RO strikes gold

By Henia Yacubowicz

Large-diameter RO seawater system helps with mining in Chile

Workers at Chilean copper-gold mine port facilities soon will be quenching their thirst with drinking water from a new seawater reverse osmosis (RO) system supplied by Koch Membrane Systems (KMS).

Located in the Antofagasta region of Chile's north coast, Minera Esperanza's copper-gold mine is about 930 miles north of Chile's capital city of Santiago. The area is a desert with extremely scarce supplies of drinking water and developers of mines and other industrial facilities must provide their own water.

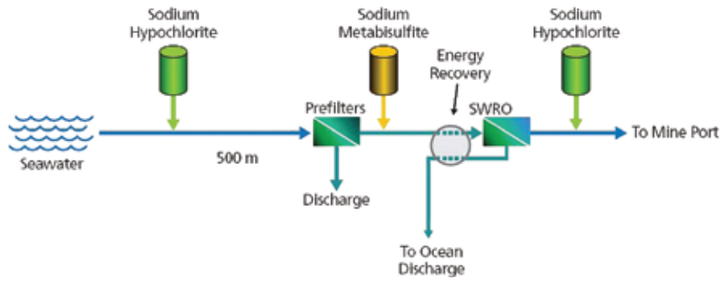
The initial RO facility will supply water to the mine's port facilities at Michilla Port, about 105 miles from the mine. The port is used to ship copper concentrate out of Chile. The overall water treatment facility, being developed by Nicolaides S.A., will provide drinking water to the mining camp as well as process water for the filter units that will concentrate copper coming down from the mine.

A second RO system is already in the next project phase. This will involve pumping seawater from the port through an insulated underground pipe to the mine at an elevation of more than 8,530 ft above sea level. There the seawater will be stored in a 50,000-cu-meter pond. Mining operations will take seawater from the storage pond and process it through a series of filters and finally an RO system. The desalinated water will be used for both processing operations and drinking water. Construction of the full-scale system to be placed at the mine began in 2010.

The prevalence of gold and copper mines in the region, which require a lot of water with different salinity level requirements, made the seawater RO system one of the only feasible options for obtaining water for construction, drinking, mining operations and processing.

Pilot plant using new RO elements.

Figure 1. Process Flow Diagram



Solution Summary

While other technologies were reviewed, a seawater membrane solution was the most feasible because of the lack of available surface water or groundwater.

To take advantage of the significantly reduced footprint, project costs and installation time, Nicolaides selected a system that uses MegaMagnum high-capacity seawater membranes made from a unique thin-film composite developed specifically for seawater applications.

The large-diameter RO systems use one-seventh the number of elements compared to standard 8-in. elements and also contain fewer of the O-ring seals that prevent mixing between the seawater and product water. This results in significantly lower maintenance costs over the life of the plant.

The RO system can be maintained easily using onsite routine maintenance practices. The system includes an energy recovery device and was designed and built to minimize the life-cycle costs over the system's 20-year life expectancy.

Pilot System Performance

KMS initially installed a pilot unit at the port to demonstrate the effectiveness of the large-diameter RO system and to provide a water supply to the construction crew. Since it went online in the beginning of 2009, the facility has performed extremely well.

Figure 1 is a graphic depiction of the pilot water system, which is now being expanded and converted into a permanent water source for the port facilities.

The seawater, drawn from about 500 meters offshore in waters about 8 meters deep, is pumped for about a mile to a water treatment unit that has a prefiltration system that contains a self-cleaning filter with a first stage of 25 microns and a second stage of 3 microns. The system is designed to deliver water quality of less than 1 NTU and 3 silt density index. From there, the water is pumped through the pilot RO system, which consists of a single-vessel RO equipment skid with a total of five seawater elements inside. The combined effective membrane surface area measures 15,000 sq ft, or the equivalent of 38 standard size 8-in.-by-40-in. elements.

The final permeate is disinfected with chlorine, and then the finished water is pumped to a storage tank in the port. The permeate capacity is 130,000 gal per day given a maximum feed total dissolved solids of 40,000 ppm, and the required chloride concentration is less than 250 ppm in the finished water.

Port's Permanent RO System

The original pilot operates at a rate of 20 cu meters per hour. This unit will be removed and replaced by the permanent RO system, which consists of two new MM2 units that provide the port facilities with a storage capacity of approximately 520,000 gal per day. Each unit is comprised of two seawater large-diameter pressure vessels, and the total project will utilize 20 seawater elements.

Water Supply Issues

The availability of reliable potable water is a key issue in developing mines and other facilities located far from developed regions. There is no potable water available at the mining site and no other local water source available. This mine is one of many that are using RO systems to obtain potable and industrial water for operations. In the future, KMS expects most new developments will have to consider desalination as a water source, and believes large-diameter seawater RO systems show great potential for use in mining operations. MT

Henia Yacubowicz is director of process engineering for Koch Membrane Systems. Yacubowicz can be reached at hyacubowicz@kochmembrane.com.

For more information, write in 1104 on this issue's Reader Service Card or visit www.wwdmag.com/lm.cfm/mt071004.