Efficient Power

Freeport-McMoRan Copper & Gold and Jacobs Engineering deliver an energy-efficient acid plant in Arizona.

By BRIAN SALGADO

There are plenty of aspects to consider when building a $150 million sulfuric acid plant. However, for owner Freeport-McMoRan Copper & Gold, the No. 1 priority during construction of the 50,000-square-foot production facility adjacent to its open-pit copper mine in Safford, Ariz., is the safety of the more than 800 workers who will man this job at the height of the construction schedule.

“It is a challenge trying to manage a large group like that safely and efficiently,” says David Simmons, project manager.

Add a fast-track schedule and a job site with limited space to the mix and you get a project that would have most contractors scratching their heads about how to pull it off. However, with an experienced company like Jacobs Engineering on the job as the engineering, procurement and construction manager, the project was delivered within budget and on time in April 2011.

The sulfur-burning plant is a key component of the Dos Pobres copper...
everyone’s minds during construction of the sulfur plant. Simmons says the leadership team hammered this point home throughout the year-long schedule. This included hosting tailgate meetings to address potentially dangerous situations as well as detailed, site-specific procedures posted throughout the job site.

The job site also implemented a “Stop the Drop” program that kept workers out of harm’s way during the various crane lifting processes. This created a systematic way to alert all employees on the job site that cranes were in use by sounding horns, flagging areas and setting up barricades around the area.

mine in Safford. The high-efficiency facility supports the copper leach-and-recovery process: sulfuric acid is required to recover copper from raw ore.

To keep up with the 1,550 tons of copper ore per day produced by the mine, the sulfur plant has the capacity to produce approximately 500,000 tons of acid annually. The plant sits on a 10-acre site with an enclosed building that houses the control room directly behind it. The main facility contains 5,000-horsepower main compressors, a catalytic converter, gas-to-gas heat exchangers, absorber columns and associated process controls, according to Simmons.

SAFETY FIRST
With so many trades involved for this project, safety was at the forefront of
“There was a high level of awareness for this one,” Simmons says.

Along with paying close attention to the location and operation of cranes on the job site, trades working on the sulfur plant had to make room for each other in tight conditions. With as many as eight cranes on site at any given time, the trades shared cranes as much as possible.

“The crane sharing was successful,” Simmons explains. “If you let every subcontractor have its own crane, it would have been an impossible task. We strategically located multiple cranes to be used by all the different subs instead.”

MAJOR CHANGES

Though the capacity to produce 1,500 tons of copper makes this facility one of the most efficient in existence, it took some cajoling by Jacobs Engineering to bring the plant to this state. The original capacity for the plant was designed to top off at 1,350. However, a week before groundbreaking was set to commence, Freeport-McMoRan decided to increase capacity to 1,500.

Although this was only a 15 percent hike, the Simmons says this essentially changed the entire scope of the project. For instance, sulfur plants like this typically require cast iron pipes fabricated with silica lining for protection against erosion. These pipes – known as Mondi pipes – are cast in specific sizes and typically take four to six weeks to deliver.

With the increased capacity, the pipes originally delivered to the site did not meet the new requirements for the project. Instead of ordering new pipes and delaying work for a month or so, the construction team reached out to a job shop located in Phoenix that could retrofit the Mondi pipes in less than two days.

While the incremental cost of the increased capacity was $3 million, Simmons says the project would not have continued without a hitch without the talented EPCM team Jacobs had in place. “The fact that we had such a good engineering and procurement and construction team was key,” Simmons says. “Our mantra was, ‘Just move forward,’ so we kept moving forward while understanding we might

The Production Process

Leaching – also known as solution extraction and electrowinning – is a process that uses weak sulfuric acid solutions to remove copper from rock, according to Freeport-McMoRan Copper & Gold. In the first step, low-grade ore from the mine is either stockpiled for treatment or is crushed before stockpiling. This ore is then placed in these stockpiles, or “pads,” in 15- to 30-foot-high “lifts.”

As each level is built, a network of plastic tubing and drip systems or sprinklers is spread over the top of the pad to deliver the slightly acidic solution known as “raffinate.” The raffinate percolates through the stockpile, dissolving copper minerals contained in the rock surface, according to Freeport-McMoRan, and the copper-laden water called “pregnant leach solution” exits the bottom of the stockpile and flows into collection ponds. From there, the company says, it is pumped to tanks at a solution-extraction plant on the site.
Worldwide Leader

Based in Phoenix, Freeport-McMoRan Copper & Gold Inc. is a leading international mining company that operates large, long-lived and geographically diverse assets with significant proven and probable reserves of copper, gold and molybdenum. The company says it is the world’s largest publicly traded copper producer, boasting a portfolio of operating, expansion and growth projects throughout the copper industry. It is also among the world’s largest producer of molybdenum and a significant gold producer.

This portfolio includes the Grasberg mining complex in Indonesia, which is one of the largest copper and gold mines in terms of recoverable reserves. Freeport-McMoRan also has significant mining operations in the Americas, including the large-scale Morenci and Safford minerals districts in North America and the Cerro Verde and El Abra operations in South America. The Tenke Fungurume minerals district in the Democratic Republic of Congo is another area of work.

“Our global work force includes over 29,700 employees,” Freeport-McMoRan states. “The company has a strong commitment to safety performance, environmental management and to the local communities where it operates. FCX is a founding member of the International Council on Mining and Metals and committed to implementation of the ICMM Sustainable Development Framework.”

run into issues along the way.”

For the controls of the structure, Simmons says approximately 1,200 integrated operations systems had to be coordinated with the main facility, including a Foundation Fieldbus two-way communications system and conventional analog systems. Some of the technology was new to a number of the contractors on site, so Foundation Fieldbus set up onsite training programs for the Freeport-McMoRan employees who would serve as instrument hands.

Along with the Foundation Fieldbus field team, Freeport-McMoRan also commissioned the construction of a training simulator for the facility. The company tapped SNC-Lavalin for this portion of the job.

The simulator not only helped get operators up to speed on how to run the facility, but also taught them how to handle potentially critical situations. These operators can now han-
dle high-pressure steam in a 750-psi system, which could lead to dangerous conditions if not operated properly. Operators knew exactly how to run the highly technical facility long before it was operational.

“Our operators knew how to run this thing by startup,” Simmons says. “It provided a way to train operators with mitigated risk. It was especially useful for new processes and inexperienced operators.

“Among lessons learned, this one of the best things we’ll recommend going forward,” Simmons adds.

SELF-SUSTAINING PLANT

The 750-psi system is part of a self-sustaining power-generating plant created for the sulfur-burning facility. The superheated steam from the 17-megawatt steam generator powers plant. Gas scrubbers decrease the SO2 emissions by more than 20 percent below regulated mandates.

“Part of our recent performance test came in considerably below the recent PPO,” Simmons says. “That is a real feather in our cap. The acid plant exports power to the mine site.

“It is an island – the acid plant is...
Because of the remoteness of the site, the project required a 3-mile-long pumping system to transfer its product. This system, designed by HDR Engineering of Phoenix, involves three in-line vertical pumps and stainless steel pipe fully contained in a heat deflection temperature liner.

“This pump is capable of transferring all product 3 miles with elevation changes that drop lower than 500 feet,” Simmons says.

STRONG TEAM
Freeport-McMoRan benefits from having a corporate engineering division that designs facilities like this sulfur-burning plant throughout the world. This, combined with the subcontractors hired by Jacobs Engineering, created a formidable team that could adapt to any situation created during the course of construction.

“This team was incredibly flexible and supported all aspects of the project,” Simmons says.

“Our mantra was to move forward and resolve problems,” he continues. “We understood there would be obstacles and conflicts, so we had daily meetings to inform each other of what was pertinent and hot.”

Mid-Project Acquisition
Freeport-McMoRan initially partnered with Aker Solutions’ Tucson, Ariz., office for engineering, procurement and construction of its sulfur-burning plant. However, in February 2011, Jacobs Engineering acquired Aker Solutions’ process and construction division, and consequently took over the project.

part of a startup that can go into island mode,” he adds.

“Everything else around us can shut down and we can continue to operate. It provides acid to the site, but it also exports power.”

EMI + QUADNA. A DXP Company, was pleased to support Freeport-McMoRan’s on its recent Safford Arizona acid plant project. Our involvement included the supply and start-up of the plant’s main cooling tower circulation water and boiler feedwater pumps, partnering with ITT/Goulds Pumps in Seneca Falls, N.Y., and Lubbock, Texas. Quadna engineered, packaged and successfully performed commissioning services for the pumping systems supplied for this effort.

At Quadna, a DXP Company, we dig mining solutions and long lasting relationships. That’s why we are honored to be an integral supplier of industrial products to FMI for more than 35 years. We extend our congratulations on your continued success.

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