

# Zero Liquid Discharge in the Mining Industry



# Transforming mining wastewater into a valuable resource



## THE CLIENT

Mining company in China



## INTEGRATED MEMBRANE SOLUTION: REVERSE OSMOSIS



## OUTCOME

Achievement of zero liquid discharge (ZLD) in combination with water for irrigation and industrial purposes

## THE CUSTOMER

The customer is a large global mining group that is engaged in the exploration and extraction of metals such as copper, gold, zinc, lithium, silver, and molybdenum. Their activities also include in-house research and engineering of mining solutions.

As an important player in the global mining industry, the customer is committed to becoming a green, high-tech, leading global mining company, contributing to global economic growth and sustainable development by producing and supplying high-quality minerals with minimum environmental footprint.

## THE PROJECT

In line with national environmental protection requirements and to reduce operational water costs, the project was designed to achieve complete wastewater reuse and ZLD.

The system has a treatment capacity of 25,000 m<sup>3</sup>/d. The process includes enhanced pretreatment, integrated reverse osmosis (RO) membrane treatment, sulfate separation, nanofiltration salt separation, mechanical vapor recompression (MVR) concentration, and evaporation crystallization. The reclaimed water is reused as both irrigation water and industrial supply water.

## FAST FACTS

### Location:

Inner Mongolia, China

### Technology:

Integrated membrane solutions for ZLD applications

### Application:

Water reuse and waste reduction

### Plant capacity:

25,000 m<sup>3</sup>/d

### Water type:

Mine water

### Start-up date:

December 2022

### Number of elements:

1,260 pieces

### THE CHALLENGE

The mine effluent contained high salinity, with total dissolved solid (TDS) levels above 20,000 mg/L—predominantly chloride. To meet project requirements and minimize thermal downstream processes, the three-stage RO system is designed for a recovery rate of 75% and operates at nearly 70 bars. The system is designed to achieve a salt rejection of 98% in the first year and maintain a minimum of 95% for the following three years. In addition, high hardness and the risk of calcium sulfate scaling made the RO design particularly challenging.



### THE SOLUTION

Five parallel RO trains were designed, each with three stages and equipped with booster pumps at every stage, using MANN+HUMMEL MICRODYN seawater RO elements. Each line delivers a capacity of 208 m<sup>3</sup>/h. The low-energy MICRODYN SWL 8040-400/34 elements provide a nominal NaCl rejection of 99.75%. The wide 34-mil feed spacer ensures minimum fouling, good cleanability, and minimum pressure drop.



### THE RESULTS

Since the start-up in 2022 and until the publication of this case study, the RO system is achieving a permeate TDS below 1000 mg/L, thus achieving the required salt rejection and making it directly reusable for industrial use. The system delivers a reuse ratio greater than 75%, with more than 18,750 m<sup>3</sup>/d of reclaimed water supplied, meeting the customer's demand as well as national regulations to address water scarcity in the mining area while reducing pollutant discharge, lowering external water procurement, and cutting wastewater disposal costs.



**PROCESS FLOW** - RO operation flow chart

## FEED

Value	COD <sub>Cr</sub>	NH <sub>3</sub> -N	TN	COD <sub>Mn</sub>	BOD <sub>5</sub>	HCO <sub>3</sub> <sup>-</sup>	F <sup>-</sup>	Total hardness
mg/L	30	5	8	20	10	240	2.4	6,017

  

Value	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	Na <sup>+</sup>	Mg <sup>2+</sup>	Ca <sup>2+</sup>	TDS	SiO <sub>2</sub>	TP
mg/L	12,000	518	5,344	220	2,040	20,390	19.2	1

## PERMEATE

Value	COD <sub>Cr</sub>	NH <sub>3</sub> -N	TN	TP	COD <sub>Mn</sub>	BOD <sub>5</sub>	TDS	Cl <sup>-</sup>
mg/L	<20	<1.5	<1.5	<0.1	<10	<6	<1,000	<600

### Membrane model: 8040-SWL-400/34

Number of RO trains	5
Number of passes	1 pass, 3 stages
System array	42
# of elements per pressure vessel	6
Total number of elements	1,260
Permeate flow	156.2 m <sup>3</sup> × 5
Feed flow	208.3 m <sup>3</sup> /h*5
Recovery rate	75%
Pretreatment	UF

Complete our contact form  
to connect with a product expert:

[CONTACT US →](#)

Learn more about our  
RO water spirals:

[LEARN MORE →](#)