

ALLOWABLE DUST LAYER THICKNESS – NEW NFPA REQUIREMENTS

Effective March 21st, 2011, the National Fire Protection Agency (NFPA) issued a Tentative Interim Amendment (TIA) to NFPA654, *Standard for Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, 2006 edition. One change to the standard that will largely impact industry is how they define where a deflagration hazard exists. Previously, the general rule of thumb was to identify any area where there were dust accumulations 1/32 of an inch or greater as a hazardous area. The TIA has changed that rule to now read:

“Those portions of the process and facility where dust accumulations exist shall be evaluated to determine if a dust deflagration hazard exists, unless the dust layer depth is 1/64 in. (0.4 mm) or less or the underlying surface colors are readily discernible.”

Although this appears to be a more stringent ruling, it actually now enables facilities to more accurately define hazardous locations. Keep in mind, this is not saying that you have a deflagration hazard if dust layers exceed 1/64”; it just states that you need to do a little investigative work to determine if there is a hazard present.

So what is defined as a dust hazard? Guidance on this is also provided in the TIA and it reads as such:

“A dust deflagration hazard shall be deemed to exist where dust clouds of a hazardous concentration exist or where any of the following conditions exist:

- (1) For buildings or rooms with footprint areas smaller than 20,000 ft² (1860 m²)
 - a. the area of dust accumulations exceeding the layer depth criterion is greater than 5% of the footprint area, or*
 - b. the total volume of dust accumulations is greater than the layer depth criterion multiplied by 5% of the footprint area.**
- (2) For buildings or rooms with footprint areas greater than or equal to 20,000 ft² (1860 m²)
 - a. the area of dust accumulations exceeding the layer depth criterion is greater than 1000 ft² (93 m²), or*
 - b. the total volume of dust accumulations is greater than the layer depth criterion multiplied by 1000 ft² (93 m²).”**

These new guidelines can actually be used to increase the layer depth criterion from 1/32” to a value that is more appropriate for the actual material present in the facility. To do this it is important to first define what NFPA means by “layer depth criterion”. The equation for this value is shown below:

$$\text{Layer Depth Criterion (in)} = \frac{(1/32 \text{ in}) \cdot (75 \text{ lb/ft}^3)}{\text{Bulk Density (lb/ft}^3)}$$

As shown, the bulk density of the material is needed to determine the layer depth criterion. This value can be found using a variety of test methods such as ASTM D1895 “*Standard Test*

Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials". Once the bulk density of the material is known, then the layer depth criterion can be calculated.

So how is this helpful? Let's say the room in question has dimensions of 80 ft by 80 ft and contains a process where wheat flour (bulk density of 30 lb/ft³) is being added to a hopper. There is a 1/32" layer of dust covering an approximate area of 300 ft² around the hopper. The following steps outline how to determine if a deflagration hazard exists.

Step 1: Determine the layer depth criterion

$$\text{Layer Depth Criterion (in)} = \frac{(1/32 \text{ in}) \cdot (75 \text{ lb/ft}^3)}{30 \text{ (lb/ft}^3)} = 0.078 \text{ in } (\sim 5/64 \text{ in})$$

Step 2: Calculate the actual volume of dust

$$\text{Actual Volume of Dust (ft}^3) = 0.078 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} \times 300 \text{ ft}^2 = 1.95 \text{ ft}^3$$

Step 3: Determine the volume of allowable dust

Since the room is less than 20,000 ft² and the thickness of the observed dust is less than the layer depth criterion it is appropriate to calculate this value by multiplying the layer depth criterion by 5% of the footprint area.

$$\begin{aligned} \text{Allowable Volume of Dust (ft}^3) &= 80 \text{ ft} \times 80 \text{ ft} \times 0.05 \times 0.078 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} \\ &= 2.08 \text{ ft}^3 \end{aligned}$$

Step 4: Compare

Since the actual volume of dust is less than the allowable volume of dust a deflagration hazard does not exist. However, this level is approaching the allowable volume of dust and therefore should trigger some housekeeping efforts at this point. Keep in mind that this is solely addressing fugitive dust hazards and does not give any indication to the deflagration hazards associated with process equipment. However, using these tactics can help fine tune the frequency of housekeeping efforts and can ultimately aide in reducing deflagration hazards due to fugitive dust.

Please feel free to contact us for more information on identifying combustible dust hazards and how the TIA released by NFPA can impact your industry.