

Centralised vs point venting

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Ventilation systems in cement plants constructed during the 1960s and 1970s typically consisted of one large centrally located collector to vent all of the necessary process and nuisance vent points for the entire ventilation system. The collector, generally located at the top of the system, was connected to a myriad of ductwork routed to all the required vent points. Unfortunately, the ventilation system was usually the last thing considered during the cement plant design, so the ductwork had to be routed over, under and around the building structure and the process equipment to reach all the vent points. In addition, little consideration was put into proper sizing of the ducts, resulting in poor system ventilation and increased wear on the ductwork.

Centralised venting

The purchase and installation of ductwork are significant costs of a centralised venting system. Plus, maintaining the ductwork can prove to be an ongoing and costly drain on maintenance budgets. High fan static pressure, which is required to overcome significant ductwork losses associated with this type of system,

Centralised venting and point venting systems are methods for controlling fugitive or nuisance dust at cement plants. The modern technique is to install a point venting system as it required less duct work, maintenance and is arguably more energy efficient.

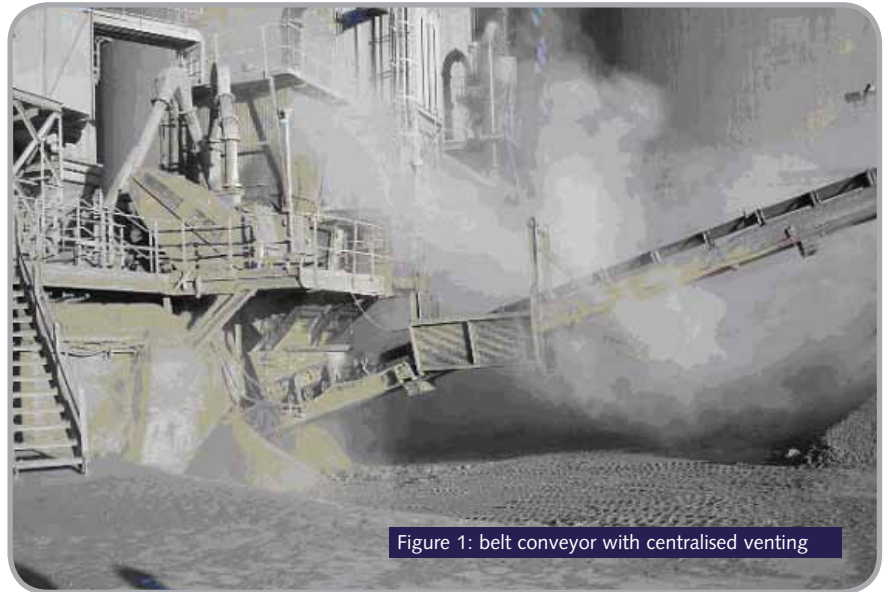


Figure 1: belt conveyor with centralised venting

ultimately results in increased energy costs.

Centralised venting depends heavily upon proper system balance to vent the various vent points, and in these systems, maintaining proper balance can be like trying to untie a 'Gordian knot': both are nearly impossible.

Centralised venting systems are also frequently changed as new or modified equipment is added, and new vent lines

are required to accommodate the changes. When the vent points are dampened back to accommodate these changes, the system becomes out of balance as the majority of the vent air will now be directed to the process equipment (see Figure 1).

Point venting

Modern design concepts now separate the collection needs of the process equipment and the nuisance venting points. Point venting (having individual venting equipment at the source of the emission) is a proven solution for effectively capturing nuisance dust and eliminating the need for costly and troublesome ductwork. Point venting may reduce energy consumption by as much as 35 to 50 per cent, as the dust is both captured and returned to the system at the source. Point venting systems are typically employed at material transfer points, and on bucket elevators, silos, air conveyors and belt conveyors. Because of the quantity of belt conveyors used in a cement plant, adding point venting collectors at the belt transfer points can dramatically reduce dust emissions (see Figure 2).

Figure 2: conveyor belt with point venting collector



Figure 3: typical belt venting design



For older cement plants with centralised ventilation systems, point venting is a dual advantage solution for gaining control of nuisance dust emissions while at the same time improving process equipment ventilation. Adding individual venting collectors on nuisance dust emission points and removing them from the primary system collector allows more venting air for process equipment. In addition, having the primary collector devoted to the process equipment provides a more consistent source of venting to the process equipment, enabling better control of the overall process. Adding point venting collectors to the system also eliminates the need for much of the ductwork.

Nuisance dust vent points demand higher static pressure, as they are often located furthest away from the collector. By adding point venting collectors, the static pressure requirement of the overall process system can be reduced, resulting in lower power consumption and increased process venting air.

The cement industry has made significant improvements in particulate control of process equipment, but much work remains to be done in controlling nuisance dust emission points. MACT (Maximum Achievable Control Technology) standards established by the EPA require the control of emissions from nuisance dust points, and the cement industry is now faced with the difficult task of determining how this can be accomplished since many of the nuisance dust emission points are difficult to access and require special equipment to accommodate venting needs. Among the difficult access nuisance dust points are finish mill feed belt conveyors, screening units, silo venting, clinker handling

conveyors, and especially clinker tunnel ventilation.

When designing point vent collectors, it is important to adhere to good design practices while at the same time ensuring that the collector fits in the space available. The difficult access aspect has led many collector manufacturers to focus on collector size at the expense of good design practices. Filter air-to-cloth ratios, can velocity, inlet design, and filter selection are the most important issues to consider when designing smaller sized nuisance point venting collectors. Manufacturers selling collectors that have aggressive air-to-cloth ratios or using designs that cram filters into small spaces may be putting cement producers at risk of high pressure loss, reduced gas flow and excessive filter wear. Nuisance dust point venting is a difficult application, and collectors that function well in easy, low dust-loading, non-abrasive applications may not function well in the harsh conditions that exist within cement plants. Collectors with tight filter spacing, high air-to-cloth ratios, and high can velocities should be avoided, as packing a larger filter area into a small space often results in poor cleaning of the filters, higher pressures, shorter filter life and ultimately poor venting of the emission point.

An excellent method for designing smaller collectors is to use pleated filters, as this allows a larger filter area to fit into a small collector. Still, the basic concepts of good collector design must be followed.

Collectors with many moving parts, filters with tight pleat spacing, and high air-to-cloth ratios are design characteristics that will negatively impact collector operation in the difficult operating conditions found in cement plants. When considering a collector design, it's a good

Figure 4: horizontal point venting collector



practice to check that the design has a good operational history in cement plant applications.

Case study

Ask cement plant maintenance personnel about their least favourite workspace, and many will say it's the clinker tunnel. Most clinker tunnels are hot, dark, dirty, and potentially dangerous places. Clinker tunnels typically have such high degrees of airborne dust that visibility is severely limited. In addition to the emission issues, dust build-up on the tunnel floor can be a trip hazard for workers, and cleanup involves excessive maintenance costs.

A cement plant in the Midwest was experiencing a severe problem with dust in the clinker tunnel ventilation system. The ventilation system consisted of a single dust collector located at the discharge end of a clinker tunnel that was more than 200ft long. The belt conveyor had eight feed points where clinker feeder belts dropped clinker from the clinker storage area onto the main clinker belt going to the mill building. A long duct with vent lines for each of the eight feeder belts was installed along the length of the tunnel (see Figure 3). The eight vent points were designed to vent each feed point to the 36in belt at a gas volume of 1100ACFM, for a total of 8800ACFM. The main trunk line and the eight branch lines were sized



Figure 5: dust-free clinker tunnel

for approximately 3800FPM. Dampers were installed for balancing the system, but had become worn from the clinker dust. The system typically had three-to-four feeders in operation at any given time. Therefore, the gas volume actually required was only 3300 to 4400ACFM, although the dust collection system pulled 8800ACFM. Because of damper wear and poor balance, the system pulled more

with build-up that it failed, rendering the system ineffective.

A specially designed unit was required due to the space limitations in the clinker tunnel. Horizontal collectors with pleated filter elements were selected to vent each of the feed points from the feeders onto the main clinker belt. The horizontal units were chosen because they could be

air from the feed lines nearest to the collector and less air from those furthest from the collector. This caused over-venting of the nearer lines along with severe duct wear and poor venting of the further points, causing material fallout and material build-up in the ductwork. Eventually, the ductwork became so heavy

installed directly above the belt on top of the belt cover. The horizontal collector creates a negative pressure within the cover and at the feed point, therefore all airflow is 'into' the cover and collector, and almost no dust escapes the feed chute or the cover area (see Figure 4). The collectors are interlocked to the feed conveyor, so only the feed points in operation are vented, saving wear and tear on the equipment and reducing energy costs. No ductwork is required, and the clinker material is collected and returned on the clinker belt. This is a 'hopperless' design, so no airlock motor or airlock starter is required, which saves on installation costs.

Since their installation over four years ago, the horizontal collectors have eliminated the emissions problems and the clinker tunnel cleanup issues. Filter life has been excellent, and most of the original filters are still in place (see Figure 5).

Thanks to point venting collectors, cement plant maintenance personnel can now see 'light at the end of the tunnel'. ■