Get ready for NFPA 652: The new combustible dust standard

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This NFPA committee member and dust collection expert summarizes what you most need to know about NFPA 652, the new combustible dust standard slated for publication next year.

A new combustible dust standard from the National Fire Protection Association (NFPA) is on its way. Scheduled for release in 2015, *NFPA 652: Standard on Fundamentals of Combustible Dusts* will cover the fundamentals of recognizing and managing combustible dust hazards and help overcome the problems in following the current NFPA combustible dust standards for specific applications.[1, 2]

OSHA, NFPA, and combustible dust hazards

Many of us think the catastrophic 2008 explosion at the Imperial Sugar plant in Georgia, which left 14 dead and 36 injured, triggered the current government emphasis on the risks of combustible dust hazards. But this event was just the final straw in the growing national awareness of these risks between 2002 and 2007, when several dust explosions in US plants resulted in 25 deaths. Surprising as it seems now, the *only* OSHA rules for handling combustible dusts at the time covered the agricultural industry. In 2007, increasing public concern about dust explosion risks led OSHA to issue its first National Emphasis Program (NEP) directive for facilities in various industries that handle or generate combustible dusts. Then, after the Imperial Sugar explosion just a few months later, OSHA issued an updated NEP directive.[3]

This March 2008 directive is essentially a set of instructions for OSHA inspectors and agents on how to inspect facilities where combustible dust hazards are thought to exist. The directive also states that NFPA standards "should be consulted to obtain evidence of hazard recognition and feasible abatement methods." By this statement, OSHA makes NFPA's published standards the backbone of its enforcement tools for managing combustible dust hazards. Since issuing the NEP directive, OSHA hasn't made significant progress in developing its own combustible dust rules or standards, nor is it likely to do this in the near future. That's why the NFPA standards remain the basis for managing combustible dust hazards.

The need for a new NFPA standard

Right now, NFPA standards on combustible dust hazards cover specific industries or commodities. For instance, there's *NFPA 61: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, NFPA 484: Standard for Combustible Metals,* and *NFPA 664: Standard for the Prevention of Fires and Dust Explosions in Wood Processing and Woodworking Facilities.* Another — *NFPA 654: Standard for the Manufacturing, Processing, and Handling of Combustible Particulate Solids* — is more general. But users trying to follow the applicable standards to manage their combustible dust hazards have found conflicting information, factual discrepancies, and unclear or inadequate explanations in them.

These problems have led NFPA to develop the new standard, *NFPA 652: Standard on Fundamentals of Combustible Dusts,* which will apply to *all* industries with combustible dust hazards. It will provide the fundamentals of combustible dust management: the basic principles of and requirements for identifying and managing the fire and explosion hazards of combustible dusts and particulate solids.

How NFPA 652 will apply

NFPA 652's purpose is to provide the minimum general requirements for managing combustible dust hazards and to direct users to the appropriate NFPA standards for a specific industry or commodity. The new standard will apply to all facilities and operations that generate, manufacture, process, handle, or repackage combustible dusts, with exceptions for retail facilities, households, and similar locations.

But because users will still need to comply with the other specific standards, there will be conflicts. What are the rules for handling these conflicts? When a requirement in an industry- or commodity-specific standard differs from that in NFPA 652, the specific standard's requirement will be applied. And when the specific standard prohibits a particular NFPA 652 requirement, again, the specific standard will be applied. When no industry- or commodity-specific standard applies or prohibits a particular NFPA 652 requirement, NFPA 652 will be applied.

The highlights

The following highlights briefly summarize the parts of NFPA 652 that are most important to bulk solids users like you. By checking them out now, you'll get a headstart in learning the new standard's requirements for recognizing and managing combustible dust hazards. [***Editor's note:*** The information in chapters 1 and 2 isn't summarized here because it doesn't include requirements.]

First, a word about the standard's *retroactivity.* As with the previous NFPA standards, NFPA 652's requirements generally will not apply retroactively, with one major exception that relates to OSHA's combustible dust NEP: The requirements *are retroactive* if OSHA, your local fire marshal, or another authority having jurisdiction (AHJ) deems they are. In addition, certain portions of NFPA 652, including the management of change, housekeeping, training, maintenance, and documentation requirements, are retroactive for all existing and new facilities, while chapter 7's dust hazards analysis (DHA) requirements will be phased in for existing facilities over a 3-year period.

Chapter 3: Definitions. This chapter defines many terms related to managing combustible dust so that users will have the same understanding of them. Here are definitions for a few critical terms — *combustible dust:* 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; *combustible particulate solid:* any solid material composed of distinct particles or pieces, regardless of size, shape, or chemical composition, that, when processed, stored, or handled in the facility has the potential to produce a combustible dust; *dust deflagration hazard:* the presence of explosible dust that is suspended in an oxidizing medium in concentrations at or above the dust's minimum explosible concentration (MEC) or the presence of accumulations of explosible dust where a means of suspending the dust (such as cleaning with compressed air) is present; and *threshold housekeeping dust accumulation:* the maximum quantity of dust permitted to be present before cleanup is required.

Chapter 4: General requirements. This chapter sets out the responsibilities of the facility's owner or operator (that is, the entity with overall responsibility for the facility), including determining whether the material is a combustible dust hazard (by testing) and what hazards exist (by developing the DHA), and then communicating these hazards to affected personnel, such as employees, contractors, and visitors.

Chapter 5: Hazard identification. Information in this chapter will help the facility owner or operator determine if the material is combustible — and, if so, to what degree — *before* assessing how to manage the hazard. Detailed information explains how to test a representative material sample for various explosibility values, including, at minimum, K_{St}, P_{max}, minimum ignition energy (MIE), and MEC, with specifics on running inexpensive *go/no-go* tests to determine whether the material is explosive at all. However, for the first time in an NFPA standard, the owner or operator can base these explosibility values on historical (published) data *if* the data truly represents the material and process conditions. The chapter cites an appendix (included at the standard's end) that lists explosibility characteristics for various materials, but even when no previous explosions of a given material have occurred, this fact can't be used to determine that the material isn't combustible. The requirement to retain all explosibility test and related documents is also covered.

Chapter 6: Performance-based design option. This chapter covers what's called *performance-based design,* the often-forgotten alternative to prescriptive solutions (such as explosion venting, suppression, or isolation) for managing or mitigating combustible dust hazards. When followed correctly, the requirements in this chapter provide a means of successfully managing or mitigating the combustible dust hazard without using a prescriptive method (covered in chapter 8). The design option can be used when a prescriptive method is either not applicable or feasible, as well as when the facility's owner or operator deliberately chooses this option. The chapter explains that the owner or operator must determine the qualifications of the party who implements the design option to be acceptable. Be aware that using this approach still requires documentation in a form acceptable to the AHJ, and, when the AHJ requests it, the owner or operator must provide enough documentation to support the proposed design method's validity, accuracy, relevance, and precision.

Chapter 7: Dust hazards analysis. This chapter covers the hazard analysis that the facility's owner or operator *must* complete when a material is identified as combustible. (NFPA now calls this analysis a *dust hazards analysis [DHA],* replacing the previous term, *process hazards analysis [PHA],* to distinguish the narrower requirements of assessing combustible dust hazards from the PHA's more general requirements.) Completing the DHA is required — *not* an option — for any facility handling a combustible dust, because the only way to manage or mitigate a combustible dust hazard is to first determine the hazard's scope. More requirements: The DHA must be conducted or led by a qualified person (or persons), but the facility's owner or operator ultimately responsible for the DHA must determine who is qualified to do it; the DHA must be fully documented; and the owner or operator must complete a new DHA or revise the existing one if any process involved in the DHA changes. A step-by-step example of how to complete a DHA is provided in an appendix. As previously stated, the DHA is one of the requirements that's *retroactive.* While it applies to both existing and new facilities, existing facilities have 3 years to comply as long as they demonstrate progress during that time and don't wait until the last minute.

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Chapter 8: Hazard management — mitigation and prevention. In this chapter, requirements for mitigating and preventing combustible dust hazards are discussed in detail. The requirements cover a wide range of hazard management methods, such as equipment design, housekeeping, ignition source control, dust control, explosion prevention and protection, and fire protection. This extensive chapter deserves an in-depth review, but following are the key requirements affecting you and other bulk solids users:

Documented risk assessment: A documented risk assessment acceptable to the AHJ will be permitted for various hazards covered in this chapter. This assessment, which usually is included as part of the DHA, determines a hazard's *level* (that is, the degree of risk the hazard involves) to help users determine which hazards require more attention or must be addressed first. The documented risk assessment will also help users select a method for managing or mitigating each hazard.

Building protection: Each building or building compartment where a dust explosion hazard exists must be protected (for instance, by construction method or explosion venting) from the explosion's consequence.

Dust-buildup prevention: When a combustible dust is present in a building or area, the building or area must be designed to minimize dust accumulations and facilitate cleaning — for instance, by eliminating structures with ledges, uncovered joists and beams, and other hard-to-access surfaces where dust can collect.

Separation: The exposure of personnel, equipment, and property to a combustible dust hazard must be minimized by separating or segregating them from the hazard with physical barriers and other methods.

Containment: In an enclosed system handling a combustible dust, the components must be designed to prevent the dust's escape except for normal intake and discharge of air or material (or both) at inlets and outlets. If it's not feasible or safe to design the components this way, the system *must include dust collection.*

Any dust-handling system: For any dust collection, pneumatic conveying, or central vacuum cleaning system handling a combustible dust, several requirements apply: The system must be designed and installed by a qualified person (or persons) as determined by the facility owner or operator. Any changes to the system must be made according to management of change requirements (covered in chapter 9). The system must be designed to ensure that the air velocity through it meets or exceeds the *minimum* required to keep the piping or ducting interior surfaces free of dust accumulations under *all* normal operating modes. If the system's air-material separator, such as a filter-receiver, dust collector, or cyclone, has an enclosure (dirty-side) volume greater than 8 cubic feet, the enclosure must be protected against an explosion's effects by a valid protection method, such as explosion venting, suppression, or containment. And, as *NFPA 69: Standard on Explosion Prevention* requires, when an explosion hazard exists with any of the system's operating equipment (as it does in almost any dust-handling system), isolation devices *must be provided* on equipment to prevent an explosion from propagating between connected equipment in the system.

Dust collection systems: At each dust pickup point (that is, dust-capture hood), the dust collection system must be designed to achieve the minimum air velocity required for the dust's capture, control, and containment. Each dust pickup point must have a documented minimum airflow based on the system's design. Branch ducts must not be disconnected, and the system's unused ducts must not be blanked off, without providing a means for maintaining the system's required air velocity and airflow balance. Advice in the chapter's appendix recommends against using slide (or blast) gates for controlling system airflow because they allow workers to make uncontrolled airflow volume changes that can lead to improper system airflow balance and dust accumulation in ducts; the appendix details system design strategies for controlling airflow balance and duct air velocities, even when airflow to a dust source must be managed, without using such gates. Branch ducts must not be added to the system without first confirming that the entire system will maintain the required air velocity and airflow balance when a branch duct is added.

Central vacuum cleaning systems: The central vacuum cleaning system (which typically consists of a central tubing network extending from a vacuum power unit to multiple operator stations equipped with flexible hoses and vacuum tools) must be designed to provide minimum dust-conveying velocities *at all times,* whether it's being used by one or multiple operators. To ensure that the system can provide adequate conveying velocity, no more than two hose operators at a time should be allowed on one tubing line. To allow more than two operators to use the system simultaneously, the system can have multiple tubing lines connected to the air-material separator. The system's hoses must be specified with a diameter typically from 1.5 to 2 inches and a maximum length of 25 feet. The flexible hoses and tools must dissipate static or be conductive and grounded.

Air-material separators: The air-material separator should be located outdoors, but if that isn't feasible, it must be properly protected from both fire (when applicable) and explosion. However, if its dirty-side enclosure volume is less than 8 cubic feet, the air-material separator doesn't require explosion protection.

Recycling cleaned air: Returning or recycling the clean air from the air-material separator to the processing system is allowed but only with proper safety measures, such as using isolation or fire protection devices just after the air-material separator. To protect against a failed filter in the air-material separator, secondary filtration or filter-leak detectors should also be installed downstream from it.

Housekeeping: The facility's owner or operator must develop a permissible threshold level for dust accumulations (called the *threshold housekeeping dust accumulation*) in the plant so that housekeeping methods and frequency can be established to minimize explosion hazards and to facilitate required housekeeping documentation. The chosen cleaning methods must minimize the potential for creating a dust cloud (for instance, using vacuum cleaning to remove dust from surfaces rather than blowing it off with compressed air). Compressed-air cleaning can be used *only* after taking precautions, including — but not limited to — using compressed air at a maximum pressure of 30 psig, precleaning the area before using compressed-air blow-off, and cleaning with compressed air only when the area contains no ignition sources.

Ignition source control: Ignition sources that represent an explosion risk will require mitigation to minimize that risk. Ignition source examples are hot work, hot surfaces, static electricity, bearings, electrical wiring, grounding, and others. Users will need to closely examine this information to determine whether any of these ignition sources are present in the plant.

Bulk bags: Certain materials, especially those with a low MIE, such as sulfur, can be explosion hazards as they're loaded into or discharged from bulk bags (also called *flexible intermediate bulk containers [FIBCs]*). Information here will help users choose a bulk bag that can handle a high-risk material.

Enclosures: In enclosures with explosion hazards, such as dust collectors, bucket elevators, and silos, the hazards must be managed or mitigated by one or more prescriptive methods, as defined in NFPA 69 and *NFPA 68: Standard on Explosion Protection.*

Operating equipment: When an explosion hazard exists in any operating processing, handling, or dust collection equipment, the equipment must include isolation protection measures to prevent an explosion from propagating through the entire system.

Fire protection: In some industries, such as wood processing, fire is a greater risk than an explosion. The facility's DHA will determine that fire protection is required and what method is best suited to mitigating the fire risk.

Chapter 9: Management systems. The requirements in this chapter cover management systems for combustible dust hazards and *apply retroactively* to all new and existing facilities. Management systems are typically written explosion protection procedures, training, and other documentation for all activities involving combustible dust. Examples are equipment operation procedures; training procedures for employees, contractors, and visitors; and housekeeping procedures. An important requirement is management of change, which is a procedure for predetermining the consequences of making any change to a dust collection system, material handling system, or similar system where a combustible dust hazard exists. This procedure must be documented and followed at any facility with a combustible dust hazard to ensure that system changes don't increase the hazard or create new hazards.

Appendices. NFPA 652's several appendices include information to help users understand and correctly implement the standard's requirements. In the standard's chapters, an appendix is cited with an asterisk (*) to indicate that more information on the topic can be found in the appendix. **PBE**

References

1. All NFPA standards discussed in this article are available at www.nfpa.org.
2. NFPA 652's publication may be delayed if an NFPA member files a *notice of intent to make a motion (NITMAM)* indicating that the member wishes to make a motion amending the standard; find more information at www.nfpa.org.
3. The OSHA National Emphasis Program (NEP) directive on safely handling combustible dusts is available at www.osha.gov/OshDoc/Directive_pdf/CPL_03-00-008.pdf.

For further reading

Find more information on safely handling combustible dusts in articles listed under "Dust collection and dust control" and "Safety" in *Powder and Bulk Engineering*'s comprehensive article index in the December 2013 issue or the Article Archive on *PBE*'s website, www.powderbulk.com. (All articles listed in the archive are available for free download to registered users.) You can also find books and webinars on this topic in the website Store.

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