Safety Alert: Dust Explosion!

- **Incident Summary :** On the morning of June 30, 2025, a devastating explosion occurred at the Microcrystalline Cellulose (MCC) drying/reactor unit of M/s Sigachi Industries Private Limited's pharmaceutical facility in Pashamylaram, Sangareddy district (near Hyderabad). The incident, reportedly caused by a suspected pressure buildup in the spray dryer or air-handling system, resulted in a tragic toll of 44 fatalities, 17 injuries, and 8 individuals still reported missing, according to news sources.

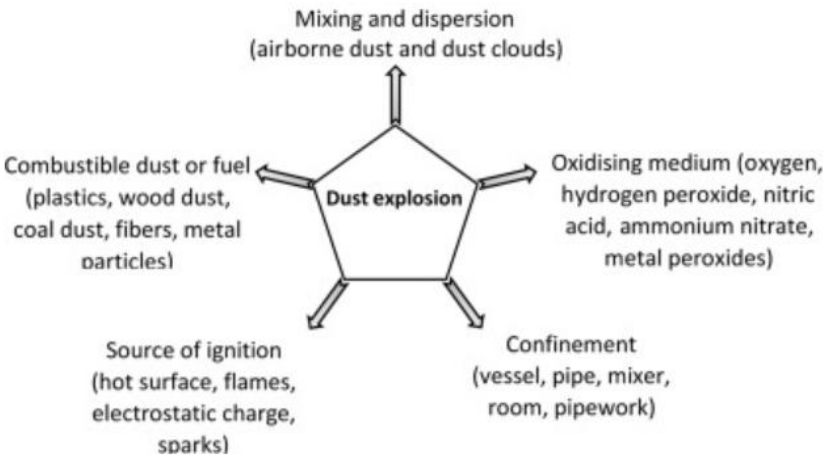
- **Probable Root Cause :** Such disaster is unlikely to have been caused by a single error. Early investigations suggest overheating, faulty temperature sensors/alarm systems, and suspected lapses in the safety monitoring system led to this deadly explosion. A tentative summary of the root cause is mentioned below:

Factor	Description
Primary Trigger	Overheated spray dryer due to inadequate airflow control (Air handling system malfunction)
Explosion Type	**Dust explosion** - rapid combustion of fine MCC particles
Contributing Failures	Faulty temperature sensors, alarms, interlocks; poor maintenance, etc.

The confluence of process failure, process safety instrumentation failures, and safety non-compliance appears to be central to this catastrophic event.

- **What is Dust Explosion?**

A dust explosion is caused by a quick release of a large amount of energy due to the combustion of a particulate material of small size. For instance, coal dust, catalyst fines, sulphur, flour, etc., poses a risk of dust explosion, metallic dust such as aluminium, copper, iron, etc. can also lead to dust explosions. Generally, a dust explosion occurs when the following five conditions are met: fuel (combustible particulate), mixing (turbulence), oxidising medium (generally air), ignition source (hot surfaces, open flames, sparks, electrostatic charging), and confinement (partial or complete).



- **<u>Safety Recommendations</u> :**

  Dust Explosions are a threat to process industries. For example, various systems/processes in Refineries handle/use fine particles such as Catalyst Handling Units (e.g., FCC Units), Coke Handling Systems (DCU), Sulphur Recovery Units / Tail Gas Treatment, Blending and Additive Areas, etc. Mitigation measures should be in place to prevent Dust Explosion including:

  - Dust suppression and extraction systems
  - Proper grounding and bonding to prevent static charge
  - Avoidance of hot work near dusty environments
  - Explosion-proof electrical equipment
  - Dust hazard analysis (DHA) in process safety management (PSM)
  - Housekeeping and regular inspection

- **<u>Conclusion</u> :** The Sigachi industries incident serves as a stark reminder of the catastrophic potential of dust explosions and the critical importance of robust process safety systems. All stakeholders in the oil and gas sector - including refineries, gas processing plants, and petrochemical units - are urged to proactively identify and assess dust explosion hazards and take necessary mitigation measures in their facilities.

Dust Explosion Pentagon

Element	Description
Fuel	MCC fine powder (<420 microns) easily disperses in air.
Oxidizer	Ambient air provides oxygen.
Ignition	Even a static spark (~0.25 mJ) can ignite MCC dust cloud.
Dispersion	Inadequate cleaning or ventilation leads to airborne dust.
Containment	Confined spray dryer/reactor acts as pressure vessel.
→ Explosion	Rapid combustion generates shock waves, fireball, and thermal radiation.

Dust Explosion Science (NFPA 652, 654 Guidelines)

Levelled Shed after Explosion

Rescue Operations underway at the incident site