

Sulfuric Acid

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Mosaic South Pierce upgrades decades-old drying tower

Fertilizer producer Mosaic recently replaced a 40-year-old brick lined drying tower at its unit 10 sulfuric acid plant at its South Pierce facility in Mulberry, Fla. Where the old tower once stood is a new MECS ZeCor®-Z drying tower, which came online last February after a quick 16-day shutdown.

The drying tower replacement project is part of Mosaic's broader effort to improve reliability of acid plants in Florida and Louisiana. The long-range capital improvement plan, with projects continuing over the next few years, is replacing acid towers and converters that have been in service for four decades or more.

With 40 years of service, the old drying tower at unit 10 operated beyond the typical asset life expectancy of 30-35 years.

About Mosaic South Pierce

Mosaic is a leading worldwide producer of concentrated phosphate and potash fertilizers. With nine locations in North America and South America, the company produces 25m tonnes finished product annually and serves customers in 40 countries.

The South Pierce facility has two sulfuric acid units, numbers 10 and 11, both with 2,500 tpd design capacity. The units produce sulfuric acid for the company's internal use. Acid is stored in storage tanks and shipped to sister plants as needed to supplement fertilizer production. "The South Pierce facility is considered a 'swing plant,'" says Jailall Jairam, Sulfuric Acid Plant Maintenance Superintendent, currently at Mosaic's New Wales site. "This means at any given time, depending on acid demands, Unit 10 and



For maximum efficiency, the top section of the drying tower was welded after the internals were installed.

Unit 11 can ramp up acid production to meet these demands."

South Pierce manufactures sulfuric acid in a sustainable way. Jairam explains: "In a nutshell, we produce acid by converting SO₂ gas to SO₃ gas. The process enables us to produce steam by utilizing boiler feed water in different phases of the process through temperature regulation of the equipment at each phase. We use the steam to generate power from turbines and generators on site, and we utilize the power internally and sell power externally when we have excess capacity," he said.

Project overview

In January 2022 South Pierce secured commitments for capital funding to begin engineering and design. In the summer of 2022, MECS was contracted to supply all the engineering, the drying tower, and mesh distributor pad. The tower and distributor pad are made of MECS ZeCor®-Z material—a corrosion resistant high silicon stainless steel alloy.

The tower was fitted with FLEXERAMIC® ceramic structured packing supplied by Knight Materials. Knight provided the hydraulic rating calculations to confirm the allowable flow rates along with the supervision during installation to maintain quality assurance.



The tower was fitted with FLEXERAMIC® ceramic structured packing supplied by Knight Material Technologies. The unique geometry maximizes the surface area available for mass transfer.

CMW planned and executed the demolition of the old tower and installation of the new one. CMW fabricated the new tower in its Lithia, Florida shop, shipped it in modular sections, field welded and erected it prior to the outage. During the outage, they dismantled and removed the old tower, then installed the new tower, including internals, ducting, and piping.

The technology

The new ZeCor® tower offers Mosaic maintenance advantages. First ZeCor®-Z alloy is corrosion resistant in a wide range of concentrations and temperatures. Second, if a leak develops, it's easy to find and the material can



The drying tower bottom and mid section lifted into place.

be patched and welded simply. "Because of the material upgrades and new metallurgy, the reliability is much better and maintenance is much easier to perform and cost-effective," said Jairam.

The upgraded design also represents an advancement in the capture of fugitive gas emissions. "The new tower has improved technology in the distribution system, mist eliminators, and structured packing, all of which enhance the tower's performance," Jairam said.

The packing provides its own benefits. "The advantages of structured packing are simple," said Kevin Brooks, President, Knight Material Technologies LLC. "Our unique geometry maximizes the surface area available for mass transfer (for the drying tower case, water absorption into the sulfuric acid) while minimizing the energy required to push



Ian Legg of CMW, left, and Jai Jairam of Mosaic pictured in front of newly constructed drying tower. CMW's experience and relationship were some of the key factors for the success of the project.

the process gas up through the packed bed. The resulting energy savings can be as high as 50%."

Then there are distinct installation advantages. "ZeCor towers can be replaced during a normal shut-down causing no loss in production and cost less than building on a new foundation with new duct tie-ins," says John Horne, Sales Manager, Elesent MECS Technologies.

A separate concrete foundation can cost \$1 million and brick-laying is very time consuming. "It takes two months to brick a tower and it must be built on-site. It can't be fabricated elsewhere and moved. Add to that all the new duct work, acid piping, and platforms that are required and it winds up costing 30% less to install a ZeCor® tower versus brick-lined. For the last 25 replacements we have done for Mosaic, they have utilized existing foundations and infrastructure for the new equipment," Horne said.

Beating the clock

A big challenge Mosaic faced was completing the project within the scheduled turnaround time of 16 days.



John Horne of Elesent MECS Technologies, left, and Jai Jairam of Mosaic with new ZeCor®-Z drying tower in background. The distribution systems and meshpads are also made of MECS ZeCor®-Z corrosion resistant material.

"I had about one year to lead the project team from engineering and design to working with MECS to produce a new drying acid tower that meets Mosaic's needs and fulfills our obligations to produce sulfuric acid for our sister plants," Jairam said.

Jairam cites collaboration within Mosaic and with contractors as the reason the new tower started up as planned in February 2023.

"Mosaic stakeholders supported the project from day one. The project was identified at an early stage, and the design parameters were established, which helped drive the capital process management (CPM) processes that included planning, leading, fabrication, and commissioning of the new tower last February. We established early decision-making and effective communication internally, and MECS helped pave the way for a successful project outcome," said Jairam.

Choosing the right contractors for the job played a significant role in finishing on schedule. Mosaic selected MECS for its technology and reliable service

history. "As a technology provider for sulfuric acid plants worldwide, it was easy for us to choose MECS to help us design a new acid tower that meets 21st century acid technologies," Jairam said. "Over the years, MECS has done major projects with Mosaic when it comes to sulfuric acid equipment, troubleshooting, and support," he said.

Mosaic also contracted with structured packing supplier Knight Materials, who was recommended by MECS, Jairam said. Knight has many years of experience installing structured packing in sulfuric acid drying and absorption towers.

"Using a combination of detailed drawings, careful labeling of the packaging, and supporting supervision during installation, proper packing installation has become routine," said Brooks.

For old tower demolition and new tower construction, Mosaic chose experienced contractor CMW. "CMW is by far one of the most capable contractors you can rely on when it comes to mechanical, fabrication, and installation," Jairam said. "They have the experience, leadership, and technical abilities when it comes to providing quality workmanship in our facilities. More importantly, CMW had zero safety or environmental issues throughout the entire demolition, fabrication, and installation process," he said.

CMW has provided and managed over 30 brick lined acid tower demolitions across the country and safety is always at the forefront. "Each and every one is carefully planned to minimize potential risks from falling debris and reduce the need for workers to enter confined spaces while still completing within a critical timeframe," said Legg. "CMW's partner, KT-Grant, provides remote operated brick removal which minimizes or eliminates the need for tower entry. This has been a tried-and-true method in support

of safety and meeting tight deadlines" Legg said.

Elbow room

Another major challenge, particularly for demolition and construction, is maneuvering in tight spaces. "Over the years of additions to a plant or even from its original design, ground space and overhead space for use of cranes and equipment is limited," Legg said. "We address these challenges by strategic planning for crane use, sizing and placement, while also trying to minimize cost," he said.

"While there are many challenges in replacing industrial equipment of this size and age, including sulfite growth between brick and shell, rotten steel, acid leaks, and structural integrity to name a few," Legg said, "our goal is to recognize and mitigate those challenges early during the planning stages."

The result

Since its commissioning in February, the tower has performed very well, Jairam explained, including operating fully within design parameters.

While a project of this caliber requires careful planning and scheduling, ultimately the people doing the work are responsible for the outcome.

"The key reason for the success of this project can be summed up in two words: experience and relationship," Legg said. "CMW has a longstanding relationship with Mosaic and we share many successful projects. And the team brought a wealth of experience. CMW's project manager worked closely with Mosaic's project manager, Jai Jairam, on pre-planning, schedule creation, fabrication order, site layout, turnaround execution plan, and overall completion. Experienced personnel make these projects a success." □

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