Combustible Dust Program

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1. PURPOSE

   To establish a comprehensive Combustible Dust Program to ensure the protection of all personnel from the hazards associated with exposure.

2. SCOPE

   This procedure applies to those employees and contractors in Mosaic Phosphates Business Unit facilities where combustible dust exists.

3. DEFINITIONS

   3.1 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.

   3.1.1 Dusts traditionally have been defined as a material 420 microns or smaller (capable of passing through a U.S. No. 40 standard sieve).

   3.1.2 Combustible particulates with an effective diameter of less than 420 microns should be deemed to fulfill the criterion of the definition.

   3.1.3 Flat platelet-shaped particles, flakes, or particles of fibers with lengths that are large compared to their diameter usually do not pass through a 420 microns sieve yet still pose a deflagration hazard.

   3.2 Explosion - The bursting or rupture of an enclosure or a container due to the development of internal pressure from a deflagration.

   3.3 Minimum Explosible Concentration (MEC) - The minimum concentration of a combustible dust suspended in air, measured in mass per unit volume, which will support a deflagration.

   3.4 Minimum Ignition Temperature (MIT) – The minimum temperature at which a combustible dust will ignite

3.5 Minimum Ignition Energy (MIE) – the minimum energy required to trigger an ignition of combustible dust or energy necessary to ignite a dust layer and a dust cloud.

3.6 Hazardous Area - Areas where dust accumulations exceed 0.03 inches (0.8 mm) or areas where dust clouds of a hazardous concentration exist, unless otherwise permitted.

3.7 Noncombustible Material - A material that, in the form in which it is used and under the conditions anticipated, will not ignite, support combustion, burn, or release flammable vapors when subjected to fire or heat.

3.8 Spark - A moving particle of solid material that emits radiant energy due to either its temperature or the process of combustion on its surface.

3.9 Owner/Operator - The organization with fiscal responsibility for the operation, maintenance, and profitability of the facility.

4. PROCEDURE

4.1 General

4.1.1 Systems that handle combustible particulate solids shall be designed by and installed under the supervision of qualified engineers who are knowledgeable about these systems and their associated hazards.

4.1.2 The facility and processes shall be designed to prevent fires and explosions that can cause failure of adjacent compartments, emergency life safety systems, adjacent properties, adjacent storage, or the facility's structural elements.

4.1.3 Areas in which combustible dusts are produced, processed, handled, or collected shall be detached, segregated, or separated from other occupancies to minimize damage from a fire or explosion.

4.1.4 Physical barriers that are erected to segregate dust hazards shall have all penetrations of floors, walls, ceilings, or partitions sealed dust tight, and, where structural assemblies have a fire endurance rating, the seal shall maintain that rating.

4.1.5 Physical barriers that are erected to segregate dust deflagration hazards shall be designed to preclude failure of those barriers before the deflagration pressure can be safely vented to the outside.

4.1.6 Means shall be provided to prevent foreign material from entering the system when such foreign material presents an ignition hazard.

4.1.7 When separation is used to limit the fire or dust explosion hazardous area, the hazardous area shall include areas where dust accumulations exceed 0.03 inches (0.8 mm) or areas where dust clouds of a hazardous concentration exist, unless otherwise permitted.

4.1.8 Portable fire extinguishers shall be provided throughout all buildings in accordance with the Mosaic Fire Protection Program

4.1.9 Smoking is not permitted in facilities where combustible dusts may be present.

4.1.10 When performing any work in areas containing combustible dust, follow all applicable provisions of the Hazardous Work and Hot Work programs.

4.2 Ventilation

4.2.1 Recycling of air–material separator exhaust to buildings shall be permitted if the system is designed to prevent both return of dust with an efficiency of 99.9 percent at 10 µm and transmission of energy from a fire or explosion to the building.

4.2.2 Recycling of air–material separator exhaust to the building shall not be permitted under any circumstances when combustible gases or vapors or hybrid mixtures are involved.

4.2.3 If a room or building contains a dust explosion hazard that is external to protected equipment, such areas shall be provided with deflagration venting to a safe outside location.

4.3 Signage

4.3.1 Appropriate hazard warnings, or alternatively, words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the materials, and which, in conjunction with the other information immediately available to employees under the Mosaic Hazard Communication Program, will provide employees with the specific information regarding the physical and health hazards of the hazardous material.

4.4 Grounding

4.4.1 All machinery, conveyors, housings, and collectors shall be thoroughly bonded and grounded to prevent the accumulation of static electricity.

4.4.1 All metal parts of machinery, casings, bins, and spouts shall be bonded and grounded to prevent the accumulation of static electricity.

4.5 Tools

4.5.1 Power-operated tools shall not be used where combustible dust or dust clouds are present. When the use of such tools becomes necessary, all dust-producing machinery in the area shall be shut down, all equipment, floors, and walls shall be cleaned thoroughly, and all accumulations of dust shall be removed.

4.5.2 After such work has been completed, a check shall be made to ensure that no cartridges or charges have been left on the premises where they could enter equipment or be accidentally discharged after operation of the dust-producing or dust-handling machinery is resumed.

4.6 Cleaning & Tramp Materials

4.6.1 Dusts containing combustible materials shall be maintained less than 0.8 mm (0.03 in.) on all surfaces and equipment in the facility.

4.6.2 Regular cleaning frequencies shall be established for walls, floors, and horizontal surfaces, such as equipment, ducts, pipes, hoods, ledges, beams, and above suspended ceilings and other concealed surfaces, to minimize dust accumulations within operating areas of the facility.

4.6.3 Floor sweepings shall not be returned to any machine. *Note: At the time of review, this requirement is under consideration

4.6.4 Foreign materials, such as unwanted metal which finds its way into the mill ore stream, that are capable of igniting combustible material being processed shall be removed from the process stream by one of the following methods:

a. Permanent magnetic separators or electromagnetic separators that indicate loss of power to the separators.
b. Pneumatic separators.
c. Grates or other separation devices.

4.7 Design

4.7.1 The structure shall be located, designed, constructed, and maintained to minimize the propagation of fire or explosion to adjacent properties and to avoid injury to the public.

4.7.2 The design of the fire and explosion safety provisions shall be based on a process hazard analysis of the facility, the process, and the associated fire or explosion hazards.

4.7.3 The process hazard analysis shall be reviewed and updated at least every 5 years.

4.7.4 The design of processes and facilities that handle combustible particulate solids shall consider the physical and chemical properties that establish the hazardous characteristics of the materials.

4.7.5 All electrical equipment and installations shall comply with the requirements of:

a. NFPA 70, National Electrical Code, or

b. NFPA 496, Standard for Purged and Pressurized Enclosures for Electrical Equipment.

4.7.6 The design of explosion protection for equipment shall incorporate one or more of the following methods of protection:

a. Oxidant concentration reduction in accordance with NFPA 69, Standard on Explosion Prevention Systems:

i. Where oxygen monitoring is used, it shall be installed in accordance with ISA 84.00.01, Functional Safety: Application of Safety Instrumented Systems for the Process Industry Sector.

ii. Where the chemical properties of the material being conveyed require a minimum concentration of oxygen to control pyrophoricity, that level of concentration shall be maintained.

b. Deflagration venting. *Note: At the time of review, this requirement is under consideration

c. Deflagration pressure containment.

d. Deflagration suppression systems.

e. Dilution with a noncombustible dust to render the mixture noncombustible.

f. Deflagration venting through a listed dust retention and flame-arresting device.

g. Design of the system so as to prevent the explosive dust from concentrating to hazardous levels

4.7.7 Interior surfaces shall be designed and constructed to facilitate cleaning and to minimize combustible dust accumulation.

4.7.8 Where an explosion hazard exists, air–material separators shall be located outside of buildings. *Note: At the time of review, this requirement is under consideration

4.7.9 Air–material separators shall be constructed of noncombustible materials.

4.7.10 Continuous suction to minimize the escape of dust shall be provided for processes where combustible dust is liberated in normal operation. The dust shall be conveyed to dust collectors. Avoid the use of bag house dust collectors.

4.7.11 Belt drives shall be designed to stall without the belt's slipping, or a safety device shall be provided to shut down the equipment if slippage occurs.

4.7.12 All system components shall be conductive.

4.7.13 Where the use of conductive components is not practical, nonconductive equipment shall be permitted where one of the following criteria is met:

a. A documented engineering analysis that is acceptable to the authority having jurisdiction has determined that no electrostatic ignition potential exists.

b. Materials being conveyed are not compatible with metal ductwork, and other means of explosion protection are provided.

4.7.14 Fire protection systems, where installed, shall be specifically designed to address building protection, process equipment, and the chemical and physical properties of the materials being processed.

5. TRAINING

5.1 Personnel shall be trained to use portable fire extinguishers in a manner that minimizes the generation of dust clouds during discharge.

5.2 Operating and maintenance procedures and emergency plans shall be developed.

5.3 Initial and refresher training shall be provided to employees who are involved in operating, maintaining, and supervising facilities that handle combustible particulate solids.

5.4 Initial and refresher training shall ensure that all employees are knowledgeable about the following:

5.4.1 Hazards of their workplace

5.4.2 General orientation, including plant safety rules

5.4.3 Process description

5.4.4 Equipment operation, safe startup and shutdown, and response to upset conditions

5.4.5 The necessity for proper functioning of related fire and explosion protection systems

5.4.6 Equipment maintenance requirements and practices

5.4.7 Housekeeping requirements

5.4.8 Emergency response plans

5.5 The employer shall certify annually that the training has been completed.

6. PROGRAM REVIEW/PERIODIC INSPECTIONS

6.1 An inspection, testing, and maintenance program shall be developed and implemented to ensure that the fire and explosion protection systems and related process controls and equipment perform as designed.

6.2 The plans and procedures shall be reviewed annually and as required by process changes.

6.3 The inspection, testing, and maintenance program shall include the following:

6.3.1 Fire and explosion protection and prevention equipment in accordance with the applicable NFPA standards

6.3.2 Dust control equipment

6.3.3 Housekeeping

6.3.4 Potential ignition sources

6.3.5 Electrical, process, and mechanical equipment, including process interlocks

6.3.6 Process changes

6.3.7 Lubrication of bearings

6.4 All fire-extinguishing systems shall be maintained pursuant to the requirements established in the standard that governs the design and installation of the system.

6.5 All explosion prevention systems and inerting systems shall be maintained pursuant to the requirements of NFPA 69, Standard on Explosion Prevention Systems.

6.6 Records shall be kept of maintenance and repairs performed.

7. CONTRACTORS

7.1 Contractors shall be informed that they will be working in a process area that processes potentially explosive materials, of the hazards of those materials, safety considerations for their tasks, and that they will be required to follow Mosaic's Combustible Dust Procedure.

8. REFERENCES

8.1 NFPA

8.1.1 NFPA 69 - Standard on Explosion Prevention Systems ISA 84.00.01, Functional Safety: Application of Safety Instrumented Systems for the Process Industry Sector.

8.1.2 NFPA 70 - National Electrical Code

8.1.3 NFPA 496 - Purged and Pressurized Enclosures for Electrical Equipment.

8.1.4 NFPA 654 - Prevention for Prevention of Fire and Dust Explosions

8.1.5 NFPA 655 - Prevention of Sulfur Fires and Explosions

8.2 ISA

8.2.1 ISA 84.00.01, Functional Safety: Application of Safety Instrumented Systems for the Process Industry Sector.

8.3 OSHA

8.3.1 Safety and Health Topics – Combustible Dust

8.3.2 Safety and Health Topics – Combustible Dust Standards

8.3.3 Status Report on Combustible Dust – National Emphasis Program (October, 2009)

8.3.4 Letters of Interpretation

8.3.5 As of 2011 the most common serious Combustible Dust OSHA violations or findings reported:

a. Dust collector located indoors with no explosion protection
b. Venting of dust into a “safe area”.
c. Electrical equipment not explosion proof.
d. 1/8” of dust collected in 24 hours.
e. Horizontal surfaces not minimized to prevent dust accumulation.
f. No method to prevent foreign objects from entering the process.
g. Grinders and shakers not designed to minimize dust.
h. Dust returns system without spark arrest.
i. Ductwork not grounded.
j. PHA’s not done in 5-years.
k. No Contractor training/management.

8.4 Publications

8.4.1 *Addressing Combustible Dust Hazards*, J. Perry, M. Myers, M. Murphy, Chemical Engineering Progress (AIChE), pp. 36 to 41, May, 2011.

8.4.2 *Practical Issues with Marginally Explosive Dusts – Evaluating the Real Hazard,* S. Rogers, E. Ural, Process Safety Progress (AIChE), pp. 266 to 279, Vol. 30, No. 3, September, 2011.

8.4.3 *Combustible Dust Hazard Recognition – An Insurers View*, H. Febo Jr., Process Safety Progress, pp. 82 to 86, Vol. 30, No. 1, March, 2011.

8.4.4 *Reduce Dust Explosions the Inherently Safer Way* P. Amyotte, F. Khan, A. Dastidar, Chemical Engineering Progress (AIChE) pp. 36 to 43, October, 2003

8.4.5 *Safely Handle Powdered Solids* R. Zalosh, S. Grossel, R. Kahn, D. Sliva, Chemical Engineering Progress (AIChE) pp. 23 to 30, December, 2005.

9. REVISION LOG

Revision Log				
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0	Initial Issue for Mosaic		J. Gliksman Brent Roberts	8/23/2012
	Mike Neal	Mike Neal	Reese Withers	12/13/2012
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Contact the Subject Matter Expert for additional information on this program.