APPENDIX D

COMBUSTIBLE DUST BULK SAMPLING

Combustible dust sampling is conducted where the potential for rapid burning (deflagration) or violent burning with rapid release of pressure (explosion) is suspected due to the presence of accumulations of settled dust. **Non-ferrous metals are especially hazardous and must be collected according to regional CSHO safety and health program policies and procedures.** In general, a thickness greater than 1/32 of an inch is cause for concern when the surface area covered by settled dust exceeds 5% of the floor area in a given room. The 5% factor should not be used if the floor area exceeds 20,000 square feet (ft^2), in which case a 1,000 ft^2 layer of dust is the upper limit. Accumulations on overhead beams, joists, ducts, the tops of equipment, and other surfaces, including vertical surfaces, should be included when determining the dust coverage area. Note that the available surface area of bar joists is approximately five percent of the floor area and the equivalent surface area for steel beams can be as high as 10%. Further detail is included in the compliance directive for the Combustible Dust National Emphasis Program (CPL 03-00-008).

Examples of combustible dust include but are not limited to:

- Metal dust such as aluminum and magnesium
- Wood dust
- Coal and other carbon dusts
- Plastic dust and additives
- Biosolids
- Other organic dust such as sugar, flour, paper, soap, and dried blood
- Certain textile materials

Examples of industries that handle combustible dusts: agriculture, food products, chemicals, textiles, forest and furniture products, wastewater treatment, metal processing, tire and rubber manufacturing plants, paper products, pharmaceuticals, wastewater treatment, recycling operations (metal, paper, and plastic), and coal handling and processing facilities.

Examples of OSHA standards applicable to combustible dust hazards:

- 29 CFR 1910.22, Walking-Working Surfaces
- 29 CFR 1910.176(c), Materials Handling and Storage
- 29 CFR 1910.272, Grain Handling Facilities
- 29 CFR 1910.307, Electrical, Hazardous (Classified) Locations
- 29 CFR 1910.269(v)(11)(xii), Electric Power Generation, Transmission, Distribution
- 29 CFR 1910.1200, Hazard Communication Standard
- Section 5(a)(1) of the Occupational Safety and Health Act, the General Duty Clause, may used to cite deflagration, other fire, or explosion hazards where combustible dust hazards exist within dust control systems or other containers.

Personal Protective Equipment (PPE): To conduct combustible dust sampling, CSHOs shall wear non-spark producing clothing such as natural fiber (e.g., cotton). CSHOs should also be equipped with flame-resistant (FR) clothing as appropriate. Other PPE for the reduction of static electric discharge includes conductive gloves and electrostatic dissipative (ESD) footwear without metal eyelets. Note: CSHOs should not rely on ESD footwear as being effective in all environments. Accumulation of debris, wax, and

other high resistivity materials will compromise the conductivity of any floor. Conductive footwear should not be used where the potential for electric shock by line voltage exists.

Cameras: In areas classified as requiring intrinsically safe equipment, use only cameras that are intrinsically safe. If not available, either portray the scene with a sketch or use the zoom lens to take photos from a safe location. In areas that are not classified, the low energy levels produced by use of a regular camera will not normally present a hazard when dust concentrations in the air are below an OSHA PEL. If the dust levels in the air necessitate the use of a respirator, DO NOT USE YOUR CAMERA.

Safe Practices:

- If CSHOs find that there are potential combustible dust hazards, dust samples must be safely collected. Written statements should be taken from workers and employers regarding the properties of the combustible metals and any hazardous conditions present, such as but not limited to:

- Any history of fires/explosions/deflagrations involving combustible metals of concern (e.g. aluminum, magnesium, titanium, tantalum, niobium, zirconium, others). *If a fire, explosion, or deflagration has previously occurred at the establishment related to the handling of a combustible metal, document the occurrence and circumstances involved through the interview process. If a material has shown to be combustible at the establishment, there may not be a need for obtaining a bulk sample.*

- The experienced consistency/size fraction of the combustible metals of concern. *Interview the workers charged with emptying the collection bins beneath the dust collection devices. Document their experience regarding the particle size of the metal being collected. Common materials and their size are:*
    - *White granulated sugar: 450 to 600 microns*
    - *Table salt: 100 microns*
    - *Flour: 1 to 100 microns*
    - *Sand: 50 plus microns*
    - *Talcum powder: 10 microns*

- The results of any previous combustible metals sampling conducted or commissioned by the employer. *If the employer has previously conducted combustibility testing, obtain the results for the file.*

- Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS[1]) identification of metal material(s), SDS warnings or other instructions. *Obtain MSDSs or SDSs for the materials being utilized at the establishment for the file.*

- Do not collect a sample from an area unless a safe means of access is available.

- Take all precautions necessary to avoid the generation of a dust cloud while collecting a sample.

[1] The hazard communication standard was revised in 2012. Safety Data Sheets (SDSs) will replace MSDSs. SDSs have a standardized 16-section format with specific information required in each section. Manufacturers and importers have until June 1, 2015 to replace MSDSs with SDSs, and until then a mixture of MSDSs and SDSs may be received by employers.

- Use conductive nonsparking tools when collecting samples. If possible, bond and ground the tools.

- Do not use plastic bags, as they cannot be sealed tightly enough to avoid sample leakage or moisture loss, and may cause a bellows effect resulting in airborne exposure during sample handling.

Sample Collection Equipment may include:

- Natural bristle hand brushes for collecting settled dust.
- Non-sparking conductive dust pans (aluminum) for collecting settled dust.
- Non-spark producing sample container (1-Liter nonconductive plastic bottle, obtained locally or from the SLTC).
- Non-spark producing funnel for filling sample containers.
- Non-spark producing scoops for removing dust from cyclone containers or other ventilation equipment.

Sampling locations:

- Observe and document areas where the dust layer exceeds 1/32 inch in thickness, approximately the thickness of a small paper clip.

- Collect separate samples from:
    - Equipment and floors where dust has accumulated. Note that samples collected at floor level present a significantly reduced potential for dust cloud generation.

    - "High spaces" such as roof beams, open web beams, and other ceiling supports; tops of pipes, railings, ductwork, conduit, electrical boxes/panels and other horizontal surfaces located as high in the overhead as possible. Samples collected from elevated surfaces present a significantly greater potential for dust cloud generation from the inadvertent falling of material. High spaces are the preferred location for collecting samples, so long as there is a means of safe access.

    - The interior (i.e., bins and/or bags) of a dust collector.

    - Within ductwork.

- Avoid taking samples in close proximity of recognized ignition sources such as open flames, motors, electrical equipment, equipment bearings, etc.

Procedures:

- Use the correct equipment for collecting dust samples (see sample collection equipment above).

- Avoid contaminating the sample with other substances (some contaminants lead to underreporting of the explosiveness of the dust sampled).

- Collect at least 1 Liter of dust per sample.

    - One sample of each type dust is sufficient.

- Each type dust must be collected as separate sample.
- Dust from several locations can be pooled into one sample container IF it is all the same type of dust.
- Several tests are conducted from the same bulk sample.

- If possible, collect the sample from the highest elevated horizontal surfaces in the plant. Finer particles more easily ignite and tend to collect on elevated surfaces.

- Determine if there is a hybrid mixture of combustible dust with a flammable gas or vapor.

- If it is grain dust, send an additional sample for percent (%) combustible analysis.

- Affix an OSHA-21 sample identification seal to the container. To seal the bottle, apply one end of the seal to the center of the lid, and run the seal down the edge of the lid and as far down the side of the bottle as it will reach.

- Document where, when, and how dust is used and/or generated. Document the description of the operation and the requested tests on the OIS sampling worksheet as follows:

  - When requesting analyses for fire or explosion hazards that may result from housekeeping, 5(a)(1), or 29 CFR 1910.37 (Means of Egress) violations, write K_{st}.

  - Where 29 CFR 1910.307 (Hazardous Locations) violations are a concern, write "Potential Class II Dust." This test must be done to support a citation for Class II hazardous (classified) locations. Note: This test only applies to electrical ignition sources in Class II locations. When in doubt, contact the SLTC.

- The Area Director must review the sampling plan and the number of samples being submitted. A concurrence letter is required due to the resource-intensive nature of these laboratory tests.

- Ship the sample with the paperwork (including the MSDS/SDS) in a box to SLTC. Note: No special DOT shipping requirements apply; however, when shipping metal dusts, especially dusts involving aluminum or magnesium, CSHOs should verify with the shipping company whether any special shipping requirements apply.