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Managing Combustible Dust

Bayless Kilgore, CIH, CSP



Consulting Excellence

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Why Are We Here Today?

- To become aware of the hazards of **Combustible Dust** in the Pulp & Paper industry.
- Learn what can be done to minimize the risks.
- Discuss what companies are doing to protect themselves from combustible dust hazards.
- Brief overview of regulations and standards.

Combustible Dust Video – U.S. Chemical Safety Board (CSB)



Combustible Dust Incidents - Pulp & Paper

OSHA Regional News Release

U.S. Department of Labor
Office of Public Affairs

Region 2

Employee's death "preventable"

- /// A 57-year-old general mechanic was removing burned filter bags of [combustible](#) fly ash dust from a dust collector in the facility's power plant and replacing them with new bags when the fly ash ignited. He sustained severe burns as a result and subsequently died.
- /// The agency opened its inspection on Jan. 24, 2015, and found that --- failed to supply the employee with necessary fire-resistant clothing and did not train him and employees on the specific physical hazards of combustible fly ash.
- /// In addition, the system for conveying and collecting the fly ash was deficient. It had not been inspected for defects, did not comply with National Fire Protection Association standards and had not been maintained adequately.

What are Combustible Dusts?

Combustible dusts are small particles found in our workplace that under certain conditions can cause serious harm:

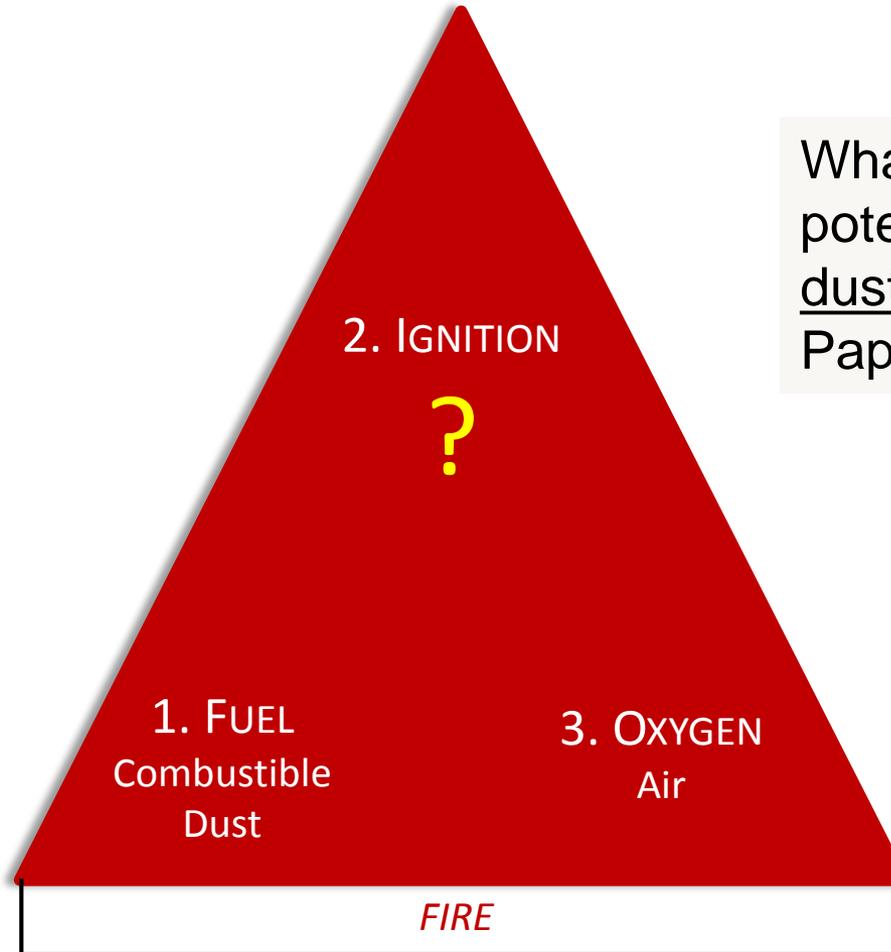
- // Small particle size
- // Will ignite
- // Can cause flash fire (Deflagration)
- // Can also cause explosion



The smaller and drier the dust particle the more hazardous the dust.

Combustible Dust - Fire

The Fire Triangle graphically represents the three conditions necessary for a **combustible dust fire**:



What are some potential combustible dust sources at Pulp & Paper facilities?

Combustible Dusts – Pulp & Paper

- // Wood
- // Paper
- // Coal
- // Petroleum coke (Petcoke)
- // Tire-Derived Fuel (TDF)
- // Boiler/fly ashes
- // Resins
- // Starch

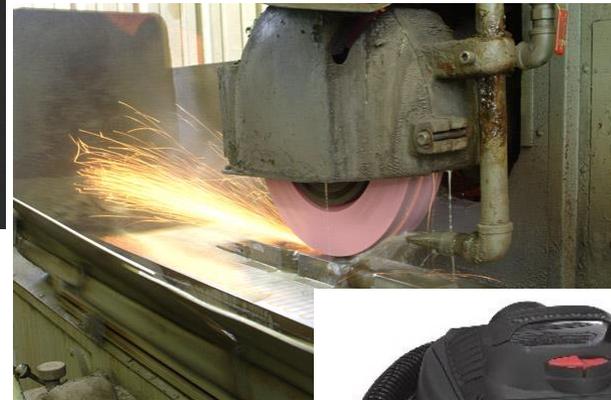


*Any dust that will “burn”
is a combustible dust.*

Ignition Sources

- /// Open flames
- /// Hot surfaces
- /// Mechanical sparks
- /// Hot slag
- /// Embers
- /// Lighting
- /// Heaters
- /// Equipment surfaces
- /// Overheated bearings
- /// Electrical sparks and arcs
- /// Electrostatic discharge
- /// Friction
- /// Electrical equipment not approved for dust locations

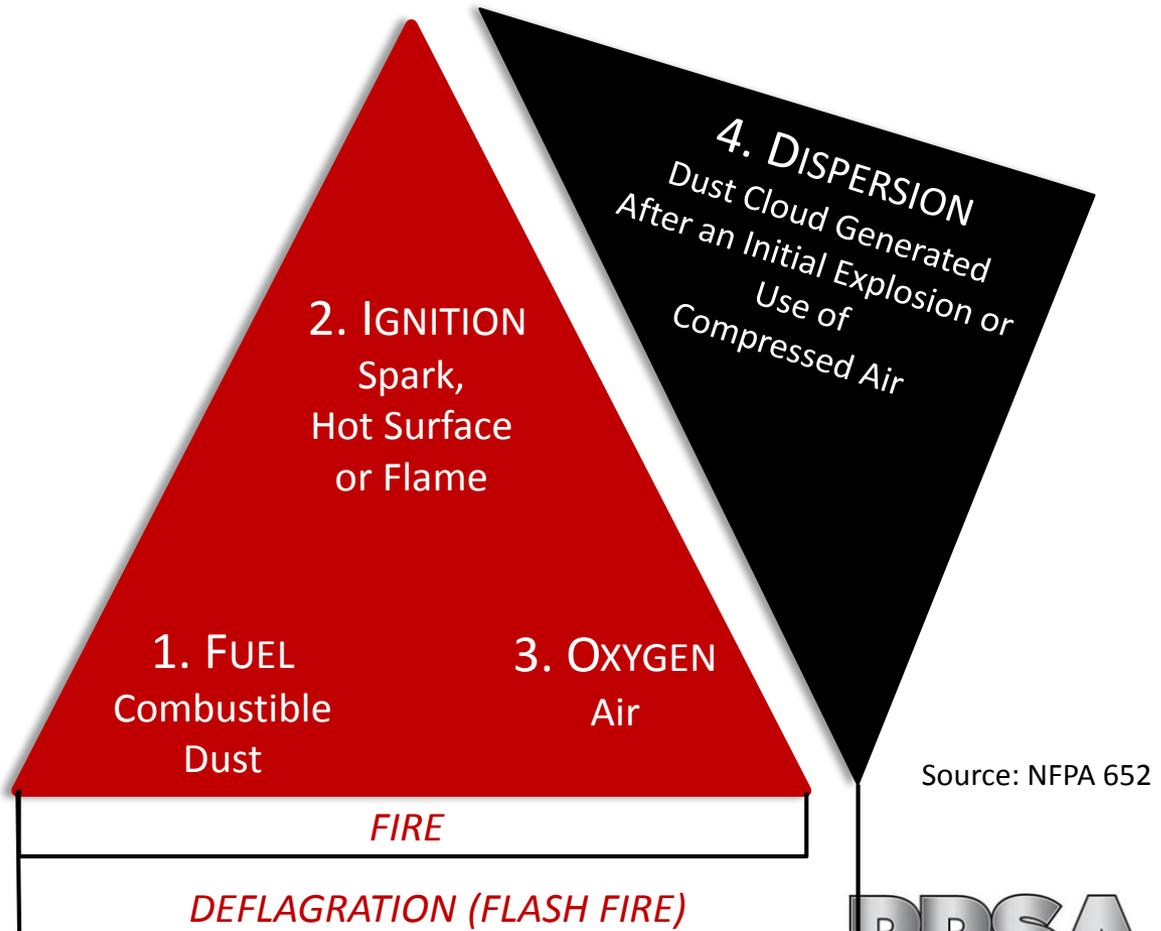
– Photos by CV Technology



Combustible Dust - Deflagration (flash fire)

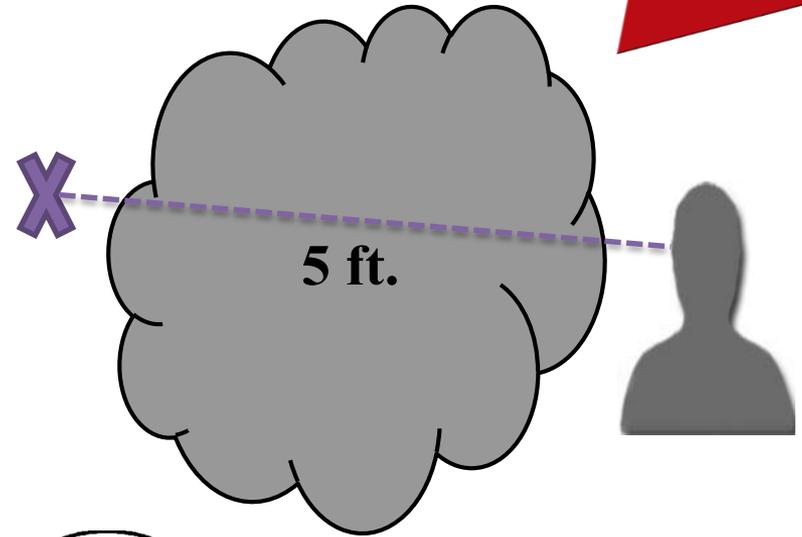
If **dispersion** of dust (create a dust cloud) is added to the fire triangle, it can result in a **combustible dust deflagration (flash fire)**.

1. Fuel
2. Ignition
3. Oxygen
4. Dispersion of dust



Concentration Matters

A minimum exposable concentration of dust must be present for a deflagration (flash fire) to occur.

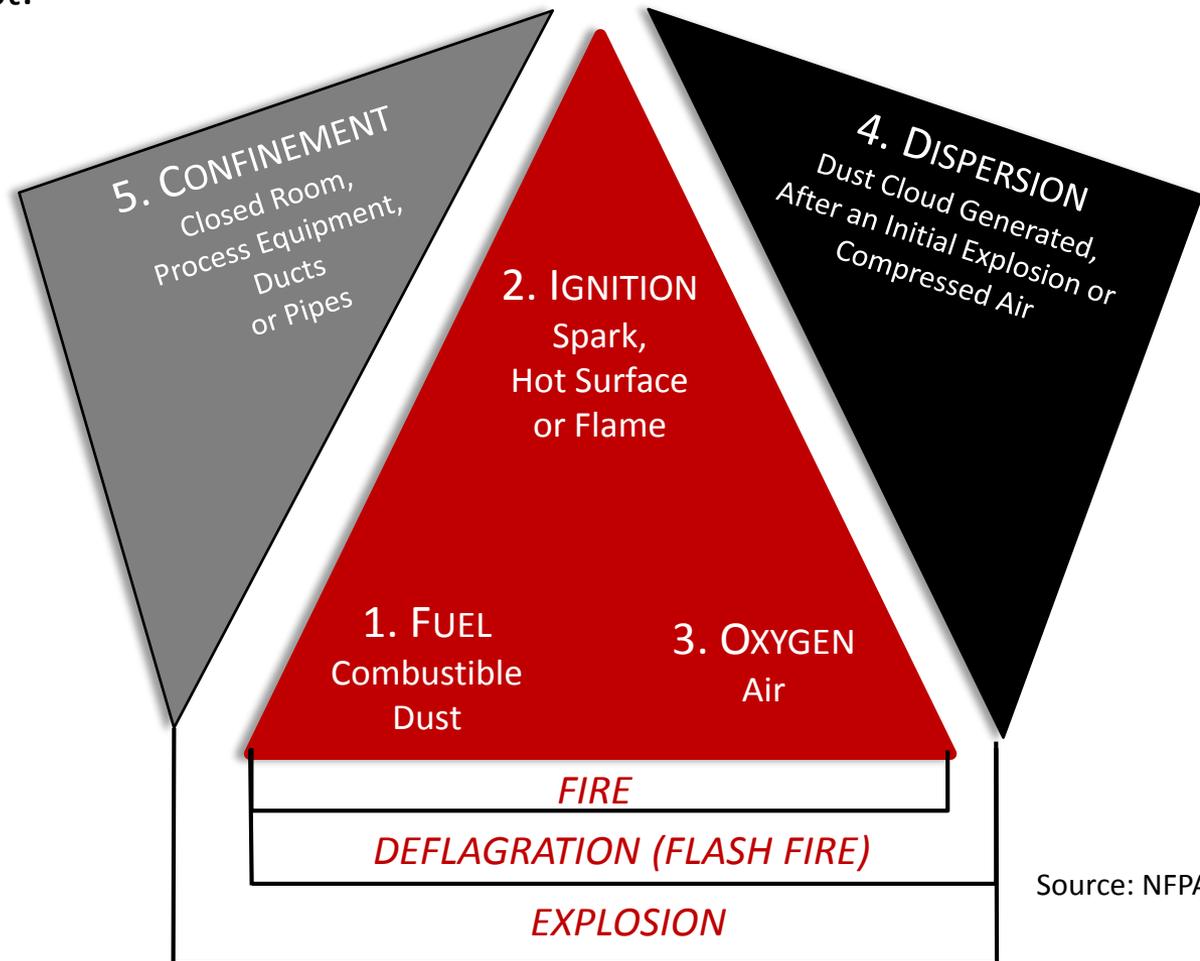


If you can't see through the dust cloud this may present a deflagration (flash fire) risk.

Combustible Dust - Explosion

For a **combustible dust explosion**, there is one more required condition needed: **confinement** of the dust.

A deflagration (flash fire) occurring within a confined area or space can lead to an explosion due to a rapid pressure increase.

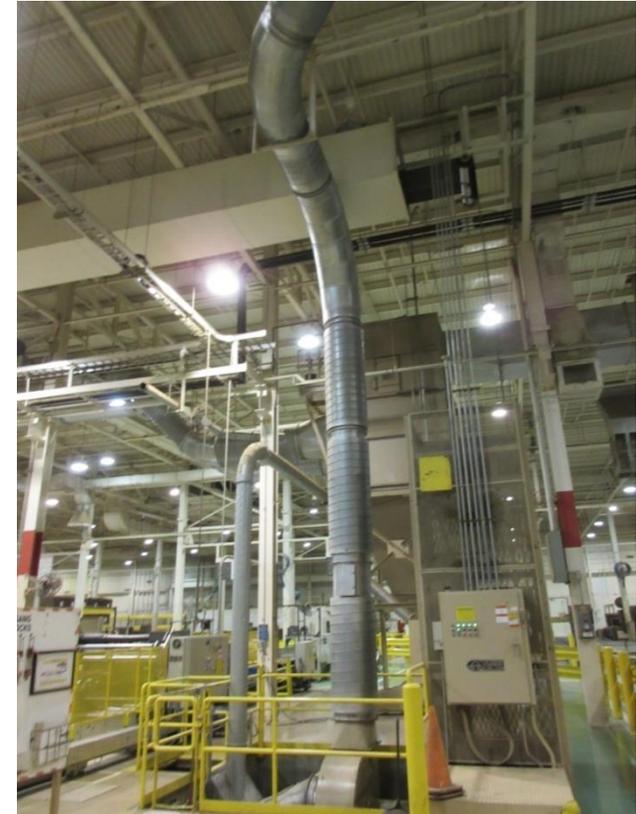
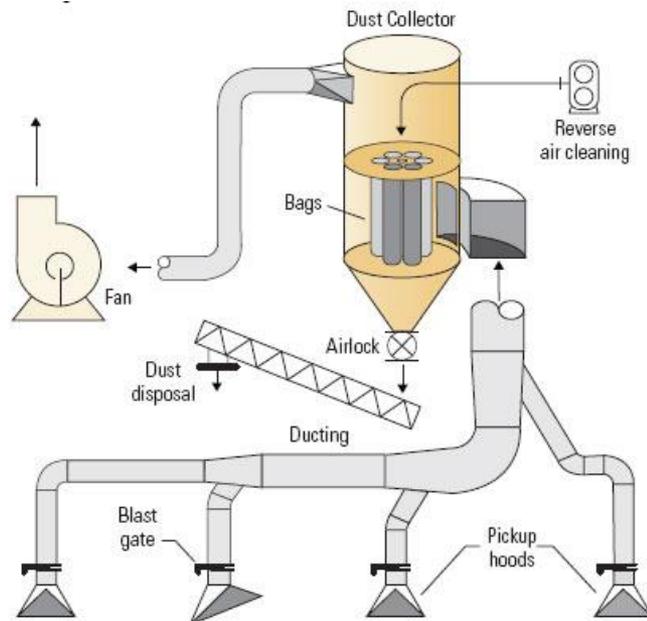


Source: NFPA 652

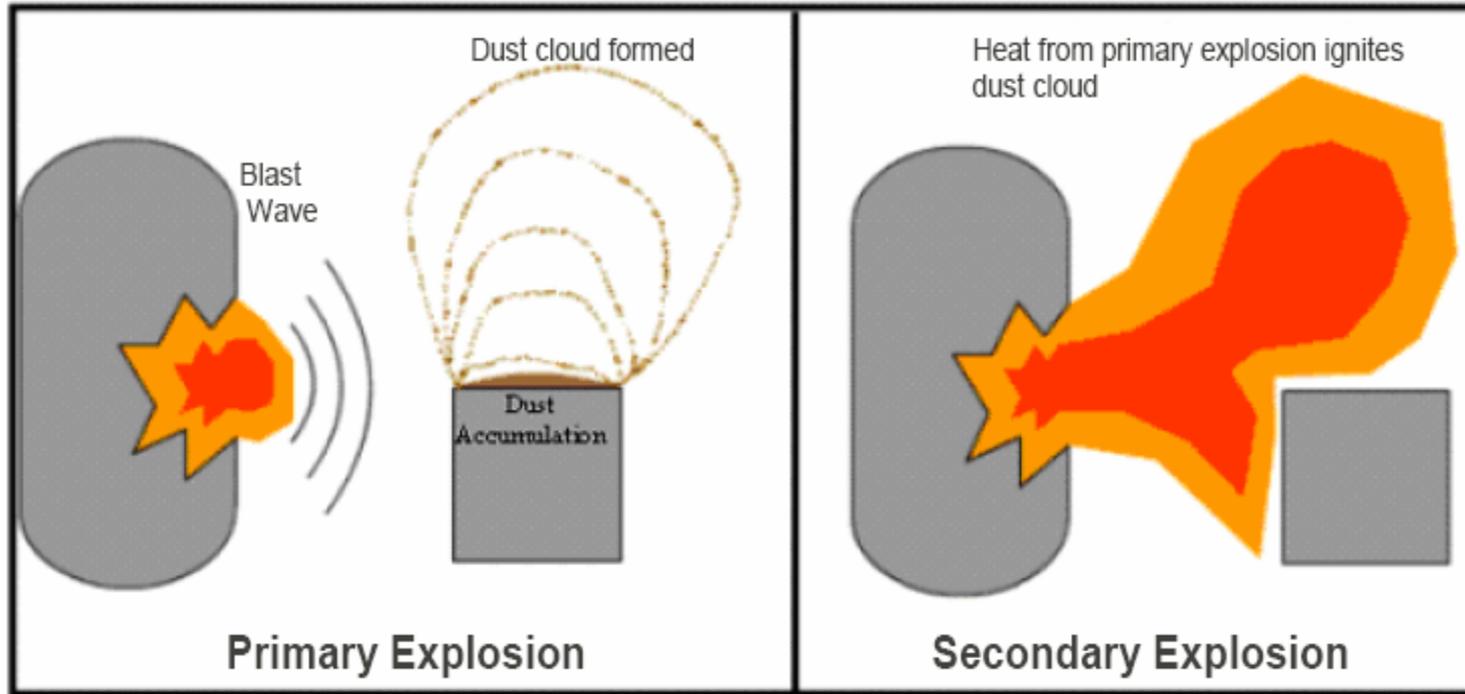
Confinement

Potential locations where confinement can occur include:

- Dust collectors, silos, blending/mixing tanks
- Ducts
- Fan housings
- Buildings



Two Categories of Explosions

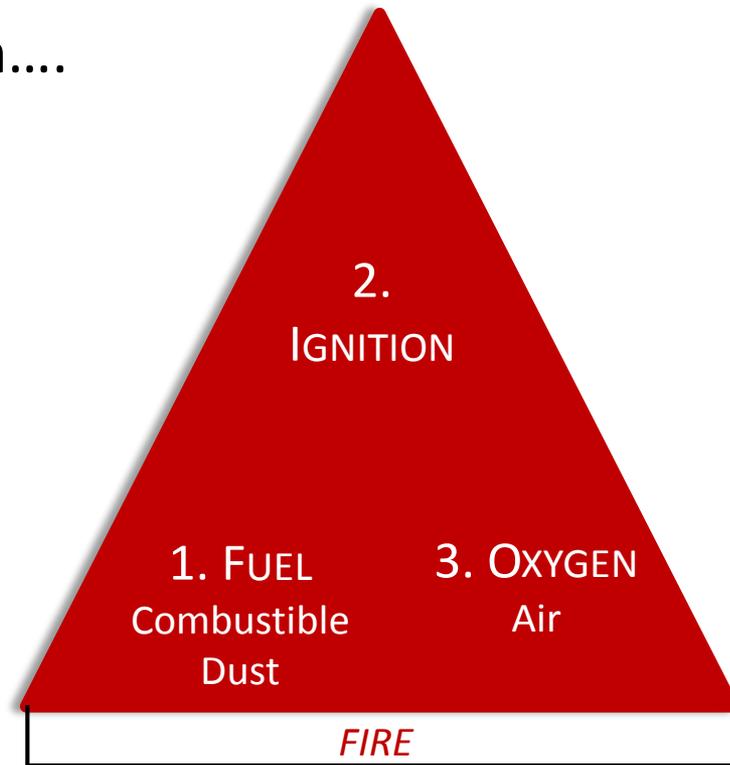


Primary explosion occurs in equipment or a confined space.

If accumulated dust in the area (just a fraction of inch) on floors, beams or other horizontal surfaces is dislodged and ignited a secondary explosion will occur. *These secondary explosions can be far more destructive than primary explosions.*

How are Combustible Dust Hazards controlled?

- Remove one side of the fire triangle
 - Housekeeping
 - Remove ignition sources
- Proper dust collection system....
 - Design
 - Operation
 - Maintenance
- Others?



Engineering Controls

- ✓ Ensure dust collection and conveyance systems are designed and maintained properly to prevent a primary explosion.
 - Passive (explosion venting, etc.)
 - Active (isolation or suppression systems, etc.)
- ✓ **Must know properties of the dust**
 - Ensure vents are sized properly
 - Ensure active systems are designed properly



Photo by Camfil

Housekeeping Removes the Dust Fuel

Keep combustible dusts accumulations to a minimum with frequent cleaning

Clean all:

- // Walls
- // Floors
- // Horizontal surfaces
- // Ducts
- // Pipes
- // Hoods
- // Ledges
- // Cable trays
- // Concealed surfaces above suspended ceilings, interior of electrical enclosures and high above on ledges and beams.



Dust Clean Up Methods

Preferred Methods

- // Wet methods – water hoses (*not fire water*)
- // Vacuuming – if approved for combustible dust locations
- // Light sweeping

Methods to Avoid

- // Aggressive sweeping
- // Blow down with compressed air

Blow downs with compressed air may be allowed if done frequently enough that large dust clouds are not created.



Housekeeping Tip

From NFPA 654

$$LD \text{ (in)} = ((1/32 \text{ in})(75 \text{ lb/ft}^3)) / BD \text{ (lb/ft}^3)$$

LD = Layer Depth

BD = Bulk Density



If you can write your name in the dust, see footprint, or not see the paint on equipment – you probably have too much dust



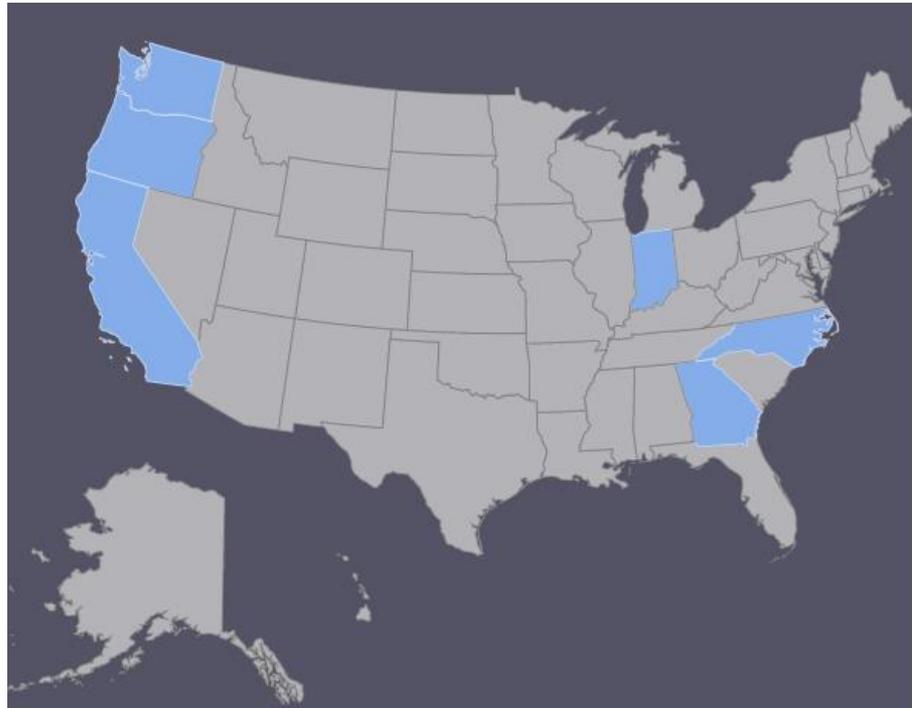
Current Regulatory Status

- /// **OSHA announces development of a combustible dust standard**
 - *Published on December 7, 2009*

- /// **OSHA not likely to issue new rule any time soon**
- /// **Combustible Dust National Emphasis Program**
 - CPL 03-00-008
- /// **OSHA can (and will) cite other standards. Examples...**
 - Housekeeping
 - Emergency action plans
 - Ventilation
 - Electrical - hazardous (classified) locations
 - Hazard communication
 - Personal protective equipment
 - General Duty Clause

States with Combustible Dust Standards

- /// Georgia
- /// Washington
- /// Oregon
- /// Indiana
- /// North Carolina
- /// California



NFPA 652 - 2015

Standard on the Fundamentals of Combustible Dust

- Effective Date: September 7, 2015
- General requirements for managing combustible dust
- Key Elements
 - Determining combustibility
 - Identifying the hazards
 - Managing the hazards
 - Communicating the hazards



NFPA 652 - 2015

■ Dust Hazard Analysis (DHA)

- Very similar to a Process Hazard Analysis (PHA)
- Break system down into nodes
- Determine if:
 - Not a hazard
 - Maybe a hazard
 - Deflagration hazard
- Assess needs for engineering or other controls

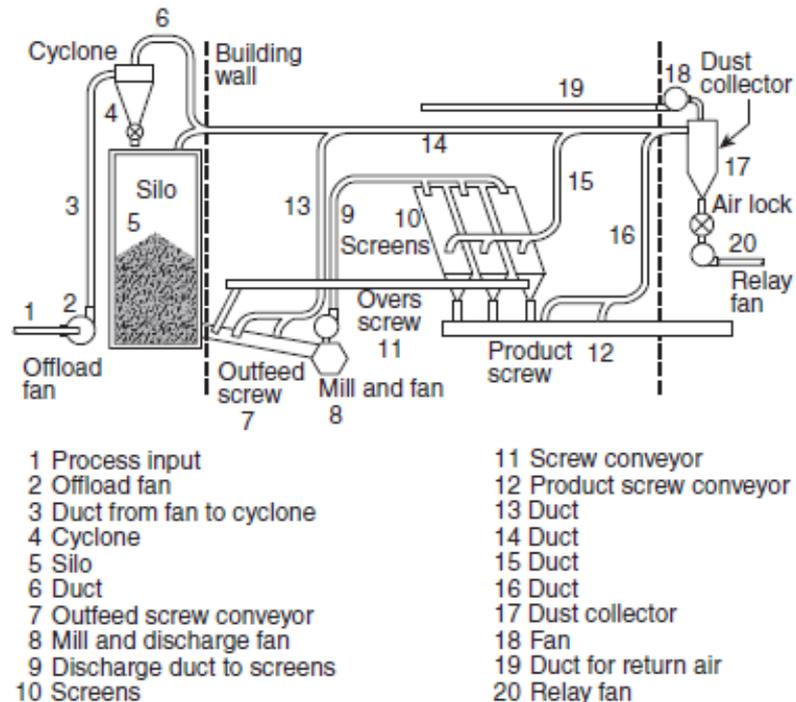


FIGURE B.4.5 An Example Process. (Source: J. M. Cholin Consultants, Inc.)

NFPA 652 - 2015

- // Hazard Identification (screening/sampling)
- // Dust Hazard Analysis (DHA)
- // Hazard Management
 - Building/Equipment Design
 - Housekeeping
 - Ignition Source Control
 - Personal Protective Equipment
 - Dust Control
 - Explosion Prevention/Protection
 - Fire Protection
- // Management System
 - Operating procedures
 - Inspection, testing, maintenance
 - Training & hazard awareness
 - Contractors
 - Emergency planning and response
 - Management of change (MOC)
 - Document retention
 - Management systems review (periodic)
 - Employee participation

PSM

Questions?

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