PPE and Combustible Dust –
the often overlooked piece of protection

Agenda

- What Is Combustible Dust?
- Why Are We Talking About Combustible Dust?
- OSHA and Combustible Dust
- Combustible Dust Standards
- NFPA® 652 and PPE
- NFPA® 2112
- NFPA® 2113
- How To Create An FR Clothing Program

What is Combustible Dust?

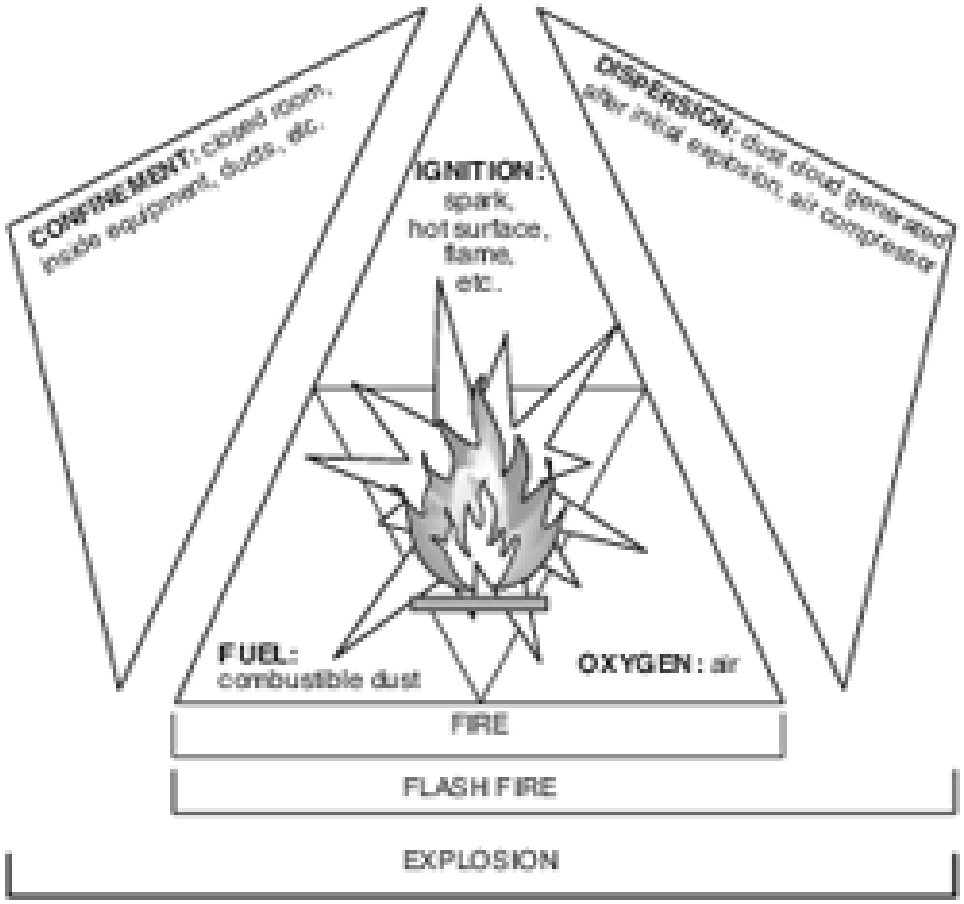
Combustible Dust Definition:

Combustible dust (CD) is defined as 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® **654,** 2013]

NFPA® 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids. (2013) (p. 8). Quincy, MA.

What is Combustible Dust?

The Combustible Dust Pentagon: elements required for fires, flash fires, and explosions.



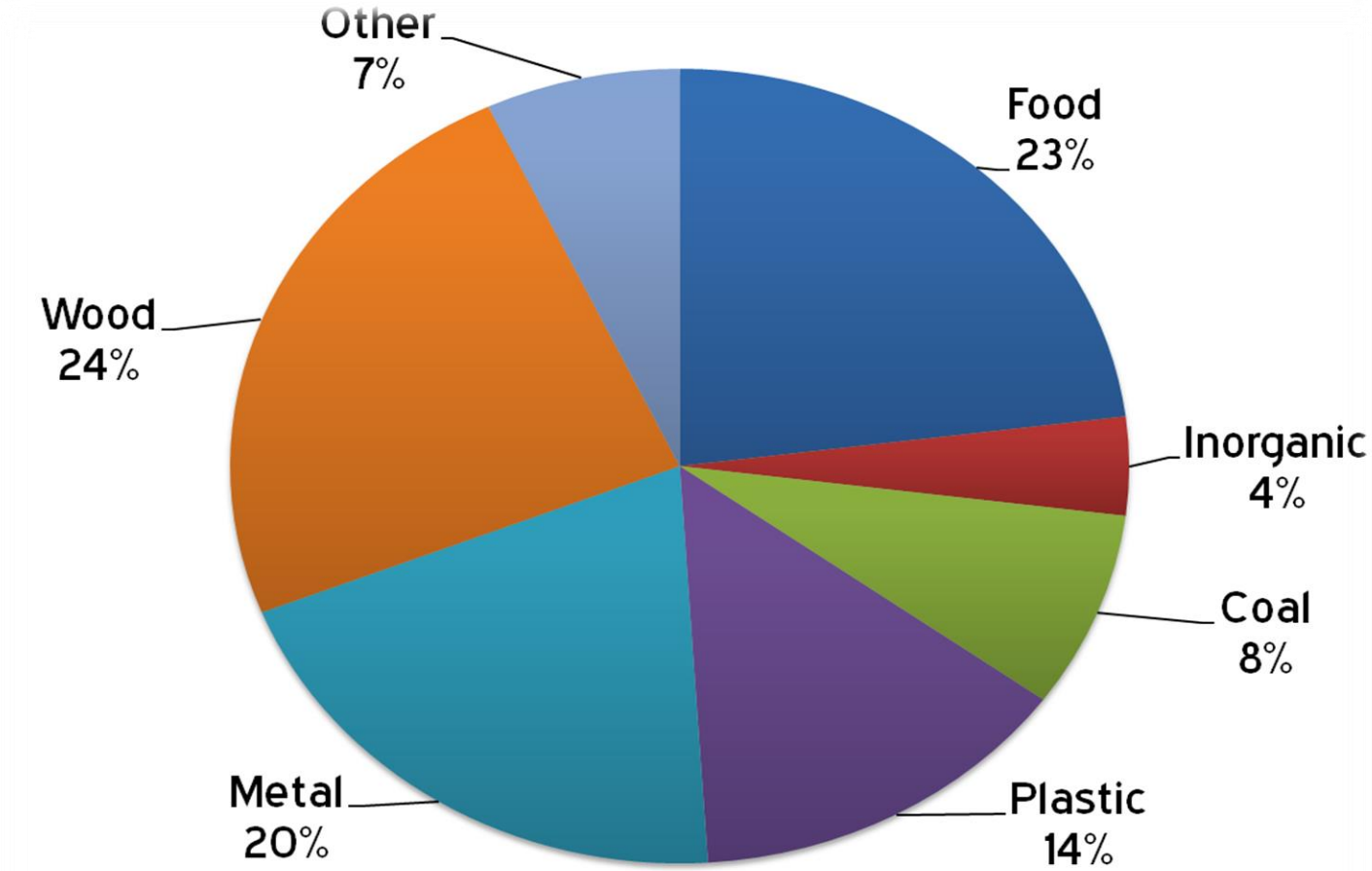
What is Combustible Dust?

Common Sources of Ignition

- Mechanical Sparks
- Frictional Heat
- Electric Arc
- Open Flames
- Slag from Welding or Flame Cutting

What is Combustible Dust?

Common Combustible Dusts



What is Combustible Dust?

When is dust considered a hazard?

- Layer Depth
  - Minimum allowable depths vary
- Particle Size/Shape
  - Less than 420 microns
  - Works well when applied to spheres
  - Not descriptive of irregular shapes

No. 40 standard sieve

Why Are We Talking about Combustible Dust?

- In 2006, the Chemical Safety Board conducted a study of combustible dust accidents across U.S. industries
  - 281 combustible dust accidents from 1980-2005
  - 119 deaths
  - 718 injuries
- The results encouraged OSHA to develop a federal standard on combustible dust

Why Are We Talking about Combustible Dust?

Imperial Sugar Port Wentworth, GA 2008

OSHA and Combustible Dust

OSHA General Duty Clause – OSH Act 1970

SEC. 5. Duties

(a) Each employer --

(1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

OSHA and Combustible Dust

- OSHA is the **"SHALL"**
- NFPA® is the **"HOW"**
  - Industry consensus standards, such as NFPA®, ASTM and ANSI are used in OSHA enforcement actions as evidence as to whether the employer acted reasonably

OSHA
Occupational Safety and Health Administration

NFPA®

Combustible Dust Standards

NFPA® 654, was widely seen as filling the “everyone else” gaps between these other industry-specific standards:

- NFPA® 61 *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*
- NFPA® 484 *Standard for Combustible Metals*
- NFPA® 655 *Standard for the Prevention of Sulfur Fires and Explosions*
- NFPA® 664 *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*
- And others, such as NFPA® 120 *Standard for the Prevention and Control in Coal Mines*

Combustible Dust Standards

NFPA® 654 was focused on:

- Preventing the formation and/or accumulation of hazardous dust
- Preventing the ignition of dust
- Limiting the consequences of an explosion or fire (mitigation and control)
- Currently, NFPA® 654 does require PPE, specifically FR clothing, but the key sections that mention FR clothing are very general:
  - 6.1.1.10 Personnel exposed to a dust flash fire hazard shall be protected in accordance with 11.2.2.
  - 11.2.2 Operating and maintenance procedures shall address personal protective equipment (PPE), including flame-resistant garments, in accordance with the workplace hazard assessment required in NFPA® 2113

Combustible Dust Standards

The Impact of NFPA® 652

- *Origin and Development of NFPA® 652* states:
  "This new standard establishes the relationship and hierarchy between it and any of the industry - or commodity-specific standards, ensuring that fundamental requirements are addressed consistently across industries, processes, and dust types."

- NFPA® 652 was needed because, before its publication near the end of 2015, OSHA inspectors were still forced to rely on the General Duty Clause, a handful of limited federal regulations and a patchwork of industry-specific consensus standards when citing combustible dust violations.

Combustible Dust Standards

The Impact of NFPA® 652 on Business:

Although there is still no federal regulation to address combustible dust, the release of NFPA®652, *Standard on the Fundamentals of Combustible Dust* represents a change in the way that employers and employees will treat the combustible dust hazard

NFPA® 652 and PPE

NFPA® 652, Chapter 1 – Administration:

- **1.4 Conflicts** section establishes a protocol for addressing discrepancies between the general, over-arching standard and the "commodity-specific" standards that are already in place. Specifically, it states:
  - Where a specific standard prohibits a general standard, the specific is applied
  - Where a specific standard differs from the general, the specific is applied
  - Where a specific standard neither prohibits nor provides a requirement, the general is applied
  - Where there is a conflict between specific and general, the specific applies

NFPA® 652 and PPE

NFPA® 652, Hazard Assessment – DHA:

- In the new standard there is a preliminary requirement that the owner or operator of a facility that produces or handles dust must determine whether that particular dust is explosible or combustible.
- This determination must be made prior to conducting the hazard risk assessment
- The absence of previous incidents shall not be used as the basis for deeming a particulate to not be combustible or explosible.

NFPA® 652 and PPE

Definitions in NFPA® 652:

- 3.3.16* Dust Hazards Analysis (DHA). A systematic review to identify and evaluate the potential fire, flash fire, or explosion hazards associated with the presence of one or more combustible particulate solids in a process or facility.
- 3.3.20* Flash Fire. A fire that spreads by means of a flame front rapidly through a diffuse fuel, such as dust, gas, or the vapors of an ignitable liquid, without the production of damaging pressure. [921, 2014]
- 3.3.34* Risk Assessment. An assessment of the likelihood, vulnerability, and magnitude of the incidents that could result from exposure to hazards. [1250, 2010]

NFPA® 652 and PPE

NFPA® 652, Chapter 5 – Hazard Identification

- **5.1 Responsibility.** The owner/operator of a facility with potentially combustible dusts shall be responsible for determining whether the materials are combustible or explosive, and, if so, for characterizing their properties as required to support the DHA.
- If a dust is deemed combustible or explosible, a Dust Hazards Analysis, or DHA, must be conducted to determine whether existing workplace conditions could cause the dust to ignite and burn/explode.

NFPA® 652 and PPE

NFPA® 652, Chapter 8.6 Personal Protective Equipment

8.6.1 Workplace Hazard Assessment.

- **8.6.1.1*** An assessment of workplace hazards shall be conducted as described in NFPA® 2113.
- **8.6.1.2** When the assessment in 8.6.1.1 has determined that flame-resistant garments are needed, personnel shall be provided with and wear flame-resistant garments.
- **8.6.1.3*** When flame-resistant clothing is required for protecting personnel from flash fires, it shall comply with the requirements of NFPA® 2112.

NFPA® 652 and PPE

The most significant takeaways from the new NFPA® 652 standard with the greatest impact are:

- NFPA® 652 places responsibility for the Dust Hazards Analysis on the owner/operator.
  - Conducted within three years (by September 7, 2018)
- Emphasis on training and awareness
- FR clothing requirements are very specific and distinct to this standard
- Employers must now implement a written policy for the care, cleaning, and maintenance of FR garments

Conclusions

- Employees who could be exposed to a combustible dust explosion should be in FR clothing
- Refer to NFPA® 2113, *Standard on the Selection, Use, Care and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-duration Thermal Exposures from Fire* (2015)
- More to come in terms of….
  - Regulation
  - Standards
  - Best practices

NFPA® 2112 and 2113

NFPA® 2112

1.1 Scope:

The standard shall specify the minimum performance requirements and test methods for flame-resistant fabrics and components and the design and certification requirements for garments for use in areas at risk from flash fires.

NFPA® 2112

Standard on Flame Resistant Garments for Protection of Industrial Personnel Against Flash Fire

What it is….

- A means of certifying fabrics & findings suitable for use in FR clothing to be worn as protection against possible flash fire exposure

Fabrics must :

- Retain flame resistance through multiple launderings
- Meet standards for heat transfer performance, thermal stability and heat resistance
- Result in less than 50% predicted body burn when tested on a thermal manikin over underwear in a flash fire of 3 seconds

NFPA® 2113

Standard on Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire

Provides common sense protocol for issues like:

- Conducting a hazard assessment
- Selecting FR garments (specifications)
- Properly using FR garments (Training)
- Care and Maintenance

How to Create an FR Clothing Program

Why Not Wear Everyday Street Clothes?

Everyday fabrics can ignite, burn and possibly melt when exposed to a thermal hazard

If everyday fabric does ignite and burn, it will increase the extent of a worker's injury

How to Create an FR Clothing Program

After a flash fire you are either on fire or you are not!

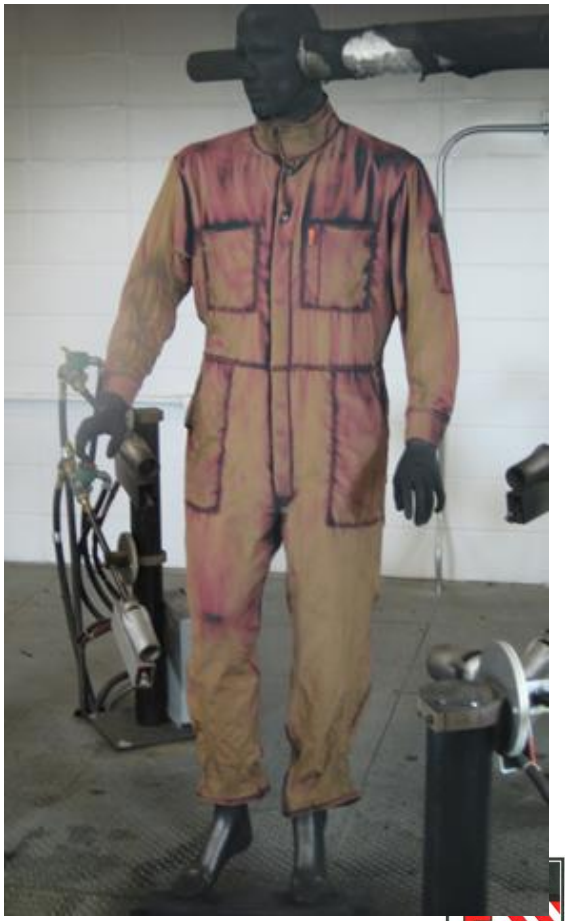
How to Create an FR Clothing Program

What is flame-resistant clothing?

- Clothing made from fabrics that self-extinguish
- Fabrics may be natural or synthetic
- Designed to limit (not eliminate) burn injury
- Survival, extent of injury, recovery time and quality of life are all dependent on FRC performance

How to Create an FR Clothing Program

FR fabrics are engineered to self-extinguish



How to Create an FR Clothing Program

“Primary” vs. “Secondary”

- **Primary Protective Clothing**
  - Definition; “Clothing that is designed to be worn for work activities where significant exposure to molten substance splash, radiant heat, and flame is likely to occur.”
    Example: Firefighter Turnout Gear

- **Secondary Protective Clothing**
  - Definition; “Clothing that is designed for continuous wear in designated locations where intermittent exposure to molten substance splash, radiant heat, and flame is possible.”

How to Create an FR Clothing Program

Flame-Resistant Clothing is
Your Last Line of Defense.

Hierarchy of Controls

- Eliminate or replace
- Engineering
- Administration/policies
- PPE

How to Create an FR Clothing Program

Engineered Flame-Resistant Fabrics:

- Natural fibers
- Synthetic fibers
- Natural / synthetic blends

- NOTE: Flame resistance must be durable to launderings, wear, environment, etc. for the service life of the garment
- **ALL** FR fabrics are engineered. Do not let marketing terms confuse you—*inherent, treated* etc.

– **Look for <u>proven</u> products!**

How to Create an FR Clothing Program

Training for Proper Use

FR clothing must be:

- Appropriate to hazard
- Always the outermost layer
- Worn correctly; zipped, buttoned, etc.
- All-natural, non-melting undergarments
- Clean—no flammable contaminants
- Repaired correctly and removed from service when needed

How to Create an FR Clothing Program

Maintenance of FR Clothing:

- Garments should be cleaned to maximize performance
- Contaminants can “mask” or negate flame resistance
- Care choices
  - Home-wash
  - Industrial Laundry
  - Dry-cleaning

Conclusions

- In the hierarchy of safety measures and precautions in any safety program, personal protective equipment is the last line of defense.
- FR clothing is designed to self-extinguish once the ignition source is removed, but it does not guarantee that the wearer will be unharmed in the event.
- FR clothing that meets the requirements of NFPA® 2112, *Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire* is designed to minimize personal injury in a flash fire.
- It is important to partner with market-proven suppliers to ensure not only that the proper garments are selected, but also that appropriate training on correct use, care, and maintenance is provided per NFPA® 2113, *Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel*

Questions, Comments, Feedback?

Bulwark University