

Combustible Dusts Safety & Compliance Game Plan



Combustible dust hazards are among the easiest to underestimate. Because dust appears harmless and accumulates slowly, companies often treat it as a housekeeping nuisance rather than a time bomb ready to detonate at any moment. **Exhibit A:** One of Canada's worst workplace disasters—the 1992 [Westray Mine explosion](#) that killed 26 miners—demonstrates how combustible materials and airborne dust can combine with ignition sources to produce devastating [fires and explosions](#). Industries at the highest risk include food processing, agriculture, wood products, chemicals, pharmaceuticals, plastics, and metal fabrication. Here's a 12 step Game Plan for controlling these hazards and complying with Occupational Health and Safety [\(OHS\) combustible dusts requirements](#).

The Combustible Dust Explosion Chain

For dust explosions and fires to occur, four things must be present simultaneously.

1. **Combustible Dust:** There must be fuel in the form of dust particles from combustible materials, such as wood, coal, rubber, grain, sugar, flour, cotton,

cardboard, or aluminum.

2. **Dispersion:** The dust cloud must be widely dispersed and concentrated above what's called the lower explosive limit (LEL) at which it's capable of producing a flash of fire if ignited.
3. **Oxygen:** The area in which the dust particles are present must contain oxygen.
4. **Ignition Source:** The combustible dust cloud must be exposed to a source of ignition such as sparks, static electricity, friction, open flames, or hot surfaces.

If these four elements are present, ignition of the combustible dust will cause what's called "deflagration," or rapid combustion. If deflagration takes place in an area that's enclosed, like a building, room, or vessel, it may release pressure high enough to produce an explosion.

Take 12 Steps to Control Combustible Dust Hazards

Essentially, OHS laws require employers to interrupt this explosion chain by taking measures that prevent these elements from converging.

Step 1. Determine If Combustible Dusts Are Present at Your Workplace

The first step is simply to determine whether there are any combustible dusts at your own workplace. In so doing, consider the materials you handle and the operations you conduct. Processes that generate combustible dust include:

- Grinding or milling grain or flour.
- Cutting or sanding wood products.
- Handling powdered chemicals or plastics.

- Processing aluminum, magnesium, or other metals.
- Food manufacturing (sugar, spices, milk powder).

What To Do: Collect dust samples from equipment, floors, and surfaces and send them to a lab for explosibility testing, a form of analysis that measures properties such as minimum ignition energy, dust explosibility (Kst value), and minimum explosion concentration. Assume that any dust you don't test **is** combustible unless and until proven otherwise.

Step 2. Perform a Hazard Assessment of All Identified Combustible Dusts

Perform a [hazard assessment](#) of the combustible dusts you identify. Calculate whether such dusts are found in concentrations at or above the LEL for the particular substance(s) that comprise them. Determine if combustible dusts at or above the LEL are exposed to any sources of ignition.

What To Do: Have a [competent person](#) perform a hazard assessment following a process similar to a “dust hazard analysis” used in National Fire Protection Association (NFPA) standards that identifies where the elements needed to create a combustible dust explosion are likely to converge, including:

- Locations where combustible dust accumulates such as surfaces, floors, structural beams, and lighting fixtures.
- Equipment that generates dust.
- Enclosed spaces where dust clouds may form.
- Potential ignition sources.

Map out and mark any high-risk areas of the facility, such as conveyors, silos, bins, dust collectors, and bagging and packaging lines.

Step 3. Consider Substitution or Total Elimination of Combustible Dust Hazards

The next challenge is to determine how to control the combustible dust hazards you identify, following the “hierarchy of controls” approach.

What To Do: First, consider whether it’s [reasonably practicable](#) to totally eliminate the hazard by getting rid of the materials and/or processes that generate combustible dusts and substituting safer alternatives. Unfortunately, while substitution is the best possible solution, it’s rarely a viable option.

Step 4. Select Engineering Controls to Manage Combustible Dust Hazards

The next level of the hierarchy is the use of [engineering controls](#) that physically prevent the combustible dusts at your site from accumulating and coming together with ignition sources.

What To Do: Key engineering systems to consider for controlling combustible dust hazards may include:

- Local exhaust ventilation at or enclosure of dust-producing equipment.
- Centralized dust collection systems.
- Explosion-vented dust collectors that are properly rated for use with combustible dusts.
- Isolation devices to prevent explosion propagation.

Step 5. Implement Housekeeping Measures to Control Combustible Dust Accumulation

Dust buildup is one of the key ingredients of dust explosions, including small primary explosions that disturb settled dust

and trigger much larger explosions.

What To Do: In addition to engineering controls like work surfaces made of materials that don't collect dusts, use work/administrative controls to prevent hazardous dust buildup. Among the most important work control is implementing [combustible dust safety policies](#), including a strict housekeeping program that provides for:

- Scheduled cleaning of floors, beams, and equipment.
- Removal of dust layers before they reach dangerous concentrations.
- Use of explosion-safe vacuum systems instead of compressed air.
- Use of cleaning methods that produce minimum amounts of heat and friction.

Best Practice: Ensure dust accumulation doesn't exceed 1/32 inch/0.079375 cm (roughly the thickness of a paper clip) over large surface areas. Also keep a [Housekeeping Log](#) documenting the regular efforts you take to check for dust accumulations and other dust fire and explosion hazards and promptly clean or correct any problems you identify.

Step 6: Control Ignition Sources

It's crucial to identify and take steps to control all equipment and conditions capable of igniting dust fires and explosions at your workplace. Common ignition sources include:

- Static electricity.
- Hot surfaces.
- Sparks from metal contact.
- Electrical equipment.
- Forklifts and other powered mobile equipment.
- Open flames or welding operations.
- Cigarettes and cigarette lighters.

What To Do: Key ignition source controls to consider:

- Grounding and bonding systems.
- [Restrictions on types of powered mobile equipment](#) that can be used in high-risk areas.
- Mandatory [permits for welding and hot work](#) operations.
- Spark detection and suppression systems.
- Use of tools and equipment that don't generate sparks or heat.
- No smoking bans.

Step 7. Implement Explosion Protection Measures

Personal protective equipment (PPE) is the bottom of the hierarchy of controls, a last-resort measure to guard workers against the hazards that can't be eliminated. Conceptually at least, explosion protection systems are like PPE for dust fires and explosions.

What To Do: If combustible dust hazards are unavoidable, consider using explosion protection systems like:

- Explosion venting panels
- Explosion suppression systems
- Explosion isolation valves
- Deflagration barriers.

Such controls are particularly important for enclosed equipment like silos, dust collectors, conveyors, and processing vessels.

Step 8. Implement Routine Inspections & Housekeeping Protocols

Routine inspection is crucial to prevent dust accumulations before they reach hazardous levels.

What To Do: Establish a schedule and protocols for routine dust inspections of all work areas, especially less obvious spaces like ceiling areas, ventilation systems, beams, lighting fixtures, ducts, and equipment. Designate inspectors and provide them checklists to ensure they inspect thoroughly.

Step 9. Ensure Workers Receive Combustible Dust Safety Training

What To Do: Ensure all workers get training covering:

- What combustible dust is.
- How dust fires and explosions occur.
- Housekeeping, ignition sources, and methods of controlling combustible dust hazards.
- Safe cleaning practices.
- Reporting dust accumulation.
- Emergency response and evacuation procedures.

Step 11. Monitor Your Combustible Dust Safety Measures

Continually monitor your current combustible dusts controls to determine if they're effective and identify problems that require corrections.

What To Do: Regular monitoring should take place at least once a year as well as:

- During regular safety committee inspections of work areas containing combustible dusts.
- As part of incident investigations of fires, explosions, and other combustible dust events.
- In response to significant changes not accounted for in your current hazard assessment, such as the introduction of new and potentially hazardous equipment or work processes.

- Step 12. Keep Records Documenting Your Combustible Dust Safety Measures

If OHS inspectors show up at your site after a dust fire or explosion, they'll demand proof that you took all the measures required by OHS laws to control combustible dust hazards. Such records will also be key to making out a due diligence defence in case you're ever penalized or charged with a combustible dust offence.

What To Do: Maintain records of:

- Dust testing results.
- Hazard assessments.
- Housekeeping logs.
- Training provided and steps taken to verify that workers understood it.
- Inspections.
- Incident reports, including investigation findings.
- Monitoring performed.
- Corrective actions implemented.