The Impact & Implications of NFPA 652 – NFPA's Newest Combustible Dust Standard

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Jason Reason

• Education & Certifications
  • B.S. Industrial Hygiene – Purdue University
  • MBA – University of Indianapolis
  • CIH, CSP, CHMM

• Experience
  • 12.5 years as OSHA Compliance Officer
  • Performed over 50 combustible dust inspections
  • Assisted Federal OSHA & State Plan OSHAs on numerous combustible dust inspections and issues
  • Instructor for OSHA Combustible Dust Course at OTI

Jason Reason

• NFPA Technical Committees
  • Chair of Committee for Wood & Cellulosic Materials (NFPA 664)
  • Principle Member of Committee for Handling & Conveying of Dusts, Vapors and Gases (NFPA 91, 654 & 655)
  • Principle Member of Committee for Fundamentals of Combustible Dusts (NFPA 652)
  • Principle Member of Flash Fire Protective Garment Committee (NFPA 2112 & 2113)
  • Member of Correlating Committee for Combustible Dusts (Over all NFPA combustible dust committees)
Overview

• Current Combustible Dust Landscape
• Why was NFPA 652 needed?
• Who does NFPA 652 cover and how is it applied?
• Key Aspects of NFPA 652
• Conflicts between NFPA 652 and other NFPA standards
• Examples of Hazards Covered by NFPA 652

A Continuing Problem

• Between 1982 and 2007, there were 281 dust fires and explosions
• Between 2009 and 2013, there were 57 dust fire and explosions

FM Global Loss Data by Industry
Key Factors Contributing to Incidents

- Workers and managers often unaware of dust explosion hazards
- Facility management failed to conform to NFPA standards that would have prevented or reduced the effects of the explosions
- Warning events were accepted as normal and their causes were not identified and resolved
- Outside parties inspecting the facilities failed to identify dust explosion hazards:
  - Government Enforcement
  - Insurance Underwriters
  - Safety & Health Professionals

How Many Standards Currently Address Combustible Dust Hazards?

Why Was NFPA 652 Needed?

- Requirements were inconsistent between the various industry sectors and the dust types
- Establishes the relationship and hierarchy between NFPA 652 and any of the NFPA combustible dust standards
- Simplifies OSHA compliance and enforcement
Contents

• Chapter 4 – General Requirements
• Chapter 5 – Hazard Identification
• Chapter 6 – Performance-Based Design
• Chapter 7 – Dust Hazard Analysis
• Chapter 8 – Hazard Management Mitigation & Prevention
• Chapter 9 – Management Systems

Scope & Application of NFPA 652

• Provides the basic principles of and requirements for identifying and managing the fire and explosion hazards of combustible dusts and combustible particulate solids
• Applies to ALL facilities and operations manufacturing, processing, blending, conveying, repackaging, generating, or handling combustible dusts or combustible particulate solids

Retroactivity

• Where specified, provisions of the standard are retroactive
• In those cases where the AHJ determines that the existing situation presents an unacceptable degree of risk, the AHJ shall be permitted to apply retroactively ANY portions of this standard that, based on the application of clear criteria derived from the objectives in this standard, the AHJ determines to be necessary to achieve an acceptable degree of risk
Industry or Commodity-Specific NFPA Standards

- **61-2017**
  - Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
- **484-2015**
  - Standard for Combustible Metals
- **664-2017**
  - Standard for the Prevention of Fires and Dust Explosions in Wood Processing and Woodworking Facilities
- **654-2017**
  - Standard for the Prevention of Fires and Dust Explosions from Manufacturing, Processing and Handling of Combustible Particular Solids

Hierarchy of NFPA Combustible Dust Standards

1. **652-2016**
2. **61-2017**
3. **484-2015**
4. **664-2017**
5. **654-2017**

Combustible Dust

- A finely divided combustible particulate solid that presents a flash fire hazard 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
To Test or Not To Test?

- Testing may not be required where reliable, in-house commodity-specific testing data or published data of well-characterized samples are available.
- Test data derived from testing material within a facility will result in the most accurate results for the DHA, performance-based design, and hazard management options.
- Absence of previous incidents cannot be used as the basis for deeming a dust to not be combustible or explosive.

Hierarchy of Combustible Dust Testing

Importance of Test(s) | Specificity of Hazard
---------------------|----------------------

- $K_{st}$, $P_{max}$
- Particle Size
- MEC, MIE, MIT, LIT
- LOC, Charge Relaxation, Resistivity, Chargeability

Which Dust Is Worse?

<table>
<thead>
<tr>
<th>Dust</th>
<th>$K_{st}$ (b·m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust A</td>
<td>275</td>
</tr>
<tr>
<td>Dust B</td>
<td>150</td>
</tr>
<tr>
<td>Dust C</td>
<td>350</td>
</tr>
</tbody>
</table>
### Which Dust Is Worse?

<table>
<thead>
<tr>
<th></th>
<th>$K_v$ (b.m/s)</th>
<th>MEC (g/m$^3$)</th>
<th>MIE (mJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust A</td>
<td>275</td>
<td>75</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Dust B</td>
<td>150</td>
<td>40</td>
<td>500</td>
</tr>
<tr>
<td>Dust C</td>
<td>350</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

### Dust Hazards Analysis (DHA)

- The owner/operator of a facility where materials that have been determined to be combustible or explosible are present in an enclosure shall be responsible to ensure a DHA is completed.
- Absence of previous incidents cannot be used as the basis for not performing a DHA.
DHA Methodology

What’s Normal?
What Can Go Wrong?
How Bad is Bad?
What Protection Currently Exists?
What Additional Protection is Needed?

Timeline to Complete DHAs

• For existing processes and facility compartments that are undergoing material modification, the owner/operator shall complete DHAs as part of the project
• For existing processes and facility compartments that are not undergoing material modification, the owner/operator shall schedule and complete DHAs of existing processes and facility compartments within a 3-year period from the effective date of the standard

Qualified Person(s)

• DHA is required to be performed or led by a qualified person
• Person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems related to the subject matter, the work, or the project
• Unqualified individuals can negatively affect the identification and mitigation of combustible dust hazards
Who's Qualified?

- EHS Professionals?
- Engineers?
- Plant Managers?
- Consultants?
- Human Resources?
- Insurance Adjusters?
- Fire Code Officials?
- Building Code Officials?
- OSHA Compliance Officers?

Common Mistakes Associated with DHAs

- Experience of individuals performing DHAs not adequately verified
- Misinterpretation of NFPA and other combustible dust standards
- Assuming assessments, testing, etc., are equal to DHAs
- Adequate solutions not provided
- Valuing cost over content
Combustible Dust Services

Explosion Prevention/Protection

- Where explosion hazards exist within any operating equipment greater than 8 ft³ of containing volume, the equipment must be protected by:
  1. Oxidant concentration reduction
  2. Deflagration venting
  3. Deflagration venting through listed flame-arresting devices
  4. Deflagration pressure containment
  5. Deflagration suppression system
  6. Dilution with a noncombustible dust to render the mixture noncombustible
Dust Collection Systems

- System Documentation & Monitoring
- Required Duct Transport Velocity Maintained
- Bonding and Grounding
- Analysis of Additional Branch Ducts
- Prohibition of Blanking Off Unused Portions
- Limit Use of Blast Gates
Poor Housekeeping Can Affect

- Electrical Classification
- Emergency Egress Requirements
- Selection of Powered Industrial Trucks
- Use of Flame-Resistant Clothing

What Causes Poor Housekeeping?

- Inadequate Cleaning Schedules
- Leaks in Equipment, Ducts, Pipes, etc.
- Ineffectively Designed or Maintained Industrial Ventilation Systems
- Improper Use of Cleaning Methods

Portable Vacuum Cleaners
Combustible Dust Relocation System

Other Important Aspects of NFPA 652
- Sources of Ignition
- Flame-Resistant Garments
- Operating Procedures
- Inspection, Testing & Maintenance
- Employee Training
- Management of Change
- Emergency Planning
Future of NFPA Combustible Dust Standards

- Standardized Definitions for Specific Terms
- Similar Layouts for Standards
- Better Correlation Between Standards
- One NFPA Combustible Dust Standard?

Combustible Dust Hazard Mitigation Process

- Hazard Mitigation
- Administrative Controls
- Engineering Controls
- Hazard Assessment
- Dust Hazards Analysis (DHA)
- Hazard Identification
- Dust Testing
Questions???

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