

Hoeganaes Combustible Dust Flash Fires

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<https://www.csb.gov/hoeganaes-corporation-fatal-flash-fires/>

Activity

Hoeganaes facility is located in Gallatin, TN and specializing in melting and converting scrap metal to assorted metal powders. The plant's chief product is a powder that is 99% iron. The process comprises of melting the iron, cooling, and then milling it into a coarse powder. The powder is then sent through an annealing furnace on a 100-foot –long conveyor belt. The furnace is a hydrogen atmosphere, which reduces oxides in order to prevent the chance of oxidation. The hydrogen is delivered through pipes that are situated in a trench in the floor, which is covered by metal plates. The product that comes from the furnaces is called cake, which is then sent to a cake breaker and then crushed into a particles size of about 45-150 pm.

Hazard

Dust explosions can be catastrophic and cause death and damage. If all five elements (oxygen, heat, fuel, dispersion, & confinement) of the dust explosion pentagon are present, an explosion will occur.

Preventative Actions and Safeguards

Ensure all workers are aware of all risks and hazards of the process.

Contingency Plan/ Mitigating Actions

Perform frequent housekeeping to keep dust amounts to a minimum.

Initiating Event

Since the facility specializes in creating a metal powder, there would be a lot of powder dispersed around the plant. In 2011, the Hoeganaes faced multiple incidents.

Incident

The first incident happened on January 31st. Operators believed that a bucket elevator used to transfer the powder was off track, which can cause the motor to overheat. When the motor was shut down, a maintenance mechanic and electrician inspected the equipment and did not think the belt was off track. They requested the operator to restart the motor, and once started the vibrations spread powder from the equipment and on the floor. Almost immediately a flash fire ensued and immersed the two workers, killing them. The second incident happened on March 29th when an engineer and contractor were changing igniters on an annealing furnace. They had a problem reconnecting a gas line, so the engineer tried using a hammer to force the connection. Dust on the nearby surfaces was displaced by the hammering an ignited almost instantly. The engineer experienced first and second degree burns while the contractor was able to escape without injury. The third incident occurred on May 27th when operators discovered a gas leak near an annealing furnace. The leak was coming from a trench that contained hydrogen, nitrogen, cooling water runoff pipes, and a vent pipe for the furnaces. The mechanics were sent to find and repair the leak. Maintenance knew that hydrogen piping was in the same trench, but they assumed the leak was nonflammable nitrogen because there was a recent leak from a nitrogen pipe earlier. The trench covers were too difficult to lift alone, so a forklift was necessary to lift the cover near the leak. Friction was created when the forklift lifted the covered, the friction creaked sparks and an explosion proceeded. The hydrogen explosion displaced a sizeable amount of iron dust from rafters and other surfaces, parts of this dust ignited creating multiple dust flash fires. Three employees died from burns they suffered from the flash fires.

Lessons Learned

It is important to fully understand the hazards and risks of the process. Hoeganaes knew the iron dust was a weak explosion hazard and relatively hard to ignite, but they did not think much about it. No matter the level of severity of a hazard, it should always be taken into account and be fully disclosed to workers. The lack of learning from experience was a critical issue for Hoeganaes considering they had three different dust fire incidents within the first half of 2011. An important part of a good process safety culture is learning from previous incidents and trying to prevent the same thing from happening in the future. Good housekeeping is also critical in plants especially those who handle large amounts of dusts and powders. Hazards increase by having large quantities of dust present.

