OSHA & COMBUSTIBLE DUST

Presented by:

Jeffry S. Carter
Deputy Commissioner of Labor
Indiana Occupational Safety and Health Administration

and

Jason Reason
Senior Industrial Hygienist
Indiana Occupational Safety and Health Administration
Speakers

Jason Reason

- Senior Industrial Hygienist
- Member NFPA Committee on Combustible Dust
- CIH
- CSP
- CHMM
- Handles many of the more complex IH fatality cases

Jeff Carter

- Deputy Commissioner & head of IOSHA
- Previously served as an Environmental, Health, and Safety Director with United Technologies Corp.
Current Enforcement

- Indiana uses the General Duty Clause to enforce existing consensus standards
- Various NFPA and other consensus standards may apply
- Trends in Combustible Dust enforcement for Indiana. Relatively few actual investigations
Current Enforcement

- Much of what we do today is driven by National Emphasis Program (NEP) Directive dated March 11, 2008
- NEPs focus agency resources on a specific typically narrow issue
- Some NEPs are voluntary, Combustible Dust was not one of those
Future Enforcement

- Advanced Notice of Proposed Rulemaking published 10/21
- Final Rule by mid year 2010 (end of FFY 2010)
- NEP guides our work until then
Future Enforcement

- New rule likely to look very similar to current NFPA standards
- Will incorporate some provisions from Grain Dust Standard
- Very similar enforcement appearance to what we do today except that it will now be a hazard specific standard
Enforcement

- How do I know if this applies to my Company?
  - Accumulations of 1/32 of an inch of dust
  - Covering at least 5% total floor area
  - Dust is tested and determined to be “explosive”
Enforcement

- How did your plant get chosen for an inspection?
  - Formal employee complaint
  - Inter agency referrals
  - Significant incident or event
Changing Enforcement

- New OSHA attitude in Washington
- Enforcement Driven highly aggressive
- Feds are suspicious of some State Plan State programs
- Nevada report
Changing Enforcement

- Indiana has increased the number of willful and repeat violations written
- Search warrants can be obtained in as little as 4 hours now
- Post Final Order enforcement tools such as Sheriffs warrants
Changing Enforcement

- Work with employers “who get it”
- Educational efforts with INSafe
- Improved communication with employers including customer satisfaction cards
- Use of Partnerships and Alliances
- VPP program
Metrics

- Governor Daniels
  - Overall injury rate
  - Number of inspections
  - Number of fatal incidents

- Federal OSHA
  - 26 separate data points
  - Some fairly obscure
  - None references overall injury or fatality rate
SESSION BREAK
IOSHA’s
ENFORCEMENT OF
COMBUSTIBLE DUST
STANDARD

Jason Reason, CIH, CSP, CHMM
Overview

- Background Information
- OSHA's Current Policies and Procedures for Combustible Dust Inspections
- Some Hazards OSHA Looks for on a Typical Combustible Dust Inspection
Combustible Dust Definition

- A 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)

- Traditionally a material 420 μm or smaller
  - Capable of passing through a U.S. No. 40 standard sieve
    - Does not have to pass through a U.S. 40 standard sieve to be considered a combustible dust (Section A.3.3.4 of NFPA 654-2006)

- Typically, the finer (smaller) the dust, the more explosive (combustible) it is
Combustible Dust Definition

- Combustible dust are considered Class II dusts
- Class II Combustible Dusts are divided into three groups
  - Group E: Metal Dusts
  - Group F: Carbonaceous Dusts
  - Group G: All other dusts not found in Groups E or F (flour, grain, wood, plastic, chemicals)
Other Important Definitions

• Deflagration
  – Propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium

• Air Material Separator
  – A collector designed to separate the conveying air from the material being conveyed
  – Includes dust collectors, baghouses, etc.
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
Elements Needed for a Combustible Dust Deflagration

1. Fuel (Combustible Dust)
2. Ignition Source
   - Friction, heat (conduction, convection), electrical, sparks (embers), electrostatic discharge, smoldering nests, hot work (grinding, welding, etc.)
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
A HUGE Problem

- Several combustible dust explosions and fires in the United States, including several fatalities
  - Two major combustible dust explosion fatalities in Indiana in the last 5 years
  - Two combustible dust explosions and four combustible dust fires in Indiana in 2009
- OSHA says that 30,000 employers in the United States are at risk for combustible dust fires and/or explosions
- Congress says that 200,000 employers in the United States are at risk for combustible dust fires and/or explosions
- OSHA currently has no specific standard for combustible dust
- OSHA does have a National Emphasis Program (NEP) for combustible dust
  - CPL 03-00-008 (Reissued) - Provides policies and procedures for inspecting workplaces that create or handle combustible dusts that could cause deflagration, fire or explosion
Combustible Dust Tests (Alphabet Soup)

- Limiting Oxygen Concentration (LOC)
- Minimum Ignition Energy (MIE)
- Minimum Ignition Temperature (MIT)
- Minimum Explosible Concentration (MEC)
- Ignition Sensitivity (IS)
- $K_{st}$
- Explosion Severity (ES)
- Class II
- Maximum Rate of Pressure Rise ($dp/dt$)
- Maximum Explosion Pressure ($P_{max}$)
Combustible Dust Sampling

- Take a one liter sample of the combustible dust in a plastic bottle or container.
- All IOSHA 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.
Typical $K_{st}$ Values for Common Combustible Dusts

- Cotton: 20-24 b.m/s
- Wood: 26-102 b.m/s
- Paper: 168 b.m/s
- Corn Starch: 128-163 b.m/s
- Wheat Flour: 87-139 b.m/s
- Sugar: 75-154 b.m/s
- Coal: 10-143 b.m/s
- Rubber: 106-138 b.m/s
- Polyethylene (Plastic): 46-156 b.m/s
- Polypropylene (Plastic): 38-101 b.m/s
- Aluminum Powder: 400-1100 b.m/s
- Magnesium: 30-500 b.m/s
# Dust Explosion Classes

<table>
<thead>
<tr>
<th>Dust Explosion Class</th>
<th>$K_{st}$ (bar.meters/second)</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>St 0</td>
<td>0</td>
<td>No Explosion</td>
</tr>
<tr>
<td>St 1</td>
<td>&gt;0 to ≤200</td>
<td>Weak Explosion</td>
</tr>
<tr>
<td>St 2</td>
<td>&gt;200 to ≤300</td>
<td>Strong Explosion</td>
</tr>
<tr>
<td>St 3</td>
<td>&gt;300</td>
<td>Very Strong Explosion</td>
</tr>
</tbody>
</table>
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)
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”
- 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
General Duty Clause

- Must have a feasible means to abate the hazard in order for OSHA to cite the General Duty Clause
- Compliance Officers are allowed to use the NFPA standards as evidence of feasible means of abatement
  - NFPA standards can also be used for evidence of industry recognition of the hazard
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
- 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)
## Four Main NFPA Combustible Dust Standards

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Require Explosion Protection</td>
<td>Industry Specific</td>
</tr>
<tr>
<td>Control Sources of Ignition</td>
<td>Require Different Forms of Explosion Protection</td>
</tr>
<tr>
<td>Means of Egress</td>
<td>Different Ventilation Requirements</td>
</tr>
<tr>
<td>Emergency Action Plan</td>
<td></td>
</tr>
<tr>
<td>Housekeeping Requirements</td>
<td></td>
</tr>
<tr>
<td>Employee Training</td>
<td></td>
</tr>
<tr>
<td>Process Safety Management</td>
<td></td>
</tr>
<tr>
<td>Elements</td>
<td></td>
</tr>
</tbody>
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Additional Combustible Dust 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)
- Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protection of Personnel Against Flash Fire (NFPA 2113-2007)
- Prevention and Mitigation of Combustible Dust Explosion and Fire (FM Data Sheet 7-76)
Combustible Dust Inspections

- Average cost to abate (fix) all IOSHA combustible dust citations
  - $337,500 per combustible dust inspection
- Field Operations Manual (FOM)
  - If an employer’s level of compliance lags significantly behind that of its industry, allegations of economic infeasibility will not be accepted
  - Federal OSHA is allowed to use State Plan OSHA citations to prove Willful (Knowing) citations for multi-state employers
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)
If you used deflagration venting, how would you vent this structure and where would the vent(s) go?
Combustible Dust is Required to be Conveyed to a Dust Collector or Dust Collection System
Enclosureless Dust Collector

No Explosion Protection Required
DO DUST COLLECTORS HAVE TO BE LOCATED OUTSIDE?
DANGER

EXPLOSION PANEL

DO NOT STAND OR WORK IN FRONT OF THIS PANEL WHILE EQUIPMENT IS IN SERVICE
Explosion Suppression Systems
IMPROPER DEFLAGRATION VENTING

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

- Section 8.8.2 of NFPA 68-2007 (Page 23)
- \[ D = K \left( \frac{V}{n} \right)^{1/3} \]
  - \( D \) = Axial Distance (front) from the Vent (m)
  - \( K \) = Flame Length Factor
    - \( K = 10 \) for Metal Dusts, \( K = 8 \) for Chemical and Agricultural Dusts
  - \( V \) = Volume of Vented Enclosure (m³)
  - \( n \) = Number of Evenly Distributed Vents
- Formula only valid for certain conditions (See Section 8.8.5 of NFPA 68-2007)
Is the explosion venting on this dust collector designed properly and in compliance?
Explosion Venting

- Just because a dust collector is equipped with explosion venting **DOES NOT** mean that it is vented correctly
- The employer must prove that the explosion venting is designed properly
  - Must make sure that the pressure needed to release the vent panel ($P_{stat}$) is small compared with the maximum tolerable explosion pressure ($P_{red}$)
  - Although the employer is not required to test their dust, the $K_s$ value is required to determine proper explosion vent size
- If the dust collector is equipped with explosion venting and the employer cannot prove that the explosion venting is designed properly, then a General Duty citation will be issued
  - NFPA 68 will be used as a method of abatement
Fireball Dimensions for Explosion Vent is 17 ft long by 17 feet wide

Emergency Exit Doors
**Explosion Venting**

Fireball Dimensions for Each Explosion Vent is 21 ft high by 21 feet wide

**Emergency Exit Doors**
Fireball Dimensions for Each Explosion Vent is 46 ft high by 46 feet wide
Not allowed to have more than $\frac{1}{32}$ 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 $\frac{1}{8}$ of an inch is Class II, Division 1 location (NFPA 499-2008)
VENTILATION

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

Especially Look at Classification of Electrical Equipment and Installations
What Else Does OSHA Look For?

- Use of compressed air to clean or blow off surfaces with settled fugitive combustible dust emissions
- HazCom Training
- Material Safety Data Sheets (MSDSs)
- Improper vacuums used to clean-up combustible dust
- Improperly rated forklifts used in areas where combustible dust is generated and/or settled
- Unapproved exhaust fans and motors used in ventilation systems
- Emergency Action Plans and Fire Prevention Plans
- Fire Extinguishers
- Personal Protective Equipment (PPE)
  - Flame Resistant, 100% Cotton (All Natural Fibers)
QUESTIONS
CONTACT IOSHA

Email: ioshadol.in.gov
Website: www.in.gov/dol/iosha.htm
Phone: (317) 232-2693