



## **Zero Liquid Waste: a Desalination Solution for Chloride, Sulfate Limits**

Mining operations and other energy producers face a multitude of clean-water regulations that can seriously impact their businesses. Strict standards governing discharge into waterways can increase costs and inhibit production. Veolia Water Solutions & Technologies is addressing these issues through advanced treatment processes that allow companies to generate clean water for reuse or environmental discharge with no substantial liquid waste.

Called the Zero Liquid Waste (ZLW) approach, the industrial water desalination technology benefits the mining industry, which must contend with stringent new regulatory requirements that limit the discharge of chlorides and sulfates into streams, rivers, lakes and other bodies of water. Such discharges are a byproduct of the mining process, and mitigating their effect on the environment is crucial to the mining company's ability to produce cost-efficient energy.

"The Zero Liquid Waste approach is a big step forward for industries seeking to meet challenging new environmental regulations in a cost-effective manner," said Robert Zick, Mining Market Director of Veolia Water Solutions & Technologies North America. "Mining and energy companies are turning to us for innovative solutions to their water quality needs."



*Veolia offers the ZLW technologies through Design-Build and Design-Build-Operate contracts.*

The Zero Liquid Waste approach features state-of-the-art membrane treatment to achieve discharge criteria, as well as Veolia's HPD® evaporation and crystallization technology to manage the brine from the water treatment process. The desalination system creates clean water for discharge while generating zero liquid waste. The resulting desalinated water can be used for various energy-production endeavors or discharged back into waterways, with the high-quality water benefiting downstream users.

### How the ZLW process functions, adds value

ZLW consists of a raw-water pretreatment system, reverse osmosis (RO) membrane system, brine management system and ancillary support systems. Here's a look at how this state-of-the-art process works:

- The **raw-water pretreatment system** involves pumping water into a raw-feed water tank with a jet mixing grid to prevent solids from settling. From there, the water enters the first of two aeration tanks that promote the precipitation of dissolved metals, such as manganese and iron, then into a crystallization tank where chemical softening takes place to reduce alkalinity and hardness. Veolia's MULTIFLO™ softening process provides a small footprint option for this treatment step. The MULTIFLO™ system combines softening and clarification by including the company's Turbomix™ technology, which provides thorough draft-tube mixing to minimize chemical use and promote formation of a crystalline sludge that is easily dewatered in a filter press. The water is then conveyed to an aluminum precipitation tank where acid is added to neutralize the water's pH level and precipitate dissolved aluminum for removal in the subsequent filtration step. The aluminum precipitation tank overflows into an adjacent multimedia filter feed tank and is pumped through vertical multimedia filters to remove residual suspended solids.



*Veolia's MULTIFLO™ softening technology is offered as packaged units or as field-erected tanks for larger flow rates.*

- The single-pass, three stage **reverse osmosis (RO) system** performs desalination in the ZLW water treatment process. The RO system itself consists of parallel skids, each containing multiple stages of RO pressure vessels comprising each skid. Before entering the RO system, water goes through a cartridge filtration system which removes any fine colloidal particles. The clean permeate water from the RO system – minus the majority of the chlorides, sulfates and other dissolved solids contained in the feed water – goes to a product water tank where it combines with distillate from the evaporation/crystallization process. Minerals are then added to the water to protect aquatic life before it is discharged into waterways.





***Reverse osmosis skids desalinate the mine water, enabling the ZLW system to meet limits for total dissolved solids, chlorides and sulfates.***

- Without the brine management system, the approach couldn't achieve Zero Liquid Waste. Reject from the RO system is concentrated brine containing the dissolved solids and other constituents removed from the feed water. The brine is sent to a separate MULTIFLO™ softening system to remove the calcium and magnesium hardness prior to being sent to a thermal treatment process consisting of an HPD® evaporator and crystallizer. The HPD® evaporator concentrates the RO reject by removing the majority of the water in an energy-efficient and economical manner. The evaporator and crystallizer typically utilizes a mechanical vapor recompression system that compresses the vapors created by concentrating the feed brine and then recycles the vapors back into the heater shell to provide a heat source for the evaporation process. Depending upon the relative cost and availability of natural gas and power, the crystallizer may be driven directly with low pressure steam from a natural gas boiler in lieu of using mechanical vapor recompression. The high-solids brine from the evaporator goes to the crystallizer feed tank and is pumped to the crystallizer for further concentration. As the evaporation process continues, the concentration of the brine increases, and as that happens, the solution becomes super-saturated and salts precipitate from the solution, resulting in a highly concentrated brine slurry. Centrifuges are



***Veolia's HPD® evaporation and crystallization technology enables the mine water treatment system to achieve Zero Liquid Waste.***

used to dewater the brine slurry, creating a non-hazardous solid waste containing no free water, facilitating landfill disposal.

- Ancillary systems include chemical storage and feed systems, a lime water preparation system used for remineralization, a clean-in-place system for the RO membranes and a compressed air system.

### **System improves environmental quality**

Both the solid waste from the centrifuges and the dewatered sludge generated from the two softening processes pass the paint filter test to meet landfill requirements. This means no liquid waste leaves the client's property. In addition, the discharged water improves the quality of water in the receiving stream, a major environmental benefit.

The ZLW approach is available through Design-Build and Design-Build-Operate contracts. When Operations are included with the agreement, the process guarantee is extended through the life of the operating contract. This ensures operational efficiencies, including high system availability, long-term operational life and minimal downtime for maintenance, among other advantages. More importantly, the system promotes responsible environmental stewardship and sets a new standard for water treatment in the mining industry.

Such support is another example of how Veolia Water Solutions & Technologies applies its portfolio of 350 proprietary technologies to deliver patented processes, standardized products, packaged systems and engineered solutions to a range of industries.

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### **Company Information**

**Veolia Water Solutions & Technologies**, subsidiary of Veolia Water, is a leading design and build company and a specialized provider of technological solutions in water treatment.

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