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Case Study

Material Buildup? Blow it away – Air Cannons hammer Preheater Buildup at Nebraska Cement Plant

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An American cement producer faced severe problems of material buildup in his preheater. Manual hydro-lancing meant process disruptions. So they approached Martin Engineering for a more sophisticated solution.

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In order to prevent reduced flow and blockages at the Ash Grove Louisville plant, Martin Engineering installed a network of 25 air cannons to remove material that becomes adhered to vessel walls. (Pictures: © Martin Engineering)

The largest American-owned cement manufacturer in the nation has solved a buildup problem in the precalciner of its Nebraska plant by installing a network of high-performance air cannons, improving material flow and drastically reducing the need to hydro-lance. The series of 25 air cannons from Martin Engineering fires a powerful discharge of compressed air in a prescribed pattern to remove material that becomes adhered to the vessel walls. The solution helps the plant avoid downtime and eliminate the potential for water blasting to cause lumps of material to fall into the kiln feed and interfere with production.Ash Grove Cement Company has established a longstanding tradition of service, reliability and quality that stretches back more than 125 years. A pioneer of the lime and cement industries, the company was incorporated in Missouri in 1882 as the Ash Grove White Lime Association. Today, Ash Grove Cement is the sixth-largest producer in the U.S., with nine manufacturing plants, two deep water import terminals and a major quarry operation in Blubber Bay, British Columbia. In all, the company has a total annual capacity of nearly 9 million short tons of cement, including a wide range of specialty products for difficult service environments. Located on the south bank of the Platte River between Omaha and Lincoln, the facility in Louisville, Nebraska has an annual output of about a million ST per year of Portland and blended cement.When system operators began noticing material buildup in the precalciner, they found that it was impeding the flow through the preheater and into the kiln. The staff used the common technique of water lancing to remove blockages, particularly from the preheater tower’s riser duct. But the time-consuming process had to be repeated twice daily, when maintenance personnel would open access doors into the tower and remove the accumulation with a high-pressure spray.“Efficient material flow is a critical element of dry-process cement manufacturing, and accumulation or blockages can take a big bite out of a plant’s profitability,” explained Martin Engineering’s Andy Marti. “Although many plants still use manual techniques to remove build-up, the cost of labor and periodic shutdowns has led many producers to investigate more effective methods for dealing with this type of maintenance,” he said.

Air-Powered Solution

In order to prevent the loss of efficiency and clinker quality at Ash Grove Louisville, a group led by process engineer Mark Junkins investigated possible solutions. They met with material handling experts from Martin Engineering, and together the group designed a network of Martin® XHV Air Cannons Air Cannons for the main production line.

The air cannons in the main production line network are equipped with a negative pressure-firing valve design that delivers reliable operation and long service life in challenging applications.

Martin Engineering technicians installed the air cannons during a scheduled maintenance outage, starting where the accumulation appeared most severe:

below the riser orifice, where the duct is reduced in size to increase velocity. The unique cannon design requires no high-temperature discharge pipes or special mounting plates, and discharge nozzles are embedded directly in the refractory lining of the preheater tower.All of the air cannons in the main production line network are equipped with the Martin Engineering XHV Valve, designed specifically to deliver premium performance and long service life in preheater towers, clinker coolers and other high-temperature applications. The negative pressure-firing valve was developed to provide reliable operation and long service life in challenging applications.The cannons discharge in a timed sequence that moves in an upward spiral around the tower firing about 20 seconds apart, with the entire cycle taking just over eight minutes to complete. Control room operators can alter the schedule to accommodate a range of kiln pressures and operating conditions, extending the sequence to as much as 45 minutes.

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A crew from Martin Services installed the entire system, including cannons, air lines and controls, as well as the company’s Thermo Safety Shields on each unit. Operating like trap doors, the sliding shields bolt in between the air cannon valve

and mounting flange, helping to protect workers from exposure to severe heat, gases and high-temperature materials.

Stage II

Based on its success with the initial air cannon system, Ash Grove started planning a similar system for the plant's second production line. For that operation, engineers designed a network of 15 additional air cannons, equipped with Martin® Tornado Exhaust Valves. Described as the latest advancement in air cannon valve design, the patent-pending Tornado fires in response to a positive air pressure surge delivered by a solenoid valve, which can be located as far as 200 feet away.The unique design improves air cannon safety, since the discharge sequence requires a positive signal. Unlike nega-tive pressure-firing designs, a cannon equipped with the Tornado valve will not discharge accidentally in response to a pressure drop, so an air supply failureor broken line won't trigger its firing. In addition, this positive-acting valve amplifies the discharge force, delivering up to 20% greater force than a standard XHV-equipped air cannon of the same size.

Results

With the new air cannon network in place, the Louisville plant has been able to significantly reduce the need for water blasting. Material now flows more efficiently, and maintenance personnel have drastically reduced the man-hours that were spent on manual removal.“We still have to hydro-lance occasionally, because of changes in raw material or fuel,” Junkins explained. “But we don't have the issues we had before. We can see that the air cannon system has paid for itself, by allowing us to maintain production rates without many of the interruptions and issues that water blasting created.”

About the Author
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