

Combustible Dust Prevention Guide

Understanding Combustible Dust Hazards in the Workplace



Prepared by
The Manufacturing Safety Alliance of BC
October, 2017

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Introduction

This Combustible Dust Prevention Guide, produced by the Manufacturing Safety Alliance of BC, has been developed to provide practical information for determining if a combustible dust hazard is present and how to deal with that hazard. This guide was developed in consideration of WorkSafeBC's OHS regulations 4.46 to 4.53 which covers the risk factors, identification by assessment and controls to be put in place.

The Manufacturing Safety Alliance of BC, formerly known as FIOSA-MIOSA Safety Alliance of BC, was established in December 2007 to reduce the high injury rate in the food and manufacturing industries.

Our mission

We are catalysts for improving workplace health and safety within the BC Manufacturing Industry. Our leading edge health and safety programs, services and tools enable companies to make a difference in the lives of their employees – every day.

Our vision

Partnering with BC's industry leaders to achieve cultural change that ensures safe workplaces for all employees. The Manufacturing Safety Alliance of BC strives to accomplish our mission and vision through the delivery of a variety of core services including:

- Training in areas such as occupational health and safety (OHS) leadership, program building, and auditing
- Consultation and advisory services
- The Occupational Safety Standard of Excellence (OSSE) CoR Certification in partnership with WorkSafeBC

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Characteristics of combustible dust

Combustible dusts are fine particles that present a hazard when suspended in air under certain conditions. Hazards such as dust explosion, or deflagration, can cause catastrophic loss of life, injuries and destruction of assets. Dust accumulations can also cause a fire.

The key parameters of combustible dust are particle size, particle size distribution, particle moisture content and the concentration of dust in the air (including dust accumulations that have the ability to become airborne).

Dust with a moisture content below 33% and 420 microns or less in size – approximately the size of a grain of salt – is considered to be combustible.



Materials that can be combustible

Many materials that are not normally considered combustible can become combustible when the moisture content and particle size is reduced. Within the manufacturing and food processing industry, some of the commonly produced combustible dusts include:



Organic Materials

- Wood
- Textiles



Metals

- Aluminum
- Bronze
- Magnesium
- Zinc
- Titanium



Chemical Dusts

- Sulphur
- Rubber
- Pharmaceuticals
- Pesticides
- Plastics



Agricultural Products

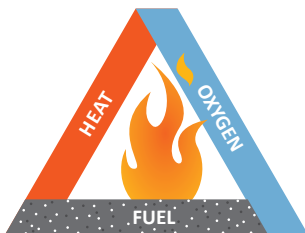
- Sugar
- Powdered Milk
- Corn Starch
- Flour
- Grain
- Potato
- Malt

Hazards of combustible dust

Fire occurs when a fuel (combustible material), in combination with sufficient oxygen, is exposed to a source of heat. Allowing combustible dusts to accumulate increases the fuel; this increases the risk of fire as well as possible chain reactions that cause further fires, explosions or deflagration events.

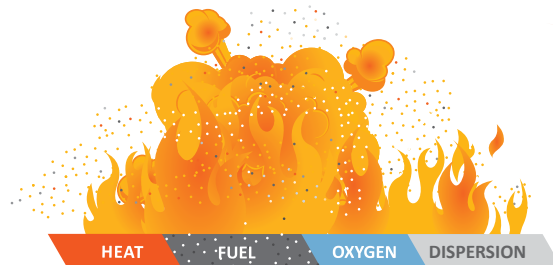
Deflagration is another type of combustion involving fine dusts that catch fire when suspended in the air. When combustible dusts are allowed to be dispersed into a cloud, ignition can cause a very rapid burning of the dust. A small deflagration can disturb more dust, further feeding the cloud and allowing the ignition to travel. Commonly referred to as a fireball, this type of event can quickly move throughout an area.

Explosions are deflagration events that happen in an enclosed or partially enclosed space. When an explosion occurs, it will produce a pressure wave that can rupture the container/ enclosure. Aside from the hazards of the initial rupturing structure, the force of the explosion can disperse other accumulated combustible dusts in the area causing further explosions (possibly including the building structure itself).



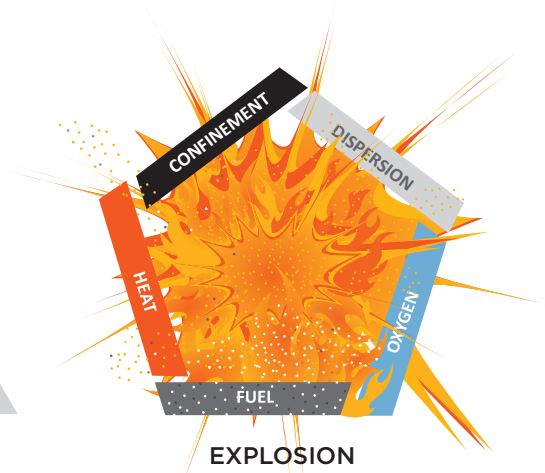
FIRE

Fuel + O₂ + Heat/Ignition



DEFLAGRATION

Fire + Dispersion



EXPLOSION

Deflagration + Containment

Where do I look for combustibile dust?

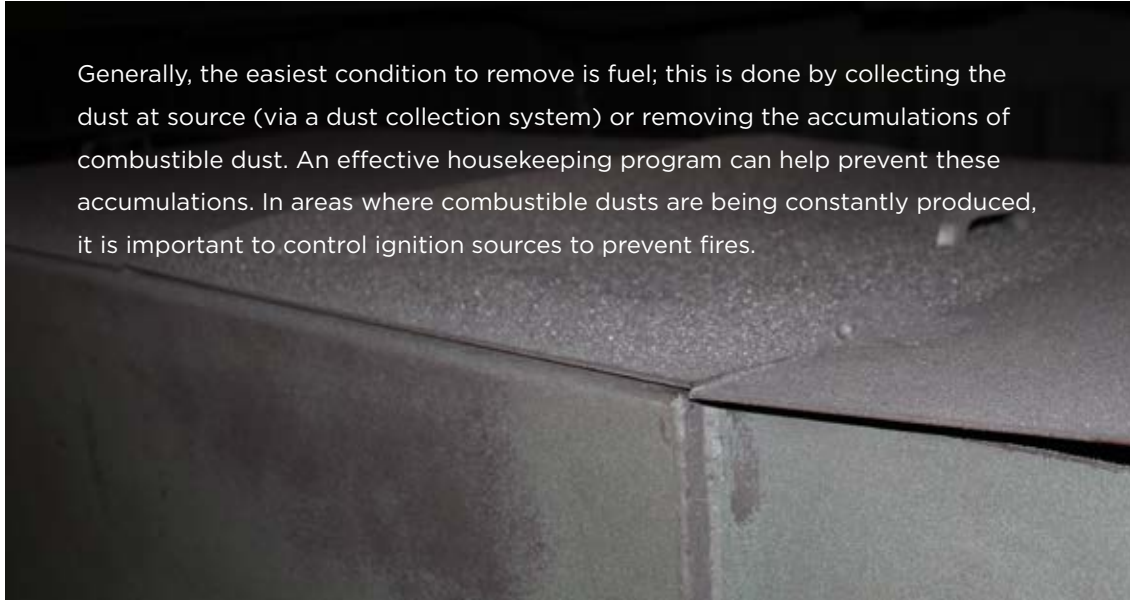
Combustibile dust is generally located inside process equipment such as dust collectors and ductwork, or it has escaped from the process and has settled on horizontal surfaces and roof support structures where it is out of sight and out of reach from most housekeeping inspections.



How do I prevent combustible dust fires?

In order for a fire to take place, three conditions are required: oxygen to support combustion, fuel to burn, and heat or ignition to start the fire. Removing at least one of these conditions will control the hazard.

Generally, the easiest condition to remove is fuel; this is done by collecting the dust at source (via a dust collection system) or removing the accumulations of combustible dust. An effective housekeeping program can help prevent these accumulations. In areas where combustible dusts are being constantly produced, it is important to control ignition sources to prevent fires.



If dust obscures the colour of the surface below, it requires cleaning.



How do I prevent combustible dust deflagrations?

In order for a deflagration to take place, the three conditions for a fire is required plus one more -dispersion. Dispersion is caused when the combustible dust (fuel) is sent airborne causing a cloud; this could be by compressed air discharge, by vibration, impact or pressure wave. Deflagration events can occur inside or outside the process equipment.

The most effective way to prevent deflagration that occurs outside your process equipment is by having an effective housekeeping program. This will prevent combustible dust (the fuel) from accumulating to levels that could create a concentrated cloud of dust. For inside your process equipment, controlling ignition sources (such as hot work, metal contamination, static electricity, etc.) will be the most effective strategy.



How do I prevent combustible dust explosions?

In order for an explosion to take place, the three conditions for a fire is required plus two more—dispersion and confinement. Process equipment, such as dust collectors, provide a confinement structure where all the conditions for an explosion are present with the exception of ignition. The addition of hot work, metal contamination or static electricity can ignite the flammable mixture and create an explosion that can rupture the container—potentially causing a chain-reaction through other areas if fuel is available. The key to controlling explosions in process equipment is to control ignition sources.



How do I protect against combustible dust hazards?

Conducting a hazard assessment on an area-by-area basis is one of the most important first steps. This will identify the combustible dust risks, including ignition sources, as well as possible mitigation controls.

Building a combustible dust management plan will layout the strategy for managing the combustible hazard in your facility; this could include Engineering Controls and Administrative Controls.

Engineering Controls include preventative and detection systems such as:



Spark detection system



Explosion protection system



Fire protection systems

Implementing administrative controls are effective at controlling hazards, and work with engineering controls to provide additional protection.

Administrative controls include such measures as:

- Housekeeping programs and audit standards
- Hot work programs
- Preventative maintenance programs
- Employee and contractor training
- Program review

Dust collection systems: are they adequate?

Statistics show that dust collectors are the most common source of primary explosions.

The National Fire Protection Association (NFPA) recognized this risk and created NFPA 654: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids. An additional standard—NFPA 68: Standard on Explosion Protection by Deflagration Venting—was created to address the protection of dust collectors. The NFPA recognized this risk and created NFPA 654: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids. An additional standard—NFPA 68: Standard on Explosion Protection by Deflagration Venting—was created to address the protection of dust collectors.

For more information on NFPA Standards visit nfpa.org

The screenshot shows the NFPA Catalog website interface. At the top, there is a navigation bar with links for Xchange™, NFPA Journal®, Sparky®, Fire Sprinkler Initiative®, and Firewise USA™. Below this is a header section with the NFPA logo and the word "CATALOG" in large red letters. To the right of the header are links for "Canadian Customers | International Customers", "Cart", "My Profile", and "Sign In", along with a search bar and a "Search" button. A main navigation bar contains links for "HOME", "ADVANCED SEARCH", "LIST OF CODES AND STANDARDS", "NEC®", and "CONTACT US".

The "CATEGORIES" section on the left lists several options: "2017 NEC: National Electrical Code Codes and Standards", "National Fire Codes Subscription - New or Renew", "NEC Online", "NFPA Membership - New or Renew", "NFPA Training", "Browse Products By Topic", "Browse Products by Format", "Resources", and "Translated Products". A specific category entry reads "CMS Adopts 2012 NFPA 101® and 2012 NFPA 99".

The main content area features a large banner for "2017 NFPA® 58" Liquefied Petroleum Gas Code, 2007, with an "Order Now!" button and an image of the code book. Below the banner is a "NEW AND FEATURED PRODUCTS" section with three product cards:

- NFPA 101 and NFPA 80 Fire Door Inspection for Health Care Facilities 1-Day Classroom Training**: Accompanied by an image of a training manual.
- NFPA 101: Life Safety Code Handbook**: Accompanied by an image of the handbook cover.
- NFPA Products and Solutions Catalog (Late Fall 2017)**: Accompanied by an image of the catalog cover.

Unfortunately, many dust collectors in BC do not meet the NFPA code requirements due to inadequate material analysis. This leads to improper equipment selection, putting employers, workers, and company assets at risk. The material that the dust collector will be handling will determine the required size and type of explosion protection required.

Dust collectors can be classified into three broad categories:

Enclosure-Less Dust Collector



Enclosure-less dust collectors have exposed filter bags and are not an explosion risk since there is no containment, but there is a deflagration (fireball) risk.

Dust Collector *without* explosion protection



Dust collectors without explosion protection are designed for collecting non-combustible dust.

Dust Collectors *with* explosion protection



Dust collectors with explosion protection are designed for collecting combustible particulates.

Installing a dust collector that captures combustible dust outside and with a back-flow preventer will protect the building and the employees inside from an explosion. Employees outside of the building need to be shielded from explosion vent areas. Dust collectors located inside the building must be safeguarded with a flameless vent or explosion suppression system designed for the process materials.

Dust collection systems: What to know before you buy

Before purchasing a new dust collection system, or modifying an existing installation, a qualified engineer familiar with the National Fire Protection Association (NFPA) standards should be consulted for design recommendations.

Requests for quotes on dust collection systems should specify clearly “must meet or exceed applicable standards”. Having a dust collection system built to NFPA standards will ensure the safety of workers, protect the company assets, as well as protect the company management from criminal prosecution in the event of a serious incident.

Your dust collection system is a key part of your manufacturing and food processing safety systems. Having a properly designed and installed dust collection system will control respirable and combustible particulate hazards without having additional explosion hazards.

How the Alliance can help

The Manufacturing Safety Alliance of BC employs a team of knowledgeable and experienced Safety Advisors who are available for general consultation – a service that is included with membership.

Combustible Dust Training

The Manufacturing Safety Alliance has developed free online training courses for managers, workers, and contractors to help with combustible dust awareness training. To access these courses, as well as other online training and resources, visit the Alliance's Online Learning Center to create your account. There is no cost to create an account.

Visit the online learning centre: safetyalliancebc.ca/online-learning



Combustible Dust Assessment

Companies can hire the Alliance to produce a combustible dust hazard assessment report and management plan for their facility.

STEP 1: Consultation



First things first, we want to find out your risk level! During your consultation, an advisor will come out to your facility to determine if you have a combination of conditions that put you at risk.

STEP 2: The proposal



If an assessment is needed, the program administrator will send you a service proposal. This will outline the costs and deliverables based on the findings from the consultation. Once this proposal is signed and returned, we can book a date for your service(s).

STEP 3: The deliverables



Our specialist advisor will complete the services agreed to in the proposal which generally includes the production an assessment report and management plan for your records. Awareness training for employees may also be recommended in order to satisfy regulatory requirements.

Call to book a Combustible Dust consultation: 1.604.795.9595

