



# Combustible Dust – An IH Perspective

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# Goal for Presentation

- ▶ Provide practical information regarding combustible dust identification
- ▶ How are industrial hygienists involved with combustible dust issues?
- ▶ Insight to regulatory requirements
- ▶ Options for control measures

# OSHA National Emphasis Program

- ▶ Directive Number CPL-03-00-008
- ▶ Issued in 2008 with modifications in 2015
- ▶ Citations issued under Section 5(a)(1) of the OSH Act "General Duty Clause"
- ▶ Corrective measures for compliance reference NFPA standards

# What is Combustible Dust?

- ▶ OSHA Definition: "Combustible dust is defined as a solid material composed of distinct particles or pieces, regardless of size, shape, or chemical composition, which presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations. Combustible dusts are often either organic or metal dusts that are finely ground into very small particles, fibers, fines, chips, chunks, flakes, or a small mixture of these."
- ▶ Less than 420 microns (those passing through a U.S. No. 40 standard sieve)

# Hazard Communication Standard

- ▶ Physical and chemical characteristics of the hazardous chemical (for example, vapor pressure or flash point) including the potential for fire, explosion, and reactivity (if known, Kst, MIE, MEC and particle size are combustible dust characteristics) (1910.1200(2)(g)(ii) and (iii))

# Explosiveness of Combustible Dust

- ▶ MIE
  - ▶ Minimum ignition energy
  - ▶ Ease and likelihood of ignition of a dispersed dust cloud
- ▶ MEC
  - ▶ Minimum explosible concentration
  - ▶ Minimum amount of dust dispersed in air required to spread an explosion (similar to LEL)
- ▶ Kst
  - ▶ Relative explosion severity compared to other dusts

Aren't these supposed to be in the Safety Data Sheets?

# Safety Data Sheet Examples

- ▶ Wholegrain:  
[https://www.agrexinc.com/assets/docs/SDS\\_-\\_Grain\\_SDS\\_2015\\_AGREX\\_INC.v1.0.pdf](https://www.agrexinc.com/assets/docs/SDS_-_Grain_SDS_2015_AGREX_INC.v1.0.pdf)
- ▶ BASF Igrasof 168:  
[https://worldaccount.basf.com/wa/NAFTA~en\\_US/Catalog/Additives/doc4/BASF/PRD/30546656/.pdf?asset\\_type=msds/pdf&language=EN&validArea=CA&urn=urn:documentum:ProductBase\\_EU:09007af880363a08.pdf](https://worldaccount.basf.com/wa/NAFTA~en_US/Catalog/Additives/doc4/BASF/PRD/30546656/.pdf?asset_type=msds/pdf&language=EN&validArea=CA&urn=urn:documentum:ProductBase_EU:09007af880363a08.pdf)
- ▶ Sigma Aldrich Tantalum Powder:  
<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=262846&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F262846%3Flang%3Den>

# Why Sample?

- ▶ Different dusts of the same chemical material can have different ignitability and explosibility characteristics, depending upon physical characteristics such as particle size, shape, and moisture content.
- ▶ Combustibility can also be influenced by the processing or generation of the powder/dust



# Sample Analysis

- ▶ It can be expensive
- ▶ It can be variable
  - ▶ Moisture content
  - ▶ Location of fines in the dust collection system
- ▶ Is it required by OSHA?

# Standards and Regulations

- ▶ Focus on NFPA 652
  - ▶ Hazard identification
    - ▶ Requires sampling or published data
  - ▶ Dust Hazard Analysis

# NFPA 652 Requirements

- ▶ Determine combustibility of materials
- ▶ Conduct a DHA
- ▶ Manage identified hazards
- ▶ Establish safety management systems

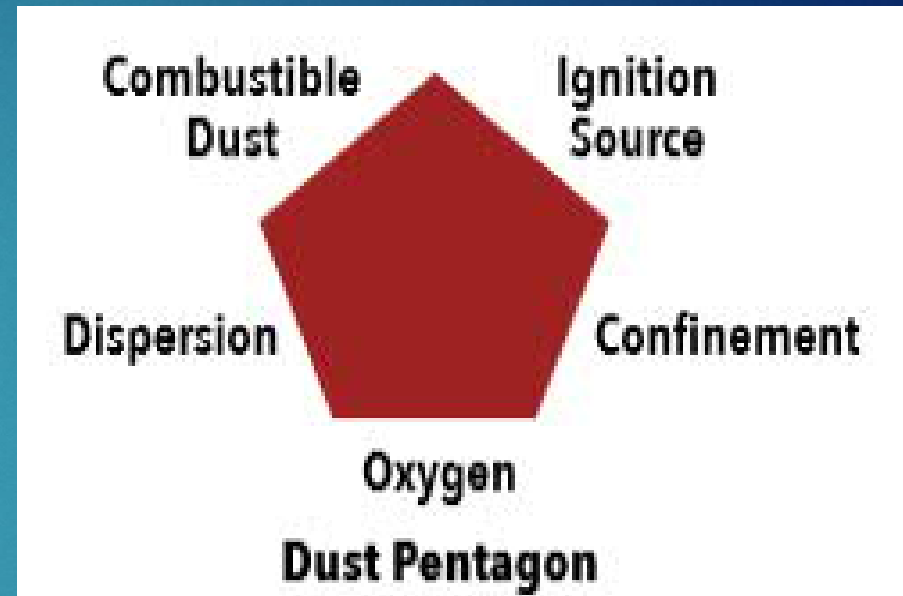
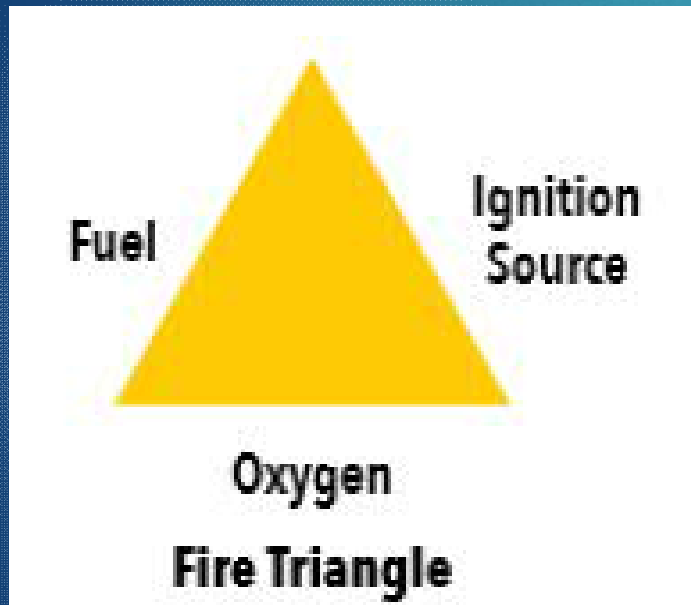
# Dust Hazard Analysis (DHA)

- ▶ A DHA shall be completed for all new processes and facility compartments
- ▶ For existing processes and facility compartments, a DHA shall be completed by September 7, 2020
- ▶ DHA to be updated and reviewed every 5 years
- ▶ Performed by a “qualified person”
- ▶ Similar to process safety management requirements

# Dust Hazard Analysis (DHA)

- ▶ Prescriptive controls
- ▶ Performance based controls

# Combustible Dust Pentagon



# History – Jahn Foundry



# History – Imperial Sugar





# News – Dust Collector Fires/Explosions

## **2 injured in Minneapolis building explosion**

According to Minneapolis Fire officials, two employees were transported to an area hospital with "significant injuries" following a dust explosion Wednesday.

Fire at El Cajon business knocked down quickly; firefighters undergo decontamination

## **Widner Products fire in Rogers burns thru night**

Fire at General Dynamics confined to dust collection system

## **Firefighters Extinguish Small Fire at West Lebanon Business**

# Dry Dust Collectors

- ▶ Fuel (in the form of a combustible dust of the right particle size and in the right concentration)
- ▶ Suspension (usually in air)
- ▶ Oxidant (usually air)
- ▶ Confinement (in equipment or a room)
- ▶ Ignition source

# Air Material Separators (aka Dust Collectors)

- ▶ If >8 cubic feet dirty side volume, must be located outside
- ▶ Why 8 cubic feet?
- ▶ What if there is an existing process inside a building?

# Dust Collector Controls

- ▶ Isolation
  - ▶ Backdraft damper
- ▶ Explosion vents
- ▶ Duct orientation and velocity
- ▶ Chemical suppression
- ▶ Inerting



# Flameless Vent



# Interim Controls

- ▶ Inspection and Maintenance
- ▶ Housekeeping
- ▶ Cleaning frequency
- ▶ Explosion proof vacuums

# Emerging Issues

- ▶ Additive Manufacturing
- ▶ 3D Printing

# Examples for Discussion

- ▶ >8 cubic feet dry dust collector with known combustible dust located inside a building
- ▶ No current isolation devices or explosion venting
- ▶ Recommendations?



# Examples for Discussion

- ▶ <8 cubic feet dry dust collector with known combustible dust.
- ▶ Dust is observed accumulating in the collection area and residue observed on the filter media.
- ▶ Recommendations?

# Examples for Discussion

- ▶ New process that generates aluminum dust residue
- ▶ New process that generates combustible dust residue
- ▶ 3D printing process moving from non-combustible powder to reactive metal powder

# CSB Recommendations

- ▶ Education
- ▶ Regulation
- ▶ Enforcement

# Sources

- ▶ Photo slide 3: CSB, <https://www.csb.gov/imperial-sugar-company-dust-explosion-and-fire/>
- ▶ Photo slide 3 and last slide: [https://www.masslive.com/news/index.ssf/2016/02/17th\\_anniversary\\_of\\_the\\_jahn\\_f.html](https://www.masslive.com/news/index.ssf/2016/02/17th_anniversary_of_the_jahn_f.html)
- ▶ Slide 11: Guidelines for Combustible Dust Hazard Analysis By the American Institute of Chemical Engineers, Inc.
- ▶ Slide 6:  
file:///C:/Users/Michael%20Murdzia/AppData/Local/Packages/microsoft.windowscommunicationsapps\_8wekyb3d8bbwe/LocalState/Files/S0/2114/csb\_2018\_factsheet\_combustibledust\_05[2202].pdf

# Sources (continued)

- ▶ Slide 5:  
<https://www.osha.gov/Publications/3371combustible-dust.html>