Effective dust control for grain/meal truck loadout

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- Truck loading areas for grain or processed meal accumulate combustible dust and must comply with the new combustible dust safety standards implemented by NFPA 652 and enforced by the US Occupational Safety and Health Administration (OSHA).
- The electrical area classification for indoor truck loadout bays can be difficult and expensive to address, since most of these facilities were constructed before these standards were issued.
- Here are some strategies for implementing dust control that will help you satisfy electrical area classification requirements and meet these new standards in the most cost-effective way.

If your facility loads out bulk trucks of grain or processed meal, then you are well-aware of how much dust can cloud up and accumulate around the loadout area, including on floors, rafters, lights, ductwork, and equipment (Fig. 1). This dust is combustible and must be addressed for compliance with the new combustible dust safety standards implemented by NFPA 652 and enforced by the US Occupational Safety and Health Administration (OSHA). The electrical area classification for indoor truck loadout bays is a particular concern, since most of these facilities were constructed prior to the issuance of these standards. Wholesale changes to existing electrical systems is often impractical, or even impossible. What is the most cost-effective way to implement dust control and satisfy electrical area classification requirements to meet these new standards?

UNDERSTANDING THE RISKS

Bulk loadout facilities for open-top trucks are typically built indoors, or at least under a roof, for weather protection. However, this results in an "open system" where combustible dusts may be allowed to develop into dust clouds at concentration ranges that could lead to explosion. These combustible dust clouds drift and settle throughout the room, including over many potential ignition sources like hot truck exhausts and unrated electrical equipment, with operators and truck drivers often present in the area. This is why many dust explosions and flash fires have been known to occur in truck loadout areas, such as the one at White Farms in Indiana that caused a truck fire and silo collapse. A video of this event went viral in 2017 (https://www.youtube.com/watch?v=BXjwinZEPII).

Having a Dust Hazard Analysis (DHA) completed by individuals with expertise in combustible dust safety is critical to understanding the unique risks associated with each facility and is required by September

FIG. 1. Clouds of combustible dust are created when loading grain or processed meal into a bulk truck.

2020 under NFPA 652 "*Standard on the Fundamentals of Combustible Dusts.*" Whether it is performed internally or by an outside engineering consultant, the DHA will outline the potential hazards and priorities to develop an appropriate dust hazard implementation strategy for each individual site.

DUST CONTROL STRATEGIES

Once the DHA has been completed, the next step in mitigating the risk in the bulk truck loadout operation is to reduce the development and life span of combustible dust cloud formation by implementing dust control measures. By pulling the dusts away from the loadout area as quickly as possible, the potential for a cloud to drift to an ignition source is greatly reduced. Additionally, this will minimize the hazardous accumulation of dust throughout the area, thus reducing required cleanup efforts.

The difficulty with dust aspiration over open-top bulk trucks is the sheer size of the open area where the bulk material is moving and generating dust. The pick-up velocity across the entire surface of the open area needs to be maintained at 250–500 feet per minute, which requires an enormous amount of air.

One common strategy is to install dust-controlled loading spouts. These consist of stacked cups inside a dust-controlled flexible sleeve, which can raise or lower for each loadout arm. Another option is a dust suppression hopper (Fig. 2, page 14), which returns the dusts back into the bulk stream at the discharge of the loading spout. These work well if the bulk density of the solids is highly consistent, because they must be designed for a specific bulk solid. However, if there is any variation to the bulk density, or if multiple bulk solids share the same loading spout, then dust suppression hoppers will be ineffective in controlling the dusts.

In such a shared loadout system, or when the bulk density is inconsistent, a truck loadout hood is the better option (Fig. 3, page 14). This hood may be indexed up or down as needed, or may be static in position. Flaps are necessary around the edge of the hood to maintain the air velocity; however, they must be cleaned regularly to prevent dust build-up. Hoods for large bulk trucks will require 20–30,000 cfm air with a large dust collector located outside of the loadout building. To cover a full truck, over 20 pick-up points may be needed from the top of the hood. A smaller hood may be designed if the truck is moved to loadout in sections.

IGNITION SOURCE CONTROL STRATEGIES

The final step in mitigating the dust hazard is to remove or isolate potential ignition sources. One important step in the loadout procedure is to shut off the truck engine while actively loading the truck. Diesel truck exhaust pipes can reach temperatures as high as 649°C, which is more than enough to ignite any combustible dust cloud.

If the minimum ignition energy (MIE) of the dust is below 30 mJ, then personnel must not be allowed to access the pile until the dust has settled. Furthermore, the spouts and hood should be grounded and bonded per NFPA 77.

The biggest cost concern with existing truck loadout buildings is the electrical area classification. The loadout of a combustible material into an open-top truck or container constitutes an "open system" from an electrical classification standpoint. Therefore, a distance of 20 feet (about 6 meters) from the edge of the truck should be rated Class II, Group G, Division 1, with an additional 10 feet (3 meters) of Division 2 beyond that, per the guidelines of NFPA 499. This will likely encompass the entire truck loadout bay.

FIG. 2. Dust suppression hopper (dustless spout) from Sioux Steel Company

Upgrading all of the electrical equipment, conduit, wiring, and junction boxes to meet this standard may seem cost prohibitive, but may not be as bad as it seems. Unlike flammable liquids in a Class I environment, Class II dusts require "dust ignition proof" provisions in Division 1 areas and "dust tight" in Division 2, not necessarily explosion proof or intrinsically safe. For some electrical items commonly found in loadout buildings, such as ticket printers and computers, it is best to locate these inside of a separate loadout office inside of the loadout bay. These offices must be equipped with a self-closing door. If dustless or dust-controlled spouts or hoods can prevent the formation of dust clouds altogether, and the area around the trucks is kept clean, it is possible to avoid the Division 1 classification entirely.

As with any regulatory concern, having a qualified engineer survey your existing loadout area and recommend specific upgrades where necessary can prevent major problems in the long run.

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FIG. 3. A loadout hood