Combustible Dust Hazards:

Awareness & Safeguarding

Forest Industry Task Force on Mill Safety

May 2012

FITF Forest Industry Task Force

Disclaimer

The contents of this presentation represent an amalgamation of current industry understanding of best practices for controlling combustible dust in forest products manufacturing.

This presentation is not a complete listing of all possible measures that can or should be undertaken to protect against a combustible dust incident. Additional information and resources are available from WorkSafe BC on their website at www.worksafebc.com.

This presentation is not intended to constitute a statement or opinion of an expert and is provided solely for your information and consideration and is subject to change or alteration at any time.

Forest Industry Task Force

- Collaboration of major BC forest products manufacturers



- Resolved to collaborate on research and best practices to identify and mitigate dust hazards
- Committed to reach out to other BC forest product manufacturers to share information. This presentation is a first steip.

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Task Force Composition

- Working group is the existing Manufacturing Advisory Group (MAG)
- Aided by a Project Manager and external experts and stakeholders
- Reporting to a CEO Action Committee comprised of CEOs of Canfor, West Fraser, Tolko, Western Forest Products and Conifex and the USW Wood Council Chair

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Purpose of this Presentation

- Increase understanding and awareness of combustible dust hazards
- Describe how to recognize and assess combustible dust hazards
- Review control measures to reduce exposure to a combustible dust explosion

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Overview

- How does a dust explosion occur?
- How can we recognize and assess the hazards?
- What controls can we put in place?

What is a dust explosion?

- A dust explosion occurs when a fine, combustible dust is suspended in air and ignited
- This causes a very rapid burning with a release of gaseous products and subsequent pressure rise that results in an explosion

Fire Triangle

Three Elements are required for a fire:

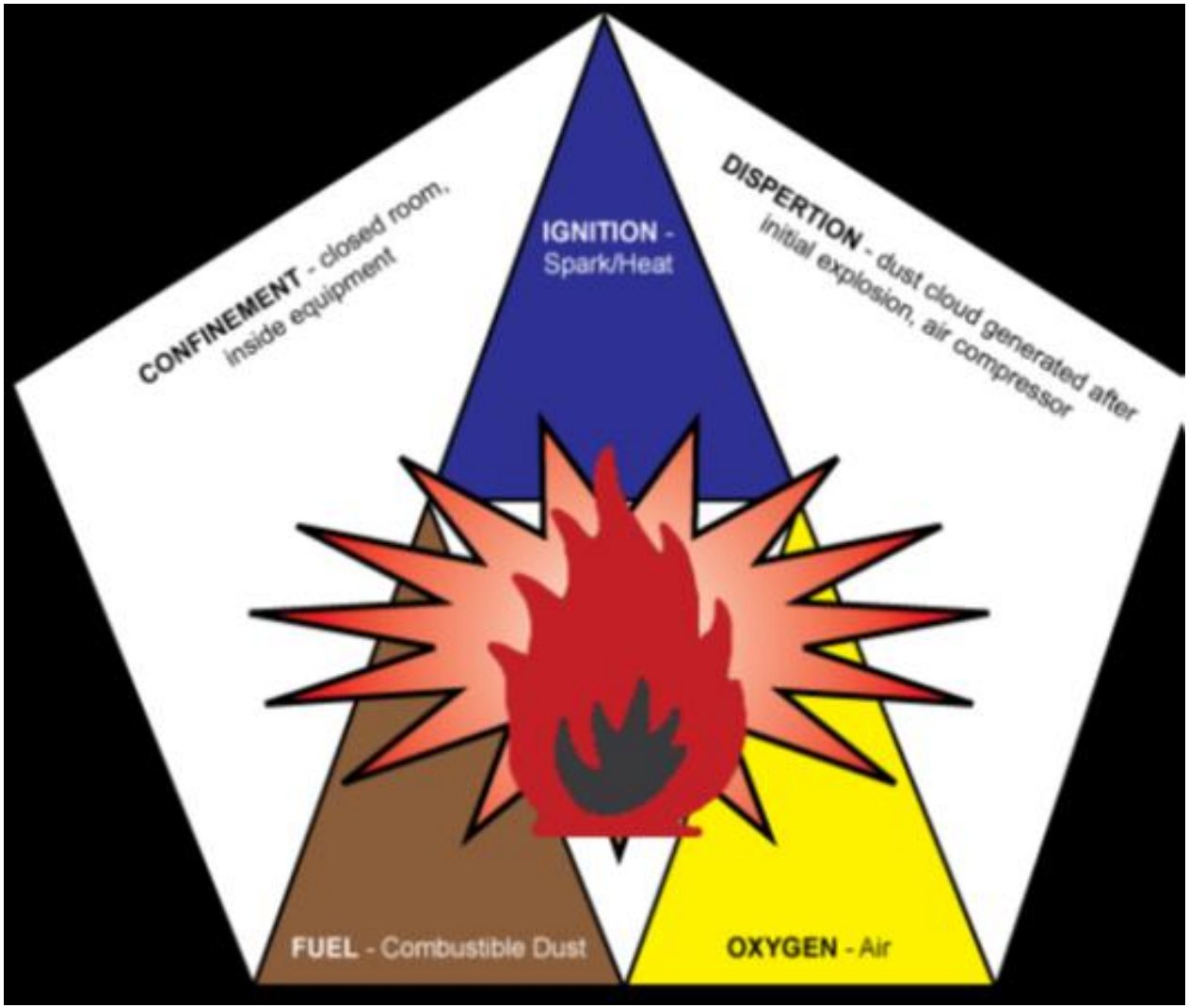
1. Fuel
2. Ignition Source
3. Oxygen

Combustible Dust Explosion

Two additional elements are needed to create a dust explosion:

4. Dispersion
5. Confinement

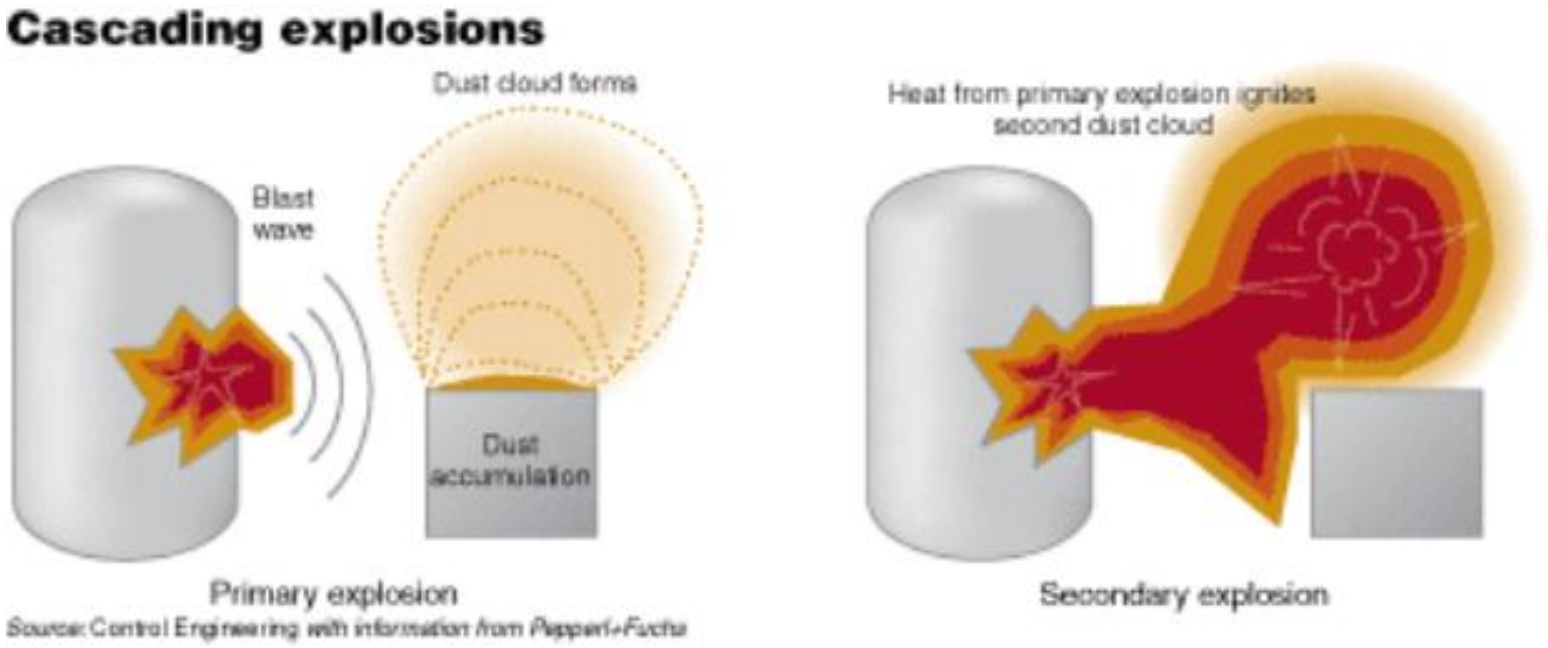
Explosion Pentagon



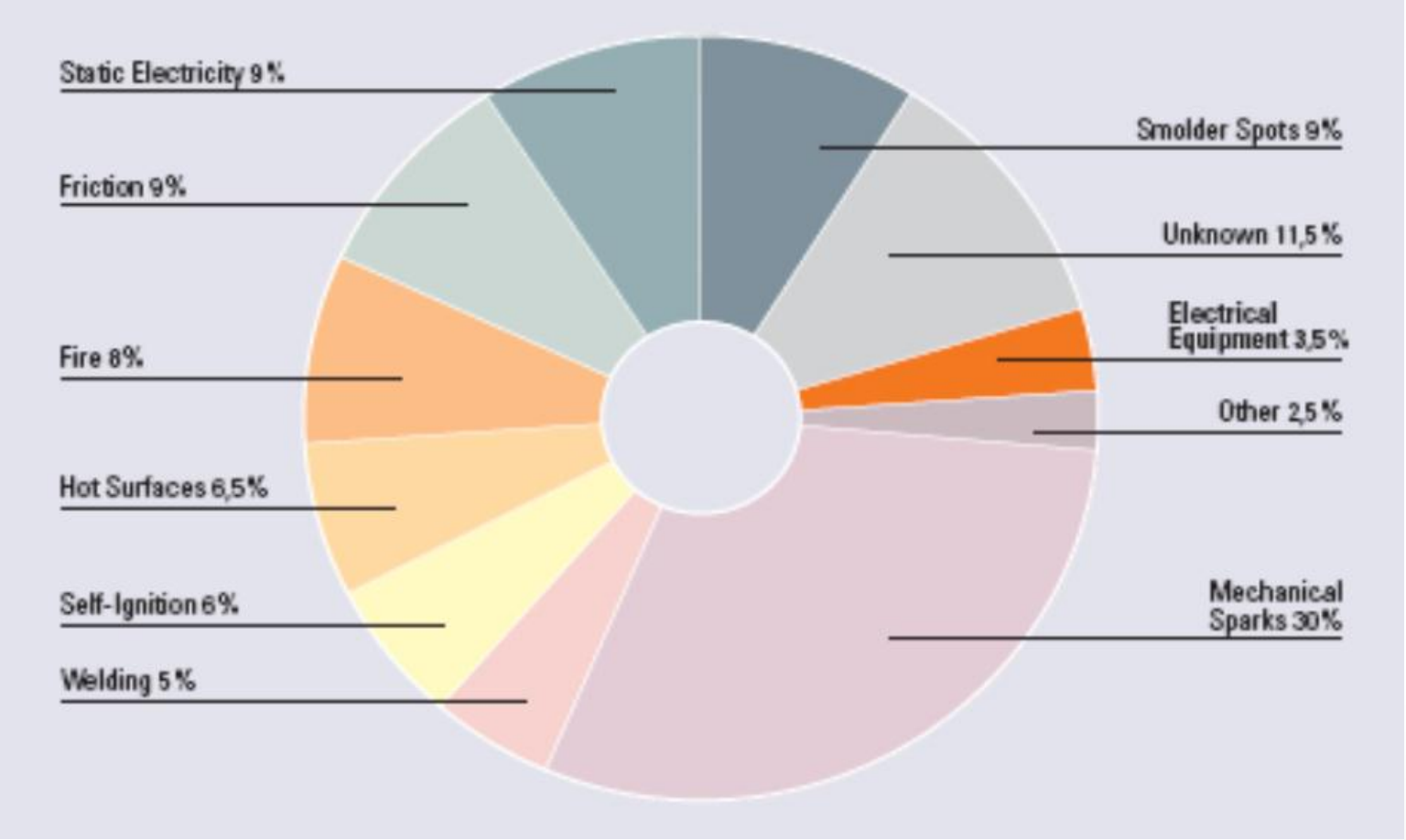
Primary and Secondary Explosions

- A primary explosion usually takes place in a confined atmosphere such as a cyclone
- The primary explosion disturbs fine dust that may have accumulated in areas such as rafters and other areas with minimal air flow
- Once airborne, this dust can support a larger explosion known as a secondary explosion

Cascading Explosions



Ignition Sources



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When is Dust Explosive?

- Dust must be:
  - combustible
  - dry - less than 25% moisture
  - fine enough to be airborne - 500 microns or smaller
  - suspended in the air in an explosive concentration - 40 grams per m^3 or greater
  - Contained or enclosed in confined area
- Adding an ignition source and sufficient oxygen could result in an explosion

Recognizing Dust Hazards

- Employees should be trained in and participate in hazard recognition.
- Employees and supervisors should identify dust and explosion hazards through job hazard and risk assessment

Hazard Assessment

- Conduct regular hazard and risk assessments to identify dust and explosion hazards
- Common areas to consider include:
  - Primary breakdown operations (saws)
  - Debarking operations
  - Canters/Edgers
  - Trim saws
  - Planers
  - Chipper enclosures
  - Chip screening areas

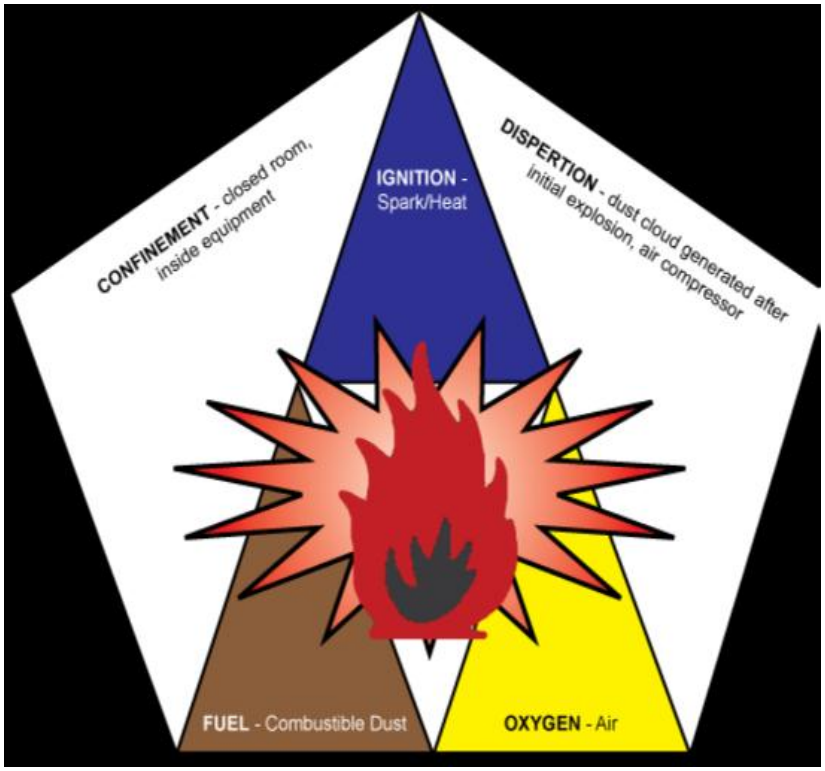
Hazard Assessment cont.

- Also pay particular attention to less obvious accumulation area's such as:
  - collection systems and other hidden or concealed areas during the assessment
  - where conveying systems change direction or at transfer points
  - on horizontal and vertical surfaces
  - conduit, pipe racks, cable trays, rafters, above suspended ceilings

Hazards Assessment cont.

- Locations, including hidden spaces, need to be also considered under upset conditions
- Conduct internal and external audits to monitor potential dust and explosion hazards and the effectiveness of controls

Controlling the Hazard



- Minimize fuel and control for potential ignition sources and mechanisms of dispersion

Dust Control

- Passive containment
- Engineering controls
- Housekeeping

Passive Containment

- Identify areas that produce fugitive dust and look for ways to enclose/contain it in that location

Engineering Controls

- **Collection systems** that remove dust from the source are the first best solution where practical
- **Suppression systems**, such as misters can be effective but may pose challenges in the colder months
- **Ventilation systems**, such as wall & ceiling fans can provide improved air circulation and assist in controlling fugitive dust
- All dust control systems must be inspected, cleaned and maintained in good working order

Housekeeping

- Clean up should:
  - be scheduled in relation to the extent that dust could accumulate
  - provide coverage for all workspaces in the facility and include walls, beams, etc.
  - be designed to perform housekeeping safely and effectively including necessary PPE and proper safe work procedures. Methods to consider include vacuuming, water wash, brooms and compressed air
  - Include regular inspections, noting any deficiencies and tracking corrective actions

Ignition Control

- Common ignition sources to control would include:
  - Hot Work
  - Preventative Maintenance
  - Electrical Equipment
  - Static Electricity
  - Hot equipment and surfaces
  - Smoking and Open Flames

Hot Work

- An effective Hot Work Program is essential and should include such elements as:
  - relocating the hot work to a safe location, if possible
  - relocating or covering combustible material in the vicinity
  - providing fire extinguishers and provisions for establishing a fire watch

Preventative Maintenance

- Perform regular inspections, lubrication and maintenance of potential ignition sources such as:
  - critical bearings
  - belts, buckets, pulleys
  - milling machinery
- Implement visual vibration detection systems, such as heat sensitive tape or other heat detection methods to highlight areas of excess heat

Mechanical Sparks and Friction

- Identify sources of friction/sparks, such as damaged guarding, slipping belts, etc.
- Implement controls to eliminate the hazard
- Conduct regular inspections to identify hazards and preventative maintenance programs to control them

Electrical Equipment

- Ensure regular maintenance and clean-up of all electrical enclosures, such as electric motor control or power distribution centres
- Verify that electrical cabinet doors and access covers for energized equipment are closed and secured
- Ensure that ventilation systems for electrical enclosures are clean and working properly
- Ensure electrical equipment is appropriately rated and installed for all applications

Static Electricity

- This can be a potential hazard associated with vacuuming, amongst other sources such as saw arbours
- Ensure equipment is appropriated rated for the job and is property bonded to the ground

Hot Equipment and Surfaces

- Shut down equipment and allow hot surfaces to cool before exposing to dust debris
- Common heat sources include:
  - pipes, compressors, motors, portable hand tools, lighting, radiant heaters

Smoking and Open Flames

- Implement/review site smoking policies and procedures and ensure they are being followed
- Be aware of and control all potential sources of open flames and sparks

Dispersion Control

- Identify mechanisms of dispersion including discharge from saws, equipment vibration, compressed air, etc.
- Consider the characteristics of the dispersed dust, such as the moisture content, particle size, density of dust cloud etc.
- Consider opportunities to reduce the level of dispersion
- Be mindful of any new hazards that might be associated with changes (unintended consequences)

Emergency Procedures

- Emergency procedures established as per WSBC Regulation 4.14
- Exit routes designed and marked
- At least one emergency drill completed and documented per year

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Information Sources

- Kirkwood Community College. Instructors Manual: Combustible Dust – Safety and Injury Prevention. Available online at http://www.scribd.com/doc/66136370/CD-Instructor-Manual

- Wood Pellet Association of Canada. Testing of Explosibility and Flammability of Airborne Dust from Wood Pellets. November 2008.

- WorkSafeBC – www.worksafebc.com

- BC Safety Authority – www.safetyauthority.ca