Cutting Costs

Tom Godbey, Donaldson, USA, Randy Casey, Southern Cement, USA, and David Bergenstock, FLSmidth, USA, discuss the cost-effficient upgrade of a cement storage warehouse.

Introduction

The expansion of a cement storage warehouse provides the opportunity for dust collection system upgrade and money savings.

In response to the increased demand for cement in the fast growing US coastal area along the Gulf of Mexico, Southern Cement expanded its cement storage warehouse at Alabama State Docks in Mobile. The expansion included:

- The addition of a 26 000 t storage bay to the two existing 36 000 t bays.
- An upgrade of the cement delivery system from the barge hopper to the warehouse.
- An upgrade to the dust control system.

This expansion provides more storage capacity and allows larger ships to be unloaded, and unloaded faster. This drives down the transportation cost.

FLSmidth was awarded the contract to provide the expansion, upgrade the ship unloading, and provide dust control. The storage expansion consisted of a new 160 $ft.^2$ flat bottom, airtight warehouse bay, with an unloading pit and cement pump. The ship unloading is via a grab bucket, using a ship-mounted crane to a barge-mounted hopper. Material is then transported to the warehouse by two Fuller-Kinyon pumps and five Fuller rotary vane compressors.

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Figure 1. The Donaldson Torit Dalamatic Insertable dust collector has no housing of its own; it mounts onto existing ducts, chutes, or roofing, saving on the cost of ductwork.

Figure 2. By distributing the dust collectors across the roof of the Southern Cement warehouse, the air in the entire building is efficiently changed every hour, which improves visibility and working conditions.

Figure 3. Operators are able to change filters via a top-access panel in the Donaldson Torit Dalamatic Collector.

Dedusting

The dust control upgrade consisted of 15 integrated Donaldson Torit Dalamatic Insertable dust collectors, five in each of the three bays, installed into the roof of the warehouse. Dust collection for the original facility consisted of two central collectors with fans, dust return systems for control of the dust from the transport system to the warehouse, and from the warehouse storage to either rail cars or bulk trucks, for the loadout system. With the ship unloading upgrade, the collectors were no longer adequate.

The two barge-based pumps have a maximum volumetric capacity of 360 and 420 tph, and a total air flow requirement of 14 420 cfm. FLSmidth estimated the maximum anticipated surge volume at 21 600 cfm. In addition to containing the dust within the warehouse during the ship unloading, the dust control system must also operate during loadout to clear the air inside the building. This is to provide visibility for the front-end loader operator. FLSmidth sized the system to accommodate the surge and to provide sufficient air changes for operator visibility.

David Bergenstock, Market Manager for FLSmidth, noted how the flat storage reclaim generates a lot of dust. This creates a harsh environment for the equipment operators. By distributing Donaldson Torit Dalamatic Insertable filters across the entire roof area, the air in the building is efficiently changed every hour. This generally improves the working conditions.

The equipment has no housing of its own. Instead, it is mounted into existing ducts, chutes, or roofing. Integrating collectors into the roof of the building offers other significant advantages, which are discussed below.

The original ducted system suffered because it caused most of the air to be pulled from the pick-up point closest to the collector, creating operator visibility problems inside the warehouse during loadout. This was a key design consideration when the decision was made to locate the collectors along the roof line of the warehouse, and one near the roll up access door for the front end loader.

The integrated collectors allow the collected dust to fall back into the storage warehouse, similar to a bin vent. This eliminates any requirement for dust return equipment, such as screw conveyors and rotary locks. Bergenstock commented that dust return systems, whether pneumatic or mechanical, are an unnecessary waste of capital, power and maintenance dollars. These return the dust directly to the material stores with no additional equipment required.

Using multiple collectors instead of one central collector also provides redundancy. With one central collector fan and dust return system, if any component in the central system is “down,” the entire system is “down” and the operation is brought to a halt. With multiple collectors, however, one unit can be “down” but the operation can continue, sometimes more slowly, using the remaining units, without loss of production. Also, because of the size and simplicity of the Insertable collectors, any required maintenance can be accomplished quickly and efficiently, and the unit returned to service.

The elimination of the ducting prevented not only the maintenance costs associated with ducting problems in cement installations (i.e. abrasion and plugging), but also the pressure loss and flow of air through the ducting. Bergenstock explained that, for the original flat storage

warehouse, the client's consulting engineer specified two single-point dust collectors, each with its own dust return system. The FLSmidth distributive system, using the Donaldson filters, significantly improved efficiency, while reducing total power consumption by over 35%.

Results

The system was commissioned during the first quarter of 2003, and has been in continuous operation since. Randy Casey, plant manager for the Southern Cement warehouse facility, now owned by Lafarge Cement, estimates that the collectors have operated over 48 000 collector hours pa. The airflow through each of the collectors was measured at 5000 cfm.

Based on eliminating a ducting loss of 5 in. wg, airflow of 5000 cfm for each of the 15 units, operating hours and a power cost of US$0.06 per kWh; the power savings of the collectors has exceeded US$60 000, since the collectors were commissioned over four years ago. As noted by Casey, the company was able to unload ships during the tropical storm "Bob" and survived hurricane Katrina.

After 4 years service, plant maintenance initiated a programme to replace the original 16 oz polyester filter bags with a new performance media, Dura-Life, made from a hydro-entangled polyester felt. The results have shown:

A decrease in pressure drop from 4.5 to 3.5 in. wg.

A 10% air flow increase to 5500 cfm.

This helps the front-end loader operator because more air brings improved visibility. Even with the increase in airflow, the plant still realises an additional 15% decrease in power cost for the collectors, due to the lower pressure drop across the filters.

Figure 4. The FLSmidth distributive dust collection system significantly improved efficiency while reducing total power consumption by over 35%.

Power cost (pa) = yearly cost (pa) =

$$= \frac{Q \times DP \times H \times 52 \times C \times 0.746}{6356 \times N_f \times N_m}$$

Where:

Q = the airflow in SCFM.

DP = the pressure drop across the system in in. wg.

H = hours of operation each week.

C = cost of electricity US$/kWh.

Nf is fan efficiency (typically about 72%, 0.72, for a good backward inclined fan).

Nm is motor and electrical efficiency (90%, 0.90, for this calculation).