

FLUENT LINES™

INTEGRATED PROCESS WATER, WASTEWATER, AND SUPPLY WATER SOLUTIONS *FOR THE MINING INDUSTRY* • VOL.4, NO.1

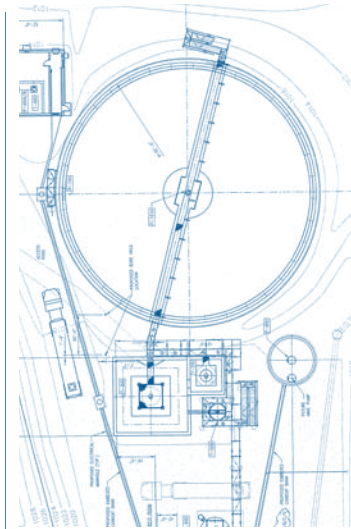
TREATING ACID MINE DRAINAGE

Maximizing Water Recovery, Minimizing Sludge Volumes

Net results from MEPCO's new AMD plant include reduced operational costs, improved process control and less sludge generation.

IN ORDER FOR BITUMINOUS COAL mining and processing firm Morgantown Energy Producing Company (MEPCO), LLC to mine the majority of its Sewickley Coal Seam reserves in Northern Appalachia's mining region, it must pump water from four other mine pools in sufficient quantity to lower the water level to an elevation below the seam.

To treat the water, MEPCO operates two acid mine drainage (AMD) treatment facilities at the Shannopin Mine Steele Shaft site in Dunkard Township, Greene County, Pa. The newest AMD facility commenced operation in April 2008. Designed and procured by N.A. Water Systems, a business unit of



A new 4,000 gpm AMD treatment plant, designed and procured by N.A. Water Systems, is helping MEPCO meet its production goals.

Veolia Water Solutions & Technologies, the plant uses the innovative DenseSludge™ treatment technology to maximize water recovery

and minimize the associated sludge volumes.

Process Overview. The 4,000 gpm (15.14 m³/m) plant consists of four concrete tanks (pre-aeration, aeration/neutralization, sludge conditioning, and clarifier/thickener) to treat and clarify the deep mine pool water. Sludge is recirculated through the treatment system from the bottom of the clarifier to the sludge conditioning tank where it is mixed with lime as an alkali source.

The sludge particles react with the alkali (calcium hydroxide) to provide attraction sites for precipitation of metals (mostly iron, manganese, and aluminum) and the gypsum crystals grow larger. The resultant mixture of sludge and alkali overflows the sludge conditioning tank into a ferrous oxidation process where it combines with pre-aerated influent AMD mine water.

Blowdown from the sludge recirculation loop is pumped to a borehole drilled into old mine workings in the Sewickley Coal Seam located about 100 feet geologically above the Pittsburgh Coal Seam.

Faster Settling. "Conventional water treatment for metals removal and pH adjustment can produce significant

see AMD Treatment, page 3.

The DenseSludge™ process improves AMD treatment operations by reducing sludge generation by up to 90 percent.

TAILINGS WATER TREATMENT

ACTIFLO® Improves Arsenic Treatment For Goldcorp Mine

High-rate clarification process selected to precipitate and separate arsenic and other heavy metals out of tailings water.

TO IMPROVE ARSENIC TREATMENT of tailings water at its Cochenour Wilanour mine in Northern Ontario, Goldcorp is using high rate liquid/solids separation utilizing established chemistries. To perform this task in the limited space available, an ACTIFLO® high-rate sand-ballasted clarification system was selected. Today, with the successful removal of impurities, the water can now be discharged directly into the environment.

Wilanour mine is located less than five miles (8 km) from Goldcorp's Red Lake Mine, Canada's largest gold mine and one of the world's richest and lowest cost gold producing operations. Goldcorp purchased the Wilanour mine in the late 1990s, and the site is currently in care and maintenance mode with an active exploration program underway.

Batch Treatment. Water had been batch treated for arsenic con-

see Arsenic Removal, page 4.



ACTIFLO® provided needed capacity without the large surface area requirements.



Water is pumped from mine pools to lower the water level to an elevation below the Sewickley seam, then treated prior to discharge.

Pressure Leaf Filters Bring Effective Clarification Of Cyanide Leach

Worldwide system provider says Auto-Jet® Pressure Leaf Filters provide high flux rates, minimum downtime to bring consistent large volume, high-grade recovery.

THE MERRILL-CROWE ZINC PRECIPITATION PROCESS is advantageous to many large-volume gold and silver operations due to its relatively small equipment footprint and the ability to recycle and reuse a quality "tail." Attaining optimum results with the process, however, is highly dependent upon the design and operation of the conditioning steps preceding the zinc dust treatment.

Clarification a Key Factor. In order for the pregnant leach to work most effectively, all impurities must be removed prior to its exposure to zinc dust. The solution and zinc dust are deposited on the precipitate filters, where the zinc pulls the cyanide and leaves the gold and silver as precipitant. The barren solution is then recycled for reuse in the process.

"The solution must be clarified to create a very clean stream with essentially less than 1.0 ppm suspended solids," explains Eldan Hill, Project & Service Manager for Summit Valley Equipment & Engineering, Inc. (SVEE). "The stream then goes through a vacuum tower that reduces dissolved oxygen down to less than 1.0 ppm," Hill says. "These two steps are necessary to make the process precipitate optimally and use less zinc."

Pressure Leaf Filters.

Hill says pressure leaf filters have proven to be the best option for clarification applications in Merrill-Crowe systems. In a typical system, the clarifying tanks are fitted with a compartment where the leaf filter elements are pre-coated with diatomaceous earth as a filter aid material. This precoat layer forms a dynamic filtration surface that achieves less than 1 ppm suspended solids with particles no more than 1 micron in size.

"You can backwash a well-designed leaf filter in about 5-10 minutes, precoat it with diatomaceous earth, and put it back on-line,"

Hill says. "Other filter types could be used but, comparatively, the service time on a pressure leaf filter is typically very low," Hill says.

SVEE, based in West Bountiful, Utah, designs and fabricates modular plants and equipment for gold and silver extraction worldwide. In addition to Merrill-Crowe systems, SVEE designs and fabricates electrowinning systems, mercury retort systems, carbon regeneration systems, and ADR plants for gold and silver operations worldwide.

"These filters offer high flux rates and can run continuously and clean every one to three days."

Reducing Downtime. "Our equipment is designed for minimal maintenance," Hill says. "Less maintenance means less downtime, and less downtime means more profitable operations for customers."

Hill says his firm typically designs Merrill-Crowe systems around the Auto-Jet® Pressure Leaf Filter from Whittier Filtration, a Veolia Water Solutions & Technologies company.

"These filters offer high flux rates and can run continuously and clean every one to three days." The filter is designed to remove fine clays down to 0.5-1.0 micron size. One of the advantages

of the design of the Auto-Jet filter, according to Hill, is its sluicing system. As the filter leaves rotate, flat, knife-like jets of cleaning liquid efficiently remove heavy cake and scrub the entire surface area in three minutes or less. In addition, Hill says that some leaf filter designs make serving

the units burdensome, "whereas the way the Auto-Jet is designed, a single operator can open its front door and pull all of the filters out of the front for service."

Fully Automated. Auto-Jet Filters are fully automated. When one filter is full, the feed is shut off and switched over to the standby filter. The



The Auto-Jet® Filter offers high flux rates and exceptional cleaning using a leaf assembly that rotates past spray nozzles during cleaning.

internal high-pressure water jets automatically remove the filter cake and the clarified pregnant solution feeds directly to the Merrill-Crowe aeration tower. The newly cleaned filter is placed on standby for the next rotation.

"We often include three filters, depending on the size of the operation," Hill says. "Two filters will be on line at one time, and when one loads up, it's taken off line and the third filter is brought on. While one filter is backwashing and precoating, another filter is ready to be dropped in, so there is really no downtime." ■

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Auto-Jet® Pressure Leaf Filters are designed to remove fine clays down to 0.5-1.0 micron size.



Solutions & Technologies

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AMD Treatment At MEPCO

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volumes of sludge for disposal,” says Bob Zick, Director of the Mining Market for N.A. Water Systems.

“DenseSludge technology, however, can reduce the volume of sludge generation by up to 90 percent, when comparing clarifier underflow streams from both processes. This also improves sludge management by reducing the storage volume in remote parts of the mine pool. Up to 50 percent solids, in situ, is typically achieved due to further consolidation and draining of water from the particles.”

Reduced Water Volume. Another cost benefit accrues due to a significant reduction of water

The DenseSludge™ particles settle faster, dewater more readily, and hold much less water than conventional precipitates.

returning to the mine pool with the sludge particles. Conventional treatment systems continuously re-treat this, whereas with DenseSludge systems, the incremental difference in water volume passes through and gets discharged. Approximately 10 operating systems

have been installed by Veolia Water Solutions & Technologies on mine drainage, with the majority located in the United States and one in Peru.

Typical AMD streams contain high dissolved metals and sulfate concentrations. When lime-based treatment systems are used, gypsum crystals are formed. Compared to conventional lime treatment systems, the physical form of these gypsum particles is radically altered when the DenseSludge process is utilized and the metals become layered like an onion, transforming into oxides from the hydroxide form.

“The DenseSludge particles settle faster, dewater more readily, are more easily pumped, and hold much less water than conventional precipitates,” Zick says.

Automated Process. For its project, MEPCO wanted the treatment plant to be highly automated. “The system can be configured to allow plant operation with little need for operator intervention,” Zick says, “yet gives the operator the required information necessary to monitor and perform simple control functions to ensure that the system is in compliance with regulatory requirements.”



The DenseSludge™ system can be configured to allow plant operation with little need for operator intervention, yet gives the operator the required information necessary to monitor and perform simple control functions to ensure that the system is in compliance with regulatory requirements.

An important function is the DenseSludge system’s automatic sludge wasting feature. Real-time measurement of sludge density allows for a very tight operating range. If density rises above the established setpoint, sludge is

automatically wasted from the process until the density level drops to the lower setpoint. ■

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Aquamove™

Mobile Water Treatment Solutions for Mining

Aquamove™ is a new water utilities service for mining customers that require temporary or supplemental mobile water treatment equipment for their wastewater or process water operations. Aquamove can be de-

ployed as a stand-alone unit or combined with other unit operations to form complete systems with state-of-the-art water process technologies.

Aquamove mobile solutions technologies are designed for sites with short-, mid-, or long-term water needs. Several applications that may require Aquamove include:

- Environmental compliance due to stricter discharge regulations
- Maintenance outages and turnarounds
- Process trials
- Delayed delivery of new plant equipment
- Supplement clarification or waste treatment plant expansions
- To accommodate changes in raw or waste water quality



Aquamove™ mobile solutions technologies are designed for sites with short-, mid-, or long-term water needs.

The first line of trailers available for rental are ACTIFLO® TURBO, Hydrotech Discfilter, and Reverse Osmosis (RO). The applications available range from clarification of raw water by reduc-

ing turbidity/total suspended solids through the ACTIFLO TURBO trailer as well as wastewater effluent treatment to improve discharge compliance. The technologies also provide opportunities for wastewater recycle/reuse. The Discfilter trailer provides additional filtration and waste treatment polishing. It can remove total suspended solids as fine as 10 microns. The RO trailers address the need for total dissolved solids removal where applicable.

All units are immediately available for dispatch. A minimal number of connections are necessary to place the units into service. ■

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Tailings Water Arsenic Removal For Goldcorp Mine

tamination in the past by adding ferric sulphate to ponds of standing water within the tailings. Goldcorp managed the mine as a zero discharge site while plans for a water treatment



Wilanour Mine's tailings pond.

facility were developed to meet or exceed environmental requirements for closure.

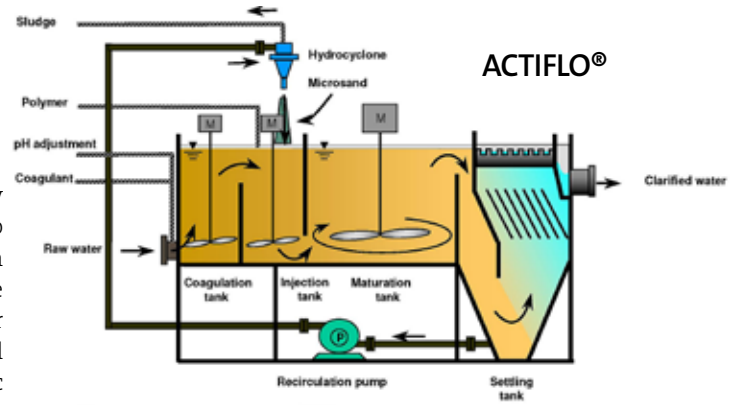
A biological treatment plant was built to treat the tailings water discharge for arsenic. Once the plant was completed and on-line, however, it did not consistently meet the required treatment objectives.

Liquid/Solid Separation. The mine decided to replace the process with liquid/solids separation using metal precipitation chemistries.

Goldcorp ultimately elected to install two 4,000 m³/d (1 million U.S. GPD) concrete ACTIFLO clarifiers for the precipitation and separation of arsenic and other heavy metals out of the tailings water.

"ACTIFLO relies on microsand to significantly increase the settling velocity of particles, and this results in optimum process performance and a very small equipment footprint," says David Oliphant, Regional Sales Manager for Veolia Water Solutions & Technologies Canada. "We were contacted by a consultant with the Wilanour mine who was aware of our technology and knew of its small footprint and excellent removal capabilities. From there the project went from pilot to design and construction very quickly."

Plant startup was in June 2006. Due to the



small footprint of the ACTIFLO units, half of the remaining circuit was taken out of the existing building and the entire treatment plant was built in that space.

The ACTIFLO® units reduce arsenic levels in the tailings water down to 0.02 ppm, allowing for its discharge into the environment.

Treatment Goals Met. "The new system lowered arsenic levels in the discharge tailings water down to 0.02 ppm, well below our target," says David Gelderland, Environmental Manager for Goldcorp Red Lake Gold Mines. The plant's permitted limit for arsenic is currently 0.25 ppm.

"We initially based plant operations on a single data set for water chemistry, due to timelines," Gelderland says. "But because the chemistry changes so dynamically at the tailings area, we found we needed to adjust the system for seasonal variations. In 2007, we increased treatment capacity to 12,000 m³/d (3.2 million U.S. GPD) and added a pH adjustment circuit as well as a contact tank for conditioning the water prior to it entering the ACTIFLO units."

The mine's tailings water treatment plant is consistently achieving arsenic removal of 0.02 ppm as well as reducing iron and manganese concentrations to below regulatory limits. Due to the success of the ACTIFLO units at the Cocheour Wilanour Mine, Goldcorp ordered two additional ACTIFLO package plants for its Red Lake Mine as well. ■

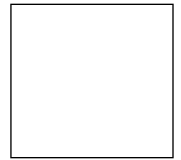
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Two 4,000 m³/d concrete ACTIFLO® high-rate clarifiers successfully treat tailings water effluent, lowering arsenic levels in the discharge tailings water down to 0.02 ppm, well below Goldcorp's target. The plant's permitted limit for arsenic is currently 0.25 ppm.

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