COMBUSTIBLE DUST

How to Avoid a Dust Explosion

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Types of Dust
dust
Aluminum
powder
metal
Dust
Metal
Wood
dusts
Powder
Powders
Carbon
Organic
Laser
Coal
Sugar
Grain
Weld
welding
Welding
plasma
Paper
Machining
Related
fumes
aluminum
Silica
Corn
Flour
Steel
clients
Various
Material
wood
houses
Titanium
Acrylic
Plastic
Combustible
Aluminium
collectors
Combustable
different
metals
inorganic
manufacturing
combustible
paint
laser
Blasting
General
cutting
Food
Activated
Construction
composite
Cutting
blasting
powders
chromium
Wheat
Woods
Welded
Exposive
Metallic
glass
firm
boards
calcium
Cardboard
Custom
machine
shells
HDPE
Toner
Lime
shot
Converting
Product
Many
Grinding
Phenolic
Glass
peanuts
Kaolin
Shavings
polishing
Gluten
serving
carbon
pesticide
variety
chemical
PMMA
house
WOOD
Hexchrome
Composite
50-lb
polymer
drying
Personnel
EVERYTHING
titanium
ingredients
operations
Steel/Aluminum
methylcellulose
field
Metallics
Pharmaceutical
starch
production
shredding
Grains
subject
cellulose
wood-shingles-plastic
epoxy
general
Media
wheat
packaging
batch
Bag
smoke
Tissue
granule
collectors/bag
Powdercoat
factories
Fugitive
grain
integrator
garnet
specify
dumping
systems
addatives
Variety
clay
Combustable
Alternative
organic
Plastics
facilities
particulate
Salts
various
foam
Oil
stone
processing
zinc
collection
coupe
mdf
bags
solid
body
EPCM
ferrous
physically
Additives
Dusts
plastics
Ventilation
friction
cut
used
mineral
spray
Consultant
Polymer
hexavalent
generated
clean
grindings/filings
coating
based
Fumes
Smoke
Mist
client
finishing
Polymethylmethacrylate
CMC
mostly
electronics
Blast
cocoa
resins
cnc
processes
steel
dry
additives
Ferrous
traditionnel
distributor
Process
sugar
surface
ventilation
corn
will
fine
flour
Fine
material
milk
Consultants
paper
conveying
Paint
Starch
related
created
EVA
mixes
Stainless
Sulfate
Consulting
LEV
blend
Metals
products
pharmaceutical
oxide
brake
Ammonium
Alloy
formulation
multiple
Antimony
E-scrap
Shredding
applicability
fines
demolition
Realizamos
environment
Industrial
market
plastic
additive
Fuels
antioxidant
filler
class
selling
users
instalacionde
silica
bag
weld
Friction
shop
lines
resin
particles
carbonate
standard
Bark
blast
application
non-ferrous
Pharma
Composites
PVC
Resin
Circuit
Output
BioChar
Attending
Fume
Brake
Rubber
drive/motor
pads
might
coat
Custom
Cardboard
calcium
boards
firm
glass
Exposive
bead
Woods
Wheat
chromium
Rubber
Brake
powders
blasting
Construction
composite
Cutting
Output
Aluminum
dust
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Why are we here today?

- Learn best practices to control explosive dusts in manufacturing environments
- Discuss critical components of a Dust Hazard Analysis
- Change Management – ECO system development

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Dust Generation in a Manufacturing Environment

Dust is an unrelenting hazard in manufacturing environments

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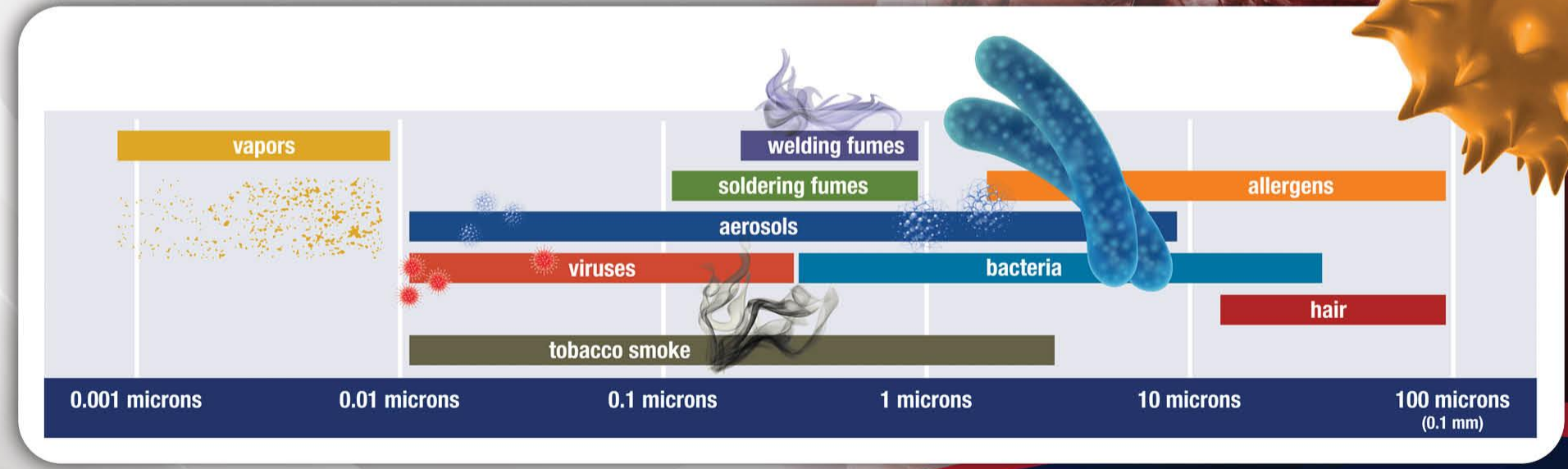
Is Your Dust Explosive?
Does Process & Particle Size Matter?

Manufacturing Processes that generate dust:

- ✓ Welding
- ✓ Grinding
- ✓ Milling
- ✓ etc.
- ✓ Cutting
- ✓ Forming
- ✓ Sifting



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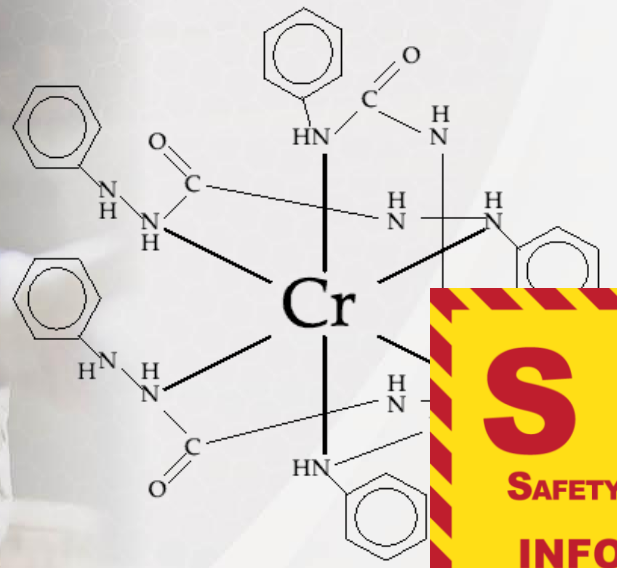
Why is it Important?

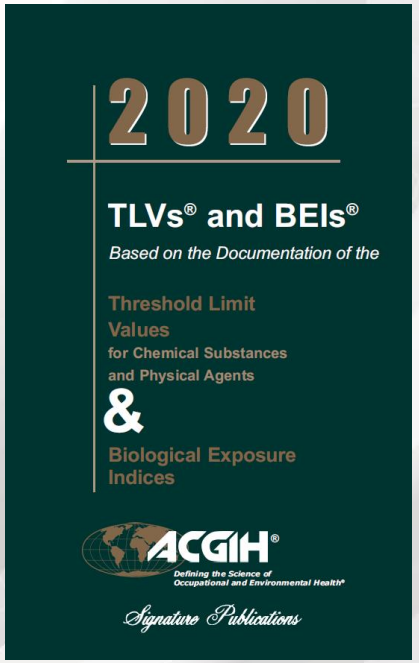
Employee Health & Safety



SDS

Safety Data Sheets

Information For Employees



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Employee Health & Safety

Breathing in toxic fume and particulate

- Cr(VI) (Hexavalent Chromium)
- Mn (Manganese)
- Asbestos (Serpentine & Amphibole)
- Crystalline Silica
- Refractory Ceramic Fibers
- Glass Wool Fibers

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Other reasons to manage your dust problem

- Creates increased maintenance
- Negatively affects your equipment efficiency
- Impairs vision in the plant
- Dirty work environments can affect:
  - Employee retention
  - Employee happiness
- Risk of industrial dust explosions

All of these cost money!

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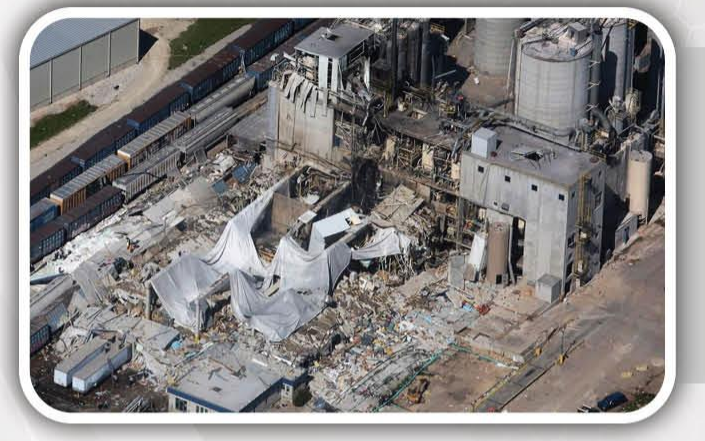
Combustible Dust Explosions



- Wisconsin, 2017.
- Grain Dust Explosion.
- 5 killed, 12 injured.

- USA, 2018.
- 194 Dust Explosions and Fires
- +25% from 2017

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Combustible Dust Explosions

- Georgia, 2008.
- Sugar Dust Explosions.
- 14 killed, 38 injured.

- WV, 2010.
- Metal Dust Explosion.
- 3 killed, 1 injured.

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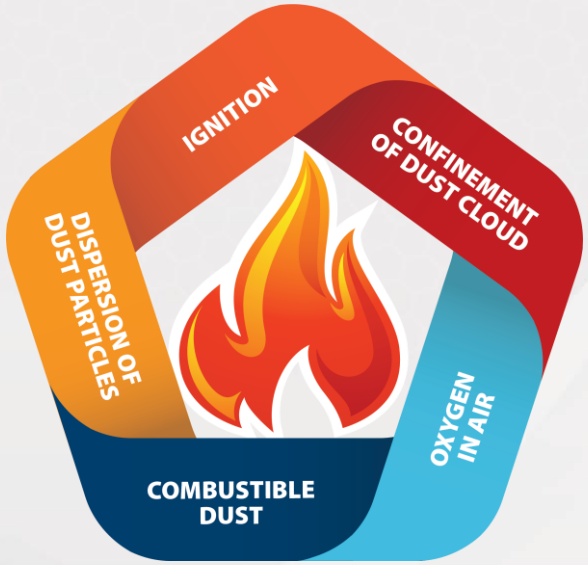
How does a dust explosion happen?

- High Concentration of Dust
- Oxygen
- Enclosed Space
- Ignition Source
  - Static
  - Friction
  - External Source



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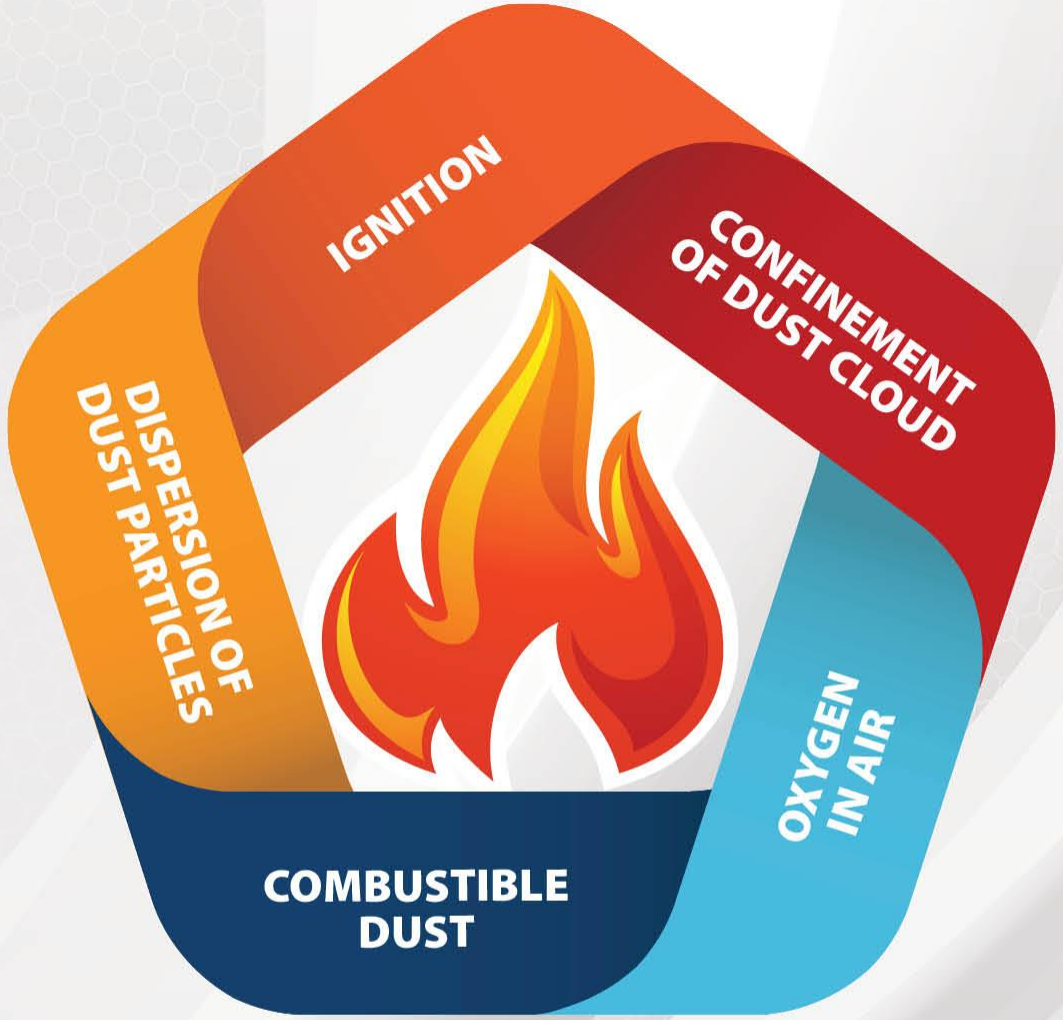
Explosion

Pentagon



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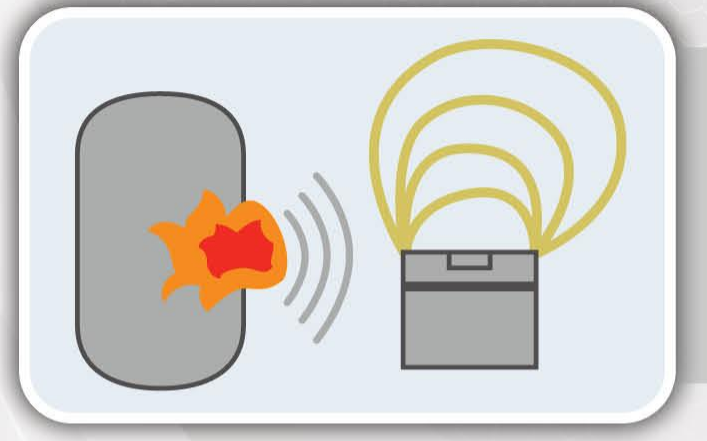
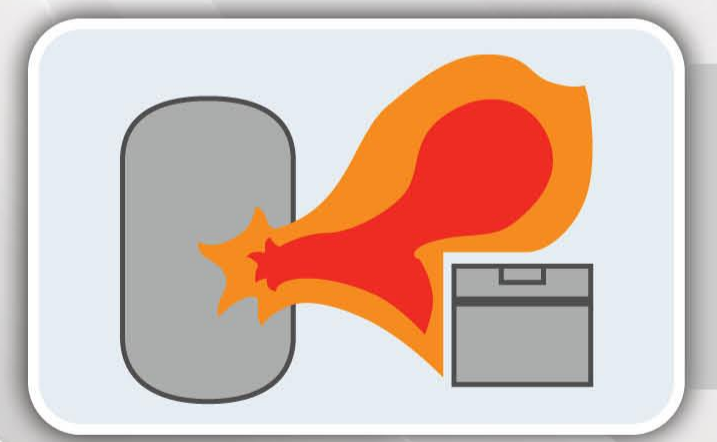
The Two Explosions



Primary Explosion

- The initial explosion after ignition
- Dislodges surrounding dust particles



Secondary Explosion

- Occurs when dust goes airborne and ignites
- This explosion is often more destructive

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How to Control Dust in a Facility

- Targeted PM/Cleaning Schedules
- Dust Control Systems w/Proper Protection
  - Filter Collectors
  - Wet Collectors
  - Dry Centrifugal Collectors
  - Electrostatic Precipitators
- Guarding/upgraded equipment
- Process Controls

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Dust control Systems and Safeguards

- *Prevent over-pressurization of the dust collector*
  - *Suppression*
  - *Venting*

- *Prevent Propagation of an explosion with isolation*
  - *Chemical*
  - *Mechanical*

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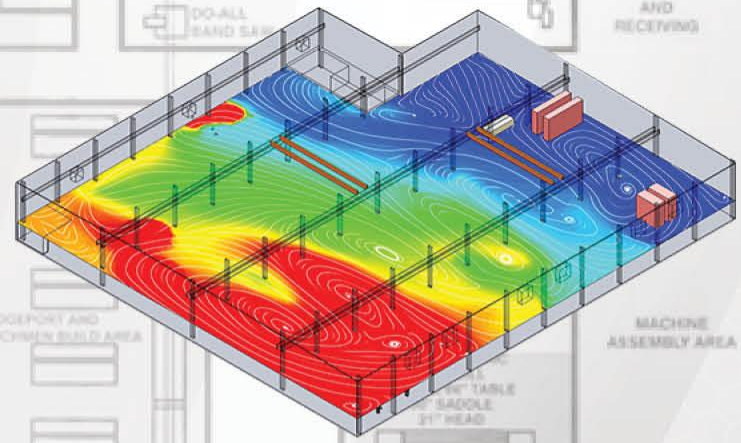
Have you done enough?

Now that you have started to think of all the ways you can control dust in your facility – how do you know if you have done enough?



Dust Hazard Analysis (DHA)

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What is a Dust Hazard Analysis? (DHA)

- A DHA is a systematic review of the process to:
  - Identify where fires and explosions can occur
  - Identify the potential causes and consequences
  - Determine if existing and proposed safeguards are sufficient
- Who can perform a DHA
  - NFPA 652 7.2.2 – "The DHA will be performed by a qualified person"

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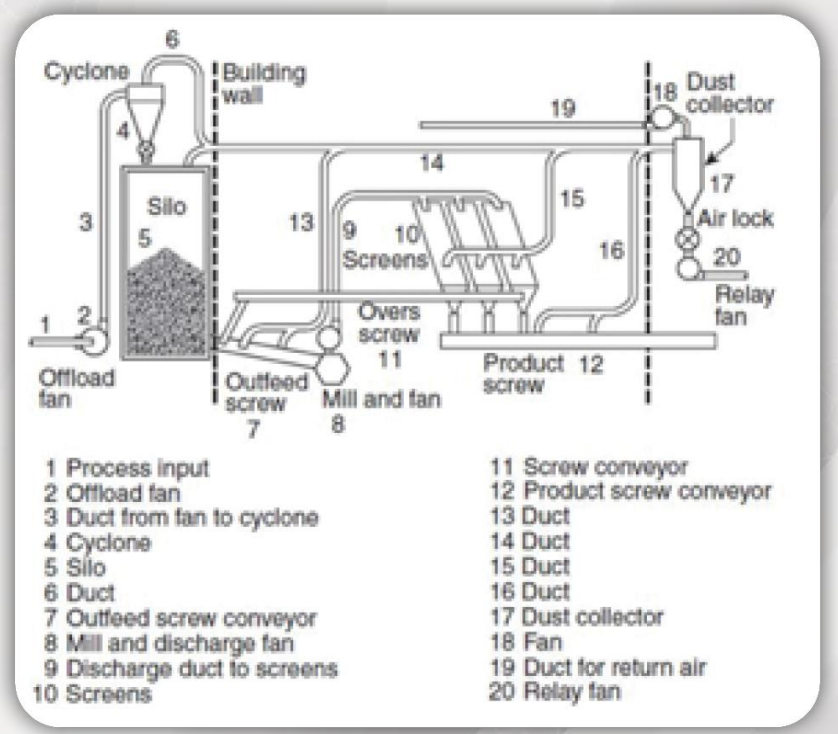
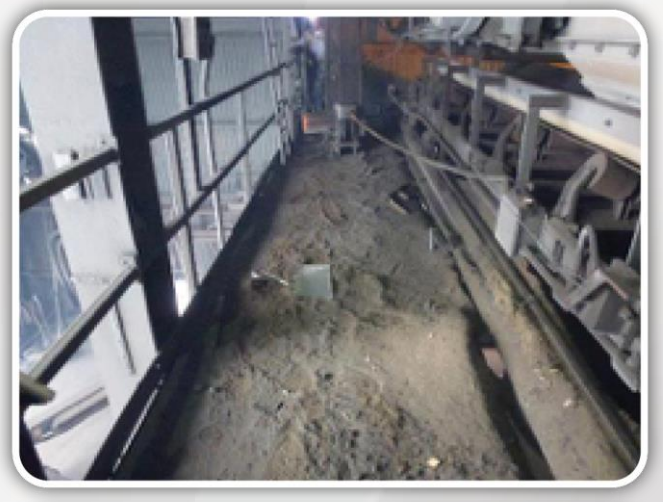
What Equipment Should be Included in a DHA?

- Identify all process equipment and areas where dust is handled
- Consider how fires and deflagrations can move between pieces
- Consider normal, abnormal and upset conditions
- Itemize all pieces of equipment, paying special attention to:
  - Bins, tanks and silos
  - Hammermills, pulverizers and grinders
  - Dryers and ovens
  - Dust Collectors
  - Conveyors, screw augers and bucket elevators
  - Sifters, screens and classifiers



What Materials Should be Included in a DHA?

- The first step to the DHA is relatively obvious: identify all potential dusts HANDLED and GENERATED at the facility
- Review SDS for the materials and contact the vendors for any additional data.
- Review textbooks, online databases and NFPA standards. If unknown, conduct laboratory testing.



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Conduct Laboratory Testing [NFPA 652 5.4]

There are a few ways to analyze representative samples. If you are unsure if your dust is combustible, you can perform a "Go/No-Go" screening.
This will tell you if the material is a "Go" (combustible) or a "No-Go" (not combustible).

- ***K_{st} – Deflagration index***
- ***MIE – Minimum Ignition Energy***
- ***MEC – Minimum Explosible Concentration***
- ***P_{max} – Maximum pressure from a concentrated deflagration***
- ***P_{red} – Maximum pressure developed within an enclosure during a vented deflagration***

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Where should samples be taken?

- Prior to sampling, develop a plan
- Two types of materials to consider for testing:
  - Fugitive Dust
  - Process Dust
- Lab work can be expensive, so consider which samples are most representative
- Be safe when collecting samples
- What happens if you do not have dust?

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When should we do a DHA?

Dust collection Process	Up front engineering and specification	Manufacture equipment and filters	Project management and installation	Service work
DHA incorporated in dust solution	System or full plant DHA of combustible dust handling	Specified protection devices included	Ensure protection devises are installed properly	PM on dust collection and protection devices

- ***Deadline for non-food & agricultural facilities: September 7, 2020***
- ***Deadline for food & agricultural facilities: January 1, 2022***
- ***Design Phase & Pre-installation (Desktop DHA)***
- ***After installation/Current Equipment & Processes (On-site/Virtual)***
- ***Revalidation every 5 years [NFPA 652 7.1.4]***

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Examples of Safeguards

Deflagration Venting

Deflagration Suppression

Back-Blast Damper

Spark Detection & Suppression

Abort Gate

Housekeeping!
Training
Preventative Maintenance

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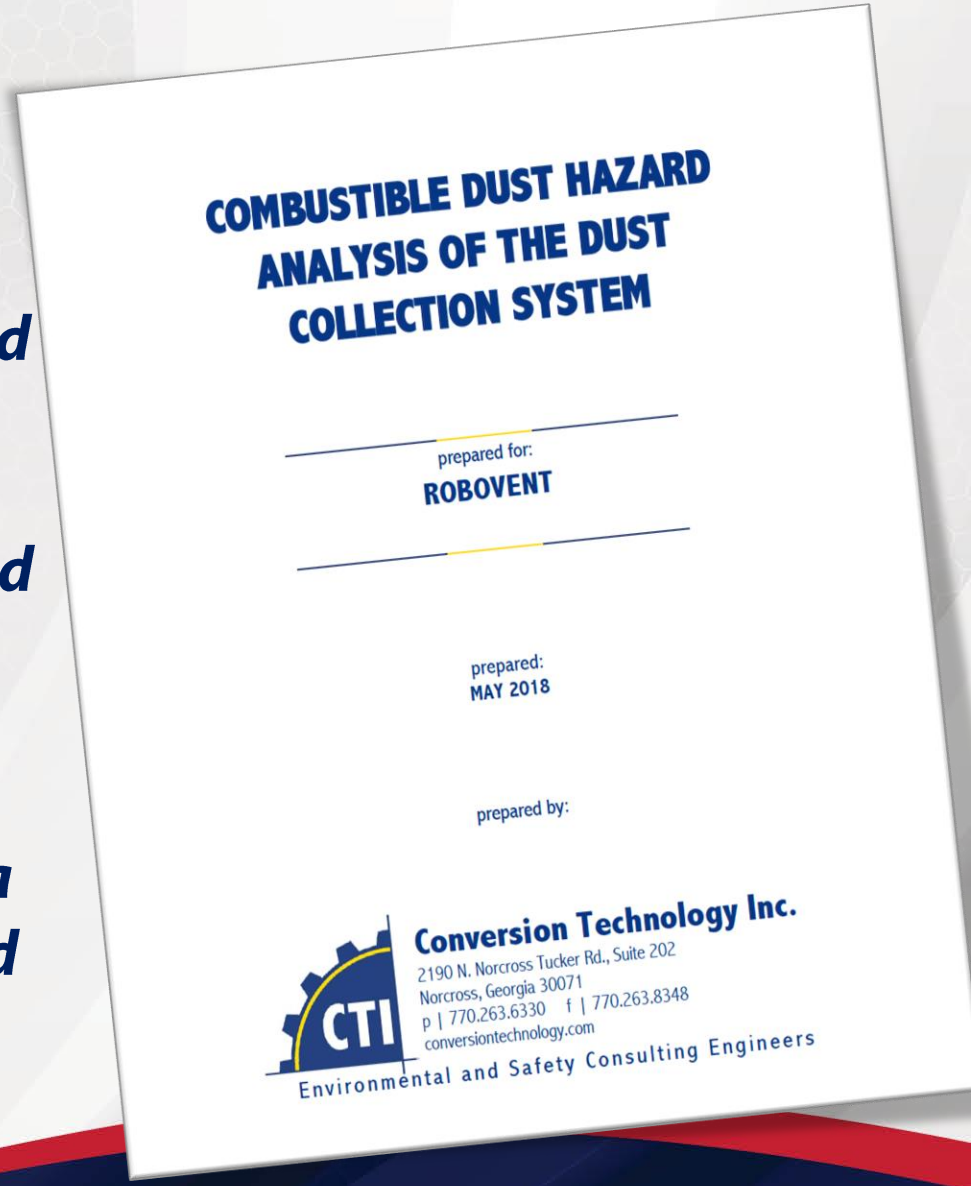
What will the results tell me?

- *The completed risk matrix will identify the areas and equipment that are at unacceptable levels of risk*
- *Recommendations designed to reduce the likelihood and-or severity of fires and explosions should be developed for everything that is unacceptable*
- *The priority of the recommendations are based on a balance of which items present the greatest risk and which recommendations are most feasible*


COMBUSTIBLE DUST HAZARD ANALYSIS OF THE DUST COLLECTION SYSTEM

prepared for:
ROBOVENT

prepared:
MAY 2018

prepared by:

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What comes after a DHA?

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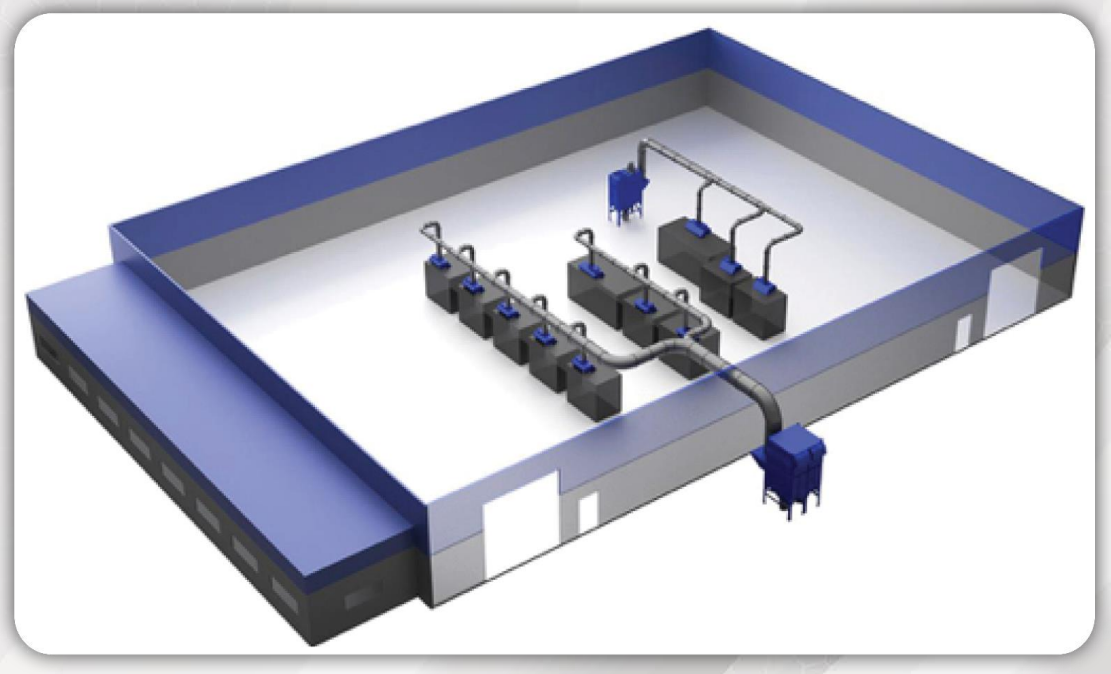
Completing Action Items from DHA/Commissioning of System

- *System Commissioning and Start-Up*
- *Process Validation*

Process for Change Management

Important Steps in a Change Management System:

1. ***Identify the areas affected by the change***
2. ***Analyze impact / risk***
3. ***Establish a plan for implementation***
4. ***Provide recourses for the change***
5. ***Validate and Monitor***



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QUESTIONS?
Please Submit Questions
in the Q&A area at the bottom of
your screen.
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Have Questions or Need Support?

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