NFPA 61 Overview

Brendan Coughlan – Director of EHS

The Mennel Milling Company

NFPA 61

- Current Edition 2017
- Applies to:
  - All facilities that receive, handle, process, dry, blend, use, mill, package, store, or ship dry agricultural seeds, legumes, sugar, flour, spices, feeds, dry dairy/food powders, and other related materials
  - 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
  - See preparation and meal-handling systems of oilseed processing plants not covered by NFPA 36.

Move or Be Pushed to Comply

- Insurance
- AHJs (Local FDs/Building Code Enforcement)
- OSHA
  - OSH ACT of 1970 Section (5)(a)(1): The employer did not furnish employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to employees in that employees were exposed to combustible wheat flour dust deflagration, explosion or other fire hazards while working...AMONG OTHER METHODS, A FEASIBLE METHODS TO CORRECT THIS HAZARD WOULD BE TO FOLLOW NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARDS - NFPA 61...

NFPA 61 Supporting Documents

- NFPA 68
  - Standard on Explosion Protection by Deflagration Venting
- NFPA 69
  - Standard on Explosion Prevention Systems
- NFPA 652
  - Standard on the Fundamental of Combustible Dust
- NFPA 70
  - National Electrical Code
- NFPA 101
  - Life Safety Code

NFPA 61

- General Requirements
- Prescriptive Approach (Chapters 5,7,8 & 9)
- Performance-based Approach (Chapter 6)

NFPA 61 Prescriptive Approach

- Chapter 5 – Hazard Identification
- Chapter 7 – Dust Hazard Analysis (DHA)
- Chapter 8 – Hazard Management: Mitigation & Prevention
- Chapter 9 – Management Systems

NFPA 61 Prescriptive Approach

- Chapter 5 – Hazard Identification
  - Know your dust – Via Testing
    - ASTM E1226 (Go/No Go)
    - ASTM E1515 (MEC Determination)
    - MEC – The minimum concentration of a combustible dust suspended in air, measured in mass per unit volume, that will support a deflagration.
    - MIE – The lowest capacitive spark energy capable of igniting the most ignition-sensitive concentration of a flammable vapor-air mixture or a combustible dust-air mixture as determined by a standard test procedure.
    - P_{Max} – The maximum pressure developed in a contained deflagration of an optimum mixture.
    - K_{St} – The deflagration index of a dust cloud

NFPA 61 Prescriptive Approach

- Chapter 5 – Hazard Identification
  - Know your dust – Via Published Data
    - Table A.5.2.2 of NFPA 61

Table A.5.2.2 20-L Sphere Test Data — Agricultural Dusts

Dust Name	Percent Moisture	Median Particle Size (μm)	Percent < 200 Mesh (%)	P_{max} (bar g)	(1) K_{St} (bar m/sec)	Minimum Explosive Concentration (g/m^3)	Minimum Ignition Energy (mJ)
Alfalfa	2.1	36	83	6.7	94		
Angel food cake mix	4.1	41		7.5	132		
Wheat flour	12.9	57	60	8.3	87	60	
Wheat grain dust		80	48	9.3	112	60	
Wheat starch		20		9.8	132	60	25–60*

NFPA 61 Prescriptive Approach

- Chapter 7 – DHA (Dust Hazard Analysis)
  - Required for new processes or those undergoing significant modification (25% of replacement cost)
  - Existing bucket elevators, conveyors, grinding equipment, spray dryer systems, and dust collection systems must be completed by **June 2, 2021**

NFPA 61 Prescriptive Approach

- Chapter 7 – DHA (Dust Hazard Analysis)
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DHA

7.2.2 * Qualifications.

The DHA shall be performed or led by a qualified person. [**652:**7.2.2]

A.7.2.2

The qualified person who is leading or performing the DHA should be familiar with conducting a DHA. The qualified person should also be familiar with the hazards of combustible dusts. Typically, a team performs a DHA. For some processes this team might be a little as two persons, or for larger and more complex processes, the team might require a many more than two persons. This team is made of a variety of persons whose background and expertise can include the following:

(1) Familiarity with the process
(2) Operations and maintenance
(3) Process equipment
(4) Safety systems
(5) History of operation
(6) The properties of the material
(7) Emergency procedures

[**652:**A.7.2.2]

The individuals involved in the DHA could include facility operators, engineers, owners, equipment manufacturers, or consultants. [**652:**A.7.2.2]

DHA – Appendix F

- Combustible Dust Explosion Prevention Training Information
- Contractors
- Housekeeping
- Preventative Maintenance
- Dry Solid Product Movement & Storage (General)
- Grain Receiving & Storage (Legs)
- Grain Receiving & Storage (Conveyors)
- Electrical
- Dust Filter Systems
- Grain Processing Equipment
- Dust Suppression Oil Systems
- Grain Dryers
- Hazard Monitoring & Alarm Systems
- Emergency Response

DHA

Mennel

Key Element 4.12 Appendix B
Dust Hazard Analysis (DHA)

Issue Date: 8/17/2018 — Approved By: Brendan Coughlan– Director of EHS

Site: 45 Bucyrus

Date Completed: 10/21/2018

		Y/N	Evidence/Comments	orrective Action Required/Recommendation
1.0 Combustible Dust Explosion Prevention Training Information				
1.1	[illegible] combustible dust provided annually to all employees, including, but not limited to, cleaning procedures for grinding equipment, loading areas, dust control systems, ducting, conveyors, and elevators (including cleaning choked legs); housekeeping; preventive maintenance; critical safety devices; and hot work?	Yes		
1.2	Is combustible dust training provided annually to the design engineers and other technical staff involved in facility engineering and upgrade projects?	N/A		
1.3	Is orientation provided for supervisors who are transferred to a new location? (Orientation is to include specific information and training on plant safety control systems and testing requirements for combustible dust operations.)	N/A		
1.4	Are "Smoking Prohibited" or similar signs posted throughout the facility? Are formal hot work procedures in place?	Yes		
1.5	Are the properties and hazards of all combustible dusts (including Kst, Pmax, and MIE, with related particle size information) present on the site known and communicated to all employees using safety data sheets and/or other technical documents?	N/A	This isn't communicated directly to the employee. However they do know how to locate the SDS for critical information.	
1.6	Are combustible dust hazard area identification procedures in place and are all hazardous areas identified in the field (e.g. by EX sign)?	No		

Table 1: Material Properties and Explosion Hazard Results

Material	Moisture Content (wt.%)	Mean Particle Size (μm)	P_{max} (bar)	$(dP/dt)_{max}$ (bar/s)	K_{St} (bar-m/s)
AFC Dust Collector	10.3	9 100% < 75 μm	8.2 ± 10%	428 ± 12%	116 ± 12%
MAC Dust Collector	11.4	62% > 500 μm	7.5 ± 10%	212 ± 20%	57 ± 20%
B-Mill Dust Collector	11.5	15 100% < 75 μm	8.2 ± 10%	396 ± 12%	107 ± 12%
C-Mill Pneumatic Dust Collector	12	14 100% < 75 μm	8.0 ± 10%	355 ± 20%	96 ± 20%

	Kst	Pmax	MEC	MIE
Corn	75	9.4	60	
Corn Meal				40
Corn Flour				20
Flour, Cake	137			25-80
Grain Dust				30
Soy Flour	110	9.2	200	100-460
Sugar	138	8.5	200	30
Wheat Flour	137			50

NFPA 68 Standard on Explosion Protection by Deflagration Venting

11.4.4	The inspector shall verify, as applicable, that the vent inspection determines the following:
(1)	The opening is free and clear of any obstructions on both
(2)	The discharged material and fireball pathway does not extend into an area normally occupied by personnel or critical process equipment.
(3)	The closure has been properly installed according to manufacturer's instructions.
(4)	The closure is not corroded or mechanically damaged.
(5)	The closure is clearly identified with manufacturer's
(6)	The closure is clearly labeled as an explosion relief device.
(7)	The closure has no dmaage and is protection from the accumulation of water, snow, ice, or debris after any act of nature.
(8)	The closure has not been painted or coated other than by manufacturer.
(9)	The closure has no buildup of deposits on the inside surfaces or between layers of the vent.
(10)	The closure has not been tampered with.
(11)	The closure show no fatigue and has not released.
(12)	The closure hinges (if provided) are lubricated and operate freely.
(13)	The closure restraints (if provided) are in place and
(14)	The closure seals, tamper indicators, or vent rupture indicators (e.g., breakwire switches), if provided, are in place.
(15)	The flame-arresting and particulate-retention device is being maintained, is clean, and is unobstructed in accordance with the manufacturer's listing.
(16)	The closure has no conditions that would hinder its operation.

Class II, Division 1 location is a location:

(1) In which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitible mixtures, or

(2) Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitible mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electrical equipment, through operation of protection devices, or from other causes, or

(3) In which Group E combustible dusts may be present in quantities sufficient to be hazardous.

Informational Note: Dusts containing magnesium or aluminum are particularly hazardous, and the use of extreme precaution is necessary to avoid ignition and explosion.

Class II, Division 2 location is a location:

(1) In which combustible dust due to abnormal operations may be present in the air in quantities sufficient to produce explosive or ignitible mixtures; or

(2) Where combustible dust accumulations are present but are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but could as a result of infrequent malfunctioning of handling or processing equipment become suspended in the air; or

(3) In which combustible dust accumulations on, in, or in the vicinity of the electrical equipment could be sufficient to interfere with the safe dissipation of heat from electrical equipment, or could be ignitible by abnormal operation or failure of electrical equipment.

Informational Note No. 1: The quantity of combustible dust that may be present and the adequacy of dust removal systems are factors that merit consideration in determining the classification and may result in an unclassified area.

Informational Note No. 2: Where products such as seed are handled in a manner that produces low quantities of dust, the amount of dust deposited may not warrant classification.

NFPA 61 Prescriptive Approach

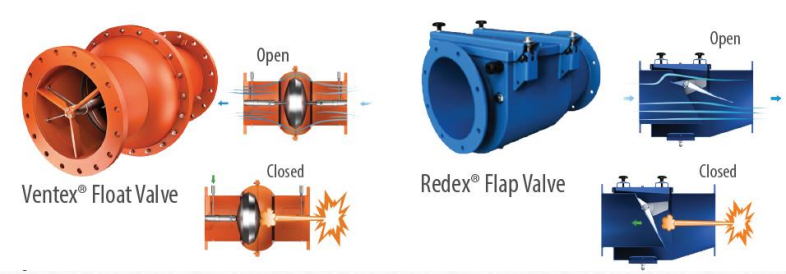
- AMS Requirements
  - AMS – A device designed to separate the conveying air from the material being conveyed. (Dust collects/Baghouses/Cyclones)
  - Connected to processes with potential sources of ignition such as hammer mills, ovens, and direct-fired dryers, and other similar equipment must have explosion protection.
    - Protection by Venting
    - Protection by Suppression

NFPA 61 Prescriptive Approach

- AMS Explosion Protection
  - Consider
    - Intake
    - AMS Body
    - Exhaust
    - Product discharge

NFPA 61 Prescriptive Approach

- Vent Panels
- Flame Free Vents
- Suppression Devices
- Fast acting valve/gate



NFPA 61 Prescriptive Approach

- Central Vacs
  - Static conductive tools
  - Static dissipative hoses
  - Properly grounded
- Dryers
  - Must have explosion protection if an explosion hazard exists
- Bucket Elevators
  - Hazard monitoring
  - Inside legs handling raw grain:
    - Vented per NFPA 68, or
    - Protected per NFPA 69
  - New outside legs must be vented

NFPA 61 - Exemptions

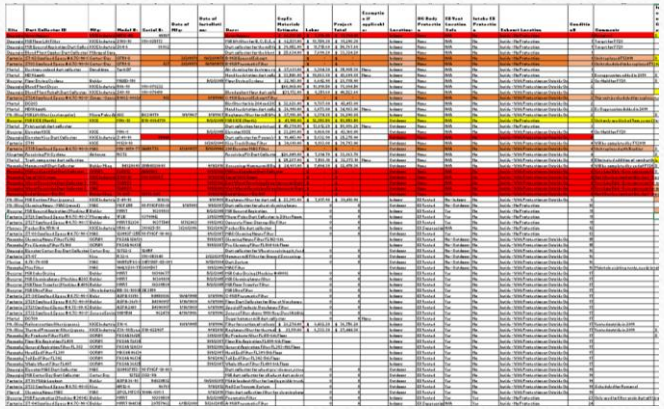
- Explosion Protection Not Required
  - Ingredient Transport Systems
  - Cyclones <30" diameter
  - AMS <8 ft^3 dirty side volume
  - Bin vent dust collectors

Moving Toward Compliance

- UNDERSTAND the requirements (61/68/69/652)
  - NFPA Guide to Combustible Dusts
- IDENTIFY the hazards of your process,
- RANK the risk, and
- PRIORITIZE

Moving Toward Compliance

- IDENTIFY Hazards
  - DHA
  - Insurance Reports
  - Consultants
  - Safety Audits/Inspections
  - Leverage work that is already complete



Moving Toward Compliance

- RANK
  - Risk Matrix
  - Severity/Likelihood

Condition	Location	DC Body Protection	EX Vent Location Safe	Intake EX Protection	Exhaust Location
1	Indoors	None	N/A	No	Inside - No Protection
2	Indoors	None	N/A	No	Inside - With Protection or Outside Only
3	Outdoors	None	N/A	No	Inside - No Protection
4	Outdoors	None	N/A	No	Inside - With Protection or Outside Only
5	Indoors	EX Vented	No - Indoors	No	Inside - No Protection
6	Indoors	EX Vented	No - Indoors	No	Inside - With Protection or Outside Only
7	Indoors	EX Vented	No - Indoors	Yes	Inside - No Protection
8	Indoors	EX Vented	No - Indoors	Yes	Inside - With Protection or Outside Only
9	Indoors	EX Vented	No - Outdoors	No	Inside - No Protection
10	Outdoors	EX Vented	No - Outdoors	No	Inside - No Protection
11	Indoors	EX Vented	Yes	No	Inside - No Protection
12	Indoors	EX Suppression	N/A	No	Inside - No Protection
13	Outdoors	EX Vented	Yes	No	Inside - No Protection
14	Outdoors	EX Suppression	N/A	No	Inside - No Protection
15	Indoors	EX Vented	No - Outdoors	No	Inside - With Protection or Outside Only

Moving Toward Compliance

- PRIORITIZE
  - Which projects get CapEx 1st
  - Which programs to develop/improve 1st
- GET STARTED!

Questions