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AMERICAN FEED INDUSTRY ASSOCIATION, INC.
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the proper filter media selection, efficiencies of 99.8% can be achieved.

There are three basic types of filters used in the feed industry.

- *Low pressure, high volume reverse air* cleaning filters are commonly used. Because they clean with low pressure air, internally mounted fans provide all cleaning air needed. There are no compressors, no air lines to freeze in cold weather, and no valves or mechanical flaps to fail. These units are ideal for cleaning where high humidity and freezing conditions are common. They also lend themselves to outside locations.
- *High pressure compressed air*, commonly called Reverse Pulse, filters are also used. The cleaning action of the bags is accomplished by the use of compressed air. The filters have a compressed air header that stores high pressure air until the control panel timer electrically fires (or discharges) one row of bags at a time and cleans each row in the unit on an adjustable time basis.
- *Shaker filters* are designed for low maintenance and are used when no compressed air is available. A rocking arm shaker mechanism accomplishes bag cleaning and can be either manually operated or motor driven. Snap band bag removal from the tube sheet is quick and easy while assuring a positive bag seal. There are two major disadvantages of the shaker filter. First, it is not a continuous filtering unit, since the air flow must be shut off during the cleaning operation; and second, the air-to-cloth ratio must be held to a maximum of 4:1.

Cyclone Collectors

There are many styles of cyclone collectors. Many are very good collectors, but all are limited to features that affect their efficiency and capability: collector body diameter, air inlet velocity, dust loading, particle size, and particle density. The proper application for a centrifugal collector is one which can be precisely defined and controlled so that performance can be maintained. Examples of this type of system would be pellet coolers, petfood dryers, and other high temperature, high moisture, low dust loading applications. Field test results that indicate high efficiency (no visible emission) from this type system can be obtained from most knowledgeable manufacturers (Table 13-2).

Table 13-2. EFFICIENCY CHART FROM FIELD TEST H. E. COLLECTORS.

MODEL	TYPE PRODUCT	OPTIMUM AIR FLOW	ACTUAL AIR FLOW	OUTLET TEMPERATURE	EMISSION—GRAINS PER 1000 CU. FT.	MASS EFFICIENCY	EMISSIONS SOURCE	FIELD TEST LOCATION
*** 2H38	Pelleted Cattle Feed	14250 CFM	14111 CFM	86°	.052	99.97%	California Pellet Cooler	Land-O-Lakes Clarence, Iowa
* 2H39	Extruded Petfood 7 TPH	15400 CFM	15484 CFM	152°	.446	99.3%	Wenger Dryer	Tuffy's Perham, Minn.
* 2H43	Extruded Cat Food 6½ TPH	20250 CFM	19957 CFM	154°	.341	93.67%	Wenger Dryer	Tuffy's Perham, Minn.
* 2H47	Extruded Dog Food 7 TPH	23624	13882	204°	.420	83%	Proctor-Schwartz Dryer	Perk Foods K.C. KS.

It is very important to maintain the recommended air flow. This installation was 41% *below the optimum air flow causing the much reduced mass* efficiency.

It is important to note that none of the above tests had any visible emissions.

MODEL	TYPE PRODUCT	OPTIMUM AIR FLOW	ACTUAL AIR FLOW	OUTLET TEMPERATURE	EMISSION—lbs/hr.	ALLOWABLE EMISSIONS lbs./hr.	EMISSIONS SOURCE	FIELD TEST LOCATION
** 2H43	Spent Grain Dryer	20250 CFM	15160 CFM	190°	3.385	18.030	Rotary	Midwest Solvents Atchison, KS.
** 2H43	Spent Grain Dryer	20250 CFM	16200 CFM	190°	1.310	18.030	Rotary	Midwest Solvents Atchison, KS.
** 4H47	Spent Grain Dryer	47240 CFM	37620 CFM	190°	3.115	39.760	Rotary	Midwest Solvents Atchison, KS.

* Test Conducted by Dr. Jason Annis, K.S.U.

** Test Conducted by Midwest Solvents under observation of Kansas Air Environmental Health Division

*** Test Conducted by MAC Equipment Engineering Department

MAC EQUIPMENT, INC., Box 205, Sabetha, Kansas 66534 Tel. 913/284-2191

Chapter 53

Air Pollution Control

Glenn J. Boresi
Ralston Purina Company

Industry has a responsibility to assist in maintaining environmental conditions at a level that will assure the health and welfare of man, animal, and vegetation. To fulfill this responsibility, the complex ecological cycle of nature must be preserved. Great strides toward achieving this have been made as a result of government's legislative initiative and industry's technological cooperation.

One problem, which is constantly being improved, is air pollution. In feed manufacturing, the primary air pollutant is particulate matter, i.e., dust, while the secondary pollutant is sulfur dioxide. The handling of grain, starting with receiving and ending with shipping, generates particulates. Generation of particulates can, in certain circumstances and under certain conditions, have deleterious effects including, but not limited to, the following:

- Precursor to dust explosions in confined areas.
- Toxic to man and animals via the respiratory system as a result of physical interference with respiratory passages.
- Aggravates symptoms of individuals suffering from respiratory diseases.
- Obscures visibility.
- Corrosive depending on the particulate's chemical characteristics.

Sulfur dioxide is generated in the fuel combustion process used to produce steam. Due to the low amount of steam required, sulfur dioxide emissions from feed plants are not usually a major concern; however, they should not be dismissed. Some of the effects of sulfur dioxide in the atmosphere remain the subject of intense debate; these effects can, under certain conditions and circumstances:

- Constrict respiratory passages that aggravate the symptoms of individuals suffering from heart and lung disease.
- Be toxic to plants' foliage.
- Corrode textiles, building materials, paints, and metal.
- Be a precursor to acid rain.
- Obscure visibility.

Because of these effects, the potential impact on the environment must be fully appreciated, particularly since acceptable sulfur dioxide emission rates can usually be achieved by using low sulfur content fuels.

The remainder of this chapter discusses how pollutants are generated in feed manufacturing, how they are typically controlled, and the framework of air pollution control legislation. It is important to keep in mind that it is the air pollution regulations that ultimately determine the required level of control. It is equally important to realize that air pollution regulations are constantly being updated and that they have built-in flexibility in certain cases.

GENERATION OF POLLUTANTS

Particulate matter, i.e., dust, is generated when ingredients or finished products are flowing in mass with or without the assistance of mechanical systems. The amount of dust generated is a function of the material's characteristics including moisture content, density, texture, and component configuration; and the processing equipment's operating characteristics including agitation, processing rate, air flow rate, material conveyance method, and moisture control.

Since many factors affect dust generation and an awareness of the mechanics involved is necessary to minimize its incidence, the phases of material handling and the manufacturing process must be analyzed separately. Feed manufacturing and material handling operations have been discussed in Sections III and IV; therefore, this chapter concentrates on the mechanics of dust generation by specific operation.

Bulk Material Receiving

Ingredients are shipped to feed manufacturing plants by rail cars and trucks. The type of truck or rail car determines the type of unloading system that is used.

Railroad hopper cars, hopper-bottom trucks, trailers, and dump trucks are self-unloaded by gravity flow into subgrade unloading hoppers. Mass flow rates from these transporters can be regulated to accommodate the capacity of the unloading pit. Several self-unloading, gravity flow systems are available because different systems are required for different transporter types. Figures 53-1 and 53-2 illustrate hopper bottom and truck dump unloading systems.

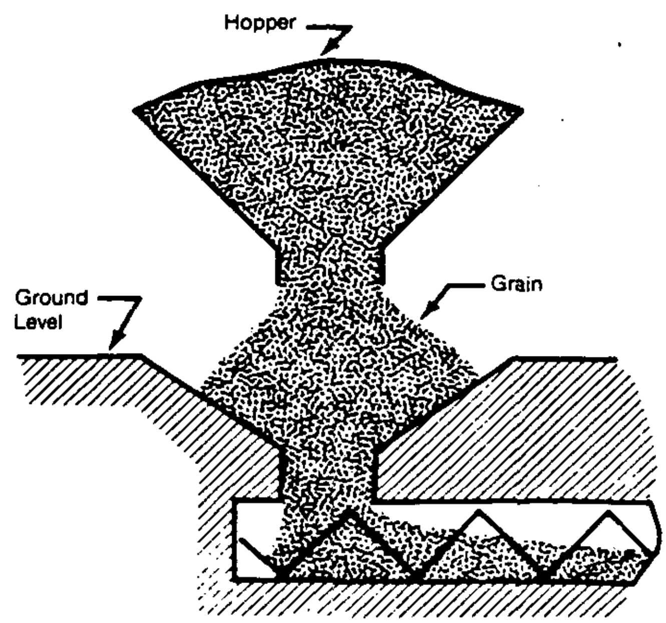

Figure 53-1. Hopper bottom unloading system.

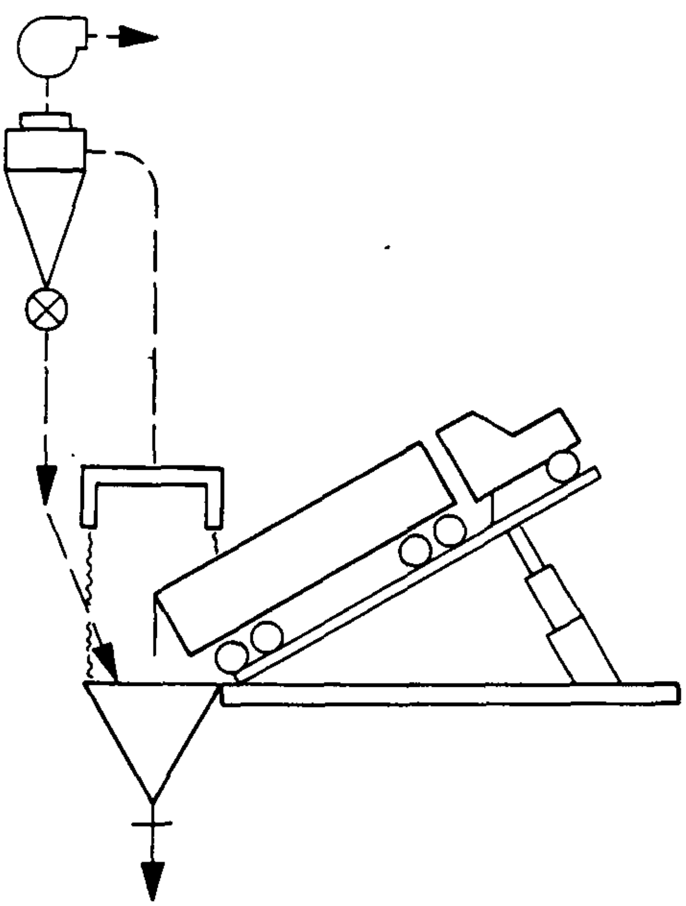

Figure 53-2. Truck dump unloading system.

The construction of the unloading pit, type of transporter, material free-fall distance, unloading rate, material characteristics, and ambient conditions are all significant factors contributing to dust generation. Of these six factors, the material characteristics and type of transporter are frequently not controllable by the feed manufacturer.

Hopper bottom unloading allows greater control over dust generation than truck dumping, as mass flow and free-fall distance can be more strictly regulated. Deep unloading pits used in truck dumping operations to allow for material surge are not necessary for hopper bottom unloading operations because greater mass flow control can be exercised.

In truck dumping operations, the angle of inclination and interparticle friction govern mass flow. Consequently, the operator cannot effectively control the surging flow. Conversely, in hopper bottom unloading, mass flow can be accurately regulated by using shallow unloading pits and screw conveyors, as shown in Figure 53-1. This application, termed the choke-feed method, eliminates material free-fall and surging mass flow rates. Since the feed manufacturer cannot completely control the type of railcar or truck supplying the plant, both types of transporters must be serviced; however, the choke-feed method minimizes dust generation.

Boxcars emptied by front-end loaders or power shovels constitute another type of unloading system. As in truck dumping operations, the material is allowed to free-fall from the transporter into the unloading pit, thereby producing a dust cloud. Besides generating dust, this system consumes inordinate manpower. Therefore, if possible, ingredient suppliers should be required to employ self-unloading transporters.

Occasionally, ingredients are transported from the rail cars and trucks by pneumatic conveyors. The material is usually blown through a cyclone receiver, which separates the materials from the air. The air is discharged to the atmosphere and the material to a storage bin. Infrequently, the material is expelled directly into a storage bin and the excess air emitted through a bin vent filter. A vent is required on the storage bin to relieve air displaced by the entering materials.

Bulk Material Conveyance

Bulk material is conveyed to storage and processing equipment by conveying mechanisms that include screw conveyors, belt conveyors, pneumatic conveyors, oscillating conveyors, drag conveyors, bucket elevators, and gravity flow. The type of conveyor, its application, and the operating procedure all greatly affect dust generation.

Screw conveyors are among the oldest and simplest methods used to move bulk materials. A screw conveyor consists of a rotary screw mounted inside a conveying trough. For each rotation of the screw the material is channeled along the trough by the spiralled flange. A screw conveyor can transport bulk material horizontally or at inclines of 90 degrees. Screw conveyors are easily covered making them dust tight; however, allowance for air displacement must be made. The displaced air should be discharged to an air pollution control device to recover valuable product and to protect the environment. Screw conveyors are an excellent and simple method of controlling dust.

Belt conveyors are widely used to transport bulk materials due to their simple and inexpensive operating characteristics. They can be troughed or flat, but are not as adaptable to inclined conveyance as screw conveyors. Also, they are not as easily enclosed as screw conveyors, which results in dustier operations. Therefore, in dust sensitive areas, it is advisable to use screw conveyors. Also, screw conveyors are more compact than belt conveyors. This characteristic is very important in space limited areas. Thus, belt conveyors can be successfully applied when the material is relatively dust-free and space is not a major factor.

Pneumatic conveyors were originally used to control dust. Some advantages of pneumatic conveying include ease of installation, layout flexibility, multiple feed and discharge points, low maintenance requirements, self-cleaning capability, and dust control. Some disadvantages include high operational cost compared to mechanical systems, high initial costs that can exceed capital expenditures for a mechanical system, and limited material applicability.

Since pneumatic conveyors operate by blowing or sucking material through a pipe, dust containment is an inherent property of the system. Dust is generated but is conveyed along with the material. Due to the relative weight of the dust compared to the material, the dust remains suspended in the air when the material is discharged. However, the suspended particles are easily directed to an air pollution device to separate them from the air. The air is discharged to the atmosphere and the dust is returned to the process. Although pneumatic conveyors are environmentally desirable, operating costs may be prohibitive.

Oscillating conveyors move material by the forward and upward repetitive motion of a trough. They can handle a wide variety of material, can easily be made dust tight, and are relatively compact. By varying the oscillating speed, dust generation can be minimized. Their major disadvantage is that a single drive is effective for a maximum length of only 100 feet.

Oscillating conveyors, properly operated, can keep dust concentrations to a minimum; however, for long transitions they

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are not cost competitive with screw and belt conveyors. Also, oscillating conveyors are more operation and maintenance intensive then most of the other systems.

Drag conveyors can be used in many of the same applications as screw conveyors. However, drag conveyors move material more gently and are relatively self-cleaning. A drag conveyor consists of a series of paddles mounted on a drive chain that revolves within a stationary trough. The trough is easily covered to make it dust tight. Drag conveyors are more effective in moving material up an incline than screw conveyors; however, an allowance should be made for displaced air. Application of an air pollution control device to the displaced air is necessary to recover product and minimize dust emissions. Although operating costs for drag and screw conveyors are comparable, drag conveyors are usually a more expensive capital and maintenance cost item.

Bucket elevators are used to move material vertically or up steep inclines. They consist of a series of buckets attached to a drive chain or belt that revolves within a casing. Material is fed into the bottom and discharged at the top, and the buckets are empty on the downward return. Due to the rotary motion of the system, air currents develop within the casing and generate dust. If the bucket elevator is operated at too great a speed, spillage and dusting can become intolerable. As with all conveyors, an air pollution control device is recommended to recover product and minimize dust emissions.

Gravity flow of material requires enclosures such as spouts or chutes. The angle of inclination and the spouting arrangement (angles, elbows, etc.) determines how much dust will be generated. However, dust can be controlled by applying dust tight enclosures and air pollution control devices.

All conveyors require dust control, including enclosures and air pollution abatement devices, to recover product and minimize dust emissions. The entire conveyance system should be analyzed to optimize the centralization of the air pollution control device(s). Not every conveyor requires an air pick-up to transfer the dust to the control device. These pick-ups are selected by establishing key areas (e.g., transfer and discharge points) and determining their ventilation requirements. Refer to Section III, Chapter 13, for a discussion of dust collection systems for materials handling and storage.

Manufacturing Operations

After ingredients are received, several operations are employed. These include ingredient processing, proportioning and mixing, pelleting, extruding or blocking, and possibly, packaging.

Ingredient processing includes grain cleaning and grinding. Grain cleaning removes dockage that includes dust, dirt, stalks, sticks, stones, stems, and other grains mixed with the bulk ingredient. Cleaning is a three-step operation. The first step is scalping, which employs a coarse mesh screen supported within a dust tight enclosure. The whole unit either shakes or revolves. Since the velocity of the grain through the screen is low, the enclosure is dust tight and there is no aspiration; therefore, dust control is not required. The second step is aspiration, which employs air streams directed perpendicular to dispersed, falling grain. The aspirator removes field dust, chaff, and light trash. Due to the nature of the unit's operation, large amounts of dust may be generated. The air discharged from the aspirator must be cleansed before being discharged to the atmosphere. Sieving is the final step in the grain cleaning process. The sieve is designed to remove mixed grains and weeds. It consists of a series of different sized, meshed screens supported within a dust tight enclosure requiring no air pollution control.

Many feed plants use hammermills to grind ingredients. These units accomplish both grinding and air conveyance. Grain is fed into the center of a high-speed rotor where the pivoted hammers move it to the perimeter screen. The grain is forced through the screen, usually with the aid of supplemental air. The ground product is pneumatically conveyed to a cyclone separator or filter receiver that separates the air from the ground ingredient. It can also be moved using mechanical conveyors and bucket elevators.

In proportioning and mixing, ingredients are conveyed from storage bins to a hopper scale that weighs the batch and feeds it to a mixer. Dust is generated when the ingredients are dumped into the hopper scale, which should have a vent fitted with a filter to relieve the displaced air and minimize dust emissions. No other dust control is required.

Pelleting, extruding, and blocking are methods of producing moist agglomerated particles with little or no dust emissions. However, following pelleting and extruding, cooling or drying is required, utilizing large air flow rates. Although the dust generated in these operations is not great, its control is necessary to prevent product loss. Cyclone collectors are typically used to prevent such loss.

The pelleted or extruded product passes through a shaker to achieve particle separation before packaging, bulk storage, or bulk shipping. Some dust may be generated during this operation depending on product moisture; therefore, a dust tight enclosure is required to prevent product loss.

Bulk Product Shipping

The bulk loading of rail cars or trucks is similar to bulk storage operations; however, the amount of dust generated may be much less due to liquid additions and product forming. Downspouts feed the product into the rail car or truck; however, due to the free-fall and impact of the product inside the compartment, a dust plume may be generated. Dust control methods include spout jackets, area enclosure and hooding, and ventilation to air pollution control equipment.

Loading of bulk feed into rail cars and trucks can also be accomplished pneumatically. If pneumatic conveyors are used, a filter cloth screen should be applied to the opening to contain the dust.

Boilers

The incomplete combustion of fuel for steam generation releases particulates, sulfur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons to the atmosphere. Particulates and sulfur dioxide are of primary concern. The percentages of ash and sulfur in the fuel are directly proportional to the emission of particulates and sulfur dioxide. Emission levels can be controlled by fuel selection. Natural gas and No. 2 fuel oil are relatively clean burning and usually require no air pollution equipment. Coal and Nos. 5 and 6 fuel oils are dirtier fuels and occasionally require air pollution control equipment to clean the flue gas.

The decision and capability to burn a certain fuel type depends on the relative price of different types of fuel, the capital and operating cost of air pollution control equipment, the USEPA designation of the plant's geographical location, and the applicable regulations. Due to fluctuating fuel prices and low levels of fuel consumption, it is usually advisable for small users to burn the cleaner fuels.

CONTROL OF POLLUTANTS

Excluding boilers, the control of air pollutants at a plant is limited to dust control. Suitable dust control can be achieved by adopting strict operating standards and utilizing air pollution control equipment. This equiment can usually be limited to simple inertial separators and filters while operating standards relating to air pollution control are based on containing and minimizing dust generation.

Cyclone Separators

Cyclone separators are the most commonly used air pollution control devices in feed manufacturing. There are many different types of cyclone separators; however, feed plants usually employ simple, low, medium, and high efficiency cyclones. High efficiency, multiple cyclones and wet cyclones have higher operating costs and are more prone to maintenance problems.

Cyclones employ inertial separation as the removal mechanism. Centrifugal force separates the particulates from the air. The dirty gas is forced to rotate within the cyclone. The heavier particles impact the cyclone wall and fall to the bottom of the unit while the gas reverses its downward spiral and exits at the top of the unit as shown in Figure 53-3. Cyclone separators are used to remove particles 10 to 20 microns in size and larger. The efficiency of cyclones in plant applications ranges from 80 to 95 percent depending on the dust stream and the type of cyclone employed. High volume, low efficiency cyclones are sometimes used as precleaners before the gas passes on to another piece of air pollution control equipment.

Cyclone applications in feed mills include pneumatic conveyors, storage bins, ventilating hoods, receiving systems, and processing units. Cyclones can be used almost exclusively in rural areas; however, in more congested or air pollution sensitive areas, more efficient air pollution equipment (i.e., fabric filters) may be required.

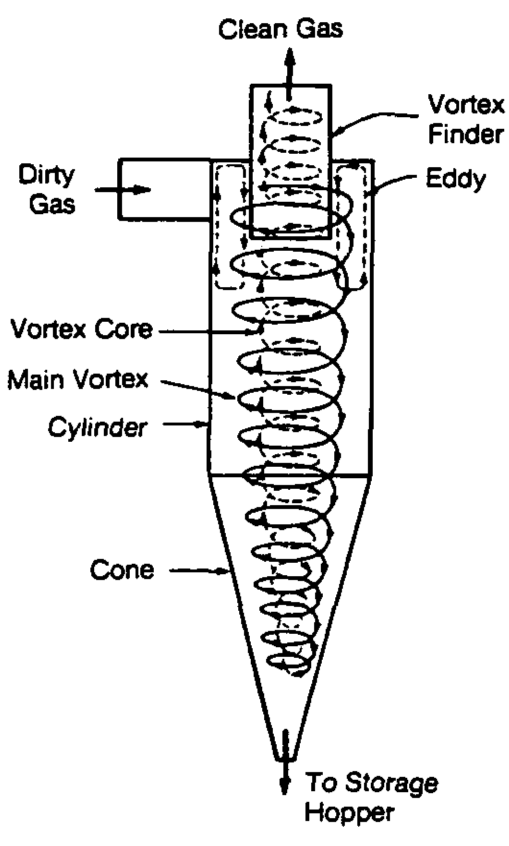

Figure 53-3. Typical cyclone separator.

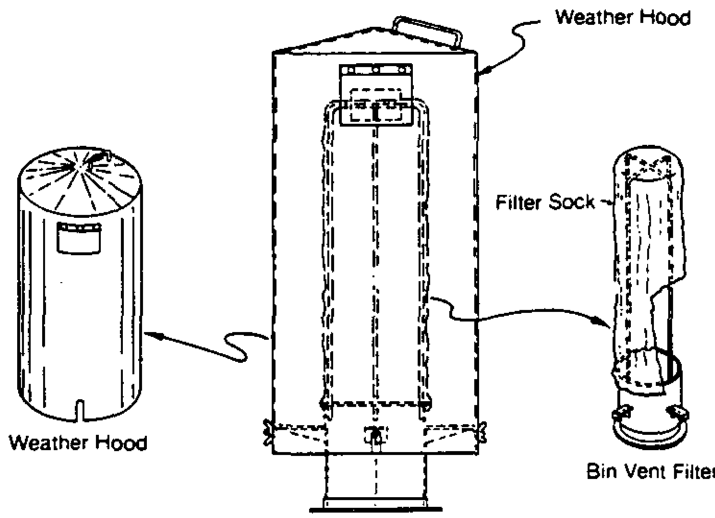

Figure 53-4. Typical bin vent filter.

Vent Filters

Vents, necessary for relieving displaced air, require dust control to retain product and ingredients and to minimize dust emissions. Storage bins without dust control can emit dust plumes that can completely obstruct visibility. Dust plumes emitted from storage bins and surge hoppers can be effectively controlled by fitting the vent with a filter consisting of a cloth sock or bag securely fastened to the vent. Cotton sateen is a common filter cloth material. If the bin vent filter is exposed to the elements, a metal enclosure is required to protect it. Figure 53-4 illustrates a typical vent filter, which is usually 1 to 3 feet in diameter and 2 to 5 feet in height.

Typical design loadings for vent filters range from 4 to 6 cubic feet per minute per square foot of cloth area. A dust cake should not be permitted to accumulate on the cloth as it encourages insect infestation and reduces the filter's efficiency.

Spout loading of trucks and rail cars is a second application for vent filters. As bulk product is discharged into a rail car or truck, dust escapes through the loading portals. To contain the dust, a vent filter skirt can be secured (wrapped) around both the spout and the opening. A third application of vent filters is on pneumatic systems consisting of a filter cloth screen fitted on boxcars, hatchways, and loading portals to retain dust materials.

Baghouses

Baghouses are used in lieu of cyclones when a greater removal efficiency is required. Baghouses or fabric filters can achieve removal efficiencies of 95 to 99.9 percent; however, they are more operation and maintenance intensive than cyclones. Also, for some applications, baghouses require precleaning of the dirty air stream, which is usually accomplished by using a cyclone.

Generally, dirty gas enters the bag at the bottom of the baghouse and exits through the individual bags leaving the dust

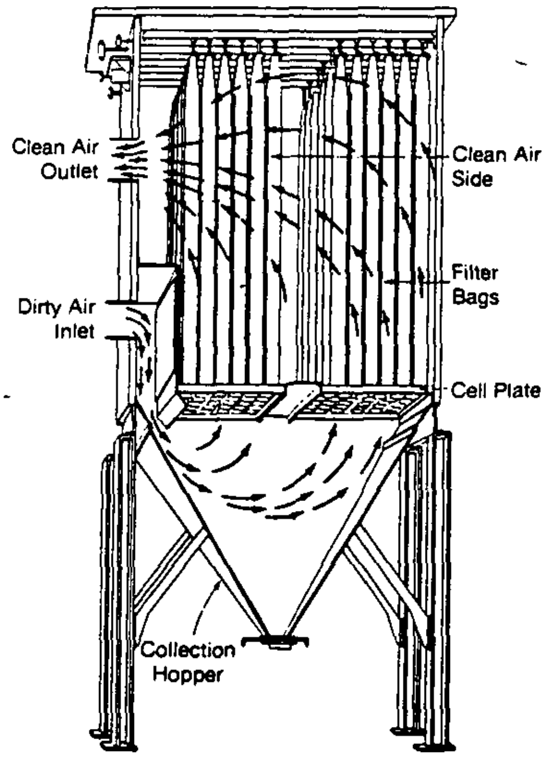

Figure 53-5. Typical bag house unit.

deposited on the interior. Figure 53-5 illustrates a typical baghouse. Baghouses are available in a variety of designs that are classified by the method of cleaning and whether the cleaning operation is intermittent or continuous.

There are many methods of cleaning; but, basically, bags are either flexed, backflushed with air, or a combination of both. The cleaning cycle is necessitated by the deposition of particulate matter that forms a dust cake. The dust cake must be removed or it will reduce, and eventually stop, the flow of gas through the filter. When the bags are cleaned, the dust falls to the bottom of the unit where it is collected and transported away. The bags can be cleaned all at once (intermittent operation) or a few at a time (continuous operation). In continuous operations, a modular design is recommended to keep the falling dust from being re-entrapped in the dirty air stream.

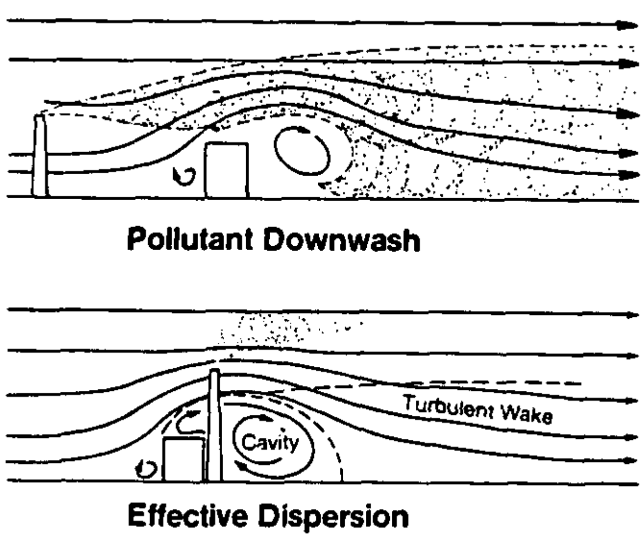

Figure 53-6. Building location effects upon dispersion.

Other Air Pollution Control Techniques

Dust may be controlled, in part, by the method in which materials are handled. These techniques are varied, but are all important in minimizing dust emissions. The techniques include stack height and location, method of bulk unloading, method of bulk loadout, hooding, enclosure, internal venting, and housekeeping.

Stack discharge height and location affect the dispersion of the air pollutants. If a discharge stack or vent is not located at a high enough elevation, air currents over nearby structures could cause downwashing as shown in Figure 53-6. For low emission rates, downwashing is not an important consideration.

In bulk unloading operations, the design of the unloading system can greatly impact dust emissions. The choke feed method of unloading is highly desirable in minimizing dust generation. Also, unloading by pneumatic conveyance allows for dust containment. However, deep unloading pits are undesirable due to the amount of dust generated; but economic conditions may require their use.

To control dust with such a pit, two measures should be implemented. First, air should be exhausted below the grate to air pollution control equipment; baffling should be used below the grating to reduce the area open to the atmosphere and the air capacity required for adequate venting. Figure 53-7 illustrates the design of a hood for a deep receiving hopper. The second measure entails complete enclosure of the receiving area during the unloading operation. Enclosure isolates the receiving area from wind

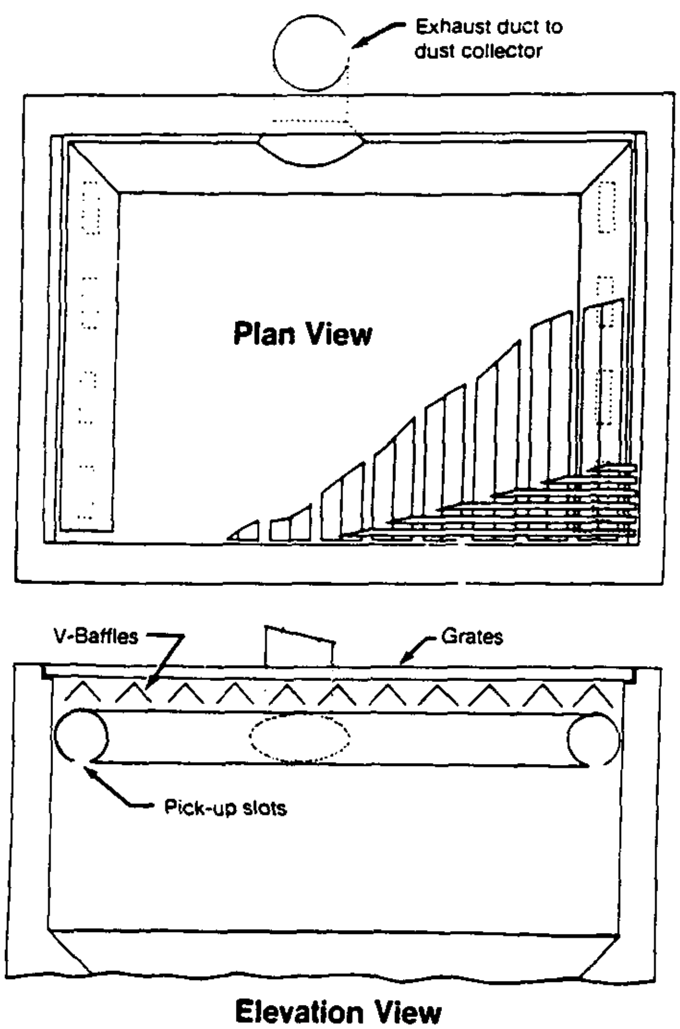

Figure 53-7. Hood design for a deep receiving hopper.

currents, thereby allowing effective operation of the deep hopper venting system.

In sensitive air pollution areas, internal venting of cyclones and fabric filters may be warranted. However, the affected internal area should not be frequented by employees, and precautions should be observed to prevent dust explosions (e.g., National Electric Code).

An important practice in minimizing dust is housekeeping, which includes regular cleanup of settled dust and spilled grain in all areas. Neglecting this practice can contribute to a violation of federal, state, or local regulations depending on meteorological conditions. Poor housekeeping can negate an otherwise good air pollution control program.

The above air pollution control techniques are only a few of the many measures that can minimize dust concentrations. It is important to carefully review all designs to ascertain their potential affect on dust generation. The degree of enclosure, hooding, ventilation rate, conveyance method, and material agitation are a few things to consider when reviewing any design.

REGULATIONS

Air pollution regulations in the United States are embodied in a very complex and changing piece of legislation termed the Clean Air Act. The purpose of the Clean Air Act is to realize the national commitment to protect and enhance the nation's air quality. To attain this goal, the National Ambient Air Quality Standards (NAAQS), various national emission standards, and a state and local regulatory framework have been established. Emissions from feed plants do not normally include those pollutants covered by national performance standards, except in certain new or upgraded facilities. Therefore, the following discussion will be limited to the legislation promulgated to attain the NAAQS.

The NAAQS were designated for specified pollutants, including particulate and sulfur dioxide, to fulfill two criteria: (1) the protection of human health with an adequate margin of safety; and (2) the protection of public welfare, which includes wildlife, plants, climate, and recreation. To attain or preserve the NAAQS, the following key programs were adopted under authority of the Clean Air Act:

- State Implementation Plans (SIP).
- Prevention of Significant Deterioration (PSD) Program.
- Nonattainment Program.

State implementation plans outline the programs to be used to attain the NAAQS within each state. They incorporate both state and local air pollution regulations and make them federally enforceable.

The purpose of the PSD program is to preserve air quality in areas that are in compliance with the NAAQS. These areas are called "attainment" or "PSD" areas. They have been subcategorized into Class I, II, and III regions. Class I regions are pristine areas with extremely stringent permitting requirements, such as national parks. Most PSD areas are Class II and have less stringent permitting requirements. Class III areas can afford a large increment of deterioration before NAAQS are violated. To preserve air quality, no Class III areas have been designated.

The PSD program requires a preconstruction review of all projects affecting air quality. If the increase in the mass emission rate of a criteria pollutant is large enough to define the project as a new major source, application of best available control technology (BACT) and an extensive permit review process is required. New minor sources may or may not require air pollution control. Permitting procedures are much less stringent.

The USEPA has identified certain industries and promulgated special regulations applicable to them entitled New Source Performance Standards (NSPS). Grain elevators are included under the NSPS; however, the definition of a grain elevator usually excludes feed plants. Affected facilities and their new construction must apply the best demonstrated technology (BDT) for air pollution abatement. BDT takes into account air pollution control costs, unlike BACT. The NSPS also establishes minimum criteria for BACT. The NSPS has its own separate body of regulations; however, for the purposes of this text, it has been discussed under the PSD program to facilitate a simple understanding of complex regulations.

The purpose of the nonattainment program is to achieve compliance with the NAAQS within a specified period of time in those areas that exceed the standards for any of the criteria pollutants. However, it must be understood that attainment and nonattainment status are pollutant specific. That is, an area could be designated as attainment for one pollutant and as nonattainment for another.

Nonattainment regulations are applied to existing sources through control strategies or equipment. The application of control technology to existing sources is defined as reasonably available control technology (RACT). An example of a control strategy is a vehicle inspection and maintenance program. Nonattainment regulations are applied to new major sources in the form of emission offsets and a control technology designated as the lowest achievable emission rate (LAER). Offsets are the mandatory net reduction of emissions within the affected area for every institution of a new major source. LAER technology for major sources requires compliance with the most stringent emission standard established by the state or attainment of the most stringent emission level achieved by a source in the same category, whichever is more stringent. A minor source must comply with the emission standards established for the facility's location and industrial category.

Due to its complexity and the periodic modifications to the Clean Air Act, a more detailed analysis will not be pursued. The preceding was presented to provide a basic understanding of the Act's structure. To comply with this legislation and its accompanying regulations, the feed manufacturer should refer to the applicable state's air pollution regulations and seek the advice of an environmental specialist or the state's a r pollution control agency. These organizations can advise on th specific regulations, their flexibility (e.g., bubble policy) and possible cost saving mechanisms (e.g., emission reduction credits).

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