



Considerations for Processing Materials with Dust Explosion Hazards in a Granulation Process

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About Stellar Manufacturing

- Stellar Manufacturing Co. is a contract manufacturing company that specializes in processing dry chemicals.
- Stellar has over 25 years of experience in contract manufacturing.
- Stellar offers integrated manufacturing processes to make your materials marketable - from powder to product.

From Powder to Product

MATERIAL PROCESSING

COMPACTION
GRANULATION



BLENDED
& MIXING



COMPACTION
BRIQUETTING



TABLETING



PACKAGING & SUPPLY MANAGEMENT

FILLING



INDUSTRIAL
PACKAGING



CONSUMER
PACKAGING



WAREHOUSING

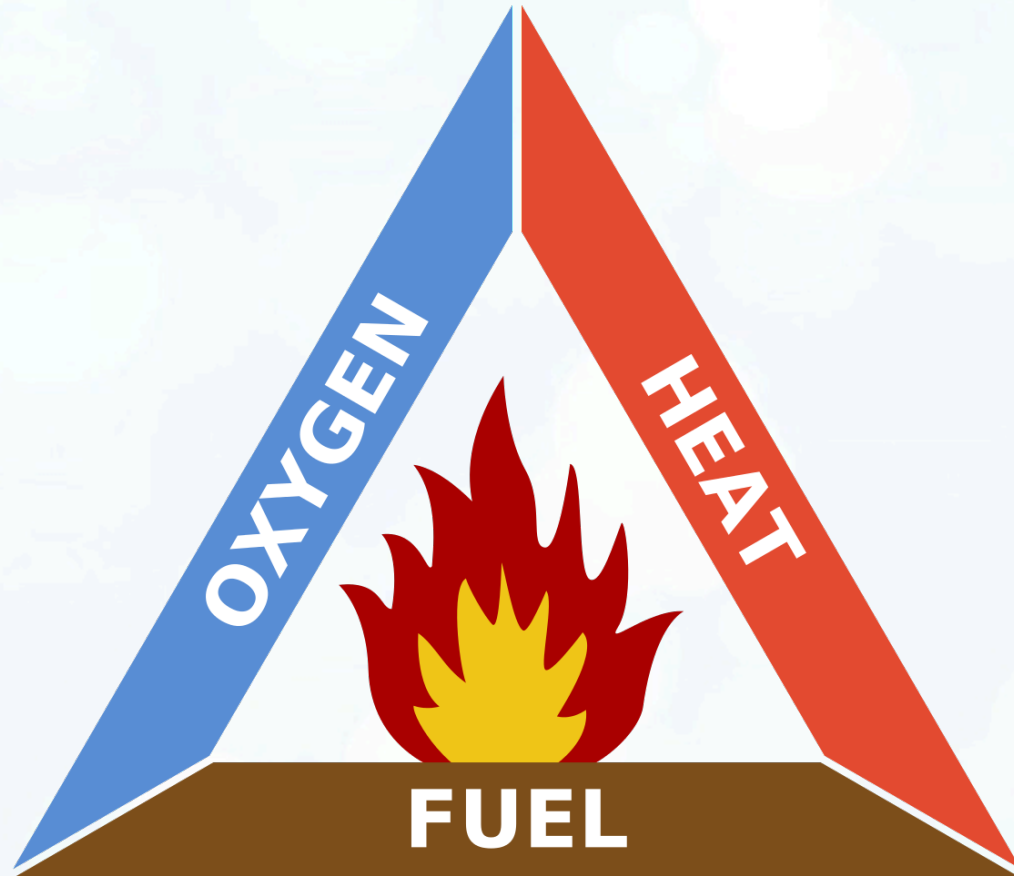


Don't Ignore Dust Explosion Hazards!

- *Imperial Sugar Dust Fire and Explosion:*
 - Georgia (14 killed, dozens injured) February 2008



What are the 3 Requirements for a Fire to Occur?



What are 2 Additional Requirements for Dust Explosion to Occur?



What is Combustible Dust?

- Dry powder that presents a fire or explosion hazard when suspended in air
- Either organic or metal dusts that are finely ground into very small particles

Identify If Material Presents Hazard

- SDS
 - Hazards
 - Storage and Handling
 - Physical Properties
- Material Testing Information
 - Severity of Explosion
 - Ease of Ignition
 - Concentrations



Kst Value

- The dust deflagration index, measures the relative explosion severity compared to other dusts. The larger the value for Kst, the more severe the explosion.

Examples of K_{st} Values for Different Types of Dusts

Dust explosion class*	K_{st} (bar.m/s)*	Characteristic*	Typical material**
St 0	0	No explosion	Silica
St 1	>0 and ≤ 200	Weak explosion	Powdered milk, charcoal, sulfur, sugar and zinc
St 2	>200 and ≤ 300	Strong explosion	Cellulose, wood flour, and poly methyl acrylate
St 3	>300	Very strong explosion	Anthraquinone, aluminum, and magnesium

The actual class is sample specific and will depend on varying characteristics of the material such as particle size or moisture.

* OSHA CPL 03-00-008 - *Combustible Dust National Emphasis Program*.

** NFPA 68, *Standard on Explosion Prevention by Deflagration Venting*.

Minimum Ignition Energy (MIE)

- The minimum ignition energy, which predicts the ease and likelihood of ignition of a dispersed dust cloud.
- Materials that ignite above 0.50 joules are not considered sensitive to ignition by electrostatic discharge.
 - Min. Ignition Temp. of a Cloud < 400° C
 - Min. Ignition Temp. of a Layer 5mm < 300° C
 - Min. Ignition Energy of a Cloud < 15 mJ

Minimum Explosible Concentration (MEC)

- The minimum explosible concentration, which measures the minimum amount of dust dispersed in air required to spread an explosion.



Factors Impacting A Powder's Explosibility

- Moisture content
 - Below 5% is considered “dry”
 - Surface moisture of particle can impact electrical conductivity
- Particle Size
 - Ignition sensitivity and explosibility increases as particle size decreases
- Particle Shape
- Operating Temperature
- Operating Pressure
- Concentration



Explosion Protection Strategies

- Detection and Removal of Oxygen
 - Inert Gas (CO₂, Nitrogen)
- Containment of Explosion
 - Control Propagation
- Venting
 - Explosion Door

Eliminate Sources of Ignition

- Static Electricity
 - Properly grounded equipment and personal
- Heat from bearing or motor
 - Temperature Sensors, Alignment Sensors
- Tramp Metal Spark
 - Magnets
- Electrical Spark
 - Properly sealed wiring, special plugs
- Forklift
 - Appropriately rated forklift

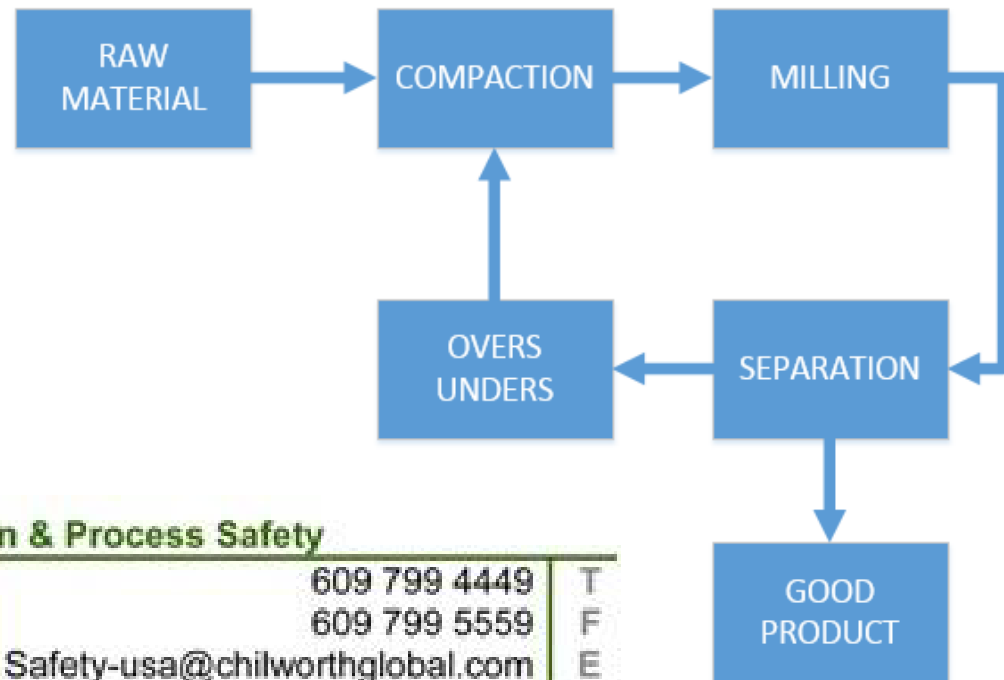
Eliminate Sources of Fuel & Oxygen

- Buildup of Dust on Equipment
- Purging Equipment with an Inert Gas



Case Study

- Compaction and Granulation System



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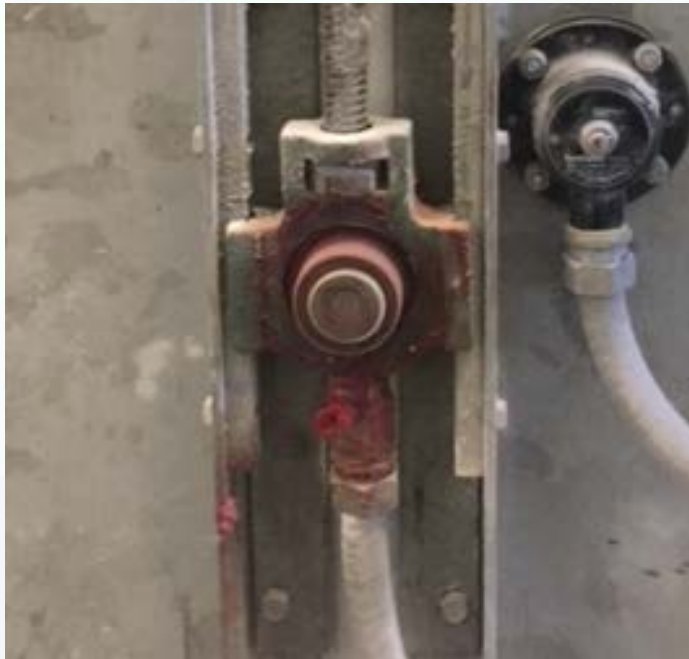
OSHA & NFPA Standards May Apply

Equipment Specific

- Dust Collector
 - Explosion Venting, Ductwork Isolation Valve, and Grounding



- Bucket Elevators
 - Belt Alignment, Speed, and Bearing Temperature Sensors, Explosion Venting



- Milling
 - Rare Earth Magnets



Overall Process

- Electrical
 - Motors, Electrical Wiring, and Sensors (Class 2 Div2)
- Personnel
 - Training, Grounding, Forklift, Vacuums
- Structure/Building/Walls
 - Fire Rating, Dust Accumulations
- Procedures
 - MOC

Compaction System





Summary





Thank you!
Questions?



STELLAR
MANUFACTURING CO.
Making Materials Marketable