

Cherie Berry, Commissioner of Labor

1-800-625-2267 ♦ www.labor.nc.gov

Occupational Safety and Health Division

1101 Mail Service Center, Raleigh, NC 27699-1101

Combustible Dust Poses a Dangerous, Explosive Threat



A fire burns following an explosion of fine plastic powder.

In North Carolina, an explosion of fine plastic powder used in the manufacture of polyethylene products killed six people and injured 38. In Pennsylvania, wood dust in a particle board manufacturing plant explosion killed three and injured 10. In Mississippi, rubber dust exploded in a rubber manufacturing plant, killing five and injuring 11. Also, in Kansas, a series of wheat-dust explosions in a large grain storage facility resulted in the deaths of seven people. Accident investigators in each of these facilities, although different industries, found similar conditions that resulted in a massive, tragic dust explosions.

Your facility may have the same hazard!

How Dust Explosions Occur

In addition to the familiar fire triangle (oxygen, fuel and ignition source), one other element must be present: dispersion of dust particles in sufficient quantity and concentration.

When all of these elements are in place, rapid combustion known as deflagration can occur. If the event is confined by an enclosure such as a building, room, vessel or process equipment, the resulting pressure rise can cause an explosion.

Secondary Explosions Are Catastrophic

An initial (primary) explosion in processing equipment or in areas where fugitive dust has accumulated may dislodge additional dust or damage a collection system (such as a duct, vessel or collector). This dust, if ignited, causes additional explosions, which can result in more severe damage than the original explosion due to increased concentrations and quantities of dispersed combustible dust.

What Industries Are at Risk?

Combustible dust explosion hazards exist in a variety of industries, including:

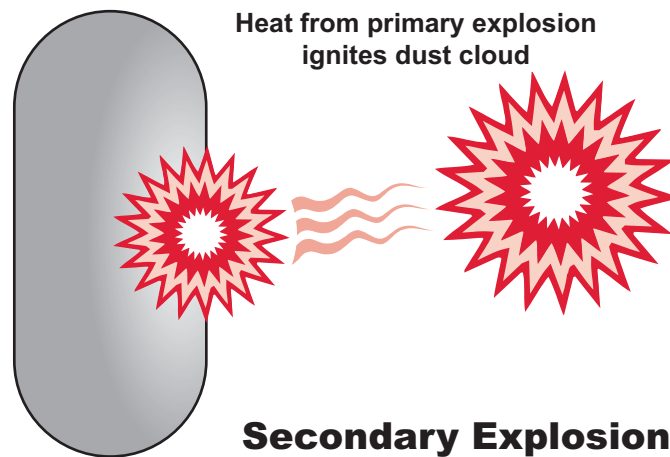
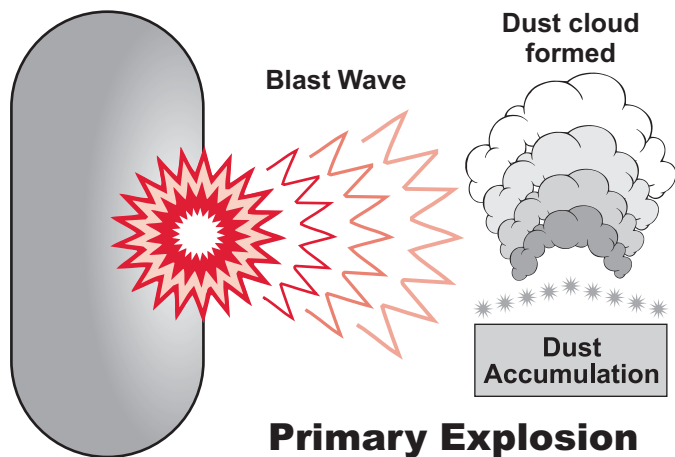
- * Agriculture
- * Chemicals
- * Food (e.g., candy, sugar, spice, starch, flour, feed)
- * Grain elevators, bins and silos
- * Fertilizer
- * Tobacco
- * Plastics
- * Wood processing and storage
- * Furniture
- * Paper
- * Tire and rubber manufacturing
- * Textiles
- * Pharmaceuticals
- * Metal powder processing or storage (especially magnesium and aluminum)

Hazard Assessment

A thorough hazard assessment is essential in identifying and eliminating factors contributing to an explosion. Dusts are generated in various parts of any production process. Explosions can occur within any process where a combustible dust accumulates, is produced or stored, is airborne, and can be triggered by a variety of energy sources. The severity of the resulting explosions is related to the heat released in the combustion of these materials. Only a couple of these dust types spontaneously ignite in air; the majority of them need another source of ignition. Possible ignition sources include:

- * Open flames (welding, cutting, matches, etc.)
- * Hot surfaces (dryers, bearings, heaters, etc.)
- * Heat from mechanical impacts
- * Electrical discharges (switch and outlet activation)
- * Electrostatic discharges
- * Smoldering or burning dust
- * Cigars, pipes and cigarettes

continued on page 2



Prevention

In simple terms, a dust explosion is a very rapid combustion or burning. Reducing any one of the factors necessary to sustain the explosion can prevent it. The primary method for prevention is reducing or eliminating the fuel load with good housekeeping. Good housekeeping in this context is essential for explosion prevention. Dust removal can be accomplished by good ventilation, extraction and removal systems, dust collection systems, and manual housekeeping where automated collection systems cannot reach. In dusty environments, vacuums and other electrical equipment will need to be spark and explosion proof. Compressed air blowers should never be used for the removal of dust. Minor but steady leaks in any production system must be addressed, as these can cause large amounts of dust to accumulate over a period of time, especially if the process runs at a slightly elevated pressure.

Small amounts of dust can create large clouds. Dust will always be present in some processes. The best way to avoid dust accumulation is to be constantly aware of the surroundings. Respect for the hazard and a good housekeeping program are essential in eliminating the explosion hazard.

Training employees to recognize this hazard as an unsafe condition and do something about it can break a link in the chain of events that could lead to an explosion, thereby preventing it.

Applicable OSH Regulations

- * Housekeeping (§1910.22)
- * Hazardous Locations (§1910.307)
- * Hazard Communication (§1910.1200)
- * Electric Power Generation, Transmission and Distribution (coal handling) (§1910.269)
- * Grain Handling Facilities (§1910.272)
- * General Duty Clause (NCGS §95-129(1))

Applicable Consensus Standards

The National Fire Protection Association (NFPA) codes address the combustible dust hazard in many chapters, each based on the particular flammability characteristics of a given dust. NFPA Articles 650–664 discuss controlling and preventing dust explosions in various industries.

Education, Training and Technical Assistance Bureau

1101 Mail Service Center
Raleigh, NC 27699-1101
919-807-2875



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