COMBUSTIBLE DUST SAFETY PROGRAM

PURPOSE / SCOPE

This safety awareness program is intended to provide suitable information to Winger Companies, herein referred to as Winger, employees regarding the potential hazards of combustible dust explosions so that adequate measures can be taken to limit exposures through controls in the workplace.

A dust explosion occurs when a fine, combustible dust is suspended in air and ignited. This causes a very rapid burning with a release of gaseous products and subsequent pressure rise. The resulting explosive force can damage plant, property, and people. Dust explosions can be categorized as either primary or secondary. Fine particles of grain, fertilizer, sugar, coal, and finely ground metals such as aluminum and chromium are examples of combustible dusts.

In addition to explosion hazards, dusts pose a range of other hazards. Minor hazards may include reduced visibility and slippery surface conditions. Some dusts, such as asbestos and silica, pose serious respiratory hazards and long-term health effects, such as pneumoconiosis.

Combustible dust explosion hazards exist in a variety of industries, including: agriculture, chemicals, food (e.g., candy, sugar, spice, starch, flour, feed), grain, fertilizer, tobacco, plastics, wood, forest, paper, pulp, rubber, furniture, textiles, pesticides, pharmaceuticals, tire and rubber manufacturing, dyes, coal, metal processing (e.g., aluminum, chromium, iron, magnesium, and zinc), recycling operations, fossil fuel power generation (coal), and 3D welding (a form of 3D printing).

Dust explosions are a serious problem in many industries in the U.S. Over the last 28 years, there have been approximately 3,500 combustible dust explosions. Of those explosions, 281 have been major incidents resulting in the deaths of 119 workers and 718 workers sustained injuries. In 2005 alone, there were 13 reported agricultural dust explosions in the US, resulting in two fatalities and 11 injuries. These explosions have occurred in many different industries, including agriculture, food products, chemicals, textiles, forest and furniture, woodworking, metal processing, paper products, pharmaceuticals, and coal dust.

In many dust explosions, employers and employees were unaware that a hazard even existed. Not only can these explosions cost lives and permanently change the lives of workers who are injured, there can also be serious economic hardships on workers and business owners alike. Businesses that suffer these explosions can be closed while the facility is being rebuilt; resulting in possible lost wages for employees and income for businesses. Some businesses may be forced to close permanently. The cost of these explosions can run into the millions of dollars.

The purpose of this program is to help both the employer and employee do the following:

- Identify the elements necessary for dust to explode.
- Explain how to prevent dust from reaching combustible levels.
- Describe the difference between primary and secondary dust explosions.

HOW CAN A DUST EXPLOSION TAKE PLACE?

In addition to the familiar fire triangle of oxygen, heat, and fuel (the dust), dispersion of dust particles in sufficient quantity and concentration can cause rapid combustion known as a deflagration. If the event is confined by an enclosure such as a building, room, vessel, or process equipment, the resulting pressure rise may cause an explosion. These five factors (oxygen, heat, fuel, dispersion, and confinement) are known as the “Dust Explosion Pentagon”. If one element of the pentagon is missing, an explosion cannot occur.

For a dust explosion to take place, several key conditions must be present:

- The dust must be combustible and fine enough to be airborne.
- The dust cloud must be of explosive concentration; i.e. between the lower explosive limit (minimum explosive concentration) and upper explosive limits for that particular dust. These limits are 15g/m³ to 1200g/m³ Dust combustibility is in the range when you cannot see a 25 watt light bulb six feet away. This is the dust combustibility range which is LEL 2.5ug/m³ and 15mg/m³. This is called the minimum explosive concentration (MEC).
- There must be sufficient oxygen in the atmosphere to support and sustain combustion.
- The dust must be dry.
- The dust must be in a confined space.
- There must be a source of ignition.

A primary explosion takes place in a confined atmosphere such as a cyclone, storage silo, or enclosed part of the manufacturing plant. After detonation, the shock wave can damage and often rupture walls, allowing burning dust and gases from the explosion to be expelled into the surrounding area.

The primary explosion will disturb settled dust that may have accumulated. Once airborne, this dust can support a larger explosion; this is referred to as a secondary explosion. Secondary explosions can cause severe damage to surrounding plant buildings. All large-scale dust explosions result from chain reactions of this type. There may be a chain reaction of many explosions caused by the initial explosion.

Primary Explosion | Secondary Explosion

PREVENTION

HAZARD ASSESSMENT

A thorough hazard assessment is essential in identifying and eliminating factors contributing to an explosion. It is important for every employee to do an informal hazard assessment every day at their work site. Always be on the lookout for accumulations of dust. And that doesn't mean just out in the open. Check above, below, behind, and inside storage containers, ductwork, dropped ceilings, etc. Check ignition sources. Only a couple of dust types spontaneously ignite in air; the majority of them need another source of ignition. Possible ignition sources include:

- Open flames (welding, cutting, matches, etc.)
- Hot surfaces (dryers, bearings, heaters, etc.)
- Heat from mechanical impacts
- Electrical discharges (switch and outlet activation)
- Electrostatic discharges
- Smoldering or burning dust
- Cigars, pipes, and cigarettes

Look for combustible dust hazards at your workplace and discuss how to eliminate them. Ask yourself questions such as the following as you go through your workday:

- Is vacuuming used whenever possible rather than blowing or sweeping combustible dust?
- Is there electrical installations in hazardous dust or vapor areas?
- Is metallic or conductive dust prevented from entering or accumulating on or around electrical enclosures or equipment?
- Is it possible to wet down the area?
- Are accumulations of combustible dust routinely removed from elevated surfaces, including the overhead structure of buildings, dropped ceilings, shelves, etc.?

- Where may dust accumulate that we have not considered?

Combustible dust is an innocent-looking disaster waiting to happen. Every employee should be aware of this potential hazard and should take every precaution to be sure that their workplace stays safe from sudden explosions and the other hazards of combustible dust. Regarding explosion protection, the first step in a hazard analysis is determining whether your dust is explosive.

GOOD HOUSEKEEPING

A primary method for prevention of dust explosions is reducing or eliminating the accumulation of dust with good housekeeping. Good housekeeping in this context is essential for explosion prevention. Dust removal can be accomplished by good ventilation, extraction and removal systems, dust collection systems, and manual housekeeping where automated collection systems cannot reach. In dusty environments, vacuums and other electrical equipment will need to be spark- and explosion-proof. Compressed air blowers should never be used for the removal of dust. Minor but steady leaks in any production system must be addressed, as these can cause large amounts of dust to accumulate over a period of time, especially if the process runs at a slightly elevated pressure. Small amounts of dust can create large clouds. (Dust will always be present in some processes).

The best way to avoid dust accumulation is to be constantly aware of the surroundings. Respect for the hazard and a good housekeeping program are essential in eliminating the explosion hazard. Some general rules include the following:

- Use appropriate electrical equipment and wiring methods;
- Use separator devices to remove foreign materials capable of igniting combustibles from process materials;
- Separate heated surfaces from dusts;
- Separate heating systems from dusts;
- Proper use, grounding, and type of industrial trucks and mobile equipment;
- Minimize the escape of dust from process equipment or ventilation systems;
- Locate relief valves away from dust hazard areas;
- Control static electricity, including bonding of equipment to ground;
- Control smoking, open flames, and sparks;
- Control mechanical sparks and friction;
- Never use compressed air, dry sweeping, or other cleaning methods that can disperse combustible dust into the air (when feasible);
- Limit and control potential ignition sources in dust accumulation areas;
- Pay attention to customer workforce training and education courses regarding recognition and control of combustible dust hazards, and follow the instructions given at the training sessions;
- Maintain an effective housekeeping program to prevent or eliminate dust buildup on ledges, ductwork, building framing, or other surfaces. (Even small accumulations of dust (as little as 1/32 of an inch) can create a dust explosion hazard if spread over sufficient surface area.)

TRAINING

All Winger employees that perform work activities, where the potential of exposure to combustible dusts may be apparent, will be provided awareness training in this program in order to be familiar with the potential hazards and proper safe work procedures to follow. This training will include an overview of dust explosions, and provide explanations of what they are, how they occur and what can be done to prevent them.

Training records shall be kept at the Winger corporate office at 918 Hayne Street, Ottumwa, Iowa.

SOURCE CREDITS

OSHA Combustible Dust Explosions Fact Sheet www.osha.org
OSHA Hazard Communication Guidance for Combustible Dusts Publication OSHA 3371-08 2009
OSHA Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions SHIB 07-31-2005
Applicable OSHA Requirements Include:

- §1910.22 Housekeeping
- §1910.307 Hazardous Locations
- §1910.1200 Hazard Communication
- §1910.269 Electric Power Generation, Transmission and Distribution (coal handling)
- §1910.272 Grain Handling Facilities
- General Duty Clause, Section 5(a)(1) of the Occupational Safety and Health Act (Employers must keep workplaces free from recognized hazards likely to cause death or serious physical harm).

Combustible Dust: Safety and Injury Prevention Awareness Training Program, Kirkwood Community College Community Training and Response Center, Susan Harwood Grant Number SH-17797-08-60-F-19
Special Report: Combustible Dust BLR—BUSINESS & LEGAL RESOURCES 2013
The primary National Fire Protection Association (NFPA) consensus standards related to this hazard are:

- NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
- NFPA 484, Standard for Combustible Metals
- NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
- NFPA 655, Standard for the Prevention of Sulfur Fires and Explosions
- See www.nfpa.org to view NFPA standards.

DOCUMENT CONTROL

Initial Program June 23, 2015
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