The importance of water

Little can exist without water and few operations in mining can effectively run without including its management within operating parameters. Barry Mansfield speaks to industry experts and insiders about how the industry is innovating to deal with the ebb and flow in H_2O conditions, from too much to too little and everything in between.

Water is an invaluable shared resource, with considerable social, cultural, environmental and economic worth. It is an indispensable human right and a fundamental requirement for healthy, functional ecosystems that are essential to sustaining life on Earth. Water is also a vital resource for all mining and metals operations, and is used in every process from minerals processing, power generation and dust management to the drinking and sanitation facilities used by staff. In dry climates like Australia and Mexico, mining takes between 3.0 and 3.5% of national water consumption annually. The industry couldn't exist without it.

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But water is a business risk. An example of direct risk is the severe flooding of coal-producing regions in Queensland during 2011, which resulted in billion-dollar production losses. Indirect risk is well demonstrated by the impact of expansion plans on water security at Minera Yanacocha's mine in Cajamarca, Peru, which angered villagers and led to the eventual abandonment of plans for exploration of a nearby mountain. Finally, there is a catchment risk. Locals in the Witbank Coalfield area complained of contaminated drinking water from upstream users, leading to protests and costly delays to operations.

In the area: water as a factor in location choices

Many mining areas are located in water-stressed regions and are increasingly facing competition from myriad users, presenting challenges to the security of supply. Operations need to reliably secure suitable quality water over periods spanning 30 to 50 years. A water disclosure survey of the industry by the Carbon Disclosure Project (CDP) identified that 92% of respondents see water risks as highly influential to their business operations, revenue or expenditure up to 2020. With the critical role that water plays, mining companies are keenly aware of their responsibilities as effective water stewards.

Catchment-based water management in mining requires a particularly careful evaluation of the socioeconomic and ecological aspects of the catchment. Water users will have water-quantity requirements of a specific quality (say for drinking water); upstream users should therefore evaluate how their water use and discharge will likely affect downstream users. The operator must consider local development plans, catchment institutions, spatial development, WaterAid's briefing note on Universal Access by 2030, ESIAs, WBCSD's Water Pledge and CEO Water Mandate's Guidance on human rights to water.

The competition: when demand outstrips supply

Operators are stepping up their game; Andrew Watson, VP of sustainability in mining at MWH Global, notes a marked change in customer demand in the past five years.

"Mining projects have to compete for water in a more regulated environment, leading many to explore optimisation and reuse," he explains. "Water has also become the nexus for interaction with communities and in Latin America. This has had profound impacts on some mining projects. Customers want a reliable water supply, measures that protect community water resources and treatment technology that permanently removes contaminants."

Furthermore, Watson adds, supply uncertainty due to climate change has forced urgency for water-management services. In his view, the industry should aim for performance gains in energy-efficient water-treatment technologies; in finding means of immobilising highly soluble, recirculating contaminants; and in economically recovering valuable products present in mine water at very low concentrations. "A breakthrough in mineral processing resulting in significantly lower water and energy demand is required, if we're to continue exploiting ores with lower grades with an ever more limited water supply," he says.

Using experience for future predictions

Watson, who has 20 years of experience in the design and construction of infrastructure, dams, tailing storage, heap leach, waste containment facilities and civil works, expects further market shifts, with MWH adding value through the transfer of know-how to make its clients' projects more efficient.

"We have brought municipal drinking and wastewater technology to mining companies, and our work in the beverage and electronics industry has prepared the company to deal with more exotic metals found at very low concentrations in the mining industry," he says.

Extensive diversions are often necessary and restorations are expensive. At Meirama, north-west Spain, Limeisa found that the proximity of the water table to the pre-mine surface necessitated a dewatering system to prevent flooding

of the pit during operations. It built several kilometres of diverting tunnels and a mobile pumping system for runoff water.

Years later, during a €60-million restoration project, it was necessary to install a thick clay seal at the bottom of the pit to lessen the oxidation of sulphur and also reinforce the safety factor of the slopes, which was overseen with a laser tracking system.

In real time: dealing with the issues as they occur

Fabio Mielli, the US mining, minerals, and metals segment manager for Schneider Electric, singles out "improved visibility of real-time water balances and water awareness under a production context" as a key issue for operators in future.

"Some companies don't have such visibility due to a lack of instruments in critical points or the lack of tools and personnel for analytics," he says. Mielli also emphasises the importance of creating an integrated water approach. He thinks the main problem with water management is the complexity and diversity of disciplines.

These include climate impact, pollution, balances, quality, levels, usage, flows, dust suppression, acid mine drainage, tailing management and reporting. But Mielli also notes that grade declines imply the need for more processing and consequently even more water usage. He points out the continued trend of the development of mining operations in water-stressed areas, which presents an extra hurdle. Compliance with regulations is usually enforced with financial penalties such as a fine, and in extreme cases, mining operations may have their licences withdrawn if they fail to meet the necessary strict standards.

Watson's colleague Resa Furey, a senior market analyst for energy and infrastructure, works to competitively position MWH. She has found that many mining clients are developing new corporate water strategies and setting water management, governance and policy structures at the very highest levels of the business.

> "AquaDania manufactures a modular water purification system called WaterStillar, which can produce thousands of litres a day of clean drinking water from any water source in a multistage distillation process, using solar thermal collectors."

"We're seeing a move from managing water at the site and surrounding communities towards managing water within an entire watershed. Mining companies still need mine-site water-management services, yet, by and large, the trend is managing the big picture around water and water use," Furey says.

Cross-sector inspiration

Furey adds that the mining industry is also looking to other industries for efficiencies, for ideas and approaches that will lead to the step change that the industry wants and needs. "Taking ideas from other industries and making them work within mining will be key to mine-water management of the future," she predicts.

That's where companies like AquaDania come in. The Danish company manufactures a modular water purification system called WaterStillar, which can produce thousands of litres a day of clean drinking water from any water source in a multistage distillation process, using solar thermal collectors.

"The concept is simple: clean water wherever you happen to be," says founder and CEO Tom Juul Andersen. "WaterStillar is low tech, affordable, with no moving parts. It's corrosion resistant, using enamelled stainless steel and silicone. It totally removes the need to transport and dispose of polluting plastic PET water bottles."

End note: the future of H_2O management

The technology is already available in Latin America through AquaDania's subsidiary, Playa del Carmen-based WaterStillar Mexico, and was first installed by schools, cafes and shops in the resort town.

With this and other water solutions flowing into the market, managing water in the mining industry can potentially become a much easier task. ■

Less is more

A big challenge for the mining industry is the question of how to minimise water losses during processing, while maximising water recycling. Process water can be retained in a closed cycle and stored in a tailings facility. Focused efforts to save water may have major benefits:

- BHP Billiton initiated a water-savings project at its Olympic Dam mine in Australia to cut the volume of water used in its processes, achieving a significant reduction of 450 million litres a year.
- Xstrata reduced evaporative losses in the heap-leaching process in the Lomas Bayas mine, in Chile's Atacama, by 54%, by replacing sprinkler systems with an advanced drip-feed system, and installing impermeable plastic covers over leach pads.
- Rio Tinto has cut water use from Lake Argyle at its Argyle Mine, Western Australia, by 95%. Water is now recycled back through the processing plant, water seepage from tailings is captured and dewatering underground supplies two dams.