Combustible Dust

an Explosive Issue

August 2014

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Photo: U.S. Chemical Safety Board

Overview

- What is Combustible Dust?
- Who's in Charge?
- Can it Happen in My Facility?
- Prevention

Photo: U.S. Chemical Safety Board

What is Combustible Dust?

Examples

- Air Handling Systems
- Sawdust Cannon, courtesy of Navy Island
- Mythbusters - Creamer Cannon
- FM Global – Dust Explosion

What is Combustible Dust?

Poll

Why are you concerned about combustible dust?

- Health and Safety of Employees
- Concern of potential OSHA Inspection
- Already had OSHA Inspection
- Fear of an Explosion

Photo: U.S. Chemical Safety Board

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 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
Parsley (dehydrated)
Peach
Peanut meal and skins
Peat
Potato
Potato flour
Potato 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

Carbonaceous Dusts
Charcoal, activated
Charcoal, wood
Coal, bituminous
Coke, petroleum
Lampblack
Lignite
Peat, 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
Paraformaldehyde
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
Phenolic resin
(poly) Propylene
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

Dust Control Measures

The dust-containing systems (ducts and dust collectors) are designed in a manner (i.e., no leaking) that fugitive dusts are not allowed to accumulate in the work area.

The facility has a housekeeping program with regular cleaning frequencies established for floors and horizontal surfaces, such as ducts, pipes, hoods, ledges, and beams, to minimize dust accumulations within operating areas of the facility.

The working surfaces are designed 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.

The facility selects and uses industrial trucks that are approved for the combustible dust locations.

Prevention Measures

The facility has separator devices to remove foreign materials capable of igniting combustible dusts.

MSDSs for the chemicals which could become combustible dust under normal operations are available to employees.

Employees are trained on the explosion hazards of combustible dusts.

Protection 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.

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What is Combustible Dust?

Agricultural Products	Cottonseed	Soybean dust	**Chemical Dusts**	Epoxy resin
Egg white	Garlic powder	Spice du	Adipic acid	Melamine resin
Milk, powdered	Gluten	Spice	thraquinone	Melamine, molded
Milk, nonfat, dry	ss dust	Sug	corbic acid	(phenol-cellulose)
Soy flour	ffee		cium	Melamine, molded
Starch, corn	H			d flour and
Starch, rice				neral filled phenol-
Starch, wheat				formaldehyde)
Sug				crylate
Sugar,				nyl acrylate,
Whey				ene
Ag				lded
Apple				ne copolymer
Beet				lcohol
Carrot				ly) Vinyl chloride/
Cocoa bean				lene/vinyl
Cocoa powder				acetylene suspension
Coconut shell dust	ust	Soc	stic Du	copolymer
Coffee dust	Rice flour	Cellu	ly) Acrylamide	(poly) Vinyl chloride/
Corn meal	Rice starch	Cellulos	ly) Acrylonitrile	vinyl acetylene
Cornstarch	Rye flour	Cork	(poly) Ethylene	emulsion
Cotton	Semolina	Corn	(low-pressure process)	copolymer

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

Source: OSHA Fact Sheet.

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What is Combustible Dust?

Combustible Fine Particles

It is not simply defining a dust, it is determining the explosibility of the dust.

- Important factors include, but no limited too:
  - Particle Size
  - Particle Shape
  - Particle Aging
  - Triboelectric Attraction (electro-static charge)
  - Hydrogen Bonding (moisture)
  - Environment

What is Combustible Dust?

Combustible Fine Particles

Additionally…

K_{st} value is used as a factor in the deflagration of your dust.

- e.g. Wood flour has a K_{st} Value of >200 and $\leq$ 300 meaning it has a strong explosion characteristic.

Dust explosion class rating system from St 0 – St 3

- e.g. Dust explosion class of wood flour is St 2.

NFPA defines the size of "Deflagrable Wood Dust" as 500 microns (.5 mm, 0.0196") or less and has a moisture content of less than 25%. Another way to measure is to see if the material will pass through U.S. No. 35 Standard Sieve which is approx. the "size of fairly coarse sand". (NFPA 664 (3.3.27.1)

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What is Combustible Dust?

Combustible Fine Particles

Layer Depth Criterion – In **general mfg** – 1/32 in.+ depending on bulk density and total area. (NFPA 654-2013 6.1.3.1)

Layer Thickness Criterion - In **woodworking facilities**, a dust layer of 1/8 in. thick (over 5% of area) can be sufficient to warrant immediate cleaning of area. (NFPA 664-2012 4.2.1)

What is Combustible Dust?

Combustible Fine Particles

If there is any doubt of combustibility, the dust must be sent to a certified facility to be tested.

(More on testing, on future slides…)

What is Combustible Dust?

Fuel
(combustible dust)

Ignition
(heat, spark)

Classic Fire Triangle

Oxygen
(air)

Remove any one element eliminates the possibility of fire.

What is Combustible Dust?

Dust Explosion Pentagon

Fire
Fuel
(combustible dust)

Fire
Ignition
(heat, spark)

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

Explosion
Dispersion
(Dust Suspension)

Explosion
Confinement

Fire
Oxygen
(air)

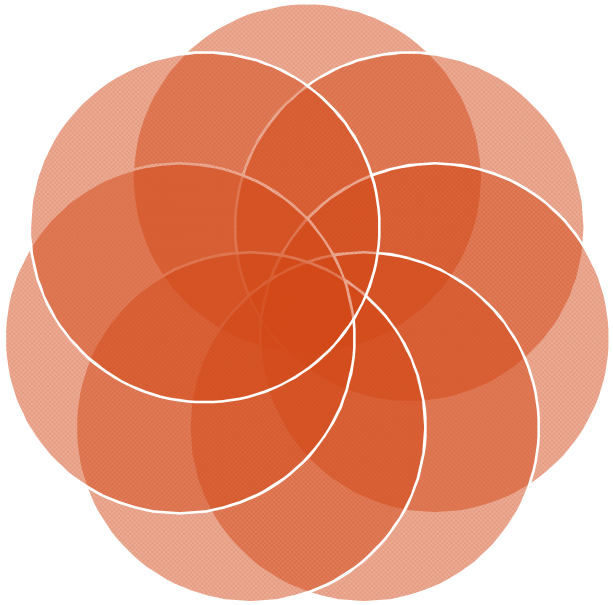
*the concentration of suspended dust must be within an explosible range, lowest amount of dust in air that will explode, referred to as Minimum Explosible Concentration (MEC) ï (1)

Who's in Charge?

OSHA

Employee

Congress



Business Owner

NFPA

Insurance Company

AHJ

Who's in Charge?

Regulatory Organizations & Agencies

OSHA:

2005 - Safety & Health Bulletin: Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions

2007 – OSHA Combustible Dust National Emphasis (NEP) Program 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**.

Who's in Charge?

Regulatory Organizations & Agencies

OSHA:

March 2008 - Hazard Alert: Combustible Dust Explosions. OSHA Fact Sheet

Spring 2009 - OSHA considers rulemaking (ANPRM) to develop a combustible dust standard for general industry.

Dec 2009 – OSHA hosts first in series of Stakeholder meetings in Washington DC.

Who's in Charge?

Regulatory Organizations & Agencies

OSHA:

2013 - Updated Hazard Communication Standard

- Å Employers required to train workers by Dec, 2013 on the new labels elements and safety data sheets format to facilitate recognition and understanding.
- Å According to OSHA - *"Hazardous chemical"* means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, **combustible dust**, pyrophoric gas, or hazard not otherwise classified.

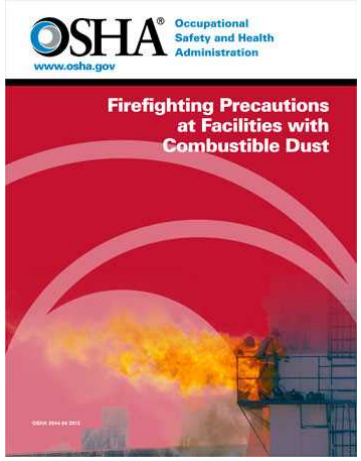
Who's in Charge?

Regulatory Organizations & Agencies

OSHA:

January 2013 – OSHA announces plan to finally initiate SBREFA (Small Business Regulatory Enforcement Fairness Act) meetings – currently revised for December 2014.

April 2013 - New publication: Firefighting Precautions at Facilities with Combustible Dust



Who's in Charge?

Regulatory Organizations & Agencies

OSHA:

Dec. 2013 - Classification of Combustible Dusts under the Revised Hazard Communication Standard.

"This memorandum provides guidance for compliance safety and health officers (CSHOs) to use in determining whether manufacturers or importers have ***properly classified their products for combustible dust hazards under the revised Hazard Communication Standard (HCS).****"*

WHY? According to OSHA *"the GHS does not contain a classification for combustible dust hazards, and to maintain coverage of this hazard under the HCS,* ***OSHA amended the standard's definition of "hazardous chemical" to include "combustible dust"****."*

Who's in Charge?

Regulatory Organizations & Agencies

OSHA:

Dec. 2013 - Classification of Combustible Dusts (con't.)

"If the classifier knows that its product has been involved in a deflagration or dust explosion event, the classifier should classify the product as a combustible dust"

"Where there is no test data, or if the testing is inconclusive, classification may be based on particle size, if particle size information is available. If the material will burn and contains a sufficient concentration of particles 420 microns or smaller to create a fire or deflagration hazard, ***it should be classified as a combustible dust****"*

Who's in Charge?

Regulatory Organizations & Agencies

U.S. Congress

2008 – HR 5522, Worker Protection Against Combustible Dust Explosions and Fires Act of 2008 - To require the Secretary of Labor to issue interim and final occupational safety and health standards regarding worker exposure to combustible dust, and for other purposes.

Reintroduced in 2013 – HR 691, The Worker Protection Against Combustible Dust Explosions and Fires Act of 2013.

Who's in Charge?

Regulatory Organizations & Agencies

NFPA – National Fire Protection Association - International Codes and Standards Organization that creates voluntary consensus standards.

Voluntary Consensus Standards – According to 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.****"*

Who's in Charge?

Regulatory Organizations & Agencies

NFPA – National Fire Protection Association Standards

- **NFPA 61** Standard for the Prevention of Fires & Dust Explosions in Agricultural & Food Processing Facilities
- **NFPA 68** Standard on Explosion Protection by Deflagration Venting
- **NFPA 69** Standard on Explosion Prevention Systems
- **NFPA 484** Standard for Combustible Metals
- **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 & Explosions on Wood Processing & Woodworking Facilities
- **Proposed NFPA 652 Preliminary Draft Standard on Combustible Dusts, Proposed 2015 Edition. This Standard shall be applied to all facilities where combustible dusts or particulate solids are present**

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Who's in Charge?

Regulatory Organizations & Agencies

AHJ (Authority Having Jurisdiction)

Typically government (local, state, federal or other regional) authority having jurisdiction, including but not limited too:

- Fire Marshal
- Building Inspector
- Labor Department
- Health Department
- Other Local and State Authorities
- Insurance Inspector

Who's in Charge?

Regulatory Organizations & Agencies

Insurance Companies

FM Global – 7-76 Prevention and mitigation of combustible dust

- This data sheet describes recommended preventive measures to reduce the frequency of combustible dust explosions, and protection features to minimize damage from a combustible dust explosion.

Losses by Industry	
Dust Group	*Number Losses*
Woodworking	64
Food	26
Metals	18
Chemical/Pharmaceutical	14
Pulp/Paper	12
Mineral	11
Utility	7
Plastics	5
Rubber	5
Printing	1
Textile	1
Other	2
Grand Total	166

Source FM Global - Prevention and mitigation of combustible dust 7-76 ï January 2012 Page 36

Who's in Charge?

Regulatory Organizations & Agencies

Insurance Companies

FM Global – 7-76 Prevention and mitigation of combustible dust

- This data sheet describes recommended preventive measures to reduce the frequency of combustible dust explosions, and protection features to minimize damage from a combustible dust explosion.

Losses by Equipment Type	
Equipment Type	*Number Losses*
Dust Collector	66
Impact Equipment	22
Storage Silo	8
Processing Equipment	7
Oven	5
Conveyor	4
Grain Elevator	4
Spray Dryer	4
Dryer	3
Boiler	3
Storage Silo/Dust Collector	3
Waste Bin	3
No Data	2
Storage Bin	2
Various	30
Grand Total	166

Source FM Global - Prevention and mitigation of combustible dust 7-76 ï January 2012 Page 38

Who's in Charge?

Regulatory Organizations & Agencies

So while there is NO specific Combustible Dust REGULATION there is plenty to be concerned about:

OSHA

U.S. Congress

NFPA

AHJ

Insurance Co.

and more.

Who's in Charge?

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

Used with permission from Steve Spiro

Who's REALLY in Charge?

YOU!!!!!!

Sugar Refinery Ignored Explosive Dust Before Blast

September 25, 2009 *by Russ Bynum, Associated Press Writer*

Can it Happen?

Photo: U.S. Chemical Safety Board

Can it Happen?

1785 – First recorded dust explosion at a flour mill in Italy.

Feb 2008 - Georgia sugar refinery explosion – Imperial Sugar refinery explosion was an industrial disaster that occurred in Port Wentworth, Georgia. Primary explosion, then secondary explosion.

Can it Happen?

Photo: U.S. Chemical Safety Board

Can it Happen?

Jan 2011 – Hoeganaes Corp, Tennessee – **THREE incidents involving combustible dust within six months** – Jan, March, May. CSB created video "Iron in the Fire".

Photo: U.S. Chemical Safety Board

Can it Happen?

Feb 2011 - Mississippi mill slapped with ComDust violations - $67,800 - OSHA has cited the 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.

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Can it Happen?

Mar 2011 - Gov. Malloy tours CT firm cited by OSHA - $83,400 OSHA cited Volvo Aero on specific safety violations. **They include improperly designed combustible dust collection system.**

- Employees were exposed to fire and explosion hazards caused by the **presence of combustible dust**: Penalty: $5000
- The Donaldson Torit Model VS1200 dust collection system provided was not designed and installed to be used with **combustible metal dust**.

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Can it Happen?

Mar 2011 - Gov. Malloy tours CT firm cited by OSHA (con't)

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)

Can it Happen?

Mar 2011 - Gov. Malloy tours CT firm cited by OSHA (con't)

Specifically:

- 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)

Can it Happen?

Mar 2011 - Gov. Malloy tours CT firm cited by OSHA (con't)

Specifically:

- Å Exhaust air from the dust collector was recycled into the work area. (NFPA 484, Section 6.3.6 & 10.4.9)
- Å **"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."**

Can it Happen?

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 - Repeat violations address deficiencies involving **inadequate housekeeping** in areas where **combustible dust** build-up had exceeded allowable limits.

Can it Happen?

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."

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.

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Can it Happen?

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. 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 - 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.

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Can it Happen?

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**.

Can it Happen?

Apr 2012 - Prince George, BC, Canada, Lakeland Mills sawmill 'ball of flame' kills 1, injures 24 (CBC Video)

- 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.
- **Some outside experts have pointed to high dust levels and limited ventilation at the Burns Lake mills as a possible cause.**

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Can it Happen?

Photo: CBC News

July 29, 2014 ï The Globe and Mail: Owners of a sawmill that exploded in Prince George, B.C. two years ago, killing two workers, have been fined more than $700,000 by the provinceôs workplace safety agency. WorkSafeBC announced Tuesday that Lakeland Mills Ltd., has been found to be in violation of the provinceôs Workers Compensation Act and occupational health and safety regulations as a result of the explosion April 21, 2012. Twenty-two others were injured.

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Can it Happen?

Apr 2012 - Fire Breaks Out At Wood Pellet Plant – Fire officials in Jaffrey, NH were on the scene of a three-alarm.

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.

Photo: OSHA

Can it Happen?

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 & explosion hazards, **and for using unapproved electrical equipment to vacuum combustible dust.** The wood pellet maker was previously was fined $135,000 by OSHA in July 2008 for combustible dust-related and other violations.

Can it Happen?

May 2012 – Pellet maker faults OSHA $147,000 – Analysis 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.*" 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 and/or explosion hazards. i.e. on **overhead** and **wall horizontal** surfaces, where one location it ignited in a fireball.

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Can it Happen?

May 2012 – Pellet maker faults OSHA $147,000 - Con't.

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 & equipment shall be vacuumed **prior** to blowdown.

Can it Happen?

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

- Scholar Craft Products Inc., has been cited by OSHA for 25 safety and health violations at its Birmingham furniture manufacturing plant . OSHA initiated an inspection in Feb. as part of the agency's NEP on Amputations and its Local Emphasis Program on High Noise Industries. Proposed penalties $94,500. **NOTE: Nothing related to combustible dust initiated this inspection.**

Can it Happen?

Aug 2012 - Alabama furniture manufacturer (cont.)

- 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

Can it Happen?

Aug 2012 - Alabama furniture manufacturer (cont.)

- 19 serious safety and health violations involve (con't):
  - 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."***

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Can it Happen?

Aug 2013 - Cardell Cabinetry LLC has been cited for combustible dust and other safety and health violations by OSHA.

- The semi-custom cabinet company faces a penalty of $267,434 for 29 violations at the San Antonio, TX, facility.
- Cardell faces penalties of $99,000 for the **repeat failure** to ***"remove combustible wood dust, cover electrical boxes and reduce the pressure of compressed air."***
- The **repeated failure** to **remove wood dust from the parts mill area** is a $34,034 penalty for the failure-to-abate violation.

Can it Happen?

Aug 2013 - Cardell Cabinetry LLC (cont.)

- *"The sizable penalties proposed here reflect the severity of the various hazardous conditions found at this facility, including the* ***accumulation of combustible dust*** *that can lead to a needless catastrophic incident,"*
- *"The fact that such an incident has not occurred does not absolve Cardell Cabinetry of its responsibility to find and eliminate hazards that could endanger workers' lives."* stated director of OSHA's San Antonio Area Office. See more at Woodworking Network.
- September 9, 2013 Cardell Cabinetry closed it doors.
- 900,000 sq. ft facility/900 unemployed.

Can it Happen?

Sept 2013 – Merritt B.C. **-** WorkSafeBC shuts down Merritt mill temporarily due to dust. Source Vancouver Sun.

- **Buildup of wood dust** at the Aspen Planers sawmill took place despite several industry wide regulatory warnings.
- After the stop-work order was issued Sept. 11, Aspen Planers cleaned up the **wood dust** by the next day.
- WorkSafeBC lifted the order, but told the company it must provide a written plan that specifies the steps it will take to ensure it follows the regulations and lays out its own dust-control program.

Can it Happen?

Sept 2013 – Merritt Mill B.C. (con't).

- During the inspection WorkSafeBC **found dust had collected on beams, duct work and heat sources such as lights.**
- According to the inspection report, the accumulations were in excess of 1/8 inch over more than 5% of the enclosed area, the safety standard set by WorkSafeBC last year. *"Given that the enclosed areas are confined by floor, walls and ceiling structures, the dust accumulations could be dispersed into the air, and could come into contact with ignition sources… Dispersion of these accumulations in the presence of ignition sources poses a high risk of fire or explosion."*

WORK SAFE BC

WORKING TO MAKE A DIFFERENCE

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Can it Happen?

Apr 2014 – Albany, NY - OSHA cites cabinetry, countertop manufacturer for combustible dust, chemical hazards

- Salko Kitchens Inc. faces proposed fines of $51,800 for combustible dust and potential carcinogen exposure violations.
- *"These workers face both immediate and long-term health and safety hazards from on-site conditions,"* said OSHA's area director in Albany. *"The combustible dust can ignite and explode in seconds. For the health and well-being of its employees, it's imperative that this employer correct these hazards and take effective steps to prevent them from happening again."*

Can it Happen?

July 2014 – U.S. Chemical Safety Board: **CSB Releases Safety Video, "Combustible Dust: Solutions Delayed"**

Charleston, WV, July 16, 2014 – Today the CSB released its final report, safety recommendations and accompanying safety video into a fatal combustible dust explosion at the AL Solutions metal recycling facility in New Cumberland, West Virginia. The report **reiterates a recommendation that OSHA promulgate a general industry combustible dust standard**, something the agency has been calling for since its definitive 2006 study on these preventable accidents.

Prevention

What is Combustible Dust?

Poll

Which combustible dust safeguards do you use?

Abort Gate

Air Cleaner (self contained, ceiling suspended)

Dust Collection

Explosion Protection Venting/Suppression

Housekeeping

Spark Detection System

Other

Prevention

CCOHS

(Canadian Centre for Occupational Health & Safety)

Clearly defined prevention measures

- Eliminate
- Substitute
- Engineering
- Administration

Photo: Work Safe BC

Prevention

Use OSHA & NFPA as guidelines

- Hazard Recognition/Assessment
- Building Design & Engineering Controls
- Housekeeping
- Worker Training

Photo: U.S. Chemical Safety Board

Prevention

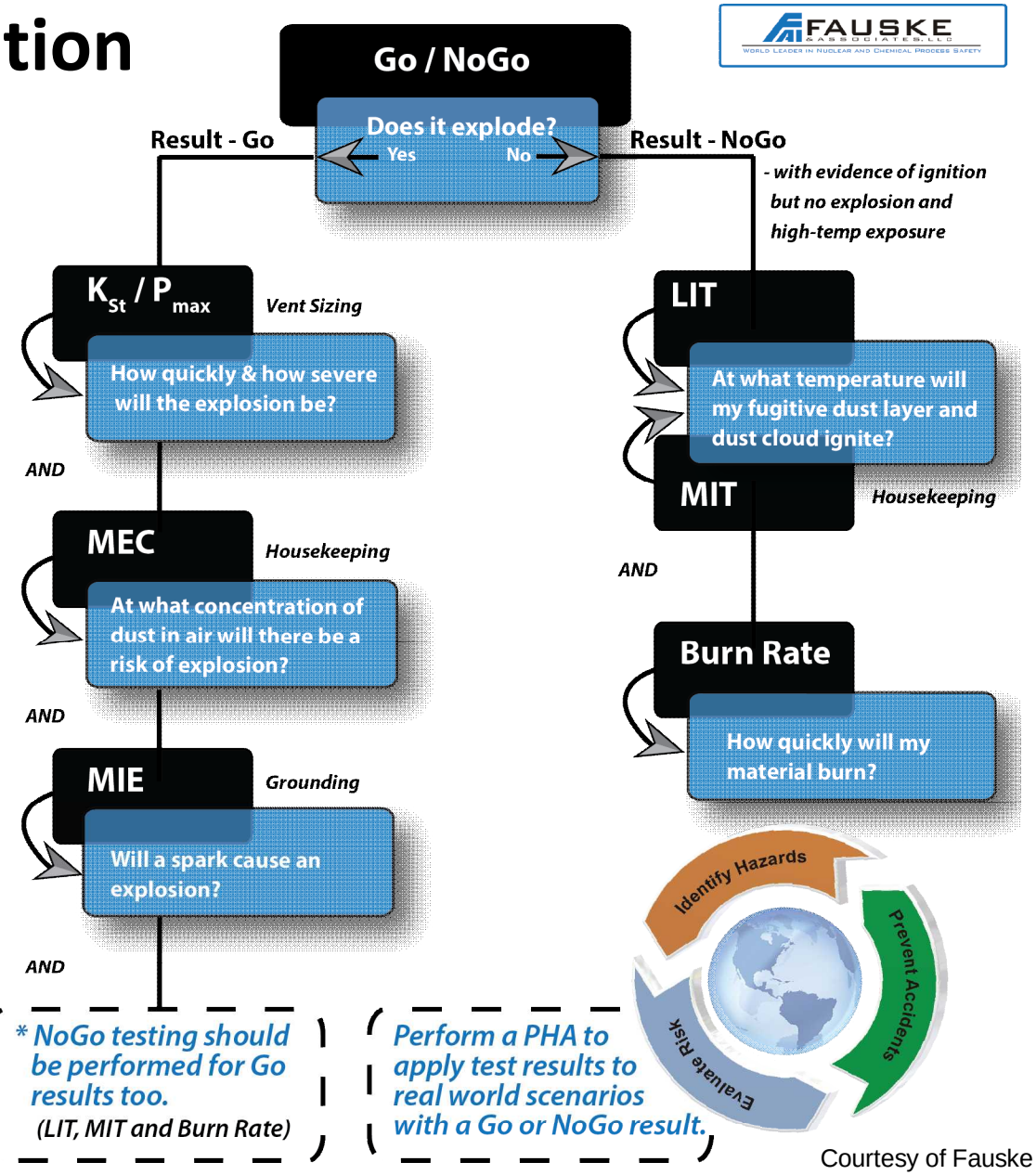
Hazard Recognition/Assessment

Determining if dust is combustible via TESTING

NFPA 652 (proposed) – states "To determine if the dust can present an explosion hazard, the simplest test that can be performed is known as the "go/no/go" test "yes, it blows up, or no, it doesn't" ASTM E 1226 *Standard Test Method for Explosibility of Dust Clouds*"

- (MIE) Minimum Ignition Energy test ASTM E-2019
- Explosion Severity Test (KSt and PMAX) ASTM E-1226
- Testing prices ranges from $350-$1300 up to $3850 for a full OSHA NEP Package.

Prevention



Courtesy of Fauske

Prevention

Hazard Recognition/Assessment

- Assessment
  - Process Hazards Analysis (PHA) – Example provided in the Preliminary First Draft Proposed 2015 Edition NFPA 652 Standard on Combustible Dusts (A.3.3.23).
    - Detailed Analysis of the fire and/or explosion hazard at each point along the process.
    - Documentation
    - Identify hazards
    - Quantify hazards
    - Document how the hazard is managed
    - Revised as part of the Management of Change requirements.
- Insurance Company – Inspection
- Check State and Local Codes
- AHJ (Authority Having Jurisdiction) – Fire Marshall, Building Inspector.

Prevention

Building Design & Engineering Controls

Prevent accumulation of FUGITIVE dust.

- Rectangular HVAC ducting - NOT good
- Overhead beams - NOT good
- Electrical cable trays - NOT good
- Lighting fixtures - NOT good
- And “invisible” areas such as THOSE ABOVE suspended ceilings - NOT good
- Flat surfaces - NOT good
- Round metal ducting – Better.

Prevention

Building Design & Engineering Controls

Equipment

- Å Abort Gates exhaust hazardous air flow from the ducting. Used in return air systems, Abort Gates safely exhaust hazardous air to the atmosphere, thereby protecting plant and personnel.

Source: GreCon Spark Detection and "Explanatory Materials" Annex A NFPA 664

Prevention

Building Design & Engineering Controls

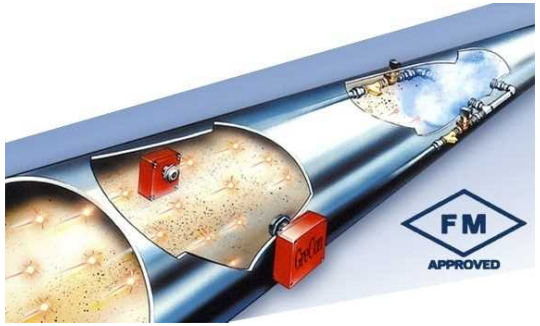
Equipment

- Explosion Protection VENTING Video
- Explosion Protection SUPPRESION Video
- Additional information - Explosion Protection Annex B NFPA 664

Prevention

Building Design & Engineering Controls

Equipment

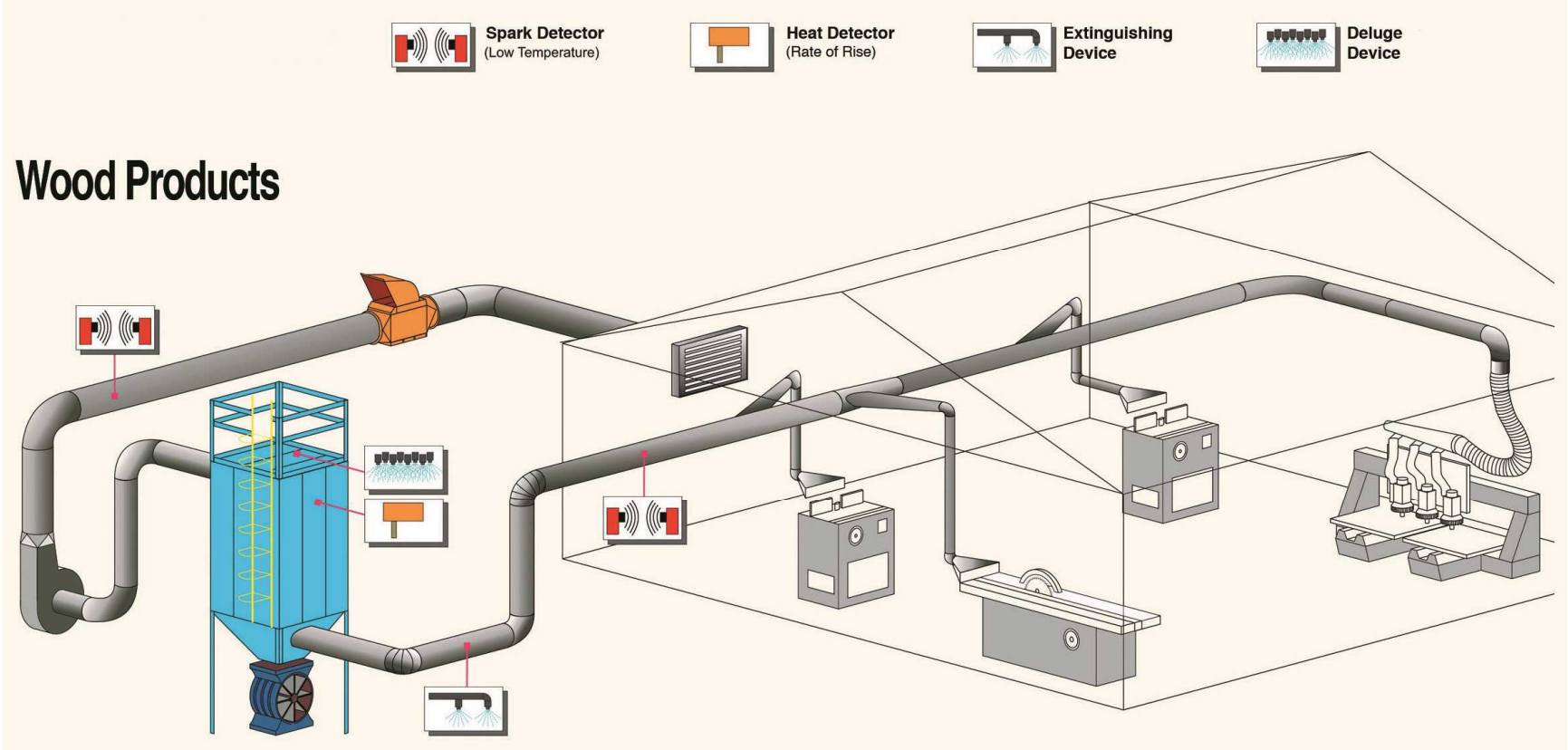


- Spark Detection Information
- Spark detection systems are primarily used as a fire prevention method in dust collectors by detecting and extinguishing sparks and embers.
- A dull tool, a damaged fan bearing, an over heated motor, or a foreign object within the material can be the cause.
- Spark Detection and Extinguishing video simulation for dust collection.

Source: GreCon Spark Detection and "Explanatory Materials" Annex A NFPA 664

Prevention

Building Design & Engineering Controls



Prevention

Photo: OSHA

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 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.

AIR HANDLING SYSTEMS

IWF ATLANTA

Prevention

Photo: OSHA

Housekeeping – FUGITIVE Dust Control

For example per NFPA 664-2012 11.2.1.1

- "Surfaces shall be cleaned in a manner that minimizes the generation of dust clouds. Blowing down with compressed air or even vigorous sweeping shall be permitted only if the following requirements are met:
  - The floor area and equipment shall be vacuumed prior to blowdown.
  - Electrical power and other sources of ignition shall be shut down, removed from the area, classifies for use in dusty area per *NFPA 70, National Electrical Code.*

Prevention

Housekeeping – FUGITIVE Dust Control

For example per NFPA 664-2012 11.2.1.1 (con't)

- Å Only a low gauge pressure 15 PSI steam or compressed air shall be used
- Å No open flames, sparks from spark-producing equipment, or hot surfaces
- Å All fire protection equipment shall be in service."

Å Explosion proof vacuum or fixed pipe suction system shall be used per NFPA voluntary consensus standard.

Prevention

Worker Training

"Safe work habits are developed and do not occur naturally."
as stated in NFPA 652 (A.8.4.2.1)

- 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?

Photo: OSHA

Resources

FM Global Insurance Company

- Loss Prevention Data Sheet 7-76, Prevention and Mitigation of Combustible Dust Explosions and Fires

NFPA – National Fire Protection Association

- **NFPA 61** Standard for the Prevention of Fires ad Dust Explosions in Agricultural and Food Processing Facilities
- **NFPA 68** Standard on Explosion Protection by Deflagration Venting
- **NFPA 69** Standard on Explosion Prevention Systems
- **NFPA 484** Standard for Combustible Metals
- **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
- **NFPA 652** (Proposed) Standard on Combustible Dusts

OSHA – Occupational Safety & Health Administration

- Combustible Dust

U.S Chemical Safety Board

- Combustible Dust

Questions & Summary

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More info on combustible dust:

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