Combustible Dust Avoiding Disaster

Presenter

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Disclaimer

This presentation is not intended to be a comprehensive program covering all aspects of this topic. All technicians are encouraged to read and follow all applicable standards, codes and regulations related to this topic.

- ✓ It is the responsibility of each individual contractor to follow local building codes and licensing requirements and to work safely in accordance with OSHA guidelines.
- ✓ It is the contractor's responsibility to take proper precautions on each project to prevent cross contamination. Always take the health and safety of the building occupants into consideration before you conduct any cleaning procedures.
- ✓ All of the following tips are only general tips. They do not cover every situation and it is your responsibility to adapt these tips to the individual system you are working on.
- ✓ The Instructor is not responsible in any way for the work you perform after viewing this slide show. You are responsible for your own work.
- ✓ The views and opinions following are the instructor's opinions and not necessarily the official position of the National Air Duct Cleaners Association.

What We'll Learn

- Define Combustible Dust
- Required Equipment for Mitigation
- Where to Target
- Opportunities

OSHA SAYS

What is Combustible Dust?

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

A dust explosion can be catastrophic and cause employee deaths, injuries, and destruction of entire buildings.

What is Combustible Dust?

OSHA SAYS

- Combustible dust may be minute and barely visible to the naked eye but is amongst the most destructive materials.
- Combustible dust is the finest material that can cause a dust explosion when it comes in contact with fire and air.
- Any dust particle can become combustible like sugar, flour, grain, wood, metals, and even non-metallic or inorganic materials.

NFPA SAYS

What is Combustible Dust?

National Fire Protection Association

Issued standards on handling, risks etc.
Industry specific.

A finely divided combustible particulate solid that presents a flash-fire hazard or explosion hazard when suspended in air or the process-specific oxidizing medium over a range of concentrations. (NFPA 652)

NFPA SAYS

NFPA 654:

<u>Immediate cleaning</u> is warranted whenever a dust layer of 1/32-inch thickness accumulates over a surface of at least 5% of the floor area.

It's also important to recognize that the dust coverage area includes structures such as overhead beams and joists, ducts, the tops of equipment, and areas around any dust collection equipment installed within the facility.

Combustible Dust – Avoiding Disaster

What is Combustible Dust?

Essentially, a combustible dust is any fine material that can catch fire and explode when mixed with air. Combustible dusts can be from:

- most solid organic materials (such as sugar, flour, grain, wood, etc.)
- many metals, and
- some nonmetallic inorganic materials.

Combustible Dust – Avoiding Disaster

Where most Duct Cleaners may Encounter Combustible Dust:

- Wood dust - exhaust systems
- Flour exhaust systems
- Food manufacturing plants
- Metal manufacturing – exhaust systems
- Pharmaceutical plants – exhaust systems
- Chemical plants
- Paper plants

Combustible Dust – Types

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

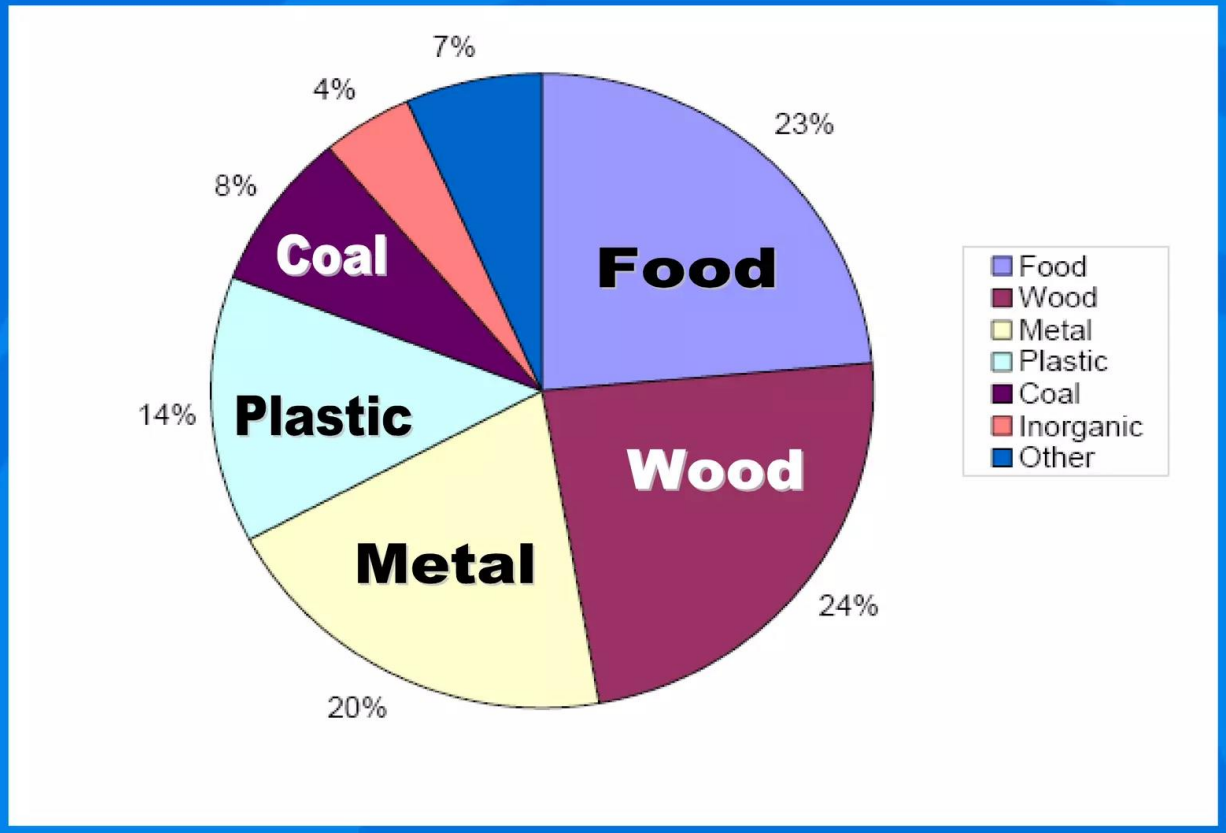
Combustible Dust – Avoiding Disaster

What is Dust?

Dust – Fine, dry powder consisting of tiny particles of earth or waste matter lying on the ground or on surfaces or carried in the air.

Combustible Dust – Avoiding Disaster

Types of Dust Involved in incidents



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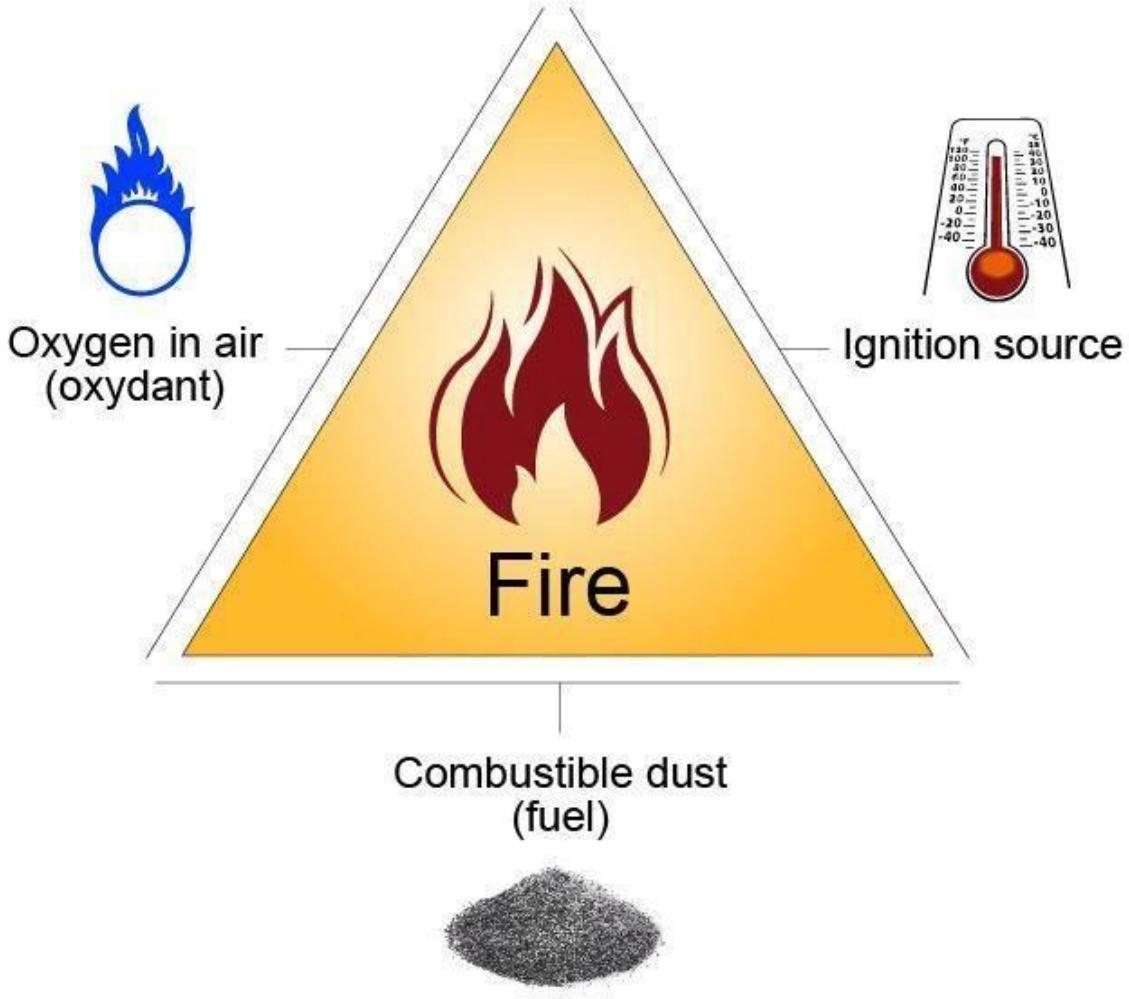
How do combustible dust explosions happen?



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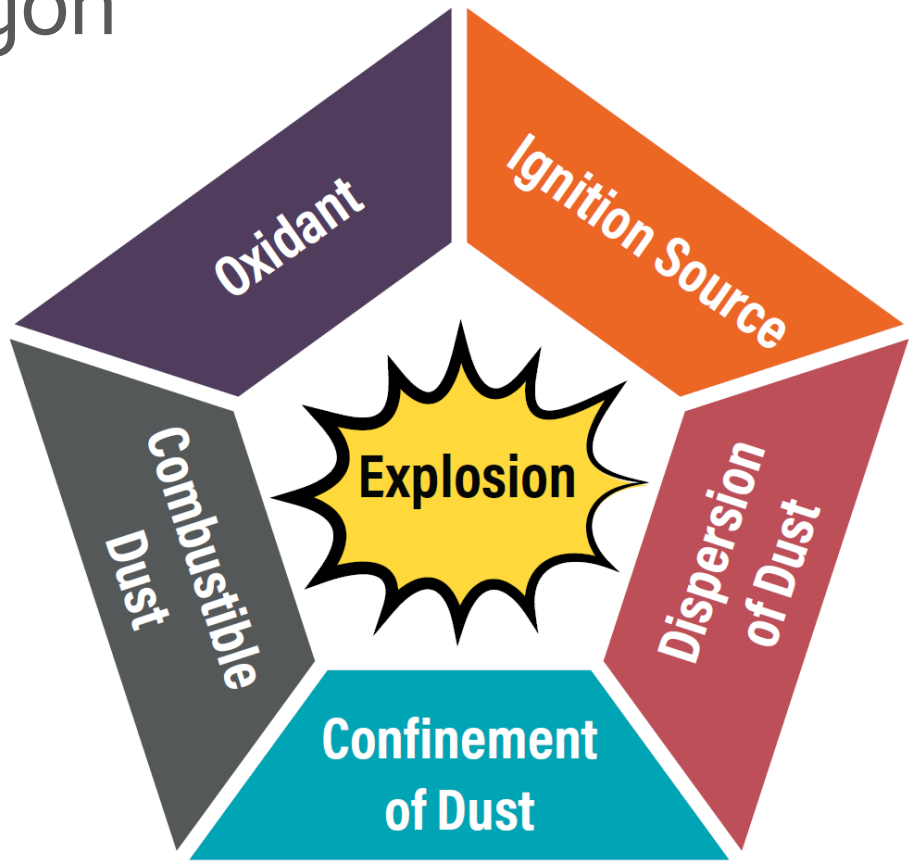
A dust explosion needs two additional elements - known as the "dust pentagon"



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Primary vs. Secondary

- The primary dust explosion is the first explosion.
- It occurs when there is a dust suspension in a confined space (such as a container, room, or piece of equipment) that is ignited and explodes.

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Primary vs. Secondary

- The primary explosion will shake other dust that has accumulated.
- When this dust becomes airborne, it also ignites.
- This secondary dust explosion is often more destructive than the primary one.

Imperial Sugar Company plant after an explosion, GA.

Killed 14 workers and injured 40 others.

Caused By:

Ongoing releases of sugar from inadequately designed and maintained dust collection equipment, conveyors, and sugar handling equipment.

Inadequate housekeeping practices allowed highly combustible sugar dust and granulated sugar to build up throughout the refinery's packing buildings, CSB investigators concluded.

Caused By:

- The first explosion – known as a "primary event" – likely occurred inside a sugar conveyor located beneath two large sugar storage silos.
- The conveyor had recently been enclosed with steel panels creating a confined, unventilated space where sugar dust could accumulate to an explosive concentration.
- Sugar dust inside the enclosed conveyor was likely ignited by an overheated bearing, causing an explosion that traveled into the adjacent packing buildings, dislodging sugar dust accumulations and spilled sugar located on equipment, floors, and other horizontal surfaces.

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Combustible Dust – Avoiding Disaster

Q: Can Flour Explode?

As astonishing as it may sound, the fact is that flour dust is more explosive than gunpowder and 35 times more combustible than coal dust.

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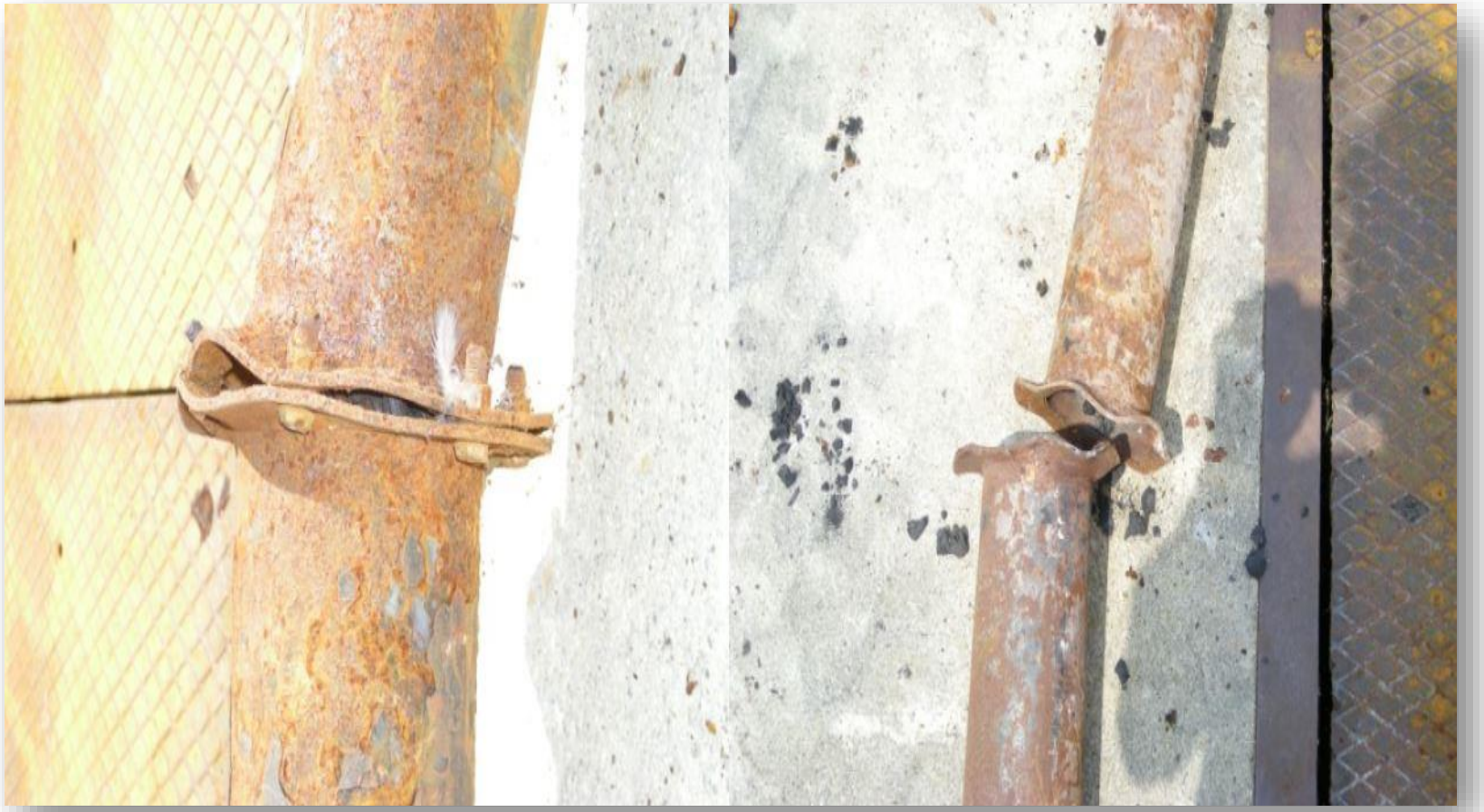

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DANGER

Testing and sampling the powder and bulk dust particulate is required to see if the dust particulate is combustible or explosive.

Material Safety Data Sheets (SDS) of each product will be useful in testing the dust.

Many times, the facility managers know its combustible.

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DANGER

The act of broom sweeping and compressed air actually stirs up dust and particulates into the air, which may create more issues with sensitive equipment and possible dust explosions.

Combustible Dust – Avoiding Disaster

DANGER

- Performing combustible dust cleaning requires several important procedures.
- The first and most important procedure is safety.
- Preventing static electricity, sparking, and any electrical charge is the first preventative step.
- Proper grounding of in-house electrical systems, equipment, forklifts, high-reach equipment, vacuums, extension cords and lighting is mandatory.

Combustible Dust – Avoiding Disaster

DANGER

- The simple act of dragging a piece of metal across a concrete floor can create a spark, which can lead to a dust explosion.
- Or a tool used to scrape inside a duct or silo.

Combustible Dust – Avoiding Disaster

DANGER

Proper lock-out/tag-out documentation, slip and fall prevention, high reach and harness protection and confined space awareness are some examples of safety musts.

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DANGER

Donning proper personal protection equipment (PPE), including safety lanyards and harnesses, hard hats, safety glasses, ear protection, disposable gloves, special coveralls and steel toe boots, is essential as well.

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Equipment Requirements

- Industrial, explosion-proof, high-efficiency particulate air (HEPA) filter equipped vacuums are the main pieces of equipment for this type of cleaning.
- Anti static hoses, grounded equipment.
- Non sparking cleaning tools.
- Anti static brush pieces.

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Equipment Hazards

Fully bonded and grounded;

A grounding strap to ensure any charge generated within the vacuum has a clear path to ground.

Antistatic wheels and an antistatic main filter that has stainless steel weave within it to conduct any static charges.

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Equipment

A certified vacuum will carry an approval from an NRTL - Nationally Recognized Testing Laboratory, which is the only body that may provide certification for equipment for hazardous locations in the United States.

Recognizes private sector organizations to perform certification for certain products to ensure that they meet the requirements of both the construction and general industry OSHA electrical standards.

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What Makes a Vacuum Explosion Proof?

- Normal vacuums utilize an electric motor to create suction.
- Explosion proof vacuums have no motor or moving parts.
- Utilizes compressed air to create suction.
- No motors or electric parts to create hazards.

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The vacuum doesn't directly use any electricity, so there are no electrical wires or electrical sparks to worry about causing issues in a hazardous situation.

In normal vacuums that are powered by electricity there are plugs and switches or arcing motors that can cause sparking hazards, or if the wire becomes damaged it can create sparks and heat that ignite the dust.

Combustible Dust

The movement of dusts through hoses creates static electricity, which can build up to be enough to create a spark strong enough to ignite a combustible dust cloud.

An explosion proof vacuum has all of its parts bonded together and then grounded, in order to discharge any built-up static safely, preventing any sparks or explosion hazards.

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Explosion proof vacuums are mounted on a metal drum that collects the dust, and when full the drums are sealed off and disposed of, keeping the dust contained and safe from any future explosion risks.

Combustible dust is considered a hazardous material and must be handled like one when collected, and metal drums are an approved method of containment.

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Combustible Dust – Avoiding Disaster

- Plastic
- Aluminum
- Magnesium
- Brass

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Anti Static generating brush pieces

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Equipment Hazards

Use cleaning methods that do not generate dust clouds – wet suppression, contact vacuum, negative air.

Use vacuum cleaners approved for combustible dust collection.

Locate relief valves away from dust hazard areas.

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Disposal????

- Disposal depends on what the debris contains.
- Every AHJ will have different regulations.
- I normally make it the facilities problem.
- 3rd party environmental company, oversight & disposal.
- I'm no expert on disposal, so I leave it up the experts.

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Where to Target

Overhead & Structure:

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Where to Target

- High ceilings and surfaces
- Heating, ventilation and air conditioning (HVAC) systems
- Dust collectors + duct work
- Conveyor belts
- Silo tanks
- Exhaust ductwork
- Dust control vacuuming (structure)

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Where to Target

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Where to Target

Is it Hazardous??

Where to Target

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Where to Target

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Where to Target

Cleaning should be performed under containment to prevent any cross contamination of other areas and equipment.

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Opportunity

- Grain elevators
- Food production
- Chemical manufacturing (e.g. , rubber, plastics, pharmaceuticals)
- Woodworking facilities
- Metal processing (e.g. , zinc, magnesium, aluminum, iron),
- Recycling facilities (e.g. , paper, plastics, metals).

Title of Presentation

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Thank you for Participating!