NOVA SCOTIA
Labour and Advanced Education
Occupational Health and Safety Division

Dust Explosion Hazard

Hazard Summary

Dust explosions can be devastating. The United States Chemical safety Board (CBS) identified 281 combustible dust incidents between 1980 and 2005 that killed 119 workers and injured 718, and extensively damaged industrial facilities. These incidents occurred in 44 states, in many industries, and involved a variety of different materials. [1] (Including wood, coal, peat moss, flour, sugar, pharmaceuticals etc) Recently, (2012) British Columbia experienced two tragic sawmill explosions and fire that killed four workers and injured 20 more workers, some seriously.

Accident investigations have identified key causation factors including:

- A failure for all parties including managers, workers and inspectors to recognize the serious nature of dust explosion hazards
- Workplaces not conforming to the NFPA standards to prevent or reduce the effects of a dust explosion
- Accumulation of combustible dust- inadequate housekeeping (cleaning)
- Procedures and training to eliminate or control dust explosion hazard
- Ignoring warning events
- Dust collection systems inadequately designed or maintained safety features
- Process changes without adequate hazard mitigation for new hazards introduced

Background

For a dust explosion to occur, 5 key elements are required- fuel (combustible dust,), oxygen (air), ignition source (for example heat, static electricity, spark, friction or mechanical failure etc), confinement (inside a space or inside equipment) and dispersion (dust in sufficient small size and concentration dispersed in an air/oxygen mixture, minimum explosion concentration MEC). Many times a dust explosion occurs as a secondary explosion. This is where a smaller unrelated event occurs that disperses dust into the air resulting in a catastrophic dust explosion. These explosions cause devastating property damage and the potential for serious injury/deaths. (ie Westray Mine explosion).

Risk factors such as humidity levels and water content in materials can elevate the risk of explosion. Moist dust requires a higher ignition temperature than dryer dust. Also, when humidity levels are low, like those seen in winter months, dust can easily disperse and ignite, increasing the risk. In fact, industrial accident investigations by the U. S. Chemical Safety Board found that seven out of eight fatal combustible dust explosions from 1995 to 2009 occurred during cold winter months when these weather conditions were most prominent. One of the two tragic

[1] http://www.csb.gov/assets/1/19/Dust_Final_Report_Website_11-17-06.pdf

sawmill incidents in British Columbia occurred in the middle of winter, the second occurred in early spring. Reasons that colder months are thought to cause more risk is that a number of changes tend to occur including:

- Control measures and clean up practices that rely on the use of water may not be suitable or effective
- Openings such as bay doors and wall dampers may be closed up increasing the degree of enclosure and reducing natural ventilation or make up air
- Ventilation may be reduced or shut down to conserve heat
- Re-circulation of air from exhaust systems may also increase
- Portable heating units potentially introduce additional ignition sources into workspaces [2]

Preventative Measures

1. Complete a combustible dust risk assessment by a competent person/consultant addressing all the elements required for an explosion including the presence and accumulation of combustible dust, sources of ignition and conditions such as confinement, dispersion, low humidity.
2. Verify compliance with NFPA standards such as 654 and 77, and other pertinent standards (see below).
3. Implementation the dust control program including:
    - List all combustible dust sources, control equipment, provision for managing changing conditions (ie change in process, production levels, or seasonal variations)
    - Safe work procedures- (ie Hot work permit system, cleaning, inspections, emergency procedures) Housekeeping- Preventing accumulation of dust. Any accumulation greater than 3.2 mm (1/8" approximate thickness of a dime) over 5% of a work area needs to be cleaned
    - Communicate to workers their role in the implementation and train them on the program elements, including hazard awareness, specific safe work procedures, and inspection and emergency procedures.

[2] http://www2.worksafebc.com/i/posters/2012/ha2012-08_dust_winter_alert.html

Additional Resources

NFPA consensus standards related to this hazard are:
• NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
• NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
• NFPA 484, Standard for Combustible Metals
• NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
• NFPA 655, Standard for the Prevention of Sulfur Fires and Explosions
• NFPA **77** *Recommended Practice on Static*
• NFPA 91 *Standard for Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids*

• See www.nfpa.org to view NFPA standards.

http://www.csb.gov/assets/1/19/Dust_Final_Report_Website_11-17-06.pdf

Combustible Dust: An Insidious Hazard (video)
http://www.csb.gov/videos/combustible-dust-an-insidious-hazard/

http://www.worksafebc.com/news_room/features/2012/assets/pdf/WoodDustMitigationControlAudit.pdf

For information on Wood Dust in Sawmills:

Compilation of Industry Best Practices see
http://www.worksafebc.com/news_room/features/2012/assets/pdf/WoodDustSawmillsCompilation.pdf