



Second Revision No. 10-NFPA 61-2019 [Global Comment]

Change section numbers, and add headings, reserved sections, and extracted/adapted material throughout the document.

Supplemental Information

File Name	Description	Approved
61_SR10_Global_Reorganization.docx	Staff use only	
61_SR10_Global_Reorganization.docx	Staff use only- updated 2/8 LM	

Submitter Information Verification

Committee:

Submittal Date: Thu Jan 24 11:31:41 EST 2019

Committee Statement

Committee Statement: These changes are made to align NFPA 61 with the layout of NFPA 652 to assist in locating and applying similar requirements in both documents. Some sections have been extracted directly from NFPA 652, but others have been adapted to meet the needs of the users of NFPA 61.

Response Message: SR-10-NFPA 61-2019



Second Revision No. 14-NFPA 61-2019 [Global Comment]

Add a reference to ASTM D378-13.2 to sections 8.3.2.4.1 and 8.3.7.1.11.3.

8.3.2.4.1 [9.3.15.4.1 after reorg]

Belts shall be fire resistant by complying with the requirements of the Mine Safety and Health Administration (MSHA) 2G flame test for conveyor belting in 30 CFR 18, Section 18.65 (July 2006) or ASTM D378 13.2 Flammability Test for Belting.

8.3.7.1.11.3 [9.3.14.1.11.3 after reorg]

Belts shall be fire resistant by complying with the requirements of the Mine Safety and Health Administration (MSHA) 2G flame test for conveyor belting or ASTM D378 13.2 Flammability Test for Belting.

Submitter Information Verification

Committee:

Submittal Date: Thu Jan 24 14:37:53 EST 2019

Committee Statement

Committee Statement:

ASTM D378 13.2 is another belt flammability test method that is acceptable.

In addition, a year is being specified for the CFR, because the test is no longer included in more recent editions.

Response Message:

SR-14-NFPA 61-2019



Second Revision No. 4-NFPA 61-2019 [Global Comment]

Extract Updates:

Update NFPA 1250 edition to 2020 in Section 2.4

Update NFPA 654 edition to 2020 in Section 2.4, A.3.3.9 Deflagration, and A.3.3.11 Dust Collection System (x2).

Update the extracted section number in the following sections:

- 8.3.12 Mixers and Blenders: change [654:7.16.1] to [654:9.3.16.1] and [654:7.16.5] to [654:9.3.16.5]
- A.8.5.3.3 Diesel-powered front-end loaders: change [654:A.9.8.2.X] to [654:A.9.4.8.2.X]

Submitter Information Verification

Committee:

Submission Date: Thu Jan 17 14:36:12 EST 2019

Committee Statement

Committee Statement: Updating extract edition years and tags. Note that other Second Revisions have been created where extracted material (other than the tag) has changed.

Response Message: SR-4-NFPA 61-2019



Second Revision No. 20-NFPA 61-2019 [Section No. 2.3]

2.3 Other Publications.

2.3.1 AMCA Publications.

Air Movement and Control Association International, Inc., 30 West University Drive, Arlington Heights, IL 60004-1893.

ANSI/AMCA Standard 99, Standards Handbook, *Classifications for Spark Resistant Construction*, 2010.

2.3.2 ASME Publications.

ASME Technical Publishing Office, Two Park Avenue, New York, NY 10016-5990.

Boiler and Pressure Vessel Code, Section VIII, Division I, "Rules for Construction of Pressure Vessels," 2015.

2.3.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D378, *Standard Test Methods for Rubber (Elastomeric) Conveyor Belting, Flat Type*, 2010, reapproved 2016.

ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds*, 2012a.

ASTM E1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*, 2007 2014.

2.3.4 ISA Publications.

International Society of Automation, 67 T.W. Alexander Drive, Research Triangle Park, NC 27709.

ANSI/ISA 84.00.01, *Functional Safety: Safety Instrumented Systems for the Process Industry Sector*, 2004.

2.3.5 MSHA Publications.

Mine Safety and Health Administration (MSHA), 201 12th Street South, Suite 401, Arlington VA ~~22209-5450~~ 22202-5450.

MSHA Title 30, Code of Federal Regulations, Part 18, Section 18.65, "2G Test."

2.3.6 UN Publications.

United Nations Publications, ~~Room DC2-853, 2 UN Plaza, New York, NY 10017.~~ Customer Service, P.O. Box 960, Herndon, VA 20172.

UN Recommendations on the Transport of Dangerous Goods: Model Regulations — Manual of Tests and Criteria, 13th edition.

2.3.7 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Fri Feb 01 15:53:23 EST 2019

Committee Statement

Committee Statement: Updating references.

Response Message: SR-20-NFPA 61-2019



Second Revision No. 5-NFPA 61-2019 [Section No. 3.3.28]

3.3.28* Pneumatic Conveying System.

A material feeder, an air-material separator, an enclosed ductwork system, or an air-moving device in which a combustible particulate solid is conveyed from one ~~point~~ location to another with a stream of air or other gases. Pneumatic conveying for product transfer is distinguished from dust collection systems that are designed to handle dust.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Wed Jan 23 10:53:28 EST 2019

Committee Statement

Committee Statement: A point is a mathematical concept with no dimensions, so changing the terminology from "point" to "location" better clarifies the committees intent.

Response Message: SR-5-NFPA 61-2019

[Public Comment No. 2-NFPA 61-2018 \[Section No. 3.3.28\]](#)



Second Revision No. 2-NFPA 61-2019 [Section No. 3.3.32]

3.3.32* Risk Assessment.

An assessment of the likelihood, vulnerability, and magnitude of the incidents that could result from exposure to hazards. [1250,2015 2020]

A.3.3.32 Risk Assessment.

A risk assessment is a process that performs the following:

- (1) Identifies hazards
- (2) Quantifies the consequences and probabilities of the identified hazards
- (3) Identifies hazard control options
- (4) Quantifies the effects of the options on risks of the hazards
- (5) Establishes risk tolerance criteria (i.e., maximum tolerable levels of risk)
- (6) Selects the appropriate control options that meet or exceed the risk acceptability thresholds

Items 1 through 3 are typically performed as part of a dust hazards analysis (DHA). [652, 2019]

Risk assessments can be qualitative, semi-quantitative, or quantitative. Qualitative methods are used to identify the most hazardous events. Semi-quantitative methods are used to determine relative hazards associated with unwanted events and are typified by indexing methods or numerical grading.

Quantitative methods are the most extensive and use a probabilistic approach to quantify the risk based on both frequency and consequences. [652, 2019]

See SFPE *Engineering Guide to Fire Risk Assessment*, or AIChE *Guidelines for Hazard Evaluation Procedures*, for more information. [652, 2019]

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 17 11:29:54 EST 2019

Committee Statement

Committee Statement: Updating the extracted definition year, and adding extract tags to the annex material.

Response Message: SR-2-NFPA 61-2019



Second Revision No. 15-NFPA 61-2019 [New Section after 5.4.4.2]

5.4.4.3

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

[**652:** 5.4.4.3]

5.4.4.4*

Where there is a potential for fines to segregate from the sample, a representative fine fraction shall be tested.

A.5.4.4.4

If the material is a mixture of fine, noncombustible, and coarse combustible material, the fine fraction might not represent the most conservative sample. See 5.5.2 . [**652:** A.5.4.4.4]

Submitter Information Verification

Committee: CMD-AGR

Submission Date: Thu Jan 24 14:56:38 EST 2019

Committee Statement

Committee Statement: This material is being added to NFPA 61 to complete the extracted section on Quantification of Combustibility and Explosibility Characteristics. One section was adapted to suit this industry.

Response Message: SR-15-NFPA 61-2019



Second Revision No. 12-NFPA 61-2019 [Section No. 8.3.2.4]

9.3.15.4*

Bulk material conveyor belts and lagging shall have a surface resistivity not greater than 300 megohms per square and shall be fire resistant and oil resistant.

A.9.3.15.4

CFR 1910.272(b)(2)(p)(2) requires that belting have a surface electrical resistance not greater than 300 megohms. ~~Subsection Paragraph~~ 9.3.15.4 requires that belting have a surface resistivity not greater than ~~400~~ 300 megohms per square. Surface resistance in ohms and surface resistivity in ohms per square are two different specifications. Surface resistance is a point-to-point measurement. Surface resistivity is a measurement of resistance of a square unit of area and is the same regardless of the size of a material.

There is still much debate on the correct test method to use for each measurement, since it is dependent on a number of variables, including the type of material and its resistivity (how conductive or insulative the material is). This topic needs to be reviewed in much greater detail. Surface resistance and surface resistivity are not the only factors to consider. Volume resistivity should also be considered, along with the conductivity of the pulleys and the total resistance from the belt to ground.

According to NIBA — The Belting Association Technical Note 9, “Static Electricity Considerations” (2009), extensive studies by the British National Coal Board (BNCB) (1950-1966), reported by Barelay and summarized by Norman, found that belts with a surface electrical resistance of 1×10^9 ohms or under did not retain a static charge when run on a typical grounded conveyor, while those with a surface electrical resistance of 6×10^9 ohms and greater did retain a static charge. As a result of this work, the BNCB concluded that a maximum of 3×10^8 ohms resistance was a safe condition in new conveyor belts in underground coal mines.

The International Standards Organization (ISO), the National Coal Board of Britain, and the Canadian Standards Association (CSA) have selected 300 megohms (300×10^6 ohms or 3×10^8 ohms) as their definition of *static conductive*. In the United States, OSHA has also selected 300 megohms (300×10^6 ohms or 3×10^8 ohms) as the definition of *static conductive* for grain applications.

Global SR-14

9.3.15.4.1

Belts shall be fire resistant by complying with the requirements of the Mine Safety and Health Administration (MSHA) 2G flame test for conveyor belting in 30 CFR 18, Section 18.65 (July 2006), or the flame test for belting in Part 13.2 of ASTM D378, *Standard Test Methods for Rubber (Elastomeric) Conveyor Belting, Flat Type*.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 13:18:00 EST 2019

Committee Statement

Committee Statement: Annex material has been added to provide the source material justifying the change made to 8.3.2.4 and 8.3.7.1.10 at the First Draft.

Response Message: SR-12-NFPA 61-2019

[Public Comment No. 5-NFPA 61-2018 \[Section No. 8.3.2.4\]](#)



Second Revision No. 22-NFPA 61-2019 [Section No. 8.3.3.1.1]

9.3.3.1.1

Pneumatic conveying, dust collection, and centralized vacuum cleaning systems shall be installed in accordance with Sections ~~7.3~~ [9.3.3](#) and ~~7.5~~ [9.3.5](#) through ~~7.9~~ [9.3.9](#) of NFPA 654.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Mar 07 12:17:12 EST 2019

Committee Statement

Committee Statement: NFPA 654 has relocated these sections for the 2020 edition.

Response Message: SR-22-NFPA 61-2019



Second Revision No. 16-NFPA 61-2019 [Section No. 8.3.5.2.1]

9.3.5.2.1*

Recycling of air from collectors to buildings shall be permitted if the system is designed in accordance with methods found in NFPA 69, using methods found in 8.3.3.1 through 8.3.3.4, 8.3.4.1, and Section 8.9 Chapter 11 and Chapter 12, to prevent a return of dust, combined combustion products, flammable vapors, heat, and flames into the building.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 15:27:58 EST 2019

Committee Statement

Committee Statement: This revision corrects a past error in references. The references are to chapters in NFPA 69, not NFPA 61. In addition, the term "combustion products" was erroneously changed after the ROP stage for the 2013 edition.

Response Message: SR-16-NFPA 61-2019



Second Revision No. 6-NFPA 61-2019 [Section No. 8.3.9.5.5.1]

9.3.17.5.5.1

~~When determined to be required by a DHA, explosion protection shall be provided for the dryer and associated equipment. Spray dryer systems shall be protected in accordance with 9.7.3.1 unless a documented risk assessment determines a different level of protection is required.~~

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Wed Jan 23 11:50:46 EST 2019

Committee Statement

Committee Statement: It is more likely that spray dryers would require explosion protection than not. This aligns with the language used in other dust documents such as NFPA 652.

Response Message: SR-6-NFPA 61-2019

[Public Comment No. 7-NFPA 61-2018 \[Section No. 8.3.9.5\]](#)

**Second Revision No. 7-NFPA 61-2019 [Section No. 8.7.2.4]****9.6.2.4***

A point-of-use dust collector shall be permitted to be mounted directly to conveying equipment in both indoor and outdoor locations, provided all of the following conditions are met:

- (1) When the point-of-use dust collector is mounted to an enclosure, such as a bucket elevator leg, the enclosure shall have explosion protection per the provisions of this standard. The volume of the dirty air side and of the transition shall be included in the determination of explosion protection design.
- (2) The point-of-use dust collector shall be mounted directly to the conveying equipment housing via a transition duct without an airlock.
- (3) The transition between the point-of-use dust collector and the vented equipment shall be designed such that dust will release from the filter media and return to the equipment product stream and the transition is not a collection point for dust accumulation under normal operations.
- (4) The cross-sectional area of the transition connection shall be equal to or greater than the cross-sectional area of the point-of-use dust collector.
- (5) The point-of-use dust collector shall include an integral air-moving device on the clean side of the dust collector to maintain negative pressure.
- (6) The point-of-use dust collector shall not be connected to any other pieces of equipment.
- (7)* Point-of-use dust collectors that return air to the inside of buildings shall be capable of a minimum filtering efficiency of 0.02 g per dry standard cubic meter of airflow (0.008 grains per dry standard cubic foot of airflow).

A.9.6.2.4(7)

Filtering efficiency specifications are provided by manufacturers. There are commercially available dust collectors using filters, both bag and cartridge type, that can be warranted by the supplier to meet this specification for a specific application. The filtering efficiency can also be verified by testing of existing equipment.

A.9.6.2.4

The purpose of this dust control method is to remove displaced air from the equipment so that it operates under a slightly negative pressure in order to reduce fugitive dust emissions from the equipment, keep the dust generated from the material being conveyed with the material, and eliminate the propagation hazard of interconnecting the conveying equipment with a central dust collection system. The dust is not removed from the equipment, and this approach does not lower the risk of a dust deflagration within the equipment itself. The point-of-use dust collector should be located near the material inlet point on the conveyor. Little dust should be drawn into the point-of-use collector.

When used on a bucket elevator leg, it is recommended that the point-of-use dust collector be installed in the down leg of the bucket elevator leg to facilitate dust release from the filters. The cross-sectional area of the transition between the duct and the leg casing should be 2.5 times the cross-sectional area of the dust collector inlet. The angle of the transition duct to the leg casing should be no less than 60 degrees.

This dust control method should be used in conjunction with a good housekeeping program, equipment maintenance strategy, and dust deflagration mitigation actions as required.

Submitter Information Verification

Committee: CMD-AGR

Submission Date: Wed Jan 23 12:07:05 EST 2019

Committee Statement

Committee Statement: This new annex provides information as to how to determine if this requirement has been met.

Response Message: SR-7-NFPA 61-2019

[Public Comment No. 11-NFPA 61-2018 \[Section No. 8.7.2.4\]](#)

**Second Revision No. 17-NFPA 61-2019 [Section No. 8.8.2.1.5]****9.7.3.1.2***

The requirement in 9.7.1.1.1 shall not apply to bins and silos where explosion venting is not practical due to bin or silo geometry, building constraints, or both.

A.9.7.3.1.2

When explosion protection methods (such as venting, suppression, etc.) in bins, silos, or tunnels cannot be fully utilized, all required prevention methods in this standard should be utilized (such as bearing sensors, belt alignment sensors, speed monitors, housekeeping, management systems, dust control systems, etc.).

Protection methods that could also be considered include, but are not limited to, separating the bin or silo from other structures and from areas where personnel are located; avoiding intervening the bins and silos; incorporating a weak seam roof into the bin or silo design; and arranging fill equipment in a manner such that the fill spouts are closed on bins and silos not being filled. An additional consideration could be calculating the surface area needed to do partial volume venting of a bin or silo to provide protection from a less-than-worst-case deflagration. For example, if a bin or silo is normally 75 percent full before the headspace is above the MEC, the venting calculation should be based on 25 percent of the silo volume.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 17:22:05 EST 2019

Committee Statement

Committee Statement: This requirement is being moved because it applies to equipment rather than buildings.

Annex material has been added to add clarity to the topic.

If global SR 10 does not pass ballot, then this section will be moved to 8.8.4.1.2 under Equipment Requirements.

Response Message: SR-17-NFPA 61-2019



Second Revision No. 11-NFPA 61-2019 [Section No. 9.9]

8.12 Management of Change.

8.12.1*

Documented procedures shall be established and implemented to manage proposed changes to process materials, combustible dust handling equipment, facilities, and fire and explosion protection devices that affect dust, fire, or explosion hazards.

A.8.12.1

The owner/operator can determine what type of change in process materials requires management of change based on what change is important to the process and what the process is designed to handle. Examples of fire and explosion protection devices include, but are not limited to, fire sprinklers, fire doors, fire walls, detection and alarm systems, explosion venting, explosion suppression systems, walls designed for segregation, and explosion-resistant walls.

In addition to the listed changes in 8.12.1, documented procedures should also be considered to manage proposed changes to staffing, job tasks, technology, and procedures that affect dust, fire, or explosion hazards. Establishing a documented procedure for managing changes will help identify when a qualified person is needed to assess the impact of change and to help track the outcomes of their review.

8.12.1.1

The owner/operator shall require that a qualified person knowledgeable in the fire and deflagration hazards of agricultural or food dust be informed of changes to facilities, equipment, or processed materials before implementation of the change. review the proposed changes.

8.12.1.2

The knowledgeable qualified person shall consider whether or not the change would comply with NFPA 61 and if the change does not comply, then a method of compliance shall be determined.

A.8.12.2

Written procedures should be established and implemented to manage proposed changes to process materials, staffing, job tasks, technology, equipment, procedures, and facilities. Establishing a written procedure for managing changes will help identify when a qualified person is needed to assess the impact of change and to help track the outcomes of his or her review.

A written procedure should ensure that the following are addressed prior to any change:

The technical basis for the proposed change

Safety and health implications

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

Modifications to operating and maintenance procedures

Employee training requirements

Authorization requirements for the proposed change

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

For the purposes of this standard, a qualified person at a facility is one who has direct knowledge of the facility operation and NFPA 61, and is accountable for the safety of the plant employees and/or safety of the food produced at the facility.

8.12.2*

The procedures shall ensure that the following are addressed prior to any change:

(1)* The basis for the proposed change

A.8.12.2(1) _

The proposed change and why it is needed should be described. 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.

[**652:** A.8.12.2(1)]

(2)* Safety and health implications

A.8.12.2(2) _

Some fire and explosion protection systems introduce additional hazards into the process environment. These hazards can include, but are not limited to, energy in suppression canisters, asphyxiation hazards from inert gases, and mechanical laceration/amputation hazards from explosion isolation systems. While these are not fire or explosion hazards, they should be addressed as part of the management of change review per this document so that appropriate controls can be applied. [**652:** A.8.12.2(2)]

(3) Authorization requirements for the proposed change

A.8.12.2

In addition to the items in 8.12.2 , the following should be considered for inclusion in the documented procedure:

- (1) Whether the change is temporary or permanent, including the authorized duration of temporary changes
- (2) Modifications to operating and maintenance procedures
- (3) Employee training requirements
- (4) Results of characterization tests used to assess the hazard, if conducted

8.12.3*

Implementation of the management of change procedure shall not be required for replacements-in-kind.

[**652:** 8.12.3]

A.8.12.3

While implementation of the management of change procedure is not required for replacement in kind, it is critical that only qualified personnel are the ones who determine if the replacement is "in kind." These qualified personnel should be intimately familiar with the items listed in 8.12.2 , as well as the broad scope of hazards associated with the particular process. [**652:** A.8.12.3]

Replacement "in kind" for raw materials. Care must be taken when substituting raw materials. There have been cases where a seemingly equivalent material substitution resulted in a large change in the process hazard. Not all safety properties of a material are characterized in, for example, an MSDS. Chemical composition might be identical, but quite different static ignition hazards due to bulk resistivity and charge relaxation rate can appreciably increase the hazard. Flowability differences can affect the hazard probability too. Differences in natural raw materials are generally less of a concern than manufactured materials in this regard. [**652:** A.8.12.3]

File Name	Description	Approved
61_SR11_9.9_move_to_8.12.docx	Staff use only	

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 12:45:40 EST 2019

Committee Statement

Committee Statement: This revision was made to clarify the correct procedure for management of change for this commodity-specific standard.

Response Message: SR-11-NFPA 61-2019

[Public Comment No. 9-NFPA 61-2018 \[Section No. 9.9\]](#)



Second Revision No. 3-NFPA 61-2019 [Section No. A.3.3.2]

A.3.3.2 Air-Material Separator (AMS).

Examples include the following:

- (1) Cyclonic separator (cyclone) — a device utilizing centrifugal forces and geometry to separate the conveying air/gas from the majority of the conveyed material. The efficiency of this separation is based upon many factors such as the geometry of the cyclone, material particle size and density, and air/gas mass flow. Generally, this unit is considered only an initial or primary separator, and additional separation devices are applied to meet air pollution control requirements.
- (2) Dust collector — a device utilizing filter media to separate fine dust particles from the conveying air/gas stream. Such devices often have automatic methods for continuous filter cleaning in order to maintain the operational efficiency of the device. Typically the filter medium is either cartridges or bags. The operating pressure of this device is usually limited by its shape and physical construction.
- (3) Filter receiver — similar to a dust collector but designed for higher differential pressure applications.
- (4) Scrubber — a device utilizing geometry, physical barriers, and/or absorption methods, along with a fluid (e.g., sprays, and streams) to separate and collect gases and/or dusts.
- (5) Electrostatic precipitator — a device utilizing that utilizes differences in electrical charges to remove fine particulates from the air stream.
- (6) Final filter — a high-efficiency device commonly utilizing a pre-filter and a secondary filter within an enclosure to provide the last particulate removal step before the air is discharged from the system. Such devices Final filters are commonly used when recirculating the air stream is recirculated to occupied areas. This device can provide protection against the failure of a dust collector or filter receiver upstream of the device. A high efficiency particulate air (HEPA) filter is an example.

[654, 2017 2020]

Submitter Information Verification

Committee: CMD-AGR

Submission Date: Thu Jan 17 11:58:36 EST 2019

Committee Statement

Committee Statement: Updating the extracted text to match NFPA 654

Response Message: SR-3-NFPA 61-2019



Second Revision No. 18-NFPA 61-2019 [Section No. A.5.2.2]



A.5.2.2

Data can be from samples within the facility that have been tested or data can be based on whether the material is known to be combustible or not. There are some published data of commonly known materials, and the use of these data is adequate to determine whether the dust is a combustible dust. For well-known commodities, published data are usually acceptable. A perusal of published data illuminates that there is often a significant spread in values. It is useful, therefore, to compare attributes (such as particle distribution and moisture content) in published data with the actual material being handled in the system whenever possible. Doing so would help to verify that the data are pertinent to the hazard under assessment. Even test data of material can be different from the actual conditions. Users should review the conditions of the test method as well to ensure that it is representative of the conditions of the facility. Where that is not possible, the use of worst-case values should be selected. Composition and particle size are two parameters that are useful to identify the number and location of representative samples to be collected and tested. (See Section 5.5 for information on sampling.)

These are locations in which combustible dust is in the air in quantities sufficient to produce explosive or ignitable mixtures under normal operating conditions, or locations where mechanical failure or abnormal operation of machinery or equipment could cause explosive or ignitable mixtures to be produced, and combustible dust in the air could provide a source of ignition through simultaneous failure of electrical equipment, operation of protection devices, or other causes.

Situations can occur in which it is not possible to provide calculated deflagration venting as described in NFPA 68. Such situations do not justify the exclusion of all venting. The maximum practical amount of venting should be provided, since some venting should reduce the damage potential. In addition, consideration should be given to other protection and prevention methods.

Table A.5.2.2 contains examples of test data for selected agricultural dusts with known explosion data parameters. Other databases, such as the IFA (Institute for Occupational Safety and Health of the German Social Accident Insurance), GESTIS-DUST-EX Database Combustion, are available for data on explosion characteristics of dusts.

Please note that the information provided in the table is for the specific agricultural dust sample tested. Explosion severity and ignition sensitivity parameters are greatly influenced by many factors, including particle size distribution, particle morphology, and moisture content. Differences in specific material composition and possible contamination will also affect explosibility parameters. Thus, the information in Table A.5.2.2 will not apply in all cases.

If dealing with an agricultural dust with unknown explosion or ignition sensitivity when designing explosion protection or developing risk mitigation strategies, consider testing the dust in accordance with the relevant ASTM, ISO, or CEN standards so the data being used is as applicable as possible.

Table A.5.2.2 Test Data — Agricultural Dusts

<u>Dust Name</u>	<u>Test Report Date</u>	<u>Sample Dried</u>	<u>Percent Moisture as Tested (%)</u>	<u>Median Particle Size as Received (µm)</u>	<u>Median Particle Size as Tested (µm)</u>	<u>Percent <200 (or <250) Mesh as Tested (%)</u>	<u>P_{max} (bar g)</u>	<u>K_{St} (bar m/sec)</u>	<u>Minimum Explosive Concentration (MEC) (g/m³)</u>	<u>Mi</u>	<u>Ig</u>	<u>E</u>
Alfalfa concentrate	1997	Yes	2.1	Unk	36	99	6.7	94	NT			
Alfalfa powder	2011	Yes	4.5	Unk	103	100	7.9	75	NT			
Angel food cake mix	2012	No	4.1	107	41	100	7.5	132	NT			
Apple	Unk	Unk	Unk	Unk	155	Unk	6.7	34	125			
Barley	2016	Yes	2.3	Unk	28	Unk	8.7	192	75–100			1
Barley (barley dust)	2011	Yes	2.6	Unk	83	(83.8)	7.5	107	NT			
Betaine – nutraceutical anhydrous betaine	2018	Yes	0.6	Unk	<45	100	9.0	286	190			
Canola dust	2016	Yes	2.5	Unk	12	Unk	6.2	40	60–75			1
Canola meal	2016	Yes	2.4	Unk	59	Unk	7.1	91	110–125			10

<u>Dust Name</u>	<u>Test Report Date</u>	<u>Sample Dried</u>	<u>Percent Moisture as Tested (%)</u>	<u>Median Particle Size as Received (µm)</u>	<u>Median Particle Size as Tested (µm)</u>	<u>Percent</u>	<u>P_{max} (bar g)</u>	<u>K_{St} (bar m/sec)</u>	<u>Minimum Explosive Concentration (MEC) (g/m³)</u>	<u>Mi</u>
						<u><200 (or <250) Mesh as Tested (%)</u>				
Canola meal dust	2003	No	6.4	Unk	149	(59.8)	6.2	15	NT	
Carrageen	1992	Yes	3.8	Unk	Unk	100	8.5	140	NT	
Carrageenan	1995	Yes	1.2	Unk	47	100	5.2	32	NT	
Carrot	1997	Yes	4.0	Unk	29	97	6.9	65	NT	
Cereal dust	2003	Yes	4.9	Unk	94	80	6.6	96	265	
Cheesy pasta (corn starch and various spices)	2014	Unk	7.9	Unk	45	80	7.2	99	NT	30
Chili (corn starch and various spices)	2014	Unk	7.0	Unk	79	65	6.6	60	NT	30
Cocoa bean shell dust	2016	Yes	4.4	Unk	52	100	6.7	42	NT	
Cocoa powder	2009	Yes	3.9	Unk	194	50	8.0	162	65	100
Coconut shell dust	1990	Unk	6.5	Unk	Unk	80	6.8	111	NT	
Coffee grounds dust	2009	Yes	4.0	Unk	40	100	7.7	158	NT	
Coffee dust – coarse particles	Unk	Unk	4.8	Unk	321	0.4	6.9	55	NT	
Coffee dust (instant coffee)	2016	Yes	2.4	Unk	45	100	6.8	101	NT	
Coffee (green)	2009	Yes	4.6	Unk	57	100	7.6	116	NT	
Coffee creamer (French vanilla)	2006	Yes	3.1	Unk	57	(94.6)	7.6	156	NT	
Corn maize	Unk	Unk	Unk	Unk	165	55	8.7	117	30	
Corn meal	1996	Yes	1.6	Unk	589	8	7.0	35	NT	
Cornstarch	2013	Unk	11.4	Unk	45	98	7.8	139	NT	
Cornstarch – coarse particles	2006	Yes	2.2	Unk	217	(62.5)	7.9	186	NT	30
Cotton (flocks, pulverized)	Unk	Unk	Unk	Unk	44	100	7.2	24	NT	
Cotton lint dust	2006	Yes	4.8	Unk	180	(43.6)	8.6	88	NT	
Cottonseed (expeller, silo entrance)	Unk	Unk	Unk	Unk	245	(50)	7.7	35	125	

<u>Dust Name</u>	<u>Test Report Date</u>	<u>Sample Dried</u>	<u>Percent Moisture as Tested (%)</u>	<u>Median Particle Size as Received (µm)</u>	<u>Median Particle Size as Tested (µm)</u>	<u>Percent <200 (or <250) Mesh as Tested (%)</u>	<u>P_{max} (bar g)</u>	<u>K_{St} (bar m/sec)</u>	<u>Minimum Explosive Concentration (MEC) (g/m³)</u>	<u>Mi lg E</u>
Dried distillers dried grains w/solubles (DDGS)	2016	No	3.8	Unk	26	Unk	7.6	135	75–100	1
Dried distillers dried grains (yellow corn) w/solubles (DDGS)	2009	Yes	4.2	Unk	225	(43.8)	6.5	42	NT	
Dried distillers dried grains (wheat) w/solubles (DDGS)	2011	Yes	4.4	Unk	189	(67.1)	7.5	105	NT	
Fudge brownie mix	2012	No	4.8	291	221	(65.3)	5.8	43	NT	
Garlic powder	1988	Unk	Unk	Unk	Unk	Unk	8.6	164	NT	
Garlic powder, onion powder extract loc bac and salt (from dust collector)	2010	Yes	2.3	Unk	176	(35.3)	4.0	15	NT	
Gluten meal	Unk	Unk	Unk	Unk	150	Unk	7.7	110	125	
Gluten – wheat	1999	Unk	5.2	Unk	81	(96)	7.3	137	NT	
Grain dust – mixed (wheat, corn, beans)	2016	Yes	3.3	Unk	Unk	48	7.1	108	NT	
Grain dust – mixed (wheat, corn, beans)	2016	No	4.4	Unk	33	Unk	8.3	170	60–75	1
Grain dust – mixed (reintroduced from dust collector)	2003	No	8.3	Unk	65	(83.1)	7.7	129	NT	
Grass dust	Unk	Unk	Unk	Unk	200	Unk	8.0	47	125	
Hops, malted	Unk	Unk	Unk	Unk	490	Unk	8.2	90	NT	
Hops dust (overhead ceiling structure)	2006	No	8.3	Unk	54	(98)	7.4	159	75	
Lemon peel dust	1999	No	9.5	Unk	38	(95.6)	6.8	125	NT	

<u>Dust Name</u>	<u>Test Report Date</u>	<u>Sample Dried</u>	<u>Percent Moisture as Tested (%)</u>	<u>Median Particle Size as Received (µm)</u>	<u>Median Particle Size as Tested (µm)</u>	<u>Percent <200 (or <250) Mesh as Tested (%)</u>	<u>P_{max} (bar g)</u>	<u>K_{St} (bar m/sec)</u>	<u>Minimum Explosive Concentration (MEC) (g/m³)</u>	<u>Mi</u>	<u>lg E</u>
Lemon pulp dust	1997	Yes	2.8	Unk	180	(61)	6.7	74	NT		
Linseed, soya (dust from silo)	Unk	Unk	Unk	Unk	30	100	8.0	50	NT		
Locust bean gum	1992	Unk	1.7	Unk	Unk	100	7.8	78	NT		
Malt	1995	No	10.5	Unk	72	(95)	7.5	170	NT		
Maltodextrin	2015	Yes	2.7	Unk	45	100	8.1	125	100		
Maltodextrin flavoring	2015	Yes	2.7	Unk	47	100	9.2	207	NT		
Milk powder	1998	Yes	3.1	Unk	41	(99.5)	7.5	145	NT		
Oat flour	2013	Yes	4.5	Unk	107	(87.1)	6.3	82	NT		
Oat grain dust from aspirator	2017	Yes	4.4	245	113	(63.1)	7.0	51	NT		
Oat bran dust	2010	No	8.0	Unk	195	(78.3)	6.8	77	80		
Olive pellets	Unk	Unk	Unk	Unk	Unk	100	10.4	74	125	>	
Onion powder	1988	Unk	Unk	Unk	Unk	Unk	9.0	157	NT		
Parmesan sauce mix (corn starch and spices)	2014	No	6.7	Unk	66	(84.9)	6.1	45	NT	30	
Parsley (dehydrated)	1988	Unk	5.4	Unk	Unk	63.3	7.5	110	NT		
Parsley (dried)	2015	Unk	4.5	Unk	132	(72)	6.4	67	NT		
Pea fiber (>95% pea dust)	2013	Yes	3.3	206	107	(74.8)	6.4	68	NT		
Peach powder, hot-spray-dried (hygroscopic)	Unk	Unk	Unk	Unk	140	Unk	8.4	81	60		
Peanut hull dust from aspirator	1999	Unk	9.9	Unk	90	(98.4)	7.4	165	NT		
Peanut meal and skins	1993	Unk	3.8	Unk	Unk	Unk	6.4	45	NT		
Peat dust (from overhead ceiling structure)	Unk	Unk	Unk	Unk	49	66	8.4	81	60		
Potato dust (>95% from aspirator)	2013	Unk	5.0	Unk	45	(99.7)	8.5	93	NT		
Potato flour	Unk	Unk	Unk	Unk	65	100	9.1	69	125		

<u>Dust Name</u>	<u>Test Report Date</u>	<u>Sample Dried</u>	<u>Percent Moisture as Tested (%)</u>	<u>Median Particle Size as Received (µm)</u>	<u>Median Particle Size as Tested (µm)</u>	<u>Percent <200 (or <250) Mesh as Tested (%)</u>	<u>P_{max} (bar g)</u>	<u>K_{St} (bar m/sec)</u>	<u>Minimum Explosive Concentration (MEC) (g/m³)</u>	<u>Mi lg E</u>
Potato flakes (90% potato, 10% water)	2009	Unk	Unk	Unk	313	(26.3)	7.3	38	NT	
Potato starch	Unk	Unk	Unk	Unk	28	100	8.2	116	NT	
Rice dust	1992	Unk	2.5	Unk	Unk	(50)	7.7	118	NT	40
Rice flour	2010	Unk	12.2	Unk	45	100	7.7	140	65	
Rice starch	Unk	Unk	Unk	Unk	18	90	10.0	190	NT	
Rye dust (from aspirator)	2014	Yes	3.7	Unk	45	100	8.5	139	NT	
Rye flour (from silo)	2009	Unk	7.8	Unk	57	100	7.1	100	NT	
Rye meal	2000	Unk	6.2	Unk	45	(64.4)	7.3	140	NT	
Semolina	2001	Unk	13.6	Unk	57	100	7.0	109	NT	
Snack seasoning	2006	Unk	4.7	Unk	203	(70.7)	5.1	34	510	
Sorghum	2016	No	4.2	Unk	18	Unk	8.1	124	100-125	1
Soybean dust	1992	Yes	2.1	Unk	Unk	100	7.5	125	NT	
Soybean flour (defatted)	2015	Unk	3.7	Unk	45	100	7.7	148	NT	
Spice powder	1988	Unk	10.0	Unk	Unk	Unk	7.8	172	NT	
Sugar dust	2015	Yes	1.6	Unk	45	100	7.1	188	NT	
Sugar dust (beet)	2018	Yes	1.6	Unk	<45	100	5.8	84	NT	
Sugar dust (beet)	2018	Yes	1.0	Unk	<45	100	5.4	74	NT	
Sugar dust (beet-cooler baghouse)	2014	Yes	1.0	Unk	<45	100	8.0	146	NT	
Sugar (granulated)	2006	Yes	0.6	Unk	76	(73.6)	6.3	122	NT	
Sugar (powdered)	2006	No	13.0	Unk	45	100	7.0	122	NT	
Sunflower seed dust	1996	No	9.7	Unk	500	(17)	7.8	92	NT	
Tea (from overhead beams)	1998	No	6.3	Unk	77	(72.3)	7.6	102	NT	
Tobacco blend	1990	Yes	1.0	Unk	120	100	8.0	124	NT	
Tomato (powder, hot-spray-dried, highly hygroscopic)	Unk	Yes	1.0	Unk	120	100	8.0	124	NT	

Dust Name	Test Report Date	Sample Dried	Percent Moisture as Tested (%)	Median Particle Size as Received (µm)	Median Particle Size as Tested (µm)	Percent <200 (or <250) Mesh as Tested (%)	P _{max} (bar g)	K _{St} (bar m/sec)	Minimum Explosive Concentration (MEC) (g/m ³)	Mi Ig E
Walnut dust	1988	Unk	6.0	Unk	Unk	72	8.4	174	NT	
Wheat flour (whole grain)	2009	Yes	2.7	Unk	58	100	7.7	145	NT	
Wheat grain dust	Unk	Unk	Unk	Unk	80	Unk	9.3	112	60	
Wheat starch	Unk	Unk	Unk	Unk	20	Unk	9.8	132	60	2
Wheat starch	2010	Unk	11.5	Unk	45	(98.9)	7.6	155	130	3
Wheat cereal 55%, rice flour 20%	2012	Unk	2.8	Unk	187	(64.7)	5.7	28	NT	
Xanthan gum	1996	Unk	8.6	Unk	45	(99)	7.5	61	NT	
Yellow cake mix	2012	Unk	2.7	354	219	(30.6)	6.3	73	NT	
Yucca seed dust (raw)	1995	Unk	12.7	Unk	403	(29.9)	6.2	65	NT	
Yucca seed dust (hydrolized)	1995	Unk	5.5	Unk	194	(64)	7.0	156	NT	

Unk: Unknown. NT: Not Tested.

*Data is not from this product test. It is from the SFPE *Handbook of Fire Protection Engineering*, 4th Edition, Table 3-18.2 of a similar product.

Notes:

(1) Please note that the information provided in this table is for the specific agricultural/food dust sample tested. Explosion severity and ignition sensitivity parameters are greatly influenced by many factors such as particle size, shape, and moisture content. Differences in specific mixture composition and possible contamination will also affect explosibility parameters. The information in this table should be used for general hazard assessment and not be used for design purposes.

(2) Normalized to 1 m³ test vessel pressures, per ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds*.

(3) See also Table F.1(a) in NFPA 68 for additional information on agricultural dusts with known explosion hazards.

(4) For those agricultural dusts without known explosion data, the dust should be tested in accordance with established standardized test methods.

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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		
Apple		155	9	6.7	34	125	
Beet root		108	26	6.1	30	125	
Carrageen	3.8		98	8.5	140		
Carrot	4.0	29	76	6.9	65		

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)
Cereal dust (mixed)	4.4	121		6.7	74	265	
Cheesy pasta sauce mix (corn starch and spices)	7.9	<45	68	7.2	99		45
Chili sauce mix (corn starch and spices)	7.0	79	70	6.6	60		74
Cocoa bean dust	2.3	45	100	7.1	133		
Cocoa powder	3.9	194	14	8.0	162	65	100–180*
Coconut shell dust	6.5		51	6.8	111		
Coffee dust—coarse particles	4.8	321	0.4	6.9	55		160*
Coffee dust—fine particles	4	40	100	7.7	158		
Corn (maize)	9.0	165		8.7	117	30	>10
Corn meal	8.2	403	0.6	6.2	47		
Cornstarch—coarse particles	2.2	217	0.1	7.9	186		30–60*
Cornstarch—fine particles		11	100	9.5	194	60	
Cotton		44	72	7.2	24	100	
Cottonseed		245	10	7.7	35	125	
Fudge brownie mix	4.8	221		5.8	43		
Garlic powder				8.6	164		
Gluten		150	33	7.7	110	125	
Grass dust		200		8.0	47	125	
Green coffee	5.0	45	81	7.8	116		
Hops (malted)		490	9	8.2	90		
Lemon peel dust	9.5	38	73	6.8	125		
Lemon pulp	2.8	180	17	6.7	74		
Linseed		300		6.0	17		
Locust bean gum	1.7		53	7.8	78		
Malt	10.5	72	54	7.5	170		
Milk powder	3.1	41	88	7.5	145		
Oat flour	4.3	180	0.2	6.8	64		
Oat grain dust		295		6.0	14	750	
Olive pellets				10.4	74	125	

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)
Onion powder				9.0	157		
Parmesan sauce mix (corn starch and spices)	6.7	66	60	6.4	45		62
Parsley (dehydrated)	5.4		26	7.5	110		
Peach		140	17	8.4	81	60	
Peanut meal and skins	3.8			6.4	45		
Peat		74	48	8.3	51	125	
Potato		82	30	6	20	250	
Potato flakes	8.0	249	7.0	6.2	33		
Potato flour		65	53	9.4	69	125	
Potato starch		32	100	9.4	89		>3200
Raw yucca seed dust	12.7	403	5	6.2	65		
Rice dust	2.5		4	7.7	118		40–120*
Rice flour	12.2	45	100	7.7	140	65	>500
Rice starch		18	90	10	190		
Rye flour		29	76	8.9	79		
Semolina	13.6	57	100	7.0	109		
Snack mix spices	8.3	85		6.8	73		
Soybean dust	2.1		59	7.5	125		
Spice dust	10.0		2	6.9	65		
Spice powder	10.0			7.8	172		
Sugar, fine	1.3	45	100	7.6	117	135	38
Sugar, granulated	2	152	13	6.2	66		
Sugar, powdered	13	45	100	7.0	122		30*
Sunflower		420	10	7.9	44	125	
Tea	6.3	77	53	7.6	102	125	
Tobacco blend	1.0	120		8.0	124		
Tomato		200		1		100	
Walnut dust	6.0		31	8.4	174		
Wheat/rice cereal base	2.8	187		5.7	28	150	
Wheat/rice cereal base regrinds	6.4	217		6.4	29		
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*
Xanthan gum	8.6	45	91	7.5	61		

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)
Yellow-cake mix	6.1	219		6.3	73		

*The SFPE *Handbook of Fire Protection Engineering*, 4th Edition, Table 3-18.2.

Notes:

(1) Normalized to 1 m^3 test vessel pressures, per ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds*.

(2) See also Table F.1(a) in NFPA 68 for additional information on agricultural dusts with known explosion hazards.

(3) For those agricultural dusts without known explosion data, the dust should be tested in accordance with established standardized test methods.

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Supplemental Information

File Name	Description	Approved
61_SR18_Table_A.5.2.2.xlsx	Staff use only	

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 17:30:14 EST 2019

Committee Statement

Committee Statement: This revised table includes updated information on the existing dusts in the table. In addition, new dusts that were not on the previous table have been added.

Response Message: SR-18-NFPA 61-2019

[Public Comment No. 12-NFPA 61-2018 \[Section No. A.5.2.2\]](#)



Second Revision No. 13-NFPA 61-2019 [Section No. A.8.3.7.1.10]

A.9.3.14.1.10

See A.9.3.15.4 . CFR 1910.272(b)(2)(p)(2) requires that belting have a surface electrical resistance not greater than 300 megohms. Subsection 9.3.15.4 requires that belting have a surface resistivity not greater than 100 megohms per square. Surface resistance in ohms and surface resistivity in ohms per square are two different specifications. Surface resistance is a point-to-point measurement. Surface resistivity is a measurement of resistance of a square unit of area and is the same regardless of the size of the material.

There is still much debate on the correct test method to use for each measurement, since it is dependent on a number of variables, including the type of material and its resistivity (how conductive or insulative the material is). This topic needs to be reviewed in much greater detail. Surface resistance and surface resistivity are not the only factors to consider. Volume resistivity should also be considered, along with the conductivity of the pulleys and the total resistance from the belt to ground.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 13:27:53 EST 2019

Committee Statement

Committee Statement: A.8.3.2.4 contained the same material, but has been updated and expanded upon. Instead of repeating it here, a reference has been added.

Response Message: SR-13-NFPA 61-2019



Second Revision No. 23-NFPA 61-2019 [Section No. A.8.10.3]

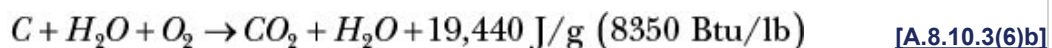
A.8.10.3

The following are incipient fire-fighting techniques for agricultural dust fires:

- (1) *Leg Fires.* Material flow into a leg should be stopped and the leg should be shut down. Leg fires should be extinguished by water fog or gentle application of water. Fires should be located by feeling the leg casing for heat or observing discoloration of metal. If the location is unknown, water should be applied first in the boot section, then in the bin-pulley access door, and last in the head section.
- (2) *Conveyor Belt Fires.* The conveyor belt should be shutdown (halted). Conveyor belt fires should be extinguished by application of water. Material flow to the conveyor belt should be stopped. If necessary, the belt should be cut to isolate the fire.
- (3) *Dryer Fires.* Dryer fires should be extinguished by removing burning material from the dryer or gentle application of water. Fuel to burners, fans, and material flow into the dryer and from the facility should be stopped. If necessary, emergency dump should be used to remove material from the dryer.
- (4) *Concrete Bin or Silo and Steel Tank Fires.* Concrete bin or silo fires should be extinguished by wetting the top surface of the material with gentle application of water at a low flow rate directly to the burning materials, and then removal of burning material from the bin or silo directly to the outside. Water fog should be applied to walls and to the underside of the roof to reduce airborne dust. Fire should be located by thermometer probes, thermographic photography, or feeling heat on bin or silo surfaces. Openings to the bin or silo should be sealed to limit oxygen entry. Material flow to and from the bin or silo should be stopped. Fire-fighting operations should be done from outside the bin or silo. Fires should be isolated by selective unloading of material near the fire into a steel tank.
- (5) *Fumigant or Chemical Fires.* Fires involving fumigants containing phosphine should be extinguished by inert material or non-aqueous agent used for Class B fires. Water should not be used for phosphine fires to avoid exothermic reaction and development of explosive gases.
- (6) *Water Gas Reaction.* Application of small amounts of water on glowing grain in a partially confined space, such as a grain silo, and in the presence of air can generate a water gas reaction. The glowing grain must be at a temperature of at least 700°C to 800°C (1290°F to 1470°F), and initial water contact might not cool the mass of glowing grain below 600°C (1110°F). The partial oxidation reduction between carbon and water forms carbon monoxide and hydrogen as follows:



In the presence of oxygen (air), the carbon monoxide and hydrogen burn, immediately releasing heat as follows:



In a partially confined space, the combustion energy will rapidly pressurize the space beyond what the silo walls or tops can withstand, causing destruction of the silo.

Submitter Information Verification

Committee: CMD-AGR

Submission Date: Tue Apr 09 15:54:51 EDT 2019

Committee Statement

Committee Statement: It appears that this information was inadvertently removed during the reorganization of material for the 2017 edition of NFPA 61.

Response Message: SR-23-NFPA 61-2019



Second Revision No. 19-NFPA 61-2019 [Section No. A.9.8.1]

A.8.11.1

Events where there are injuries, equipment damage, or significant business interruption are subject to investigation.

In addition to investigation of fires and explosions, it is also a good practice to investigate near misses (events that could have resulted in fires or explosions under different circumstances) and all activations of active fire and explosion mitigation systems. It is important to educate facility personnel on the concept of what a near miss is and to clearly communicate their responsibility for reporting both incidents and near misses.

Near-miss events often indicate an underlying problem that should be corrected. See NFPA 654 for additional information. Barriers to reporting should be removed, as described in ANSI/AIHA Z10, *Occupational Health and Safety Management Systems*. Investigations should include workers and their representatives, as appropriate. [652:A.8.11.1]

The retroactivity of this chapter is not intended to require investigation of incidents that occurred prior to the adoption of this standard. [654: A.8.11.1]

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Thu Jan 24 17:41:16 EST 2019

Committee Statement

Committee Statement: After the reorganization, this section will be in a chapter that is applied retroactively, so annex material has been added to clarify that it is not intended to require investigation of incidents that occurred before the standard was issued.

Response Message: SR-19-NFPA 61-2019



Second Revision No. 8-NFPA 61-2019 [Section No. F.3]



F.3 Checklist.

See Figure F.3 for an example of a combustible dust checklist, an agricultural and food dust hazard analysis (DHA) checklist.

Figure F.3 Combustible Dust Checklist, Agricultural and Food Dust Hazard Analysis (DHA) Checklist.

COMBUSTIBLE DUST CHECKLIST				
Site:	Expectation Compliance	Comments/Actions	Responsible	Date Due
Date:	Yes / No / NA			
1.0 COMBUSTIBLE DUST EXPLOSION PREVENTION TRAINING INFORMATION				
1.1				
1.2				
1.3				
1.4				
1.5				
1.6				
2.0 CONTRACTORS				
2.1				
2.2				
3.0 HOUSEKEEPING				
3.1				
3.2				
3.3				
3.4				

COMBUSTIBLE DUST CHECKLIST				
Site:	Expectation Compliance	Comments/Actions	Responsible	Date Due
Date:	Yes / No / NA			
3.0 HOUSEKEEPING				
3.5				
3.6				
3.7				
4.0 PREVENTATIVE MAINTENANCE				
4.1				
4.2				
4.3				
4.4				
4.5				
4.6				
4.7				
5.0 DRY SOLID PRODUCT MOVEMENT AND STORAGE (GENERAL)				
5.1				
5.2				
5.3				
5.4				
5.5				
5.6				
5.7				
5.8				
5.9				
5.10				
6.0 GRAIN RECEIVING AND STORAGE (LEGS)				
6.1				
6.2				
6.3				

COMBUSTIBLE DUST CHECKLIST		Expectation Compliance	Comments/Actions	Responsible	Date Due
Site:	Date:				
		Yes	No	NA	
6.0 GRAIN RECEIVING AND STORAGE (LEGS)					
6.4	Are all bearings mounted externally on elevator legs?				
6.5	Are all elevator legs appropriately protected/vented?				
6.6	Are elevator leg sprinkler systems installed?				
6.7	Is each elevator leg equipped with a slow-down device that will cut power to the leg and alarm, in accordance with NFPA 61, at a minimum of 80 percent of normal operating speed? Note: Feed to leg by mechanical means shall be diverted or stopped.				
6.8	Has a system been established to ensure slow-down devices are installed properly and inspected regularly, and that the following have been done? (a) Verify inspection records. (b) Visually verify slow-down device installation. (c) Visually verify slow-down device set points and function.				
6.9	Are bearing temperature sensors installed?				
6.10	Has a system been established to ensure bearing temperature sensors are installed properly and inspected regularly, and that the following have been done? (a) Verify inspection records. (b) Visually verify bearing temperature device installation. (c) Visually verify bearing temperature set points and function.				
6.11	Are belt alignment devices (e.g., rub blocks) installed?				
6.12	Has a system been established to ensure belt alignment sensors (e.g., rub blocks) are installed properly and tested regularly, and that the following have been done? (a) Verify inspection records. (b) Visually verify belt alignment sensor installation. (c) Visually verify belt alignment sensor set point and function.				
6.13	Where explosion vents are applied, is the vent designed to avoid injuries to personnel by vent discharge? Have there been any process changes since the design basis was determined?				
6.14	Are ducts isolated in accordance with NFPA 614 to prevent propagation of a dust explosion?				
7.0 GRAIN RECEIVING AND STORAGE (CONVEYORS)					
7.1	Are flippers, plows, and/or wipers installed and functioning properly?				
7.2	Is an inspection system established to ensure belt wipers are in place and not worn?				
7.3	Is an inspection system established to ensure conveyor covers are secured?				
7.4	Are conveyor emergency stops installed and routinely tested to ensure appropriate function?				
7.5	Are bearing temperature sensors installed?				
7.6	Is process shutdown automatic when bearing temperature exceeds the set point?				
7.7	Has a purchasing standard for belts and lagging been established and implemented to ensure such belts are static conductive, oil resistant, and fire retardant (SCOP or FRAS), and will not have a surface electrical resistance that exceeds 300 megohms?				

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COMBUSTIBLE DUST CHECKLIST		Expectation Compliance	Comments/Actions	Responsible	Date Due
Site:	Date:				
		Yes	No	NA	
8.0 ELECTRICAL					
8.1	Has the location completed a survey to identify and classify areas with combustible dusts for electrical hazardous risks (e.g., Class I, Group C, Division 1 or Class II, Group C, Division 2? Note: A Class II, Group C, Division 1 location is a location in which combustible dust is normally in suspension during normal operation. A Class II, Group C, Division 2 location is a location in which combustible dust is not in suspension during normal operation.)				
8.2	Does electrical equipment and wiring within the location meet the requirements for the area hazard classification?				
8.3	Are the Motor Control Centers (MCC) clean and buckets (containers) free of dust accumulations?				
8.4	Is the MCC pressurization system and alarm installed and working properly?				
8.5	Are infrared tests and other specified preventative maintenance tests on electrical equipment conducted?				
8.6	Where determined necessary is lightning protection installed and properly maintained?				
8.7	Is comfort heating in areas of combustible dust designed to prevent an ignition of a dust cloud or layers of dust on hot surfaces, in accordance with NFPA 61?				
9.0 DUST FILTER SYSTEMS					
9.1	Are dust collectors installed outside or in accordance with one of the following options: (a) Located in an area inside the facility that is protected by an explosion suppression system, or (b) Located in an area inside the facility that is separated from other areas of the facility by construction having at least a 1-hour fire resistance rating and being adjacent to an exterior wall, and explosion vented to the outside?				
9.2	Are filter systems interlocked?				
9.3	Is a pressure drop instrumentation installed and functioning properly?				
9.4	Are pressure drop gauges interlocked?				
9.5	Has a bag or other filter media change schedule been established and followed?				
9.6	Is dust from the dust collection system prevented from being returned directly to the elevator leg?				
9.7	Are ducts isolated to prevent propagation of a dust explosion? Note: Where clean air lines are returned into the building, these also require isolation.				
9.8	Are appropriate grounding measures in place for filter body and bag mechanisms?				
10.0 GRAIN PROCESSING EQUIPMENT					
10.1	Are hammer mills and other processing equipment equipped with spark detection?				
10.2	Is the spark detection device included on maintenance inspection schedules and tested as required?				
11.0 DUST SUPPRESSION OIL SYSTEMS					
11.1	Are dust suppression oil systems installed where required?				
11.2	Is there a means to determine oil dosage?				
11.3	Is there a signal in place to inform the operator that the system is not working properly?				
12.0 GRAIN DRYERS					
12.1	Is there a pre-drying system ahead of the dryer?				
12.2	Is the dryer equipped with adequate access doors for cleaning or fire fighting?				
12.3	In the event of a fire, is there an emergency grain dump system to prevent hot grain from going to storage?				

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COMBUSTIBLE DUST CHECKLIST				
Site:	Expectation Compliance:	Comments/Actions:	Responsible:	Date Due:
Date:	Yes No N/A			
12.0 GRAIN DRYERS				
12.4		In the event of a fire, can the dryer be quickly isolated from the lines that feed the dryer and lines that receive grain from the dryer?		
12.5		Are emergency shutdown switches safely and readily accessible?		
12.6		In the event it is contacted, is the dryer equipped with a high level probe in the dryer feed hopper that will shut off grain flow to the dryer?		
12.7		Is the dryer equipped with a low level alarm and shutdown interlock?		
12.8		Is the dryer equipped with a temperature readout that indicates the temperature of gases entering the drying section?		
12.9		Is the dryer equipped with an exhaust air high temperature shutdown?		
12.10		Is the dryer equipped with a hot air temperature shutdown set at a maximum of 110°C (230°F) or lower?		
12.11		Does the hot air shutdown accomplish the following: (a) Shut off the fuel or heat to the burners? (b) Stop the flow of product out of the dryer? (c) Stop all airflow from fans into the dryer? (d) Sound an alarm to prompt emergency procedures?		
12.12		Is the dryer equipped with a loss of airflow shutdown?		
12.13		Are there motion switches on all discharge loaders and conveyors?		
12.14		In the event of power failure, will grain/steam flow be automatically cut off?		
12.15		Is the grain dryer equipped with a fire suppression system?		
12.16		Is the dryer equipped with a fire detection system that will activate an alarm?		
12.17		Has the dryer fuel supply up to the point of connection to the dryer burner been installed appropriately?		
12.18		Are operating procedures in place for dryer startup, shutdown, fire or other emergency, power failure, cleaning and inspection of critical sections?		
12.19		Is there documented training of all elevator personnel in dryer operating and emergency procedures?		
13.0 HAZARD MONITORING AND ALARM SYSTEMS				
13.1		Are all defined critical hazard monitoring devices tied into an audible alarm in accordance with the process safety assessment? Examples include, but are not limited to, the following: (a) Heating temperatures (b) Alagments (c) Leg slowdowns (d) Dryer high temperatures (e) Grinder spark detectors		
13.2		Has a system been established to ensure alarm systems are installed properly and tested regularly, and that the following have been done? (a) Verify inspection records. (b) Verify alarms can be heard in all areas.		
13.3		Do records and tests confirm there is no history of problems with hazard-monitoring devices or alarm systems?		
13.4		Are critical bypass procedures established when a problem is identified or a critical hazard-monitoring device is found to not be functioning?		
14.0 EMERGENCY RESPONSE				
14.1		Is there more than one means of egress from the top of the elevator or bin(s)?		
14.2		Is the site emergency action plan in place, and does it clearly define procedures for addressing grain bin fires?		

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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
Completed document and associated reference material meets the requirements for documentation of "Dust Hazard Analysis (DHA)." A systematic review to identify and evaluate the potential for flash fire, or explosion hazards associated with the presence of one or more combustible particulate solids in a process or facility (NFPA 652, 2019). It can be used at facilities that have simple conversion technologies, such as, but not limited to, grain elevators, flour mills, man plants, cereal plants, and food plants.						
Date DHA completed: _____						
Date DHA modified: _____						
Date DHA reviewed: _____						
For new processes that will be constructed and facility processes that are undergoing significant modification, the owner/operator shall complete DHAs as part of the project. For existing processes and facility components that are not undergoing significant modification, the owner/operator shall schedule and complete DHAs of bucket elevators, conveyors, grinding equipment, sprayer dryer systems, and dust collection systems by January 1, 2023. (NFPA 61)						
Facility owner: _____						
Facility operator: _____						
Person responsible for DHA: _____						
Others involved in DHA: _____						
The DHA shall be performed or led by a qualified person. (NFPA 61) The owner/operator of a facility where materials determined to be combustible or explosive are present in an enclosure shall be responsible to ensure a DHA is completed in accordance with the requirements. (NFPA 61)						
1.0 MATERIALS EVALUATION	Yes	No	N/A	Comments	Action	Date Due
1.1 Is there a comprehensive list of all materials at the facility that present a credible combustible dust hazard?						
Hazard identification is based on the most recent Chapter 3 of NFPA 61. The list of materials should be kept in electronic or paper form and should reference the methods used to define hazard. In process, bulk product and areas that contain dust less than 500 microns should also be listed and evaluated.						
1.2 Does the list include material data, sieve analysis, K _{st} testing, MIE, or minimum ignition energy, and references used to define material characteristics, etc.?						
1.3 Location of list						
1.4 Do any of the materials on the list have a K _{st} greater than 200?						
1.5 If yes, where are these materials stored, transported, and used?						
Hazard identification is based on revised factors. A higher than 200 K _{st} means the material is more energetic than a typical agricultural or food dust, and therefore these materials should be listed on any facilities enclosure list. If all materials have smaller K _{st} and other characteristics, the evaluation of the hazard can be simplified to a typical general case.						
1.6 Do any of the materials on the list have an MIE of less than 30 mJ?						
1.7 If yes, where are these materials stored, transported, and used?						
If the MIE is found to be less than 30 mJ, an updated static risk rating, and the facility must be prepared to institute special handling procedures to prevent dust ignition.						
1.8 Have P&IDs or similar documents been used to identify equipment and processes that need to be evaluated?						
1.9 Location of critical P&IDs highlighting equipment to be evaluated						
1.7 Location of facility drawings illustrating areas of potential concern						
1.8 Do you have a breakdown of the materials used in each process or facility area?						
1.9 Where is this information kept?						
The DHA shall include the following: (1) Identification and structure of the process or facility areas where fire, flash fire, and explosion hazards exist (2) Where such a hazard exists, identification and evaluation of specific fire and deflagration scenarios shall include the following: (a) Identification of all operational stages (b) Identification of the safeguards that are in place to manage fire, deflagration, and explosion events (c) Documentation of additional safeguards when warranted, including a plan for implementation (NFPA 61)						
4.2.1.2 The objectives stated in NFPA 61, Section 4.2, shall be deemed to be met when, consistent with the goal in 4.2.1 and the provisions in NFPA 61, Sections 1.4 and 1.5, the following have been achieved: (1) The facility, process, and equipment are designed, constructed, and maintained in accordance with the prescriptive criteria set forth in this standard. (2) The management system on both is this standard are implemented.						
If the material evaluated matches that of a typical agricultural or food dust, use of the prescriptive requirements in NFPA 61 meets the minimum requirements for mitigation of the hazard. If not, then process requires a hazard analysis method appropriate to the size, complexity, and hazards of the process.						
2.0 BUILDING AND FACILITY DESIGN (NFPA 61, Section 9.2)	Yes	No	N/A	Comments	Action	Date Due
2.1 NFPA 61 defines location, hazard class, division, and group in Article 901.1. Class II locations are those that are hazardous because of the presence of combustible dust. In Division 1 locations, the hazard is present in quantities sufficient to produce explosive or ignitable mixtures. In Division 2 locations, the hazard could be present under abnormal operating conditions including agricultural and food dusts. "Unclassified" is used to describe low hazard locations and areas with management and mitigation plans that prevent dust accumulation. This assessment is a best practice and is seen as a method of understanding what flows a current structure has compared to NFPA 61 requirements prior to the 2020 edition.						
2.1 Has the construction, modification, renovation, change of use, or change of occupancy classification of all buildings and structures complied with all governing building code?						
2.2 Has a qualified person evaluated the facility and determined locations that are Class II, Group C, Division 1 or Division 2, and where the facility should be considered unclassified due to cleaning practices or absence of combustible dust?						

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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
2.0 BUILDING AND FACILITY DESIGN (NFPA 61, Section 9.2, continued)						
	Yes	No	NA	Comments	Action	Date Due
2.3						
2.3.1 Has a drawing or map of the rated areas been developed?						
Where is this information kept?						
2.4						
2.4.1 Are all areas determined to be Class II, Division 1 or 2 in full compliance with applicable requirements related to NFPA 61, Article 1007?						
2.5						
2.5.1 Do electrical wiring and power equipment meet all applicable requirements of NFPA 70 including those for hazardous locations, based on a review by a knowledgeable person?						
2.6						
2.6.1 Are enclosures built to prevent dust explosion hazard areas from other areas designed such that they will not fail before the explosion pressure is vented to a safe outside location?						
Are there any areas classified as Class II, Group C, Division 1 that are necessary for the construction of exterior walls or roofs?						
2.7						
2.7.1 If yes, are the necessary walls designed for explosion resistance to preclude failure of these walls or the explosion pressure can be vented safely to the outside?						
2.8						
2.8.1 Are structures housing personnel intensive areas not directly connected to operations located remote from storage silos and headhouse structures, with the exception of small central rooms?						
Are any silos and headhouses constructed of masonry concrete?						
If yes, are they supported from personnel intensive areas by at least 30 m (100 ft)?						
2.9						
2.9.1 Do the structures have inside elevator legs?						
If yes, are the structures equipped with explosion venting, or are the inside elevator legs equipped with explosion protection?						
2.10						
2.10.1 Is a lightning protection system provided?						
If yes, is it in accordance with NFPA 700?						
2.11						
2.11.1 Are there any areas where separation is used to limit the dust explosion, hazard or deflagration hazard area within a building? If yes, proceed to 2.12. If no, proceed to 2.13.						
2.12						
2.12.1 Was the separation distance between the dust explosion or deflagration hazard area and adjoining structures determined by an engineering evaluation, and is the distance at least 11 m (35 ft)?						
2.13						
2.13.1 Is the separation area free of dust?						
If no, where does dust accumulation exist on any surface, in the case of the surface readily discernible?						
2.14						
2.14.1 Are horizontal surfaces in the buildings maintained to prevent accumulations of dust in interior structural areas where significant dust accumulations could occur?						
2.15						
2.15.1 Are storage areas larger than 60 m ³ (2000 cu ft) and containing pesticides, fertilizers, perfumes, and perfuming ingredients (I) If not, are all other areas with hot heating coils designed for a minimum fire resistance of 2 hours in accordance with Chapter 9 of NFPA 1000?						
2.16						
2.16.1 Are warehouse areas designed in accordance with NFPA 1000?						
2.17						
2.17.1 Are necessary openings in fire walls and fire barriers kept to a minimum, as much as practicable, and protected with listed self-closing fire doors, fire shutters, fire dampers, or pneumatic seals installed in accordance with Chapter 8 of NFPA 1000?						
2.18						
2.18.1 If half-open doors are used, are they listed and designed to minimize and reduce the dust to clear space opening to one or more of the following: (1) listed, (2) double, (3) double, or (4) products of combustion?						
2.19						
2.19.1 Is adequate means of egress provided in accordance with NFPA 1001?						
2.20						
2.20.1 Are fire doors provided with two means of egress remote from each other, such that a single fire or explosion event will not likely block both means of egress, or is the travel distance less than 15 m (50 ft), if only one means of egress is available?						

AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
2.0 BUILDING AND FACILITY DESIGN (NFPA 61, Section 9.2, continued)						
	Yes	No	NA	Comments	Action	Date Due
2.21						
2.21.1 Do any NFPA require a pressurization system and alarm installed per code?						
2.22						
2.22.1 Are there any deficient or nonconforming items identified?						
If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?						
3.0 IGNITION SOURCE CONTROL (NFPA 61, Section 9.4)						
	Yes	No	NA	Comments	Action	Date Due
3.1						
3.1.1 Have grounding and bonding of pipes and equipment been universally applied to the system and its components to ensure static will be dissipated? (resistance to ground < 1 megohm)						
3.2						
3.2.1 Does any static device equipment meet requirements of NFPA 651 and 9.4.2.1 through 9.4.9 of NFPA 61?						
3.3						
3.3.1 Are antistatic bearings used on all machinery, conveyors, legs, and processing equipment?						
3.4						
3.4.1 Are bearings kept free from dust, product, and equipment lubricant?						
3.5						
3.5.1 Are bearings that are directly exposed to a dust deflagration hazard monitored for combustion?						
3.6						
3.6.1 What fans does the monitoring tab? Describe the process or process and where lubrication is kept.						
3.7						
3.7.1 Are bearings on legs and conveyors located outside the machinery enclosures and protected from dust exposure?						
3.8						
3.8.1 Are bearings accessible for inspection?						
3.9						
3.9.1 Are support bearings on screw conveyors and other similar equipment sealed?						
3.10						
3.10.1 Are parametric covering systems installed in accordance with 9.2.1 and 9.2.2 through 9.2.3 of NFPA 61?						
3.11						
3.11.1 Are all system components electrically conductive?						
3.12						
3.12.1 Is a hot work program in place for dust hazard-rated areas to prevent hot work from being conducted, including the use of non-sparking tools, or powder-driven tools, except where in dust producing operations are working plans, and no combustible materials or dust is located in the vicinity of the operation? (See 21.5B, 21.4.2)						
3.13						
3.13.1 Are there any deficient or nonconforming items identified?						
If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?						
4.0 BINS, TANKS, AND SILOS (NFPA 61, 9.3.9)						
	Yes	No	NA	Comments	Action	Date Due
4.1						
4.1.1 Does the construction of bins, tanks, and silos conform to applicable local, state, or national codes?						
4.2						
4.2.1 Where explosion relief vents are provided on bins, tanks, and silos, are they rated to operate before the container walls fail?						
4.3						
4.3.1 Do access doors or openings meet the following requirements: (1) They shall be provided to permit inspection, cleaning, and maintenance and to allow effective use of fire-fighting techniques in the event of fire within the bin, tank, or silo. (2) They shall be designed to prevent dust leaks.						
4.4						
4.4.1 Where a bin, tank, or silo has a personnel access opening provided in the roof or cover, is the smallest diameter of the opening at least 602 mm (24 in.)?						
4.5						
4.5.1 Are there any deficient or nonconforming items identified?						
If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?						
5.0 MARINE TOWERS (NFPA 61, 9.2.8)						
	Yes	No	NA	Comments	Action	Date Due
5.1						
5.1.1 Has the location of marine towers been included in the map and assessment in 2.2 and 2.3?						
5.2						
5.2.1 Are marine towers constructed of noncombustible materials?						

AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
5.0 MARINE TOWERS (NFPA 61, 9.2.8, <i>continued</i>)						
Item	Yes	No	NA	Comments	Action	Date Due
5.3				Are movable marine towers provided with automatic or manually operated hatches?		
5.4				Are movable marine towers provided with automatic or manual wind checks?		
5.5				Do wind closure systems when the wind velocity is great enough to cause movement of the tower, open when broken or gear drives are permitting the wind wheels from turning?		
5.6				Is equipment to monitor wind velocity installed on movable marine towers?		
5.7				Do movable marine towers have provisions for emergency tie-downs?		
5.8				For marine vessel loading, do conveyors, spouts, and chutes have safety devices to prevent the equipment from falling if the supporting cables break?		
5.9				Are there any deficient or nonconforming items identified? If yes, was a plan system with estimated dates for bringing structure into compliance with this set of requirements?		
6.0 CONVEYORS, SPOUTS, AND THROWS OF MATERIAL (NFPA 61, 9.3.15)						
Item	Yes	No	NA	Comments	Action	Date Due
6.1				Are both material conveyer belts designed to either rotate or stop if the discharge and become plugged?		
6.2				Are both material conveyer belts (spine handling or similar) equipped with both alignment and belt bearing sensors at the head and tail?		
6.3				Are screw, drag, or air mass conveyors fully enclosed in metal housing and designed to either rotate or stop if the discharge and become plugged?		
6.4				Are food spouts automatic?		
6.5				Are combustible linings used in spouts or other handling equipment in any location other than wear points or impact points?		
6.6				Do dusts or vapors that generate fine mist walls or particulates have necessary provisions to prevent fire propagation from the unit?		
6.7				Are there any deficient or nonconforming items identified? If yes, was a plan system with estimated dates for bringing structure into compliance with this set of requirements?		
7.0 GENERAL EQUIPMENT DESIGN (NFPA 61, 9.3.2.2)						
Item	Yes	No	NA	Comments	Action	Date Due
7.1				Are any ingredient transport systems present in the process per NFPA 61, 3.3.2.2? Class system shall be permitted to be installed inside of a building unless the process within all of the following requirements from 9.3.3.2.4 are met: (1) The system is negative or positive pressure pneumatic conveying system. (2) The system, through its design, is isolated from the addition of mechanical or electrical energy and process activities such as cooling or drying, for positive pressure, such as rotary valves, filters, normally closed valves, or sealed hoppers, from outside events that could trigger an event such as a flash fire or deflagration. (3) The system is not a bulk grain transportation pneumatic system or dust collection system. Are ingoing and outgoing located upstream of equipment and arranged where they can be easily inspected and cleaned?		
7.2				Are a steps installed and routinely tested to ensure operation function?		
7.3				On normal shutdowns of any process that contains combustible dust, does the fire system continue purge air velocity until the material is purged from the system?		
7.4				If a conveyor runs adjacent to buildings or structures of combustible construction or adjacent to walls with vents, windows, or gaps or conveyor openings, are there seals, chutes, or dust-closing valves to minimize propagation potential through these openings?		

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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
7.0 GENERAL EQUIPMENT DESIGN (NFPA 61, 9.3.2.2, <i>continued</i>)						
Item	Yes	No	NA	Comments	Action	Date Due
7.5				Are all contained areas suitable for material handling?		
7.6				Are there any deficient or nonconforming items identified? If yes, was a plan system with estimated dates for bringing structure into compliance with this set of requirements?		
8.0 PIPING, VALVES, AND BLOWERS (NFPA 61, 9.3.3.3)						
Item	Yes	No	NA	Comments	Action	Date Due
8.1				Positive and negative-type pressure systems are permitted. Where the blower discharge pressure and its conveying system are designed to operate at gauge pressures exceeding 100 kPa (7.5 psi), the system shall be designed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code.		
8.2				Are all piping and valve systems complete, durable, and grounded? (resistance to ground: 1 inch/25.4 mm)		
8.3				Are all piping and valve systems properly supported to include the weight of material in a full or partial position, and can they be disassembled for cleaning and unloading in a safe and efficient manner?		
8.4				Are all pressure- and vacuum relief valves located, designed, and set to relieve pressure to protect system components?		
8.5				Are multiple direction valves of upright and straight observation and used to reflect a positive direction of the product, and flow direction in one direction and all other directions free of dust, or product buildup?		
8.6				Are there any deficient or nonconforming items identified? If yes, was a plan system with estimated dates for bringing structure into compliance with this set of requirements?		
9.0 RECEIVING AND SHIPPING CONVEYANCES (NFPA 61, 9.3.3.4)						
Item	Yes	No	NA	Comments	Action	Date Due
9.1				Do all transport modes such as railcars (hopper cars, hoppers, or side cars) and trucks (bulk conveying and shipping in bulk), into which or from which potentially combustible materials are generated are permanently conveyed, electrically bonded to the plant ground system, or earth grounded? (resistance to ground: 1 inch/25.4 mm)		
9.2				Are all systems protected with Fibers on the inlet air used for transporting the combustible material?		
9.3				Are all trucks, railcars, and other containers being filled provided with Fibers designed to prevent dust blowback into the building or storage?		
9.4				Are unloading systems protected with magnets or magnet detectors?		
9.5				Are receiving systems equipped with one or more devices in e.g., grinding, wire mesh screens, permanent magnets, metal electromagnets, pneumatic separators, or specially gravity separators to maintain or eliminate tramp material from the product stream?		
9.6				Are there any deficient or nonconforming items identified? If yes, was a plan system with estimated dates for bringing structure into compliance with this set of requirements?		
10.0 DUST COLLECTION SYSTEMS PRESCRIPTIVE REQUIREMENTS (NFPA 61, 9.3.3.5)						
Item	Yes	No	NA	Comments	Action	Date Due
10.1				Do any fans or blowers transport combustible dust through the fan or blower? If yes, are fans built of spark resistant construction? Are any dust control devices attached to equipment that grind, pulverize, mill, or hammer mill agricultural or food materials that are combustible unless from other systems?		
10.2				Are the dust collection systems designed to be attached only to equipment that is used for mixing of solvent solids or grain bulk?		
10.3				Does the dust collection system for hoppers and pits effectively control the dust and prevent a flow leaving the system?		

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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST

10.0 DUST COLLECTION SYSTEMS PRESCRIPTIVE REQUIREMENTS (NFPA 61, 9.2.3.5, continued)						
	Yes	No	N/A	Comments	Action	Date Due
10.4						
10.5						
10.6						
10.7						
10.8						
10.9						
10.10						
11.0 DUCT SYSTEMS PRESCRIPTIVE REQUIREMENTS (NFPA 61, 9.3.3.6)						
	Yes	No	N/A	Comments	Action	Date Due
11.1						
11.2						
11.3						
11.4						
11.5						
11.6						
11.7						
11.8						
11.9						
11.10						
11.11						
11.12						
11.13						

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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST

12.0 CENTRALIZED VACUUM CLEANING SYSTEMS (NFPA 61, 9.3.3.7)						
	Yes	No	N/A	Comments	Action	Date Due
Does the facility have a centralized vacuum cleaning system? If yes, complete 12.0, if no, skip to 13.0						
12.1						
12.2						
12.3						
12.4						
12.5						
12.6						
12.7						
12.8						
12.9						
13.0 AIR-MATERIAL SEPARATORS (NFPA 61, 9.3.4.1.1 - 9.3.4.1.2)						
	Yes	No	N/A	Comments	Action	Date Due
13.1						
13.2						
13.3						
13.4						
13.5						
13.6						
13.7						
14.0 RECYCLING OF FILTERED AIR (NFPA 61, 9.3.4.1.3)						
	Yes	No	N/A	Comments	Action	Date Due
Does the facility recycle air from air material separators? If yes, complete 14.0, if no, skip to 15.0						
14.1						
14.2						
14.3						
14.4						

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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
15.0 BUCKET ELEVATOR LEGS (NFPA 61, 9.3.14)						
Yes	No	NA	Comments	Action	Date Due	
Does the facility have fully enclosed bucket elevators or lifts that handle potentially combustible dust hazard materials? If yes, complete 15.0; if no, skip to 16.0. Does Enclosed bucket elevator product transported in open bottom lifts, used for an example of a national DHA affected by the action.						
15.1			Are any bucket elevators located fully or partially inside of a building, structure, or vessel?			
15.2			Are bucket elevators that store combustible materials that could generate dust during loading, haul and haul actions, across openings, and connecting components, designed and constructed of noncombustible materials?			
15.3			Is explosion venting or suppression provided for each elevator leg?			
15.3			If not, is isolation provided on the feed and discharge end with deflagration isolation in accordance with NFPA 61?			
15.4			Is each leg independently driven by motor and drive means capable of handling the full rated capacity of the elevator leg without overloading?			
15.5			Are line shaft drive systems of handling the full rated capacity of all connected equipment without overloading?			
15.6			Are multiple motor drives prohibited to prevent operation of the leg upon failure of any single motor?			
15.7			Can drive start on unchoked lag under full (100%) load?			
15.8			Is each leg provided with a speed sensor device that will cut off the power to the drive motor and create an alarm in the event the lag belt drives to 90% of normal operating speed, and will feed to lag to stop or decelerate?			
15.9			Has proper lagging been installed on system pulleys and related devices?			
15.10			Has proper maintenance equipment been installed to ensure that belt bearings, misalignment, and other abnormal conditions are detected before they cause a dangerous situation?			
15.11			Are all covers installed to prevent grain or combustible dust hazard materials directly deposited and installed to handle the full rated elevating capacity of the largest leg feeding each space?			
15.12			Are there any deficient or nonconforming items identified? If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?			
16.0 PROCESSING MACHINERY AND EQUIPMENT (NFPA 61, 9.3.21)						
Yes	No	NA	Comments	Action	Date Due	
16.1			Are rotating systems that process the designed with one or more devices such as grinding, size each screen, granulation, impact, ball mill equipment, planetary separator, or specific gravity separator?			
16.2			Are rotary screens or screens that feed grain or grain products for size reduction and separation, planetary separator, ball mill equipment, planetary separator, specific gravity separator, impact, or screens to exclude metal or foreign matter?			
16.3			Is equipment bonded and grounded?			
16.4			Are processing machinery and components such as magnets provided to facilitate access for cleaning?			
16.5			For starch grinding mills, is rubber steel installed in the grinding chamber and for mixing parts?			
16.6			Are the mills or parts of mills, hoppers, and similar devices in dusttight enclosures?			
16.7			Are conducting dust for starch processing machinery metal or electrically conductive, noncombustible or double noncombustible dust for long electrical resistance not greater than 1 megohm?			
16.8			Where multiple steam material sources are connected to a common conveyor, an isolated separator, or a rotary device, is each material source equipped with deflagration isolation in accordance with NFPA 61?			

AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
16.0 PROCESSING MACHINERY AND EQUIPMENT, continued						
Yes	No	NA	Comments	Action	Date Due	
16.9			In dry milling or grinding of starch performed in a separate building with explosion relief or in a separate room isolated from other areas by exterior walls designed not to fall below explosion pressure a vent to a safe, outside location? Or, is the grinding chamber designed to be pressure in accordance with NFPA 61 or NFPA 68?			
16.10			Have all elevator legs handling bulk raw grain been assessed based on 9.3.14?			
16.11			Are there any deficient or nonconforming items identified? If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?			
17.0 GRAIN AND SPRAY DRYER (NFPA 61, 9.3.122 - 9.3.125)						
Yes	No	NA	Comments	Action	Date Due	
Does the facility have grain or spray dryers? If yes, complete 17.0; if no, skip to 18.0.						
17.1			Have each of the key equipment type designs been assessed based on requirements of NFPA 61, 9.3.122?			
17.2			Are there any deficient or nonconforming items identified? If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?			
18.0 HEAT TRANSFER OPERATIONS (NFPA 61, 9.3.19)						
Yes	No	NA	Comments	Action	Date Due	
Does the facility have heat transfer operations? If yes, complete 18.0; if no, skip to 19.0.						
18.1			Are heat transfer devices utilizing air, steam, or vapors of heat transfer fluids provided with pressure-rated valves where necessary?			
18.2			Are relief valves on systems employing combustible heat transfer media vented to a safe, outside location?			
18.3			Are heaters and pumps for combustible heat transfer fluids located in a separate, dust-free room or building of noncombustible construction that is protected by automatic sprinklers?			
18.4			Is air for combustion drawn from a clean, outside source?			
18.5			Are enclosures for heat exchangers constructed of noncombustible materials and equipped with access openings for cleaning and maintenance?			
18.6			Are heat exchangers located and arranged in a manner that does not allow combustible dust to accumulate on coils, fins, or other heated surfaces?			
18.7			Are heat exchangers protected to their doors the heater and heat transfer pumps upon activation of the fire protection and/or deflagration protection system for any area served by this system?			
18.8			Are heating units provided with a source of combustion air ducted directly from the building exterior or from an unconfined location?			
18.9			Are there any deficient or nonconforming items identified? If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?			
19.0 VENTILATION AND VENTING (NFPA 61, 9.3.20)						
Yes	No	NA	Comments	Action	Date Due	
19.1			Have each of the key equipment type designs been assessed based on requirements of NFPA 61, 9.3.20?			
19.2			Are there any deficient or nonconforming items identified? If yes, was a plan written with estimated dates for bringing structure into compliance with this set of requirements?			
20.0 MITIGATION						
Yes	No	NA	Comments	Action	Date Due	
20.1			Have each of the key equipment type designs been assessed based on requirements of NFPA 61, Section 9.0?			

AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
20.0, MITIGATION, continued						
Dust Control, continued						
20.2	Are there any deficiencies or nonconforming items identified?	Yes	No	NA	Comments	Action
If yes, was a plan written with estimated dates for bringing structures into compliance with this set of requirements?						
Explosion Prevention/Protection						
20.3	Have each of the hot equipment type designs been assessed based on requirements of NFPA 61, Section 5.1?					
Are there any deficiencies or nonconforming items identified?						
20.4	If yes, was a plan written with estimated dates for bringing structures into compliance with this set of requirements?					
Fire Protection						
20.5	Have each of the hot equipment type designs been assessed based on requirements of NFPA 61, Section 5.2?	Yes	No	NA	Comments	Action
Are there any deficiencies or nonconforming items identified?						
20.6	If yes, was a plan written with estimated dates for bringing structures into compliance with this set of requirements?					
21.0 HUMAN FACTOR						
21.1	Does the facility have a sanitation program that includes cleaning and equipment integrity assessment based on dust release and accumulation?	Yes	No	NA	Comments	Action
Are all areas shown in 2.1 noted as unclassified due to equipment design and maintenance to prevent or limit dust release, and do they include a sanitation program that calls for frequent cleaning to ensure they meet the requirements to remain unclassified?						
21.2	Does the sanitation program include requirements of NFPA 61, Section 6.4, Housekeeping?					
Are aerial control systems (MCCs) permitted to prevent dust infiltration?						
21.4	If not, are they arranged to limit dust infiltration, and are they combined with an effective program to keep the vents and cabinets free of dust accumulation?					
Does the housekeeping program address combustible dust accumulations at the following priority areas:						
21.5	(i) Floors of enclosed areas containing grinding equipment?					
(ii) Floors of enclosed areas containing dryers located inside the facility?						
21.6	Are dust accumulations on ledges, walls, ceilings, beams, ducts, and ceiling surfaces in identified priority areas maintained below acceptable limits (i.e., 100 mg/m ² or 100 mg/m ²)?					
Is there a plant based awareness training program?						
21.7	Does it include the hazards associated with dust, dust accumulation, and deflagration?					
21.8	Where are the plant program and records of inspection and testing kept?					
21.9	Is combustible dust hazard area identification performed in peak and off-peak conditions areas identified to employees and contractors (e.g., by sign, map, or other instruction)?					
Before any activity that could create dust to be suspended in air is the use of equipment for dust cleaning of ledges, walls, beams, ducts, and surfaces, does the facility report that it assessed electrical equipment to be de-energized and all other known sources of ignition be removed or controlled?						
21.11	Has a formal prevention maintenance program been established for dryers, dust collectors, ducts, maintenance, differential pressure gauges, bucket elevators, and any other dust handling/pneumatic conveying equipment that specifically includes the verification of grounding and bonding?					
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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
21.0 HUMAN FACTOR, continued						
21.13	Are all critical safety systems inspected, tested, and/or calibrated per the OSHA guidelines (as required by process safety assessment and NFPA facility standards)?	Yes	No	NA	Comments	Action
21.14	Are all bearings maintained per the manufacturer's instructions and preventive maintenance program, and are they kept free of combustible dust, product, and excessive lubrication?					
21.15	Is there a contractor safety training program? Does it include instruction on the plant's dust hazard, hot work program, no smoking requirements per NFPA, and other requirements?					
21.16	Is there training for operators, maintenance personnel, and contractors on how to use and repair the central vacuum system?					
21.17	Is a means of fire fighting (to include the use of water as an extinguishing agent) covered in operator, maintenance personnel, and contractor training?					
21.18	Are portable vacuums used for cleaning up combustible dust limited for use in Class II areas?					
If a portable vacuum is used:						
21.19	(a) Is it a conductive system?					
(b) Are the hoses conductive and grounded, or static dissipative?						
(c) Is the floor protected from dust laden air by a filter?						
21.20	If an electric portable vacuum is used, is the motor rated for a Class II, Division 1 location?					
21.21	Is there training for operators, maintenance personnel, and contractors on how to use and repair the portable vacuum system?					
21.22	In the portable vacuum used only for dry particulate solids so that the filter is always in place?					
21.23	Is there training for operators, maintenance personnel, and contractors on how to use and repair the portable vacuum system (e.g., conductive tools, ensuring that the exhaust dust does not disperse and suspend layers of dust deposits)?					
21.24	Does combustible dust accumulate on the overhead ductwork so that it could support a deflagration of dispersant?					
21.25	When a break line is disconnected, checked off, or otherwise modified, is the design of the entire system updated to ensure the whole system operates effectively?					
21.26	Is verifying that the ductwork is clean of combustible dust a prerequisite to issuing hot work permits?					
21.27	Is there a hot work procedure in place before welding or cutting on dust?					
21.28	Do maintenance and contract maintenance personnel receive training to know that hot work procedures include hotting of equipment and piping, as well as sparks, which can create dust fires and explosions?					
21.29	Does the hot work permit reflect the intent of NFPA 51B?					
21.30	Is a new permit issued for every shift of hot work?					
21.31	Is equipment undergoing hot work always taken out of service and kept inaccessible until the work is complete and equipment cooled?					
21.32	Have all hazards been cleared internally and externally from the equipment before starting hot work?					
21.33	Are all spicible materials within 11 m (35 ft) removed or protected?					
21.34	Are all combustible dust layers within 11 m (35 ft) removed by cleaning before starting hot work?					
21.35	Has the area been checked for spicible vapors and gases?					
21.36	Are floors and structures in the work area covered with fire proofed material or adequately wetted with water?					
21.37	Are welding shields present, if required, to protect personnel?					
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AGRICULTURAL AND FOOD DUST HAZARD ANALYSIS (DHA) CHECKLIST						
210 HUMAN FACTOR, continued						
	Yes	No	NA	Comments	Action	Date Due
21.38				If agents could travel to an adjacent room through ducts or openings, have combustible materials all been removed or protected?		
21.39				Will any fire protection or detection systems be disabled as a result of the hot work?		
21.40				If yes, is an active fire watch available?		
21.41				Is a trained fire watch present during the hot work and for 30 minutes after the hot work is completed?		
21.42				Are regular inspections of the work area made to ensure that no combustible fire debris, including a final inspection performed prior to closing the area for the day or weekend?		
21.43				Have people responsible for the hot work operations received documented training to (1) inspect the proposed work area to determine that the conditions of the permit system have been met, (2) designate additional personnel as deemed necessary, and (3) sign the permit to authorize the work to begin?		
21.44				Is combustible dust removal provided normally by staff involved in facility design and operation, including plant engineering and maintenance?		
				Are contractors informed of all known/potential hazards related to their work as well as safe entry routes to reduce combustible dust fire and explosion hazards, including, but not limited to, emergency action plans, hot work permits, avoiding potential ignition sources, grounding requirements, cleaning out of combustible material before commencing work, and prohibition of smoking in hazardous areas?		

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Supplemental Information

File Name	Description Approved
61_SR8_Table_F.3.xlsx	Staff use only

Submitter Information Verification

Committee: CMD-AGR
Submission Date: Wed Jan 23 16:14:20 EST 2019

Committee Statement

Committee Statement: The table has been replaced with a more detailed, comprehensive example of a DHA that covers agricultural and food dust.
Response Message: SR-8-NFPA 61-2019

[Public Comment No. 3-NFPA 61-2018 \[Section No. F.3\]](#)



Second Revision No. 21-NFPA 61-2019 [Section No. G.1.2]

G.1.2 Other Publications.

G.1.2.1 AIHA Publications.

American Industrial Hygiene Association, 3141 Fairview Park Drive, Suite 777, Falls Church, VA 22042.

ANSI/AIHA Z10, *Occupational Health and Safety Management Systems*, 2012.

G.1.2.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E582, *Standard Test Method for Minimum Ignition Energy and Quenching Distance in Gaseous Mixtures*, 2007, reapproved 2013e1.

ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds*, 2012a.

ASTM E1491, *Standard Test Method for Minimum Autoignition Temperature of Dust Clouds*, 2006 (2012).

ASTM E1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*, 2007 2014 .

ASTM E2019, *Standard Test Method for Minimum Ignition Energy of a Dust Cloud in Air*, 2003, reapproved 2013.

ASTM E2021, *Standard Test Method for Hot-Surface Ignition Temperature of Dust Layers*, 2009 2015 .

ASTM E2931, *Test Method for Limiting Oxygen (Oxidant) Concentration of Combustible Dust Clouds*, 2013.

G.1.2.3 IFA Publications.

Institute for Occupational Safety and Health of the German Social Accident Insurance, Alte Heerstr. 111, 53757 Sankt Augustin, Germany.

GESTIS-DUST-EX Database Combustion, February 2001.

G.1.2.4 National Grain and Feed Association Publications.

National Grain and Feed Association, 1400 Crystal Drive, Suite 260, Arlington, VA 22202.

Dust Explosion in Simulated Grain Conveyor Galleries, 1983 edition.

Emergency Preplanning and Fire Fighting Manual — A Guide for Grain Elevator Operators and Fire Department Officials, 1987.

G.1.2.5 NIBA Publications.

NIBA — The Belting Association, 22 North Carroll Street, Suite 300, Madison, WI 53703.

Technical Note 09, “Static Electricity Considerations,” 2009.

G.1.2.6 U.S. Government Publications.

U.S. Government Printing Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

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

G.1.2.7 Other Publications.

AICHE *Guidelines for Hazard Evaluation Procedures*, 2008.

CCPS/AICHE *Guidelines for Safe Handling of Powders and Bulk Solids*, 2005.

FM Global Data Sheet 7-76, *Prevention and Mitigation of Combustible Dust Explosion and Fire*.

FM Global Data Sheet 10-3, *Hot Work Management*.

SFPE *Engineering Guide to Performance-Based Fire Protection*, 2006.

SFPE *Handbook of Fire Protection Engineering*, 2016.

Submitter Information Verification

Committee: CMD-AGR

Submittal Date: Fri Feb 01 15:54:55 EST 2019

Committee Statement

Committee Statement: Updating references.

Response Message: SR-21-NFPA 61-2019