



Explosive Dust Management Overview

New OSHA Requirements

Nate McGarrh, CEMCP

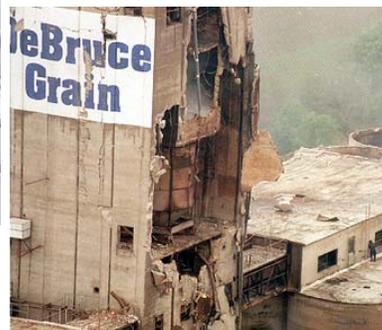
Sr. Safety Engineer



Where it truly started...

Grain Dust Explosions

(59 dead, 49 injured since 1976)



How the Spotlight Came to Indiana



Jasper – January 8, 2009



- February 1999
 - Automotive Foundry - Massachusetts
 - (3 Killed, 9 Injured)
- January 2003
 - Pharmaceutical Plant - North Carolina
 - (6 Killed, 38 Injured)
- February 2003
 - Acoustics Insulation Plant - Kentucky
 - (7 Killed, 37 Injured)



Other Combustible Dust Incidents Across the Nation...



North Carolina Pharmaceutical Plant (6 Killed, 38 Injured)

A Fire at the
Facility
Caused Dust
to be
Dispersed
and Explode
in the Ceiling
Space



Kentucky Acoustics Insulation Plant (7 Killed, 37 Injured)

The explosion at the plant was fueled by resin dust accumulated in a production area, likely ignited by flames from a malfunctioning oven.



History

- ◆ Nearly 300 explosions have injured or killed over 800 workers since 1980.
- ◆ OSHA reissued a National Emphasis Program (NEP) with the purpose to inspect facilities in industries where frequent or catastrophic combustible dust events have occurred.
- ◆ OSHA has since inspected over 1,000 firms for combustible dust. Of the firms visited, 87% have received citations. PPE violations are the 3rd most common category.



Common Questions

- ◇ Does the National Emphasis Program affect me?
- ◇ What type of facilities does the NEP affect?
- ◇ What types of dust does this include?
- ◇ What do I need to be sure my facility is compliant?
- ◇ What are the penalties for non-compliance?



Important Definition

Definition by OSHA

Combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape.



Combustible Dust: An Explosion Hazard



Any combustible material can burn rapidly when in a finely divided form. If such a dust is suspended in air in the right concentration, under certain conditions, it can become explosible. Even materials that do not burn in larger pieces (such as aluminum or iron), given the proper conditions, can be explosible in dust form.



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	Cottonseed Garlic powder Gluten Grass dust Green coffee powder 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 sugar seed dust Rice dust Rice flour Rice starch Rye flour Semolina	Soybean dust Spice Spice powder Sugar (10x) Sunflower Sunflower seed dust Tea Tobacco blend Tomato Walnut dust Wheat flour Wheat grain dust Wheat starch Xanthan gum	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	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 acetate suspension copolymer (poly) Vinyl chloride/vinyl acetate emulsion copolymer
Agricultural Dusts Alfalfa Apple Beet root Carrageen Carrot Cocoa bean dust Cocoa powder Coconut shell dust Coffee dust Corn meal Cornstarch Cotton	Carbonaceous Dusts Charcoal, activated Charcoal, wood Coal, bituminous Coke, petroleum Lampblack Lignite Peat, 22% H ₂ O Soot, pine Cellulose Cellulose Pulp, cork Iron	Metal Dusts Aluminum Bronze Iron carbonyl Magnesium Zinc	Plastic Dusts (poly) Acrylamide (poly) Acrylonitrile (poly) Ethylene (low-pressure process)	

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. Dust 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 detagration propagation

between pieces of equipment connected by ductwork.

The dust collector systems have spark detection and explosion/

detagration suppression systems.

Emergency exit routes are maintained properly.



U.S. Department of Labor Occupational Safety and Health Administration

DIRECTIVE NUMBER: CPL 03-00-008 EFFECTIVE DATE: 3/11/08 SUBJECT: Combustible Dust National Emphasis Program (Reissued)

****NOTE:** As a result of the March 26, 2012, revision to OSHA's Hazard Communication Standard, minor changes (in brackets) were made to this directive on October 1, 2015. These changes do not impact this directive's enforcement policy.

ABSTRACT

Purpose: This instruction contains policies and procedures for inspecting workplaces that create or handle combustible dusts. In some circumstances these dusts may cause a deflagration, other fires, or an explosion. These dusts include, but are not limited to:

- Metal dust such as aluminum and magnesium
- Wood Dust
- Coal and other carbon dusts
- Plastic dust and additives
- Biosolids
- Other organic dust
- Certain Textile materials

Scope: This instruction applies OSHA-wide.

Cancellations: This directive cancels OSHA Instruction CPL 03-00-006 Combustible Dust National Emphasis Program, October 18, 2007. State Plan Impact: Notice of Intent required. See paragraph VI.

Action Offices: National, Regional, and Area Offices.

Originating Office: Directorate of Enforcement Programs
200 Constitution Avenue, NW Room N3107
Washington, DC 20210

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OSHA Citations

- ✓1910 Subpart D , Walking/Working Surfaces
- ✓1910 Subpart E, Emergency Action Plans
- ✓1910 Subpart G, Occupational Health/Environmental Control
- ✓1910 Subpart L, Fire Protection
- ✓1910 Subpart N, Material Handling and Storage
- ✓1910 Subpart R, Special Industries
- ✓1910 Subpart S, Electrical
- ✓1910 Subpart Z, Toxic and Hazardous Substances

- ...and last but definitely not least, 1910.5(a)(1)
General Duty Clause



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 starch Rye flour Semolina	Soybean dust Spice 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 ₂ O 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 formaldehyde) 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
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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, nooks, 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 a housekeeping 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.
 Dust 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.
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.



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 starch Rye flour Semolina	Soybean dust Spice 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 ₂ O Soot, pine Cellulose Cellulose pulp Cork Corn	Soybean dust Spice 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 ₂ O Soot, pine Cellulose Cellulose pulp Cork Corn
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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) Methylacrylate (poly) Methylacrylate, emulsion polymer
Phenolic resin (poly) Propylene
Terpene-phenol resin Urea-formaldehyde/ cellulose, molded
(poly) Vinylacetate/ ethylenecopolymer
(poly) Vinyl alcohol (poly) Vinyl butyral (poly) Vinyl chloride/ ethylene/vinyl acetylene
suspension copolymer
(poly) Vinylchloride/ vinyl acetylene emulsion copolymer

Does this affect my operations?

In your facility, do you store, handle or produce dust?

Is the dust any of the following?

- ◇ Agricultural Product
- ◇ Agricultural Dust
- ◇ Carbon dust
- ◇ Chemical Dust
- ◇ Metal Dust
- ◇ Plastic Dust



Where do I Start?

Determine if your dust is explosive.

▶ **Go – No Go Testing (Explosive Screening) – ASTM E1226**

This is an economical and practical way to determine if the dust in the sample has the potential to be explosive. If the dust is not found to be an explosive threat, the analysis can be aborted to avoid unnecessary fees. If the sample turns out to be explosive more comprehensive analyses listed below should be conducted.

▶ **Explosion Severity (K_{st} , P_{max} , $[dP/dt]_{max}$) – ASTM E1226**

This testing provides an indication of the severity of the dust explosion. The larger the value of K_{st} , the more severe the explosion is.



I have my K_{st} Value, now what?

K _{st} Value	Characteristic
0	Non-explosive
> 0 and < 200	Weak or Moderately Explosive
> 200 and < 300	Strongly Explosive
> 300	Very Strongly Explosive



Applicable Guidelines

- ◇ **NFPA 499:** Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations
- ◇ **NFPA 654:** Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- ◇ **NFPA 652:** Standard on the Fundamentals of Combustible Dust



Audit the Facility

- ◇ **NFPA 499**
- ◇ **NFPA 652**
- ◇ **NFPA 654**
- ◇ **PPE assessment - OSHA 1910.132**



Items to Audit

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.



Items to Audit

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.



Items to Audit

Prevention Measures

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



Items to Audit

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.



After the Audit

- ◇ Determine the classification of areas where dust may exist in your facility - Class II, Division I, Division II non-classified (a map and written documentation of this should be developed and maintained).
- ◇ Develop your facility's written dust safety plan
- ◇ Training needs of your facility



Area Classification

Determine what areas should be classified and what the classification should be

Unclassified

Class II Division II

Class II Division I



Class II Areas

Class II Division I Locations

The criterion for a Division II location is whether the location is likely to have ignitable dust suspensions or hazardous dust accumulations under normal conditions.



Class II Areas

Class II Division II Locations

The criterion for a Division II location is whether the location is likely to have ignitable dust suspensions or hazardous dust accumulations only under abnormal conditions. The term “abnormal” is used here in a limited sense and does not include a major catastrophe.



Class II Unclassified Areas

Unclassified

Experience has shown that the release of ignitable suspensions from some operations and apparatus is so infrequent that area classification is not necessary.



Class II Unclassified Areas

Unclassified

Typically these areas are storage areas where materials are stored in sealed containers, bags, drums, or fiber packs etc.

Rarely (unless extreme housekeeping measures are taken) are process areas unclassified.



Area Classification

A map of the facility including the areas and the classification of those areas should be developed.

This map should be included in your written dust safety plan.



Classifying the Areas

The classification will determine:

- ◆ What electrical components can be installed and used in the area
- ◆ What engineering controls need to be put into place
- ◆ What if any and the location of ignition sources
- ◆ What housekeeping measures need to be implemented



Training

- ◇ Applicable employees shall be trained in the hazards associated with the dust, applicable controls, safety requirements, emergency action plans including evacuation plans.
- ◇ Training should also include key portions of your facility's written dust safety plan.
- ◇ Training should also include the classification of the areas and what that classification means.
- ◇ Communicate required PPE to each affected employee



1910.132(d) Hazard Assessment and Equipment Selection

1910.132(d)(1)

The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the employer shall:

1910.132(d)(1)(i)

Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment;

1910.132(d)(2)

The employer shall verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.



Important Note:

If your facility has dust that is found to be explosive, you now have extra requirements involving the new GHS for Hazardous Materials.

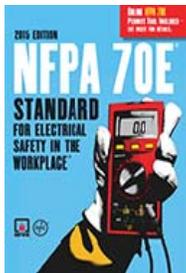


GHS Special Requirements

- ◆ Placarding
- ◆ Storage
- ◆ Handling
- ◆ Removal and Disposal



Important Note

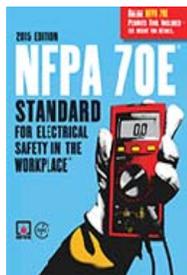


Energized work in Classified areas?



Important Note

Typically energized electrical work **CANNOT** be conducted in classified areas.



Summary

- ◆ Is your dust explosive (Kst, Go or NO go)
- ◆ Facility Assessment
- ◆ Classification of areas
- ◆ Written Dust Safety Program
- ◆ PPE
- ◆ Employee Training



Waiting is NOT an Option



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