By the Numbers Combustible Dust

DID YOU KNOW?

Combustible dust explosions can cause employee injuries, deaths and destruction of entire buildings. Combustible dust is one of the biggest hazards confronting a wide variety of industries. Because it is mostly unseen or otherwise sensed, it is easily unrecognized for the damage and injury it can cause.

- From the 2018 CDID incident reporting, wood processing, food processing and agricultural activities account for almost 60% of the dust-related fire and explosion incidents. Automotive manufacturing, metal working, power generation and mining contributed an additional 17%. The remaining 24% of incidents occurred in other industries, including pulp and paper, education, coatings, oil and gas, textiles and recycling.
- Very frequently, materials involved in wood-product incidents were specified as sawdust or wood dust, and materials involved in food processing or agriculture were specified as grain dust. In cases were specific materials were named, pine chips, cellulose, corn, pecan, cocoa, flour, cereal, barley and spices were implicated in dust incidents. Although not broken out in the data, coal dust accounted for almost 7% of the total incidents. In cases involving metal dusts, aluminum, titanium, magnesium and iron were cited most often.
- This suggests that explosions tend to be more severe in terms of injuries and lives lost than facility fires. However, the trend for facility damages shows the reverse. Out of the eleven incidents with reported losses of $1 million and above, eight were from fires and three were from explosions. This highlights the importance of both fire and explosion prevention in facility safety measures.
- In terms of materials involved, the number of fires, explosions, injuries and fatalities for the two most common

categories are as follows: Wood products were involved in 33 fires, five explosions, 10 injuries and 0 fatalities, while food products were involved in 24 fires, 12 explosions, 14 injuries and eight fatalities.

- Although both categories are responsible for a similar total number of incidents, fires appear to be more prevalent in wood processing facilities and explosions tend to be more common in food processing and agriculture. In cross-referencing these data with the equipment data provided earlier, these differences may be due to more frequent use of dust-collection systems in wood-dust-handling facilities and more frequent use of silos and conveyors for food production.
- As a result of the higher number of explosions, food products have a larger number of high-severity incidents in terms of injuries and fatalities. In terms of facility damage, industry activities involving wood products resulted in more incidents that generated $1 million or more in losses. Six of these incidents involved wood dust, sawdust, wood pellets and wood shavings. Five of these were fires and one was an explosion. This again demonstrates that both fire and explosion hazards need to be addressed in industries handling combustible dust.
- Global data from the first half of 2018 indicated that 89% of the fatalities from dust incidents occurred due to explosions. With regard to injuries, 70% occurred from explosions, while 30% were the result of fires. The total breakdown of injuries and fatalities from fires and explosions is as follows: Explosions caused 28 injuries and eight fatalities, while fires caused 12 Injuries and one fatality.

The 2018 mid-year incident report was released in August 2018. In addition to global fire and explosion incidents, the Occupational Safety and Health Administration (OSHA; Washington, D.C.; www.osha.gov) citations, upcoming events, and new technology and products were also featured. In the first six months of 2018, 75 fires, 14 explosions, nine injuries and one fatality were reported in North America. One of these explosions occurred in

Canada and 13 within the U.S. Internationally, 14 fires, 12 explosions, 31 injuries, and eight fatalities were recorded.

The first incident report was released in 2016 and covered combustible dust explosions within North America. In 2016, 31 explosions were reported in the U.S. and two were reported in Canada. These incidents caused a reported total of 22 injuries and three fatalities in 2016.

In 2017 mid-year and year-end incident reports were released. The year-end report covered both combustible dust fires and explosions around the world. In North America, 132 fires, 32 explosions, 61 injuries, and six fatalities were recorded. Four of the explosions were reported in Canada, while the other 28 were in the U.S. Internationally, 37 fires, 36 explosions, 102 injuries and seven fatalities were recorded.

KEEP IN MIND

The National Fire Protection Agency (NFPA) defines combustible dust as “any finely divided solid material that is 420 microns or smaller in diameter and presents a fire or explosion hazard when dispersed and ignited in air.” Any combustible material can burn rapidly when in a finely divided form. If such a dust is suspended in air in the right concentration, under certain conditions, it can become explosible. Left uncontrolled, dusts may migrate from the point of production/release, increasing the portion of the facility subjected to combustible dust fire and explosion hazards. Even materials that do not burn in larger pieces, given the proper conditions, can be explosible in dust form.

Any combustible material can burn rapidly when in a finely divided form. Combustible dusts can come from: sugar, spice, starch, and flour; grain, feed, and tobacco; plastics and rubber; wood, paper, and pulp; pesticides, pharmaceuticals, dyes, and coal, and metals.

If such a dust is suspended in air in the right concentration, under certain conditions, it has the potential to explode.

These conditions are known as the “Dust Pentagon”

1. Fuel to burn
2. Oxygen?
3. Ignition source (heat, spark, etc.)
4. Dispersion, or suspension of dust particles in the right concentration in the air, and
5. Confinement of the dust cloud. Confinement means the dust is in an enclosed or limited space. This restriction allows pressure to build up, increasing the likelihood of an explosion.

EXPLOSION-EXPLAINED

Not all dust is combustible but if there is a material “that will burn in air” as a solid, then it will also burn if it is in a finer, dust, form. Combustible dust sources include most solid organic materials such as sugar, flour, grain, and wood; many metals; and some non-metallic inorganic materials.

The potential for a dust explosion depends on many factors, including the dust particle’s size, shape, and moisture content. Your employer should assess any dust-producing activity to determine if it’s combustible. □□□□□□□□ If it is, processes must be in place to remove or minimize the amount of dust present.

Combustible dust will only ignite if the conditions allow it, sometimes known as the ‘fire triangle’. This means there must be: combustible dust, of the right size and amount; a heat source, and oxygen to make the dust catch fire.

The build-up of even a small amount of dust on surfaces such as rafters, roofs, suspended ceilings, ducts, and window sills can cause serious damage if an explosion occurs.

Canada does not have one set of legislation to manage the risks from combustible dust. Even though many areas have similar legislation, workers moving around different regions, need to know the rules for each region.

Many combustible dusts, such as flour and metal dust, may seem unlikely to cause an explosion or fire, but they can. It is vital workers know the risks and follow all measures in place to control

dust and ignitions sources.

The saying, “If it ain’t broke, don’t fix it” isn’t a wise model to follow in the workplace safety world. Chilling examples of the danger in that type of thinking can be found in any industry where combustible dust accumulates.

Do not think that just because your workplace has never experienced a dust explosion, you don’t need to worry about letting dust accumulate. It can take years for materials such as sugar, flour, feed, grain, wood, metal, textile and other types of dust to accumulate to levels where they can suddenly explode, with devastating consequences for workers.

These types of explosions and fires are far from rare in Canada and the United States. For example, British Columbia experienced two fatal wood dust explosions at sawmills within a short span in 2012. Two workers were killed in each of those incidents, and more than 40 others were injured in both blasts.

In the United States, 281 combustible dust incidents killed 119 workers and injured 718 others between 1980 and 2005, according to the US Chemical Safety and Hazard Investigation Board (CSB).

Poor housekeeping practices, in which various types of dust are not cleaned up and left to accumulate, are a major cause of dust explosions.

These six conditions set the stage for an explosion:

1. Dust must be suspended in air.
2. Dust particles must be small.
3. Dust concentrations must be within the “exposable range.”
4. There must be enough oxygen or other oxidizing agent available.
5. There must be an ignition source having enough energy to generate flame.
6. The dust cloud must be in a closed or partially enclosed space to create pressure effects.

If dusts are created by processes in your workplace, good

housekeeping is extremely important in controlling dust buildup.

Here are six housekeeping dos and don’ts related to combustible dusts, with the information provided by senior process safety engineer David E. Kaelin Sr.

DO:

- Use water to clean areas where dust may fall, whenever possible.
- Perform regular cleaning on horizontal surfaces, floors and walls, including equipment, ducts, pipes, hoods, ledges, beams, stair rails, and above suspended ceilings and other concealed surfaces.
- Clean floors and work areas at least once per week.
- Use a vacuum cleaner that is listed for use in Class II hazardous locations, or a fixed-pipe system with a remotely located exhauster and dust collector.

DON’T:

- Allow dust layers to accumulate to hazardous levels. The National Fire Protection Association (NFPA) defines hazardous surface dust accumulations as being as little as 1/32 of an inch.
- Use compressed air or steam to blow down surfaces unless there is no other practical alternative. If compressed air or steam must be used, it is vital to apply it under low pressure to avoid disbursing clouds of dust to other areas.

Catastrophic Secondary Explosions

An initial (primary) explosion in processing equipment or in an area where fugitive dust has accumulated may dislodge more accumulated dust into the air, or damage a containment system (such as a duct, vessel, or collector). As a result, if ignited, the additional dust dispersed into the air may cause one or more secondary explosions. These can be far more destructive than a primary explosion due to the increased quantity and concentration of dispersed combustible dust. Many deaths in past accidents, as well as other damage, have been caused by secondary explosions.

Industries at Risk

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, and fossil fuel power generation (coal).