uses[2]
    - Pressure sensors
    - High rate of discharge suppression canister (with dispersion nozzles)
    - Control panels

When ignition of the dust cloud occurs, pressure is emitted along with a flame front. When the pressure increase caused by the explosion is detected it releases suppressing agents rapidly into the piece of equipment.[2,1]

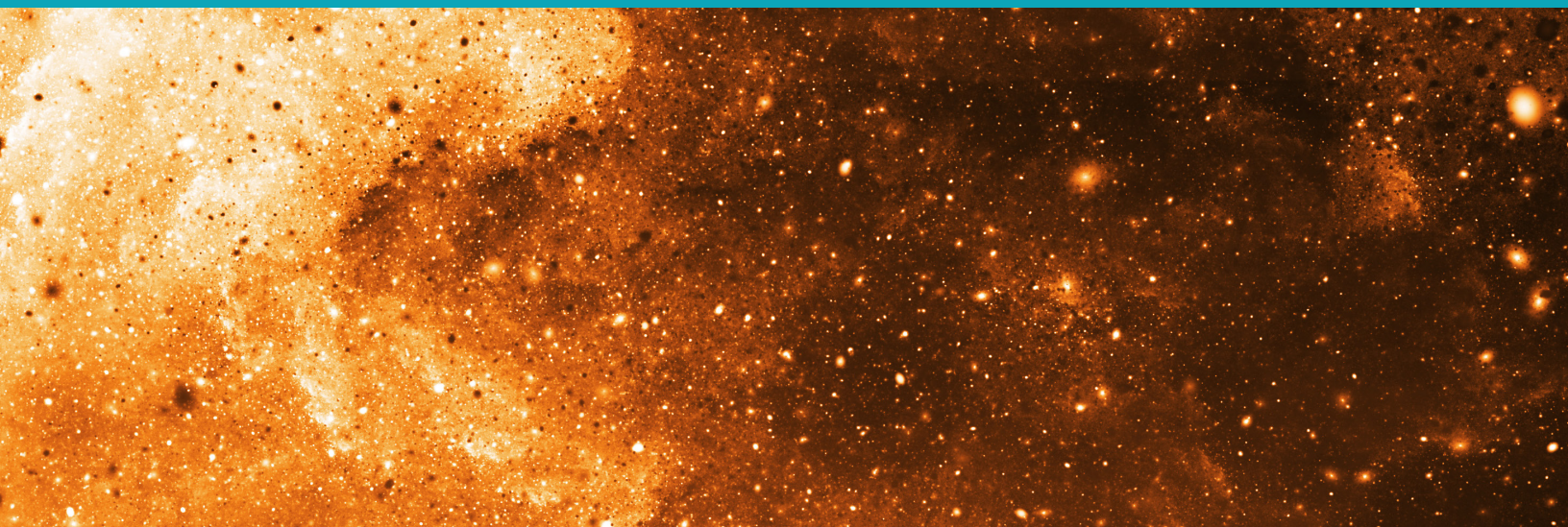
Suppression can be a good alternative to regular venting because pressure, material, and flame release does not occur. The explosion is suppressed and limited to the piece of equipment that it happened in.[2]

Suppression systems are typically expensive and can be hard to use in enclosures that are smaller than 1 m^3. This is due to the time it takes for the pressure to rise to explosion levels. In small enclosures this does not take much time.[2]

Explosion Suppression Video: https://youtu.be/yFhof5viBqY

Sources:

1. https://www.ieptechnologies.com/assets/images/file/guidelines-for-dust-collector-protection-part-1.pdf
2. https://core.ac.uk/reader/82740676



SUMMARY

Isolation and suppression are ways to mitigate a dust explosion at different stages. For isolation, an explosion occurs but is prevented from propagating to other parts of the system. Suppression technology senses a developing explosion, reacts, and subdues it before it becomes an explosion event, which eliminates the need to vent the system. Each system is unique and will need to be evaluated for the best option to protect against dust explosions.

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