

# Deadline 2020: New Dust Analysis in NFPA 61 and NFPA 652

Matt Bujewski, PE, ARM

St. Louis

MJB Risk consulting



EDUCATIONAL WEBINAR SERIES

# Objectives

- Describe history of NFPA 652 and NFPA 61
- Discuss Dust Hazard Analysis Checklist from NFPA 61

# Polling Question

Are you familiar with/regularly use these NFPA standards:

- A. NFPA 61
- B. NFPA 652
- C. Both
- D. Neither

# Imperial Sugar Explosion February 2008



- 14 killed
- 36 injured

# Imperial Sugar Explosion



- Poor housekeeping
- Overloaded dust collectors
- Equipment maintenance
- Poor Management of Change

# Imperial Sugar Explosion

- Chemical Safety Board Investigation
- Confusion over which NFPA documents to use
- Congressional hearings and a call for more regulation
- OSHA proposed Combustible Dust rule

# NFPA 652 (Standard on the Fundamentals of Combustible Dust)

- Developed out of a perceived need to provide basic requirements for handling combustible dust.
- 2016 was the first addition and set a requirement to complete a dust hazard analysis within 3 years of the effective date of the standard. This would be 2019.
- 2019 edition of NFPA 652 sets a date of September 7, 2020 to complete the dust hazard analysis.
- It requires the dust hazard analysis to be reviewed and updated every 5 years.



# NFPA 61 (Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities)

- First adopted in 1923 for grain terminals and flour mills. Modern version adopted in 1995 with the combining of several agricultural dust documents.
- Applicable to all facilities that receive, handle, process, dry, blend, use, mill, package, store, or ship dry agricultural bulk materials, their by-products, or dusts that include grains, oilseeds, agricultural seeds, legumes, sugar, flour, spices, feeds, dry dairy/food powders, and other related materials
- Applicable to all facilities designed for manufacturing and handling starch, including drying, grinding, conveying, processing, packaging, and storing dry or modified starch, and dry products and dusts generated from these processes
- Applicable to those seed preparation and meal-handling systems of oilseed processing plants not covered by NFPA 36
- 30 members on the committee including me, Ag Processing, AFIA, Ardent Mills, Cargill, General Mills, GEAPS, NGFA
- Dust hazard analysis required by 2022



# Conflicts

## From NFPA 61

### 1.4.1

Where a requirement specified in this industry-specific standard differs from a requirement specified in NFPA 652, the requirement in this standard shall be permitted to be used instead.

### 1.4.2

Where a requirement specified in this standard specifically prohibits a requirement specified in NFPA 652, the prohibition in this standard shall be permitted.

### 1.4.3

The requirements of this standard shall be applied or construed so as not to create an unreasonable risk to public food safety.

# Correlating Committee on Combustible Dusts

- Oversees all of the dust documents

Industry dust documents include:

- NFPA 61 Agricultural Dust
- NFPA 484 Combustible Metals
- NFPA 652 Fundamentals of Combustible Dust
- NFPA 654 Combustible Particulate Solids (mostly for the chemical industry)
- NFPA 655 Sulfur Fires and Explosions
- NFPA 664 Woodworking Facilities
- 14 members on the committee (including me)
- Cargill is the only grain industry representative on the committee

# Retroactive

- Normally the requirements of the standard are not retroactive and a facility would only need to be upgraded to the current standard if there were major modifications or new processes/buildings.
- The requirement for a dust hazard analysis is retroactive, however.
- Dust hazard analysis is also required for new construction or significant modifications that exceed 25% of the replacement cost of the equipment.

# Polling Question

What document do you follow to perform a dust hazard analysis at a grain handling facility?

- A. NFPA 61
- B. NFPA 652
- C. Both
- D. Neither

# Is there a need?

- Minneapolis, MN Washburn “A” Mill – 1878
- Westwego, LA – 1977
- Cambria, WI – May 2017
- Northrup, MN – December 2017
- South Sioux City, NB – May 2018
- Crystal City, Manitoba – August 2018



# Who's in Charge?

- OSHA
- Local fire marshal or building code official
- NFPA
- Insurance company

# Dust Hazard Analysis (Chapter 7)

Purpose of Dust Hazard Analysis: To identify hazards in the process and document how those hazards are being managed. The hazards addressed are the fire and explosion hazards of combustible dusts.

Very minimal prescriptive requirements in Chapter 7

- Responsibility
- Criteria
- Methodology



# Dust Hazard Analysis (Chapter 7)

## Responsibility and Criteria

- Owner/operator is responsible to ensure the dust hazard analysis(DHA) is completed.
- The DHA shall evaluate the fire, deflagration, and explosion hazards and provide recommendations to manage the hazards.
- The DHA shall be performed or led by a qualified person.
- The results of the DHA review shall be documented, including any necessary action items requiring change to the process materials, physical process, process operations, or facilities associated with the process.

# Dust Hazard Analysis (Chapter 7)

## Qualified Person

- The qualified person who is leading or performing the DHA should be familiar with conducting a DHA and with the hazards of combustible dusts.
- Typically, a team performs a DHA. This team is made of a variety of persons whose background and expertise can include the following:
  - Familiarity with the process
  - Operations and maintenance
  - Process equipment
  - Safety systems
  - History of operation
  - The properties of the material
  - Emergency procedures
- The individuals involved in the DHA could include facility operators, engineers, owners, equipment manufacturers, or consultants.

# Dust Hazard Analysis (Chapter 7) Methodology

The DHA shall include the following:

- Identification and evaluation of the process or facility areas where fire, flash fire, and explosion hazards exist
- Where such a hazard exists, identification and evaluation of specific fire and deflagration scenarios shall include the following:
  - Identification of safe operating ranges
  - Identification of the safeguards that are in place to manage fire, deflagration, and explosion events
  - Recommendation of additional safeguards where warranted, including a plan for implementation
- The DHA shall be based on data obtained in accordance with Chapter 5 for material that is representative of the dust present.

# Hazard Identification (Chapter 5)

## Do You Have a Combustible Dust?

- The owner/operator shall be permitted to either assume the dust is combustible or determine the combustibility.
- To determine combustibility you can:
  - Use historical or published data that is representative of the current conditions
  - Analyze a representative sample
  - Samples can be tested using the ASTM E1226 Standard Test Method for Explosivity of Dust Clouds
  - Samples can also be tested using the ASTM E1515 Standard Test Method for Minimal Explosible Concentration of Combustible Dusts
  - Or and equivalent testing methodology

# Hazard Identification (Chapter 5)

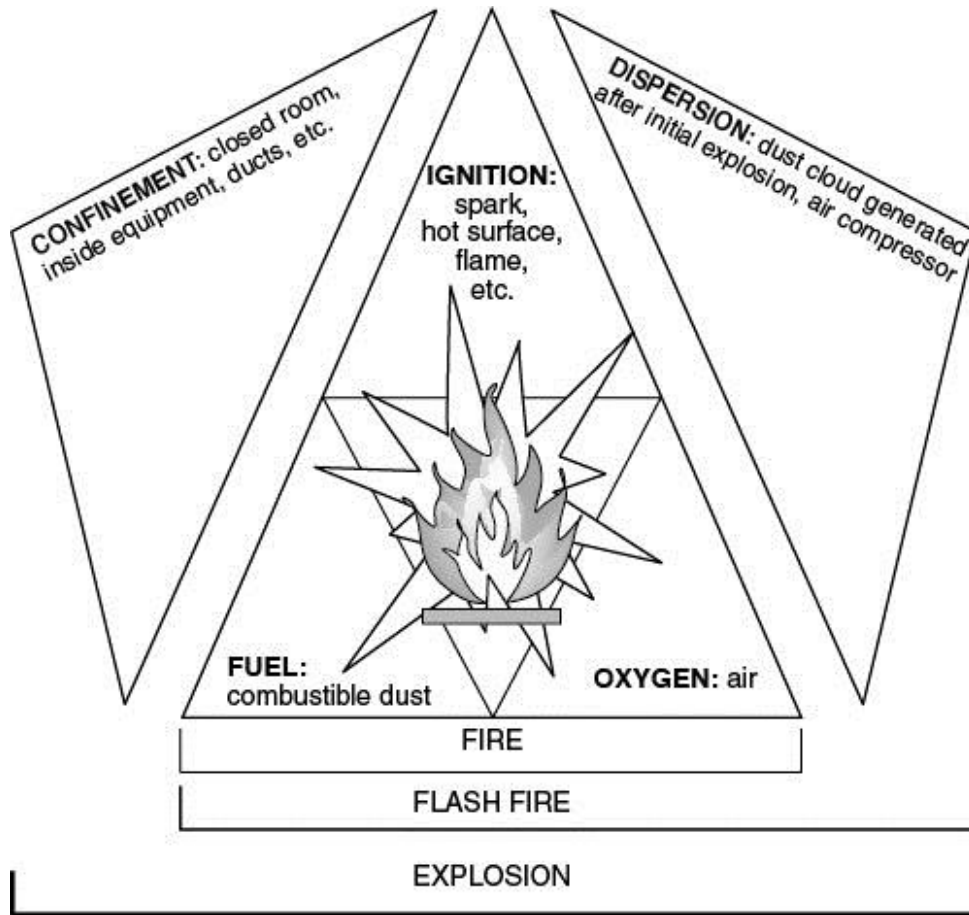
## Will the Combustible Dust Explode?

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

The DHA should consider the four conditions that are required for a deflagration:

- (1) A combustible particulate solid of sufficiently small particle size to deflagrate
- (2) A combustible particulate solid suspended in air to deflagrate (or other oxidizing medium)
- (3) A combustion particulate solid suspension of sufficiently high concentration to deflagrate
- (4) A competent igniter applied to the suspension of combustible particulate solids where the concentration is sufficient for flame propagation

# Hazard Identification (Chapter 5)



# Polling Question

Fuel, an ignition source, and an oxidant are required for fire. What additional items are required for an explosion?

- A. Dispersion of the dust but no enclosure
- B. Dispersion of the dust in an enclosure
- C. No dispersion of the dust in an enclosure
- D. None of the above



# Dust Hazard Analysis (Chapter 7)

Possible Methods to Performing a Dust Hazard Analysis include:

- Checklist
- What-if analysis
- Failure mode and effects analysis
- Fault tree analysis
- Hazard and Operability (HAZOP) study
- Additional guidance on performing a DHA is available in the NFPA *Guide to Combustible Dust* and in the AIChE *Guidelines for Hazard Evaluation Procedures*. process.

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Employee Training

- Are employees made aware of the combustible dust hazards
- Does the training include housekeeping, cleaning equipment, maintenance, critical safety devices, and hot work
- Is combustible dust training provided annually to technical personnel involved in new projects and everyday engineering
- Are combustible dust hazard identification procedures in place
- Are contractors trained on the dust hazards present in the facility

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Housekeeping

- Are there written housekeeping and inspection procedures
- Does the housekeeping program address high priority areas such as floors within 35 feet of bucket elevators, the area around grinding equipment, and dryer areas
- Are dust accumulations on building ledges, beams, roof maintained below acceptable limits (e.g. 1/8-inch)
- Is the use of compressed air or other means that can cause dust to be suspended in air permitted only after all ignition sources have been de-energized.
- Is the storage of combustible and flammable liquids and gases in a detached building or separate room.

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Preventive Maintenance

- Is there a formal preventive maintenance program for dust handling/producing/processing equipment that specifically includes verification of grounding and bonding
- Is explosion venting inspected in accordance with NFPA 68
- Are all critical safety systems tested at least annually
- Are bearings maintained per manufacturers guidelines and kept free from excessive grease, product, and combustible dust
- Are records of preventive maintenance activities and testing programs maintained

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### **Dry Solid Product Movement and Storage**

- Do receiving systems have a means to remove tramp metal before the elevator leg or processing equipment (e.g. hammer mills)
- Is grounding and bonding provided for trucks and rail cars and any flexible connections
- Is the process dust tight
- Where explosion venting is used, is there a record of the vent design basis and is the flame ball trajectory verified as safe
- Are process connections isolated to prevent propagation of a dust explosion

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Receiving and Storage – Elevator Legs

- Are leg casing head and boot systems dust tight
- Are bearings mounted externally
- Are head and boot sections provided with inspection openings to allow clean out and inspect belt tracking, lagging, and discharge
- Are all elevator legs appropriately protected with explosion venting
- Do all elevators have hazard monitoring such as bearing temperature, slip switches, and belt alignment (e.g. rub blocks)

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### **Receiving and Storage – Conveyor Systems**

- Are belts static conductive, oil resistant, and fire retardant
- Is bearing temperature provided and interlocked to shut down
- Are conveyor emergency stops provided and tested
- Are flippers, plows, and wipers installed and functioning properly
- Is there an inspection program for conveyor covers to reduce fugitive dust



# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Electrical

- Has an electrical survey been conducted to identify areas that may be Class II, Division 1 or Class II, Division 2 locations
- Does electrical equipment and wiring in an area meet the requirements of the hazard classification
- Is there a management of change procedure to maintain the electrical classification
- Are MCC rooms pressurized/sealed from fugitive dust
- Is infrared testing done on electrical equipment to detect hot spots that could start a dust fire

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Dust Filter Systems

- Are dust collectors installed outside, or if inside protected by an explosion suppression system or flameless venting
- Are pressure gages and alarms provided to indicate blockage
- Is dust prevented from being returned directly to the elevator leg
- Are ducts isolated to prevent propagation of a dust explosion
- Is there a change schedule for dust collector bags or other filter media

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Grain Processing

- Are hammer mills and other processing equipment equipped with spark detection
- Are magnets or other means to remove tramp metal provided upstream of the hammer mills/grinding equipment
- Is the equipment grounded and bonded
- Are screw/drag, or en-masse conveyors fully enclosed and designed to stop if the discharge becomes plugged
- Is processing equipment adequately sealed to reduce fugitive dust

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Grain Dryers

- Does the dryer have a high temperature interlock to shut down the burners, fans, and flow of product into and out of the dryer
- Does the dryer have a low level alarm and shut down interlock
- Does the dryer have a fire suppression system
- Are documented operating procedures in place for dryer startup, shutdown, normal operation, power failure, cleaning, and inspection of critical safety systems
- Is there a procedure/capability to remove any burning grain from the dryer (e.g. emergency dump)

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### **Hazard Monitoring and Alarms**

- Are critical hazard monitoring devices tied into an audible alarm
- Has a system been established to ensure alarm systems are tested regularly and records are kept
- Is there a history of any problems with the hazard monitoring devices
- Are procedures established to take appropriate action if a critical hazard monitoring device is bypassed

# Dust Hazard Analysis Checklist

## NFPA 61 Annex F

### Emergency Response

- Is there an overall site emergency response plan
- Does the emergency response plan have specific procedures for grain bin/silo fires
- Are fire hoses provided where required by NFPA 61
- Is the local fire department aware of firefighting procedures for grain fires and potential dust explosions
- Is there adequate means of egress from the top of the elevator/silos/ and tunnels

# Dust Hazard Analysis Checklist NFPA 61 Annex F

## **Additions being considered for the 2020 Edition:**

- Materials evaluation
- Building and facility design
- Ignition source control
- Marine towers
- Recycling of filtered air
- Heat transfer systems (steam)



# Dust Hazard Analysis (Chapter 7) Documentation

The results of the Dust Hazard Analysis review shall be documented and include:

- Any action items requiring change to the process materials
- Any action items requiring change to the physical process
- Any action items requiring change to the process operations or facilities associated with the process.

The hazard management document for all the areas of the process should include, but not be limited to, the following:

- Test reports
- Drawings
- Sizing calculations for explosion venting

# Deadline 2020: New Dust Analysis in NFPA 61 and NFPA 652

## Questions?

Thank You

Matt Bujewski

Matt.Bujewski@mjbriskconsulting.com

President

MJB Risk Consulting

MJB 

---

Risk consulting

---



EDUCATIONAL WEBINAR SERIES