FOR SAFER OPERATIONS

DEFLAGRATION ISOLATION

The Wood Pellet Association of Canada (WPAC), BC Forest Safety Council (BCFSC), and Dalhousie University partnered on an initiative to improve pellet industry practices regarding equipment isolation.

Process safety and hazard analysis expert Kayleigh Rayner Brown, P.Eng., M.A.Sc., director of Obex Risk Ltd., was commissioned to analyze deflagration isolation for safer operation and conducted the work alongside BCFSC safety advisor Bill Laturnus. Funding for the project was provided by Dalhousie University, arranged by Dr. Paul Amyotte.

WHAT IS A DEFLAGRATION?

According to the National Fire Protection Association (NFPA), a dust deflagration is defined as "propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium".[1]

In a dust explosion, the deflagration processes happen so rapidly that the heated air and gaseous fire products (such as carbon dioxide) produce air pressure so extreme it can blow out walls and destroy structures.

Combustible wood dust presents a significant risk of fires and explosions in all wood products manufacturing facilities—including wood pellet plants—where much of the machinery and equipment used has a propensity for generating ignition sources and the processes can involve suspended dust and dusty conditions.

> A mere spark can cause a dust explosion or serious fire and result in catastrophic loss of life, injuries, and destruction of buildings.

Often these incidents will spread throughout an entire production facility rather than being isolated to an individual process area within the plant.

OVERVIEW OF KEY FINDINGS AND RECOMMENDATIONS FOR DEFLAGRATION ISOLATION

The project involved speaking with subject matter experts from wood pellet plants across Canada, engineering consultants and specialists with expertise in combustible dust, as well as experts in deflagration isolation equipment supply.

Literature review of relevant NFPA standards and resources from the Center for Chemical Process Safety (CCPS) was also completed.

The results were compiled into a final report, *Analysis of Deflagration Isolation in Wood Pellet Production for Safer Operation*, and provide important information on:

- Different types of deflagration isolation systems commonly used in wood pellet facilities and how they work.
- Common locations for isolation systems in wood pellet production.
- Installation, operation, and maintenance of isolation systems to improve understanding.
- Summaries of the failure modes and degradation factors associated with these systems.
- Considerations for how these failure modes and degradation factors can be managed to make systems more reliable and effective.

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WOOD DUST DEFLAGRATION ISOLATION

The National Fire Protection Association (NFPA) defines deflagration isolation as the technique for the "interruption or mitigation of flame, deflagration pressures, pressure piling, and flame-jet ignition between enclosures that are interconnected by pipes or ducts".[2]

This project is focused on current practices aimed at reducing the potential for a deflagration to propagate through a process. Those involved in the study and its implementation at the plant level agree there are many benefits of deflagration isolation:

- Reduced risk of the devastating effects of a dust explosion harming personnel.
- Protection of critical process equipment from damage due to pressure and heat.
- Protection of potential impacts to the environment by way of air or water contamination due to a fire or suppression efforts.
- Dramatic reduction in production downtime, as well as reduction in other potential business impacts of an incident (e.g., reputation).

Explosions can propagate to other locations in the plant. However, these risks can be mitigated with explosion isolation technologies, which contain the explosion. This explosion isolation prevents it from spreading throughout the entire process plant (see Figure 1).

ROAD MAP FOR IMPLEMENTING DEFLAGRATION ISOLATION:

1. **Conduct a Dust Hazard Analysis** (DHA) —a systematic approach to identifying and analyzing the fire and explosion hazards posed by combustible dust within a facility.
2. **Work with equipment supplier**s on recommended deflagration isolation points.
3. **Install deflagration isolation equipment**.
4. **Maintain deflagration isolation equipment.**

Refer to the report *Analysis of Deflagration Isolation in Wood Pellet Production for Safer Operation* at pellet.org/safety for detailed information.

1 NFPA 652. 2019. *Standard on the Fundamentals of Combustible Dust*. NFPA (National Fire Protection Association), Quincy, MA.

2 NFPA 69. 2019. *Standard on Explosion Prevention Systems*. NFPA (National Fire Protection Association), Quincy, MA.

Figure 1