# New Repair System for SX-EW Cellhouse Columns Saves Time and Money

Effects of SX-EW electrolyte leakage on cell house concrete support columns.

At a large copper mine in the western U.S., the hefty volume of electrolyte stored in tank cells at the solvent extraction/electrowinning cell house imposed a significant weight load on the building's supporting structures. A series of columns in the basement of the cell house—which also serves as secondary containment for the electrolyte—support this load. Over time, the columns degrade and become susceptible to structural failure as highly acidic electrolyte leaked through from the floor above.

This exposure to electrolyte caused the steel reinforcement within the concrete columns to corrode. Corrosion resulted in oxidation within the columns, creating internal pressure that cracked the concrete. Corrosion of the reinforcing steel and delamination of the concrete shell consequently caused structural degradation and column failure.

The columns were originally constructed with No. 8 rebar spaced 6-in. O.C. vertically and 18-in. O.C. horizontally. The traditional repair approach involved coring the columns to remove the existing rebar, placing new rebar in the cored space, and pouring polymer concrete to encapsulate the column. Difficulties encountered while coring into the existing columns generally caused the repair to take more than five days per column. The excessive time to complete the job increased costs significantly and prompted the mine to investigate alternative solutions.

Tucson, Arizona-based HJ3 Composite Technologies developed a solution to the problem that it claims provided equivalent strengthening, better chemical protection to the damaged columns, and faster repair time. Because it was necessary to avoid use of conductive materials given the tremendous amount of electricity involved in the copper extraction process—conductive materials in this environment would create significant dangers to installers—the system developed by HJ3's engineers included pre-cured strips of HJ3's S-Glass laminate strips placed in the vertical direction and 30-in.-wide S-Glass fabrics wrapped in the horizontal direction.

The traditional method of repairing damaged columns involved removing damaged concrete and rebar (top), inserting new rebar (center), and encapsulating the repaired column in a poured shell of polymer concrete.

The repair method developed by HJ3 Composite Technologies involved (top to bottom): removing damaged concrete from columns and patching damaged areas with polymer material resistant to chemicals of pH 1 or less; installing vertical fiber-reinforced polymer (FRP) strips; and wrapping with FRP fabric.

The repair job began by chipping loose material from the substrate of the columns followed by abrasive blasting to eliminate traces of electrolyte. A polymer patching material that could withstand the effects of the electrolyte was then applied to resurface the column. Next, pre-cured strips of S-Glass laminate were placed against the surface of the column using HJ3's TC-300 Tack Coat. To create reinforcement in the horizontal direction, S-Glass fabric was wrapped around the laminate strips. According to HJ3, this system provided non-conductive reinforcement equivalent to the steel reinforcement specified in the traditional repair, and required only two days to repair eight columns, with a 75% cost

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savings over the traditional method when factoring in downtime costs.

HJ3 says its composite system provided significant advantages over the traditional method of repair, including less time required to completion; improved chemical resistance, ductility and strength; less surface area lost due to the system's 1/4-in. overall thickness; reduced repair costs; and elimination of safety issues associated with installation of conductive reinforcing material required by the traditional repair method.

### Outokumpu to Deliver World's Largest Sulphuric Acid Plant

Outokumpu Technology said it will design and deliver the world's largest sulphuric acid plant complex at Ras Az Zawr, Kingdom of Saudi Arabia. The Saudi Arabian Mining Co. (Ma'aden) and Outokumpu Technology's joint venture company Middle East Metals Processing Co. signed the Phase 1 contract for the engineering of three sulphuric acid plants in early May 2006. The project will be executed in two phases with project implementation and construction starting at the end of 2006.

The overall investment cost is estimated at $240 million, of which the core technology package directly subcontracted to Outokumpu Technology will comprise 50%.

With a total production of 13,500 mt/d of acid, the new plant complex will be the world's largest sulphuric acid production complex. Ma'aden will use the whole acid production to manufacture phosphate-based fertilizer. The plant complex will be operational in 2009. Possible sources for plant feedstock were not identified.

Outokumpu Technology has entered into a joint venture with Central Mining Co. Investment Ltd. of Saudi Arabia to accomplish the project. The new joint venture company, Middle East Metals Processing Company Ltd., is based in Al-Khobar.

This project is part of a program announced by Ma'aden in 2005 to create a mineral production and export zone at Ras al-Zour in eastern Saudi Arabia in a effort to diversify the country's petroleum-dominated economy. The zone will also process bauxite and phosphate from mines in northern Saudi Arabia and will include an ammonia plant, alumina refinery and plants producing phosphoric acid.

Outokumpu Technology is a major designer and supplier of sulphuric acid plants, with more than 600 plants installed worldwide.

Outokumpu also reported that it will modernize Boliden Harjavalta's copper refinery in Pori, Finland, with fast-track turnkey delivery using its new automated, full-deposit stripping technology, permanent cathodes and automated crane grab technology. The contract's scope covers basic engineering, key equipment supplies, Outokumpu stainless permanent cathodes and installation and commissioning services. Deliveries will take place in the second half of 2007. Once operational, the new refinery will produce 153,000 mt/y of high quality copper cathodes.