

A Food Manufacturer's Guide to Fire Prevention Through Housekeeping



NFPA Codes & Standards You Need to Know

The 2008 explosion and fire at the Imperial Sugar Company in Port Wentworth, Georgia, is the best-known example of a combustible dust incident at a food manufacturing plant.

And for good reason: the fire was devastating. It killed 14 people and injured 38 others.

Adding to the tragedy is the fact that the fire was “entirely preventable,” according to the result of an investigation by the U.S. Chemical Safety Board.

“The accident was caused by poor equipment design, poor maintenance, and poor housekeeping. If the dust was not allowed to build up, this terrible accident would not have happened and we would not have had the terrible injuries that we saw.”

~CSB Chairman John Bresland

It was in response to this fire that the food industry started to take combustible dust more seriously.

But perhaps not seriously enough.

The National Fire Protection Association (NFPA) estimates that in 2011, **the total cost of fire in the United States was \$329 billion**, equal to 2.1% of the GDP. And research through the OSHA National Emphasis Program has revealed that **food is a prime culprit for combustible dust fires and explosions.**

OSHA National Emphasis Program Research

- **Food dusts were found in 23% of combustible dust incidents.** For causing problems, food is second only to wood dusts, which were found in 24% of incidents.
- **The food products industry has the most combustible dust incidents, being responsible for 24% of all incidents across all industries.** This time, the race isn't even close -- wood products come in second place at 15%.

Part of the reason the food industry is so susceptible to combustible dust incidents is the vast number of ingredients that can cause problems.

It isn't just the more obvious products, like flour and sugar. Processing ingredients such as alfalfa, hops, lemon pulp, potatoes, and even tomatoes can put a plant at risk of a combustible dust explosion.

To help food companies mitigate their risks of combustible dust fires and explosions, the NFPA has issued several codes and standards covering all fire hazards found in food plants and processes.

This whitepaper reviews the main NFPA codes and standards relevant for fire prevention in the food industry, focusing on guidance related to housekeeping.



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NFPA 61

Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities

Current edition: 2013

Next edition: 2017

NFPA 61 is the main food industry-specific standard for combustible dusts. It applies to three types of food manufacturing facilities:

- All facilities that handle or process dry agricultural bulk materials, their by-products, or dusts including grains, oilseeds, agricultural seeds, legumes, sugar, flour, spices, and feeds.
- All facilities that manufacture and handle starch.
- Seed preparation and meal-handling systems of oilseed processing plants that are not already covered by NFPA 36: Standard for Solvent Extraction Plants.

Examples of Facilities Covered by NFPA 61

- Bakeries
- Flour mills
- Wet and dry corn milling
- Dry milk products
- Cereal processing
- Snack food processing
- Chocolate processing
- Sugar refining and processing

This standard is comprehensive, providing guidance for everything from construction and ventilation to heat transfer operations and pneumatic conveying.

NFPA 61 Housekeeping Guidance

The sections of NFPA that apply specifically to housekeeping are in **Chapter 10: Dust Control**.

NFPA 61 requires food manufacturers to control airborne combustible dusts generated from all processes, equipment, and material transfer points. The dust must be removed concurrently with operations.

NFPA 61 Housekeeping Requirements

- **Dust removal:** Vacuuming is the preferred method of removing dust, particularly in hazardous locations (see NFPA 70: National Electrical Code). Since compressed air causes dust to become airborne, it can be used only after shutting down all machinery and ensuring all ignition sources are under control.
- **Dust emissions:** To prevent dust from escaping from processing equipment into the surrounding environment, NFPA 61 recommends control measures including suppressants, venting systems, and air aspiration.
- **Dust collection:** Dust collection systems and all of their components must be made of noncombustible materials. If a dust collection system shuts down, its related machinery must shut down as well.
- **Centralized vacuum systems:** Centralized vacuum systems require static-conductive cleaning tools and static-dissipative hoses. The air-material separator must provide filtration and be fitted with a system for explosion prevention.
- **Documentation:** Food manufacturers are required to have a documented housekeeping program that specifies both the method and the frequency of cleaning.

NFPA 70

National Electrical Code (NEC)

Current edition: 2014

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NFPA 70 is the National Electrical Code (NEC). The NEC covers everything related to the installation of electrical equipment across all industries and all types of buildings. This code is in force in all 50 states.

Food manufacturers need to be aware of two main sections of NFPA 70 because they apply to housekeeping.

Combustible dust definition

NFPA 70 defines combustible dust as “dust particles that are 500 microns or smaller and present a fire or explosion hazard when dispersed and ignited in air.”

500 microns = 0.02 inches

500 microns is about 0.02 inches. This just goes to illustrate how even very tiny specks can lead to huge problems if they're allowed to accumulate.

Hazardous location classifications

The NEC defines different classes of hazardous (classified) and non-hazardous locations. These classes determine not just the wiring of buildings, but also the equipment and housekeeping procedures that can be used in different areas of facilities.

NFPA 61 specifies that portable vacuum cleaners should be used for dust removal in Class II, Group G, Division 1 locations.



118 EXP: NRTL-Certified Explosion-Proof Vacuum for Classified (Hazardous) Locations

Hazard classes are determined by the type of fire risk they present:

- **Class I locations** are hazardous because of flammable or combustible gases and vapors.
- **Class II locations** are hazardous because of combustible dust.
- **Class III locations** are hazardous because of easily ignitable fibers or combustible flyings.

Class II is divided into three groups based on the type of dust present:

- **Group E locations** contain metal dusts.
- **Group F locations** contain carbonaceous dusts.
- **Group G locations** contain all other combustible dusts, including those from flour, grain, wood, plastic, and chemicals.

The division definitions are a bit more complicated. But for simplicity's sake, we can summarize them like this:

- **Division 1 locations** have enough combustible dust in the air under normal operating conditions to pose a risk of fire or explosion.
- **Division 2 locations** don't normally have enough combustible dust to cause a problem (though abnormal conditions may increase the safety risk).

A Class II, Group G, Division 1 location is hazardous because non-metal, non-carbonaceous combustible dust is present under normal conditions in a concentration high enough to pose a risk.

In these areas, NFPA 61 requires a portable vacuum cleaner to be used for dust removal.

Obviously, there's a lot more to it (NFPA 70 is over 900 pages long). The important thing is to understand that these different classifications exist and that they determine the housekeeping procedures you need to use.

NFPA 652

Standard on the Fundamentals of Combustible Dust

Current edition: 2016

Next edition: 2019

NFPA 652 is a brand new standard for managing combustible dust fires and explosions across industries, processes, and dust types. It was created to clear up confusion between the five industry-specific combustible dust standards:

- **NFPA 61:** Agricultural and food processing facilities
- **NFPA 484:** Combustible metals
- **NFPA 664:** Wood processing and woodworking facilities
- **NFPA 654:** General manufacturing/other industries
- **NFPA 655:** Sulfur

This standard applies to all facilities and operations that deal with combustible dust, not just hazardous, or classified, locations.

NFPA 652 fills in the gaps, providing requirements for situations that were not adequately addressed in the individual industry-specific standards.

Relationship between NFPA 61 and NFPA 652

With more than one standard in place, it can be difficult to know which one to follow. The table below shows which standard food manufacturers should consider primary in cases conflicts may exist.

NFPA 61 or NFPA 652: Which Standard Should You Use?	
Conflict	Standard to Be Applied
Where a requirement in NFPA 61 differs from the requirement in NFPA 652...	NFPA 61
Where a requirement in NFPA 61 prohibits a requirement in NFPA 652...	NFPA 61
Where NFPA 61 neither prohibits or provides a requirement...	NFPA 652
Where a conflict exists between a general requirement and a specific requirement...	NFPA 652 - Specific

Rule of Thumb

Follow the most specific requirement available.
If there is no specific requirement, then apply the general one.

What's new for food manufacturers in NFPA 652?

The biggest change NFPA 652 brings to the table is that it requires a Dust Hazards Analysis, or DHA.

Dust Hazards Analysis

“A systematic review to identify and evaluate the potential fire, flash fire, or explosion hazards associated with the presence of one or more combustible particulate solids in a process or facility.”

According to this new requirement, the owner or operator of any facility where combustible dust exists is responsible for:

- conducting a DHA to identify the hazards
- creating a plan for managing the hazards, and
- providing training for anyone affected by the hazards.

Key Things to Know About NFPA 652 and the DHA

- **NFPA 652 is retroactive.** An insurance company, government inspector, state fire marshal, or other authority having jurisdiction (AHJ) can apply any portion of the standard if there's an unacceptable degree of risk.
- **A dust test is required.** Before you can perform a hazards analysis, you must first test your dust to determine whether it's combustible or explosible. The absence of a previous combustible dust incident is not sufficient to show that a particulate is not combustible or explosible.
- **There are no industry exceptions or automatic grandfathering.** DHAs must be completed for all processes and facilities by September, 2018, which is three years after the standard went into effect.
- **Documentation is required.** Test results as well as historical and published data must be kept on file at all times.

NFPA 652 Housekeeping Guidance

NFPA 652 provides specific guidance about housekeeping and vacuum cleaning.

Similar to NFPA 61, this standard specifies that the cleaning method must match the potential risk. In particular, **NFPA 652 requires cleaning methods to reduce the potential for creating a combustible dust cloud.**

NFPA 652 Housekeeping Recommendations

- Vacuuming is the preferred method of cleaning.
- Sweeping/water washdown is only permitted where vacuuming is not practical.
- Blowdown is only permitted when the methods mentioned above have already been used.

The vacuum you use depends on whether the area is considered classified (hazardous) or unclassified (non-hazardous). Connect with a Nilfisk expert to find the right vacuum cleaner for your food manufacturing facility.

NFPA 654

Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids

Current edition: 2013

Next edition: 2017

NFPA 654 is a general standard for dealing with combustible dust. It doesn't specifically address food manufacturing environments. In fact, NFPA 654 is primarily directed toward the chemical processing industry. However, as it is a general manufacturing standard, many in the food industry have historically turned to it for guidance, particularly before NFPA 652 went into effect.

This is likely to change. At least in terms of housekeeping, the guidelines in this standard are nearly identical to those in NFPA 652. So, for now, food manufacturers probably don't need to be too concerned with NFPA 654. Instead, **concentrate on making sure your facilities and processes comply with NFPA 61 and NFPA 652.**

These last few standards don't specifically discuss housekeeping, but they do apply to food manufacturing.

NFPA 68

Standard on Explosion Protection by Deflagration Venting

Current edition: 2013

Next edition: 2017

NFPA 68 provides requirements for deflagration venting, which includes the devices and systems that vent combustion gases and pressures. The goal is to protect buildings against explosions due to internal heat and pressure.

The following sections provide information related to combustible dusts:

- **Section 6.2.2** provides a formula for calculating vent size in an area where dust is a hazard.
- **Chapter 8** is devoted to deflagration venting for dusts and hybrid mixtures.
- **Chapter 11** details installation and maintenance requirements of vent enclosures.
- **Annex C** discusses a procedure for testing combustible dusts.
- **Annex F** provides characteristics of combustible dusts including several common agricultural dusts.

For more specific information on where deflagration venting is required in food manufacturing facilities, see NFPA 61.

NFPA 69

Standard on Explosion Prevention Systems

Current edition: 2014

Next edition: 2019

NFPA 69 covers alternative explosion prevention methods:

- Control of oxidant concentration
- Control of combustible concentration
- Predeflagration detection and control of ignition sources
- Explosion suppression
- Active isolation
- Passive isolation
- Deflagration pressure containment
- Passive explosion suppression

Performance-Based Codes

If you read any of the standards, you might see a "performance-based option." What does this mean?

In many cases, NFPA allows performance-based design options to substitute for its prescribed processes, materials, and equipment.

What this means is that instead of using the exact solutions set down by NFPA, you can demonstrate compliance using an alternative solution that meets the same fire safety goals. The performance-based code system allows you more flexibility in designing solutions for the unique needs of your food facility and operations.

Not all parts of NFPA standards are eligible for performance-based alternatives. Visit the NFPA website to learn more.

Conclusion

When it comes to fire safety, there is simply a lot to know. Especially with the introduction of NFPA 652, the requirements are stricter than ever before. This means food manufacturers need to double-down on making sure they are aware of -- and actively managing -- the risks in their facilities.

Another fire like the Imperial Sugar Company disaster is simply not an option.

If you haven't performed your Dust Hazards Analysis yet, or you aren't sure what type of vacuum you need to be in compliance, contact us.

We're here to help you keep your facility, your personnel, and your equipment safe.



OSHA Resources

- [Combustible Dust National Emphasis Program](#)
- [Combustible Dust Poster](#)

NFPA Resources

- [NFPA 61: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities](#)
- [NFPA 70: National Electrical Code](#)
- [NFPA 652: Standard on the Fundamentals of Combustible Dust](#)
- [NFPA 654: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Dust Particulate Solids](#)
- [NFPA 68: Standard on Explosion Protection by Deflagration Venting](#)
- [NFPA 69: Standard on Explosion Prevention Systems](#)

About Nilfisk Industrial Vacuums

Nilfisk Industrial Vacuums (Morgantown, PA), a division of Nilfisk, Inc., is one of the largest providers of cleaning equipment in North America. Equipped with exceptionally efficient filtration systems and user-friendly features, the company's vacuums play a critical role in thousands of manufacturing facilities and industrial processes across North America. Supported by a direct sales force and an extensive dealer network, Nilfisk Industrial Vacuums helps customers solve a variety of cleaning challenges, including combustible dust, general maintenance, overhead cleaning, abatement, process integration, laboratory/cleanroom control, and more.

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