Combustible Dust…
an Explosive Issue

IWF - August 2012

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Air Handling Systems

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More info on combustible dust:
http://www.airhand.com/combustibledust.asp

Overview

What is Combustible Dust?

- Air Handling Systems - http://www.airhand.com/combustibledust.aspx
- Sawdust Cannon - http://www.vimeo.com/260680
- Mythbusters - Creamer Cannon - http://www.youtube.com/watch?v=yRw4ZRqmxOc&NR=1

Who's in Charge?

Can it Happen in My Facility?

Prevention

What is Combustible Dust?

Combustible Dust

Does your company or firm process any of these products or materials in powdered form?

If your company or firm processes any of these products or materials, there is potential for a "Combustible Dust" explosion.

Agricultural Products
Egg w…
Milk, p…
Milk, no…
Soy flour

Cotton…
Garlic…
Glute…

Soyb…
Spi…

Chem…
A…

Epoxy resin
Melamine
M…

…e)
…ed
…d

…in a manner to minimize dust accumulation and facilitate cleaning.

Ignition Control Measures

Electrically-powered cleaning devices such as vacuum cleaners, and electrical equipment are approved for the hazard classification for Class II locations.

The facility has an ignition control program, such as grounding and bonding and other methods, for dissipating any electrostatic charge that could be generated while transporting the dust through the ductwork.

The facility has a Hot Work permit program.

Areas where smoking is prohibited are posted with "No Smoking" signs.

Duct systems, dust collectors, and dust-producing machinery are bonded and grounded to minimize accumulation of static electrical charge.

…become combus… …nder …mployees.

…sion hazards of combustible dusts.

…rotection Measures

The facility has an emergency action plan.

Dust collectors are not located inside of buildings. (Some exceptions)

Rooms, buildings, or other enclosures (dust collectors) have explosion relief venting distributed over the exterior wall of buildings and enclosures.

Explosion venting is directed to a safe location away from employees.

The facility has isolation devices to prevent deflagration propagation between pieces of equipment connected by ductwork.

The dust collector systems have spark detection and explosion/deflagration suppression systems.

Emergency exit routes are maintained properly.

OSHA® Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov • (800) 321-OSHA • TTY (877) 889-5627

Combustible dusts are fine particles that present an explosion hazard when suspended in air in certain conditions.

Source: OSHA Fact Sheet.

AIR HANDLING SYSTEMS

What is Combustible Dust?

Agricultural Products
Egg white
Milk, powdered
Milk, nonfat, dry
Soy flour
Starch, corn
Starch, rice
Starch, wheat
Sugar
Sugar, milk
Sugar, beet
Tapioca
Whey
Wood flour

Agricultural Dusts
Alfalfa
Apple
Beet root
Carrageen
Carrot
Cocoa bean dust
Cocoa powder
Coconut shell dust
Coffee dust
Corn meal
Cornstarch
Cotton
Cottonseed
Garlic powder
Gluten
Grass dust
Green coffee
Hops (malted)
Lemon peel dust
Lemon pulp
Linseed
Locust bean gum
Malt
Oat flour
Oat grain dust
Olive pellets
Onion powder
arsley (dehydrated)
each
eanut meal and skins
eat
otato
otato flour
otato starch
Raw yucca seed dust
Rice dust
Rice flour
Rice starch
Rye flour
Semolina
Soybean dust
Spice dust
Spice powder
Sugar (10x)
Sunflower
Sunflower seed dust
Tea
Tobacco blend
Tomato
Walnut dust
Wheat flour
Wheat grain dust
Wheat starch
Xanthan gum

Car onaceous Dusts
Charcoal, activated
Charcoal, wood
Coal, bituminous
Coke, petroleum
Lampblack
Lignite
eat, 22%H_20
Soot, pine
Cellulose
Cellulose pulp
Cork
Corn

Chemical Dusts
Adipic acid
Anthraquinone
Ascorbic acid
Calcium acetate
Calcium stearate
Carboxy-methylcellulose
Dextrin
Lactose
Lead stearate
Methyl-cellulose
araformaldehyde
Sodium ascorbate
Sodium stearate
Sulfur

Metal Dusts
Aluminum
Bronze
Iron carbonyl
Magnesium
Zinc

Plastic Dusts
(poly) Acrylamide
(poly) Acrylonitrile
(poly) Ethylene
(low-pressure process)
Epoxy resin
Melamine resin
Melamine, molded
(phenol-cellulose)
Melamine, molded
(wood flour and
mineral filled phenol-
formaldehyde)
(poly) Methyl acrylate
(poly) Methyl acrylate,
emulsion polymer
henolic resin
(poly) ropylene
Terpene-phenol resin
Urea-formaldehyde/
cellulose, molded
(poly) Vinyl acetate/
ethylene copolymer
(poly) Vinyl alcohol
(poly) Vinyl butyral
(poly) Vinyl chloride/
ethylene/vinyl
acetylene suspension
copolymer
(poly) Vinyl chloride/
vinyl acetylene
emulsion
copolymer

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What is Combustible Dust?

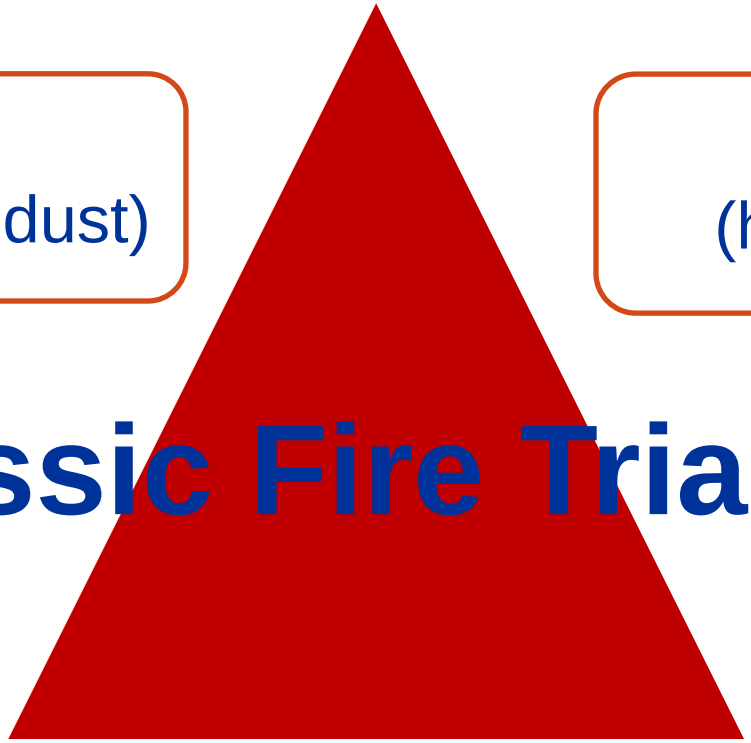
Combustible Fine Particles

- 2007 - NFPA 664-2007 - Deflagrable Wood Dust 420 micons or smaller (having moisture content of less than 25%). Material that will pass through U.S. No. 40 Standard Sieve. Size of fairly coarse sand.

- **2012** - NFPA 664-2012 3.3.27 NOW 500 microns or less, or material that will pass through U.S. No. 35 Standard Sieve. (having moisture content of less than 25%)

- **Dust layer of 1/8 in. thick can be sufficient to warrant immediate cleaning of area** (NFPA 664-2012 4.2.1)**.**

What is Combustible Dust?



Fuel
(combustible dust)

Ignition
(heat, spark)

Classic Fire Triangle

Oxygen
(air)

Remove any one element eliminates the possibility of fire.

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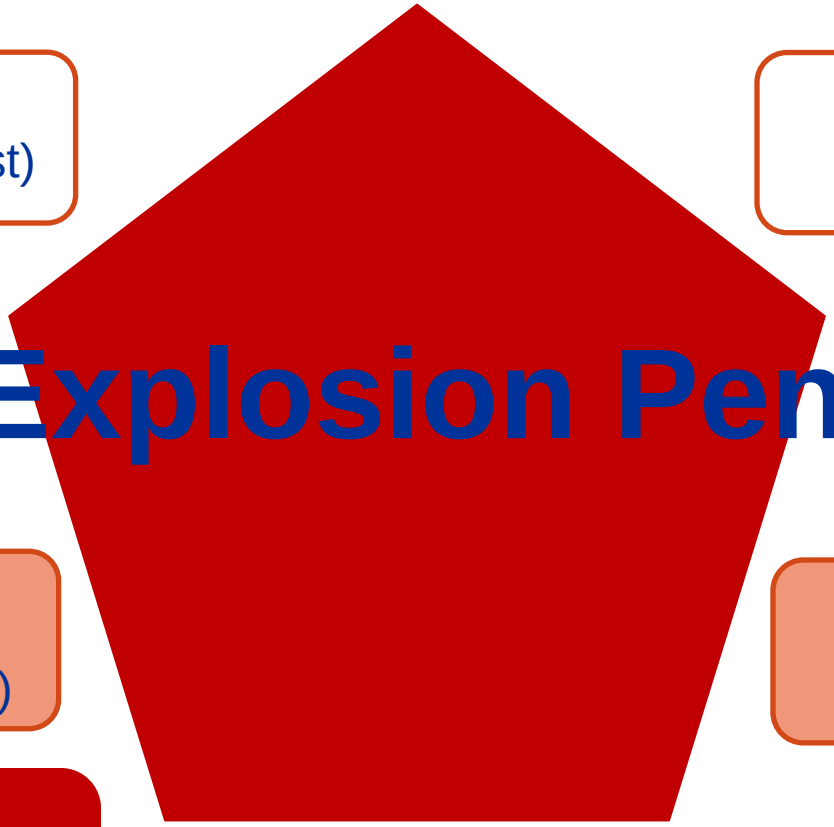
What is Combustible Dust?



Fuel - fire
(combustible dust)

Ignition - fire
(heat, spark)

Dust Explosion Pentagon

Dispersion
(explosion)
(Dust Suspension)

Confinement
(explosion)

Remove any one element prevents explosion, but not necessarily fire!*

Oxygen - fire
(air)

*the concentration of suspended dust must be within an explosible range, lowest amount of dust in air that will explode, referred to as Minimum Explosible Concentration (MEC) – (1)

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Who's in Charge?

Regulatory Organizations & Agencies

OSHA Timeline:

- 2005 - Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions
- 2007 – National Emphasis Program (NEP) targeted inspections on facilities that create or handle combustible dusts. Results from these inspections indicated that facilities had **unusually high numbers of general duty clause violations, indicating a strong need for a combustible dust standard.**
- **Feb 2008 – Imperial Sugar, dust explosion and subsequent fire at a sugar refinery.**
- Mar 2008 - Hazard Alert: Combustible Dust Explosions. OSHA Fact Sheet
- Apr 2008 – Act of Congress, First Bill introduced.
- Spring 2009 - OSHA considers rulemaking to develop a combustible dust standard for general industry.
- Oct 2009 - Combustible Dust ANPR (Advanced Notice of Proposed Rulemaking)
- Dec 2009 – OSHA hosts first in series of Stakeholder meetings in Washington DC.
- Jul 2011 - OSHA has no timeline for combustible dust rule - Labor Secretary Solis, has no timeline for when OSHA might get around to issuing a rule to deal with the dangers of combustible dust.
- Jan 2012 - Obama's OSHA puts protecting workers from dangers of combustible dust on back burner

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Who's in Charge?

Regulatory Organizations & Agencies

OSHA Timeline:

- **Feb 2012 - THE EVOLVING OSHA REGULATION OF COMDUST THROUGH EXISTING OSHA STANDARDS… By Lawrence P. Halprin**
  - *"When OSHA recently placed its combustible dust (CD) rulemaking initiative into the undetermined, long-term actions category, many people concluded that OSHA was giving it a lower priority and any further regulation of CD was on an indefinite hold.* ***Clearly, that is not the situation. OSHA's regulation of combustible dust will be substantially affected by the pending GHS*** *(United Nations' Globally Harmonized System of Classification and Labeling of Chemicals)* ***Amendment to the OSHA HazCom Standard (HCS)…the ongoing OSHA I2P2 (Injury and Illness Prevention Program)Rule initiative, and the ongoing development and revision of CD standards by the National Fire Protection Association (NFPA)."***
- Feb 2012 – Email from SBA - many fear that OSHA will attempt to use I2P2 (Injury and Illness Prevention Program) as an end all, and pack every conceivable hazard into it. These are issues we will need to explore during the SBREFA panel. The I2P2 panel is likely to be delayed while OSHA gets all the materials together.

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Who's in Charge?

Regulatory Organizations & Agencies

OSHA Timeline:

- **March 2012 - Modification of the Haz Com Standard (HCS) to conform with the UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS)**
  - Q. How has OSHA addressed Combustible dust?
  - OSHA has **NOT** provided a definition for combustible dust to the final HCS given ongoing activities in the specific rulemaking, as well as in the United Nations Sub-Committee of Experts on the GHS (UN/SCEGHS). However, guidance is being provided through existing documents, including the Combustible Dust NEP Directive CPL 03-00-008, which includes an operative definition**.**
  - **In addition, there are a number of voluntary industry consensus standards (particularly those of the NFPA) that address combustible dust.**
  - **In the final HCS, combustible dust hazards must be addressed on labels and SDSs (safety data sheets). Label elements are provided for combustible dust in the final HCS and include the signal word "warning" and the hazard statement "May form combustible dust concentrations in the air.**
  - You have till 2013 before the first requirements affect employers. "Employers are required to train workers by December 1, 2013 on the new labels elements and safety data sheets format to facilitate recognition and understanding."
- Apr 2012 – Email from OSHA specifically on combustible dust – "The official word is what is on the published regulatory agenda: long-term action, with no target date for the next official action (SBREFA review). We also have some guidance efforts proceeding at the same time."
- So while there is NO specific Combustible Dust REGULATION there is plenty to be concerned about: OSHA HCS, NFPA and more as we will see…

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Who's in Charge?

Regulatory Organizations & Agencies

NFPA – National Fire Protection Association

- Voluntary Consensus Standards - Per OSHA "These standards are NOT OSHA regulations. However, they do provide guidance from their originating organizations related to worker protection. In some cases, they may be mandated by State or local governments, or individual companies."
  - NFPA 68 Standard on Explosion Protection by Deflagration Venting. (Current 2007 Next 2013)
  - NFPA 484 Standard for Combustible Metals (Current 2009)
  - NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids. (Current 2006 Next: 2013)
  - NFPA 664 Standard for the Prevention of Fires and Explosions on Wood Processing and Woodworking Facilities (Current **2012**) Standard shall apply to woodworking operations of more than 5,000 sq. ft. or where dust producing equipment requires an aggregate dust collection flow rate of more than 1,500 CFM.
  - **2010 – NFPA discussion to merge all combustible dust related standards, NFPA 61, NFPA 484, NFPA 654, NFPA 655, NFPA 664**

Insurance Companies

- FM Global - Prevention and mitigation of combustible dust

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Who's in Charge?

Fred figured he didn't really need a dust collection system.

Who's REALLY in Charge?

YOU!!!!!!

Sugar Refinery Ignored Explosive Dust Before Blast
September 25, 2009 *by Rruss Bynum, Associated Press Writer*
http://www.impomag.com/scripts/ShowPR.asp?RID=11927&CommonCount=0

Can it Happen?

- 1785 – First recorded dust explosion at a flour mill in Italy.
- Feb 2008 - Georgia sugar refinery explosion - The 2008 Imperial Sugar refinery explosion was an industrial disaster that occurred in Port Wentworth, Georgia.
- Nov 2010 - Combustible Dust Explosion at Motorcycle Rim Manufactured Factory The explosion also caused damage to buildings and manufacturing plant, the destruction of the dust collector system and also broke windows of factories nearby.
- Jan 2011 – Hoeganaes Corp – Tennessee – THREE incidents involving combustible dust within six months – Jan, March, May. CSB created video "Iron in the Fire".
- Feb 2011 Mississippi mill slapped with ComDust violations - $67,800 - OSHA has cited a MS mill for a variety of violations, including for having an **electrical junction box open in an area where combustible wood dust accumulates**.
- Feb 2011 Combustible Dust Exposure Leads to Georgia Company's Fine - $55,250 - OSHA has cited U.S. Erosion Control Products Inc., following an inspection that uncovered 46 alleged safety and health hazards including worker exposure to heavy accumulations of combustible dust. Proposed penalties total $55,250.

Can it Happen?

- Mar 2011 - Gov. Malloy tours CT firm cited by OSHA - $83,400 OSHA cited specific safety violations. They include improperly designed combustible dust collection system. – SEE NEXT SLIDE for DETAILS

- Mar 2011 - OSHA: Carolina Skiff (GA) cited for combustible dust - $95,000 - OSHA fines Waycross, Ga., manufacturer for safety and health violations

- Apr 2011 - RY Timber (MT) cited by OSHA for worker ComDust exposure - $79,200 - Cited for five repeat and four serious violations for exposing workers to combustible dust hazards. The repeat violations address deficiencies involving inadequate housekeeping in areas where combustible dust build-up had exceeded allowable limits.

- Apr 2011 - Seating Company Slapped with fines for Combustible Dust - $117,600 - “Combustible dust, with its fine particulate composition, has the ability to create an explosive atmosphere and rapidly engulf a facility in fire,” said Area Director. “The accumulations of combustible dust must be removed, and a program must be put in place to prevent any potential build up from occurring.”

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Can it Happen?

Gov. Malloy tours CT firm cited by OSHA - $83,400

- Employees were exposed to fire and explosion hazards caused by the presence of combustible dust: Current Penalty:$5000
- The Donaldson Torit Model VS1200 dust collection system provided was not designed and installed to be used with combustible metal dust.
- Specifically:
  - The collection hood provided at the de-burring workstation was not designed and maintained so that fine particles would either fall or be projected in the direction of airflow. (NFPA 484, Section 6.3.2.2)
  - The dry-type dust collector was located inside of the building. (NFPA 484, Section 6.3.2.5)
  - The dust collection system was not dedicated to the collection of aluminum or aluminum alloy dust. (NFPA 484, Section 6.3.2.6)
  - The plastic hose that connected the exhaust hood to the dust collector was not short, straight, conductive and provided with a smooth interior surface. (NFPA 484, Sections 6.3.3.4, & 6.3.3.5.1 & 10.4.4.2)
  - The pneumatic hand tools provided for use were not interlocked with the dust collector to ensure that the dust collector was on and properly functioning before deburring. (NFPA 484, Section 6.3.4.7.1, 6.3.4.7.2, 10.4.4.6.1 & 10.4.4.6.2)
  - Exhaust air from the dust collector was recycled into the work area. (NFPA 484, Section 6.3.6 & 10.4.9)
  - **“Among other methods, one feasible and acceptable abatement method to correct this hazard is to design and install a dust collection system that complies with generally accepted guidelines such as NFPA 484 Standard for Combustible Metals.”**

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Can it Happen?

- Jun 2011 - ComDust explosion at Universal Woods injures two workers - Two injured **workers were using a metal rod to unclog the dust collection filter when it apparently touched something causing a spark and triggering an explosion** and resulting fireball that blasted more than 50 feet into the air.

- Jul 2011 - OSHA Slaps Pilgrim's Pride with fines - $85,000 Allegedly discovered an "excessive accumulation of grain dust" as the result of a housekeeping program that was neither followed nor maintained. The agency said they **allowed electrical components such as motors and drop lights to be subject to the accumulation of combustible dust**.

- Aug 2011 - OSHA proposes fine for Opelika packaging company - $54,880 Company spokesman said that the fines were unfortunate because **at the time of the OSHA inspection a new dust collection system was on site and being prepared for installation**. OSHA violations involve improper housekeeping for **allowing up to 36 inches of combustible wood dust to accumulate**.

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Can it Happen?

- Oct 2011 - Fine for exposing employees to combustible dust hazards - $58,800 "Failing to provide appropriate personal protective equipment and monitoring workers for exposure to hazards such as combustible dust puts them at an unacceptable risk for injury and illness".

- Oct 2011 – 4-alarm blaze at wood pellet plant in Jaffrey, NH - FIRE - It was a long night for firefighters who battled a blaze at the New England Wood Pellet plant in a 14 hour fight. More details on future slide.

- Jan 2012 - Cardell Cabinetry faces fines by OSHA - $45,000 OSHA said it found combustible dust accumulation, inadequate guarding of machines and unsanitary working conditions.

- Feb 2012 - Sandersville sawmill fined for health and safety violations - $78,000 Several of the alleged violations involved combustible dust in the sawmill.

- Feb 2012 - Franklin Lumber Co. in Bude cited for 22 safety violations - $103,356. OSHA initiated its inspection as part of the agency's national emphasis program (NEP) to reduce employees' exposure to combustible dust hazards.

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Can it Happen?

- Apr 2012 - Prince George Lakeland Mills sawmill ‘ball of flame’ kills 1, injures 24
  - Workers say building exploded around them
  - **Flames at the sawmill, located about one kilometre outside the city, were reported to have shot more than 60 metres in the air at one point, according to witnesses.**
  - It's the second devastating explosion in B.C. in recent months. In January, an explosion tore through a mill near Burns Lake, killing two and destroying the mill.
  - **But some outside experts have pointed to high dust levels and limited ventilation at the Burns Lake mills as a possible cause.**
  - **Link to Article and Video**

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Can it Happen?

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Can it Happen?

- **Apr/May 2012 - Fire Breaks Out At Wood Pellet Plant – Fire - Fire officials in Jaffrey were on the scene of a three-alarm early Friday morning.**

- **May 2012 - Wood Pellet Maker Criticizes OSHA Over Statements**

  - OSHA issued its news release mere hours after the plant sustained another fire - it's third since 2008 - that was ignited by sparks caused by a mechanical malfunction of a pellet mill. The April 27 fire caused minimal damage. None of the fires resulted in injuries.

  - New England Wood Pellet officials acknowledged **"that the fundamental nature of wood dust and wood pellet manufacturing presents challenges to all wood pellet mill operators."**

  - In its inspection following the Oct. 20 fire, **OSHA cited New England Wood Pellet for two repeat citations bearing $147,000** in fines, including failing to provide a workplace free of recognized fire and explosion hazards, **and for using unapproved electrical equipment to vacuum combustible dust. The wood pellet maker was fined $135,000 by OSHA in July 2008 for combustible dust-related and other violations.**

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Can it Happen?

- **May 2012 – Pellet maker faults OSHA $147,000 - Short analysis on Citation 1.**

  29 CFR 1910.22(a)(1) Places of employment were not kept clean and orderly.

  CFR 29 (Labor) Subpart d – Walking-Work Surfaces general requirements 1910.22 (a)(1) "*Housekeeping.*" **While there is not a specific combustible dust standard – it is not needed for OSHA to cite violations which fall under existing regulations.** Also referenced **NFPA 664 (2012) 11.2.1.1 Surfaces shall be cleaned in a manner that minimizes the generation of dust clouds.**

  - Instance A – Layers of combustible wood dust were allowed to accumulate to depths and over surface areas in quantities that exposed workers to fire &/or explosion hazards.
    - on overhead and wall horizontal surfaces, where one location it ignited in a fireball.
  - Instance B – When combustible wood dust was cleared from surfaces, the employer used cleaning methods that increased the potential for a combustible dust deflagration and/or explosion:
    - the employer used 30 psi compressed air to blowdown and clear combustible wood dust.
    - Blowing down with steam or compressed air or even vigorous sweeping shall be permitted only if the following requirements are met: specifically…only a low gauge pressure of 15psi steam or compressed air shall be used. The floor area and equipment shall be vacuumed **prior** to blowdown.
  - **Absence of ComDust Rule Doesn't Stop OSHA Enforcement**

AIR HANDLING SYSTEMS

Can it Happen?

- **August 9, 2012 -** Alabama furniture manufacturer cited by OSHA for exposing workers to combustible dust, other hazards

  - Scholar Craft Products Inc., doing business as Melsur Corp., has been cited by OSHA for 25 safety and health violations following an inspection at its Birmingham furniture manufacturing plant . OSHA initiated an inspection in February as part of the agency's National Emphasis Program on Amputations and its Local Emphasis Program on High Noise Industries. Proposed penalties $94,500. **NOTE: Nothing related to combustible dust initiated this inspection.**
  - 19 serious safety and health violations involve:
    - maintain the dust collection system to prevent potential fires or explosions,
    - install dust collection systems in areas where combustible dust is present,
    - ensure danger signs are posted on equipment generating combustible dust,
    - reduce the pressure on an air hose to less than 30 psi
    - train workers on the hazards associated with combustible dust and provide medical evaluations for respirator users.
    - Additional violations include allowing combustible dust to accumulate on floors, equipment and walls;
  - **"This inspection identified a broad range of hazards that, if left uncorrected, expose workers to combustible dust hazards,"** said OSHA's acting area director. **"Employers cannot wait for an OSHA inspection to identify the hazards that expose their employees to serious injury."**

AIR HANDLING SYSTEMS

Prevention

Use OSHA & NFPA as guidelines

- Hazard Recognition/Assessment
  - Also see NFPA 664 2012 4.2 Deflagration Hazard
- Building Design & Engineering Controls
  - Also see NFPA 664 2012 4.3 Process Analysis
  - Also see NFPA 664 2012 Chpt. 6 Building Construction
- Administrative Controls – Document
  - Also see NFPA 664 2012 4.4 Management of Change
- Housekeeping
  - Also see NFPA 664 2012
- Worker Training

AIR HANDLING SYSTEMS

Prevention

Hazard Recognition/Assessment

- TEST - Determining if dust is combustible via Dust Testing: Explosion Severity Test, Minimum Explosible Concentration (MEC) and Document testing.
- Insurance Company - Inspection
- Check State and Local Codes
  - AHJ (Authority Having Jurisdiction) – Fire Marshall, Building Inspector.

AIR HANDLING SYSTEMS

Prevention

Building Design & Engineering Controls

- Building
  - Design/Build to prevent accumulation of FUGITIVE dust. Use round metal ducting - flat surfaces are NOT good: rectangular HVAC ducting, overhead beams, electrical cable trays, lighting fixtures, and “invisible” areas such as areas above suspended ceilings.
- Equipment
  - Dust Collection System. Spark Detection system in Dust Collectors and Ductwork. Explosion Protection.
  - Flamex Spark Detection Video
  - Fike Explosion Protection VENTING Video
  - Fike Explosion Protection SUPPRESION Video

Prevention

Administrative Controls - Document

- Do you have a method to prevent escape of dust?
- Do you have a policy to remove FUGITIVE dust from surfaces?
- OSHA wants written rules and procedures
- Management of Change procedure – written procedures to manage change to process materials, technologies, equipment, procedures and facilities shall be established. (NFPA 4.4 2012)

Source OSHA ANPR

Prevention

Housekeeping – FUGITIVE Dust Control

- **If you can see dust, don't ignore it!**
- Underlying surface colors are NOT readily discernible, warrants immediate cleaning of area.
- Clean it up and examine source. Seal all openings to prevent the release of dust.
- Inspect workplace - consider overhead beams, electrical cable trays, lighting fixtures, and "invisible" areas such as areas above suspended ceilings.
- Change/clean filters, bags, tighten clamps.
- Use hanging air filter for ambient dust.
- Explosion proof vacuum or fixed pipe suction system shall be used per NFPA voluntary consensus standard.
- Caution in blowing off machinery – max 15 psi.

AIR HANDLING SYSTEMS

Prevention

Worker Training

- Do the workers know what to do?
- Have they read the operating procedures?
- Do they understand?
- Have they been tested?
- Have you documented worker training?

Resources

OSHA – Occupational Safety & Health Administration

- Combustible Dust

NFPA – National Fire Protection Association

- NFPA 68: Standard on Explosion Protection by Deflagration Venting
- NFPA 654: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 664: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

US Chemical Safety Board

- Imperial Sugar Company Dust Explosion and Fire

Insurance Company

- http://www.fmglobal.com
- Loss Prevention Data Sheet 7-73, Dust Collectors and Collection Systems
- Loss Prevention Data Sheet 7-76, Prevention and Mitigation of Combustible Dust Explosions and Fires

Combustible Dust Policy Institute

- http://dustexplosions.blogspot.com/

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Questions & Summary

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More info on combustible dust:

http://www.airhand.com/combustibledust.asp