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DUST CONTROL

OSHA has commenced rulemaking to develop a combustible dust standard for general industry. Combustible dust can cause catastrophic explosions like the 2008 disaster at a sugar refinery that killed 14 workers and seriously injured dozens more. Deadly combustible dust fires and explosions can be caused by a wide array of materials and processes in many industries. Materials that may form combustible dust include wood, coal, plastics, spice, starch, flour, feed, grain, fertilizer, tobacco, paper, soap, rubber, drugs, dyes, certain textiles, and metals. Combustible dust is loosely defined as material capable of passing through a U.S. No. 40 standard sieve. While several OSHA standards address aspects of this hazard, the Agency does not have a comprehensive standard that addresses combustible dust. In situations where OSHA has not developed specific standards, employers are responsible for complying with the OSH Act's General Duty Clause (Section 5.a.1). The General Duty Clause states that each employer "shall furnish… a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." The following elements are necessary for OSHA to cite a General Duty Clause violation:

- Employees are exposed to a hazard;
- The hazard is recognized;
- The hazard is likely to cause death or serious physical harm; and
- There is a feasible and useful method to correct the hazard.

OSHA has subsequently included combustible dust as meeting the definition of a hazardous chemical in the Hazard Communication standard; combustible dust hazards must be addressed on labels and SDSs by 2015. Label elements include the signal word "warning" and the hazard statement "May form combustible dust concentrations in the air". The ease of ignition and severity of combustible dust explosion are typically influenced by particle size. Finer particles are more explosive because they have large surface areas relative to their weight, allowing them to rapidly react with oxygen when dispersed in air and ignite. Combustible dusts with an average particle size smaller than 420 microns are considered by most sources to be explosive unless testing proves otherwise. To put the size of a micron in rough perspective, the particle size of table salt is around 100 microns.

NFPA defines dust categories as:

- Green material: Wood particulate that has an average moisture content equal to or greater than 25 percent by weight

- Deflagrable wood dust: Wood particulate that will propagate a flame front, thus presenting a fire or explosion hazard, when suspended in air, or the process-specific oxidizing medium over a range of concentrations, regardless or particle size or shape; wood particulate with a mass median particle size of 500 microns or smaller (ie: material that will pass through a US No. 35 standard sieve), having a moisture content of less than 25 percent.

- Dry Nondeflagrable wood dust: Wood particulate with a mass median particle size greater than 500 microns (ie: material that will not pass through a US No. 35 standard sieve), having a moisture content of less than 25 percent.

Even seemingly small amounts of accumulated dust can cause catastrophic damage. According to the NFPA, a catastrophic explosion can occur from as little as 1/32 of an inch of accumulated dust (around the thickness of a dime) covering just 5 percent of a room's surface. Per NFPA a deflagration hazard is deemed to exist where the layer of accumulated fugitive deflagrable wood dust on upward facing surfaces exceeds 1/8" over 5% of the area or 1,000 sq. ft. whichever is smaller. Per NFPA, fire and deflagration hazards shall be deemed nonexistent where only green material is collected or conveyed and construction of the equipment handling and storing the material is all noncombustible.

Like all fires, a dust fire occurs when fuel (the combustible dust) is exposed to heat (an ignition source) in the presence of oxygen (air). Removing any one of these elements of the classic fire triangle eliminates the possibility of a fire. A dust explosion requires the simultaneous presence of two additional elements – dust suspension and confinement. Suspended dust burns more rapidly and confinement allows for pressure buildup. Removal of either the suspension or the confinement elements prevents an explosion, although a fire may still occur. There are two types of dust explosions, primary and secondary. Secondary explosions are often the most damaging. A primary dust explosion occurs when a dust suspension within a room is ignited and explodes. The pressure wave from the first (or primary) explosion often shakes loose dust from flat building surfaces forming a cloud that can be ignited by the flame following it (the secondary explosion). The Chemical Safety Board says the best way to prevent secondary dust explosions is to minimize dust accumulations. Ensuring good housekeeping, designing and maintaining equipment to prevent dust leaks, using dust collectors, eliminating flat surfaces and other areas where dust can accumulate, and sealing hard to clean areas can effectively prevent secondary dust explosions. Using proper equipment and techniques to clean combustible dust are essential, for example minimizing dust clouds and making sure that vacuum cleaners are approved for combustible dust locations.

The CSB notes that some incidents involved dust explosions that spread through pipes or vent ducts, from one piece of equipment to other equipment or other areas of the facility. In many cases, the pressure can increase as the explosion moves from one location to the next, increasing the damage. The NFPA standards for dust collectors consider the risk of

propagation, with recommendations to provide isolation valves or distance to minimize chances of a dust explosion spreading to areas where workers may be present.

The following two pages represent a checklist for a combustible dust program and the minimum requirements for design. Any fluctuations from these requirements require a written recommendation be made.

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CHECKLIST FOR A COMBUSTIBLE DUST PROGRAM

- Dust hazard assessments
    - OSHA recommends that facilities carefully identify the following to assess their potential for dust explosions. A qualified team of managers should identify the following to assess their facilities potential for dust explosion:
        - Materials that can be combustible when finely divided;
        - Processes which use, consume, or produce combustible dusts;
        - Open areas where combustible dusts may build up;
        - Areas requiring special electrical equipment classification (Class II locations) due to the presence (or potential presence) or combustible dust;
        - Hidden areas where combustible dusts may accumulate;
        - Means by which dust may be dispersed in the air; and
        - Potential ignition sources (for example, welding, cigarettes, hot surfaces, and electrical/switch/outlet activation).
    - Controlling Dust
        - Implement a hazardous dust inspection, testing, housekeeping and control program;
        - Use proper dust collection systems and filters;
        - Minimize the escape of dust from process equipment or ventilating systems;
        - Use surfaces that minimize dust accumulation and facilitate cleaning;
        - Provide access to all hidden areas to permit inspection;
        - Inspect for dust residues in open and hidden areas at regular intervals;
        - If ignition sources are present, use cleaning methods that do not generate dust clouds;
        - Use only vacuum cleaners approved for dust collection; and
        - Locate relief valves away from dust deposits.

- Ignition control
    - Use appropriate electrical equipment and wiring methods;
    - Control static electricity, including bonding of equipment to ground;
    - Control smoking, open flames, and sparks;
    - Control mechanical sparks and friction;
    - Use separator devices to remove foreign materials capable of igniting combustibles from process materials;
    - Separate heated surfaces and heating systems from dusts;
    - Select and use industrial trucks properly;
    - Use cartridge activated tools properly; and
    - Use an equipment preventative maintenance program.
- Injury and damage control
    - Separation of the hazard (isolate with distance);
    - Segregation of the hazard (isolate with a barrier);
    - Deflagration isolation/venting;
    - Pressure relief venting for equipment;
    - Directing vents away from work areas;
    - Specialized fire suppression systems;
    - Explosion protection systems;
    - Spark/ember detection for suppression activation;
    - Emergency action plan development; and
    - Maintenance of emergency exit routes

Workers are the first line of defense in preventing and mitigating fires and explosions. The people closest to the source of the hazard can be instrumental in recognizing unsafe conditions. Employees with hazardous chemicals (including combustible dusts) in their workplaces are required to comply with 29 CFR 1910.1200, the Hazard Communications Standard. This includes having labels on containers of hazardous chemicals, using safety data sheets, and providing employee training. Initial and refresher training shall be provided to employees who are involved in operating, maintaining and supervising facilities that handle

combustible particulate solids. Initial and refresher training shall ensure that all employees are knowledgeable about the following:

(1) Hazards of their workplace

(2) General orientation, including plant safety rules

(3) Process description

(4) Equipment operation, safe startup and shutdown, and response to upset conditions

(5) The necessity for proper functioning of related fire and explosion protection systems

(6) Equipment maintenance requirements and practices

(7) Housekeeping requirements

(8) Emergency response plans

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Dust collection system design requirements

All ductwork shall be sized to provide the air volume and velocity necessary to keep the duct interior clean and free of residual material. The air material separator and ductwork must be of noncombustible materials with the exception of the filter media which shall be permitted to be constructed of combustible materials. The last pickup to the duct should be at least 20' from the duct building exit. The silo/hopper bottom shall be sloped. The collector shall be equipped with blast panels. Access doors or openings shall be provided to permit inspection, cleaning and maintenance.

Ducts shall be protected per the following:

Ducts with a fire hazard: Ducts conveying dry material released by equipment (five major machine or more operating at the same time) shall be designed and constructed in accordance with one of the following:

- Equipped with a listed spark detection and extinguishing system installed downstream from the last material entry point and upstream of any collection equipment.
- Equipped with a listed spark detection system actuating a high-speed abort gate, provided the abort gate can operate fast enough to intercept and divert burning embers to atmosphere before they can enter any collection or storage equipment.

Recycling of air material separator exhaust for processing of dry wood to building shall be permitted only if the following conditions are met:

- For dust collection systems of capacity less than or equal to 5000 cfm the system should have a spark detection and extinguishing system installed.
- For dust collection systems of capacity greater than 5000 cfm, the system shall be equipped with a listed spark detection and extinguishing system located on the duct upstream from the dust collector and downstream from the last material entry point and the exhaust air duct conveying the recycled air back to the building shall be equipped with a high-speed abort gate activated by the spark detector and provided with a manual reset.

A documented maintenance and housekeeping program must be in place. The inspection, testing, and maintenance program shall include the following:

(1) Fire and explosion protection and prevention equipment in accordance with applicable NFPA standard

(2) Dust control equipment (no fugitive dust release)

(3) Housekeeping (at least semi-annually)

(4) Potential ignition sources (must follow hot work permit program)

(5) Electrical, process, and mechanical equipment (must clean electrical system at least annually)

Lubrication of bearings and check of fans, blowers, and motors for excessive heat on a periodic basis.