U.S. Chemical Safety and Hazard Investigation Board

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Steve Owens
Interim Executive Authority

Sylvia E. Johnson, Ph.D.
Board Member

December 29, 2022

Jim Pauley, President/CEO
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169

RE: NFPA Document 660 Public Input Nos. 187 – 225

Dear Mr. Pauley:

Enclosed are the U.S. Chemical Safety and Hazard Investigation Board's (CSB) comments on the National Fire Protection Association's (NFPA) proposed consolidated Combustible Dust standard (NFPA 660: Standards for Combustible Dust). Combustible Dust Safety has been a topic on the CSB's Critical Drivers List for several years. The CSB has taken a comprehensive look at the proposed standard, and our comments address issues that we have identified in several investigations involving a broad range of related topics.

In addition to sending this letter, the CSB's Office of Recommendations is inputting the comments into your web-based comment submission system in order to meet the January 5, 2023, deadline. If you have any questions regarding our comments, or if we may be of further assistance, please contact Charles B. Barbee, Director of Recommendations, at 202-261-7621 or via email at charles.barbee@csb.gov.

Sincerely,

Steve Owens
Interim Executive Authority

Sylvia E. Johnson, Ph.D.
Board Member

Enclosure

cc: Stephen J. Klejst, Executive Director - Investigations & Recommendations, CSB
Lauren Johnson, Supervisory Chemical Incident Investigator, CSB
Matthew Redman, Chemical Incident Investigator, CSB
Melinda Hartz, Chemical Incident Investigator, CSB
Adam Henson, Recommendations Specialist, CSB

Public Input No. 187 – Definition for "Change" (1)

Addition of New Section

3.3.143 Change.

Modifications to equipment, procedures, raw materials, and processing conditions, other replacement in kind.

Substantiation:

No definition given for change, to prevent skirting the Management of Change (MOC) requirement, a change should be clearly defined to prevent owner/operators from skirting this requirement by carefully defining some changes as "in-kind", particularly changes that can affect transport velocity in ductwork, for example. Chapter 8 also appears to be designed to mirror most of the Process Safety Management 14 elements. To further this view, mirror PSM language regarding Management of Change.

Public Input No. 188 – Definition for "Technical Basis" (2)

Addition of New Section

3.3.144 Technical Basis for Change.

An explanation of the proposed modification, including the reason(s) for performing the work, desired results, technical design, and appropriate implementation instructions. Often included on the RFC [Request for Change] form, the technical basis for change should be of sufficient detail to allow appropriate supervisory, technical, and management review, including addressing the following questions:

- What is to be changed and how?
- What will be achieved by the change?
- How will the change achieve the intended goal?
- Is the change safe to make and why?

Substantiation:

No definition given for technical basis, which is relevant to Chapter 8. I believe the Merriam-Webster definition of these words is insufficient to convey what is truly required, and NFPA should provide a definition of this term. One possible definition is from the Center for Chemical Process Safety's (CCPS) *Guidelines for Management of Change for Process Safety*, 2008, John Wiley & Sons, p. 28.

Public Input No. 189 – Retroactivity of Section 4.2.1 Life Safety (3)

Addition of New Section

4.2.4 Retroactivity.

Section 4.2.1 shall be applied retroactively.

Substantiation:

Make retroactive so as not to allow known building collapse hazards or poorly suited construction methods to go unmitigated under the guise of being grandfathered. Life safety sections in general should be given greater deference when human lives are known to be at risk. Retroactive requirements for facility and engineering mitigative controls should not be considered invalid options in pre-existing buildings, as engineering controls and modifications can be installed without requiring new construction or significant redesign of process equipment to include protections such as deflagration venting, deflagration isolation, and structural reinforcements.

Public Input No. 190 – The Effect of Fines (4)

Addition of New Section

5.2.6

The presence of fines and the effect of fines on flammability of larger particles shall be addressed when screening for combustibility or explosibility.

Substantiation:

The presence of fines can significantly alter the combustibility results. If this is not accounted for in hazard identification, significant hazards can be missed, or testing foregone that should be done. This can result in underestimating the combustible dust or propagation hazards. See A.5.1. Also, from DEKRA Safety Guide - A Strategic Guide to Characterization and Understanding Handling Dusts and Powders Safely:

Page 15:

Particle size has a huge impact on the flammability, sensitivity and severity of dust cloud explosions. As a very rough guide, particles below 500 microns should be considered as particularly flammable. When granules or pellets are handled, the potential for attrition to form fines must be considered. Even if only a few percent by weight of a powder is fine, this could still be enough to pose a serious dust explosion risk. If the bulk material is disturbed or transferred, the fines will remain suspended long after the larger particles have deposited. It is crucial that this concept is encompassed in the assessment of **flammability hazards**. All subsequent tests should be performed on the "finest material" that can accumulate in the process situation. Testing of unrepresentative samples will undoubtedly compromise the validity of the data.

Page 19:

Large Particle Size Materials and Blends

Many materials whether they be raw ingredients, intermediates or finished products are often processed as granules or pellets rather than as finely divided powder. In such cases the question “can the material form a dust cloud?” becomes particularly important. The propensity to form a dust cloud should be based on a consideration of:

>> The friability of the powder i.e. how easily the material forms dust by attrition.

>> The concentration of fine powder within the bulk of the material. It only takes a few percent of fines to form a sizeable dust cloud. In addition, it is the fines that will persist in an airborne state if the powder is poured, conveyed or disturbed.

>> Whether an accumulation of fine powder can occur during all or only specific operations.

>>The potential of the processing operation to generate fine powder.

If fine powder exists or can readily be formed, then the normal assessment route for dust explosion hazards should be followed. If fine powder cannot accumulate “under all foreseen processing conditions” then no further assessment of dust explosion hazards is required (providing the larger material has been found not to be dust explosive).

Public Input No. 191 – Particle Attrition Due to Handling or Abnormal Process Conditions

Revision to Existing Section (5)

5.4.3.3*

Original Text:

When determining explosibility, it shall be permitted to test the as-received sample.

Proposed Revision:

When determining explosibility, it shall be permitted to test the as-received sample unless particle attrition is possible with further handling or abnormal or transient process conditions.

Substantiation:

This is to prevent ignoring potential upset or material holdup conditions and is in accordance with ASTM E1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*. As currently stated, this appears to be at least partially in conflict with 5.4.3.1, since ASTM testing requires particle size reduction if necessary to reach <75 microns per the ASTM test methods. If left unrevised, this can lead to underestimating the hazards by testing a larger particle size than is present at unusual times or due to process changes or upsets. Also, from DEKRA Safety Guide - A Strategic Guide to Characterization and Understanding Handling Dusts and Powders Safely,

Page 4:

For dust explosion testing, test standards dictate that materials should be “finest and driest” available on process. For consistency and conservatism, tests are performed on materials <5% moisture content and, where the standard methods

dictate, less than a specific particle size (typically <75 micron).

Public Input No. 192 – Particle Attrition Due to Handling or Abnormal Process Conditions Part 2

Revision to Existing Section (6)

5.4.4.3

Original Text:

When quantifying combustibility and explosibility characteristics, it shall be permitted to test the as-received sample only for those locations where the particulate remains homogenously mixed.

Proposed Revision:

When quantifying combustibility and explosibility characteristics, it shall be permitted to test the as-received sample only for those locations where the particulate remains homogenously mixed and only if particle attrition is possible with further handling or abnormal or transient process conditions.

Substantiation:

This is to prevent ignoring potential upset or material holdup conditions and is in accordance with ASTM E1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*. As currently stated, this appears to be at least partially in conflict with 5.4.3.1, since ASTM testing requires particle size reduction if necessary to reach <75 microns per the ASTM test methods. If left unrevised, this can lead to underestimating the hazards by testing a larger particle size than is present at unusual times or due to process changes or upsets. Also, from DEKRA Safety Guide - A Strategic Guide to Characterization and Understanding Handling Dusts and Powders Safely, page 4:

For dust explosion testing, test standards dictate that materials should be “finest and driest” available on process. For consistency and conservatism, tests are performed on materials <5% moisture content and, where the standard methods dictate, less than a specific particle size (typically <75 micron).

Public Input No. 193 – Stronger Language for Section 6.1.3 (7)

Revision to Existing Section

6.1.3

Original Text

The performance-based design shall be prepared by a person with qualifications acceptable to the owner/operator.

Proposed Revision:

The performance-based design shall be prepared under the supervision of a qualified person(s) acceptable to Authority Having Jurisdiction (AHJ).

Substantiation:

A person acceptable to the owner/operator could be anyone. For example, a structural engineer willing to sign off that minimum explosible concentration (MEC) is not reached inside a transfer pipe, without knowledge of the situation or of combustible dust hazards, because owner/operator asked them to. The person making this determination should be knowledgeable and have relevant experience.

Public Input No. 194 – Retroactivity of Section 6.3 Performance Criteria. (8)

Addition of New Section

6.3.6 Retroactivity.

Section 6.3 shall be applied retroactively.

Substantiation:

Make retroactive so as not to allow known building collapse hazards or poorly suited construction methods to go unmitigated under the guise of being grandfathered. Life safety sections in general should be given greater deference when human lives are known to be at risk. Retroactive requirements for facility and engineering mitigative controls should not be considered invalid options in pre-existing buildings, as engineering controls and modifications can be installed without requiring new construction or significant redesign of process equipment to include protections such as deflagration venting, deflagration isolation, and structural reinforcements.

Public Input No. 195 – Stronger Language for 7.3.2 Materials Evaluation. (9)

Addition of New Section

7.3.2.2

For hazard identification, material properties including Particle Size, Particle Size Distribution, Particle Shape, Particle Aging, Particle Attrition, Particle Suspension, Particle Agglomeration, Triboelectric Attraction, Hydrogen Bonding, Entrainment Friction, Combustible Concentration, Competent Igniter, and Dustiness/Dispersibility shall be addressed by DHA per Chapter 7 for the combustible particulate solids present when determining combustibility or explosibility. (See A.5.1)

Substantiation:

This is recommended to prevent underestimating the combustible dust hazards present by assuming no particle attrition takes place, or non-representative literature values are used for MEC, Kst, etc., for example. See A.5.1.

Public Input No. 196 – Process Interconnectivity and Propagation. (10)

Addition of New Section

7.3.3.4

Each interconnected part of a process shall be analyzed for the potential for propagation from one system to another.

Substantiation:

Dust collectors that interconnect various process equipment or transport pipes or ducts should also be considered in the dust hazard analysis (DHA). This would be the process analog to sections 7.3.4.1.2 and 7.3.4.1.3 regarding buildings. To not include this potentially misses a propagation hazard to otherwise unrelated parts of the process or other buildings.

Public Input No. 197 – Inspection, Testing, and Maintenance Program for Tramp Metal Detection and Removal Devices. (11)

Addition of New Section

8.7.2(7)

(7) Tramp metal detection and removal devices

Substantiation:

Tramp metal removal is one of the key items for eliminating ignition sources. This equipment can also fail or become faulty, but there is no testing requirement for it. Add it to this list to detect safety equipment failures. Magnets can fail, and this is not always obvious without testing. Safety equipment testing is part of ensuring layers of protection remain effective.

Public Input No. 198 – Refresher Training (12)

Revision to Existing Section

8.8.3

Original Text:

Refresher training shall be provided as required by the applicable industry-or commodity-specific-chapters of this standard.

Proposed Revision:

Refresher training shall be provided (i) when a lack of hazard awareness is suspected or evident, (ii) at least every three years after initial training, or (iii) as required by the applicable industry-or commodity-specific-chapters of this standard, whichever is shorter.

Substantiation:

As acknowledged in this draft, “Safety of a process depends on the employees who operate it and the knowledge and understanding they have of the process. It is important to maintain an effective and ongoing training program for all employees involved. Operator response and action to correct adverse conditions, as indicated by instrumentation or other means, are only as good as the frequency and thoroughness of training provided” (A.8.8.1).

In the original draft, Chapter 8 Management Systems relies upon industry-or commodity-specific chapters of NFPA 660 to establish the requirements for refresher training (8.8.3). Chapter 11 requires refresher training annually (11.8.8), Chapter 12 requires refresher training annually (12.8.8.3*) and as required by the AHJ or other relevant standard (12.8.8.5), Chapter 13 implies that refresher training is

required annually (13.8.8.4), Chapter 14 is the same as Chapter 13, Chapter 15 does not appear to address refresher training except for emergency awareness training (15.8.8.6).

The language proposed in revision would ensure a minimum frequency of refresher training where such requirements are not established in the industry-or commodity-specific chapters. It seems there is general agreement for the need for annual refresher training amongst several chapters and no direct requirements for refresher training in other chapters.

The language proposed also acknowledges the possibility of the need for refresher training that is not dependent on an amount of time that has elapsed. A lack of hazard awareness necessitating refresher training may be evident based on conversations with workers/contractors, observed hazardous conditions in and around the facility, and/or following the investigation of incidents or near misses. Owner/operators must not be permitted to wait a specified period where deficiencies are evident presently.

Public Input No. 199 – Container Labeling and Safety Data Sheets (13)

Addition of New Section

8.8.5*

The owner/operator shall promote hazard awareness regarding combustible dusts and particulate solids within the facility through a comprehensive program including container labeling and other forms of warning, safety data sheets, and training as described previously in this section. Contractors shall be included in this program as applicable.

A.8.8.5

Mandatory requirements for such a program including labeling and other forms of warning, safety data sheets, and training are contained in 29 CFR 1910.1200.

Additional guidance can be found in the United Nations publication *Globally Harmonized System of Classification and Labelling of Chemicals (GHS), 9th Edition*.

8.8.5.1

The owner/operator shall employ labels and other forms of warning to ensure hazard awareness of combustible dust and particulate solids.

8.8.5.1.1

Warning, caution, and/or safety instruction signs as appropriate shall be affixed and/or otherwise displayed on equipment, or at the entrances to places where, fire, flash fire, and explosion hazards exist within the facility

8.8.5.1.2

Containers of combustible dusts and/or combustible particulate solids within the facility shall be labeled to indicate the product identifier, signal word, hazard statement(s), pictogram(s), precautionary statement(s); and contact information of the manufacturer, importer, or other responsible party as

applicable, or a combination thereof which identify the contents of the container and provide at least general information regarding the hazards of the contents.

8.8.5.2

The owner/operator shall develop and/or gather, maintain, and make available safety data sheets for each combustible dust and/or particulate solid handled within the facility and/or distributed to other facilities.

8.8.5.2.1

The safety data sheet for combustible dusts and/or particulate solids shall identify the substance as hazardous in Section 2: Hazard Identification. This shall be accomplished using the phrases “May form explosible dust-air mixture if dispersed”, “May for explosible dust-air mixture if small particles are generated during further processing, handling, or by other means”, or similar language in conjunction with the word “Warning”.

8.8.5.2.2

The safety data sheet for combustible dusts and/or particulate solids shall address the requirements for fighting a fire caused by the combustible dust or arising in the vicinity of combustible dusts and/or combustible particulate solids in Section 5: Fire-Fighting Measures.

8.8.5.2.3

The safety data sheet for combustible dusts and/or particulate solids shall address guidance on safe handling practices that minimize the potential hazards to people, property, and the environment from the combustible dust and/or combustible particulate solid in Section 7: Handling and Storage.

8.8.5.2.4*

The safety data sheet for combustible dusts and/or particulate solids shall address basic physical and chemical properties, data relevant regarding physical hazard classes, and further safety characteristics as appropriate in Section 9: Physical and Chemical Properties.

A.8.8.5.2.4

Section 9 of safety data sheets for combustible dusts and/or particulate solids should indicate relevant safety characteristics such as lower explosion limit/ minimum explosible concentration, minimum ignition energy, deflagration index (Kst), maximum explosion pressure, etc. where such information is known. The particle characteristics to which the data apply if different from the particle characteristics as indicated elsewhere in Section 9 should also be indicated.

8.8.5.3

All information relied upon by owners/operators to ensure hazard awareness of combustible dust and/or particulate solid hazards within the facility shall be immediately available for reference by workers.

Substantiation:

Relying solely on a training program to ensure hazard awareness seems an incomplete solution. This is especially evident in consideration of OSHA's Hazard Communication Standard (HAZCOM) and the United Nation's Globally Harmonized System (GHS).

GHS was initially adopted in 2003 and is currently in its 9th revision. HAZCOM is based on the 3rd edition of GHS and has been in place since 2012. Both standards require responsible parties to communicate information to workers on hazards in their workplace through labelling and other forms of written warning and safety data sheets in addition to a training program.

HAZCOM recognizes combustible dust as its own physical hazard class (29 CFR 1910.1200(c) – Hazardous Chemical). GHS does not but contains information specific to identifying and communicating the hazards of combustible dusts (Annex 11).

The U.S. Chemical Safety Board has completed seven incident investigations of combustible dust fires and explosions and has another on going. The seven incidents with completed investigations resulted in 36 fatalities and 128 injuries between 2003 and 2012. The incident with the ongoing investigation occurred in 2017 and resulted in five fatalities and 14 injuries.

Every one of the completed investigations identified a lack of awareness/understanding of the hazards of combustible dust at the local facility as a key finding having contributed to the incident. Several of the incident investigations also identified a lack of hazard awareness amongst AHJs as having contributed to the incident.

Others including the West Pharmaceutical Dust Explosion and Fire which resulted in six fatalities and 38 injuries identified specific deficiencies in safety data sheets and hazard communication programs as having contributed to the incident. In the CTA Acoustics Dust Explosion and Fire investigation it was determined that the lack of information concerning the explosion hazard presented by phenolic resin dust in a supplier's safety data sheet contributed to the incident which resulted in seven fatalities and 37 injuries.

Ensuring signs, labels, and other forms of written warning are present in the workplace and ensuring that safety data sheets communicate all hazards of substances handled within the facility in conjunction with a formal training plan will help to ensure a level of hazard awareness greater than possible through a training program alone.

Public Input No. 200 – Stronger Language for Section 8.12.2(1)* (14)

Revision to Existing Section

8.12.2(1)*

Original Text:

The basis for the proposed change

Proposed Revision:

The technical basis for the proposed change.

Substantiation:

No definition given for technical basis, which is relevant to Chapter 8. I believe the Merriam-Webster definition of these words is insufficient to convey what is truly required, and NFPA should provide a

definition of this term. One possible definition is from CCPS. This recommendation is to reinstate the language in NFPA 654 Chapter 4.3.1.1(1) (2013 edition) and NFPA 68 Chapter 11.8.3(1) (2007 edition), as stronger language and a more substantive basis for evaluating changes effectively.

It should include sufficient technical information to facilitate review by the approvers, address adverse effects that could occur, and describe how such effects would be mitigated by the proposed change". This would be an acceptable alternative to the above "technical basis", but it is entirely optional throughout the Standard. Believe this should be made mandatory and a definition placed in Chapter 3. This same discussion applies to 11.8.12.2 and A.11.8.12.2.

The need to clearly state the items described above under basis is clearly necessary to evaluate changes effectively. The above updates do not preclude adding more information as it is relevant to a specific change. But without this basic information as a minimum standard, changes cannot be effectively evaluated for hazards. Chapter 8 also appears to be designed to mirror most of the Process Safety Management 14 elements. To further this view, mirror PSM language regarding Management of Change.

Public Input No. 201 – Stronger Language for Section 8.12.4 (15)

Revision to Existing Section

8.12.4

Original Text:

Design and procedures documentation shall be updated to incorporate the change.

Proposed Revision:

Documentation of design basis, including but not limited to: the general scope of work, design criteria, process description, material flow diagrams, basis for deflagration protection, basis for fire protection systems, and the physical properties of the process materials, documentation of design, including but not limited to: equipment layouts, detailed mechanical drawings, specifications, supporting engineering calculations, and process and instrumentation diagrams, and procedures documentation shall be updated to incorporate the change.

Substantiation:

The above language from NFPA 654 is entirely lost in NFPA 660 to date. We believe it serves an important design function and discipline and should be reinstated.

Public Input No. 202 – Pre-Startup Safety Review. (16)

Addition of New Section

8.16 Pre-Startup Safety Review.

8.16.1

The owner/operator shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require change in the process and technology information required by 8.13.1(5)*.

8.16.2

The pre-startup safety review shall confirm the following prior to the operation of a process:

(1) Construction and equipment are in accordance with design specifications

(2) Safety, operating, maintenance, and emergency procedures are in place and are adequate

(3) For new facilities, a DHA has been performed and action items have been resolved or implemented before startup

(4) For modified facilities, meet the requirements contained in section 8.12 Management of Change

Substantiation:

If a change is worthy of the Management of Change process, then it is also worthy of ensuring that the reviewed design was correctly installed. Without a PSSR, changes can be designed perfectly, but incorrectly implemented, creating unanticipated hazards. This change also aligns with PSM standards, which all require PSSR before startup of a change. Chapter 8 also appears to be designed to mirror most of the Process Safety Management 14 elements. To further this view, mirror PSM language regarding PSSR.

Public Input No. 203 – Stronger Language for Section 9.3.5.3.2*(3) (17)

Revision to Existing Section

9.3.5.3.2*(3)

Original Text:

Amount of material likely to be present outside the process equipment

Proposed Revision:

Amount of material likely to be present outside the process equipment, including during abnormal or transient operations

Substantiation:

Leaks, equipment, and other failures must be considered when estimating detachment distance so that the minimum safe distance is not underestimated by only considering normal operations. Requiring consideration to abnormal and transient operations will help to prevent underestimating explosion consequences.

Public Input No. 204 – Stronger Language for Section 9.3.5.4.2*(3) (18)

Revision to Existing Section

9.3.5.4.2*(3)

Original Text:

Amount of material likely to be present outside the process equipment

Proposed Revision:

Amount of material likely to be present outside the process equipment, including during abnormal or transient operations

Substantiation:

Leaks, equipment, and other failures must be considered when estimating detachment distance so that the minimum safe distance is not underestimated by only considering normal operations. Requiring consideration to abnormal and transient operations will help to prevent underestimating explosion consequences.

Public Input No. 205 – Inspection of Ducts. (19)

Addition of New Section

9.4.3.1.7

System performance shall be verified periodically through inspection of ducting for accumulations to ensure the design air-gas velocity is maintained.

Substantiation:

While the original design may appropriately prevent the accumulation of material in the pneumatic conveying system, deterioration in the equipment performance could allow the system to no longer function as designed. A requirement for manual inspections of ducting could catch a drift in the system performance that could present a propagation hazard due to material accumulations.

Public Input No. 206 – Stronger Language for Section 9.4.3.2.3 (20)

Revision to Existing Section

9.4.3.2.3

Original Text:

Pneumatic conveying systems conveying combustible particulate solids and posing an explosion hazard shall be protected in accordance with Section 9.8.

Proposed Revision:

Pneumatic conveying systems conveying combustible particulate solids shall be protected in accordance with Section 9.8.

Substantiation:

Recommend deletion to prevent attempts at skirting this provision by claiming MEC is never reached inside a pneumatic conveying system. Since any pneumatic conveying system can plug or accumulate solids buildup in the event of a malfunction or emergency shutdown, this qualifier could be used by owner/operators to argue that MEC is never reached inside the pneumatic conveying system and as a result Section 9.8 does not apply to them, when in fact the hazard can exist and should be accounted for.

Public Input No. 207 – Manifolding Dust Collectors for Different Processes. (21)

Addition of New Section

9.4.3.3.8

Dust collections systems from different processes shall not be manifolded together to prevent propagation from one system to another.

Substantiation:

Manifolding numerous pieces of equipment together can spread a propagation throughout a facility too quickly to allow for a safe evacuation. With the potential for pressure piling or detonation, damage can be severely underestimated in these cases and has resulted in at least one major dust explosion incident.

Public Input No. 208 – Connecting Centralized Vacuum Systems to Processes. (22)

Addition of New Section

9.4.3.4.8

Centralized vacuum systems shall not be connected to processes unless flame arrestors and/or propagation protection are/is in place.

Substantiation:

Central vacuum systems are designed for housekeeping activities and are not designed to be connected to processes. Such an interconnection can create unforeseen hazards beyond those present in the separate systems.

Public Input No. 209 – Duct Systems Inspections. (23)

Addition of New Section

9.4.6.4

Periodic inspections shall be performed to ensure that dust accumulations are maintained below the threshold dust layer thicknesses determined in 8.4.6.

Substantiation:

While the original design may appropriately prevent the accumulation of material in the pneumatic conveying system, deterioration in the equipment performance could allow the system to no longer function as designed. A requirement for manual inspections of ducting could catch a drift in the system performance that could present a propagation hazard due to material accumulations.

Public Input No. 210 – Retroactivity of Section 9.4.17* Dryers. (24)

Addition of New Section

9.4.17.2 Retroactivity.

Section 9.4.17 shall be applied retroactively.

Substantiation:

Make retroactive so as not to allow known building collapse hazards or poorly suited construction methods to go unmitigated under the guise of being grandfathered. Life safety sections in general

should be given greater deference when human lives are known to be at risk. Retroactive requirements for facility and engineering mitigative controls should not be considered invalid options in pre-existing buildings, as engineering controls and modifications can be installed without requiring new construction or significant redesign of process equipment to include protections such as deflagration venting, deflagration isolation, and structural reinforcements.

Public Input No. 211 – Stronger Language for Section 9.8.1. (25)

Revision to Existing Section

9.8.1

Original Text:

Where a dust explosion hazard exists within an enclosure, measures shall be taken as specified in Section 9.8 to protect personnel from the consequences of an explosion in that enclosure.

Proposed Revision:

Where combustible dust exists within an enclosure, measures shall be taken as specified in Section 9.8 to protect personnel from the consequences of an explosion in that enclosure.

Substantiation:

It should be clarified that calculating a dust concentration below MEC inside equipment under normal operations does not absolve owner/operator from implementing the requirements in 9.8. Such reasoning does not take accumulation or abnormal operations into account and should be expressly prohibited because owner/operators have attempted this reasoning in the past, leading to at least one major dust explosion and multiple fatalities.

Public Input No. 212 – Stronger Language for Section 9.8.2.1. (26)

Revision to Existing Section

9.8.2.1

Original Text:

Where an explosion hazard exists within any operating equipment greater than 8 ft^3 (0.2 m^3) of containing volume, the equipment shall be protected from the effects of an explosion.

Proposed Revision:

Where combustible dust exists within any operating equipment greater than 8 ft^3 (0.2 m^3) of containing volume, the equipment shall be protected from the effects of an explosion.

Substantiation:

It should be clarified that calculating a dust concentration below MEC inside equipment under normal operations does not absolve owner/operator from implementing the requirements in 9.8. Such reasoning does not take accumulation or abnormal operations into account and should be expressly prohibited because owner/operators have attempted this reasoning in the past, leading to at least one major dust explosion and multiple fatalities.

Public Input No. 213 – Stronger Language for Section 9.8.3.1. (27)

Revision to Existing Section

9.8.3.1

Original Text:

Where an explosion hazard exists, isolation devices shall be provided in accordance with NFPA 69 to prevent propagation of flames and pressure between connected equipment.

Proposed Revision:

Where combustible dust exists, isolation devices shall be provided in accordance with NFPA 69 to prevent propagation of flames and pressure between connected equipment.

Substantiation:

It should be clarified that calculating a dust concentration below MEC inside equipment under normal operations does not absolve owner/operator from implementing the requirements in 9.8. Such reasoning does not take accumulation or abnormal operations into account and should be expressly prohibited because owner/operators have attempted this reasoning in the past, leading to at least one major dust explosion and multiple fatalities.

Public Input No. 214 – Stronger Language for Section 9.8.3.3. (28)

Revision to Existing Section

9.8.3.3

Original Text:

Where an explosion hazard exists, isolation devices shall be provided in accordance with NFPA 69 to prevent propagation of flames and pressure from equipment through ductwork to the work area.

Proposed Revision:

Where combustible dust exists, isolation devices shall be provided in accordance with NFPA 69 to prevent propagation of flames and pressure from equipment through ductwork to the work area.

Substantiation:

It should be clarified that calculating a dust concentration below MEC inside equipment under normal operations does not absolve owner/operator from implementing the requirements in 9.8. Such reasoning does not take accumulation or abnormal operations into account and should be expressly prohibited because owner/operators have attempted this reasoning in the past, leading to at least one major dust explosion and multiple fatalities.

Public Input No. 215 – Clarification for Section 11.1.4 Retroactivity. (29)

Revision to Existing Section

11.1.4

Original Text:

When renovating an existing facility, equipment, or process, the provisions of this chapter shall apply to that portion of the facility, equipment, or process.

Proposed Revision:

When significant modifications are made to an existing facility, equipment, or process, the provisions of this chapter shall apply to that portion of the facility, equipment, or process (see 11.7.1.3).

Substantiation:

The current statement is unclear as it applies to modified buildings or processes. Owner/operators can use this to skirt the Standard by claiming that only all new buildings, processes or facilities must comply with Chapter 11. 11.7.1.3 defines "significant modification."

Public Input No. 216 – Stronger Language for Section 11.4.1.1. (30)

Revision to Existing Section

11.4.1.1

Original Text:

Where necessary, testing protocols in Chapter 5 shall be used to identify noncombustible dusts or provide specific information on a given uncharacterized dust.

Proposed Revision:

Testing protocols in Chapter 5 shall be used to identify noncombustible dusts or provide specific information on a given uncharacterized dust.

Substantiation:

To prevent underestimating the hazards presented by the items in A.5.1, in particular particle attrition inside the process creating more fines. Design should not be based on the best-case scenario.

Public Input No. 217 – Stronger Language for Section 11.7.1.2*. (31)

Revision to Existing Section

11.7.1.2*

Original Text:

For existing processes and facility compartments that are not undergoing significant modification, the owner/operator shall schedule and complete DHAs of bucket elevators, conveyors, grinding equipment, spray dryer systems, and dust collection systems.

Proposed Revision:

For existing processes and facility compartments that are not undergoing significant modification, the owner/operator shall schedule and complete DHAs of bucket elevators, conveyors, grinding equipment, dryer systems, and dust collection systems.

Substantiation:

Direct-fired fluidized bed dryers, for example, also present a significant enough hazard to require periodic DHAs given their inherent proximity between fire, fuel, and combustible dust above MEC such as in a fluidized bed dryer. Just by virtue of removing moisture from the product, the combustible dust hazard will increase in severity.

Public Input No. 356 – Expanding Definition to Include Section 11.1.4 Retroactivity. (32)

Revision to Existing Section

11.7.1.3

Original Text:

For the purposes of applying the provisions of 11.7.1.2, significant modification shall include modifications that exceed 25 percent of the replacement cost of the equipment system.

Proposed Revision:

For the purposes of applying the provisions of 11.1.4 and 11.7.1.2, significant modification shall include modifications that exceed 25 percent of the replacement cost of the equipment system.

Substantiation:

The proposed language in 11.1.4 includes "significant modification." As such, this definition should apply to that section as well.

Public Input No. 218 – Stronger Language for Section 11.8.5.6.1.5. (33)

Revision to Existing Section

11.8.5.6.1.5

Original Text:

Floor and wall openings within the work area shall be covered or sealed.

Proposed Revision:

All openings within the work area shall be covered or sealed.

Substantiation:

To prevent missing potential openings that may allow combustible dust into the hot work area, such as on the ceiling.

Public Input No. 219 – Delete Section 11.8.6 Annex Material. (34)

Revision to Existing Section

11.8.6*

Original Text:

Personal Protective Equipment.

A.11.8.6

Facilities handling agricultural combustible dust are not typically required to use flame-resistant garments under normal operating condition.

Proposed Revision:

11.8.6

Personal Protective Equipment

A.11.8.6

Deleted.

Substantiation:

A corn mill explosion caused five fatalities and 14 injuries, several of which were burns from flash fires that would have been mitigated by fire retardant clothing. A.11.8.6 seems to run counter to the requirements of NFPA 2112/2113 and this standard by saying that owner/operators should evaluate for flash fire hazards at all stages of operations, but then exempts agricultural dusts from basic PPE requirements that other facilities with combustible dust hazards must adhere to. While FRC may not be immediately necessary for normal operating conditions, transitions to upset conditions are not foreseeable and should not be an excuse to limit employee protections by not providing flame-resistant garments. Facilities where significant amounts of agricultural combustible dust are handled or stored should consider flame-resistant garments.

Public Input No. 220 – Clarification for Section 11.8.10*(1). (35)

Revision to Existing Section

11.8.10*(1)

Original Text:

A means of notification for occupants in the event of fire and explosion

Proposed Revision:

A means of notification for occupants in the event of fire and explosion compliant with 29 CFR 1910.165.

Substantiation:

Radios are ineffective in an emergency situation when all personnel do not have access to a radio or various groups are on different channels, or there is a language barrier. This should be a system effective

at alerting all personnel immediately to prevent injuries or fatalities in an emergency. Compliance with 29 CFR 1910.165 is already required in any case.

Public Input No. 221 – Stronger Language for Section 11.8.12.2*. (36)

Addition of New Section

11.8.12.2(4)-(7)

(4) Whether the change is temporary or permanent, including the authorized duration of temporary changes

(5) Modifications to operating and maintenance procedures

(6) Employee training requirements

(7) Results of characterization tests used to assess the hazard, if conducted

Substantiation:

Exempting agricultural combustible dusts but no other combustible dusts from these requirements does not appear to serve safety in a positive way. Temporary changes, for example, can occur in agricultural facilities as well and any other manufacturing facility. Without including all these other requirements, Management of Change would be incomplete.

Public Input No. 222 –Stronger Language for Section 11.9.4.3.3.2 Separate Collection Systems. (37)

Revision to Existing Section

11.9.4.3.3.2

Original Text:

Each department in starch manufacturing and handling (i.e., starch drying, grinding, dextrin cooking) shall have a separate dust collection system.

Proposed Revision:

Each department in all milling facilities and starch manufacturing and handling (i.e., starch drying, grinding, dextrin cooking) shall have a separate dust collection system.

Substantiation:

Recommend this be applied to all milling facilities as well as starch production to prevent propagation between processes. This type of propagation through heavily interconnected processes through a shared dust collector has caused a major dust propagation incident in the past.

Public Input No. 223 –Stronger Language for Section 11.9.4.17.1.4. (38)

Revision to Existing Section

11.9.4.17.1.4

Original Text:

Where an explosion hazard exists, protection shall be in accordance with 11.9.8.2.

Proposed Revision:

Where combustible dust exists, protection shall be in accordance with 11.9.8.2.

Substantiation:

It should not be acceptable to assume no explosion hazard exists simply by calculating that MEC is never reached. An assumption that MEC will be achieved by accumulation, or in an upset, shutdown or emergency situation should be used to prevent an erroneous assumption that no explosion hazard exists. Such reasoning does not take accumulation or abnormal operations into account and should be expressly prohibited because owner/operators have attempted this reasoning in the past, leading to at least one major dust explosion and multiple fatalities. This assumption will cause owner/operators to underestimate the hazard, and the assumption does not reflect the real world.

Public Input No. 224 –Stronger Language for Section 11.9.4.17.3.4. (39)

Revision to Existing Section

11.9.4.17.3.4

Original Text:

Direct-fired dryers with an explosion hazard located within buildings shall be protected in accordance with 11.9.8.2.

Proposed Revision:

Direct-fired dryers containing combustible dust located within buildings shall be protected in accordance with 11.9.8.2.

Substantiation:

It should not be acceptable to assume no explosion hazard exists simply by calculating that MEC is never reached. An assumption that MEC will be achieved by accumulation, or in an upset, shutdown or emergency situation should be used to prevent an erroneous assumption that no explosion hazard exists. Such reasoning does not take accumulation or abnormal operations into account and should be expressly prohibited because owner/operators have attempted this reasoning in the past, leading to at least one major dust explosion and multiple fatalities. This assumption will cause owner/operators to underestimate the hazard, and the assumption does not reflect the real world.

Public Input No. 225 – Annex Z Informational References (40)

Revision to Existing Section

Z.1.2.20

Original Text:

U.S. Government Publishing Office, Washington, DC 20402.
DOE Handbook, *Primer on Spontaneous Heating and Pyrophoricity*, DOE-HDBK-1081-1984
DOT Pipeline and Hazardous Materials Safety Administration, *Emergency Response Guidebook (ERG)*, "Table of Water-Reactive Materials Which Produce Toxic Gases," 2008.

"Hoeganaes Corporation: Gallatin, TN – Metal Dust Flash Fires and Hydrogen Explosion," U.S. Chemical Safety and Hazard Investigation Board, 2011.
Occupational Safety and Health Administration Act of 1970.
OSHA, *Firefighting Precautions at Facilities with Combustible Dust*, 2013.
Title 29, Code of Federal Regulations, Part 1910.119, "Process Safety Management of Highly Hazardous Chemicals."
Title 29, Code of Federal Regulations, Part 1910.146, "Permit-Required Confined Spaces."
Title 29, Code of Federal Regulations, Part 1910.272, "Grain Handling Facilities."
Title 29, Code of Federal Regulations, Part 1910.119, "Process Safety Management of Highly Hazardous Chemicals."
Title 29, Code of Federal Regulations, Part 1910.303, "General."
Title 30, Code of Federal Regulations, Part 36, "Approved Requirements for Permissible Mobile Diesel-Powered Transportation Equipment."

Proposed Revision:

U.S. Chemical Safety and Hazard Investigation Board, Washington, DC 20006.
"AL Solutions, Inc., New Cumberland, WV – Metal Dust Explosion and Fire," U.S. Chemical Safety and Hazard Investigation Board, 2014.
"Aluminum Dust Explosion – Hayes Lemmerz International-Huntington, Inc.," U.S. Chemical Safety and Hazard Investigation Board, 2005.
"Combustible Dust Fire and Explosions – CTA Acoustics, Inc.," U.S. Chemical Safety and Hazard Investigation Board, 2005.
"Combustible Dust Hazard Study," U.S. Chemical Safety and Hazard Investigation Board, 2006.
"Dust Explosion – West Pharmaceutical Services, Inc.," U.S. Chemical Safety and Hazard Investigation Board, 2004.
"Hoeganaes Corporation: Gallatin, TN – Metal Dust Flash Fires and Hydrogen Explosion," U.S. Chemical Safety and Hazard Investigation Board, ~~2011~~ 2012.
"Sugar Dust Explosion and Fire-Imperial Sugar Company," U.S. Chemical Safety and Hazard Investigation Board, 2009.
"US Ink/Sun Chemical Corporation – Ink Dust Explosion and Flash Fires in East Rutherford, NJ," U.S. Chemical Safety and Hazard Investigation Board, 2015.

U.S. Department of Energy, Washington, DC 20585.
DOE Handbook, *Primer on Spontaneous Heating and Pyrophoricity*, DOE-HDBK-1081-1984

U.S. Department of Transportation, Washington, DC 20590.
DOT Pipeline and Hazardous Materials Safety Administration, *Emergency Response Guidebook (ERG)*, "Table of Water-Reactive Materials Which Produce Toxic Gases," 2008.

U.S. Department of Labor, Washington, DC 20210.
Mine Safety and Health Administration:

Title 30, Code of Federal Regulations, Part 36, “Approved Requirements for Permissible Mobile Diesel-Powered Transportation Equipment.”

Occupational Safety and Health Administration:
Occupational Safety and Health ~~Administration~~ Act of 1970.
OSHA, *Combustible Dust National Emphasis Program (Reissued) (CPL 03-00-008)*, 2008.
OSHA, *Combustible Dust Poster*, 2010.
OSHA, *Fact Sheet – Hazard Alert: Combustible Dust Explosions*, 2015.
OSHA, *Fact Sheet – Protecting Workers from Combustible Dust Explosion Hazards*, 2016.
OSHA, *Firefighting Precautions at Facilities with Combustible Dust*, 2013.
OSHA, *Hazard Communication Guidance for Combustible Dusts*, 2009.
OSHA, *Safety and Health Information Bulletin – Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions*, 2005.

Substantiation:
The way the U.S. Government Publications section is laid out in Annex Z is confusing. This annex is also missing several publications from the U.S. CSB and OSHA that are very useful in identifying and mitigating combustible dust and/or particulate solid hazards.
The section is listed under the U.S. Government Publishing Office, Washington, DC, but lists publications from five different agencies of the federal government. By adding additional headings identifying these agencies the user will have an easier time navigating this section and obtaining copies of these materials if they so desire.
Regarding the U.S. CSB, in the original draft only the Hoeganaes Corporation – Metal Dust Flash Fires and Hydrogen Explosion is referenced. The U.S. CSB has completed a hazard investigation study and investigated 7 other combustible dust fires and explosions six of which have final reports published as of January 5, 2023. These reports cover incidents having resulted in 36 fatalities and 128 injuries combined in establishments covered under the scopes of NFPA 61, NFPA 484, and NFPA 654. Familiarizing the user with the hazard investigation study and with these incidents will serve to accentuate the importance of the purpose of NFPA 660.

Regarding OSHA, there is no such document titled Occupational Safety and Health Administration Act. The Occupational Safety and Health Administration was established by the Occupational Safety and Health Act of 1970. Also as originally published, the draft contained a long, but also incomplete, list of OSHA standards applicable to combustible dust hazards. I have proposed in revision that OSHA’s directive on combustible dust be listed because it addresses all the standards that were listed previously and some that weren’t and gives insight into the application of those standards to specific circumstances. Finally, several additional OSHA publications were listed applicable to combustible dust for their specific topic or their usability in providing simple explanations and information regarding combustible dust.