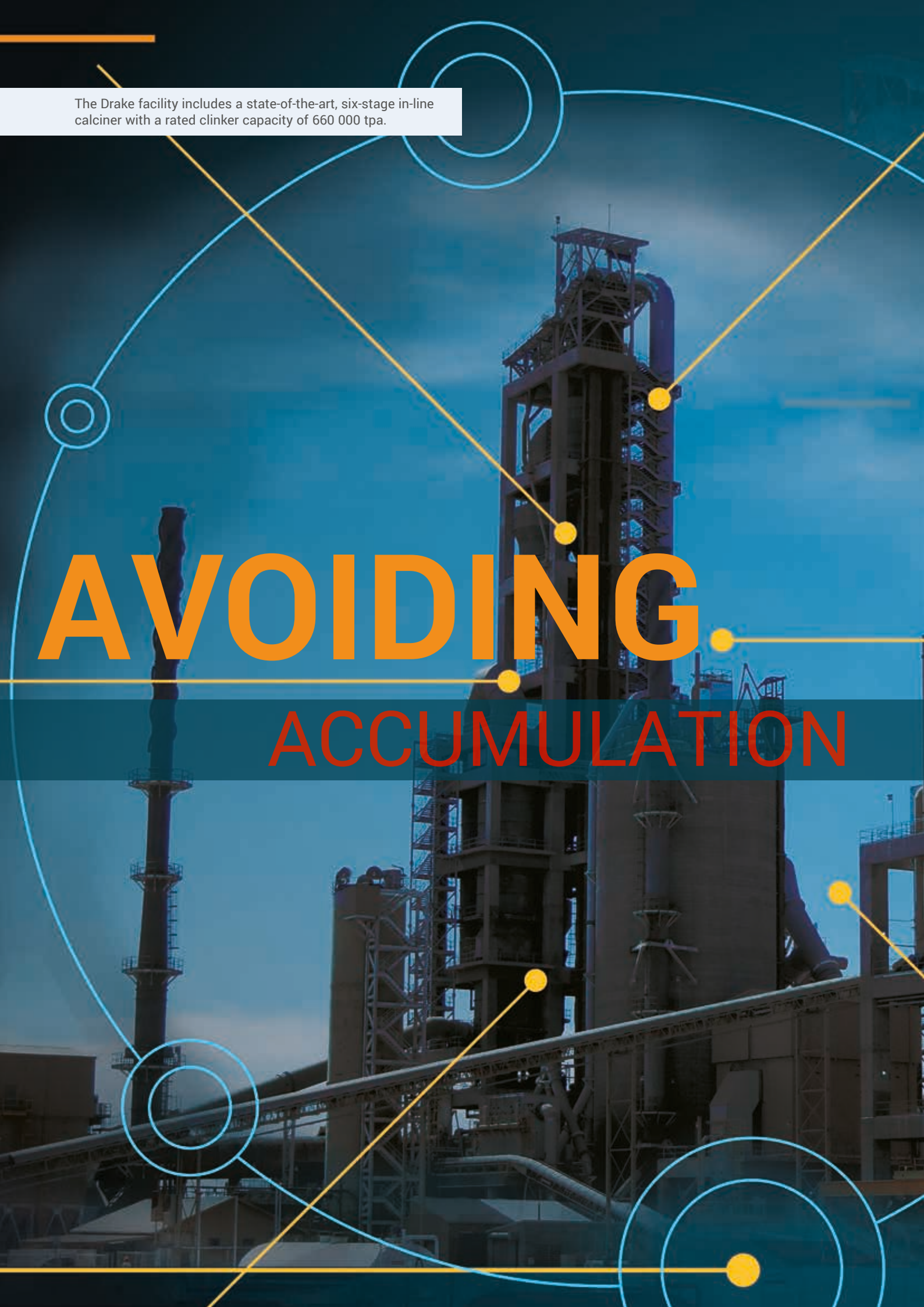
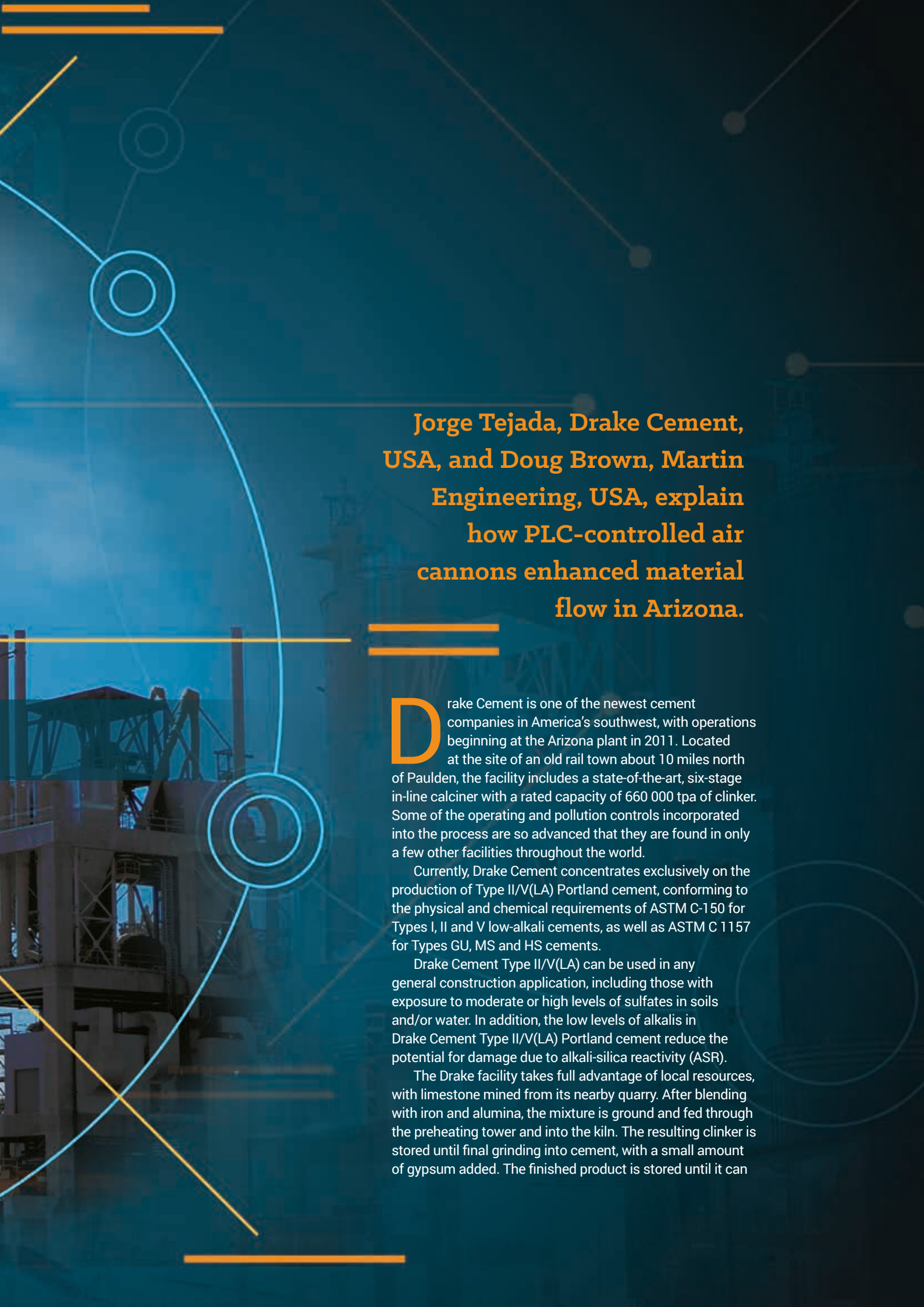
BMHR 2014

A SUPPLEMENT TO WORLD CEMENT



The Drake facility includes a state-of-the-art, six-stage in-line calciner with a rated clinker capacity of 660 000 tpa.

AVOIDING ACCUMULATION



Jorge Tejada, Drake Cement, USA, and Doug Brown, Martin Engineering, USA, explain how PLC-controlled air cannons enhanced material flow in Arizona.

Drake Cement is one of the newest cement companies in America's southwest, with operations beginning at the Arizona plant in 2011. Located at the site of an old rail town about 10 miles north of Paulden, the facility includes a state-of-the-art, six-stage in-line calciner with a rated capacity of 660 000 tpa of clinker. Some of the operating and pollution controls incorporated into the process are so advanced that they are found in only a few other facilities throughout the world.

Currently, Drake Cement concentrates exclusively on the production of Type II/V(LA) Portland cement, conforming to the physical and chemical requirements of ASTM C-150 for Types I, II and V low-alkali cements, as well as ASTM C 1157 for Types GU, MS and HS cements.

Drake Cement Type II/V(LA) can be used in any general construction application, including those with exposure to moderate or high levels of sulfates in soils and/or water. In addition, the low levels of alkalis in Drake Cement Type II/V(LA) Portland cement reduce the potential for damage due to alkali-silica reactivity (ASR).

The Drake facility takes full advantage of local resources, with limestone mined from its nearby quarry. After blending with iron and alumina, the mixture is ground and fed through the preheating tower and into the kiln. The resulting clinker is stored until final grinding into cement, with a small amount of gypsum added. The finished product is stored until it can

be loaded into trucks or rail cars. The site's high capacity rail switching facility is located on the BNSF mainline railway, expected to encourage further development in the area by offering other companies access to raw materials, energy and distribution capabilities near the Interstate 40 and US 93 transportation corridors.

Efficient material flow is a key component of Drake's dry process manufacturing, and accumulation in storage bins, process vessels or feed pipes could choke even this well-designed system. Blockages can create expensive obstacles to equipment performance and process efficiency, raising maintenance costs and diverting manpower from core business activities, in some cases introducing safety risks for personnel.

Original equipment

Engineers designing the Drake process initially specified 15 air cannons from Martin Engineering in critical locations to control accumulation and enhance material flow. Introduced by Martin Engineering in 1974, air cannon technology has developed a proven track record around the world for relieving bulk material bottlenecks. The Martin® XHV Air Cannons, which were installed when the plant was built, fire a powerful discharge of compressed air to remove material adhered to the vessel walls.

The original cannons were located in the entry to the kiln, cooler inlet and the preheater tower. Drake was already familiar with Martin Engineering's designs from its two other operations in Peru, and they wanted to stay with the technology that was working well in those locations.

Like most new cement plants, Drake officials knew that the facility would likely require some fine-tuning of material flow to optimise the process. After initial trials, operators shut down the system to examine the process and identified some additional areas where material flow could be enhanced, a strategy designed to prevent bottlenecks from occurring, rather than running production and having to shut down for maintenance to clear accumulations. Martin Engineering technicians visited the site and pinpointed the optimum locations for additional cannons in the plant's additive silos and in the riser duct, as well as the calciner and cyclones.

The second round of air cannon installations was completed in 2012, giving the facility a total of 53, with the timing and firing sequence determined primarily by programmable logic control (PLC). The PLC tracks variables such as pressures and temperatures, and those values dictate which cannons fire and when. The system was also set up to allow operators to fire individual cannons or groups of them, based on experience. The Martin® XHV Air Cannon design requires no high-temperature discharge pipes or special mounting plates, and discharge nozzles are embedded directly in refractory linings.

Valve evolution

All of the units in the network are equipped with valves designed to deliver reliable performance and long service life in high temperature applications. The original cannons were fitted with

Drake Cement specialises in high quality Portland cement products for the North American market.

Fifteen Martin Engineering air cannons were originally specified in critical locations, to control accumulation and enhance material flow.

Cannons shown here are positioned in the lower part of the preheater tower, near the automatic sampler.

The original cannons were located in the entry to the kiln, cooler inlet and the preheater tower.

Martin Engineering's XHV valves, while those added later contained the newer Tornado valve design. The XHV-equipped air cannons supply a quiet but powerful discharge of compressed air to dislodge material buildups and enhance the flow of bulk solids. They deliver good performance in high temperature applications, even with the most challenging materials. Designed for severe-duty applications where exposure to elevated service temperatures and harsh gases can affect performance, the XHV has proven successful in applications such as outside cement kiln preheaters where interior temperatures reach up to 2500 ˚F (1371 ˚C).

The patented Tornado Exhaust Valve was introduced shortly after the plant was built, and represented a significant advancement in air cannon design. Engineered to enhance material flow with even greater force and faster cycling, the Tornado-equipped cannons fire when the exhaust valve opens in response to a positive surge of air sent by a tripped solenoid. This positive-acting valve amplifies the discharge, providing up to 20% more force than a standard air cannon of the same size. In addition, the improved air path of the Tornado fills the reservoir 3 – 4 times faster than typical designs.

According to Drake, the efforts were very successful. The facility ran for about a year without accumulation issues in the areas where the cannons were installed, avoiding shutdown for manual cleanout and the associated maintenance costs.

In early 2014, the plant continued its ongoing efforts to improve the process and further eliminate material buildup in other areas. With the new Tornado valves now field-proven to deliver enhanced performance and efficiency, Drake management followed a Martin Engineering recommendation to upgrade the existing XHV valves in the tower.

"There are several advantages to the new valve design, in addition to the performance," explained Martin Engineering Service Technician Dan O'Connor. "The faster discharge and increased force output allow the same air cannon to deliver greater performance, and because they can only be activated by a positive pressure signal from the solenoid, the cannons will not fire in the event of an air pressure drop. The positive action also allows the solenoids and controls to be mounted further from the cannon and the harsh operating environment, helping to protect them and extend service life."

Martin Engineering technicians performed the valve change outs to all of the cannons in the preheater tower, using a Tornado valve retrofit kit that can be easily adapted to virtually any air cannon design, even those from other manufacturers. The work was performed during a scheduled maintenance shutdown at Drake over the course of a week.

At the same time, the 4-man crew also replaced a number of high-pressure rubber air lines with stainless steel. "The stainless lines are more efficient, and they have an extremely long service life," O'Connor continued. "At the Drake facility, we installed 3/8 in. rigid lines that we custom-bent to suit the tower layout."

With this stage of the upgrade now complete, Drake officials report that they are pleased with the performance results, even as the company considers its options for further upgrades. The firm already employs Martin Engineering conveyor belt cleaners at the facility, and management is considering other solutions for improved dust control, including Martin ApronSeal™ Skirting.