

NCDOL INDUSTRY ALERT

Division of Occupational Safety and Health

Combustible Dust: A Major Hot Work Hazard

Three contract welders received second- and third-degree burns after a flash fire broke out in a silo that had been used to store wood flour. The welders were torch cutting and welding on the silo to attach a side chute. The silo had not been thoroughly cleaned, and according to witnesses, wood dust was falling onto the floor while work was being performed.

The investigation showed the contract welders were unaware of the hazard created by the residual dust within the silo, that an effective fire protection and prevention plan was not in place, and a hot work permit was not issued before beginning work. In this incident the workers were fortunate. Although there was enough fuel dust for a flash fire, there was not enough for a catastrophic explosion.

Dust fires and explosions are preventable. Operators can prevent these fires by knowing what conditions spark these catastrophic explosions. Five factors contribute to a volatile environment that can lead to an explosion—oxygen, a fuel, ignition source, dust dispersion and confinement.

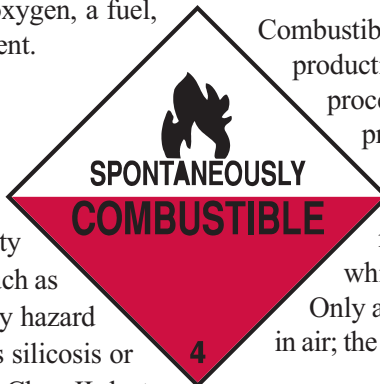
Dust Is a Hazard

Dusts pose a variety of hazards, some of which we are more familiar with than explosivity. Common hazards may include reduced visibility and slippery surface conditions. Some dusts such as asbestos and silica present a serious respiratory hazard and can cause long-term health effects such as silicosis or asbestosis. Combustible dusts are identified as Class II dusts. The variety of combustible dusts makes it difficult for a brief discussion. Areas within facilities where combustible dusts are manufactured, processed or produced are considered Class II locations according to the National Electrical Code. Class II locations require electrical equipment approved for that type of location.

Dust Hazards Can Be Found in N.C.

North Carolina is home to many industries and locations where the hazard of combustible dust can be commonly found. These include:

- Wood processing and furniture manufacturing
- Grain elevators, bins and silos
- Flour and feed mills
- Manufacture or storage of metal powders such as magnesium and aluminum
- Chemical production
- Plastic production
- Starch or candy producers
- Spice, sugar and cocoa production or storage
- Coal handling or processing areas
- Pharmaceutical plants
- Dust collection bins or bags
- Overhead beams, horizontal surfaces, inside of equipment and above false ceilings



Combustible dusts can be generated in various parts of the production process. Explosions can occur within any process where a combustible dust accumulates, is produced or stored, or is airborne. A variety of energy sources can trigger a dust explosion. The severity of the resulting explosion is related to the rapid burning of dust particles, which leads to the rapid release of energy (as heat). 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

Hazard Assessment

A thorough hazard assessment is essential to identify and eliminate factors contributing to dust fires and explosions. Ask yourself questions such as the following when you consider working at your facility or another facility where you may perform hot work activities such as welding, cutting or grinding.

- Have you been informed of any unusual hazards that may be present in the area?
- Has an assessment of the worksite been conducted to determine if hot work activities could create a fire or explosion hazard?
- Has a hot work permit been issued if necessary, before beginning work?
- Has the area been adequately cleaned of residual combustible dust?
- Is vacuuming used whenever possible rather than blowing or sweeping combustible dust?
- Are the electrical equipment and tools used in the area

where combustible dust is present, approved for use in a Class II location (i.e., installation of intrinsically safe (I.S.) apparatus, wiring and systems for Class I, II and III locations)?

- Are accumulations of combustible dust routinely removed from elevated surfaces including the overhead structure of buildings, false ceiling, shelves, etc.?
- Is metallic or conductive dust prevented from entering or accumulating on or around electrical enclosures or equipment?
- Where may dust accumulate that we have not considered in this production process?
- Wood dusts can decay and create their own heat as a possible source of ignition. Has this possibility been addressed?

Prevention

Investigators at the accident mentioned above, determined that the fire, like most accidents, resulted from a chain of events that together created the potential for a combustible dust explosion. Workers must be adequately trained to recognize the five conditions previously mentioned which together create an unsafe workplace. When the hazard is recognized, steps can be taken to break a link in the chain of events leading to an explosion, thereby preventing 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 need to be approved for Class II locations.

Compressed air 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. The best way to avoid dust accumulation is to be constantly aware of the surroundings. Even small amounts of dust can create large clouds. Dust will always be present in some processes. Respect for the significance of this hazard, a good housekeeping program, and thorough employee training are essential in eliminating the explosion hazard.

Applicable Regulations

The National Fire Protection Association codes address the combustible dust hazard in many chapters, each based on the particular flammability characteristics of a given dust. NFPA Articles 651–664 discuss controlling and preventing dust explosions in various industries. NFPA Standard 51B addresses controlling hazards associated with hot work.

Available Resources

The OSH Division’s Consultative Services Bureau provides free services to employers around the state. See the Web site www.nclabor.com/osha/consult/consult.htm for information on the program and to download a request form.

Federal OSHA Web site: www.osha.gov

Disclaimer

This industry alert provides general information about the types of combustible dusts and their characteristics. Information about a specific substance should be considered before any decisions are made in a specific situation.

Photocopying and wide dissemination of this publication is encouraged.

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