APTIM

133
COMBUSTIBLE DUST FIRES IN THE U.S. FROM 2017–2021

69%
OF GLOBAL COMBUSTIBLE FIRES OCCUR IN THE U.S

55.8%
OF COMBUSTIBLE DUST FIRES ARE CAUSED BY FOOD PRODUCTS

WHAT IS COMBUSTIBLE DUST?

Combustible dusts are any solid material consisting of small particles or pieces, regardless of shape, size, or chemical composition, that presents a flashfire or deflagration (i.e., explosion) hazard when suspended in air. Any industrial process that reduces materials into fine dusts or creates a fine dust as a byproduct presents a potential for a serious fire or explosion.

Processes potentially subject to combustible dust hazards include manufacturing of powders, as well as unintentionally creating combustible dusts through handling and processing of solid materials.

Combustible dusts include various metals, pharmaceutical powders, cosmetic powders, wood, plastic, rubber, coal, flour, sugar, paper, and cardboard.

For a more comprehensive list, please refer to the Occupational Safety and Health Administration (OSHA) Combustible Dust Information Poster. Though some dusts do not appear on this list, they can still present significant flashfire and/or explosion hazards.

Safety Data Sheets typically contain combustibility information, such as upper and lower explosion limits, but specialized testing for this data is subject to each manufacturer. Without this data, the determination of the combustible danger of a dust remains unknown. Combustible dust testing is conducted by specialized laboratories that meet testing requirements outlined in National Fire Protection Agency (NFPA) 652, Standard on the Fundamentals of Combustible Dust. However, knowing the combustibility test values of a dust itself only provides partial information. A dust's flashfire and/or explosive hazard capacity is also determined by the manufacturing, end-user production and handling, area atmosphere, material transporting, area ignition sources, etc. To fully understand the risk of a flashfire and/or explosive hazard, a dust hazard analysis (DHA) must be conducted.

DUST HAZARD AND DUST HAZARD ANALYSIS

A dust explosion occurs when a dust explosion pentagon is present. A dust explosion pentagon is an expansion of the fire triangle as it relates to dust and contains these five factors:

- **Fuel**, in the form of dust
- **Dispersion of the dust**, in which suspended dust burns more rapidly
- **Oxidant**, usually oxygen in the air
- **Ignition source**, such as overheated parts, open flame, electric spark, mechanical spark from friction or impact, or static electricity
- **Confinement of the dust**, which creates pressure buildup leading to explosion

Dust hazards begin as rapidly growing flashfires, which may propagate into primary and secondary explosion hazards. The primary explosion results from the flashfire, entraining enough dust into the fuel-air mixture and creating pressure buildup within a container, room, or equipment. There, the dust becomes suspended and contacts an ignition source. The primary explosion is often the relatively smaller and weaker of the two explosions.

Though primary explosions are important to contain and mitigate, the secondary explosion is usually more destructive. Once the primary explosion ruptures the initial container, the pressure entrains any accumulated dust on floors, in ductwork, on equipment, etc. This causes the dust fuel-to-air ratio within the secondary area, typically a large manufacturing floor, to ignite into a secondary explosion.

STEPS OF ANALYSIS

DHA is a process for analyzing the potential for flashfires and resulting primary and secondary explosions within dust processes. Steps of DHA include the following:

- Determine if dusts or powders in a manufacturing process are combustible. Sending samples to a licensed laboratory is usually necessary to make this determination.
- Evaluate the facility and dust handling processes, including administrative controls (i.e., management of dusts, housekeeping, recordkeeping, training, preventative maintenance) and engineering controls (i.e., equipment pressure designs, grounding, equipment and process materials, ventilation).
- Based on the guidelines set forth in NFPA for DHAs, the combustibility of the dusts is determined, as well as the likelihood of a flashfire and/or explosions in various locations and deficiencies in process or management procedures.
- Recommendations are made to meet administrative and engineering requirements, as defined by NFPA to mitigate explosions.

OSHA lists the following NFPA standards within their enforcement program that apply to combustible dust hazards. Under these standards, facilities need to complete an initial combustible DHA for existing processes and prior to the startup of new processes and revalidate them every five years.

OSHA NFPA STANDARDS

OSHA lists the following NFPA standards within their enforcement program that apply to combustible dust hazards. Under these standards, facilities need to complete an initial combustible DHA for existing processes and prior to the startup of new processes and revalidate them every five years.

- **NFPA 33**
- **NFPA 61**
- **NFPA 68**
- **NFPA 69**
- **NFPA 77**
- **NFPA 85**
- **NFPA 91**
- **NFPA 484**
- **NFPA 499**
- **NFPA 652**
- **NFPA 654**
- **NFPA 655**
- **NFPA 664**

SAFEGUARDING YOUR FACILITY

Dust fires and/or explosions are not necessarily unique to one region or one industry. There are many industries and processes subject to these hazards globally. It is therefore important to properly manage dust hazards which may be present within your facility. While the specific management of dust and processes vary for each commodity, the general approach is similar.

Contain, capture, and clean processing equipment responsible for producing and handling dust. Performing DHA according to NFPA standards and complying with OSHA's guidelines is critical for the health and safety of your facility.

APTIM safety professionals and fire engineers are available to assist facilities with sampling and DHA.

Contact IH-Safety@APTIM.com for more information.

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