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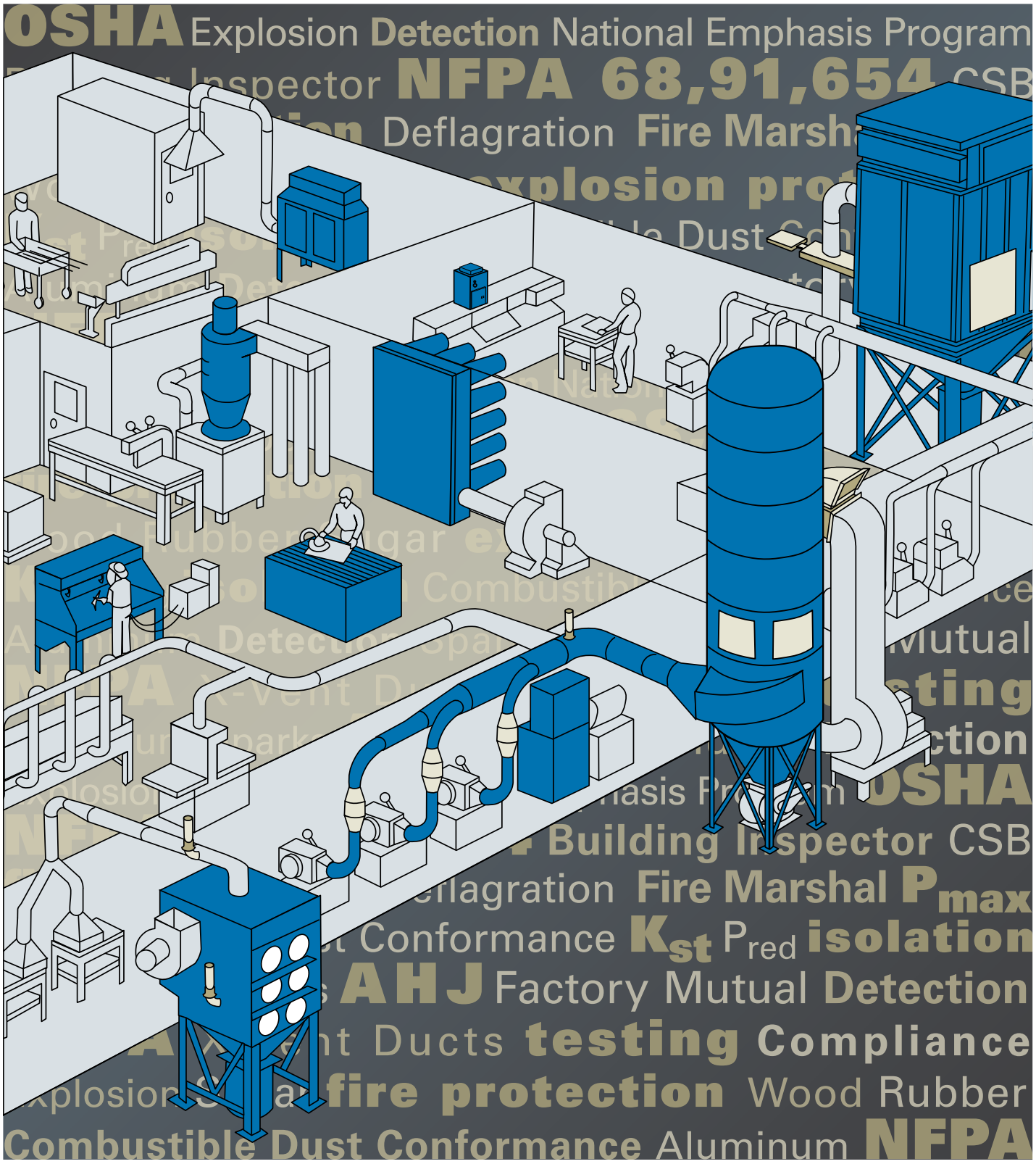
DUST COLLECTORS AND COMBUSTIBLE DUST STRATEGIES



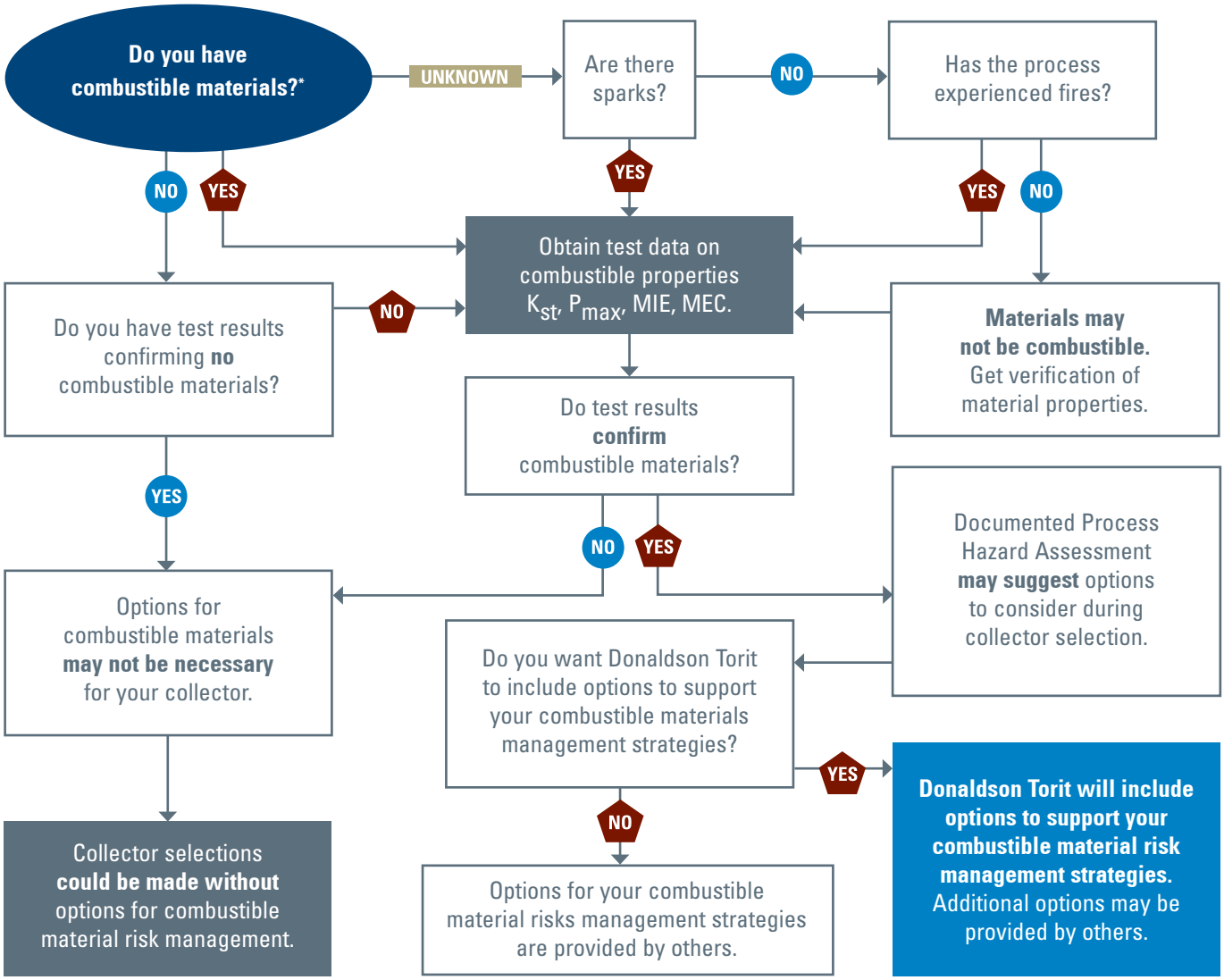
The U.S. Occupational Safety and Health Administration (OSHA) has issued a National Emphasis Program and continues to communicate with most industries on the hazards of combustible dust. The agency's focused effort is targeted at reducing combustible dust risks in industrial plant settings. **Is your plant effectively managing the risks associated with combustible dust in its processes?**

For decades Donaldson Torit has been providing quality dust collectors that have become an integral part of many plant's combustible dust compliance strategies. Donaldson remains active in supplying dust collectors to support your combustible dust control strategy by interfacing with you and your experts on fire and explosion protection equipment and strategies.

This document is intended to increase your understanding of typical combustible dust management strategies and some of the components involved.

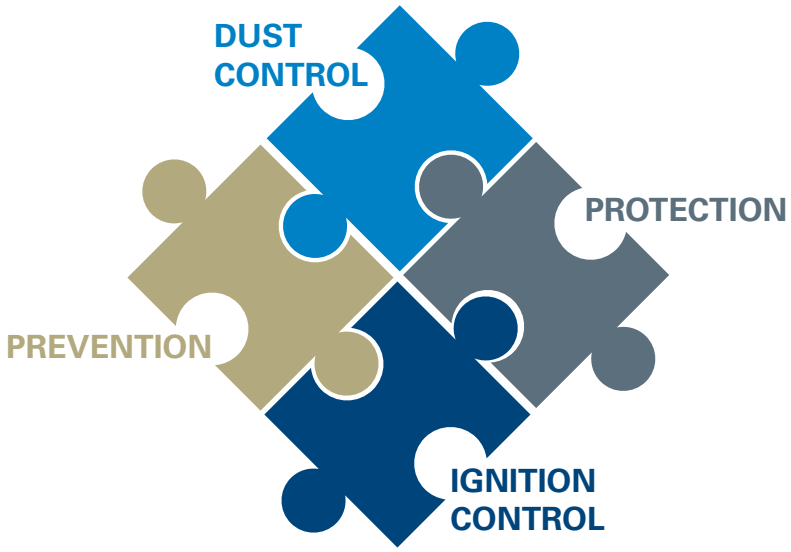
WHERE TO START?

A Donaldson Torit representative can review your operational challenges to help you better understand how to integrate dust collection into your combustible dust management strategy. The following considerations are designed to help you decide how you want Donaldson Torit to support your combustible dust management strategy:



* See the partial list from OSHA on page 6.

COMPLIANCE STRATEGY COMPONENTS*



UNDERSTANDING THE BASICS

Many manufacturing processes create very small particles of dust which may become airborne, where they settle on surfaces and in crevices throughout the plant. Eventually these particles not only create a housekeeping issue, but if the particles are combustible, they can represent a potentially explosive dust cloud if disturbed.

It is essential for plant leaders to understand the risks of combustible dust and ensure they manage combustible dusts in their facilities. Donaldson Torit can supply dust collectors to support your combustible dust control strategy by interfacing with you and your experts on fire and explosion protection equipment and solutions. Combustible dusts generally present both fire and explosion risks so it may help to consider the management of these risks separately (see side bar).

WHY DUST COLLECTORS SHOULD BE PART OF YOUR STRATEGY DECISION

Many process requirements may make elimination of combustible dust, mist, or fume impractical. However, it may still be very possible to manage the dispersion of dust within your plant by using an appropriate and effective industrial ventilation system including dust collection. A well designed, maintained, and operated industrial ventilation system including good hoods, proper duct sizes, and properly selected collection equipment can provide effective dust control and can therefore help manage the presence of dispersed dust. This not only reduces housekeeping frequency and expense, but could also help you reduce the risk of dust explosions in your facility, particularly the destructive secondary explosions, by helping reduce the presence of dispersed fuel in your facility.

* For more information, please see page 6.

FIRE TRIANGLE

Fire management strategies traditionally focus on the control or elimination of one of the three key elements necessary for a fire — often represented by the “fire triangle." Managing one or more of the elements in the triangle can decrease the fire risk.

FIRE TRIANGLE

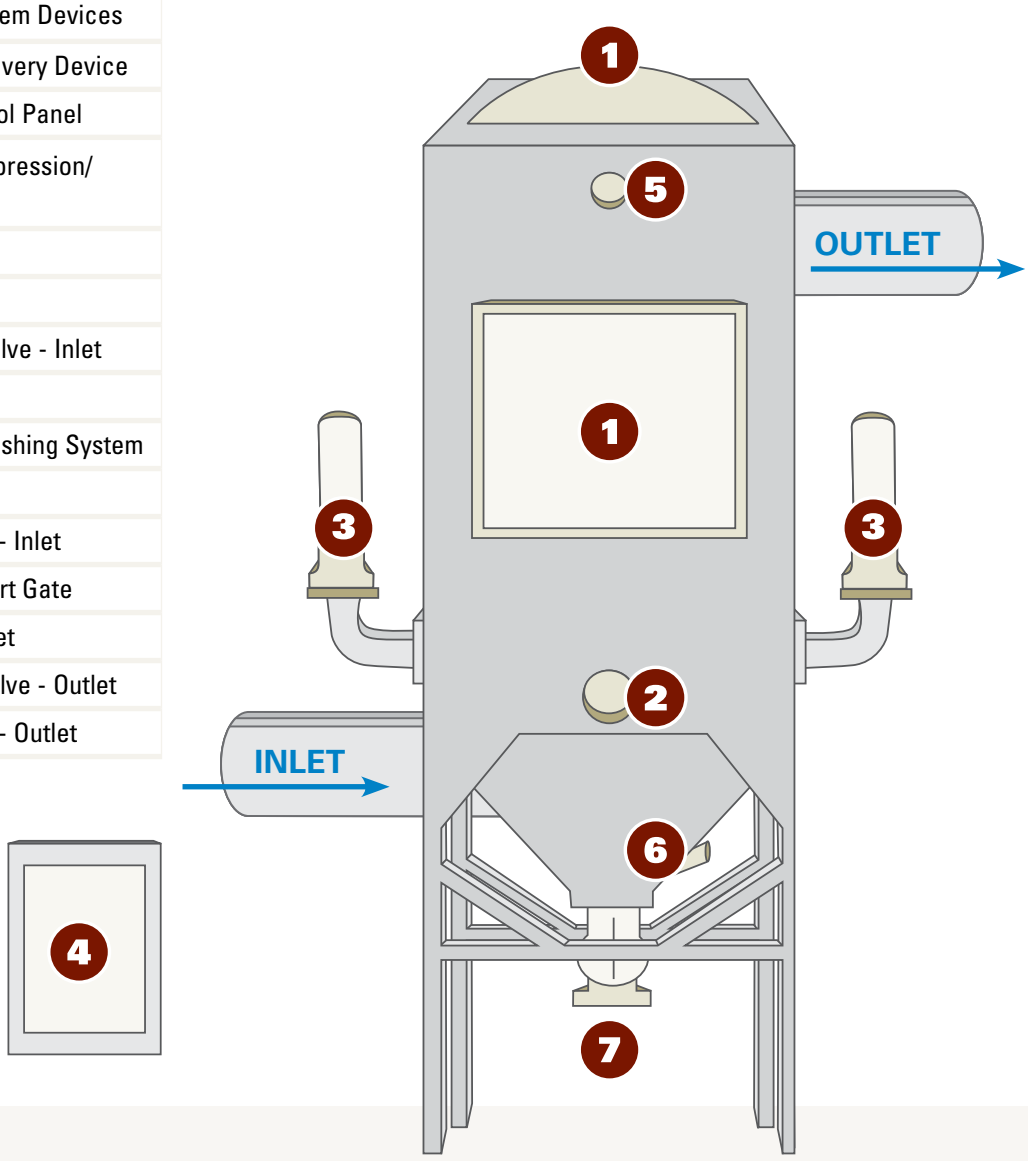
EXPLOSION PENTAGON

Explosion risk management strategies consider a slightly expanded set of elements often represented as an “explosion pentagon.” In addition to the key elements from the fire triangle — fuel, heat, and oxygen, the explosion pentagon includes two additional elements necessary for an explosion: “Dispersion of Dust” and “Confinement of Dust.” As with fire management strategies, the management or removal of one or more of the elements in the explosion pentagon can reduce the explosion risk. While many explosion management strategies focus on controlling the same elements in the fire triangle, explosion risk management strategies that focus on the dispersion of dust, or the containment of dust alone, may require a separate strategy to address any remaining fire risks.

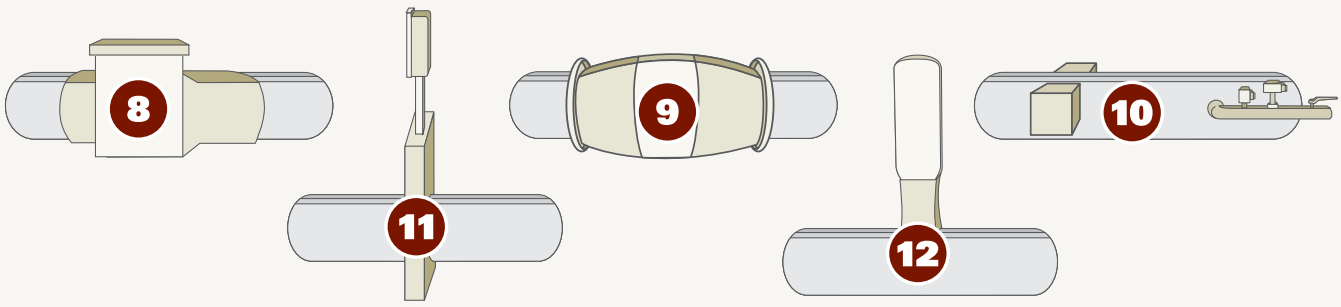
To be compliant with OSHA regulations, you must meet other requirements and all applicable standards or codes.
Visit **www.osha.gov** to find OSHA regulations.

GUIDE TO EXPLOSION/FIRE PROTECTION COMPONENTS FOR DUST COLLECTORS

ITEM #	DESCRIPTION
1	Explosion Relief Panels
2	Detector / Sensor – Chemical or Actuated System Devices
3	Chemical Suppressant Delivery Device
4	Suppression System Control Panel
5	Fire Extinguisher/ Fire Suppression/ Sprinkler Coupling
6	Overflow Drain
7	Rotary Valve/ Airlock
8	Flow Actuated Isolation Valve - Inlet
9	In-line Spark Abatement
10	Spark Detection & Extinguishing System
11	Actuated Knife Gate - Inlet
12	Chemical Isolation Device - Inlet
13	Automatic Fast Acting Abort Gate
14	Actuated Knife Gate - Outlet
15	Flow Actuated Isolation Valve - Outlet
16	Chemical Isolation Device - Outlet

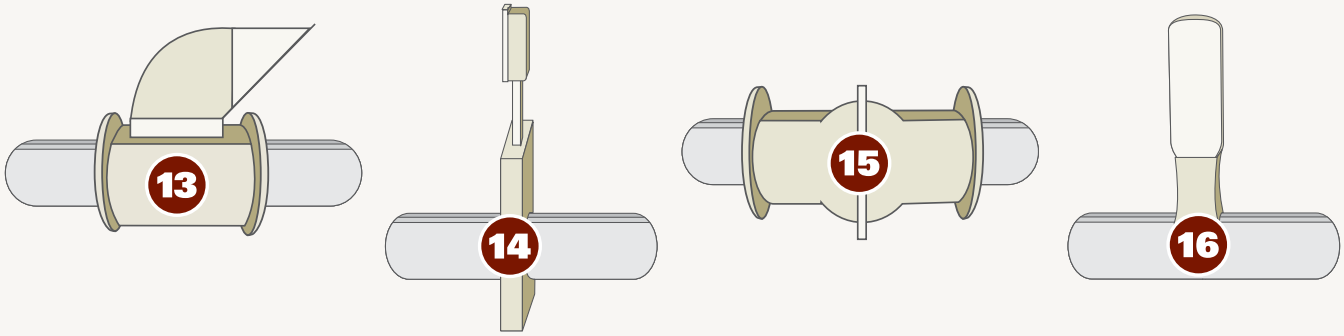


INLET OPTIONS



		Item #	Some Components in Risk Management Strategies for: EXPLOSION	FIRE
FIRE PROTECTION				
	Fire Extinguisher/ Fire Suppression / Sprinkler Coupling	5		✓
	Overflow Drain	6		✓
	Automatic Fast Acting Abort Gate	13		✓
	In-line Spark Abatement	9		✓
	Spark Detection & Extinguishing System	10		✓
EXPLOSION PROTECTION				
MECHANICAL	Explosion Relief Panels	1	✓	
CHEMICAL	Chemical Suppressant Delivery Device	3	✓	
	Suppression System Control Panel	4	✓	
	Detector / Sensor – Chemical or Actuated System Devices	2	✓	
DUST COLLECTOR ISOLATION				
INLET				
MECHANICAL	Actuated Knife Gate – Inlet	11	✓	
	Flow Actuated Isolation Valve – Inlet	8	✓	
CHEMICAL	Chemical Isolation Device – Inlet	12	✓	
	Suppression System Control Panel	4	✓	
	Detector / Sensor – Chemical or Actuated System Devices	2	✓	
HOPPER				
	Rotary Valve/ Airlock	7	✓	✓
OUTLET (IF AIR IS RETURNED TO THE BUILDING)				
MECHANICAL	Actuated Knife Gate – Outlet	14	✓	
	Flow Actuated Isolation Valve – Outlet	15	✓	
CHEMICAL	Chemical Isolation Device – Outlet	16	✓	
	Suppression System Control Panel	4	✓	
	Detector / Sensor – Chemical or Actuated System Devices	2	✓	

OUTLET OPTIONS



As a process owner, you are responsible for the selection of your combustible material management strategy and to assure compliance with all applicable federal, state, and local codes and standards.

DEFINITIONS

Authority Having Jurisdiction (AHJ): an organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure

A_v (Vent Area): Calculated from P_{red}, container volume, K_{st}, P_{max} and P_{stat}

Combustible dust: a combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape

Deflagration: propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium

Detonation: propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium

Explosion: the bursting or rupturing of an enclosure or container due to the development of internal pressure from a deflagration

K_{st} (Deflagration Index for Dust): the maximum rate of pressure rise during a contained deflagration of an optimum mixture

Millisecond (msec): 1,000th of a second
Time for light to travel: 300km in a vacuum=1 msec
Honeybee wing flap= 5 msec
Reaction speed of a human= 100 msec
Blink of a human eye= 300-400 msec

P_{max} (Maximum Pressure): the maximum pressure developed in a contained deflagration of an optimum mixture

P_{red} (Reduced Pressure): the calculated maximum pressure developed in a vented enclosure during a vented deflagration

P_{stat} (Static Activation Pressure): the pressure that activates a vent closure when the pressure is increase slowly (with a rate of pressure rise less than 0.1 bar/min)

TSP (Total Suppressed Pressure): pressure in an enclosure after a suppressed event

STANDARDS, CODES, & GUIDELINES THAT IMPACT DUST COLLECTOR DECISIONS

NFPA STANDARD	DESCRIPTION
INDUSTRY AND APPLICATION SPECIFIC STANDARDS	
61	Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
484	Standard for Combustible Metals
664	Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
33	Standard for Spray Application Using Flammable or Combustible Materials
DESIGN STANDARDS	
654	Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
68	Standard for Explosion Protection by Deflagration Venting
69	Standard on Explosion Prevention Systems
91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids

Many standards and codes may influence your decisions on dust control, including local, state, and federal regulations. **Knowing the codes that apply to your facility is critical, and you should always research the code requirements in your area.** A few commonly referenced standards for combustible dust risk management strategies include those issued by: National Fire Protection Association (NFPA), the International Mechanical Code, the International Fire Code, Factory Mutual Property Loss, and OSHA (federal).

Since each Authority Having Jurisdiction may have a specific set of codes it references, you may need to have general knowledge of more than one standard or code. Some of the most commonly referenced standards are published by NFPA, including both design and operational standards focused on combustible dust (see above).

Since these standards are often cited by OSHA, and have been adopted as code in many areas of the country, they may be a good starting point for consideration in developing your combustible dust management strategy.

OSHA ON COMBUSTIBLE DUST*

Does your company or firm process any of these products or materials in powdered form? *See side bar.***

If so, there is potential for a "Combustible Dust" explosion.

Dust Control Measures

The dust-containing systems (ducts and dust collectors) are designed in a manner (i.e., no leaking) that fugitive dusts are not allowed to accumulate in the work area.

The facility has a housekeeping program with regular cleaning frequencies established for floors and horizontal surfaces, such as ducts, pipes, hoods, ledges, and beams, to minimize dust accumulations within operating areas of the facility.

The working surfaces are designed in a manner to minimize dust accumulation and facilitate cleaning.

Protection Measures

The facility has an emergency action plan.

Dust collectors are not located inside of buildings. (Some exceptions)

Rooms, buildings, or other enclosures (dust collectors) have explosion relief venting distributed over the exterior wall of buildings and enclosures.

Explosion venting is directed to a safe location away from employees.

The facility has isolation devices to prevent deflagration propagation between pieces of equipment connected by ductwork.

The dust collector systems have spark detection and explosion/deflagration suppression systems.

Emergency exit routes are maintained properly.

Ignition Control Measures

Electrically-powered cleaning devices such as vacuum cleaners, and electrical equipment are approved for the hazard classification for Class II locations.

The facility has an ignition control program, such as grounding and bonding and other methods, for dissipating any electrostatic charge that could be generated while transporting the dust through the ductwork.

The facility has a HotWork permit program.

Areas where smoking is prohibited are posted with "No Smoking" signs.

Duct systems, dust collectors, and dust-producing machinery are bonded and grounded to minimize accumulation of static electrical charge.

The facility selects and uses industrial trucks that are approved for the combustible dust locations.

Prevention Measures

The facility has separator devices to remove foreign materials capable of igniting combustible dusts.

MSDSs for the chemicals which could become combustible dust under normal operations are available to employees.

Employees are trained on the explosion hazards of combustible dusts.

Agricultural Products
Egg white
Milk, powdered
Milk, nonfat, dry
Soy flour
Starch, corn
Starch, rice
Starch, wheat
Sugar
Sugar, milk
Sugar, beet
Tapioca
Whey
Wood flour

Agricultural Dusts
Alfalfa
Apple
Beet root
Carrageen
Carrot
Cocoa bean dust
Cocoa powder
Coconut shell dust
Coffee dust
Corn meal
Cornstarch
Cotton
Cottonseed
Garlic powder
Gluten
Grass dust
Green coffee
Hops (malted)
Lemon peel dust
Lemon pulp
Linseed
Locust bean gum
Malt
Oat flour
Oat grain dust
Olive pellets
Onion powder
Parsley (dehydrated)
Peach
Peanut meal & skins
Peat
Potato
Potato flour
Potato starch
Raw yucca seed dust
Rice dust
Rice flour
Rice starch
Rye flour
Semolina
Soybean dust
Spice dust
Spice powder
Sugar (10x)
Sunflower
Sunflower seed dust
Tea
Tobacco blend
Tomato
Walnut dust
Wheat flour
Wheat grain dust
Wheat starch
Xanthan gum

Carbonaceous Dusts
Charcoal, activated
Charcoal, wood
Coal, bituminous
Coke, petroleum
Lampblack
Lignite
Peat, 22% H_20
Soot, pine

Cellulose
Cellulose pulp
Cork
Corn

Chemical Dusts
Adipic acid
Anthraquinone
Ascorbic acid
Calcium acetate
Calcium stearate
Carboxy-methylcellulose
Dextrin
Lactose
Lead stearate
Methyl-cellulose
Paraformaldehyde
Sodium ascorbate
Sodium stearate
Sulfur

Metal Dusts
Aluminum
Bronze
Iron carbonyl
Magnesium
Zinc

Plastic Dusts
(poly) Acrylamide
(poly) Acrylonitrile
(poly) Ethylene (low-pressure process)
Epoxy resin
Melamine resin
Melamine, molded (phenol-cellulose)
Melamine, molded (wood flour & mineral filled phenolformaldehyde)
(poly) Methyl acrylate
(poly) Methyl acrylate, emulsion polymer
Phenolic resin
(poly) Propylene
Terpene-phenol resin
Urea-formaldehyde cellulose, molded
(poly) Vinyl acetate/ ethylene copolymer
(poly) Vinyl alcohol
(poly) Vinyl butyral
(poly) Vinyl chloride/ ethylene/vinyl acetylene suspension copolymer
(poly) Vinyl chloride/ vinyl acetylene/ emulsion/copolymer

* Information on this page from "Combustible Dust—Does your company or firm process any of these products or materials in powdered form?" OSHA Poster, (2008).
** The above list from OSHA should not be considered complete, nor should it replace the need to obtain validated test data on your dust.

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Dust Collectors and Combustible Dust Strategies Brochure (1/11)