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Protecting Workers from Combustible Dust with FR Clothing September 2010

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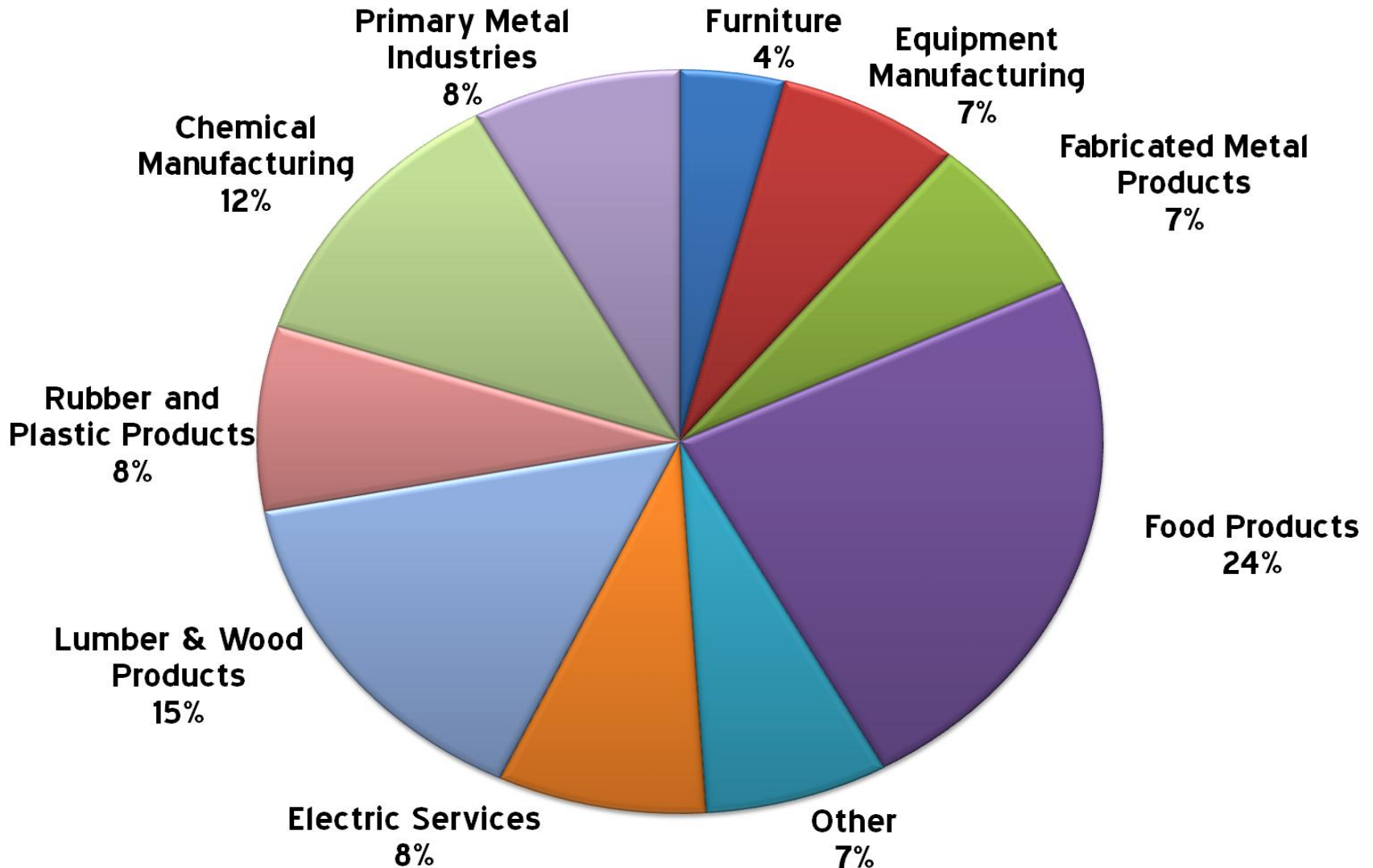
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Agenda

- Combustible Dust Statistics
- Hazard Analysis
- Case Studies
- Mitigation Strategies
- FR Clothing: Background
- FR Clothing Can Protect Workers
- Conclusion: Preventing and Protecting Against Combustible Dust

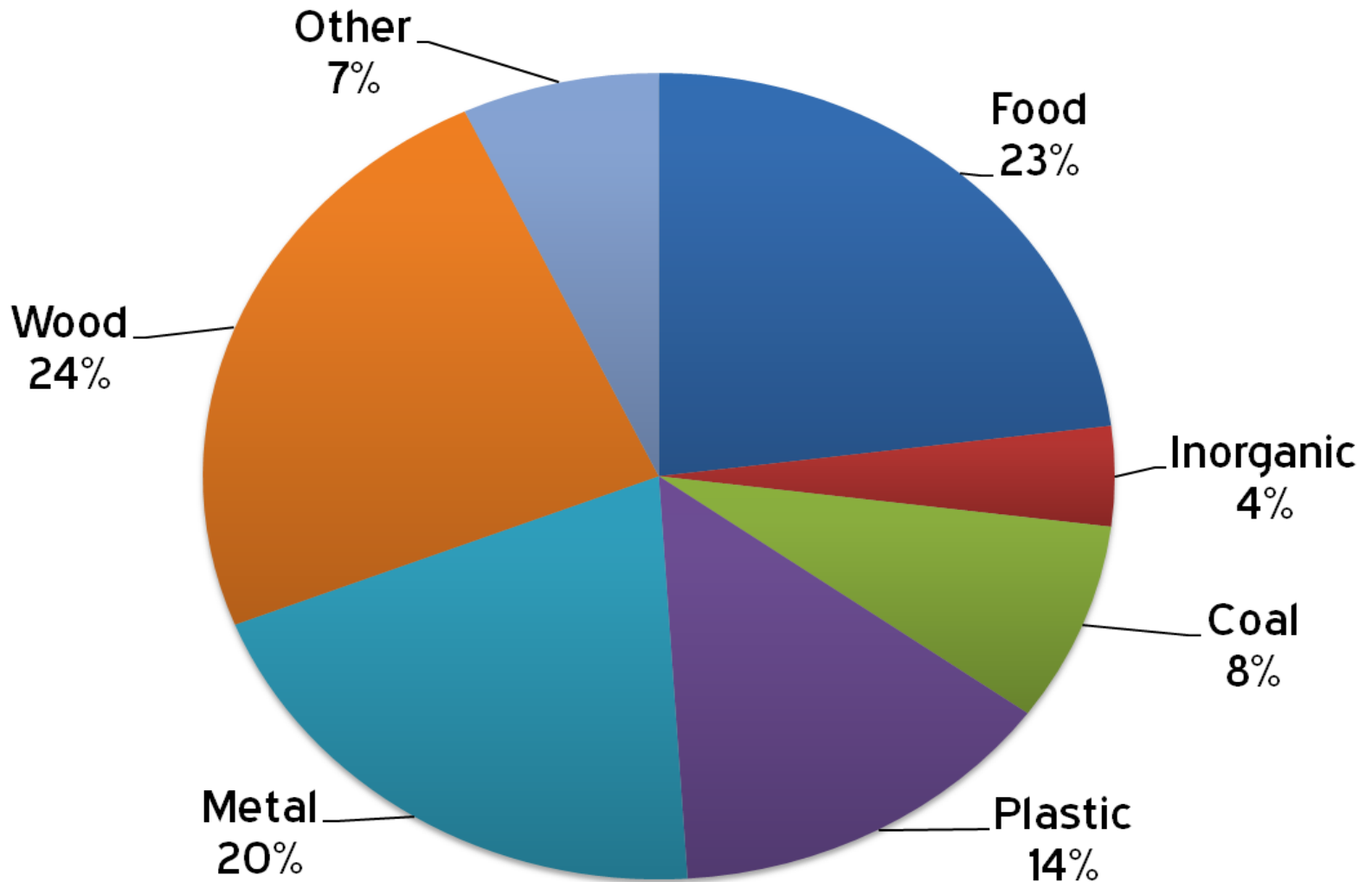


Vulnerable Industries





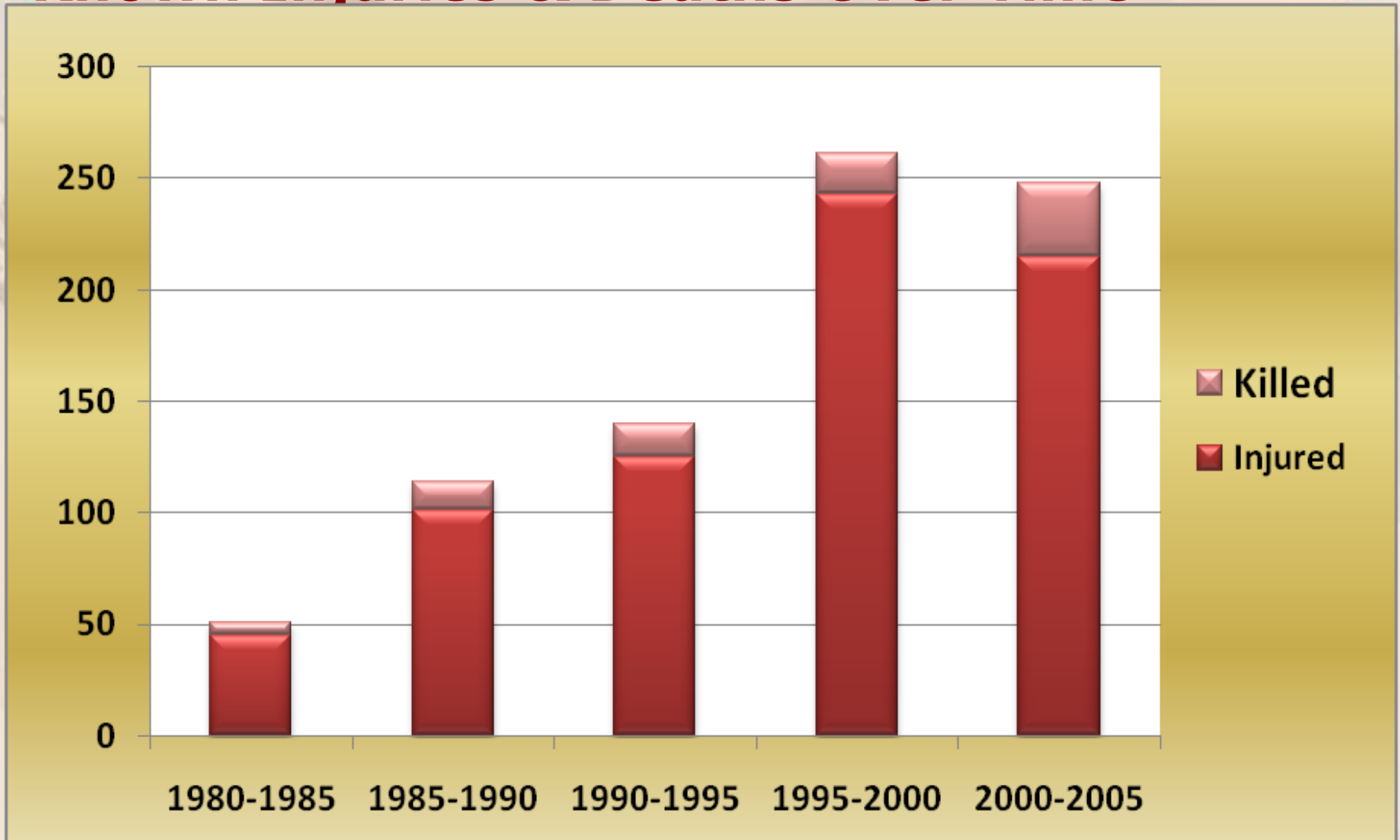
Common Combustible Dusts





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Known Injuries & Deaths Over Time



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Challenges of Combustible Dust

- Combustible dust, as a flash fire hazard, is highly unpredictable. Dust can collect in a wide variety of materials and consistencies.
- Even two scenarios with the exact same type, volume and density of dust, ventilation source, and ignition source may produce entirely different explosions at different times.
- Practical and cost-effective mitigation strategies can significantly diminish the possibility of an explosion at your firm, including the use of flame resistant clothing.
- Although no comprehensive Combustible Dust OSHA standard currently exists, we believe that the General Duty clause covers combustible dust hazards.



What Can Be Done?

- Multi-step safety processes will help to ensure that combustible dust is mitigated.
- Dust testing, adequate housekeeping, communication, training, and use of personal protective equipment (PPE) can all be used to ensure that combustible dust is kept at bay.
- No mitigation strategy will ensure that dust will be 100% prevented. It is safest to follow as many precautions as possible.



Hazard Analysis by Lab Testing

- Though hazard assessment under these circumstances is difficult at best, testing for dust explosiveness is both possible and practical.
- No enforceable, set method for conducting hazard analysis.
- Dust can be tested for a general NFPA-classified “KST” number to estimate the anticipated behavior of dust deflagration, or explosion.
- KST testing may be a good way to assess combustible dust hazard.



What does KST mean?

- When a facility opts to have testing performed, the following are analyzed:
 1. Minimum Dust Concentration
 2. Minimum Ignition Temperature
 3. Minimum Ignition Energy
- KST is a generalized number used to estimate the anticipated behavior of dust deflagration, or explosion.
- Bulk samples of dust material in plastic bottles between 2-2.5 lbs are tested for a general NFPA-classified "KST" number.
- Samples of dust are taken from several locations, such as ceilings, ductwork, and corners.
- Labs assess the above factors to analyze the "KST" number, or a dust's approximate **explosive power** and **explosive probability**.



KST Categories & Explosiveness

<u>EXPLOSION CLASS</u>	<u>KST Characteristic</u>
ST 0	0 No explosion
ST 1	>0 and \leq 200 Weak Explosion
ST 2	>200 and \leq 300 Strong Explosion
ST 3	>300+ Very Strong Explosion



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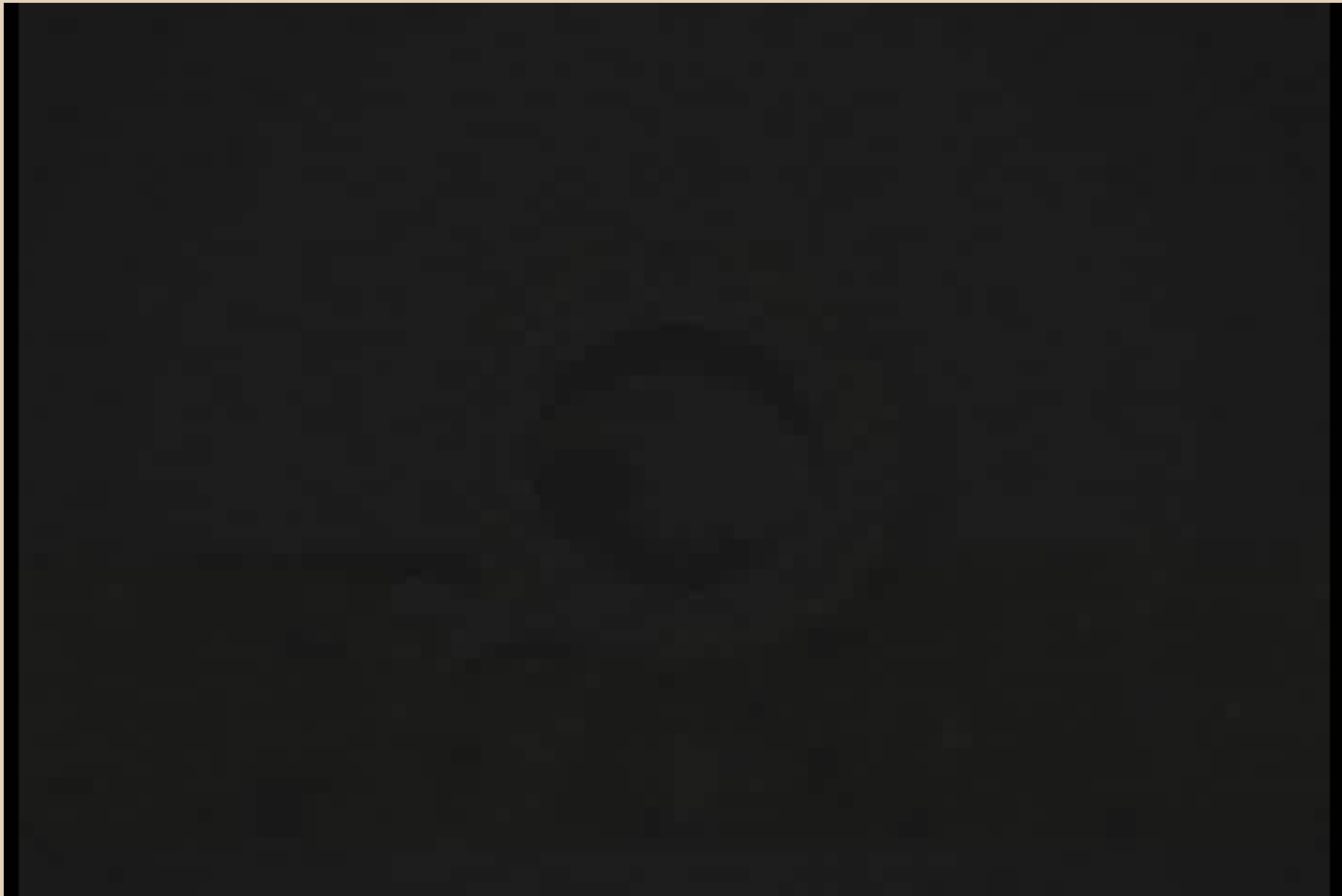
Combustible Dust Case Studies

Year	Facility	State	Dust	Killed	Injured	Estimated KST
1999	Iron Casting Foundry	MA	Phenolic Resin	3	9	129
1999	Electrical Generation	MI	Coal Dust	6	14	129
2002	Rubber Recycling	MS	Scrap Tire Grindings	5	6	139
2003	Rubber Drug Products	NC	Polyethylene	6	38	134
2003	Fiberglass Insulation	KY	Phenolic Resin	7	37	129
2008	Sugar Refinery	GA	Sugar	14	36	



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Imperial Sugar Incident



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Ford River Rouge (MI)



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Mitigation Strategies

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Mitigation: Communication is Key

Workers are always the first line of defense in preventing and mitigating fires and explosions.

“If the people closest to the source of the hazard are trained to recognize and prevent hazards associated with combustible dust in the plant, they can be instrumental in recognizing unsafe conditions, taking preventative action, and/or alerting management.” (OSHA, 2005).

Perhaps the most important component of hazard mitigation is raising employee awareness.



FR Clothing: Additional Protection

- No mitigation strategy will provide 100% protection against a combustible dust explosion for an at-risk firm.
- Choosing flame resistant clothing is an effective method to protect at-risk employees if primary mitigation strategies are economically or practically ineffective—and even if primary mitigation strategies *are* effective and employers want to prevent or minimize worker injury.



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FR Clothing Reduces Injury

- Where any flash fire hazard exists, using flame resistant clothing is a common-sense method to significantly reduce the chance of worker injury in the event of an explosion.
- On top of preventing the added burn injury inherent in the melting and dripping of non-flame resistant fabrics, the cost of flame resistant clothing is minimal compared to the devastation of a burn injury on a worker personally and economically.



FR Clothing: Voluntary Protection

- Though flame resistant clothing is not yet required for workers exposed to flash fire hazards, its procurement may be the last and most important step a company can take to insure the lives of workers.
- Many companies exposed to flash fire have already taken this preventative measure to avert worker injury, especially in the refinery industry.
- OSHA may require FR clothing in its combustible dust ruling.



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FR Industry Comparison

	Electric Utility	Refinery	Combustible Dust
Hazard	Arc Flash	Flash Fire	Flash Fire
Relative Accuracy of Hazard Analysis	High	Low	Low
OSHA Regulated	Yes	Maybe* <small>(New interp of OSHA 1910.132 may require FR as of March 2010)</small>	No
Use of PPE	High	High	Low
Mitigation Strategies	Simple	Complex	Complex



The Statistics: FR Works!

- The most serious injuries typically occur AFTER the flash fire, from non-FR fabric burning against the skin.
- Non-FR clothing burns and melts against the skin, increasing the risk of injury.
- Flame resistant clothing self-extinguishes once the source of heat is removed.
- Until there is a unified, enforceable standard regarding this hazard, voluntary compliance with the current recommendations is necessary to ensure worker safety.



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Flash Fire Incident Video

Fabric B

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FR Clothing Requirements

- All flame resistant clothing must be tested for safety and durability.
- NFPA 2112 is the best FR Clothing standard to address flash fire hazards such as combustible dust.
- NFPA 2112 says that flame resistant clothing must protect the wearer by, “not contributing to the burn injury of the wearer, providing a degree of protection to the wearer, and reducing the severity of burn injuries resulting from accidental exposure to hydrocarbon flash fires.”



Tests for FR in NFPA 2112

- **The Vertical Flame Test** determines whether a fabric will continue to burn after the source of ignition is removed.
- **The Three-Second Manikin Test** is the test method for evaluating a garment's flame resistance using an instrumented manikin. A garment is exposed to a heat flux of 2.0cal/cm².sec for three seconds. If the garment displays less than 50% total body burn, the fabric achieves a passing performance.
- The **Thermal Protective Performance** test (TPP). The 2007 edition of NFPA 2112 requires the Thermal Protective Performance test to be performed both with the fabric against the sensor and with a 1/4" spacer.



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Arc Flash Parallel: Proven Protection

- In the 1970s, before OSHA required utility workers to wear flame resistant clothing, an average of 9.5 burn accidents and 14.7 burn injuries per 100 workers resulted in devastating personal and economic costs to utilities.
- After OSHA implemented 1910.269, the Standard for electric generation, transmission, and distribution in the 1990s, worker burn injury rates in the 2000s decreased to 4 accidents and 6.2 injuries per 100 workers.



What Next? OSHA is Acting!

- OSHA will most likely consult current NFPA standards in its future combustible dust regulation.
- Hefty fines will continue to be delivered for various violations of existing standards, especially the “General Duty Clause.”
- OSHA may require FR clothing as part of its regulation.
- Voluntary adaption of known mitigation strategies will result in avoiding fines, maintaining productive working conditions, and keeping workers safe until the ruling is finalized.



Mitigation Strategies: Summary

- **Company-wide hazard communication and training is key.**
- Proper housekeeping, such as using a dust vacuum to collect dust
- Proper building engineering (i.e. ensuring that dust cannot accumulate in unmonitored areas)
- Proper ventilation systems
- Removal or careful monitoring of potential ignition sources
- Use of personal protective equipment, such as FR clothing, as a last line of defense



Last Line of Defense

- Flame resistant clothing is a secondary protective strategy providing protection from momentary burns and flames.
- FR has been proven a **cost-effective** and **successful** measure for employers to take in protecting their employees from thermal hazards in other industries.
- Even companies that implement all known mitigation strategies will find that cost-effective flame resistant clothing will offer peace of mind in the event that an explosion does occur.



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Questions?

**Thank you for the opportunity to
meet with you today!**

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