Combustible Dust an Explosive Issue

WMS – October 2013

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Overview

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

What is Combustible Dust?

Examples

- Combustible Dust 1920's
- Air Handling Systems
- Sawdust Cannon
- Mythbusters - Creamer Cannon
- FM Global – Dust Explosion

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.

What is Combustible Dust?

In Canada, one example is Alberta's Occupational Health and Safety Code which defines combustible dust as "a dust that can create an explosive atmosphere when it is suspended in air in ignitable concentrations".

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
  - Size
  - Shape
  - Moisture
  - Environment

What is Combustible Dust?

Combustible Fine Particles

Additionally…

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

- 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

- 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)

What is Combustible Dust?

Combustible Fine Particles

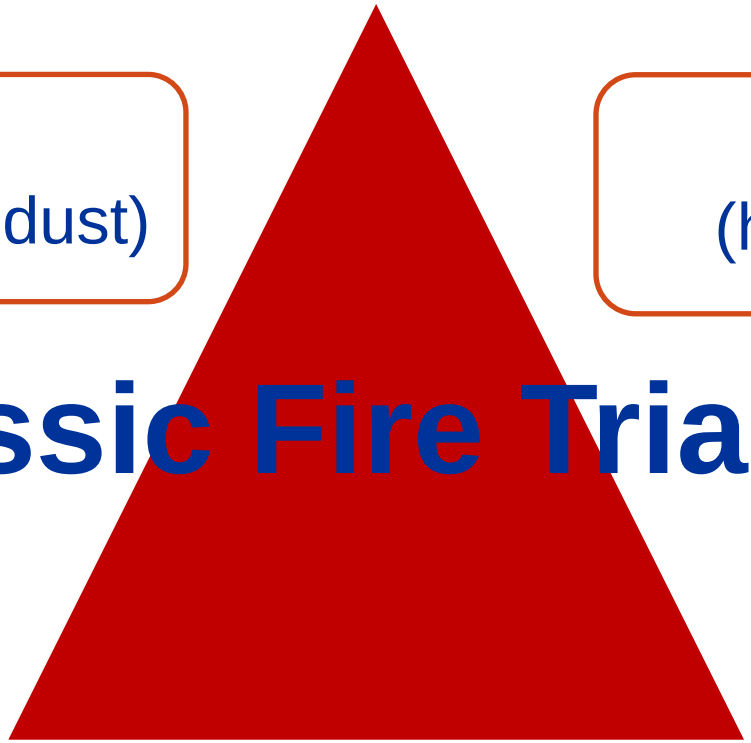
However – A dust layer of 1/8 in. thick can be sufficient to warrant immediate cleaning of area. (NFPA 664-2012 4.2.1)

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

What is Combustible Dust?

Fuel
(combustible dust)

Ignition
(heat, spark)

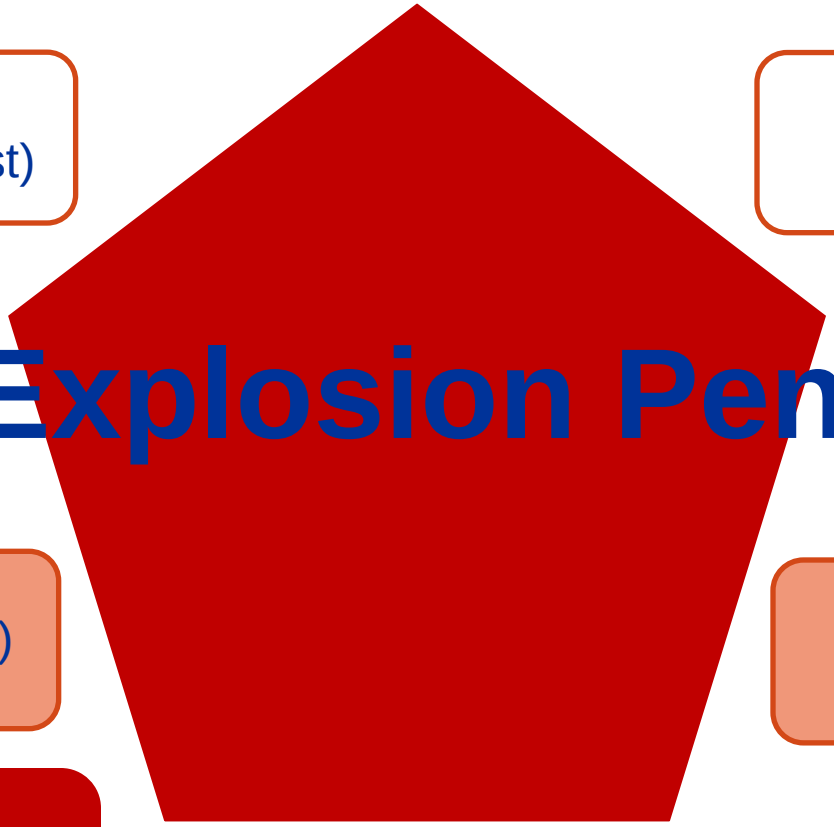


Classic Fire Triangle

Oxygen
(air)

Remove any one element eliminates the possibility of fire.

What is Combustible Dust?



Fuel - fire
(combustible dust)

Ignition - fire
(heat, spark)

Dust Explosion Pentagon

Dispersion
(Dust Suspension)
(explosion)

Confinement
(explosion)

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

Oxygen - fire
(air)

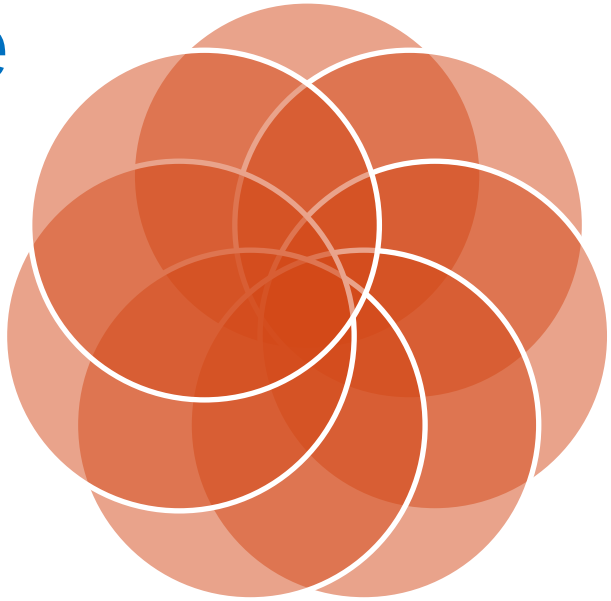
*the concentration of suspended dust must be within an explosible range, lowest amount of dust in air that will explode, referred to as Minimum Explosible Concentration (MEC) – (1)

Who's in Charge?

OSHA/
CCOHS

Employee

U.S.
Congress



Business
Owner

NFPA

Insurance
Company

AHJ

Who's in Charge?

Regulatory Organizations & Agencies

OSHA

2005 - Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions

2007 – **OSHA 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

Who's in Charge?

Regulatory Organizations & Agencies

OSHA

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

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

Who's in Charge?

Regulatory Organizations & Agencies

OSHA

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)."***

Who's in Charge?

Regulatory Organizations & Agencies

OSHA

March 2012 - Modification of the Haz Com Standard (HCS) to conform with the UN Globally Harmonized System (GHS) of Classification and Labeling of Chemicals

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. However, guidance is being provided through existing documents, including the Combustible Dust NEP, 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."*

Who's in Charge?

Regulatory Organizations & Agencies

OSHA

Q. How has OSHA addressed Combustible dust, continued…

- *"For chemicals in a solid form that do not present a combustible dust hazard, but may form combustible dusts while being processed in normal downstream uses, paragraph (f)(4) of the HCS allows the chemical manufacturer some flexibility in labeling requirements. The manufacturer or importer to may transmit the label to the customer at the time of the initial shipment, but the label does not need to be included with subsequent shipments unless it changes. This provides the needed information to the downstream users on the potential hazards in the workplace, while acknowledging that the solid metal or other materials do not present the same hazards that are produced when these materials are processed under normal conditions of use."*
- **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.**

Who's in Charge?

Regulatory Organizations & Agencies

OSHA

2013 - Updated Hazard Communication Standard

- *"Exposure to hazardous chemicals is one of the most serious threats facing American workers today,"* said U.S. Secretary of Labor Hilda Solis. *"Revising OSHA's Hazard Communication standard will improve the quality and consistency of hazard information, making it safer for workers to do their jobs and easier for employers to stay competitive."*
- 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.

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

Who's in Charge?

Regulatory Organizations & Agencies

CCOHS (Canadian Centre for Occupational Health and Safety)

CCOHS - Combustible Dust Resources & Guidelines

WorkSafeBC - Combustible Dust

Richmond, B.C., October 2013 — WorkSafeBC has provided an update on inspections of sawmills and other wood processing operations that comprise Phases I and II of the combustible dust strategy.

A directive order was issued to all sawmill employers on April 26, 2012. All operational sawmills inspected as part of Phase I of the strategy have complied with the directive order. WorkSafeBC is now reporting on inspections that have occurred since October 1, 2012 as officers revisit Phase I sawmills.

CCOHS
Canadian Centre for Occupational Health and Safety

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 68** Standard on Explosion Protection by Deflagration Venting.
- **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 on Wood Processing and Woodworking Facilities. **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** (1.1.2).
- **NEW - 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. 31 Referenced NFPA Publications that shall be considered part of the requirements of this document.

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 – January 2012 Page 36

Who's in Charge?

Regulatory Organizations & Agencies

Insurance Companies

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 – 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, OSHA NEP, NFPA, Insurance Co. and more.

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 Russ Bynum, Associated Press Writer*

Can it Happen?

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. Primary explosion, then secondary explosion.

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.

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".

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.

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.

Can it Happen?

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)

Can it Happen?

Specifically:

- 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.”**

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 - 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.

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.

Can it Happen?

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**.

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 & illness".

Can it Happen?

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.

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

- 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.**

Can it Happen?

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. The April 27 fire caused minimal damage. None of the fires resulted in injuries.

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.** **Wood Pellet Maker Criticizes OSHA Over Statements**

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 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 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.*" 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.

Can it Happen?

May 2012 – Pellet maker faults OSHA $147,000 - Con't. Analysis on Citation 1.

- 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.

The pellet manufacturer, which had contested citations and fines issued by the OSHA, also agreed to pay a fine of $100,000 (reduced from $147.000).

Absence of ComDust Rule Doesn't Stop OSHA Enforcement – Source - Woodworking Network.

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 cited by OSHA for exposing workers to combustible dust, other hazards

- 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."**

Can it Happen?

Sept 2012 - **Phoenix Industrial Dust Explosion Sends Workers to the Hospital -** Two workers were rushed to a Phoenix hospital after suffering second and third degree burns following a combustible dust fire at their place of employment. **The explosion occurred while the employees were cleaning a loft area of the business that had accumulated significant wood dust**.

Nov 2012 - Carmen Creative Cabinets Belton, Texas was cited by OSHA for 32 safety and health violations, including **combustible wood dust** and amputations from unguarded saws. Proposed penalties total approximately $64,800.

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. OSHA said the February inspection was done as a follow-up and also the result of a complaint.
- Cardell faces penalties of $99,000 - **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 continued…

- *"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."* Kelly Knighton, director of OSHA's San Antonio Area Office, said in a statement. See more at Woodworking Network.
- September 9th Cardell Cabinetry LLC closed it doors.
- 900,000 sq. ft facility/900 unemployed

Can it Happen?

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

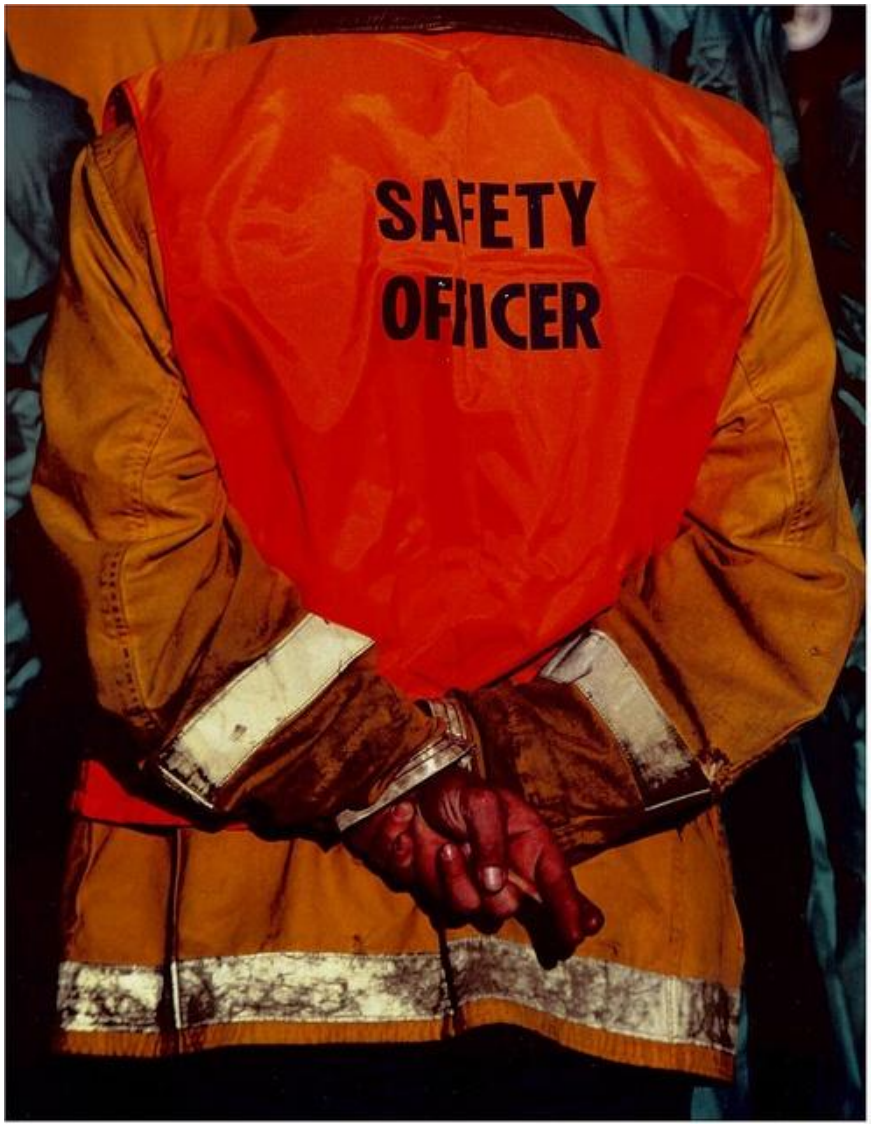
- The buildup of wood dust took place despite several industry wide regulatory warnings.
- After the stop-work order was issued Sept. 11, Aspen Planers cleaned up the wood dust by the next day.
- WorkSafeBC lifted the order, but told the company it must provide a written plan that specifies the steps it will take to ensure it follows the regulations and lays out its own dust-control program. That plan must include consideration of new equipment.
- Spokesman for Aspen Planers, called the inspection from a WorkSafeBC officer that doesn't normally visit the plant a *"good wake-up call."*
- *"If you compare it to anything else out there - to speeding, texting while you drive - people know better, they hear the stories, they understand. But for whatever reason - be it consciously, subconsciously or maliciously - they ignore it,"* said Al Johnson, WorkSafeBC VP of Prevention.

Can it Happen?

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

- During the inspection last week of Aspen Planers, WorkSafeBC safety officer Vince Strain found dust had collected on beams, duct work and heat sources such as lights.
- According to Strain's inspection report, the accumulations were in excess of 1/8 inch over more than five per cent 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,"* wrote Strain. *"Dispersion of these accumulations in the presence of ignition sources poses a high risk of fire or explosion."*
- Strain's inspection report concluded WorkSafeBC had *"reasonable grounds"* to believe the dust buildup in the sawmill posed an *"immediate danger*" that would likely result in severe injury or death to a worker.

Prevention



Photograph by Mark Lodge

Prevention

CCOHS Has Clear Prevention Measures

- Eliminate
- Substitute
- Engineering
- Administration

Prevention

CCOHS Has Clear Prevention Measures

Eliminate

- Where possible, avoid horizontal surfaces (such as window ledges, beams, light fittings, etc.) where dust can accumulate.
- Eliminate "hidden" areas where dust can accumulate unnoticed.
- Do not use brooms or compressed air hoses to clean surfaces. Only use vacuums approved for dust collection.
- Only use a dust collection / dust extraction system that is designed to eliminate or control combustible dust. Using most models of fans typically stirs the dust, adding dust particles into the air and worsening the situation.

Prevention

CCOHS Has Clear Prevention Measures

Substitute

- Install smooth ceilings and other surfaces (instead of a rough finish) to minimize dust accumulation and to make cleaning easier.

Prevention

CCOHS Has Clear Prevention Measure

Engineering

- Use an appropriate dust extraction and collection system with the inlet located as close to the dust producing process as possible. Follow required standards and codes when installing these systems. Locate dust collectors outdoors, where possible.
- Direct explosion venting away from areas where there may be employees.
- Use appropriate electrical and ventilation equipment.
- Keep all mechanical and electrical equipment in good repair.
- Keep static electricity under control, which includes the bonding and grounding of equipment. Check regularly to ensure the bonds are in good condition.
- Check equipment that may wear (e.g., bearings) as they may generate heat and become an ignition source.
- Remove open flames, sparks, friction, heat sources, and other sources of ignition.
- Select and use intrinsically safe tools or machinery.
- Put covers around pipes and cables, or embed pipes and cables in the walls, where possible, to reduce surfaces where dust can accumulate.

Prevention

CCOHS Has Clear Prevention Measures

Administration

- Develop and implement a combustible dust inspection and control program which outlines how often inspections will occur and how dust will be controlled.
- Develop a hot work permit system for activities such as welding and cutting.
- Develop an ignition control program to eliminate or reduce sources of ignition. Keep ignition sources away from dusty areas or use suitable controls.
- Educate all employees about combustible dusts, the hazards, and how they can help eliminate the risk of fire and explosions.
- Inspect for dust at regular intervals.
- Establish a housekeeping program that will remove dust regularly.
- Use proper equipment and techniques when cleaning dust. Care must be taken to minimize dust clouds, and only use vacuums approved for dust collection.
- Regularly inspect machines, ducts, and ventilation systems for dust. Repair or clean promptly.

Prevention

Use OSHA & NFPA as guidelines

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

Prevention

Hazard Recognition/Assessment

Determining if dust is combustible via testing

- NFPA 652 – 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 or ASTM E 1226 Standard Test Method for Explosibility of Dust Clouds"*
  - Screening Test go-no-go - *"yes, it blows up, or no, it doesn't".*
- (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 OSH A NEP Package.

Prevention

Hazard Recognition/Assessment

Assessment

- Process Hazards Assessment (PHA)

Insurance Company – Inspection

Check State and Local Codes

AHJ (Authority Having Jurisdiction) – Fire Marshall, Building Inspector.

Prevention

Building Design & Engineering Controls

Building

- Design/Build to prevent accumulation of FUGITIVE dust.
  - Round metal ducting – less flat surface.
  - Flat surfaces are NOT good
    - Rectangular HVAC ducting
    - Overhead beams
    - Electrical cable trays
    - Lighting fixtures
    - Horizontal Wall Surfaces
    - And “invisible” areas such as THOSE ABOVE suspended ceilings.

Prevention

Building Design & Engineering Controls

Equipment

- 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

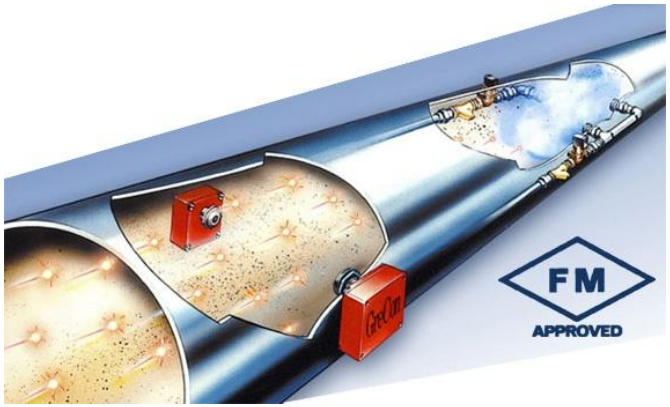
- Explosion Protection VENTING Video
- Explosion Protection VENTING Full-Scale Slow Motion (at 5.30)
- Explosion Protection SUPPRESION Video
- Additional information - Explosion Protection Annex B NFPA 664

Prevention

Building Design & Engineering Controls

Equipment

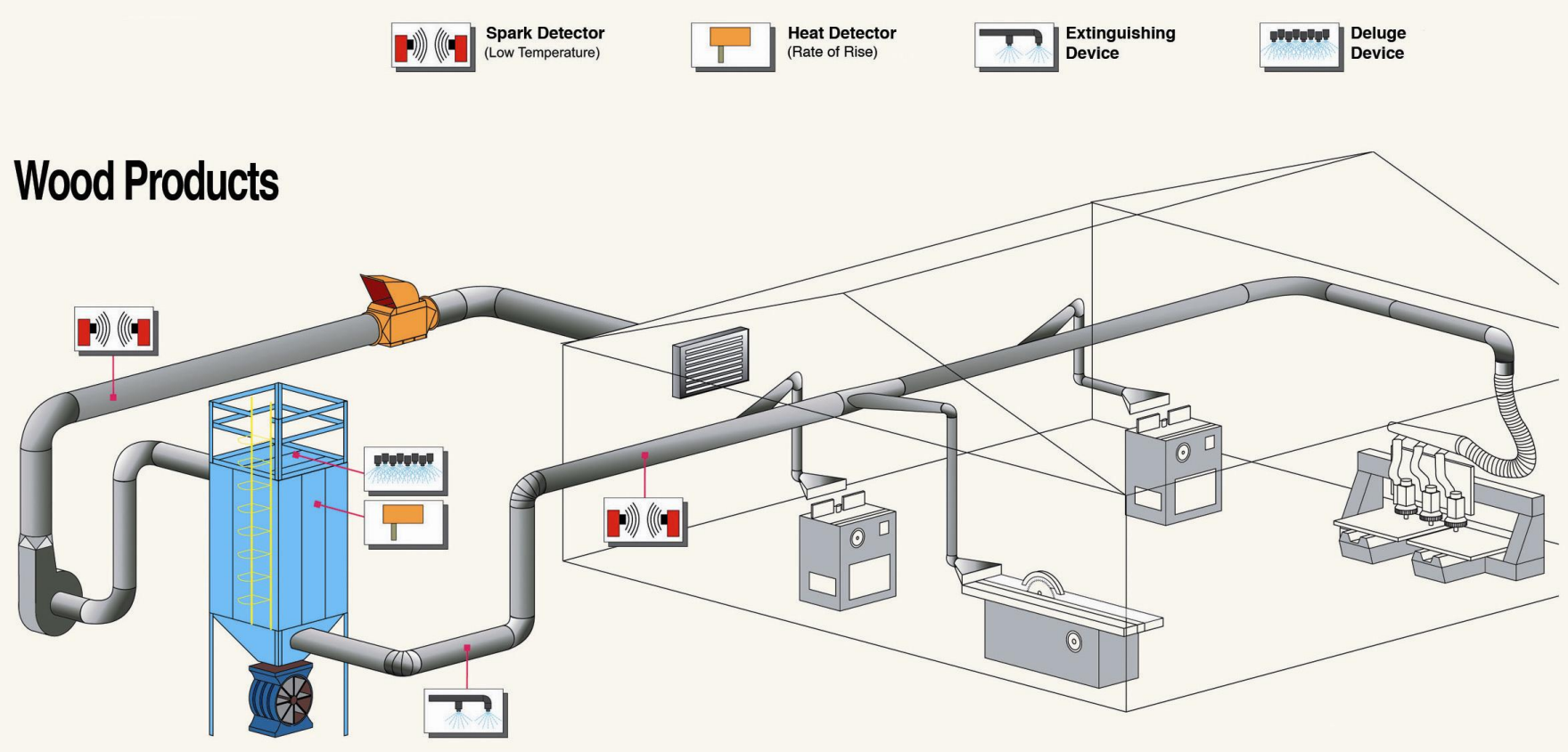
- Spark detection systems are primarily used as a fire prevention method in dust collectors by detecting and extinguishing sparks and embers.
- A dull tool, a damaged fan bearing, an over heated motor, or a foreign object within the material can be the cause.
- Spark Detection Video



Prevention

Building Design & Engineering Controls

Equipment



For more information go to Informational Primer on Spark Detection and Extinguishing Systems – Annex C NFPA 664

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.

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.

Prevention

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

Resources

OSHA – Occupational Safety & Health Administration

- Combustible Dust

CCOHS (Canadian Centre for Occupational Health and Safety)

- Combustible Dust

NFPA – National Fire Protection Association

- 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

FM Global Insurance Company

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

Combustible Dust Policy Institute

Questions & Summary

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