Turning a liability into an asset

Vancouver environmental firm at the source of water treatment advances

Photo courtesy of BioteQ Environmental Technologies

The Wellington Oro treatment plant behind heaps of dredge rock: a reminder of Breckenridge's mining past

Since last November, a water treatment facility designed by BioteQ Environmental Technologies and operated by the Town of Breckenridge in Colorado has been treating up to 35 cubic metres of contaminated water per hour from the former Wellington Oro mine. During that time, the stockpiles of zinc-cadmium concentrate — a byproduct of the treatment process (along with clean water) — has been growing at the treatment plant. Far from a nuisance to be rid of, however, creation of the concentrate had been a valuable feature of BioteQ's design. In fact, it had been instrumental in helping the company beat out international competitors for the Environmental Protection Agency-vetted contract to provide the technology to treat the drainage from an old mine a few miles upstream from the mountain resort town.

This past summer, the Colorado Department of Public Health and Environment confirmed what BioteQ had always maintained: the contents in the collection of pallets filled with zinc-cadmium sulphide, collecting in the bay of the plant, was not waste. The high-grade concentrate can, instead, be sold to a metal refiner and trucked away to be turned into anything from batteries to paint. This not only eliminates the need for sludge-filled catchment ponds and the disposal cost when that sludge has to be removed, but mines value from what once was simply waste.

The ChemSulphide™ Process

BioteQ applies its proprietary ChemSulphide™ water treatment technology to recover saleable metals that are otherwise lost through acid mine drainage or during processing. To extract the metals, sulphide is mixed into a tank containing mine drainage or waste from metallurgical processing. The chemical conditions of the sulphide reagent are tuned to target a specific metal in a contactor tank. The soluble metal precipitates, forming solid metal particles. The metal and water are then sent to a clarifying tank where the solid is filtered out and condensed. This process, put into operation last year at Jiangxi Copper Company's Dexing Mine, yielded 120,000 tonnes of copper processed from waste and low-grade stockpile drainage. The treatment plant, owned in a joint venture with Jiangxi Copper and operated by BioteQ, sells the recovered copper back to the company for refining. At a similar operation in Queensland, Australia, a series of contactor tanks — each adjusted for a specific metal — and clarifying tanks together allows the reclamation of copper, nickel and cobalt.

Traditionally, lime treatment has been the most widely applied approach to cleaning up acid mine drainage. Relatively cheap, lime made into slurry, then added to the drainage raises the pH of the water to the point where metals in it become insoluble, form particles and sink. Over time, innovation has made lime treatment more efficient, but the process inevitably generates metal-heavy sludge that remains an environmental and financial liability. Added is the problem that, as the standards for effluent rise, lime-treated water may not always meet them. The BioteQ process smooths out both of these wrinkles.

"Our technology can't solve all water treatment problems," explains BioteQ CEO Brad Marchant. "We can't do desalination. In some cases a simple lime plant can work just fine." Those cases, however, will likely become fewer as regulations tighten. For Breckenridge, the mining

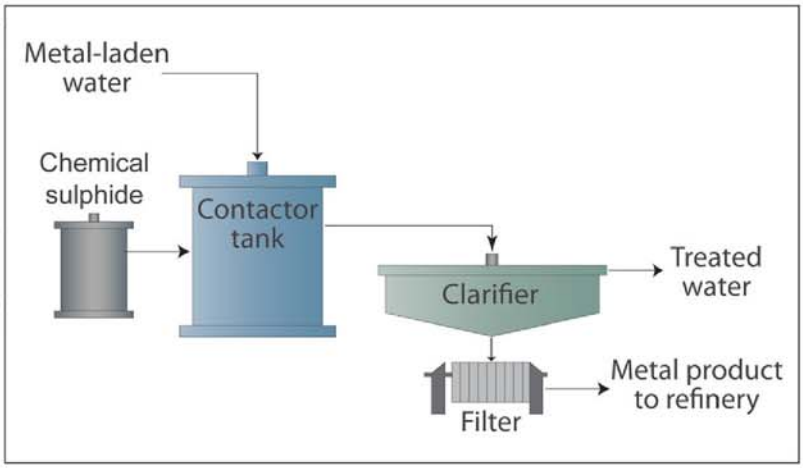

Diagram courtesy of BioteQ Environmental Technologies

ChemSulphide™ Process

town-turned-recreational tourism destination, BioteQ's chemical sulphide plant was the right fit. Breckenridge's water department operates the plant with the help of BioteQ, whose technical team can monitor all stages of the operating process from its company headquarters in Vancouver. "Putting a lime plant in there would have been a bad idea. It would have created a tremendous amount of sludge with nowhere for it to go," says Marchant.

There is, he says, no typical site where BioteQ simply "cuts and pastes" its technology. Each operation is designed to fit the needs of their customers and settings. "We work at both old and operational sites — base metal mines, gold mines, coal mines, and different geographical and geological settings."

Poised to react

This past fall, BioteQ agreed to build a water treatment plant in the Yukon at Minto Exploration's copper mine north of Whitehorse. The challenge was to capture the suspended solids and subsequent metals swept up by spring run-off and autumn rains, says Anne Labelle, manager of sustainability and legal affairs for Minto's parent company, Capstone Mining.

"Metal effluent regulations and our licence require low total suspended solids (TSS) in our discharge," says Colleen Roche, environment manager for the Minto mine. "Because of our topography, those limits are tough to meet."

BioteQ's track record, familiarity with the industry — such as its regulations and time constraints — and commitment to have the plant installed for next year's spring runoff were critical in earning the contract, according to Roche. The first step of the process will entail coagulating the fine sediment until it becomes heavy enough to sink. "If we can knock down those TSS amounts, we automatically take care of the bulk of the metal concentration in the water," explains Roche. The "polishing step," she continues, will be the chemical sulphide treatment of the residual material to reclaim the metals. "Copper is our primary metal of concern, but because sulphide chemistry goes after a host of metals, we're also taking care of zinc and other trace metals."

A smoother flow

Xstrata Nickel currently hosts a BioteQ plant at its Raglan Mine in Nunavik to meet the challenge of treating waste water in the Subarctic. Before connecting with BioteQ in 2003, the mine operator, then Falconbridge, used a low-density sludge lime treatment plant to extract nickel solute. The mine now uses both lime treatment and the chemical sulphide process. "The main advantage of the BioteQ process," says Martin Beausejour, an engineer at the Xstrata mine, "is that it is a continuous treatment and not by batch. We can treat a lot more volume and a lot later into the year. With a batch treatment you have to mix the products in the open pit. Once the recipe is okay, you can treat again, but as soon as you have ice in the pit, there are complications." With a feeder pipe drawing a constant flow of water, he continues, "you can treat longer because ice doesn't really interfere with the treatment." According to Beausejour, the BioteQ plant currently treats the bulk of the mine drainage.

The operating agreement between the client and BioteQ is also tailored. For example, at Raglan, BioteQ constructed the plant with its own capital and operates it with its own personnel. On top of a monthly fee for water treatment based on volume, Xstrata will also pay a monthly capital fee for five years and guarantees a minimum amount of water volume to be treated each year. BioteQ sells the recovered nickel back to Xstrata, where it is smelted along with the conventional output of the mine.

Biological solution

For a relatively small operation like the Wellington Oro plant, utilizing bags of chemical sulphide serve the BioteQ process. Large-scale operations that consume enough sulphide to make cost an issue are designed to include a bioreactor, an oxygen-free tank containing sulphur-reducing bacteria, which produces hydrogen sulphide gas. The gas can then be injected into the contactor tank to get the precipitation process underway. Using sulphur in the biological process rather than sulphate to produce sulphide requires significantly less electron donor, which cuts down on the space and costs needed to produce the compound. Last year, a mining firm using BioteQ's anaerobic bioreactor in Arizona recovered 590,000 kilograms of copper from acid mine drainage of a low-grade stockpile at an out-of-service mine — drainage that, in the past, had only yielded environmental damage.

Compared to blunt tools used in the past, it is an elegant solution — one that Marchant says more are willing to take a chance on. "Now that we have more operations we are starting to get cold calls." CIM

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