



Date: December 7, 2023
To: City of Houston HPW-HPC
Attention: CCM
From: Jensen Hughes
Subject: IFC – Combustible Dust

This technical memo is provided to describe the significant changes to the Houston Construction Code with regard to the new changes related to the requirements of combustible dust.

Since combustible dust presents such a hazard that results in catastrophic incidents, in order to aid the inspector and fire code official, **Chapter 22** of the 2021 International Fire Code was completely revised to provide more guidance.

Section 2201.1 contains exceptions for facilities that store or display combustible dust, such as retail or storage facilities. In general, this chapter is directed towards facilities where the release of dust into the atmosphere is anticipated.

Section 2203.1, **Section 2203.2**, and **Table 2203.1** were added to provide guidance to the code user during an inspection. Critical depth layers of dust greater than shown on the table may provide an adequate quantity of dust which can result in a dust explosion. **Section 2203.1** allows for a more in-depth analysis by adjusting the critical depth value based on NFPA standards or a dust hazard analysis from **Section 2205**.

Section 2203.3 was added so the dust collection system has to comply with the International Mechanical Code for cleaning and inspection.

Section 2203.4 was added because ignition sources must be controlled. It includes provisions for limitations on open flames, bonding and grounding, smoking, classified electrical, fuel-fire equipment, and hot surfaces/equipment.

Section 2203.5 addresses housekeeping and cleaning due to the accumulation of dust. A new exception is added to allow the use of pressurized air after other methods have been completed. Vacuuming cannot reach in certain nooks and crevices, so this new exception was added.

Section 2203.6 is to provide guidance for inspection, maintenance, and testing in a facility by having a standard operational procedure.

Section 2203.7 was added because it is required for an emergency response plan in preparation for a dust explosion.

Section 2203.8 specifies the training for new employees for housekeeping requirements, emergency response plans, and standard operating procedures.

Section 2204 makes a dust explosion screening test necessary for specific types of dust. Where the materials are proven to be combustible and explosible, additional testing can be performed to better understand how a specific hazard can be addressed.

memo.

Section 2205 provides the fire code official with the ability to require specific compliance with a standard that is applicable to a particular application, so NFPA 68, Standard on Explosion Protection by Deflagration Venting, and NFPA 77, Recommended Practice on Static Electricity, were added. The chapter retains the provision to require a dust hazard analysis for both new and existing facilities in **Section 2205.1.1**.

2021 Fire Code Changes –

SECTION 2201 GENERAL.

2201.1 Scope. The equipment, processes and operations involving dust explosion hazards **and use or handling of combustible** dust shall comply with the provisions of this **chapter code and NFPA 652.**

Exceptions:

1. Storage and use of consumer materials in Group B or R occupancies.
2. Storage and use of commercially packaged materials in Group M occupancies.
3. Materials displayed in original packaging in Group M occupancies and intended as building materials or for personal or household use.
4. Storage of sealed containers of combustible dust at facilities not associated with an operation that uses, handles or generates combustible dust.
5. Materials stored or used in farm buildings or similar occupancies intended for on-premises agricultural purposes.

2201.2 Permits. Permits shall be required for combustible dust-producing operations as set forth in Section 105.5.

SECTION 2202 DEFINITIONS.

2202.1 Definition. The following terms are defined in Chapter 2:

COMBUSTIBLE DUST.

DUST COLLECTION SYSTEM.

SECTION 202 GENERAL DEFINITIONS.

Dust Collection System. A combination of equipment designed to contain, capture, and collect airborne combustible dusts.



**SECTION 2203
PRECAUTIONS DUST EXPLOSION PREVENTION.**

~~**2203.1 Owner Responsibility.** The owner or operator of a facility with operations that manufacture, process, blend, convey, repackage, generate or handle potentially combustible dust or combustible particulate solids shall be responsible for compliance with the provisions of this code and NFPA 652.~~

2203.1 Critical Depth Layer. The maximum dust layer on all surfaces, including but not limited to walls, ceilings, beams, equipment, furniture, pipes and ducts, shall not exceed the critical depth layer specified in Table 2203.1. The critical depth layer is permitted to be adjusted for explosion hazard where further evaluated in accordance with one of the following:

1. Section 7.2.1.3 of NFPA 654.
2. Section 4.1.3.3 of NFPA 664 for wood flour.
3. Accumulated combustible dust shall be collected by one of the methods listed in Section 2203.5.

**TABLE 2203.1
CRITICAL DEPTH LAYER**

TYPE OF DUST	CRITICAL DEPTH LAYER (INCHES)
Wood flour	1/8
All other dusts	1/32

For SI: 1 inch = 25.4 mm.

~~**2203.2 Dust Hazard Analysis (DHA).** The requirements of NFPA 652 apply to all new and existing facilities and operations with combustible dust hazard. Existing facilities shall have a dust hazard analysis (DHA) completed in accordance with Section 7.1.2 of NFPA 652.~~

~~The fire code official shall be authorized to order a dust hazard analysis to occur sooner if a combustible dust hazard has been identified in a facility that has not previously performed an analysis.~~

2203.2 Dust-Producing and Dust-Handling Equipment. Dust-producing equipment and dust-handling equipment, including but not limited to vacuums, dust collection systems, dryers, mixers, blenders, separators, conveyors, storage containers, silos, or other similar devices, shall be listed and shall be maintained in accordance with the manufacturer's recommended standards.

2203.2.1 Signages and Markings. Signages and markings shall be provided in accordance with Sections 2203.2.1.1 through 2203.2.1.3.

2203.2.1.1 Deflagration Vent Discharge Area Markings. Where dust collection systems and other equipment, systems or system components are provided with deflagration vents, the area within the deflagration vent's discharge area shall be marked in an approved manner.

2203.2.1.2 Caution Signs. Signs that read as follows shall be posted near the dust-containing equipment with deflagration vents:

CAUTION: THIS EQUIPMENT CAN CONTAIN EXPLOSIVE DUST.



KEEP OUTSIDE THE MARKED AREA WHILE EQUIPMENT IS OPERATING.

2203.2.1.3 Warning Signs. Where dust collection systems and other equipment, systems or system components are provided with deflagration vents, vent closures shall be clearly marked as follows:

WARNING: EXPLOSION RELIEF DEVICE. STAY CLEAR.

~~**2203.3 Sources of Ignition.** Smoking, the use of heating or other devices employing an open flame, or the use of spark-producing equipment is prohibited in areas where combustible dust is generated, stored, manufactured, processed or handled.~~

2203.3 Dust-Collection and Dust-Conveying Systems. Dust-collection and dust-conveying systems shall be in accordance with Sections 2203.3.1 through 2203.3.3.

2203.3.1 Dust-Collection Systems. Dust-collection systems shall be designed to collect dust emissions from dust-producing equipment at the point of generation. Dust-collection systems shall be in accordance with Section 511 of the International Mechanical Code.

Exception: Closed systems using listed equipment and designed in accordance with manufacturer's recommendations and specifications, where cleanouts are provided in accordance with Section 2203.3.3.

Heating, ventilation, and air conditioning (HVAC) systems shall not be used as the means to collect dusts from localized sources.

2203.3.1.1 Location. Dust collectors shall be located outside of buildings.

Exceptions:

1. Dust collectors inside buildings complying with Section 511 of the International Mechanical Code.
2. Wet-type dust collectors specifically listed for the type of dust conveyed shall be permitted inside buildings where in accordance with the manufacturer's instructions and specifications.
3. Dust collectors designed to specific NFPA standards listed in Table 2205.1 for the specific type of dust conveyed.

2203.3.1.2 Minimum Conveying Velocities. The minimum velocities within ducts used as part of the dust collection system shall be in accordance with Table 2203.3.1.2.



**TABLE 2203.3.1.2
MINIMUM CONVEYING VELOCITIES.**

TYPE OF PRODUCT	FEET PER MINUTE
Fine light dust such as cotton, lint and wood flour (100 mesh and under)	2,000
Dry dust such as fine rubber molding powder	2,500
Average dust such as sawdust, grinding dust and coal dust	3,500
Heavy dust such as metal turnings, including aluminum and magnesium powder	4,000

For SI: 1 foot per minute = 0.00508 m/s.

2203.3.2 Plastic Ducts and Conveying Systems. Plastic, fiberglass, other nonconductive ducts, duct liners or pipes shall not be used as part of ducts and conveying systems. Ductwork utilizing a combustible lining shall be permitted only in high-impact areas and where approved. Flexible hose shall be permitted if designed and installed in accordance with the following requirements:

1. Manufactured of static dissipative construction.
2. Used only for connections and isolation purposes.
3. Limited to 18 inches (457 mm) in length.
4. Properly grounded.

2203.3.3 Cleanouts. Openings in enclosed equipment and conveyors shall be provided to allow access to all parts of the equipment and conveyors to permit inspection, cleaning, maintenance and the effective use of portable fire extinguishers or hose streams. Cleanouts for ducts used as part of the dust-collection system shall be in accordance with the International Mechanical Code.

~~**2203.4 Housekeeping.** Accumulation of combustible dust shall be kept to a minimum in the interior of buildings. Accumulated combustible dust shall be collected by vacuum cleaning or other means that will not place combustible dust into suspension in air. Forced air or similar methods shall not be used to remove dust from surfaces.~~

2203.4 Sources of Ignition. Sources of ignition shall be controlled in accordance with Sections 2203.4.1 through 2203.4.9.5.

2203.4.1 Classified Electrical. Classified electrical shall be in accordance with NFPA 70. Electrical motors and electrical components of the equipment shall not be installed in the dust-laden airstream unless listed for Class II, Division 1, locations.

2203.4.2 Static Electricity. Bonding and grounding is required to minimize accumulation of static electric charge in the following locations:

1. Dust-producing equipment.
2. Dust-collection system.



3. Pneumatic dust-conveying systems conveying combustible dust from one location to another, combustible dust conveyors, piping and conductive components. Conveying systems include transport modes such as railcars, hopper cars, boxcars, tank cars and trucks into which or from which commodities or products are pneumatically conveyed.
4. Conveying systems using metallic piping.

2203.4.3 Hot Works. Hot work and similar spark-producing operations shall not be conducted in or adjacent to combustible dust -producing areas unless precautions have been taken to provide safety. Hot work shall be permitted only in safe, designated areas in accordance with Chapter 35. Hot work is prohibited on equipment that is operating.

2203.4.3.1 Signs. Conspicuous signs with the following warning shall be posted in the vicinity of combustible dust -producing areas or in the vicinity of combustible dust use:

NO WELDING. THE USE OF WELDING OR CUTTING EQUIPMENT IN OR NEAR THIS AREA IS DANGEROUS BECAUSE OF FIRE AND EXPLOSION HAZARDS. WELDING AND CUTTING SHALL BE DONE ONLY UNDER THE SUPERVISION OF THE PERSON IN CHARGE.

2203.4.4 Hot surfaces and hot equipment. In areas where a dust explosion hazard or dust flash fire hazard exists, the temperature (in degrees Celsius) of external surfaces shall be maintained below 80 percent of the lower of the dust-surface ignition temperature or the dust-cloud ignition temperature for worst-case dusts. External surfaces shall include but are not limited to:

1. Compressors.
2. Steam, water or process piping.
3. Ducts.
4. Conveyors.
5. Process equipment.

Where steam pipes or hot surfaces occur in dust-producing or dust-handling areas, accumulation of dust on the surfaces shall be minimized by an approved method.

Exception: Drying apparatus listed for the intended use and installed in accordance with the manufacturer's instructions.

2203.4.5 Powered Industrial Trucks. Powered industrial trucks used in electrically classified areas shall be listed for such use.

2203.4.6 Smoking Prohibited. Smoking shall be prohibited in or adjacent to dust-producing or dust-handling areas. "No Smoking" signs complying with Section 310 shall be conspicuously posted in such areas. Smoking shall be permitted only in designated areas.

2203.4.7 Spark-Producing Devices. Spark-producing devices shall not be located within 20 feet (6096 mm) of areas requiring classified electrical unless separated by a permanent partition.

2203.4.8 Self-Heating Materials. Materials in silos and other large storage piles of particulates prone to self-heating shall be in accordance with Section 9.4.11 of NFPA 652.

2203.4.9 Open Flames and Fuel-Fired Equipment. Open flames and fuel-fired equipment shall be in accordance with Sections 2203.4.9.1 through 2203.4.9.5.

2203.4.9.1 Release of Airborne Combustible Dust. Production, maintenance, or repair activities that have the potential to release or force combustible dust to become airborne shall not be conducted within 35 feet (11 m) of an open flame or pilot flame.

2203.4.9.2 Space Heaters. Fuel-fired space heaters drawing local ambient air shall not be located within electrically classified areas. Space-heating appliances in dust-producing or dust-handling areas shall be located where not subject to the accumulation of deposits of combustible dust.

2203.4.9.3 Equipment Listing. Fuel-fired process equipment shall be listed for its intended use and shall be operated and maintained in accordance with the manufacturer's instructions.

2203.4.9.4 Inspection and Preventive Maintenance. Inspection and maintenance of fuel-fired process equipment shall include verification that significant combustible dust accumulations do not exist within or around the equipment.

2203.4.9.5 Sources of Combustion Air. In Class II electrically classified locations, heating units shall be provided with a source of combustion air ducted directly from the building exterior or from an unclassified location.

2203.5 Housekeeping. Accumulation of combustible dust on surfaces inside buildings shall be maintained below the critical depth layer in Section 2203.1. Pressurized air or similar methods shall not be used to remove dust from surfaces. Accumulated combustible dust shall be collected by one of the following methods:

1. Portable vacuum cleaners listed for use in Class II, Group G, Division 1, atmospheres as defined in NFPA 70.
2. Dust collection systems.
3. Other approved means that will not place combustible dust into suspension in air.

Exception: Forced air or similar methods shall be permitted to remove dust in accordance with NFPA 652, NFPA 654 or NFPA 664.

2203.6 Standard Operational Procedures. Dust-producing equipment and all associated equipment, including dust-collection equipment, shall be maintained in accordance with the manufacturer's instructions and specifications and applicable codes. The inspection, testing and maintenance program shall include the following, as applicable:



1. Fire and explosion protection and prevention equipment, as applicable, in accordance with the appropriate NFPA standards.
2. Dust-control equipment.
3. Control of potential ignition sources.
4. Electrical, process and mechanical equipment, including applicable process interlocks.
5. Lubrication of bearings for dust-collection, dust-handling and dust-producing equipment.
6. Additional maintenance in accordance with the manufacturer's instructions and specifications for dust-collection, dust-handling and dust-producing equipment.

Records shall be kept of maintenance and repairs performed. The standard operating procedures shall be submitted to the fire code official for review and approval. The written standard operating procedures shall be signed by the person responsible for facility operations.

2203.7 Emergency Response Plan. A written emergency response plan shall be developed for preventing, preparing for and responding to work-related emergencies, including but not limited to fire and explosion. The following information shall be developed into the plan:

1. Identification of dust hazards.
2. Identification and location of all utilities to affected areas.
3. Site plans or floor plans locating utility shutoff controls, including water, gas and power.
4. The potential for explosion.
5. Locations of fire-extinguishing equipment compatible with the hazards present.
6. Any additional information required by the fire code official.

2203.8 Training. The plans and procedures required in Sections 2203.5, 2203.6 and 2203.7 shall be approved by the fire code official. The plans and procedures shall be reviewed annually and updated as required by process changes. Initial and annual refresher training shall be provided to employees who are involved in operating, maintaining and supervising facilities that handle combustible dust. Initial and annual refresher training shall include:

1. Workplace hazards.
2. General orientation, plant diagrams and plant safety rules.
3. Process description or flowchart.
4. Equipment operation, safe startup and shutdown, and response to hazard conditions or an incident.
5. The location and use of all related fire and explosion protection and prevention systems.
6. Equipment maintenance requirements and practices, including visual inspections of conveyors and ducts.
7. Housekeeping requirements, including the maintenance of the critical depth layer in Section 2203.1.
8. Emergency response plans as required in Section 2203.7.

The employer shall maintain records of initial and annual training and review.

SECTION 2204

ADDITIONAL REQUIREMENTS DUST EXPLOSION SCREENING TESTS.

2204.1 Specific Hazards Standards. ~~The industry or commodity specific codes and standards listed in Table 2205.1 shall be complied with based on the identification and evaluation of the specific fire and deflagration hazards that exist at a facility.~~

2204.1 Combustibility and Explosivity Tests. Where combustibility or explosivity screening tests are required to analyze the combustible dust as part of compliance with Section 104.8 and Section 414.1.3 of the International Building Code, they shall be in accordance with Section 5.4 of NFPA 652.

2204.2 Samples. Representative samples for the screening test shall be obtained in accordance with Section 5.5 of NFPA 652.

SECTION 2205

STANDARDS

2205.1 Specific Hazards Standards. The fire code official is authorized to enforce additional industry- or material-specific provisions of the codes and standards listed in Table 2205.1 to prevent and control dust explosions, as applicable.

**TABLE 2204.1 TABLE 2205.1
SPECIFIC HAZARDS STANDARDS EXPLOSION PROTECTION STANDARD.**

STANDARD	SUBJECT
NFPA 61	Standard For the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
NFPA 68	Standard on Explosion Protection by Deflagration Venting
NFPA 69	Standard on Explosion Prevention Systems
NFPA 70	National Electrical Code
NFPA 77	Recommended Practice on Static Electricity
NFPA 85	Boiler and Combustion System Hazards Code
NFPA 120	Standard for Fire Prevention and Control in Coal Mines
NFPA 484	Standard for Combustible Metals
NFPA 654	Standard for Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids
NFPA 655	Standard for the Prevention of Sulfur Fires and Explosions
NFPA 664	Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

2205.1.1 Dust Hazard Analysis. If a dust hazard analysis (DHA) is required by the fire code official for new or existing facilities and operations, it shall be in accordance with NFPA 652. The DHA for existing facilities shall be in accordance with Section 7.1.1 of NFPA 652.

