

POWDER & BULK SOLIDS



Combustible Dust: It's Explosive

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The top four reasons people are concerned about combustible dust include: 1. health and safety of employees; 2. fear of a potential OSHA inspection; 3. already had an OSHA inspection; and 4. the possibility of an explosion. All these are valid and legitimate concerns.

It is important to understand exactly what is combustible dust? According to an

OSHA fact sheet, “Combustible dusts are fine particles that present an explosion hazard when suspended in air in certain conditions.” Additionally, NFPA defines combustible dust as “a finely divided combustible particulate solid that presents a flash fire or explosion hazard when suspended in air or the process-specific oxidizing medium over a range of concentrations, (proposed NFPA 652 (3.3.2). However, it is not simply defining a fine dust particle, it is also determining what makes a dust particle combust. Important factors include, but are not limited to, particle size, particle shape, particle aging, triboelectric attraction, hydrogen bonding, and the actual environment. If there is any question on the combustibility of the dust the material must be sent to a certified facility to be tested. In the new Preliminary First Draft Proposed NFPA 652, Standard on Combustible Dusts it states “The owner/operator of a facility with combustible particulate solids and dust shall be responsible to identify, sample, analyze, and test materials to ensure the materials are combustible and the hazards are adequately assessed.” (NFPA 652 4.4.1). Basic testing is known as the “go/no/go” test “yes, it blows up, or no, it doesn’t” as described in ASTM E 1226 Standard Test Method for Explosibility of Dust Clouds. Testing prices ranges from \$350-\$1300 up to \$3850 for a full OSHA NEP Package.

The “layer depth criterion” is another area of concern, according to NFPA is 1/32 in.+ depending on bulk density and total area. (NFPA 654-2013 6.1.3.1). Meaning if there is more than 1/32 in. of material covering a large enough area, there is cause for concern.

Another simpler way to determine whether you have too much fugitive dust is to look at your machinery or floor surfaces. If you cannot see the actual color of your floor or machine you have too much dust. For example, if you have a green machine and cannot see the green color you should clean the area and determine the source of the dust.

In order to have the perfect storm for a combustible dust explosion the three elements of fire must be met, including: fuel, which is the dust; ignition which can be in the form of a spark; and oxygen. Two additional elements are needed to create an actual explosion: dispersion and confinement.

In 2009, OSHA started the formal process of exploring the possibility of issuing a formal combustible dust regulation, a process that typically takes several years. While not having a specific combustible dust regulation, OSHA is still issuing

combustible dust citations using the general-duty clause. OSHA also has a detailed section on its website, www.osha.gov, dedicated to combustible dust including several downloadable reference documents.

NFPA (National Fire Protection Association) is an “International Codes and Standards Organization” that creates voluntary consensus standards. According to OSHA, “These standards are NOT OSHA regulations. However, they do provide guidance from their originating organizations related to worker protection. In some cases, they may be mandated by State or local governments, or individual companies.”

Several relevant NFPA standards related to combustible dust include, but are not limited to:

NFPA 61 Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities. According to NFPA, “NFPA 61 protects lives and property from fires and dust explosions in facilities handling, processing, or storing bulk agricultural materials, their by-products, or other agricultural related dusts and materials.”

NFPA 68 Standard on Explosion Protection by Deflagration Venting. The scope of this standard “applies to the design, location, installation, maintenance, and use of devices and system that vent the combustion gases and pressures resulting from a deflagration within an enclosure so that structural and mechanical damage is minimized.”

NFPA 69 Standard on Explosion Prevention Systems. NFPA 69 covers “the following methods for explosion prevention: control of oxidant and combustible concentrations, predeflagration detection and control of ignition sources, explosion suppression, active isolation, passive isolation, deflagration pressure containment, and passive explosion suppression. Criteria are also provided for installation, inspection, and maintenance of explosion protection systems.”

NFPA 484 Standard for Combustible Metals. Covers metals such as aluminum, magnesium, tantalum, titanium, or zirconium, and considers combustible metal

dust “any finely divided metal 425 microns (40 mesh) or smaller.”

NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids. NFPA states, “This standard presents safety measures to prevent and mitigate fires and dust explosions in facilities that handle combustible particulate solids, which includes combustible dusts, fibers, flocks, flakes, chips, and chunks.”

NFPA 664 Standard for the Prevention of Fires and Explosions on Wood Processing and Woodworking Facilities. “NFPA describes “this standard provides requirements for fire and explosion prevention and protection of industrial, commercial, or institutional facilities that process wood or manufacture wood products in order to protect life, property, and mission continuity.”

Additionally, NFPA is working on a new proposed standard. NFPA 652 Standard on Combustible Dusts, which is scheduled to be released mid 2015. According to NFPA “The overall goal for the new standard will be to determine those fundamental elements that apply across all five current standards – agricultural, combustible metals, general, sulfur, and wood processing/woodworking – and then direct the user to the dust-type specific standard for those requirements unique to that industry sector or dust type.”

As the U.S. Chemical Safety Board reports there have been nine severe combustible dust explosions in various industries including causing 36 deaths and 128 injuries. In addition to these devastating events, such as the Imperial Sugar explosion in Port Wentworth, GA, there are also countless OSHA inspections citing combustible dust as a hazard in the workplace. Again, without a formal combustible dust regulation, OSHA will not turn a blind eye and is using the general duty clause in issuing citations. In reviewing many of the public “Citation and Notification of Penalty” it is clear OSHA is referencing various NFPA standards merging both the regulatory agency power with voluntary consensus standards. For example, in one citation OSHA specifically states “Among other methods, one feasible and acceptable abatement method to correct this hazard is to design and install a dust collection system that complies with generally accepted guidelines such as NFPA 484 Standard

for Combustible Metals.”



Common combustible dust related citation focus on area such as “excessive accumulation of dust” or allowing “electrical components such as motors and drop lights to be subject to the accumulation of combustible dust.” Additional citations note “Failing to provide appropriate personal protective equipment and monitoring workers for exposure to hazards such as combustible dust puts them at an unacceptable risk for injury and illness.”

Creating dust dispersion as referenced earlier has also been a focus on OSHA inspections. In one case a citation references “housekeeping” and references NFPA 664 (2012) 11.2.1.1 “Surfaces shall be cleaned in a manner that minimizes the generation of dust clouds.” This means no vigorous sweeping thus creating dust clouds unless the area in question has already been vacuumed.

Another citation of interest was brought about by a NEP (National Emphasis Program) on noise which brought the attention of OSHA to one particular facility. It is interesting to note out of 25 citations issued 19 were related to combustible dust. This citation ended with OSHA stating "This inspection identified a broad range of hazards that, if left uncorrected, expose workers to combustible dust hazards," said OSHA's acting area director. "Employers cannot wait for an OSHA inspection to identify the hazards that expose their employees to serious injury." It is worth remembering once OSHA enters a facility they do not put on blinders.

AHJ (Authority Having Jurisdiction) is also an important player. Authority having jurisdiction is typically local, state, federal, or other regional government official,

including but not limited to: fire marshal, building inspector, labor department, health department, other local and state authorities, or insurance inspector.

Insurance companies can be a valuable resources and FM Global has a data sheet 7-76 Prevention and mitigation of combustible dust. This data sheet describes recommended preventive measures to reduce the frequency of combustible dust explosions, and protection features to minimize damage from a combustible dust explosion.

Prevention measures include everything from properly functioning dust collection system with additional features, depending on size including, but not limited to, abort gate, spark detection system, and explosion protection venting/suppression to housekeeping. Housekeeping might very well be one of your first lines of defense and should be proactive rather than reactive. If you see dust, do not ignore it. Clean it up and examine sources. Seal openings to prevent the release of fugitive dust. Inspect the entire workplace: consider overhead beams, electrical cable trays, lighting fixtures, and “invisible” areas such as areas above suspended ceilings. These are all areas where fugitive dust will settle and if left unchecked could be the sources of secondary dust explosions as occurred with the Imperial Sugar explosion.

Lastly, and most important, is ensuring employees are well educated on the hazard as well as preventive measures surrounding combustible dust. “Safe work habits are developed and do not occur naturally.” as stated in NFPA 652 (A.8.4.2.1) reminds us of the important of training. Do the workers know what to do? Have they read the operating procedures? Do they understand the procedures? Have they been tested? Has the training been documented?

While there is no specific combustible dust regulation there is plenty to be concerned about: OSHA, U.S. Congress, NFPA, AHJ, Insurance Co., and, most importantly, the safety of the employees and the workplace.

Jamison Scott serves as executive vice president of Air Handling Systems, a third-generation family-owned business in Woodbridge, CT. Jamison has presented several combustible dust seminars and has authored several combustible dust articles. For more information, visit www.airhand.com .

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References/Resources

ASTM International ASTM E1226 - 12a, Standard Test Method for Explosibility of Dust Clouds: www.astm.org/Standards/E1226.htm

FM Global Insurance Company - Loss Prevention Data Sheet 7-76, Prevention and Mitigation of Combustible Dust Explosions and Fires:

www.fmglobal.com/fmglobalregistration/Vshared/FMDS0776.pdf

OSHA – Occupational Safety & Health Administration:

<https://www.osha.gov/dsg/combustibledust/index.html>

NFPA – National Fire Protection Association

NFPA 61 Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities: www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=61

NFPA 68 Standard on Explosion Protection by Deflagration Venting:

[www.nfpa.org/codes-and-standards/document-information-pages?](http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=68)

[mode=code&code=68](http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=68)

NFPA 69 Standard on Explosion Prevention Systems: www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=69

NFPA 484 Standard for Combustible Metals: www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=484

NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids:

[www.nfpa.org/codes-and-standards/document-information-pages?](http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=654&DocNum=654)

[mode=code&code=654&DocNum=654](http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=654&DocNum=654)

NFPA 664 Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities: www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=664&DocNum=664

[document-information-pages?mode=code&code=664&DocNum=664](http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=664&DocNum=664)

NFPA 652 (Proposed) Standard on Combustible Dusts: www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=652&docnum=652

NFPA Guide to Combustible Dusts, Authors Walter L Frank, P.E. & Samuel A.

Rodgers, P.E. Editor Guy R Colonna, P.E. Published by NFPA, copyright 2012.

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