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Why spark detection isn't enough to eliminate explosion risks

If a dust cloud only combusts when an ignition source is introduced, does removing that ignition source confidently result in a safe operation free of combustible dust hazards? Not necessarily. While identifying, analysing and eliminating potential ignition sources is always a recommended risk-reduction practice, this is just one of many layers of safety required to ensure the worst-case scenario never happens.

The purpose of this article is to inform plant managers, health and safety managers and other decision makers about the real dangers of taking short cuts with explosion protection. Fike experts have witnessed during site visits spark detection being used incorrectly as the process' form of explosion protection and have observed at tradeshows and online spark detection being proposed as a full solution; therefore we believe it's important to address this topic from a position of honesty and expertise.

Spark detection & suppression devices

Sparks are a common ignition source of combustible dust clouds within an industrial process, so spark detectors and suppression devices are often used to reduce the risk of combustion. By quickly identifying sparks, the process can be immediately shut down and the source of the sparks may be investigated and repaired before production resumes.

Various means of spark detection and suppression are recommended by Fike; however, these should not be used as a quick and inexpensive replacement for a comprehensive explosion protection solution. That's because spark detection and suppression:

- Will not identify the various other potential ignition sources including hot surfaces, static electricity, foreign objects and many others.
- May not have the ability to detect a spark or ember within dense-phase conveyance processes such as those found within a mill.
- May not identify sparks or embers that enter the process from multiple pathways because spark detectors are often one-directional

NFPA 654 (soon to be converted into NFPA 660) addresses this topic on spark detection and suppression as well:

A.7.1.7 - "(Spark detectors) reduce the frequency or likelihood that the sparks will cause a deflagration but do not eliminate the need for deflagration isolation devices."

B.6.2 - "(Spark suppression systems) are intended to detect burning particles traveling down a duct and extinguish them with a downstream spray of water. They are not designed to stop deflagrations once they have started and are ineffective for preventing deflagration propagation through interconnected equipment."

For these reasons, spark detection and suppression should be viewed as a means of "explosion prevention," which is just one of many layers of protection required to ensure workers return home to their families.

So, what should be done?

If you have questions about the hazards within your industrial process, the first step is to contact an industrial safety solutions expert to discuss your goals and schedule an initial plant walkthrough or a comprehensive risk assessment.

Not only will the risk assessment result in a formal document known as a Dust Hazard Analysis (DHA) or Explosion Protection Document (EPD) which are required for compliance with their respective NFPA and ATEX standards, but it will also prioritize the hazardous areas within the plant that should be addressed based on the severity and likelihood of an explosion.

Based on those findings, an action plan will be developed which will include multiple recommendations on ways to reduce the risk of combustion, and if combustion were to occur, how the explosion will be mitigated. These methods include:

Improved housekeeping

The greatest potential hazards are often from secondary explosions involving fugitive dust accumulations; therefore, recommendations may include increasing efforts to minimise resting dust, normalizing a cleaning schedule, training staff and self-inspecting to ensure housekeeping goals are maintained.

Process alterations

Fike consultants have observed process equipment unnecessarily spreading dust throughout the process and have made recommendations on ways to isolate the dust to within the process. Examples like this one assist with minimising the fugitive dust throughout the plant and reducing required housekeeping efforts.

Explosion protection systems

Oftentimes, removing all possible ignition sources cannot be guaranteed, so to ensure the worst-case scenario never happens, certain explosion protection equipment may be recommended to mitigate the effects of a potential deflagration. This may include a series of "passive" devices such as explosion vents and mechanical isolation valves or "active" devices such as explosion suppression and chemical isolation systems.

Explosion prevention systems

Finally, certain devices may be installed to assist in the prevention of ignition and to stop a deflagration in its incipient stages. This includes temperature monitoring systems and of course spark detection and suppression systems. However, as you can see, spark detection and suppression is just one of many efforts used to reliably reduce the risk of an explosion. Solely relying on spark detection and suppression to do the job of these other explosion protection efforts is, quite simply, dangerous.

Can explosion protection begin with spark detection?

Absolutely! Many industrial safety solutions providers often work with their customers' budgetary needs and production schedules to develop a "phased protection strategy." It's possible that phase one may include a spark detection and suppression system as the first layer of protection, with the intention to later upgrade to a more robust system including explosion mitigation and isolation devices.

Remember, explosion protection is not an all-or-nothing proposition because reducing the risk is often completed in stages. Doing something is always better than doing nothing at all to ensure the protection of workers, and spark detection and suppression often serves an important role in the overall recommended solution. ■

About the author

Dilip Arulappan, Explosion Safety Consultant – Europe, Fike Corporation, has a Master's in Process Safety and Loss prevention Engineering (Chemical and Biological Engineering). He is a Member of IChemE Process Safety and an Exida certified Functional Safety Professional specialised in IEC 61511, with over 10 years of Engineering and Process Safety consulting experience, focusing on combustible dust and flammable liquids within the EU, UK, and Asia Pacific regions, helping clients to comply with ATEX and DSEAR regulatory requirements.

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