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Marketing Contact: Karl Sauereisen **Phone: 412-963-0303**

Polymer Concrete: Foundational Protection for the Mining Industry

For years, Metals Processors within the Mining Industry have been dealing with the problem of corrosion within their facilities. One of the most challenging functions is the solvent extraction/electro-winning process (SX/EW) which renders valuable collections of premium metals from mined ore. This is an area that Sauereisen Inc. of Pittsburgh, PA has been addressing through the new technology of polymer concrete.

The SX/EW process works by bathing metal-bearing ore within tanks of corrosive chemicals such as sulfuric acid and kerosene. As an electrical current accelerates the aggression of the chemicals, impure remnants dissolve within a series of tanks. The end result is marketable metal such as copper, nickel and zinc.

Naturally, the same chemicals that are strong enough to refine metals may wreak havoc within the storage, processing and treatment infrastructure. One of the most crucial areas are the “cell rooms” that include an extensive series of tanks mounted on beams over a large floor area. Obviously, the tanks are in need of protection. However, the SX/EW process may include batch loading and removal, so exposure to underlying supports and flooring within the cell room is extensive as well. Within this environment, Sauereisen is positioned to provide a single source of corrosion resistant materials.

The Sauereisen product array includes coatings and linings to provide thin barriers of defense if permitted, mortars for brick construction, and flooring materials where a durable, yet seamless system is desired. The primary formulations relevant to the mining industry are novolak epoxy, urethane, vinyl ester and potassium silicate. While each of the Sauereisen protective barriers offer unique advantages, our most revolutionary advances are in the realm of polymer concrete.

Polymer concrete is a castable material possessing the working properties of standard concrete with one major advantage...a chemically resistant matrix. The benefit of this feature is the ability to complete a concrete pour without the need

to come back and apply a corrosion resistant barrier. In actuality, Sauereisen polymer concretes are chemically resistant to the core. Long term performance is superior since there is no vulnerability to surface cracks or penetrations. One other major advantage is the curing process of polymer concrete which occurs chemically to limit downtime. In comparison, standard concrete requires 28 days of curing to assure adequate moisture hydration and strength development.

Until recently, most metals processing companies had resigned themselves to periodic maintenance primarily consisting of pouring new concrete. Fully realizing that the concrete would be sacrificial, their rationale was that the downtime for curing and topcoating is prohibitive. Finally, a greater environmental awareness raises the question of how to correct situations where runoff from acid-engorged foundations poses a threat to local ecosystems. Under the new framework of potential governmental mandates and enforced shutdowns, SX/EW participants are viewing polymer concrete as the most viable and efficient alternative to prevent corrosion.

The workhorse of Sauereisen's line of polymer concretes is Acidproof Concrete No. 54 - Structural Grade. This product is an outgrowth of the standard No. 54 which Sauereisen has supplied to the Power Industry for a half century. The historic application for the potassium silicate No. 54 is thermal and chemical protection of flue gas linings subject to hot, sulfuric acid-laden gases in coal burning utility plants. Construction for this type of refractory installation is typically by gunite method. Birth of No. 54 SG is the result of Sauereisen's developmental efforts to improve the physical properties for castable applications where greater compressive strength is required. The new "Structural Grade" formulation exceeds the previous gunite grade by almost 100% with a compressive strength exceeding 4100 psi.

Since No. 54 Structural Grade is an inorganic product, it possesses a certain degree of absorption. While the matrix of No. 54 - SG is resistant to full concentrations of sulfuric acid, measures should be taken to protect the underlying substrate should permeation occur over time. For this reason, Sauereisen recommends an asphaltic membrane beneath most silicate applications.

For areas subject to more diverse chemicals that may include alkalis, polymer concretes in epoxy or vinyl ester formulations may be more appropriate. Sauereisen's offering includes both general purpose and novolak versions of their epoxy and vinyl ester polymer concretes.

The products within this organic grouping of polymer concretes are much more impermeable which eliminates the need for a membrane. Bond strength of the epoxy and vinyl ester variations is tenacious. The organic polymer concretes will resist sulfuric acid concentrations up to 60%.

Sauereisen's successful applications in the Mining Industry include installations at Phelps-Dodge in El Paso, TX and Tyrone, NM, Big River Zinc in Sauget, IL and Kennecott Copper in Magna, UT. In most cases, polymer concretes have been the material of choice for containment areas, cell room foundations, processing floors and support piers. Additionally, the broad spectrum of Sauereisen coatings and linings serve a purpose in many of these same environments where chemicals pose a risk to concrete and steel.

Another advantage of polymer concrete at the jobsite is its ease of application. Virtually any contractor familiar with concrete mixing and placement will feel comfortable with Sauereisen's product. Mixing may be done in batches with a mortar mixer. For the larger projects where minimal downtime is mandatory, continuous mixing is ideal. In this configuration, the aggregate component is loaded at one end of an auger mixer while a liquid line provides the appropriate ratio of binder as regulated from a drum pump. Continuous mixing allows up to seven cubic yards of material to be placed in an hour. For select projects, Sauereisen has gone so far as to rent continuous mixing equipment to the application crew.

Since the mixed material has a comparable consistency to regular concrete, wheelbarrows may deliver and pour the polymer concrete. If necessary, another member of the installation crew can distribute product by screeding, tamping or vibration. Trowels may be handy to move material, but finishing of the polymer concrete is not required. Because of the aggregate size within polymer concrete and the need for durability, it is applied at a minimum thickness of 1-1/2 to 2 inches. Concrete reinforcement such as rebar or anchors is recommended.

As the polymer concrete cures chemically, an initial set may be obtained in 5-8 hours at 70^{o} F. Chemical exposure may be introduced after 48 hours. Compared to the curing requirements of green concrete that develops strength over 28 days, Sauereisen's product will allow processing to resume in a fraction of the time. The end result is a soundly engineered structure capable of long-term service.

Representatives of Sauereisen are located throughout the country. Several distributors in the Southwest U.S. Region stock the polymer concrete for quick delivery. For more information, contact Eric Sauereisen at the Sauereisen World Headquarters in Pittsburgh, PA (telephone 412-963-0303). Sauereisen also maintains a presence on the World Wide Web at www.sauereisen.com.