

Prevention of Fires and Explosions in Wood Pellet Facilities



Allen Wagoner, FLAMEX, Inc.











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 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	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 acetylene suspension copolymer (poly) Vinyl chloride/vinyl acetylene 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_2O Soot, pine Cellulose Cellulose pulp Cork Corn	Metal Dusts Aluminum Bronze Iron carbonyl Magnesium Zinc	Plastic Dusts (poly) Acrylamide (poly) Acrylonitrile (poly) Ethylene (low-pressure process)	



Wood Dust

- The smaller the particles the more dangerous
 - Particle size of 420 microns or less
(NFPA Code 664)
- Minimum explosible dust concentration
 - 60 grams per cubic meter
(R.K. Eckhoff, *Dust Explosions in the Process Industries*)



Fire Hazards in Collectors

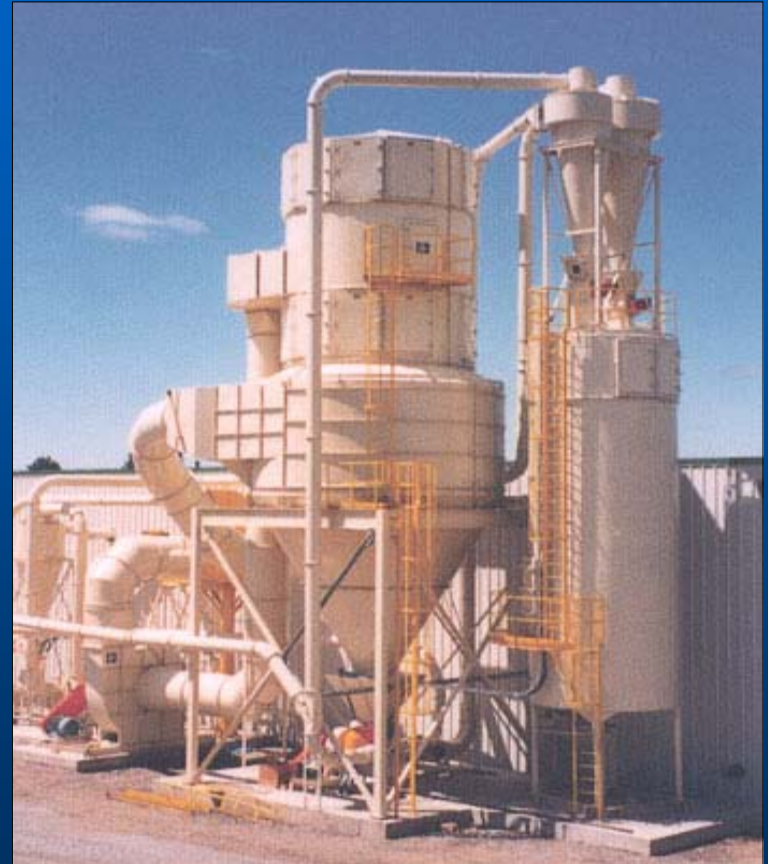
“If combustible dusts are collected, there is a fire... hazard in the collector, regardless of the bag construction.”

- Factory Mutual



The Explosion Hazard

- Dust collectors
- Cyclones
- Dust bins





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Recipe for an Explosion

- Dust = fuel
- Airflow = oxygen
- Airborne dust/material = dispersion
- Collector = confinement
- Spark/ember = ignition source



Ignition Sources

- Sparks from **normal** Manufacturing Processes

Particularly:

- Drying
- Hammer milling



ROTARY DRYERS



“Rotary Dryers shall have automatic spark detection and extinguishing systems installed between the dryer drum and downstream material handling equipment, such as cyclones or wind boxes.”

-NFPA 664 8.6.2.2 2007 Edition

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Suppression

Detection



HAMMER MILLS

“Unless the particulate size reduction equipment is strictly dedicated to handling green material or is pressurized with steam, it shall be considered a high-frequency ignition source.”

-NFPA 664 8.4.1.1 2007 Edition

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Industrial Magnets



“Foreign material shall be removed from the process material feed into all particulate size reduction equipment by permanent magnet or self-cleaning electromagnet-type magnetic separators, or by pneumatic separators, or by both.”

-NFPA 664 8.4.2.2.2 2007 Edition


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Other Ignition Sources

- Overheated Pellets
- Overheated Bearings
- Material Handling Fan Blades
- Human Error



Typical Reasons to Implement a Protection System:

- **Increase Workplace Safety**
 - **Protect Equipment and Facilities**
 - **Minimize or Eliminate Downtime**
 - **Comply with Regulations or Codes**
 - **Meet Insurance Requirements**
- 
- A decorative horizontal bar at the bottom of the slide, featuring a gradient from dark red on the left to bright orange on the right.

Spark Detection and Extinguishing Systems

*Introduced in the United States
in the mid 70s.*

*Concept: Prevent the event
by eliminating the potential
ignition source.*

System Components

- Control Panel



System Components

- Infrared Detectors

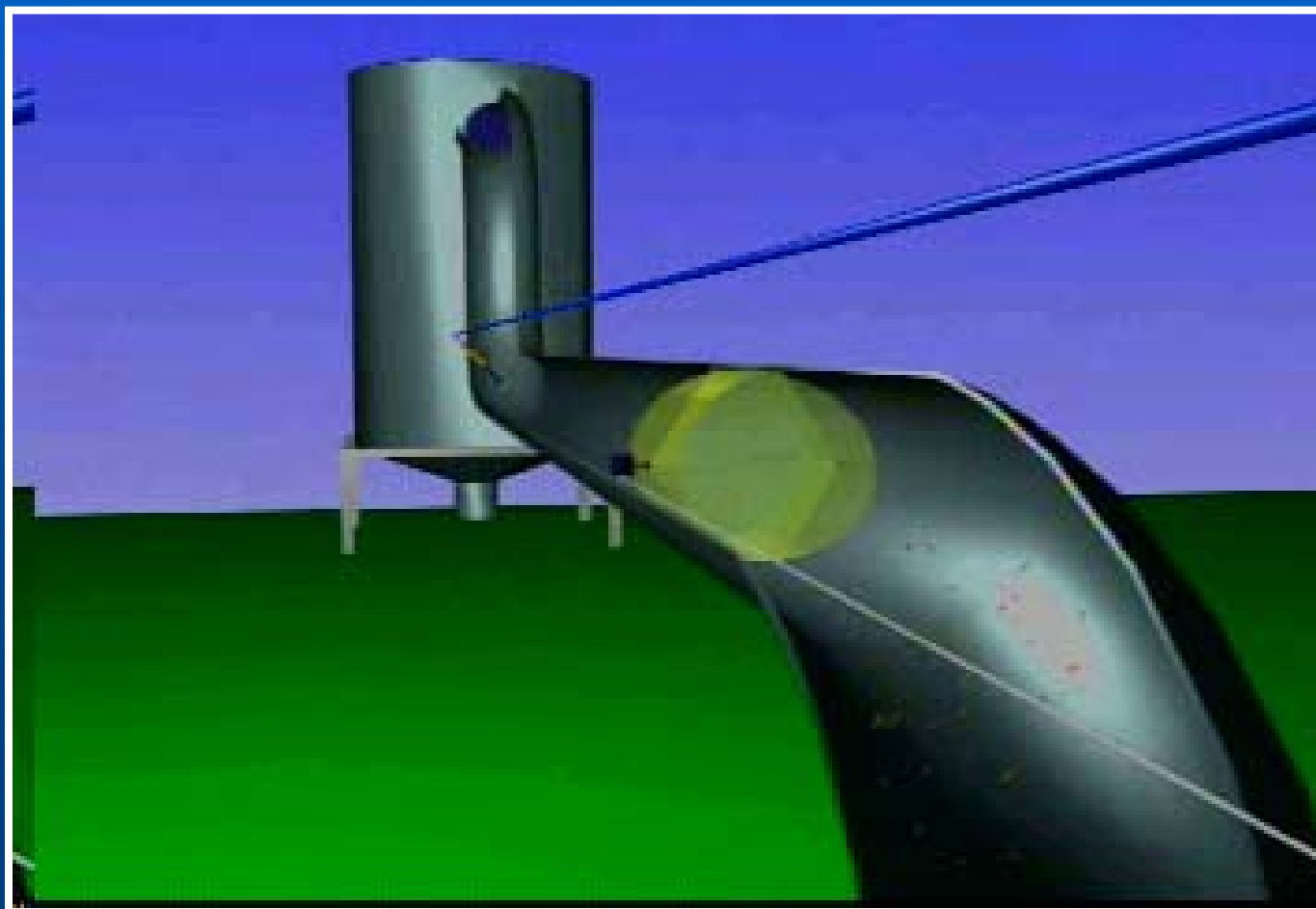


System Components

- Extinguishing Assembly



Spark Detection & Extinguishing



Advantages of the System

- Rapid detection
- Fast suppression
- Minimize/eliminate downtime and clean up
- Cost Effective
- Flexible

Flexibility allows the system to:

- Sound remote alarms
- Shut down equipment
- Trip Deluge Valves
- Divert Burning Material
- Utilize various types of detectors

Additional Detectors:

- Flame Detectors
- Heat Detectors
- Daylight Detectors
- Smoke Detectors
- Manual Release Stations

Abort Gates

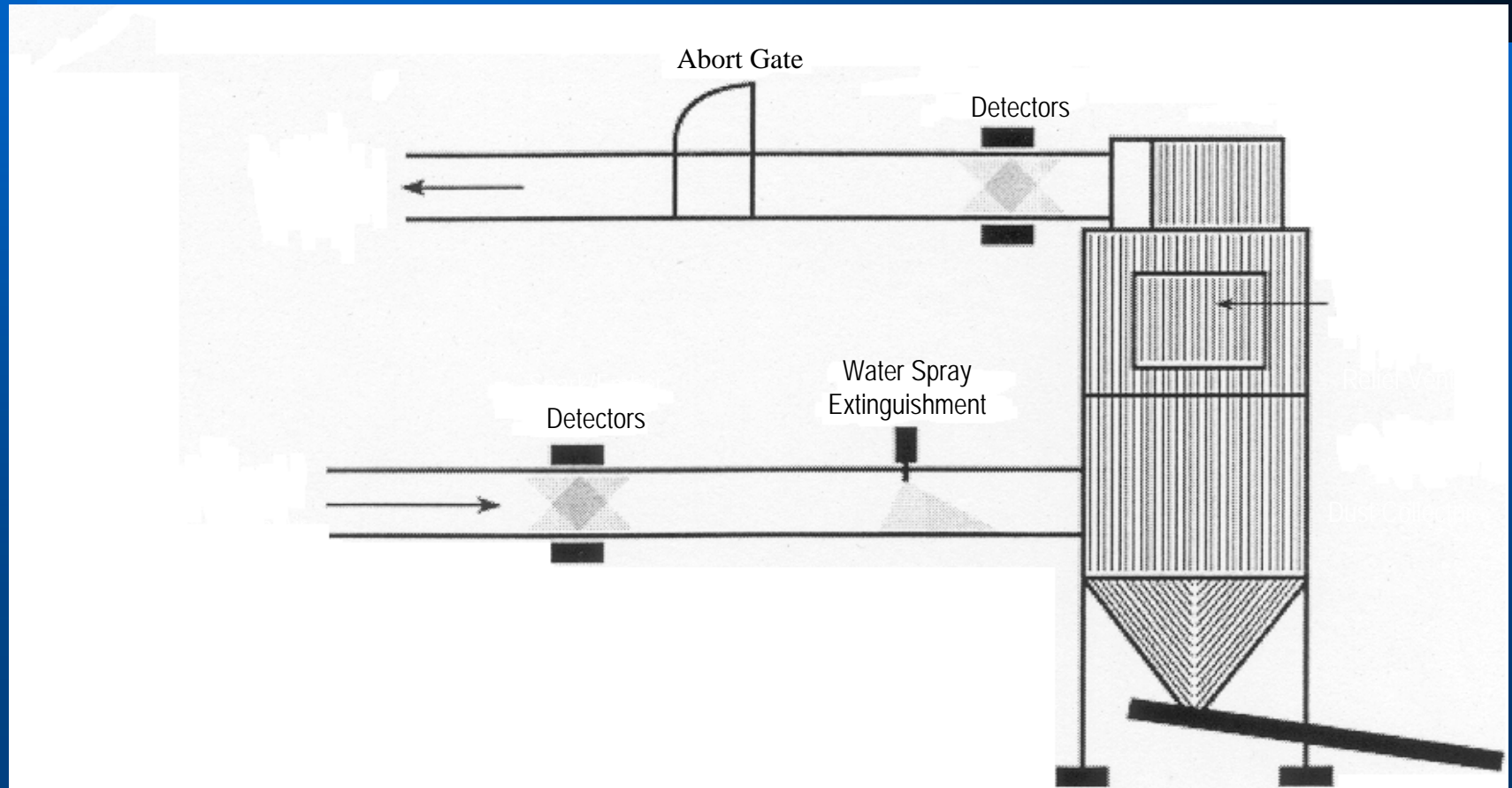
- High speed reaction
- Used for diversion and isolation
- Specified by NFPA 664 & 654



Abort Gates



The Basic Spark Detection and Extinguishing System for a Single Air Material Separator



- NFPA Code 654 Reprinted with permission from NFPA 654. Copyright © 2005, National Fire Protection Association.

Detection on Drop Chute



Back Draft Dampers



Water Deluge Systems



Other Protection Measures

- Explosion Suppression Systems
- Explosion Venting

Proper Safety Measures

- Practice good housekeeping
- Eliminate dust build-up
- Maintain sufficient air velocity in ducts
- Perform preventative maintenance



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Ensure Optimum System Reliability

- Periodic maintenance
- Regular system testing



Major Relevant Publications

NFPA Codes

- *664 Standard for the Prevention of Fires and Explosions in Wood Processing and Working Facilities*
- *654 Standard for the Prevention of Fire & Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids*
- *69 Standard on Explosion Prevention Systems*
- *68 Standard on Explosion Protection by Deflagration Venting*

Major Relevant Publications

FM Global

- Data Sheet 7-73
Dust Collectors & Collection Systems
- Data Sheet 7-76
Prevention & Mitigation of Combustible Dust Explosions & Fires
- Data Sheet 7-10
Wood Processing & Woodworking Facilities

Management Involvement:

- **System Design**
- **Equipment Specification and Procurement**
- **System Layout**
- **Installation**
- **Training of Personnel**
- **Operating Policies and Procedures**
- **Maintenance Scheduling**

THANK YOU!

