WELCOME

OSHA Combustible Dust Inspections

Presented by:

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Overview

- Background Information
- OSHA Combustible Dust Inspections
- Most Commonly Cited Combustible Dust Issues and Hazards

What is a Combustible Dust?

- OSHA's Combustible Dust Definition (CPL 03-00-008) – **As Of Right Now**
  - Combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape
- NFPA 654 Definition of Combustible Dust – **As Of Right Now**
  - Combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape (Section 3.3.4 of NFPA 654-2006)

3

Elements Needed for a Combustible Dust Deflagration

1. Fuel (Combustible Dust)
2. Ignition Source
3. Oxygen
4. Dust dispersion
   - Dust cloud at or exceeding the Minimum Explosible Concentration (MEC)
5. Confinement of the dust cloud (fugitive dust emissions)
   - Dust collectors, process machinery

Types of Combustible Dusts

- Organic Dusts
  - Sugar, Flour, Paper, Soap, Dried Blood
- Wood Dusts
  - All Varieties, Includes Sawdust
- Metal Dusts
  - Aluminum, Magnesium
- Plastic Dusts (Additives)
- Carbon Dusts
  - Coal

How Can Inspections Occur?

- Accidents/Fatalities
- Complaints (Formal and Nonformal)
- Referrals
- Programmed (Planned Health and/or Safety)
  - Appendix D-1: Industries with More Frequent and/or High Consequence for Combustible Dust Explosions/Fires
  - Appendix D-2: Industries that may have Potential for Combustible Dust Explosions/Fires

Some of the Combustible Dust NEP Inspection Items

- Plant History of Fires
- Material Safety Data Sheets (MSDSs)
- Housekeeping
- Ventilation System
- Dust Collectors (Air Material Separators)
- Explosion Protection/Prevention Systems
- Sources of Ignition
- Personal Protective Equipment

Combustible Dust Sampling

- Take a one liter sample of the combustible dust in a plastic bottle or container
- All OSHA combustible dust samples are sent to Federal OSHA Lab in Salt Lake City (SLC)
- CSHO specifies to SLC whether they want a K_{st} or Class II test done on the sample
- SLC uses a low energy and low turbulence test chamber
  - More accurate and protective, but K_{st} value may be 4-5 times lower compared to other labs
- The employer is **not allowed** to use OSHA's combustible dust sampling results for engineering controls

8

Relevant OSHA Standards for Combustible Dust

- 1910.22 Housekeeping
- 1910.36 Design and Construction for Exit Routes
- 1910.37 Safeguards and Features for Exit Routes
- 1910.38 Emergency Action Plans
- 1910.39 Fire Prevention Plans
- 1910.94 Ventilation
- 1910.132 Personal Protective Equipment
- 1910.145 Specifications for Accident Prevention Signs and Tags
- 1910.146 Permit-Required Confined Spaces
- 1910.157 Fire Extinguishers
- 1910.165 Employee Alarm Systems
- 1910.176 Material Handling
- 1910.178 Powered Industrial Trucks
- 1910.269 Electrical Power Generation
- 1910.272 Grain Handling Facilities
- 1910.307 Hazardous Locations
- 1910.1200 Hazard Communication (HazCom)

9

OSHA & NFPA Standards

- OSHA **DOES NOT** enforce NFPA or other consensus standards
- OSHA cites combustible dust hazards (fire, deflagration, explosion, etc.) under the General Duty Clause (5(a)(1))
- CPL 03-00-008
  - General Duty Clause citations may be issued for deflagration, explosion or other fire hazards that may be caused by combustible dust within a dust collection system or other containers, such as mixers
  - Compliance Officers may "rely upon NFPA standards for evidence of recognition of the hazard," as well as consult relevant NFPA standards for evidence of feasible means of abatement
- OSHA can also cite hazards not addressed in consensus standards under the General Duty Clause

10

General Duty Clause

- Section 5(a)(1) or Indiana Code (IC) 22-8-1.1, Section 2
  - Employer must "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm"
- According to the Status Report on the Combustible Dust NEP, 11% of combustible dust related violations pertain to the General Duty Clause
- Can be issued for deflagration, explosion or other fire hazards that may be caused by combustible dust within a dust collection system or other containers (mixers, bins, etc.)
- Also can be issued for conditions such as, but not limited to
  - Improper deflagration venting
  - Ductwork-related problems
  - Make-up air systems
  - Improper Work Practices

11

Four Main NFPA Combustible Dust Standards

- Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities (NFPA 61-2008)
  - Flour, sugar, starch, spices
- Standard for Combustible Metals, Metal Powders and Metal Dusts (NFPA 484-2009)
  - Magnesium, aluminum, titanium
- Standard for the Prevention of Fires and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids (NFPA 654-2006)
  - Plastic, paper, rubber, carbon dusts
- Standard for the Prevention of Fires and Dust Explosions in Wood Processing and Woodworking Facilities (NFPA 664-2007)

12

Additional Combustible Dust Consensus Standards

- **Explosion Protection by Deflagration Venting (NFPA 68-2007)**
- **Explosion Prevention Systems (NFPA 69-2008)**
- **Classification of Combustible Dusts and Hazardous (Classified) Locations (NFPA 499-2008)**
- Static Electricity (NFPA 77-2007)
- Life Safety Code (NFPA 101-2009)
- National Fire Alarm and Signaling Code (NFPA 72-2010)
- Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids (NFPA 91-2010)
- **Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire (NFPA 2112-2007)**
- Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protection of Personnel Against Flash Fire (NFPA 2113-2007)
- **ACGIH *Industrial Ventilation Manual of Recommended Practices for Design (26th Edition)***
- Prevention and Mitigation of Combustible Dust Explosion and Fire (FM Data Sheet 7-76)

13

LACK OF EXPLOSION PROTECTION

Deflagration Venting, Deflagration Suppression Systems, Oxidant Concentration Reduction, Deflagration Pressure Containment, Dilution with Noncombustible Dust (Section 7.1.2.1 of NFPA 654-2006)

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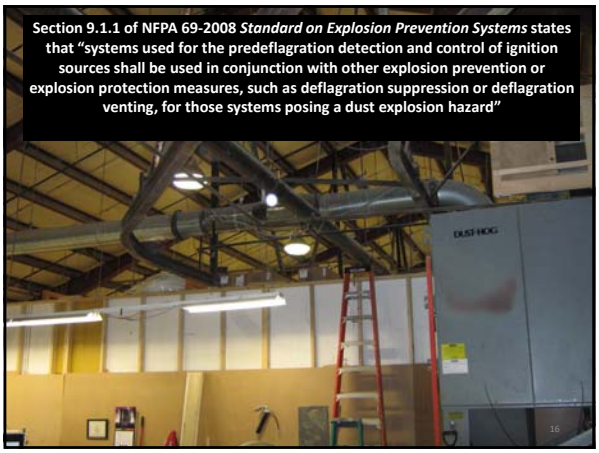

Section 9.1.1 of NFPA 69-2008 *Standard on Explosion Prevention Systems* states that "systems used for the predeflagration detection and control of ignition sources shall be used in conjunction with other explosion prevention or explosion protection measures, such as deflagration suppression or deflagration venting, for those systems posing a dust explosion hazard"
DUST-HOG
16


Combustible Dust is Required to be Conveyed to a Dust Collector or Dust Collection System


Each of These Three Silos Held Approximately 60,000 Pounds of Flour Each
18

DO DUST COLLECTORS HAVE TO BE LOCATED OUTSIDE?

IT DEPENDS ON HOW THE DUST COLLECTOR IS SET-UP

19

Do Dust Collectors Have To Be Located Outside?

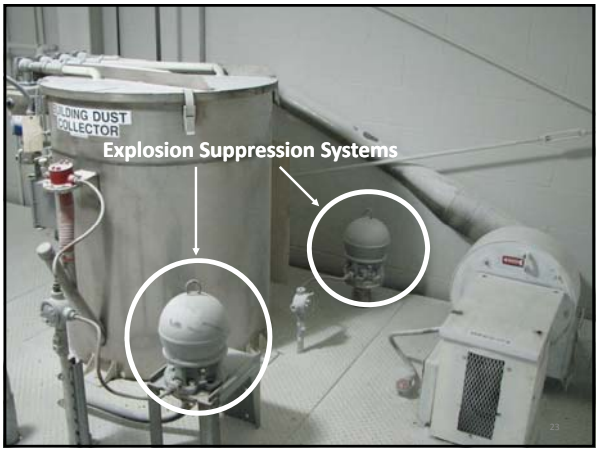
- Section 7.13.1.1.1 of NFPA 654-2006 states that where an explosion hazard exists, air-material separators (AMS) shall be located outside of buildings
- **HOWEVER,** Section 7.13.1.1.1 shall not apply to the following (7.13.1.1.2):
  1. AMSs that are protected in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5) or 7.1.2.1(6)
  2. AMSs that meet all of the following criteria:
     a) They are equipped with deflagration vents that are vented through ducts to the outside
     b) The reduced venting efficiency due to the duct has been taken into account
     c) The ducts are designed to withstand the effects of the deflagration
  3. AMSs that have a volume of less than 8 ft^3 (0.2 m^3)
- NFPA 664-2007 (8.2.2.5.1.4) and NFPA 61-2008 (10.4.3) say something similar to NFPA 654-2006
- NFPA 484-2009 requires most dry-type dust collectors to be located outside
  - No or Few Exceptions to This

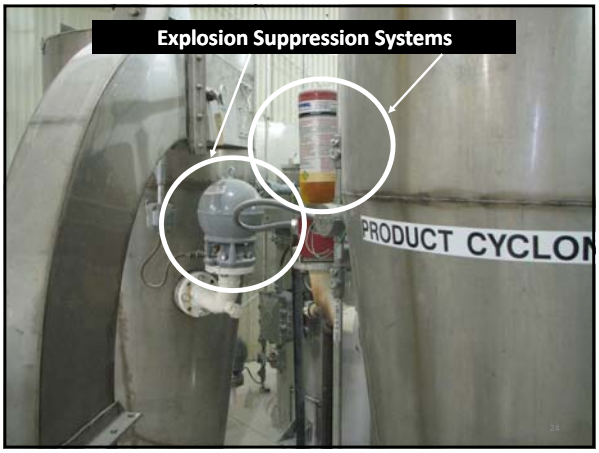
20

Ducts that are used to direct vented gases from the vent to the outside of a building shall be of noncombustible construction and shall be strong enough to withstand the expected the maximum tolerable explosion pressure (P_{red})
(Section 6.8.5 of NFPA 68-2007)

21


DANGER


Explosion Suppression Systems


Explosion Suppression Systems
PRODUCT CYCLON


Explosion Isolation
Valve (Gate)


Chemical Explosion
Isolation System


VALVE 2

IMPROPER DEFLAGRATION VENTING

Standard on Explosion Protection by Deflagration Venting
(NFPA 68-2007)

28

29

Not allowed to have more than 1/32nd of an inch on the floor or other surfaces (NFPA 654-2006)

IMPROPER HOUSEKEEPING

Moderate or Dense Dust Cloud or a Dust Layer Greater Than 1/8 of an inch is Class II, Division 1 location (NFPA 499-2008)

33

Housekeeping: Key Point

- **Good housekeeping alone <u>WILL NOT</u> prevent a fire or explosion, as well as injuries or fatalities**
- Remember that large dust accumulations are a secondary explosion hazard
  - An initial (primary) explosion in processing equipment or in an area were fugitive dust has accumulated may shake loose more accumulated dust, or damage a containment system (such as a duct, vessel, or collector)
  - As a result, if ignited, the additional dust dispersed into the air may cause one or more secondary explosions.
    - These can be far more destructive than a primary explosion due to the increased quantity and concentration of dispersed combustible dust

34

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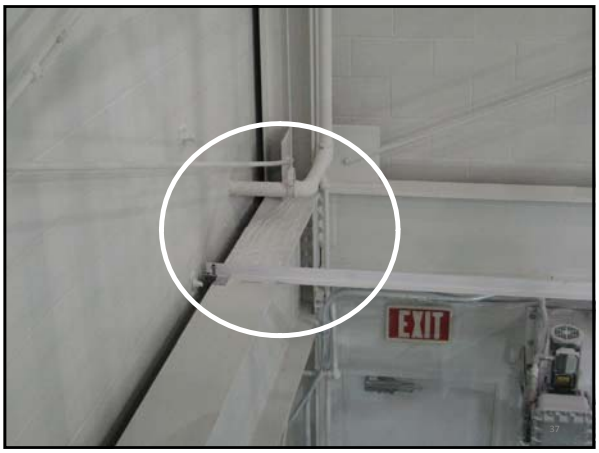
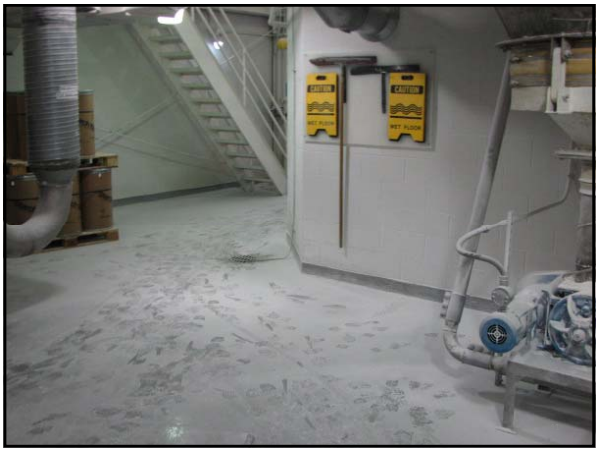

EXIT


CAUTION
WET FLOOR
CAUTION
WET FLOOR

Potential Ways to Make Housekeeping Easier

- Develop and implement a cleaning schedule
- Eliminate all horizontal surfaces where combustible dust could potentially collect
- Paint floors and surfaces where combustible dust accumulates a different color than the combustible dust

44

VENTILATION

Especially Look at the Make-Up (Recycled) Air System for Facility

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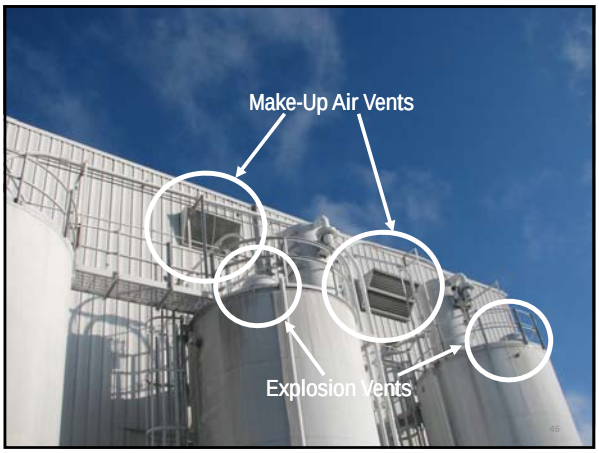
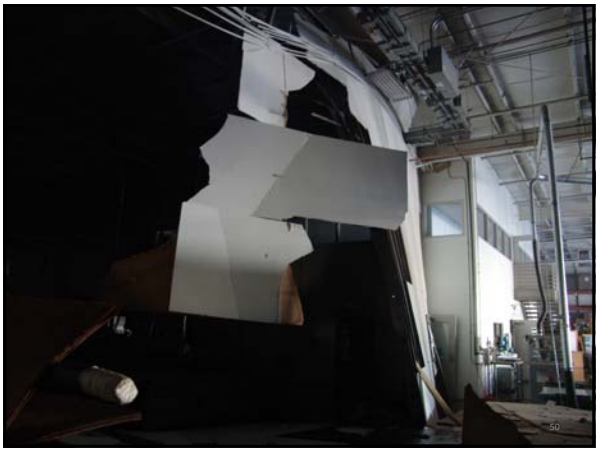

Make-Up Air Vents
Explosion Vents


Make-Up (Return) Air System


49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51

SOURCES OF IGNITION

Especially Look at Classification of Electrical Equipment, Apparatus and Installations

53

Most Common Sources of Ignition

- Friction
  - Rubbing and grinding of metal parts in machinery and equipment and ventilation ducts
- Heat
  - Conduction, convection and radiant heat
- Electrical, sparks (embers)
  - Most of the time these are byproducts of friction
- Electrostatic Discharge (Static Electricity)
  - Due to transportation of dust and vibration of mechanical equipment
- Smoldering nests
  - Dust heats itself while in piles (internal combustion) or dust laying on a heated surface
- Hot work
  - Grinding, welding, cutting, etc.

54

Electrical Citations

- If the location where the dust was present falls under any Class II location definitions, then 1910.307 will apply
- Equipment, wiring methods and installations of equipment in hazardous (classified) locations must be:
  - Intrinsically safe
  - Approved for the hazardous (classified) location, **OR**
  - Safe for the hazardous (classified) location
- If the employer chooses the last option, then they must demonstrate that the equipment is of a type and design that will provide protection from the hazards involved
  - Compliance with guidelines contained in the National Electrical Code (NEC) constitutes one means, but not the only means, of demonstrating that the electrical equipment is safe for the hazardous locations

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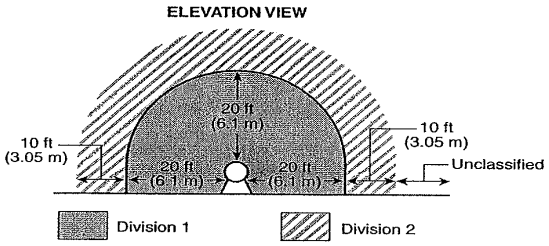

Description of dust condition

Division 1	Division 2
Moderate or dense dust cloud. Dust layer greater than ⅛ in. (3.0 mm).	No visible dust cloud. Dust layer less than ⅛ in. (3.0 mm) and surface color not discernible.

FIGURE 5.8(a) Group F or Group G Dust — Indoor, Unrestricted Area; Open or Semi-Enclosed Operating Equipment.

56

57

Dust Cloud Movies

- Extruding Department - Open Process
- Extruding Department - Open Mixer
- Blending Department - Open Process

59

General Items Cited Concerning Combustible Dust

- Use of compressed air to clean or blow off surfaces with settled fugitive combustible dust emissions without controlling sources of ignition
- HazCom Training
- Material Safety Data Sheets (MSDSs)
- Improperly rated forklifts used in areas where combustible dust is generated and/or settled
- Confined Space Entries into Dust Collectors
- Fire Extinguishers
- Flame-Resistant Clothing (FRC)
- Vacuum Cleaners

60


QUESTIONS
61