FOCUS ARTICLE

Completing a Dust Hazard Analysis

National Fire Protection Association, NFPA, has released a new edition (2019) of the NFPA 652 standard on the management of combustible particulate hazards. The new edition of the NFPA 652 standard has added more information and requirements to the already existing standard, such as requirements on hybrid mixture as well as process equipment, including bulk storage enclosure size reduction, particle size separation, pressure protection systems, material feeding devices, bucket elevators, enclosed conveyor, mixers and blenders and dryers. This standard is intended to help facilities understand and apply the various existing standards on this topic and provide a general approach to the management of fire and explosion hazards associated with the manufacturing, handling, and processing of combustible particulate solids. Past dust-explosion events in the chemical process industries have resulted in catastrophic consequences, and the investigation of these events has caused some confusion in the applicability of the various codes and standards that currently exist. The NFPA 652, Standard on the Fundamentals of Combustible Dust, contains the following intent:

"**NFPA 652, Standard on the Fundamentals of Combustible Dust**, 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: NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities; NFPA 484, Standard for Combustible Metals; NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids; NFPA 655, Standard for Prevention of Sulfur Fires and Explosions; and NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities. This standard establishes the relationship and hierarchy between it and any of the industry- or commodity-specific standards, ensuring that fundamental requirements are addressed consistently across industries, processes, and dust types."©

An important requirement of the standard is that covered sites that handle and process combustible particulate shall complete a Dust Hazard Analysis, DHA, for all new processes and facility compartments. For existing processes and facility compartment, a Dust Hazard Analysis shall be completed by September 7, 2020. The Dust Hazard Analysis shall be reviewed and updated at least every 5 years. The first step in the DHA process is described in the flowchart below. In order to determine the combustible solids hazards, the first requirement is to verify if the powders/dusts handled are indeed combustible or if materials are only handled in closed containers in storage or warehousing activities (such "benign" processing is exempted from NFPA 652 application). The purpose of testing is to answer several important safety questions. A screening test can be used to determine if small particles of a material will support combustion when suspended in air. Materials that are combustible should be tested to determine the ignition sensitivity and explosion severity. Tests to determine a dust's ignition sensitivity include the Minimum Ignition Energy, MIE, the Minimum Explosible Concentration, MEC, and the Minimum Ignition Temperature (both dust cloud and layer tests), MIT.

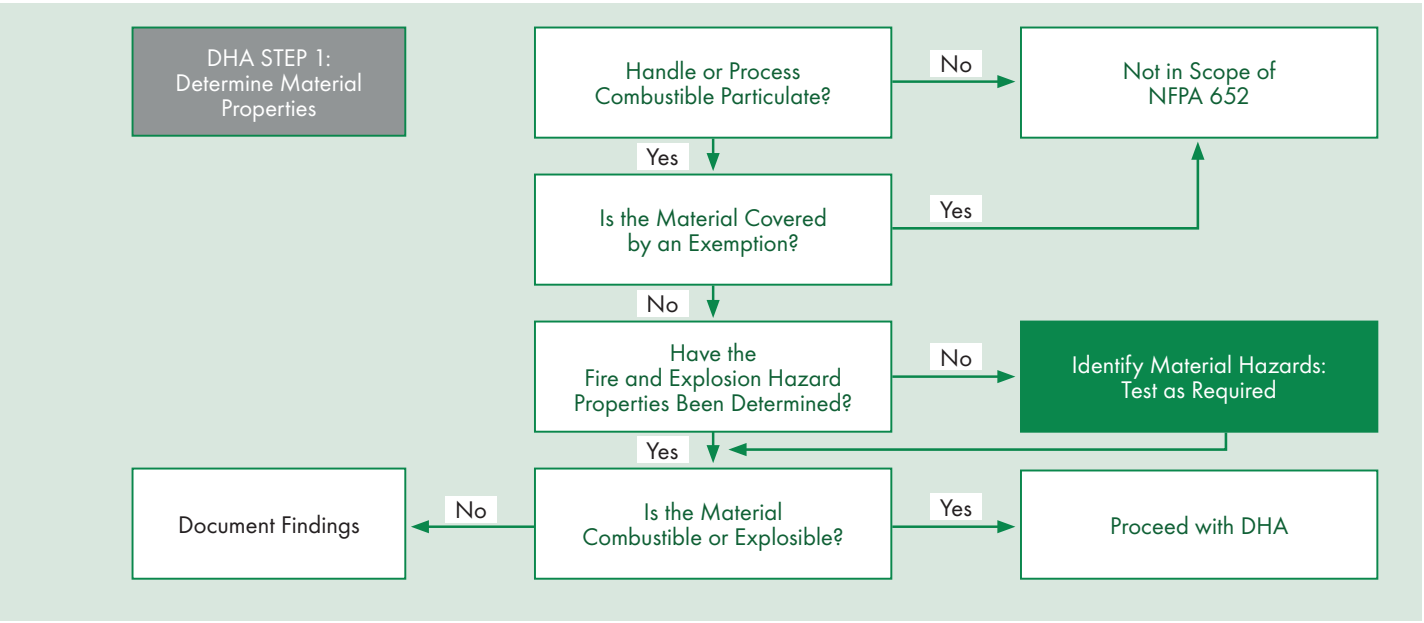

Figure 1: DHA Step 1: Determine Material Properties

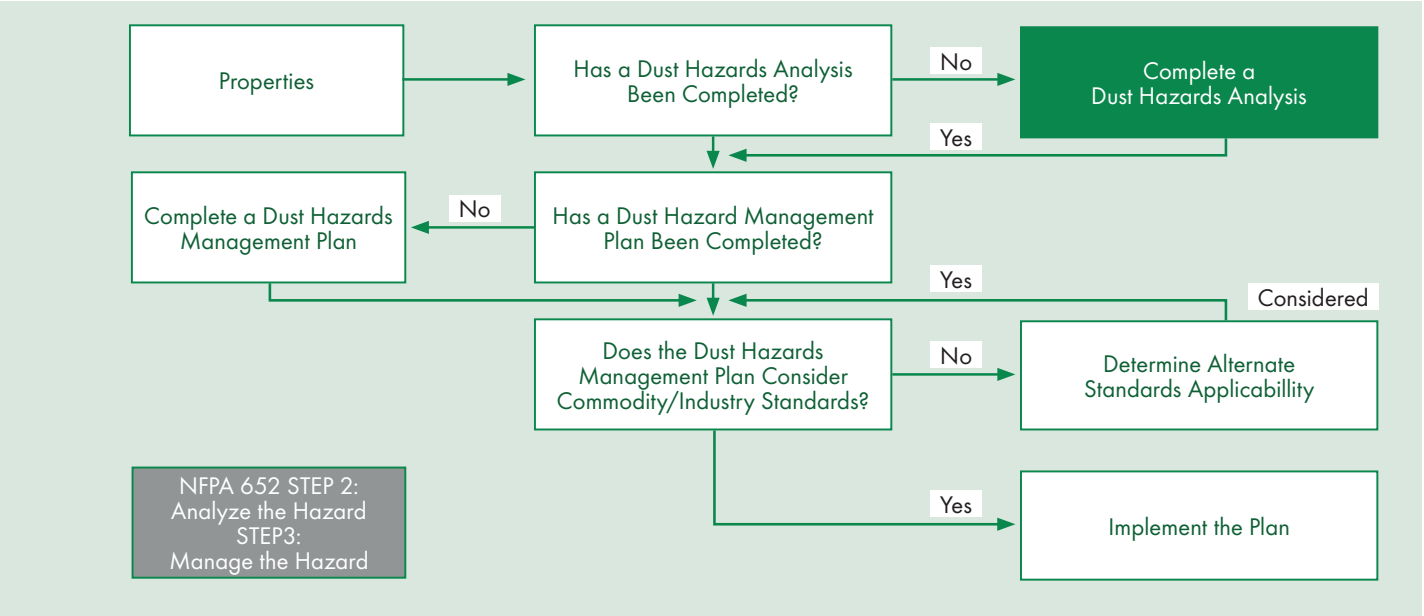

Figure 2: DHA Step 2: Analyze the Hazard + Step 3: Manage the Hazard

These tests will provide an understanding of **combustible-dust** properties and how easily dust clouds may be ignited. The test to determine a dust's explosion severity requires suspending the dust in a suitable chamber and igniting the dust cloud with a high energy source. This test provides basic information regarding the resulting explosion including peak chamber pressure and maximum rate of pressure rise. Explosion severity data are required to design explosion protections such as relief venting and allow ranking of a material's hazard. The next step in the process hazard analysis is to complete the Dust Hazard Analysis and identify areas of the process where materials could form ignitable dust suspensions or dust layers and access ignition sources.
The DHA should classify potentially hazardous dust locations within the facility into one of three categories:

- Not a hazard,
- Possible hazard,
- Fire or explosion hazard

The DHA answers the following key questions for all areas where powders and dusts are handled and processed:

1. Can particulate exist in a size that would allow flame propagation?
2. Is there a mechanism to initiate dust suspension?
3. Could the dust suspension concentration exceed the Minimum Explosible Concentration?
4. Could effective ignition sources exist during 1-3 above?

The DHA report documents the process-materials properties and the operating conditions and, for each potential hazard zone, answers the above four questions and establishes what hazard management methods exist or are appropriate.

SUMMARY

Whenever a manufacturing site handles and/or processes combustible particulates, a minimum standard of safety must include consideration of appropriate codes and standards. Codes and Standards represent RAGAGEP, Recommended and Generally Accepted Good Engineering Practices and should always be considered. The standard on combustible particulate hazards, NFPA 652, includes an expectation that a Dust Hazard Analysis be completed which includes:

- Consideration of dust hazard properties;
- Appropriate hazard expertise and experience of the DHA leader;
- A rigorous review process; and
- Prompt actions to correct identified deficiencies.

DEKRA Organisational & Process Safety

DEKRA Organisational and Process Safety are a behavioural change and process safety consultancy company. Working in collaboration with our clients, our approach is to assess the process safety and influence the safety culture with the aim of 'making a difference´.

In terms of behavioural change, we deliver the skills, methods, and motivation to change leadership attitudes, behaviours and decision-making among employees; supporting our clients in creating a culture of care and measurable sustainable improvement of safety outcomes is our goal.

The breadth and depth of expertise in process safety makes us globally recognised specialists and trusted advisors. We help our clients to understand and evaluate their risks, and work together to develop pragmatic solutions. Our value-adding and practical approach integrates specialist process safety management, engineering and testing. We seek to educate and grow client competence to provide sustainable performance improvement; partnering with our clients we combine technical expertise with a passion for life preservation, harm reduction and asset protection.

We are a service unit of DEKRA SE, a global leader in safety since 1925 with over 45,000 employees in 60 countries and 5 continent. As a part of the world's leading expert organisation DEKRA, we are the global partner for a safe world.

We have offices throughout North America, Europe, and Asia.
For more information, visit www.dekra-uk.co.uk/en/dekra-organisational-and-process-safety/
To contact us: dekra-ops.uk@dekra.com
To contact us: +44 (0) 23 8076 0722

Would you like to get more information?

Contact Us

DEKRA