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Circular on the Hazards and Controls of Combustible Dusts

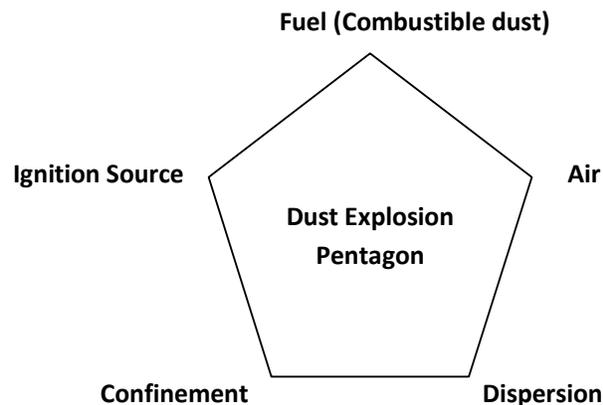
Combustible dusts are fine particles that present an explosion hazard when suspended in air under certain conditions. Examples of combustible dusts are:

Category	Powders or Particles
Organic Matter	Sugars, Corn Starch, Flour, Charcoal, Coal, Peat, Soot, Cellulose Pulp
Chemicals	Adipic Acid, Ascorbic Acid, Sodium Ascorbate, Calcium Acetate, Calcium Stearate, Sodium Stearate, Lead Stearate, Dextrin Lactose, Methyl-cellulose, Paraformaldehyde, Sulphur.
Metals	Aluminium, Bronze, Magnesium, Zinc, Iron Carbonyl.
Plastics	Polymers e.g. Polymethylmethacrylate, Polyacrylamide, Polyacrylonitrile, Polyethylene, Polyvinylchloride, Resins, Melamine.

Dust Explosions

2 A dust explosion is the rapid combustion of fine combustible dust particles suspended in air, often but not always in an enclosed location. A mass of solid combustible materials will burn relatively slowly due to the limited surface area exposed to the air. However, when the same solid is divided into fine powder and dispersed as suspended particles in air in the form of dust cloud, the result will be quite different. In this case, the surface area exposed to the air is much larger, and if ignition occurs, the whole of the cloud may burn very rapidly. This results in a rapid release of heat and gaseous products, causing pressure to rise.

3 Dust explosions can occur when all five elements in the dust explosion pentagon are present as shown below:



Control Measures

4 To prevent dust explosions, workplaces can remove one or more elements from the pentagon and consider control measures in this order:

- (i) Eliminate combustible dusts;
- (ii) Provide controls to minimise the risk;
- (iii) Provide supplementary controls to mitigate the consequences.

5 Many products are handled as fine powders but there are occasions where granular or pasty products can be used with advantage. The risk of an explosion may also be effectively eliminated if the quantity of dust present is sufficiently small.

6 Some control measures for dust explosion risks can include, but are not limited to:

Dust Control

- Well-designed and well-maintained local exhaust ventilation (LEV) systems can capture dusts effectively to prevent unnecessary dispersion of combustible dusts where people are at work. For loading, unloading or conveyance of materials, LEV systems can be implemented at suitable locations, taking care to not to have an extensive ducting network, which can cause burning materials to spread following an explosion within the LEV system.
- Implement suitable housekeeping and maintenance programmes for dust collection system and filters. Vacuuming or wet cleaning methods are preferred over sweeping methods, as sweeping would tend to cause more dispersion of dust particles.

Ignition Control

- Use suitable flame-proof equipment or non-sparking tools in areas handling combustible powders.
- Effective bonding and grounding of powder handling units to prevent the accumulation of electrostatic charges, which can be a source of ignition when inadvertently discharged. Regular continuity testing should be carried out to ensure the effectiveness of bonding and grounding.
- Inert atmospheres within powder handling units to eliminate the possibility of an ignition. For example, nitrogen can be used to reduce/eliminate the presence of oxygen in the atmosphere of the containment. Oxygen analysers can be employed to ensure the effectiveness of the inert gas blanketing.

Explosion Relief and Venting

- Provide explosion relief vents of suitable sizing at the right locations for powder handling units to safely vent the energy in the event of a dust explosion. To protect persons at work, explosion relief vents must be located or positioned away from work areas, walkways etc.
- Install detectors for sparks or glowing materials within equipment such as grinders, LEV ducting. An interlock could be added to extinguish potential ignition sources or stop further conveyance before sparks or glowing materials reach other parts of the workplace.
- Separate areas handling combustible dusts from other parts of the workplace with distance or isolate units with barriers (e.g. chokes, baffles and isolation valves).

Training and Awareness

- Provide training and refresher courses on combustible dust hazards and its controls for persons involved in work with combustible dusts.
- Communicate clearly the combustible dust hazards and its physical properties, safe handling practices and precautions to be taken.

Personal Protective Equipment (PPE)

- Workers working with combustible dusts should be equipped with the necessary PPE. For example, fire retardant clothing, static dissipative safety shoes etc.

7 For more recommendations on how to manage combustible dusts safely, workplaces can refer to:

- (i) UK Health and Safety Executive's Guide on Safe Handling of Combustible Dusts.
- (ii) NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids.
- (iii) WSH Council's Workplace Safety and Health Guidelines on Flammable Materials.

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