Hazard mitigation in fuel system design

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A little about Koda Energy

• Koda Energy is a combined heat and power facility that runs on biomass fuel.
• Koda produces ~500 megawatt hours/ day of electricity.
• Koda produces ~ 2400 mmbtu/day of thermal energy.
• Between 8,000 and 9,000 semi-trailers of biomass fuel moves through the facility every year.
• Our fuel consists of wood chips, sawdust, elevator dust and chaff, and grain hull material.
• Our electrical output powers Koda and Rahr malting, the excess is sold to Xcel Energy.
• The thermal energy we produce is sold one of Rahr’s malt production facilities ( the largest single site malting facility in the world ).
Koda as commissioned in May of 2009
The fire triangle

Oxygen

Ignition source

Fire

Fuel source
The explosion pentagon

1. Fuel to burn — combustible wood dust
2. Dispersion — high concentration of fine airborne combustible wood dust
3. Oxygen to sustain the fire — air
4. Ignition — source of heat (e.g., spark, hot surfaces including overheated bearings and other moving parts, static electricity)
5. Confinement — within an enclosure or structure
The afternoon of April 25th 2013
The location of the initial deflagration/explosion
Reduced dust creation by limiting drop height
Point and area dust collection

Velocities 2500 - 4500 fpm
Point collection and removal of dust
Reducing drop heights, to limit particle segregation and suspension.
Breaking the confinement
Pressure release panels
To break confinement
Mechanical friction
Adequate grounding to Prevent static discharge
Class 2 division 1 or Class 2 division 2
Isolating an event Mechanically
Chemical isolation
Sensing and control
System isolations
Sensing and extinguishment
Thermal imaging
Field verification
All facilities are different, and need their own strategies, suited to their purpose and function

- Maintain written documentation of the equipment design
- Management of change program
- Perform a process hazard analysis, update when changes are made
- Implement a written ignition control program
- Employee training
- Written operating and maintenance procedures
- Inspection, testing, and maintenance program
- Written housekeeping and combustible dust training program.
- Use NFPA 61, 68, 69, 664, and 654 for additional guidance