



**BAKERISK®**

Identify | Evaluate | Solve

## Overview of Combustible Dust



Providing Solutions to Manage  
Catastrophic Risks

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# BakerRisk Overview



# Overview

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- 3 Commonly Identified Hazards
- 4 Developing a Path Forward to Resolve Identified Hazards
- 5 Conclusion/Summary



# Combustible Dust Related Incidents

Event	Date	Location	Material	Fatalities	Injuries
West Pharmaceutical Services	January 29, 2003	Kinston, N.C.	Polyethylene Dust	6	38
Imperial Sugar	February 7, 2008	Port Wentworth, GA	Sugar Dust	14	42
Babine Sawmill	January 20, 2012	Burns Lake, B.C., Canada	Wood Dust	2	20
Lakeland Sawmill	April 23, 2012	Prince George, B.C., Canada	Wood Dust	2	22
Zhongrong Metal Production Co.	August 2, 2014	Kunshan, Jaingsu China	Metal Powder	146	114
Formosa Fun Coast	June 27, 2015	New Taipei, Taiwan	Colored Starch Power	14	498
Bosley Wood Flour Mill	July 17, 2015	Bosley, Chesire, UK	Wood Flour	4	4

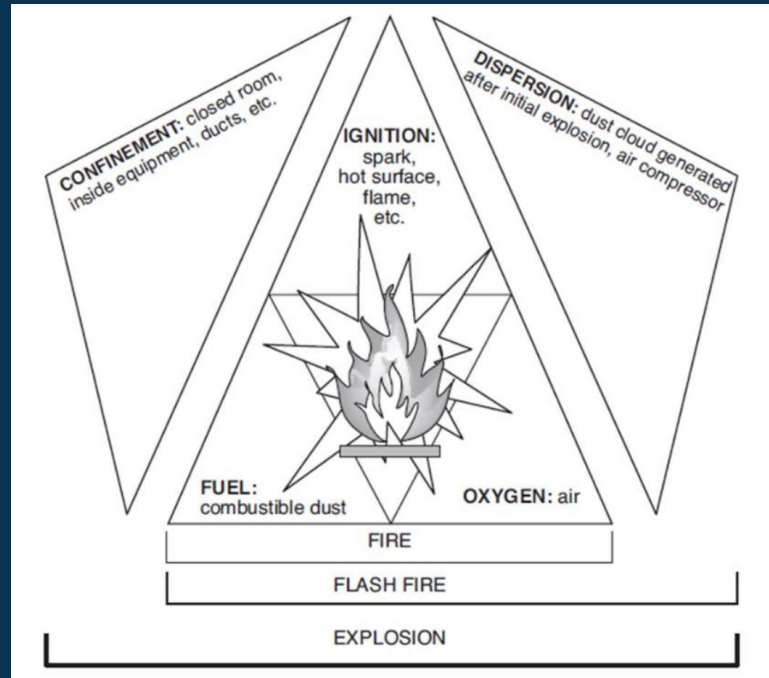
# Combustible Dust Background

## Combustible Dust (CD):

**“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.” – NFPA 652**

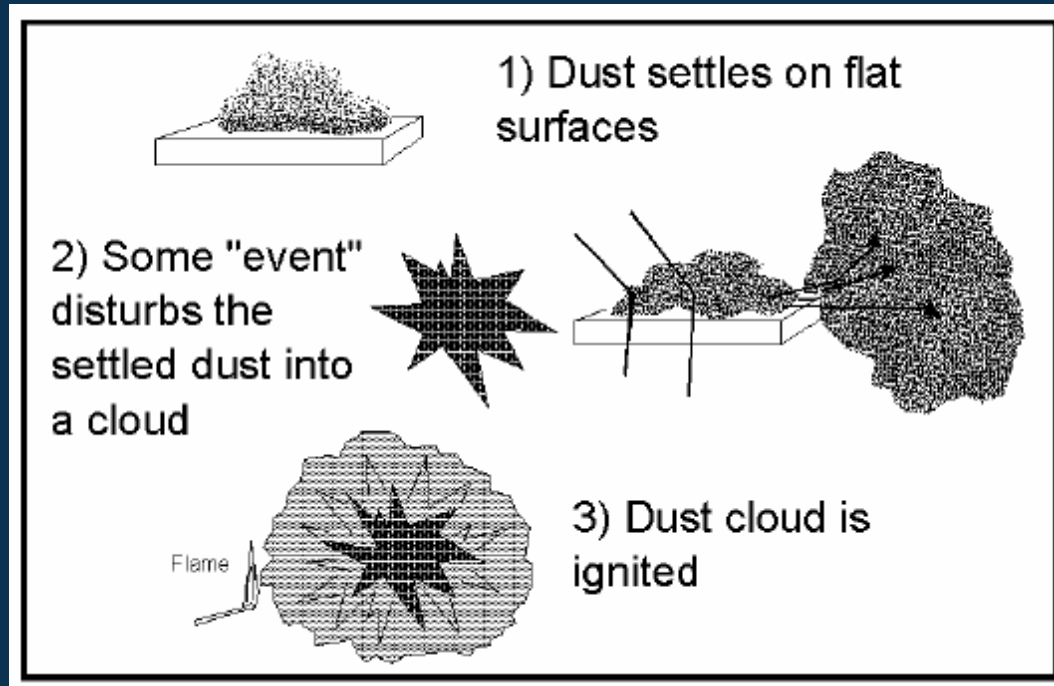
# Combustible Dust Background

## Fire Triangle and Explosion Pentagon



# Combustible Dust Background

## Secondary Dust Explosion



# Commonly Identified Hazards

## Equipment Prone to Primary Dust Explosions:

- Dust Collectors
- Silos, Bunkers
- Mills
- Dryers, Furnaces
- Conveying Systems (Ducting)



# Commonly Identified Hazards

- **Control of fugitive dust emissions and housekeeping outside of equipment is a key factor to reduce potential for secondary explosions**
- **Commodity specific NFPA standards provide accumulation layer thickness criterion**
  - General rule of thumb, if you can't see the surface underneath the accumulation, it's too thick
- **Few facilities create an auditable system of inspection and cleaning**
- **BakerRisk suggests segmenting the process into manageable zones**
  - Develop a reasonable inspection frequency
  - Document inspections and cleanings
  - Identify equipment contributing to fugitive dust emissions

# Commonly Identified Hazards



# Developing a Path Forward to Resolve Identified Hazards

## How to prevent/limit the likelihood of explosions:

- Fuel ( $< \text{MEC}$ )
- Oxygen ( $< \text{LOC}$ )
- Ignition ( $< \text{MIE}$ )
- Fuel for Secondary Explosions ( $< \text{Critical Dust Layer Thickness}$ )

# Developing a Path Forward to Resolve Identified Hazards

## Limiting Fuel:

- Use Lower Mass Flow Rates
- Keep Dust Concentration below MEC
- Reduce Dust Emissions within the system (collect any leaks)
- Implement Housekeeping Program

# Developing a Path Forward to Resolve Identified Hazards

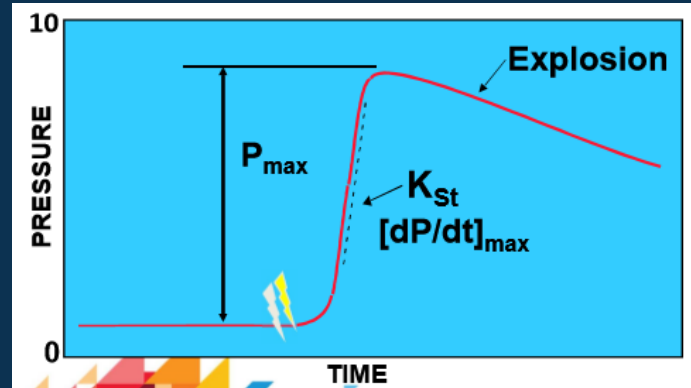
## Limiting Ignition:

- Use Mechanical/Electrical Equipment Adapted to Hazardous Locations
- Implement Bonding and Grounding
- Maintain Equipment to Avoid Friction/Hot Surfaces
- Implement Hot Work Permits

# Developing a Path Forward to Resolve Identified Hazards

## Protection

- $K_{st}$  and  $P_{max}$
- Venting
- Suppression
- Isolation



# Developing a Path Forward to Resolve Identified Hazards

## Venting

- The Most Popular Protection Technique
- Enables Pressure to be Discharged
- Prevents Equipment from Bursting
- Key Features: Reliable Opening, Non Fragmentation, Resistance to Process Conditions, Hygienic Design

# Developing a Path Forward to Resolve Identified Hazards



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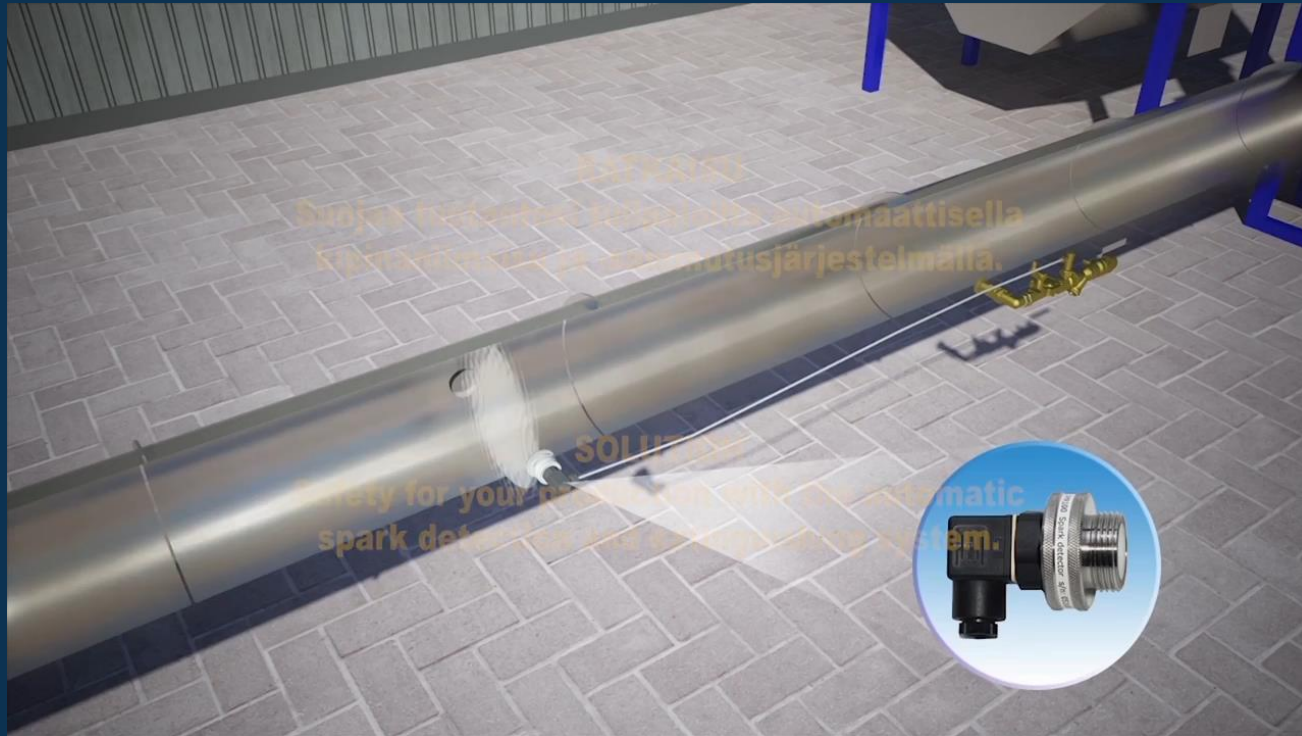


# Developing a Path Forward to Resolve Identified Hazards

## Suppression

- **Pressure Detection (Sensor)**
- **Activation (Control Panel)**
- **Extinguishment (Suppressant)**
- **Key Features: Detection and Activation Speeds, Suppressant Discharge Velocity, Amount of Suppressant Delivered**

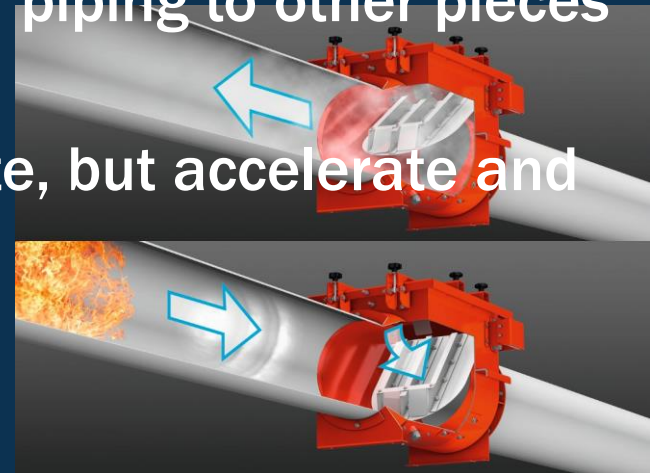
# Developing a Path Forward to Resolve Identified Hazards



# Developing a Path Forward to Resolve Identified Hazards

## Isolation

- Powder handling processes mostly comprise of interconnected equipment
- Explosions can propagate through piping to other pieces of equipment
- Dust explosions not only propagate, but accelerate and become more severe



# Developing a Path Forward to Resolve Identified Hazards

- **NFPA 652 provides the general requirements for the management of combustible dust fire and explosion hazards and directs the user to the NFPA industry or commodity-specific standards as appropriate (i.e., NFPA 61, 484, 654, 655, and/or 664).**

# Developing a Path Forward to Resolve Identified Hazards

- **The owner/operator of a facility with potentially combustible dust is responsible for the following activities:**
  - **Determining the combustibility and explosibility hazards of materials in accordance with Chapter 5 (Hazard Identification);**
  - **Identifying and assessing any fire, flash fire, and explosion hazards in accordance with Chapter 7 (Dust Hazards Analysis [DHA]);**
  - **Managing the identified fire, flash fire, and explosion hazards in accordance with Section 4.2.4 (Compliance Options);**
  - **Communicating the hazards to affected personnel in accordance with Section 9.5 (Training and Hazard Awareness).**

# Developing a Path Forward to Resolve Identified Hazards

- **As defined by NFPA 652, a DHA is a systematic review to identify and evaluate the potential fire, flash fire, and/or explosion hazards associated with the presence of combustible particulate solids in a process or facility**
  - Involves audit of process operations and equipment for fire/explosion hazards
  - Comparison against relevant commodity-specific NFPA standard, along with NFPA 652

# Developing a Path Forward to Resolve Identified Hazards

- **NFPA standards allow for a prescriptive or a performance-based (risk) evaluation**
- **Recommendations to prescriptive compliance can often be extensive since we are directly comparing to the NFPA standards.**
- **Performance-based approach employs a more detailed/rigorous technique developed in the chemical industry (e.g., HAZOP, LOPA or similar)**

# Conclusion

- Test your Dust**
- Design Adequate Prevention/Protection Measures**
- Limit Fugitive Dust Emission**
- Follow NFPA 652**
- Get Help from Specialists with Proven Experience**



# Questions?



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