Bonding and grounding of dust collection system components is a critical step if you handle combustible dust or powder, meaning that the dust can be ignited when dispersed in the air in a sufficient concentration. In general, static electricity can ignite a combustible dust cloud if the minimum ignition energy of the dust is very low. The minimum ignition energy (MIE) is the minimum amount of energy required to cause flame propagation in a combustible mixture. Most combustible dusts have MIEs greater than 10 millijoules.

Under most conditions, a dust with an MIE greater than 10 millijoules can be easily ignited by sparks but not necessarily by static electricity unless the particle size is very small and the dispersed dust concentration is at or above its minimum explosive concentration (MEC), which is the lowest concentration of a combustible dust that will propagate a flame. However, if there is a gas or a combustible vapor present in the dust cloud, which may occur in some powder processing operations, ignition by static electricity is highly likely no matter the combustible dust characteristics. Also, an increase in the dust cloud’s air temperature can lower the MIE of the dust. The safety data sheet (SDS) from the powder solids manufacturer doesn’t give enough information to determine the dust explosivity characteristics. You need to have the already processed dust, not the raw powder solids, tested to determine the resulting dust’s MIE and MEC.

Preventing static discharge in dust control systems

Propagating brush discharges can generate ignition energies of more than 1,000 millijoules and can initiate dust explosions in dust collection systems under the following conditions:

1. Transporting combustible powder and dust through a nonconductive pipe or duct.
2. Transporting combustible powder and dust on nonconductive surfaces backed by a conductive surface (a metal pipe or duct internally coated with an insulating material).
3. Installation of plastic or glass inspection windows in a pipe or duct. Static-dissipative coatings will not eliminate static electricity quickly enough to minimize ignition potential.

A propagating discharge is caused by electrical breakdown of the non-conductive layer in a capacitor. This causes a massive lateral surface discharge which results in the dissipation of most of the stored charge. The charged plastic coating inside a metal duct can be considered a capacitor.

Plastic pipe and ductwork shouldn’t be used with combustible materials in dust control systems. Running a ground wire along the length of plastic pipe and ductwork, whether on the exterior or the interior, won’t dissipate static electricity. All metal pipes and ductwork should be securely bonded and grounded to eliminate all static electricity in the conveying line. Pneumatic conveying lines typically use compression couplings with grounding strips built into the gasketing. Bonding between metal pipe and duct sections connected with these couplings should be periodically checked to assure that the resistance across the connections is less than 10 ohms.

If you need to use flexible duct when connecting metal ductwork to equipment or dust capture hoods, there are special static-conductive flexible ducts available. You need to make sure these flexible ducts are bonded at both ends to the respective connections. These should also be periodically checked to assure that the resistance across the connections is less than 10 ohms.

Static electricity inside a dust collector

The collected dust inside of a dust collector has a static electric charge. This charge will accumulate on the surfaces of the bag filters and usually doesn’t have enough energy to ignite most dusts. However, if the process generates combustible vapors, static electricity will easily ignite the hybrid dust-and-vapor mixture. Flammable liquids in the form of a fine spray may also easily ignite at temperatures less than the liquid’s flashpoint.

The static charge on a dust collector’s bag filters will transfer to the filter cages, so the supporting filter cages need to be securely bonded to the collector to dissipate static electricity. If a conductive filter cage disconnects from the dust...
collector top plate and falls into the hopper, a capacitive spark discharge can occur and ignite the dust cloud inside the dust collector. Cartridge filters need to automatically bond to the dust collector housing when installed, and all conductive components of the dust collector need to be bonded and grounded.

The dust collector body’s interior needs to be fully conductive on the dirty-air side. Unless you specify that the dust collector interior also be conductive, the interior will typically be coated with a rust-proof coating which isn’t static conductive. The interior should be coated with a static-conductive coating such as galvanized paint, which is also rust-proof.

**Static electricity in powder processing**

Powder processing that involves fast and turbulent movement, as well as contact and separation with surfaces, will result in static electricity charging. Powder handling operations such as material conveying, grinding, mixing, blending, and pouring will produce an electrostatic charge. The dust collection system components, such as capture hoods, ductwork, and dust collectors will see an electrostatic charge buildup as the dust particles pass along the walls of these components.

Remember that in order to have a dust cloud ignition, the cloud concentration needs to be at the dust’s tested MEC. Some plant health and safety managers use a safety factor of 50 percent, meaning if the suspended dust concentration is at 50 percent of the tested MEC, the chance of ignition is minimal. However, the chance is still not zero as things change often in a manufacturing environment. Changes in the process or powder from a different raw material supplier can result in a finer dust particle, or maintenance schedules can postpone routine maintenance checks and repairs. Changes like these can put a safe operation in jeopardy.

If you haven’t completely bonded and grounded your combustible dust collection system components just because you haven’t yet had an ignition incident caused by static electricity, you might already be safe depending on your process and material characteristics. Perhaps the right conditions for an incident to occur haven’t yet presented themselves. So, why take the chance? It’s better to be safe than to live with the aftermath of a dust explosion within your dust collection system. In any case, if an OSHA inspector issues you a citation for not bonding and grounding the system as required by NFPA, you’ll need to prove to OSHA that you’ve performed the necessary testing and analysis that supports your position.

---

**John A. Constance, PE (jac@engcollab.com),** a consulting engineer at The Engineers Collaborative, has more than 30 years of experience designing, engineering, and troubleshooting dust control and industrial air systems for bulk solids processing and handling industries.

The Engineers Collaborative
Canandaigua, NY
215-300-9563
www.engcollab.com