

Combustible Dust: How to prevent the danger of dust explosions

In 2018 alone there were over 250 reported factory fires or explosions related to combustible dust in the world*. Many of those could have been prevented, if industry workers had been fully informed about the risk factors, proper dust collectors and explosion safety devices had been installed and digital monitoring of the air filtration status, capacity, and maintenance had been done. With the right prevention measures and by following ATEX and NFPA directives, hazardous risk factor for human life, factory equipment and entire industry buildings can be minimised. Still, fires and explosions related to combustible dust in factory environments are reported constantly, which leads to the question - is your factory safe?

In this white paper you'll learn about:

- **Combustible dust**
- **Potential risks in different industries**
- **How to prevent the danger of dust and gas explosions**
- **Rules and regulations**

What is combustible dust

Combustible dust, or explosive dust, is a by-product created from the manufacturing processes and one of the most serious risks caused by dust in manufacturing environments. It's considered that all dust, "from apples to zinc", should be seen on as potentially explosive, and be handled in that way.

The list of products that may combust in powdered form is extensive, and includes a wide range of materials. Fine dust from e.g. wood, textiles, plastics, coal, carbon, light metals such as aluminium, magnesium and titanium, agricultural products such as flour, cacao, sugar, grain, tobacco and spices, as well as chemicals, pharmaceuticals, rubber etc. may be explosive. Some materials, such as aluminium and iron, are not combustible in larger pieces, but can be when ground to dust. Meaning, combustible dust occurs in various industries and is a risk factor in many workplaces, if not handled in the right way.

So, what are the risks with combustible dust and how does it become explosive? When a high concentrations of combustible dust particles comes in contact with the right concentration of oxygen inside an enclosed space, a small spark, metal ember, cigarette butt, or other ignition source can create an explosion that entails serious risks for both workers and facilities. This quick combustion process is known as deflagration, and results in a high-pressure airwave. As the airwave explodes out of its enclosed space, it will likely dislodge or stir up combustible dust elsewhere in the facility, this will mix the dust with the oxygen in the air, which will make the explosion bigger, and potentially fuel a second dust explosion - or even several. Some of these may occur inside other machines or containers, as the pressure wave and the fire propagate through the duct system. The risk of harm to human life, and of destruction of equipment or even entire buildings, is overwhelming.

*<https://breathelife2030.org>

The dust explosion class reveals the severity of your dust exploding

Combustible types of dusts are divided into four classes: St 1, St 2, and St 3. A high Kst value will rank highly on the class scale, indicating a potentially violent explosion.

- **St 1: Kst value >0-200 - weak explosion. Typical of charcoal, powdered milk, sugar, sulphur, wood dust, zinc.**
- **St 2: Kst value >200-300 - strong explosion. Typical of cellulose, wood flour, poly methyl acrylate (PMA).**
- **St 3: Kst value >300 - very strong explosion. Typical of metal dusts such as aluminium, magnesium and titanium.**

How to minimise the risks of dust explosions

The question every factory manager, owner or worker has to ask is: Is my factory safe? An explosion is a severe risk for workers as well as for facilities and also expensive for the business. But by installing a safe dust collector, preferably one connected to an efficient source capture extraction system, and regular monitoring to ensure that the extraction and filtration works properly and dust does not build up in pipes, machines or other work surfaces, the risks of an explosion decrease tremendously. Source capture, i.e. extracting the dust in immediate proximity to where it is produced, is an effective method of preventing dust from spreading. To install a dust collector that's also equipped with explosion isolation flap valves, reduces the risk of a dust explosion, propagating and spreading throughout the factory or workshop, even further.

”Digital solutions does not only improve workers safety, but also improve the operation effectivity and generates in a sustainable and futureproof operation.”

A modern Industrial Internet of Things (IIoT) solution connected to the dust collector, can provide operators with useful data on its status, capacity, and maintenance needs. Digital solutions does not only improve workers safety, but also improve the operation effectivity and generates in a sustainable and futureproof operation.

An IIoT connected dust collector solution with an efficient source capture extraction system is the best way to minimise the risk of combustible dust explosions. But it's also of high importance to make sure that every worker is fully aware of the safety risks and to identify potential risks to be able to prevent them. E.g. identify the dust explosion class, zones in the facilities that may have higher explosion risks and therefore need extra safety measures, possible ignition sources that may ignite combustible dust and remove or reduce them in order to lower the risk of a dust explosion. Complementary measures as the physical structure in the factory can also prevent dust and dust explosions from spreading, e.g. barriers in the form of canopies, walls, or other types of physical obstacles. Proper housekeeping routines is also an important measure that reduces the risks of dust explosions.

- **Install dust collectors**
- **Make sure every worker is fully aware of the potential safety risks**
- **Identify potential ignition sources**
- **Ensure proper housekeeping routine**

Rules and regulations to prevent explosions

It's the owner, manager or end user's responsibility to determine the possible explosion risk in their premises and to take measures to prevent this. Authorities has issued standards, rules and regulations that has to be followed. This to ensure safety for workers. But the standards are also there for guidance so that the industries can focus on their core operation.

Regarding combustible dust, the European Community addresses the ATEX directives for workplace safety and equipment in the EU to protect employees, the public and the environment from accidents with explosive atmospheres. In the U.S the National Fire Protection Association (NFPA) has developed standards which is used as the foundation for the U.S Department of Labor Occupational Safety and Health Administrations (OSHA) mandatory federal regulations to prevent fire and explosion accidents within all types of industries.

One of the obligations for the owner, manager or end user in the factory, is to classify the areas where explosive atmospheres may occur. It's also an obligation of the owner, manager or end user to develop an "Explosion Protection Document" or "Dust Hazard Analysis" that demonstrates:

- **Explosion risk and assessment**
- **Adequate measures that will be taken to attain the aims of the directive**
- **The hazardous areas that have been identified and classified into ATEX zones or into classes and divisions**
- **That the workplace equipment is operated and maintained with due regard for safety**

Using ATEX and NFPA approved solutions, such as dust collectors, extraction arms, industrial vacuum cleaners and explosion isolation flap valves you can prevent the danger of dust and gas explosions and creating a safer environment that protects both people and production.

Since July 1, 2006 all existing industrial sites, as well as new industrial sites, in the EU must be fully ATEX EX compliant. The ATEX EX directives consist of two parts. The first directive, 2014/34/EU deals with responsibilities placed upon manufacturers and suppliers of machinery and equipment for use in explosive atmospheres. While the second directive, 1999/92/EC deals with responsibilities placed upon owners and operators of the equipment.

Read more about ATEX directives in Nederman white paper *"Stricter compliance to rules and regulations will require industrial safety measures and monitoring systems"*.

A safer future for industrial workers

Neither the dust, nor the explosion, can be completely prevented. However, the ATEX and NFPA directives force companies to invest in workplace safety solutions that reduces the risks posed by combustible dust and dust explosions. With the right prevention measures and by following ATEX and NFPA directives, hazardous risk factor for human life, factory equipment and entire industry buildings can be minimised.

Modern technology, proper dust collectors, explosion safety devices and IIoT solutions enables a safer future for factory workers and highly decreases the risks of factory fires and explosions related to combustible dust. Solutions that not only protect works health and life, but also leads to sustainable industries with more efficient operation.