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# Dust Collector Fire and Explosion Highlights Need for Combustible Dust Considerations In System Designs

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*A massive fire and explosion in the dust collection system of a New Hampshire wood pellet manufacturer demonstrates the need for adequate system design to prevent combustible dust explosions in general industry.*

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**May 16 2012 – Baghouse.com Editorial** | On October 20 2011, a combustible dust fire began in the wood pellet cooler, most likely caused by a spark or ember from the pellet hammer mill. The fire then spread through the ductwork throughout the plant, eventually reaching the dust collector causing it to explode. When the collector exploded, the explosion vented through the baghouse's explosion vents into adjacent storage silos setting them ablaze further spread the fire throughout the plant. More than 100 firefighters and emergency personnel from at least 14 towns worked for over 15 hours to put out the blaze.

The [OSHA report](#) outlines specific areas where the plant lacked adequate spark detection devices, fire suppression systems, and explosion venting/protection within the dust collection system. The fact that the plant had been cited by OSHA for several of the same issues previously after a 2008 incident, led to OSHA assessing total fines of \$147,000.

Examining what went wrong in this incident highlights the need for diligence on the part of plant management and operators regarding the dangers of combustible dust.

# What Went Wrong?

The October 20 2011 fire and explosion at the Jaffrey, NH plant was not the first combustible dust related incident at the plant. In 2008 the plant experienced a similar fire and explosion that caused more destruction than the most recent one. After completing its investigation, OSHA at that time fined the plant over \$100,000 for safety violations that led to the fire. Subsequently, the plant, in an attempt to prevent another such occurrence, “retained engineers and consultants, and spent over \$2 million on various improvements to enhance worker safety at its Jaffrey facility” according to a release from the company. This apparently including the installation of some explosion isolation devices in the ductwork (Rembe explosion isolation device) and installed explosion protection (explosion vents) on the baghouse. However the company’s effort and expense failed to prevent another incident from occurring.



Fire fighters work to put out a massive blaze caused by a destructive combustible dust fire and explosion at the New England Wood Pellet Company’s Jaffrey, NH facility.

The OSHA report is quite thorough in its description each poorly designed, installed and operated part of the dust collection system either caused or intensified fire and subsequent explosion.

For example the report cites the plant for 2 main offenses. The first one is regarding poor housekeeping throughout the plant that led to large accumulations of combustible wood pellet dust forming on top of machinery (such as the pellet cooler where the fire began) and on elevated surfaces such as overhead rafters, ceiling joists, troughs, etc. Secondly, and more seriously, the plant was cited under the General Duty Clause of the OSHA Charter\* for failing to take reasonable steps to prevent a combustible dust fire/explosion from occurring. OSHA cited several industry standards such as the National Fire Protection Association building code that the plant failed to heed in the design and construction of the plant’s dust collection system.

# Ductwork Lacked Sufficient Spark Detection, Fire Suppression, or Explosion Isolation Devices

A major oversight in the ductwork system, was the lack of appropriate spark detection, fire suppression or fire isolation devices on all of the ductwork between the various machines throughout the plant. For instance, OSHA reported that the connecting ductwork between the pellet hammer mills, the pellet cooler, the bucket elevators storage silos and most of the dust collectors in the plant had no spark detection system, fire suppression system, or explosion isolation devices installed. The only control device the plant had was an explosion isolation device on the conveying duct between the pellet cooler and the pellet cooler baghouse. However, the device did not function properly and allowed the fire to propagate further downstream into the baghouse.

*NFPA 664 (2012) Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities: 8.2.1. and Hazard Determination 8.2.4.1. – Conveying systems with fire hazards should be isolated to prevent propagation of fire both upstream and downstream (OSHA isolation can mean spark detection and suppression). 5.2.5.1 Prevention of Fire Extension: When limitation of fire spread is to be achieved the following criteria shall be demonstrated...(4) Particulate processing systems (dust collection systems) shall be designed, constructed, equipped and maintained to prevent fire or deflagration from propagating from one process system to an adjacent process system.*

Additionally, the ductwork was not engineered and/or constructed to sufficient strength to withstand the maximum anticipatable explosive pressure resulting from a conflagration involving its intended payload (combustible wood dust). This led to the duct bursting open, releasing the explosion into the plant near firefighters and may have been a contributing factor in the fire by-passing the isolation device.

*NFPA 664 (2012) 8.2.2.2.3, Sets forth alternative safety criteria for ducts with a deflagration hazard, to ensure that the ducts are built with a sufficient strength and with appropriately sized/located protection devices to handle the maximum expected pressure generated by a dust explosion.*

## Baghouse Was Not Adequately Protected Against Explosion Hazards

The plant recently installed explosion vents on the baghouse explosion vents.\* However, the design and installation of the explosion protection on this particular baghouse may actually made things worse than if there had been none at all.

When the fire reached the baghouse and caused the finely dispersed dust to ignite, the resulting pressure and fireball should have been vented outside the building. However, the explosion vents on the baghouse faced the direction of adjacent storage silos (containing wood dust). When the explosion was vented out it ignited the storage silos resulting in a major portion of the fire.

Additionally, OSHA's investigation showed that the baghouse lacked an explosion suppression system, was not designed and/or constructed to withstand the maximum unvented pressure of a combustible dust explosion, and in the absence of proper explosion protection, was located indoors.

As a result of these failures, when they reached the dust collector, the resulting explosion: blew the dust collector's door off its hinges, creating a missile hazard, blew backwards into the duct, which burst open, and blew out the dust collector's exhaust muffler and roof stack, causing the pressure/deflagration to be vented inside the building near responding firefighters.

*NFPA 664 (2012) 8.2.2.5.1.4. Requires an outdoor location for the dust collectors with fire or deflagration hazards, unless they are equipped with one of the following: (4) listed deflagration suppression system, (5) deflagration relief vents with relief pipes extending to safe areas outside the building and the collector meets the strength requirement of this standard (i.e. built with sufficient strength to withstand the maximum expected explosions pressure). NFPA 664 (2012) 8.2.2.5.3 requires dust collectors with deflagration hazards be equipped with an appropriate-sized explosion suppression system and/or explosion relief venting system designed per NFPA 68 (Explosion Protection by Deflagration Venting) and NFPA 69 (Explosion Prevention Systems), and also that such dust collectors be built to design strength that exceeds the maximum expected explosion pressure of the material being collected. NFPA 69, 12.1.2 requires "Piping, ducts, and enclosures protected by an isolation system shall be designed to withstand estimated pressures as provided by the isolation system manufacturer". NFPA 69, 12.2.2.3 "System Verification" requires that systems shall be verified by appropriate testing under deflagration conditions to demonstrate performance."*

These design oversights directly increased the destructive power of what had until then been only a dust fire in the ductwork.

## Lessons Learned From Wood Pellet Company Dust Explosion

Simply put, this disaster was bound to happen due to glaring design and/or construction flaws throughout the entire system.

The fact that multiple similar incidents have occurred at the facility demonstrates that the dust collection system, and perhaps even the entire production process requires modification to ensure this kind of incident does not occur again.

Under OSHA's National Combustible Dust Emphasis Program, OSHA inspectors are on heightened alert for any combustible dust hazards in facilities in all industries. Indeed OSHA is under a federal mandate and it has as its own goal to issue a comprehensive combustible dust standard for general industry. In the meantime, OSHA has been citing plants under the general duty clause for having combustible dust hazards. In most cases, OSHA is informally requiring general industry to conform to the NFPA's guidelines for combustible dust hazards. As seen in this case following their suggestions would have prevented this kind of incident from occurring.

Therefore, we can take away from this the need to be conscientious and proactive regarding combustible dust hazards in your facility. As we have seen, being reactive will simply not do.

## *Footnotes:*

\* **OSHA General Duty Clause** (a) Each employer — (1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees; (2) shall comply with occupational safety and health standards promulgated under this Act.

\* **Baghouse Explosion Vents** – Explosion vents are a form of explosion protection used on baghouses. During normal operation the vents are closed and maintain an air-tight seal. However, if an explosion occurs within the baghouse, the vents are designed to “strategically fail” being the weakest part of the baghouse structure, thus allowing the pressure from the explosion to vent out and away from other combustible materials and workers.



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