

Explosion of Particulate or Suspended Dust Environments

Dust explosion is a sudden and violent event that occurs when a cloud of combustible dust is exposed to an ignition source. Dust explosions can cause significant damage to people, property, and equipment.

Brazil is a country with a history of dust explosions. In February 2023, an explosion at a silo in Palotina, Paraná, killed 8 people and injured 12 others. The explosion occurred in a corn silo that was being loaded onto a truck. The cause of the explosion is still under investigation, but it is believed to have been caused by a spark from an electrical device.



The explosion in Palotina is a reminder that dust explosions are a real danger and that measures should be taken to prevent them. There are a number of measures that can be taken to prevent dust explosions, which should be addressed by an expert in classified and hazardous areas.

For a dust explosion to occur, three components are required:

- **A fuel source:** the combustible dust must be present in sufficient quantity to form a cloud.
- **An ignition source:** a spark, a flame, or another heat source can initiate a dust explosion.
- **A suitable air-fuel mixture:** the dust and air must be mixed in the correct ratio for the explosion to occur.

Dust explosions can occur in a variety of environments, including:

- Food processing industries
- Construction industries

- Mining industries
- Manufacturing industries
- Warehouses
- Grain processing facilities
- Shipyards

These environments are considered classified or hazardous areas and classified according to the level of explosion risk. The risk level is determined by a number of factors, including the amount of dust/particulate present in the air, the size of the particles, and the presence of ignition sources.

Classified areas require special safety measures to reduce the risk of explosion. These measures include:

- The installation of ventilation systems to remove dust from the air.
- The use of explosion-proof electrical equipment
- The implementation of safe work procedures
- The training of workers on the risks of dust explosions

Dust explosions can cause a number of damages, including:

- Injuries and deaths
- Structural damage
- Fires
- Equipment destruction
- Operation interruption

There are a number of measures that can be taken to prevent dust explosions, when analyzing the facilities from the point of view of area or risk classification:

- Reduce the amount of dust in the air.
- Eliminate ignition sources
- Keep the air-fuel mixture out of the explosive range.
- Train workers on the risks of dust explosions

Some international and Brazilian technical standards that deal with dust explosions or area classification (**hazardous area**)

- **International Standard ISO 80079-31:2016** - Explosive atmospheres - Combustible particles - Part 31: Selection and installation of ventilation systems to prevent the formation of explosive atmospheres.
- **Brazilian Standard NBR 16101-1:2014** - Machine safety - Electrical equipment for classified areas - Part 1: Selection and installation of electrical equipment in classified areas

- **Brazilian Standard NBR 16101-2:2014** - Machine safety - Electrical equipment for classified areas - Part 2: Installation of electrical equipment in classified areas
- **Brazilian Standard NBR IEC 60079** - This international standard specifies the minimum requirements for the selection, installation, and use of electrical equipment in classified areas.
- **International Standard NFPA 654** - This American standard specifies the minimum requirements for the prevention of fires and explosions in classified areas.
- **International Standard AWWA D106** - This American standard specifies the minimum requirements for the installation of ventilation systems in classified areas.
- **International Standard ANSI/ASSE Z540.1** - This American standard specifies the minimum requirements for the training of workers in classified areas.

The adoption of these safety measures can help to protect people, property and equipment in classified or hazardous areas.

The main, but not unique, installation adjustments to prevent dust explosions in classified areas are:

- **Keep the dust out of the classified area.** This can be done using ventilation systems, seals, and other control measures.
- **Eliminate ignition sources.** This can be done by removing electrical equipment, heat sources, and other items that can cause a spark.
- **Use explosion-proof electrical equipment.** This equipment is designed not to cause a spark in an explosive atmosphere.
- **Train workers on the risks of dust explosions.** Workers should know how to identify and avoid dangerous situations.

By following these installation adjustments, you can help to protect people, property, and equipment from the risks of dust explosions in potentially classified areas.

Here are some additional recommendations for preventing dust explosions in classified areas:

- **Keep work areas clean and organized.** This will help to reduce the amount of dust in the air.
- **Avoid dust accumulation.** Dust can accumulate in areas where it is not seen, such as behind equipment and in corners and recesses.
- **Use appropriate personal protective equipment (PPE).** PPE, such as safety glasses, masks, and gloves, can help to protect workers from exposure to dust.
- **Be aware of ignition sources.** Ignition sources can include electrical equipment, heat sources, and other items.

- **Follow safe work procedures.** Safe work procedures can help to prevent dust explosions.

Dust explosions can occur throughout the environment at the same time. This is because dust or particulate has microscopic dimensions and can easily ignite from a source of ignition, such as a spark, a flame, or a heat source. When dust is ignited, it ignites quickly and can cause a powerful explosion. The explosion can spread dust to other areas, resulting in a chain explosion.



By following these tips, you can help create a safe and dust explosion-free work environment. Suitability and knowledge of the risks of the activity is the greatest prevention.

Eng. Elcio J. Blanco
CEO at Grenmark
Consulting/ Consultor Sênior de ESG / EHS/Explosive Atmosphere
PMI- RMP