Dust Control

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Abstract

Good dust control in a solvent plant includes control at the grain receiving pits, the storage area, the grain drier preparation building and the meal handling area. The techniques and equipment required are fairly standardized. The four types of collectors available are the cyclone, wet scrubber, filter and electrostatic precipitator. Most State Air Pollution Codes are set up on the basis that a certain emission rate of dust into the atmosphere is allowed for a given amount of product being handled. In most cases collector efficiencies must be greater than 90% to meet the code. This makes the use of cyclones questionable.

Dust control is certainly not a new topic to the grain industry. Health and safety considerations have made dust control a part of most elevators, feed mills and grain processing plants. There is very little difference between the appearance of a dust control system installed today and one 15 or 20 years ago. One factor that has changed though is the amount of air used to control dust. The required increase in air is due to the increase in grain handled per unit of time and to changes in harvesting, which adds more field soil to the grain therefore creating a greater dust problem. There also has been a change in the type of collector used in the grain industry due to the efficiency required of the collector to meet air pollution codes.

As far as dust collectors are concerned, four basic types are available: cyclone, wet scrubber, dry type filter and electrostatic precipitator. It seems that the electrostatic precipitator has never been used for handling grain dust because of the possibility of an explosion. Basically, an electrostatic precipitator is a device where a high electrical potential up to 20,000 volts is developed between two metallic surfaces and the dusty air is passed through this area. The dust particles are charged as they go through the ionized area and are attracted to one of the metallic surfaces from where they are periodically cleaned.

The cyclone is still the most commonly used dust collector in the grain industry. At best the efficiency of a cyclone is only marginal because of the requirements of various air pollution codes.

The wet scrubber has not been used to any great extent in the grain industry. Although it is efficient enough to meet air pollution codes, the end product is a slurry of water and dust which may create a water pollution problem. In some cases this material can be put directly into a sewer system; however, if it has to be treated before being discharged into a sewer, there is additional expense for water treatment. Wet scrubbers can best be applied on dust control systems where high humidity conditions may present condensation problems in the dust collector. There are many different types of wet scrubbers which operate at varying back pressures from 1 in. water gauge up to as much as 100 in. The simplest type of scrubber is merely a vertical stack with water nozzles in some configuration inside of the stack. The dirty air is introduced at the bottom of the stack and as it rises it goes through the water mist areas and the dust which is wettable will fall into the bottom of the scrubber with the water.

The last type of dust collector which can be used is the dry filter. Ten years ago practically no filters were being used unless they could be shown to be economically feasible from a standpoint of collecting enough product to pay for themselves. With the increasing use of filters in the grain and food industries, it is becoming evident that other factors, such as reduced maintenance costs and plant cleanup costs, can justify their cost. With the advent of the rigid air pollution codes, however, the filter is the only piece of equipment which can be used with complete assurance that it will meet any and all codes.

Most states and many cities and counties have workable air pollution codes. In the grain industry, the part of the code which covers discharge of particulate matter is of primary concern. Most of the codes are patterned after the code used by the city of Los Angeles which states that for a certain process weight or weight of product being handled there is an emission rate which cannot be exceeded. As an example, in a typical rail car unloading system the receiving system usually consists of hoods in the pit area to keep the track shed clean, a connection at the belt loader hood under the receiving pit, a connection at the discharge of the belt, and a connection at the boot of the receiving leg. All of these connections are tied together and go to one dust collector with the dust being returned to the receiving pit, or to the receiving leg. Assuming a receiving capacity of 10,000 bushels per hour, the maximum allowable rate of emission would be 60 lb. of dust per hour. The dust control system for all of the connections mentioned would require about 24,000 cfm and, based on an average dust pickup of seven grains of dust per cubic foot, there would be a total of 1,440 lb/hr of dust going to the collector. On the basis of a maximum of 60 lb/hr discharge, the collector would have to have an efficiency of 95.8%. Some codes are based on a maximum dust emission rate per unit weight of air; most of these are in the area of 0.3 lb. of dust per thousand pounds of air or 0.16 grains of dust per cubic foot of air. Using the same example, the collector efficiency based on this code would have to be 97.7%. Either of these calculations shows that a cyclone would be a questionable selection and a filter should be used.

The Federal Government has now divided the country into regions and has established ambient air quality standards for each region. These standards set a maximum allowable limit on various foreign elements in the air such as carbon monoxide, hydrogen sulfide, sulfur dioxide and particulate matter. Each Air Pollution Control Board or Boards within a region determines what the maximum allowable pollutant discharge is from each source of discharge in its area to meet the air quality standards. This may or may not require a change in some of the existing codes; however, it is very unlikely that any code would become more lenient in the future.

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