Combustible Dust

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Any combustible material which is finely divided (dust form) poses a hazard. Should the material become airborne in a sufficient quantity and in the presence of an ignition source the material can ignite. If this ignition occurs in a confined area (this could be an entire building) it can result in an explosion. Thus a combustible dust explosion requires five elements: oxygen, ignition source, fuel, dispersion and confinement. Should any of those elements be removed, an explosion cannot occur. (Note: should confinement be removed, a devastating fireball can still occur.)

Generally the initial explosion causes other collections of dust to be dislodged, putting more dust into the air, allowing secondary explosions to occur. The lower explosive limits (LEL) for combustible dusts typically range from 10 g/m$^3$ to 500 g/m$^3$; however you should never exceed a level greater than 25% of the LEL for your specific dust(s). In typical workplaces dusts levels would not approach 25% of the LEL outside of the production/processing equipment; unless accumulations of dust are disturbed and suspended in the air. Since such disturbances do occur, it is critical that you work on controlling the generation and accumulation of combustible dust.

Combustible dust explosion hazards exist in a variety of industries, including: agriculture (corn, soybeans, oats, wheat, rye, etc.), chemicals, food (e.g., candy, sugar, spice, starch, flour, feed), fertilizer, tobacco, plastics, wood processing, paper, pulp, rubber, textiles, pesticides, pharmaceuticals, coal, metal processing (e.g., aluminum, chromium, iron, magnesium, and zinc), recycling operations and fossil fuel power generation (coal).

Indicators of a Problem
The primary sign of a problem is the accumulation of dust both in the open and in hidden areas (in false ceilings, inside equipment and electrical boxes for example). “Accumulation” does not mean a specific amount of dust. It could be a fine coating of dust on a surface which could become airborne in sufficient concentration to become ignited.

Control Measures
• Implement a dust inspection, control, mitigation and housekeeping program
• Modify processes to minimize generation of dust or control dust dispersion
  o Effective and properly designed and installed dust collectors are very effective
  o Eliminate openings in equipment that allow dusts to escape
• Remove the accumulation of materials through regular cleaning
  o Utilize surfaces that don’t accumulate dust and allow easy cleaning
  o Establish cleaning schedules to minimize accumulation of dust
  o Vacuuming (using vacuum systems approved for this purpose) is the best means to clean accumulations of dust – do not use compressed air or dry sweeping as it will cause the materials to become airborne and can lead to an explosion
• Eliminate/minimize potential ignition sources through process modifications and effective preventative maintenance
  o Ignition sources include: static electricity, smoking, open flames, sparks, heated surfaces, mechanical sparks and friction internal electrical panel arcing

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Ensure electrical equipment located in areas where dust generation and accumulation are occurring is properly classified for the exposure
Ensure powered industrial trucks used in the area are appropriately listed or approved for the environment

Provide access to hidden areas to allow for routine inspection and cleaning
Follow applicable NFPA standards

Minimize the Potential for Damage
Should elimination of dust generation/accumulation and ignition sources not be possible the organization should take efforts to mitigate the damage should an explosion occur. Mitigation efforts can include:

- Separate the dust generation process (preferably outside) from the remainder of the facility. If any metal is inherent in the production process, the dust collection system should have tramp metal separators.
- Provide appropriately designed explosion venting for the room/process
- Provide spark and fire detection systems
- Provide fire suppression and explosion prevention systems

Train Employees
Employee involvement is critical for the success of your combustible dust control program. Employees should be trained on:

- Importance of housekeeping, Many companies are utilizing 5S or similar controls.
- Proper use and maintenance of the systems generating dust and their respective control systems. This should include information from the manufacturer of the systems.
- Process and procedures to minimize the generation of dust
- Process and procedures for effective housekeeping as well as housekeeping schedules
- Proper use and maintenance of control and mitigation practices
- How to report deficiencies in any of the areas related to combustible dust control

Management Review
A management team should routinely evaluate the dust generation sources and their controls to ensure systems are operating properly. In addition they should evaluate housekeeping and maintenance measures to ensure dust accumulations are prevented and preventative maintenance activities are being properly performed.

The team should also be responsible for the review and approval of process changes or new processes which may increase the generation and accumulation of combustible dust or defeat control or mitigation measures in place.

Sources and Resources:

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
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