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Dust Explosions

By Michael Schaffer

On February 8, 2008, a plant explosion at a Georgia sugar refinery killed 6 workers and injured 42 others. In addition, the structure was declared unsafe to enter and required the assistance of structural engineers to determine whether it could be salvaged, and if so, what could be saved.



The blast was not the result of a gas leak or arson. The cause of the fire was the result of dust in a silo where refined sugar was stored before being packaged. While this may seem like a freak occurrence, it's actually not as rare as one might think. Dust explosions in warehouse and factory locations are not that uncommon.

For instance, just a few years earlier in Kinston, North Carolina, when a pharmaceutical-manufacturing plant blew up, locals thought a plane hit it, which was a reasonable assumption, given that the plant was next to an airport. However, it was not an airplane that caused the

explosion—killing 6 people and injuring 38 more—but, once again, dust. Further, it took 18 months before operation and production of this factory could be resumed.

A History of Dust Explosions

In the past two decades, there have been more than 280 plant explosions in the United States, resulting in more than 700 injuries and 119 deaths, all the result of dust. Each facility has its specific reasons why it experienced a dust-related explosion, but according to the National Fire Protection Association (NFPA), the root cause is that "any industrial process that reduces a combustible material and some normally noncombustible materials to a finely divided state—essentially turning it into dust—presents a potential for a serious fire or explosion."

The reasons why these explosions continue to occur are many. Despite the NFPA's warnings, many facility managers struggle with the concept of dust combustion and simply do not understand how serious a problem it can be. Also, some managers complain that regulations that could help prevent dust explosion are not necessarily uniform throughout the country. Former OSHA chief Edwin Foulke Jr. has stated that he believes the situation can be dealt with by the regulations already implemented, which can vary from state to state, and through increased education for employers and employees.

However, it does appear that OSHA is getting more serious about dust explosions, whether a national standard or regulation is in place

or not. Last summer, they fined a sugar refinery in Gramercy, La nearly \$9,000,000 after a dust explosion because “the company showed a complete disregard for its employees' safety by knowingly placing them in an extremely dangerous work environment,” according to Foulke. Thirteen people died and more than 40 were injured due to the explosion.

Why Do the Hazards Exist?

The potential for a dust explosion in all types of industrial facilities, including paper manufacturer and distributor plants, is considerable. Just about any combustible solid the size of a dust particulate can explode under the right conditions, so this makes it difficult to develop regulations to minimize the risks. And it is believed that most industrial facilities handle potentially explosive powders or particulates at some point in the manufacturing, storage, or transport process.

Typically, for a dust explosion to occur, five conditions, referred to as the “dust explosion pentagon,” must exist concurrently. These are:

- The potentially explosive dust particulates are suspended in air.
- The concentration of particulates is within the explosive range.
- Oxygen is present in sufficient amounts.
- An ignition source is present.
- The dust particulates are located in an enclosed or confined space.

All five conditions coming together simultaneously is a somewhat random event. As a result, often even the most astute factory/warehouse managers do not see it coming. However, the evidence is clear that it can and does happen, with very serious consequences.

Prevention

Because regulations and preventive measures vary, facility managers must take an active role in preventing dust explosions in their facilities. Fortunately, there are several steps they can take. Most of these involve increased worker training and education, periodic risk audits, and, most important, enhanced housekeeping procedures.

For instance, workers should be aware of where dust tends to accumulate--for instance, on factory equipment, work stations, and floors--as well as potential ignition sources in their facilities. These ignition sources include such things as any type of hot surface, steam pipes, overheated tools and equipment, or smoldering materials. Welding and cutting equipment pose additional hazards, as does smoking, of course.

Once aware of dust and ignition sources, workers can help prevent dust explosions by eliminating or reducing those potential hazards in their immediate areas. Periodic, random audits should also be conducted. These not only help workers better understand the risks, and the steps they must take to protect themselves and others working in the facility, but ensure that these procedures are being implemented.

A Housekeeping Plan

Proper housekeeping procedures are typically the best way to prevent dust explosions in industrial settings. A housekeeping plan should be developed that spells out the steps to take on a regular and daily basis to eliminate the risks that cause explosions, including checking “hidden” areas of a facility.

For instance, at the North Carolina fire mentioned earlier, an independent federal agency charged with investigating the cause of the explosion issued a final report concluding that a combustible polyethylene dust, about 1/32nd of an inch thick, had accumulated above the ceiling on vents, pipes, and conduits and was to blame for the explosion.

How this can occur is that dust that accumulates on the factory or warehouse floor gets stirred up, becomes suspended in air, and, if an ignition source is present, can explode. There have even been cases where the bearings in ceiling fans have become overheated with continual use, and the heat was enough for accumulated dust in the air around the fans to explode.

Keeping dust from accumulating and becoming airborne is vital to preventing dust explosions. This is why proper floor maintenance is a key component of an effective housekeeping plan. In many settings, workers sweep their work stations at the end of their shifts in order to keep them clean. Although this does help minimize dust accumulation, the actual sweeping causes dust to be suspended in the air and drift on to ignitable sources.

To combat this problem, a new generation of manually operated sweepers have been introduced that are effective at gathering and trapping dust while preventing it from becoming airborne. One such system has multiple rotating brushes that can clean corner areas of the floor as well as edges. These brushes trap the dust by “upsweeping” it into a dust pan, where it is stored until emptied.

In addition to being effective, manually operated sweepers are significantly faster than conventional sweeping methods. Estimates are that as many as 30,000 square feet can be cleaned in about an hour using such machines.

Wait, Regulate, or Act

Some facility managers, while aware of the dust problem, are waiting to see if OSHA or their local governments will implement regulations or guidelines. Concern about this, many industry associations and groups are calling on OSHA to implement dust regulations and then develop a broad-reaching inspection program to help improve safety.

However, there are steps facility managers can take right now to prevent dust explosions. Worker training and education, inspections, eliminating or minimizing the use of substances and powders that can explode, and implementing an effective housekeeping plan are key. And at the top of the list should be keeping floors clean and dust-free using systems that capture and trap it, not sweep it into the air.

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