



652 and You: Challenges to and Solutions for Industry Posed by the Newest NFPA Combustible-Dust Standard

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The new NFPA standard, 652: Standard on the Fundamentals of Combustible Dust, went into effect in September 2015. This standard provides the general requirements for management of combustible-dust fire and explosion hazards and directs the user to NFPA's industry- or commodity-specific standards as appropriate. The latter include NFPA 654, 664, 484, and 61, which coexist side by side with 652. These commodity-specific standards contain some unique acknowledgments and continue to provide more commodity-specific guidance as needed.

652 is a "living document" and will be subject to a periodic review cycle as with other NFPA standards. It assists in addressing perceived discrepancies among the commodity-specific standards and will ultimately serve as the initiating, go-to document for presentation of fundamental knowledge about combustible dust.

Introducing the Dust Hazard Analysis

Chapter 7 of 652 coins and clarifies the term dust hazard analysis (DHA), which serves as a key benefit provided by the standard. Previously, the terms process hazard analysis, dust hazard analysis, and, in some cases, risk assessment had been used interchangeably in the general discussion language. By providing a clear, narrow definition of dust hazard analysis, the authors of the new standard have brought additional attention to the specific purpose of this term and the others to differentiate one from the other.

In NFPA 652, *DHA* replaces the term *process hazard analysis* (PHA), a broader hazards assessment referred to in 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*. 652's DHA requirements for existing facilities are to be complete within three years of the standard's issue date, speak specifically to the dust component of PHA, and are anticipated to be more helpful to industry and more narrowly focused in that regard.

Because so many of the investigation findings conclude that owners/operators appear to be unaware of the hazards posed by combustible particulate solids that have the potential to form combustible dusts when processed, stored, or handled, the standard-writing committee deemed it essential to establish the DHA as a fundamental step in creating a plan for safeguarding such facilities, the introduction to the standard states. It adds that the DHA must be performed by a qualified person, within all new facilities and on all new processes, and will be required for any older, existing process that is modified by more than 25 percent.

Simply put, 652's DHA chapter brings the characteristics and potential hazards of dust more clearly into view, provides a model—though not a prescribed methodology—for what a DHA might look like, and puts forth general DHA requirements for powder-bulk-solids facilities.

Never Fear: Solutions for Six Challenges Faced by Powder-Bulk-Solids Facilities in Implementing 652

It can be anticipated that industries currently following and complying with NFPA 654 will have the least number of adaptations to make to comply with 652, as the latter standard draws heavily from the former. Industries for whom other NFPA standards, such as NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, and NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities, apply, may have more work to do.

Still, the new standard was designed to be informative and useful and to build on the good industrial-engineering principles many companies have already set in place, such as effective housekeeping, hazard communication, change management, and deflagration protection. Any additional challenges posed by 652 can be met through engagement of a purposeful effort.

Challenge #1: Companies that have not performed a DHA on all of their existing processes will need to do so.

Solution: Facilities with few combustible dust hazards and a limited number of operating-equipment components will simply need to familiarize themselves with the DHA requirements, study the DHA models proposed in the standard, prepare, plan, and execute the analysis.

Facilities with numerous combustible dust hazards and perhaps dozens of processes—be they primary output, core-business processes, or ancillary support processes—will need to create a project schedule and follow it with discipline. The project map leading to timely completion will offer the best path to success. With a resource-allocated project schedule in hand, project leaders will be more readily able to determine where the engagement of additional, perhaps third-party, professional combustible-dust experts could be consulted to facilitate and expedite the process.

Challenge #2: Powder-bulk-solids companies will first need to know how to determine if their dust is combustible before assessing how to manage the subsequent hazards.

Solution: Chapter 5, “Hazard Identification,” addresses this concern head-on. The chapter provides a facility owner/operator guidance on how to determine whether dust is combustible or explosable, and what characterization of their properties is required to support the DHA. The supporting data may often include determination for explosibility values, such as rate of pressure rise dP/dT ; dust explosability, including (Kst); maximum pressure of deflagration (P_{max}); minimum ignition energy (MIE); minimum explosible concentration (MEC); and minimum auto-ignition temperature (MAIT). This chapter also answers common questions, such as, “If a material is not known to be combustible, should we assume that it is?” and “If we know that a material is not combustible, should we validate that? Will a validation satisfy an authority having jurisdiction?” (The answer to all three of these questions, as explained in Chapter 5, is yes.) Specific guidance on sampling a dust is provided, and the chapter offers details on what the sampling plan should include. One additional very important take-away from Chapter 5 is worth nothing: the absence of previous incidents shall not be used as the basis for deeming a particulate not to be combustible or explosible. Furthermore, Annex A contains supporting information, additional guidance, and explanatory materials to supplement Chapter 5.

Challenge #3: Companies will need to fully understand a material and changes to its nature while it is handled and conveyed in process equipment to comply with NFPA 652.

Solution: NFPA 652 emphasizes that when a facility takes and tests a sample, that testing should be done according to the facility’s needs, with respect to the hazards at the area from which the sample is extracted. The standard explains how a dust sample at the back end of a process is different from a sample at the front end, and that the respective sampling and testing must be performed accordingly. Similarly, the standard makes clear that a facility’s leadership can assume worst-case hazard characteristics of the various materials being handled as a basis for design. Taking this approach may be a simpler path; however, it may also end up unnecessarily penalizing the company with more stringent protective measures than may have otherwise been required. Either way, the standard emphasizes that knowing in advance what will be done with the test-outcome data is key to devising suitable goals for the purposing of the test, the selection of the test, and the criteria for how the material is prepared.

Challenge #4: In 652, Chapter 8, Section 10 explicitly states that where a fire hazard exists in an enclosure, manual or automatic fire protection means *shall* be provided when at least one of three conditions exists, and facilities will need to comply.

Solution: Fire protection is identified in the other NFPA standards, and it has generally been up to the local authorities to select and prescribe what systems are needed, used, or provided. Existing standards state

that if a facility provides fire protection, that protection shall comply with standards from building codes and practices. The “Fire Protection” section of Chapter 8 in 652, in contrast, directs that “where a fire hazard exists in an enclosure, manual or automatic fire-protection means shall be provided.” This more-assertive wording will impact some companies’ facilities; they may have to make adjustments or outright changes. In order to adequately comply with this requirement, companies will need to pay particular attention to their design strategy; a typical application is the addition of water sprinklers to the interior of equipment enclosures, which is, historically, an area within which manual fire fighting is difficult. Sprinklers, in this case, prove a beneficial addition for preservation of the property and for minimizing exposures of emergency-response personnel. However, not all combustible materials are compatible with water, therefore each application must be assessed and determined as to the best extinguishing media for the hazard.

Challenge #5: Powder-bulk-solids facilities will need to more readily embrace management systems that will improve the company as a whole and make facilities safer for their personnel.

Solution: Companies can better manage change and records using guidance from Chapter 9 of 652, “Management Systems.” The verbiage specifies that “the procedures and training in this chapter shall be delivered in a language that the participants can understand” and includes helpful sections on change management, document retention, and management systems review. The change-management section states that “written procedures shall be established and implemented to manage proposed changes to process materials, staffing, job tasks, technology, equipment, procedures, and facilities” and includes a list of specific items that must be addressed prior to implementing any change. The “Document Retention” section spells out for companies the various types of documents for which a retention plan must be put into place. These change- and document-management sections are very valuable to facilities that have struggled to maintain or locate records for how a process was originally designed, how a piece of equipment was originally specified, when it was bought, how that equipment was intended to operate, or what the safety device attached to a piece of equipment was intended to do. The loss of this type of intelligence can be devastating to a facility in terms of revenue, time, and safety. The information presented in these sections of Chapter 9 can help companies take proactive measures to prevent these types of losses.

Challenge #6: Chapter 9 also asks companies to train and educate facility personnel on the hazards of their processes. Safe work practices, training, and hazard awareness apply not only to employees but also to contractors, temporary workers, and visitors according to the potential risks to which they might be exposed or could cause.

Solution: Responsible parties within the company will be forced to think more deeply about what hazards exist within their facilities and communicate those hazards accordingly to all affected parties. This renewed focus on training will benefit the company from safety and liability standpoints. The section on training and hazard awareness within Chapter 9 states that general safety training and hazard-awareness training for combustible dusts and solids and explosion-protection systems should be provided to all affected employees, contractors, and visitors. “Refresher training” should be offered as well, and all such training must be documented. Additionally, the appendix provides helpful elaboration and pointers to company leadership regarding training, including the eight elements for which training should be provided, and examples of what level of training various employees might require. Perhaps most importantly, the appendix states that thorough background information regarding combustible-dust hazards should be provided to trainees so that they understand the reasons behind the prescribed procedures they are being asked to follow.

When to Bring in Additional Help

NFPA 652’s chapters and extensive appendices provide a wealth of clear, specific guidance and information regarding the fundamentals and handling of combustible dust; however, some companies handling combustible and/or explosible materials may wish to seek additional expert advice on this subject to ensure

compliance. Third-party experts, such as Fike, can provide consultation, services, and equipment related to the following:

- Dust sampling and testing, per ASTM, and identification of the type of risk or exposure that a particular dust creates
- Determining combustibility or explosibility hazards of a facility's materials via deflagration screening tests, explosibility-properties tests, and more
- Hazard-management mitigation and prevention, including explosion prevention and protection in equipment as well as fire protection

Applying and Complying: Industry and NFPA 652

The goals of NFPA 652 include hazard protection; preserving the safety of human lives, equipment, and facilities; and providing a thorough baseline education on the characteristics of combustible dust and its safe handling, storage, and processing. Industry need not view the new standard with apprehension, as it draws heavily from an existing standard, NFPA 654, and supports a number of good industrial-engineering practices that many companies are likely to have in place already. As part of their compliance efforts, companies are reminded to keep the following facts in mind:

- When a requirement in a commodity-specific standard differs from one in NFPA 652, the commodity-specific standard's requirement will prevail.
- Likewise, when a particular commodity-specific standard's requirement prohibits the execution of a NFPA 652 requirement, the commodity-specific standard's requirement will take precedence.
- Local fire marshals and other authorities having jurisdiction (AHJs) hold the ultimate responsibility for enforcing elements of NFPA 652.

While NFPA 652 offers some potential new challenges for industry, solutions are readily available. NFPA 652 fills the perceived gaps left by commodity-specific standards and provides a wealth of information, guidance, and support for companies that need to understand their combustible dusts and mitigate the hazards. The next revision to the standard is scheduled for 2019.

Certain statements and references contained in this paper are based upon data and information outlined in the NFPA 652 standards. To view the complete version of NFPA 652 standards, visit the National Fire Protection Association website at www.nfpa.org.

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