

**SUBJECT:** Combustible Dust

**Purpose:** To provide guidelines for the safe inspection of potential combustible worksites and for the safe collection and shipment of combustible dust

**Scope:** This instruction applies Division-wide but does not include Grain Handling or PSM covered sites.

**References:**

1. Safety and Health Information Bulletin (SHIB)--Improper Installation of Wood Dust Collectors in the Woodworking Industry—May 2, 1997.
2. SHIB--Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions—July 31, 2005.
3. 29 CFR 1910.399--Definitions applicable to Subpart S—Electrical.
4. NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities (2013 Edition).
5. NFPA 68, Guide for Venting of Deflagrations (2013 Edition).
6. NFPA 69, Standard on Explosion Prevention Systems (2014 Edition).
7. NFPA 70, National Electrical Code (2014 Edition).
8. NFPA 77, Recommended Practice on Static Electricity (2014 edition).
9. NFPA 85, Boiler and Combustion Systems Hazards Code (2011 Edition).
10. NFPA 86, Standard for Ovens and Furnaces (2011 Edition).
11. NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids (2010 Edition).
12. NFPA 120, Standard for Fire Prevention and Control in Coal Mines (2010 Edition).
13. NFPA 484, Standard for Combustible Metals (2015 Edition).
14. NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemicals Process Areas (2013 Edition).
15. NFPA 654, Standard for the Prevention of Fires and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids (2013 Edition).
16. NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities (2012 Edition).
17. NFPA 2113, Standard on Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire (2015 Edition).
18. ASTM E1226 – 12a, Standard Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts.
19. ASTM E1515-07, Standard Test Method for Minimum Explosible Concentration of Combustible Dusts.
20. FM Global, Data Sheet No. 7-76, Prevention and Mitigation of Combustible Dust Explosions and Fire (2012 Edition).
21. FM Global, Data Sheet No. 7-10, Wood Processing and Woodworking Facilities, (2010 edition)
22. FM Global, Data Sheet No. 7-73, Property Loss Prevention Data Sheets, (2012 edition)
23. FM Global, Approval Standard for Explosion Venting Devices Class No. 7730 (2014 edition)
24. National Materials Advisory Board (NMAB) 353-3-80, Classification of Combustible Dusts in Accordance with the National Electrical Code.
25. CPL 2-1.4, Grain Handling
26. CPL 2-1.18, Electric Power Generation
27. OSHA guidance on shipment of potential combustible materials  
[https://extranet.osha.gov/dts/LAP/dts/sltc/combustibledust/cd\\_shipping.html](https://extranet.osha.gov/dts/LAP/dts/sltc/combustibledust/cd_shipping.html)

28. OSHA Directive CPL 03-00-008, (2008, March 11), Combustible dust National Emphasis Program
29. OSHA website combustible dust page: [www.Osha.gov/dsg/combustibledust](http://www.Osha.gov/dsg/combustibledust)
30. ADM 3.21, OSH Division Policy for Mailing Lab Samples, February 3, 2010.

Background:

The potential for a variety of materials to be explosive has been known for many years. Those living in agricultural states know well the hazards of grain elevator explosions, for example. The American National Standards Institute has long recognized the potential as well, publishing several standards for the prevention of fire and explosions (see NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities; NFPA 484, Standard for Combustible Metals; NFPA 654, Standard for the Prevention of Fires and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids; NFPA 655, Standard for Prevention of Sulfur Fires and Explosions; and, NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.) But it was following the February, 2008 sugar refinery explosion in Port Wentworth, Georgia, which killed 14 workers, injured another 42 workers, that federal OSHA reissued its national emphasis program for combustible dusts. Minnesota, did adopt the Federal NEP, and its inspection scheduling to include potential combustible dust sites.

Action:

- I. Definitions: The following is a partial listing of definitions based on NFPA standards and 1910.399, the definitions provision of Subpart S—Electrical, that relate to combustible dust.
  - A. **Class II locations.** Class II locations are those that are hazardous because of the presence of combustible dust. The following are Class II locations where the combustible dust atmospheres are present:
    - Group E.* Atmospheres containing combustible metal dusts, including aluminum, magnesium, and their commercial alloys, and other combustible dusts whose particle size, abrasiveness, and conductivity present similar hazards in the use of electrical equipment.
    - Group F.* Atmospheres containing combustible carbonaceous dusts that have more than 8 percent total entrapped volatiles (see ASTM D 3175, *Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke*, for coal and coke dusts) or that have been sensitized by other materials so that they present an explosion hazard. Coal, carbon black, charcoal, and coke dusts are examples of carbonaceous dusts.
    - Group G.* Atmospheres containing other combustible dusts, including flour, grain, wood flour, plastic and chemicals.
  - B. **Combustible dust.** A combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape.
  - C. **Combustible Particulate Solid.** Any combustible solid material composed of distinct particles or pieces, regardless of size, shape, or chemical composition.

- D. **Hybrid Mixture.** A mixture of a flammable gas with either a combustible dust or a combustible mist.
  - E. **Deflagration.** Propagation of a combustion zone at a speed that is less than the speed of sound in the unreacted medium.
  - F. **Deflagration Isolation.** A method employing equipment and procedures that interrupts the propagation of a deflagration of a flame front, past a predetermined point.
  - G. **Deflagration Suppression.** The technique of detecting and arresting combustion in a confined space while the combustion is still in its incipient stage, thus preventing the development of pressures that could result in an explosion.
  - H. **Detonation.** Propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium.
  - I. **Dust-ignition proof.** Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.
  - J. **Dusttight.** Enclosures constructed so that dust will not enter under specified test conditions.
  - K. **Explosion.** The bursting or rupture of an enclosure or a container due to the development of internal pressure from deflagration.
  - L. **Minimum Explosible Concentration (MEC).** The minimum concentration of combustible dust suspended in air, measured in mass per unit volume that will support a deflagration.
- II. Inspection Procedures.
- A. Opening Conference.

During the opening conference and after a preliminary walkaround of the facility, if the OSHI determines that the employer's operation may have combustible dust explosion, deflagration, or other fire hazards, then the OSHI shall follow these instructions and guidelines for the evaluation of these potential hazards.
  - B. Inspection Resources.

When possible, only OSHIs trained in recognizing the hazards associated with combustible dust shall be assigned to conduct these inspections. A training course offered by the OSHA Training Institute (OTI) in recognizing combustible dust explosion hazards may be one source of such training. The training at OTI covers various topics, including engineering controls and methodologies in preventing combustible dust deflagration, other fire, and explosion hazards. In addition the training covers several NFPA documents referenced in Section III of this directive, including NFPA 654, NFPA 68, and NFPA 69. The OMT will ensure that an appropriate number of OSHIs trained in combustible dust hazard recognition are available for these inspections. If appropriate, the OMT Supervisor in coordination with the Administrative Director shall decide as soon as practicable whether or not expert services from outside the Division (such as expert witnesses) will be needed to support a combustible dust case properly. If so, such services shall be involved at the earliest date practical.

To support these inspections, these industry reference documents are available for OSHIs to use as a resource to support research and enforcement activities during the inspection.

1. NFPA 654, Standard for the Prevention of Fires and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
2. NFPA 484, Standard for Combustible Metals, Metal Powders, and Metal Dusts
3. NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
4. NFPA 68, Guide for Venting of Deflagrations
5. NFPA 85: Boiler and Combustion Systems Hazards Code
6. NFPA 69, Standard on Explosion Prevention Systems
7. NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
8. FM Global Safety Data pamphlet No. 7-76

Note: The NFPA documents are available online in readable format, without charge, at:

[http://www.nfpa.org/aboutthecodes/list\\_of\\_codes\\_and\\_standards.asp](http://www.nfpa.org/aboutthecodes/list_of_codes_and_standards.asp)

At the above web address, the following steps will allow in accessing a NFPA standard only in readable format: 1) select the standard, 2) login using the division's member ID and password, 3) agree to the disclaimer, and 4) open the standard.

The Factory Mutual documents are available online, without charge. Register first at:

<https://www.fmglobal.com/fmglobalregistration/>

### C. OSHIs' Safety and Health.

OSHIs shall take appropriate precautionary measures for the particular hazards presented in facilities with combustible dust hazards.

1. Personal Protective Equipment (PPE): In addition to the normally required personal protective equipment, OSHIs shall wear non-spark-producing clothing such as natural fiber (e.g., cotton). Flame-resistant clothing is available (St. Paul) for areas with airborne dust.
2. Equipment: Intrinsically safe cameras are not available therefore OSHIs shall take photographs or videos (using a telephoto feature) from locations within the plant that are not hazardous (classified) locations. Additionally, OSHIs shall take written statements from employees, and if possible from employers, regarding the hazardous conditions, including the alleged violative conditions (such as dust accumulations over paper clip diameter (i.e., standard 1.25" clip), explosion vents not directed to safe locations away from the employees working in the area, etc.)
3. Use safe practices when collecting samples, such as not generating a dust cloud while collecting a sample and using the right tools in collecting the samples. Additionally, if a means of safe access is not available, sample(s) should not be collected.
4. Equipment for collecting dust samples includes the following:
  - a. Three pairs of nitrile gloves (S, M, L)
  - b. Two inch nylon paint brush for collecting settled dust
  - c. Plastic scoop for collecting settled dust
  - d. Three one-liter plastic bottles

- e. Three one-gallon sealable plastic bags
- f. Plastic paper clips
- 5. Care shall be taken to ensure integrity of the sample.
- 6. Collection equipment is assembled in a kit and placed in State vehicles. Extra kits are available in the metro lab for OSHIs not using a State vehicle.

D. Inspection and Citation Procedures.

1. OSHIs should recognize that the following criteria must be met before a deflagration can occur:
  - a. The dust has to be combustible.
  - b. The dust has to be dispersed in air or another oxidant, and the concentration of this dispersed dust is at or above the minimum explosible concentration (MEC).
  - c. There is an ignition source, such as an electrostatic discharge, spark, glowing ember, hot surface, friction heat, or a flame that can ignite the dispersed combustible mixture that is at or above the MEC.
2. OSHIs should recognize that the following criteria must be met before an explosion can occur:
  - a. The above criteria for deflagration must be present.
  - b. The combustible mixture is dispersed within a confined enclosure (and the confined enclosure does not contain sufficient deflagration venting capacity to safely release the pressures) such as a vessel, storage bin, ductwork, room or building. It must be noted that a small deflagration can disturb and suspend the combustible dust, which could then serve as the fuel for a secondary (and often more damaging) deflagration or explosion.
3. OSHIs should be able to recognize the following conditions that may indicate that a potential dust deflagration, other fire, or explosion hazard exists:
  - a. Plant History of Fires: The plant has a history of fires involving combustible dusts.
  - b. Safety Data Sheets (SDS): The SDS may indicate that a particular dust is combustible and can cause explosions, deflagrations, or other fires. However, do not use SDSs as a sole source of information because this information is often excluded from SDSs.
  - c. Dust Accumulations: Annex D of NFPA 654 contains guidance on dust layer characterization and precautions. It indicates that immediate cleaning is warranted whenever a dust layer of a paper clip diameter accumulates over a surface area of at least 5% of the floor area of the facility or any given room. The 5% factor should not be used if the floor area exceeds 20,000 ft<sup>2</sup>, in which case a 1,000 ft<sup>2</sup> layer of dust is the upper limit. Accumulations on overhead beams, joists, ducts, the tops of equipment, and other surfaces should be included when determining the dust coverage area. Even vertical surfaces should be included if the dust is adhering to them. Rough calculations show that the available surface area of bar joists is approximately 5 % of the floor area and the equivalent surface area for steel beams can be as high as 10%. The material in Annex D is an idealized approach based on certain assumptions, including uniformity of the dust layer covering the surfaces, a bulk density of 75 lb/ ft<sup>3</sup>, a dust concentration of 0.35 oz/ ft<sup>3</sup>, and a dust cloud height of 10 ft. Additionally, FM Data Sheet 7-76 contains a formula to determine the dust thickness that may create an explosion hazard in a room, when some of these variables differ.

- d. OSHIs should observe areas of the plant for accumulations of hazardous levels of dust (for example, equal to the thickness of a typical paper clip). Likely areas of dust accumulations within a plant are:
    - i. structural members
    - ii. conduit and pipe racks
    - iii. cable trays
    - iv. floors
    - v. above ceiling
    - vi. on and around equipment (leaks around dust collectors and ductwork.)
  - e. If OSHIs find that there are potential combustible dust hazards, dust samples must be safely collected. OSHIs shall use means of access to upper levels of a facility only when this can be done safely. Dust samples shall be submitted to OSHA's Salt Lake Technical Center (SLTC) for analysis. The OSHA Enforcement Director shall provide approval for dust samples to be sent to SLTC. Locations from which to collect separate samples:
    - i. "High spaces" such as roof beams, open web beams, tops of pipes and ductwork, and other horizontal surfaces located as high in the overhead as possible. Note: These are the preferred locations; however, if a means of safe access is not available, sample(s) should not be collected.
    - ii. Equipment and floors where dust has accumulated.
    - iii. The interior (i.e., bins and/or bags) of a dust collector.
    - iv. Within ductwork.
4. SLTC Tests. While there are several tests which may be done, for enforcement of potential housekeeping violations, the Kst Test shall be requested. The laboratory will report the Percent through 40 mesh and Percent moisture content results as part of the Kst testing. For concerns about hazardous electrical locations, the Class II test shall be requested. Details on these or other tests are found in the federal directive CPL 03-00-008.
- a. Maximum normalized rate of pressure rise (dP/dt) – Kst Test
  - b. Class II test
5. Sampling & Analytical Methods.
- a. Air sampling is not necessary.
  - b. Bulk samples for explosibility determination should be shipped in 1-L plastic bottles. Obtain samples from several locations so that the amount can be collected in a 1-liter plastic bottle. If requesting Kst and Class II tests, collect separate samples (i.e., two liters of material). If the material is hazardous according to DOT/IATA regulations, it should be properly labeled and packaged. OSHIs should contact the SLTC for guidance if they have questions about shipping the material.
  - c. OSHIs should take precautions not to contaminate the sample material. The presence of some contaminants in a sample may result in the tests' underreporting of the explosiveness of the dust being handled at the facility.
  - d. Make sure lids on each sample bottle are sealed before packaging.
  - e. Affix a security seal on the container. To seal the bottle correctly apply one end of the seal to the center of the lid. Then run the seal to the edge of the lid and approximately half way down the side of the bottle. Rolls of security seal tape are available in all offices.

- f. Document the description of the operation and indicate the tests to be done on the OSHA 91A as follows:
  - i. When requesting analyses for explosibility determination (housekeeping or general duty violations), request the Kst test.
  - ii. When requesting analyses for Class II hazardous locations, write "Potential Class II Dust". This test must be done to support a citation for Class II hazardous (classified) locations, 1910.307. (Note: This test only applies to electrical ignition sources in Class II locations.)
  - iii. OSHA 91 forms are located at <g:/OSHA-ENF/Work Groups/Health/Lab/Sample Forms>. Each 91 Form needs to have its own unique number. See MOOSE Manual, Chapter 8, for further instructions on obtaining this number and transferring it to the paper form. See Appendix B.
  - iv. Maintain chain of custody whenever samples are handled by another party by having that party sign & date the OSHA 91 form.
  - v. The last handler of the sample shall make a copy of the OSHA 91 form and have it tiffed to the case file. Place the signed original copy in the box prior to shipping.
  - vi. **Because of the resource intensive nature of the tests, SLTC requires the Director's concurrence for all combustibility and explosibility testing.** Use a sturdy outer box for the samples to fit in. Make sure the box is rigid and in good condition with no punctures, rips, tears, or corner damage and that the flaps are intact. Package the bottle in the box so that bottle movement is minimized and provide internal protection with cushioning such as cell bubble sheeting, air bags, polystyrene peanuts, foam, corrugated liners, or crumpled shipping paper. Note that more than one sample bottle can go in the sample shipping box. **DANGER - Do not put any other types of hazardous materials into this shipping box.**
  - vii. Place the prepared materials and required identification papers (including an SDS) in the box, close securely using a strong shipping tape with 2" or greater width (do not use masking tape, scotch tape, duct tape, string or other similar products) and ship them to SLTC, following the shipping instructions provided by the shipping company or the U.S. Postal Service. Normally, no special DOT shipping requirements apply for grain dust, sugar, corn starch, coal dust, plastic dust, paper dust, textile dust, wood dust, vitamins, minerals or pharmaceuticals; however, when shipping metal dusts (especially when dusts involve aluminum or magnesium), OSHIs should verify with the shipping company whether any special shipping requirements apply. Generally, no restrictions apply if shipped by ground transportation.
6. Dust collectors, ductwork, and other containers. OSHIs should also pay attention to the dust collectors and ductwork, as well as other containers, because they maintain a cloud of finely divided particles suspended in air. Because they maintain a cloud of combustible dust, OSHIs should determine whether the plant has a sound ignition control program that prevents introduction of ignition sources (including sparks from electrostatic discharge, open flames, or other similar sources) into them. Additionally, housekeeping problems may be exacerbated by the inefficient operation of dust collectors. As noted in NFPA 654, Annex D.2, dust collectors generally operate most effectively between limited pressure drops of between 3 inches to 5 inches of water. If the employer does not have a hot work permit system that addresses hot work on and around collection points and

ductwork or in areas where hazardous levels of dust accumulations may occur, the OSHI should recommend that such a system be adopted expeditiously and rigorously implemented. In general duty cases a hot work permit system may be noted as a feasible abatement method. For chemicals covered by 1910.119 (PSM), the standard requires a hot work permit system. See 1910.119(k).

7. OSHIs must gather information about the employer's efforts to abate the combustible dust hazard. This information will be helpful in determining some violations, as well as the employer's good faith, a penalty factor. OSHIs should look at dust collectors, ductwork, associated equipment, and containers, like mixers or storage bins. The following information may be gathered during the course of the inspection:
  - a. Explosion prevention and mitigation controls such as the isolation or segregation of dust-generating processes, building damage-limiting construction, explosion venting for dust-processing areas; process equipment relief (see NFPA 68), and process isolation and explosion suppression (see NFPA 69).
  - b. The dimensions of the room as well as the areas of the dust accumulations of greater than a paper clip.
  - c. The design information on the dust collection systems, along with model numbers and serial numbers (located on the side of the equipment along with the manufacturer and phone numbers).
  - d. Size (volume) of dust collectors (Note: Dust collectors are referred to as "air-material separators" in NFPA 654).
  - e. Warning signs or alerts on the equipment referencing combustible dust.
  - f. Any sources of ignition in the area, such as welding, fork truck traffic, etc.
  - g. Information on whether the electrical equipment in the area is designed for use in a hazardous (classified) location. (Note: Do not open electrical boxes or disconnect electrical cords. Opening them could cause an electrical arc, especially in an area with metal dust.)

NOTE: Because of its spark-producing potential, no equipment, including cameras with electronic flashes or electrical equipment, shall be used in hazardous (classified) locations of the facilities, unless the equipment is intrinsically safe, approved, or safe, as defined in 1910.307(b), for use in these types of areas.

8. Citations.
  - a. Ventilation Standard Violations. If the facility's operations are covered by 1910.94, *Ventilation*, then any violations of the standard shall be cited. Paragraph (a) of the standard covers abrasive blasting; paragraph (b), grinding, polishing, and buffing operations.
  - b. Housekeeping Violations. If the surface dust accumulations (**i.e., dust accumulations outside the dust collection system or other containers, such as mixers**) can create an explosion, deflagration or other fire hazard, then citations for violations of 1910.22 (housekeeping) shall be issued. The standard provides in pertinent part: "(a) *Housekeeping.* (1) All places of employment, passageways ... and service rooms shall be kept clean... (2) The floor of every workroom shall be maintained in a clean...condition." Courts of appeals and the Occupational Safety and Health Review Commission have held that 1910.22 applies to the hazard of combustible dust. *Con Agra*,

*Inc. v. OSHRC*, 672 F.2d 699 (8<sup>th</sup> Cir. 1982); *Bunge Corp. v. Secretary of Labor*, 638 F.2d 831 (5<sup>th</sup> Cir. 1981); *Farmers Cooperative Grain and Supply Company*, 10 BNA OSHC 2086 (No. 79-1177, 1982).

- i. Citations for violations of 1910.22(a)(1) shall be issued when the levels of dust accumulations (see sections D.3. c and d of this Instruction) exist in places of employment (except floors of workrooms and storage areas), passageways, and service rooms, in such depths that they can present explosion, deflagration or other fire hazards.
- ii. Citations for 1910.22(a)(2) shall be issued when the levels of dust accumulations (see section D.3. c and d of this Instruction) exist on the **floors** of workrooms in such depths that they can present explosion, deflagration or other fire hazards.

However, small amounts of dust accumulations in isolated spots of the floor or other areas would not normally be classified as a violation of the housekeeping requirement under this directive. In order to substantiate housekeeping violations, OSHIs shall take representative measurements. Thickness measurements must be made at several locations within the sampling area. For a large area, a paint brush and dustpan can be used. As a part of determining whether the housekeeping violation is serious, the OSHI should determine whether the dust is combustible. In addition, the OSHI should also document the heat and ignition sources.

In coal-handling operations located in electric power generation, transmission, and distribution facilities, 1910.22 shall not be cited for coal dust accumulations; rather 29 CFR 1910.269(v)(11)(xii) shall be cited. See subparagraph D.9.f.

NOTE: This directive should not be construed to interfere with the application of 1910.22 or other housekeeping standards to the uncleanness of workplaces unrelated to the combustible dust hazard.

- c. Housekeeping violations in storage areas. 1910.176(c) shall be cited for housekeeping violations in storage areas. The standard provides in pertinent part: "(c) *Housekeeping*. Storage areas shall be kept free from accumulation of materials that constitute hazards from ...fire, explosion..." The criteria for the dust hazard applicable to 1910.22(a) violations under this NEP apply in determining 1910.176(c) violations. The OSHI must document whether a reasonable person would recognize a combustible dust hazard under the circumstances. NFPA standards may be relied upon in this regard. See, e.g., NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids. The OSHI must also document feasible abatement methods. See, e.g., NFPA 654.
- d. MS §182.653 Subd. (2) (general duty clause) violations. A citation under MS§182.653 (subd (2) (the general duty clause) may be issued for deflagration, explosion or other fire hazards that may be caused by combustible **dust within a dust collection system or other containers, such as mixers**. The NFPA standards, which represent the opinions of experts familiar with combustible dust hazards, are useful in providing evidence of industry recognition of the hazard. See, e.g., NFPA 654. (See *Kelly Springfield Tire Co., Inc. v. Donovan*, 729 F.2d 317 (5<sup>th</sup> Cir. 1984) (recognition of combustible dust hazard based on testimony of expert employed by dust collection equipment manufacturer.)

OSHIs shall also look at the employer's safety manuals or other instructions to determine whether there is employer recognition of the combustible dust hazard. However, if such articles or employer documents are unavailable, OSHIs may rely upon the NFPA standards for evidence of recognition of the hazard. For evidence of feasible means of abatement, OSHIs should consult relevant NFPA standards. The essence of a general duty citation is the hazard. A separate general duty citation shall not be issued for a failure to use a particular abatement method. The Attorney General's Office should be consulted prior to issuing general duty citations.

General duty citations may be issued for **deflagration and explosion hazards** if SLTC finds Kst values of the submitted dust sample to be greater than zero. General duty citations may also be issued for other fire hazards if SLTC determines that the dust is combustible. (See CPL 03-00-008 for more details on combustible dust tests, including the Kst test and its associated values relative to degree of explosion). General duty clause citations can only be issued if all elements of a general duty violation can be documented. As a part of general duty documentation, the OSHI should also document the heat and ignition sources.

The following are some conditions for which a general duty clause citation may be issued:

- i. Problems related to dust collectors, e.g., dust collection equipment located inside the building (however, there are some exceptions) and dust collectors returning air back inside the building.
  - ii. Ductwork-related problems, e.g., the ductwork not being grounded and ductwork not constructed of metal.
  - iii. Improperly designed deflagration venting (venting to areas where employees are likely to be exposed to explosion/deflagration hazards).
  - iv. Processing and material handling equipment, such as, mixers, blenders, pulverizers, mills, dryers, ovens, filters, dust collectors, pneumatic conveyors, and screw conveyors, not protected by deflagration suppression systems.
  - v. Equipment connected by pipes and ducts not protected by deflagration isolation systems, such as flame arresters, flame front diverters, spark detection, spark extinguishing equipment, and rotary valves.
- e. Housekeeping violations at coal-handling operations covered under 1910.269. If violations of 1910.269(v)(11)(xii) (sources of ignition not eliminated or controlled where coal-handling operations may produce a combustible atmosphere from fuel sources) are identified during an inspection of a coal-fired power plant, that provision shall be cited, not 1910.22.
- f. Personal Protective Equipment (PPE) Violations. Citations under 1910.132(a) (the general requirement to provide and assure the use of protective equipment, including *protective clothing*) may be issued, if an employee exposure to potential burn injuries can be documented. For example, if employees are not wearing protective clothing, such as flame-resistant clothing, in areas of the plant (e.g., bagging areas) where employees may be exposed to potential combustible dust flash fire hazards, then citations under 1910.132(a) may be issued. Another example where citations under 1910.132(a) may be

issued, would be a situation where employees (not wearing flame resistant clothing) cleaning out a piece of equipment containing combustible dust may be exposed to a flash fire propagated through the cleanout door. A citation may be issued whether or not an accident precipitated the inspection.

The OSHI shall document whether a reasonable person familiar with the circumstances would recognize hazards from combustible dust. NFPA standards may be used for this documentation. The OSHI shall also document whether there are feasible types of personal protective equipment to deal with these hazards. It has been recognized as industry practice to require flame-resistant clothing when employees may be exposed to flash fire hazards. National Fire Protection Association (NFPA) 2113, *Standard on Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire* is a national consensus standard which applies to, among others, chemical, refining, and terminal facilities with flash fire hazards. Among other provisions, NFPA 2113 has requirements for when flame-resistant clothing must be used by industrial personnel exposed to flash fire hazards. See Chapter 4 of NFPA 1123 for a discussion on selection of flame-resistant clothing.

- g. Electrical Violations. If the laboratory analysis indicates that the submitted dust meets the criteria for Class II (See Class II Test methodology in CPL 03-00-0008), and if the location where the dust was present falls under any of the Class II location definitions, then 1910.307 will apply. See the Class II definition in 1910.399. However, if violations involving Class I or III locations are found in the course of conducting these inspections, citations shall be issued. See the Class I and III definitions in 1910.399.

Equipment, wiring methods, and installations of equipment in hazardous (classified) locations shall be: 1) intrinsically safe, 2) approved for the hazardous (classified) location, or 3) safe for the hazardous (classified) location. The meaning of these terms is spelled out in 1910.307(b).

If the employer chooses the third option of providing equipment that is "safe for the hazardous location," then the employer must demonstrate that the equipment is of a type and design that will provide protection from the hazards involved. Compliance with the guidelines contained in the National Electrical Code (NEC) constitutes one means, but not the only means, of demonstrating that the electrical equipment is safe for the hazardous location.

Citations issued for electrical violations must be adequately documented in the case file. Such documentation must include the location and type of potential electrical ignition sources, the type and condition of electrical equipment located in the area, and information indicating that the equipment is not approved or safe for the location. (See NEC and NFPA 499 for more details.)

- h. Powered Industrial Trucks. For powered industrial truck violations, citations shall be issued under 1910.178(c)(2)(ii) and (vi)-(ix) and 1910.178(m)(11).
- i. Welding, cutting, and brazing. For violations involving welding, cutting, and brazing operations, 1910.252 (general welding and cutting) (see, in particular, (a)(2)(vi)(C), prohibiting cutting and welding in explosive atmospheres, including mixtures of flammable dusts with air), 1910.253 (oxygen-fuel gas welding and cutting) (see, in particular,

(c)(2)(ii) and (iv), and (f)(5)(i)(B)), and 1910.254 (arc welding) (see, in particular, (b)(2)(F)) shall be used.

- j. Warning Sign Violations. If safety instruction signs are missing on equipment, or at the entrance to places where explosive atmospheres may occur, then citations under 1910.145(c)(3) shall be issued.
  - k. Hazard communication violations. The Right-to-Know standard (or equivalent federal hazard communication standard, 1910.1200), requires all employers to provide information to their employees about the hazardous substances to which they are exposed, by means of a hazard communication program, labels and other forms of warning, safety data sheets, and information and training. See "hazardous substances" definition in 5206.0100 subp. 7 (or 1910.1200(c)), which addresses physical hazards. Employers who do not follow the requirements of this standard shall be cited with respect to substances which in the course of normal conditions of use could become combustible dusts. The standard requires chemical manufacturers and importers to develop or obtain a safety data sheet for each hazardous substance they produce or import. (5206.0800 Subp. 1; in 2016, see 1910.1200(g)(1)).
- OSHIs shall evaluate whether there is compliance with 5206.0800 (in 2016, 1910.1200(g)(2)-(5)) by examining a sample of SDSs. If SDSs are not updated when new information becomes available, they are deficient. Cite 5206.0800 subp. 1 (in 2016, 1910.1200(g)(5)). If the SDSs are found deficient with respect to the combustibility or explosibility of the dust being handled, OSHIs shall investigate whether the employer prepared the SDS.
- l. Egress violations. Citations for violations of Subpart E –Means of Egress, Part 1910, particularly 1910.33-37, shall be issued where violations of these provisions are found.
  - m. Fire protection violations. Citations for violations of 1910.156 (fire brigades) and 1910.157 (portable fire extinguishers) shall be issued where violations of these standards are found. 1910.156 only applies if the employer has a fire brigade or industrial fire department. The fire extinguisher provisions of 1910.157 do not apply where the employer requires the evacuation of employees in the event of fire, has an emergency action plan meeting the requirements of 1910.38, and has a fire prevention plan meeting the requirements of 1910.39.
  - n. Bakery equipment violations. Citations for violations of 1910.263(k)(2) shall be issued for fire and explosion hazards in sugar and spice pulverizers.
  - o. Sawmill violations. Citations for violations of 1910.265(c)(20)(i) shall be issued in connection with defects in the design, construction, and maintenance of blower collecting and exhaust systems.
  - p. Agriculture. The only provisions which may be cited in connection with combustible dust in agricultural operations are Right to Know (5206.1700-1800, see 1928.21 for reference) and the general duty clause.

Because 1910.22(a) and 1910.176(c) do not apply to agricultural operations, the general duty clause may apply to hazards associated with surface dust accumulations outside and within dust collection systems and other containers.

c

E. MOOSE Coding Instructions.

Inspection(s) scheduled under the NEP must be coded with the NEP code "DUSTEXPL" entered in National Emphasis Description of the Emphasis/Initiatives tab in MOOSE. All other inspections shall be coded as originally intended (e.g., ES, Responise).

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James Krueger, Director MNOSHA Compliance  
for the OSHA Management Team

Distribution: OSHA Compliance and WSC Director

Attachments: Appendix A: Sample Questions  
Appendix B: OSH-91A Air Sampling Worksheet (i.e., lab submission form)

NOTICE: Minnesota OSHA Directives are used exclusively by MNOSHA personnel to assist in the administration of the OSHA program and in the proper interpretation and application of occupational safety and health statutes, regulations, and standards. They are not legally binding declarations and they are subject to revision or deletion at any time without notice.

## Appendix A

Sample questions OSHIs may use during the course of an inspection.  
(OSHI may refer to appropriate NFPA standards in developing additional questions.)

What types of combustible dust does the facility have?

(Note: Please see Table 4.5.2 of NFPA 499 and Table 1 in NMAB 353-3 for additional information on the various types of dust along with their properties)

Does the facility have a housekeeping program with regular cleaning frequencies established for floors and horizontal surfaces, such as ducts, pipes, hoods, ledges, and beams, to minimize dust accumulations within operating areas of the facility? Under the housekeeping program, is the dust on floors, structural members, and other surfaces removed concurrently with operations? Is there dust accumulation of 1/32 inch thick, or greater? For housekeeping violations, what are the dimensions of the room and the dimensions of the area covered with the dust?

Are the dust-containing systems (ducts and dust collectors) designed in a manner that fugitive dusts are not allowed to accumulate in the work area?

Are dust collectors greater than 8 cubic feet in volume located inside of buildings?

If dust explosion hazards exist in rooms, buildings, or other enclosures, do such areas have explosion relief venting distributed over the exterior walls of buildings and enclosures? Is such venting directed to a safe location away from employees?

Does the facility have isolation devices to prevent deflagration propagation between pieces of equipment connected by ductwork?

Does the facility have an ignition control program, such as grounding and bonding and other methods, for dissipating any electrostatic charge that could be generated while transporting the dust through the ductwork?

Does the facility have separator devices to remove foreign materials capable of igniting combustible dusts?

Are electrically- powered cleaning devices, such as sweepers or vacuum cleaners used in dusty areas, approved for the hazard classification, as required under 1910.307(b)?

Is smoking permitted only in safe designated areas?

Are areas where smoking is prohibited posted with "No Smoking" signs?

Is the exhaust from the dust collectors recycled?

Does the dust collector system have spark detection and explosion/deflagration suppression systems? (There are other alternative measures.)

Are all components of the dust collection system constructed of noncombustible materials?

Are ducts designed to maintain sufficient velocity to ensure the transport of both coarse and fine particles?

Are duct systems, dust collectors, and dust-producing machinery bonded and grounded to minimize accumulation of static electrical charge?

Is metal ductwork used?

In areas where a hazardous quantity of dust accumulates or is present in suspension in the air, does all electrical wiring and equipment comply with 1910.307(b) requirements?

Does the facility allow hot work only in safe, designated areas?

Are bulk storage containers constructed of noncombustible materials?

Does the company use methods to dissipate static electricity, such as by bonding and grounding?

Are employees who are involved in operating, maintaining, and supervising facilities that handle combustible dust trained in the hazards of the combustible dust?

Are SDSs for the chemicals which could become combustible dust under normal operations available to employees?

Appendix B – Air Sampling Worksheet

A pdf version of the OSH-91A Air Sampling Worksheet can be found at [G:\OSHA-ENFWork\Groups\Health\Lab\Sample Forms\Air Sample Report OSHA 91A \(pdf\).pdf](G:\OSHA-ENFWork\Groups\Health\Lab\Sample Forms\Air Sample Report OSHA 91A (pdf).pdf)