What miners tend to miss in choosing mine water treatment solutions

by Ivan Cooper

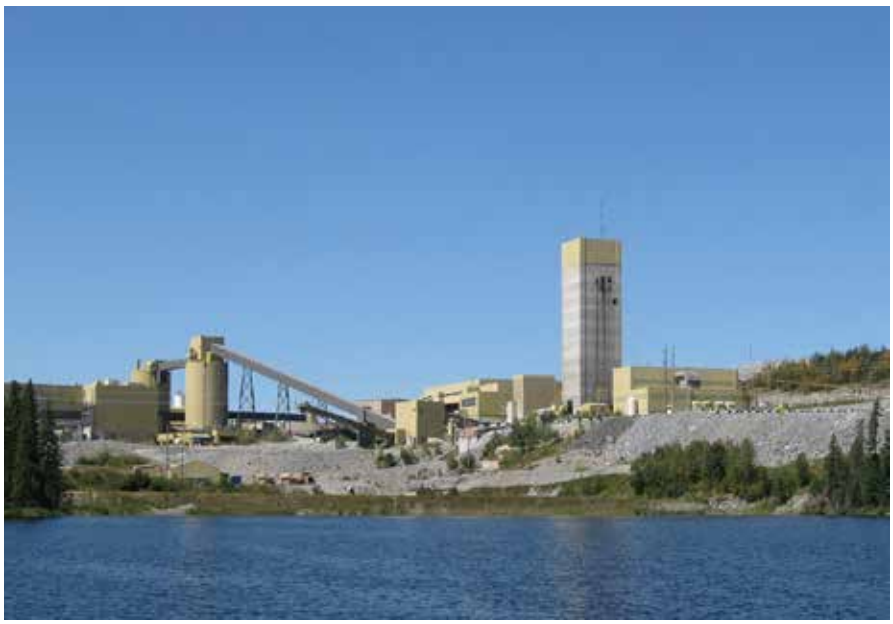
It's an all-too-common scenario in mining today: regulatory agencies become concerned that the water produced by a mine does not meet standards, even after treatment. The mine's executives work with water-treatment vendors to ship in some additional equipment to fix the problem.

However, the newly installed systems just do not seem to work, and this leads to more equipment purchases. This diverts management time from operational issues — even more so when this seemingly minor problem of water puts the mine at risk for being fined or shut down.

It can be a frustrating, expensive and distracting process. But finding a good way to treat mine water is becoming a key factor for success in mining today. This is partly because of tightening regulations and areas of growing concern such as the impacts of selenium and sulfates, and partly because of the growing need to get buy-in and acceptance from stakeholders affected by the project.

It's becoming a bigger issue as mining companies venture into cold climates and high altitudes, water-short places, and more remote areas where supplies, parts and equipment can only be shipped at great expense.

Experience working with mining companies indicates three main areas where they can improve their approach to managing water treatment issues: working appropriately with vendors, testing of equipment intended to solve the issue, and considering future needs adequately. It all comes down to the need for a more considered, systematic approach to choosing water treatment methodologies and equipment.



Mining companies need to pay adequate attention to the methods they use for treatment of mine water and process water to avoid impacts to surface and ground water.

The need for better ways to work with equipment vendors

Personnel working for water-treatment equipment vendors are often highly trained and knowledgeable about the operation of their company's equipment. This means that technical sales representatives can be very good at providing specifications on the equipment, instruction on how to use it, and trouble-shooting.

However, vendor representatives are limited with regards to the range of solutions that they can offer. This may not be so much of a problem in the case of products such as pumps and filters, because there is a finite range of options available in the way equipment is configured. Mining companies can get good benefit from vendor reps because of their detailed knowledge of their products, and how those products compare with those of competitors.

For water treatment, however, the situation may be significantly more complex. This is partly because of the wide variety of metals, salts, nutrients and other impurities the water may have picked up on its journey through the mine or mill. Accordingly, there is much less of a chance that a "plug and play" solution will work. That's why identifying which process will be the most appropriate to use in a specific situation is critical, and why relying overly on vendors to provide advice on mine-water treatment solutions may result in frustration.

In many cases, the mine's executives are under pressure to bring water to a point where it meets regulatory levels. They naturally want a fast solution and may like what a vendor tells them about how well a piece

Ivan Cooper is principal and national water/waster water practice leas for Civil & Environmental Consultants, Inc., Charlotte, NC, email icooper@cecinc.com.

Treatment of mine water is important in closed mines as well as open mines — as in this situation where a pipeline removes mine water from a now-closed mine, before release.

of equipment has performed for another operation. They also like the idea of a quick solution to their water problem. However, it is often the case that equipment that performed well under one set of circumstances does not perform well in another.

Accordingly, when working with equipment vendors, it is important for mining companies to work within the vendors' strengths — which include a good understanding of how their equipment works and the circumstances under which it does its best work, as well as training and servicing. Success also depends on understanding the limitations vendor reps work under — their focus on their own company's products and services, in many cases without a clear understanding of how their equipment might work in tandem with other technologies to produce satisfactory results.

For support in deciding which equipment to buy and how to have it configured, a more structured, methodical approach to the problem is more likely to produce a solution that works long-term and for a given mine's reality.

Future-proof your mine's water treatment system

Another big reason why water treatment systems fail to meet the need is that they are sometimes not set up with the flexibility to handle the mine's future needs.

It could be that a sudden rise in commodity prices causes the mine to increase production, overwhelming the water treatment system. Or, the company decides to open up a new section of the mine. Perhaps the mine workings venture into a new type of rock, or a new mining or milling process is being used.

It can also be that the regulatory environment changes, so that when the mine's permit expires and is renewed, the allowable levels in the output water are much reduced. Sometimes, regulators focus additional scrutiny on some substances — witness the increased levels of concern, in many jurisdictions, about selenium. There has been increased concern about nutrients such as nitrogen and phosphorus in surface water causing problems such as algae blooms — and the nitrates used in blasting may be a contributing factor.

These possible changes mean that a system that may have been a good size and configuration at the start of operations can become inadequate to the task during the life of the mine.

The need for more comprehensive and thorough testing

A third limitation of many mining companies' approaches to water treatment is inadequate testing of alternatives. This includes going well beyond laboratory testing of a few liters of water. Lab results can point the way, but for more reliable results, on-site testing of larger volumes of water is often needed.

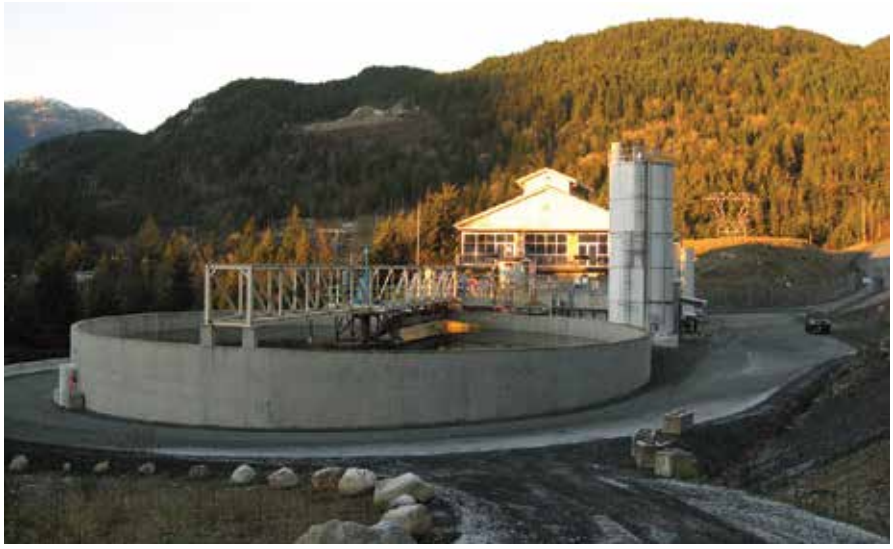
On-site testing is important, particularly given the wide range of alternatives, including active systems, such as precipitation or biological treatment processes, and passive systems such as sulfate reducing bioreactors, aerobic wetlands, limestone ponds, open limestone channels, limestone sand treatment and successive alkalinity producing systems. In many cases, combining two or more technologies and approaches is needed to produce reliable results.

A systematic approach needed to solve water issues

These three needs -- to go beyond the vendors' recommendations, to have a system flexible to meet future needs, and to perform more comprehensive testing of alternatives -- can be resolved through taking a systematic approach to the problem.

A systematic approach involves a multi-stage process:

- Source definition — water flow rates, material mass, solute concentrations, expected duration, etc.
- Reliability in meeting effluent goals



- Identification of environmental goals — discharge standards, compliance points, and human or ecological risks.
- Identification of applicable technologies — finding out which technologies are potentially capable of meeting goals.
- Identification of critical parameters — early determination of values for parameters that typically drive cost or effectiveness.
- Impartial evaluation — a feasibility analysis that is completely independent from technology vendors.
- Fatal flaw analysis — finding out if there are any critical factors that prevent implementation.
- Operation ease
- Capital and O&M costs
- Rating — relative importance and rating and weighting of factors.
- Head-on-head comparison — pair-wise with numerical score.

This structured approach may take longer up front, partly because of the amount of information to be gathered. But it is time well spent -- the solution that is chosen is more likely to be effective at solving the problem, with adequate consideration given to the changing operation of the mine and to future regulatory changes. ■

it is important for mining companies to consider their choices with the aid of advice from skilled professionals.

Non-monetary evaluation criteria

Many companies focus on purchase price when sourcing equipment for purposes such as water treatment, with some attention paid to operating costs. However, they need to look wider at non-monetary issues such as those below:

- Suitable for climate: whether the technology is suitable for the site given temperature and precipitation
- Effluent reliability and stability: demonstrated reliability in similar sites
- Operability: ease of operation minimizes operator attention and expertise needed
- Ease of maintenance: Needs are not excessive, do not need special expertise
- Operator familiarity: Possibly based on staff experience with similar equipment
- Reliability: Demonstrated performance
- Hydraulic sensitivity: Easily able to handle variations in hydraulic loads
- Waste loading sensitivity: Handles variations in waste loads easily
- Process control stability: Not subject to upsets from inadvertent operational changes
- Flexibility: Easily meets changes in process operations due to changes in waste loads and differing treatment objectives
- Environmental effects: Minimal potential for odors, noise and visual impacts
- Footprint: small geographic space needed, few trees removed
- Expandability: Footprint maximizes area available for expansion
- Implementation: Time to implement facility, including permit, design, construction and commissioning. ■