Saltworks™

ElectroChem RO Brine Concentrator for Treating Mining Waters

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Mining Water Treatment & Technology

The Project:

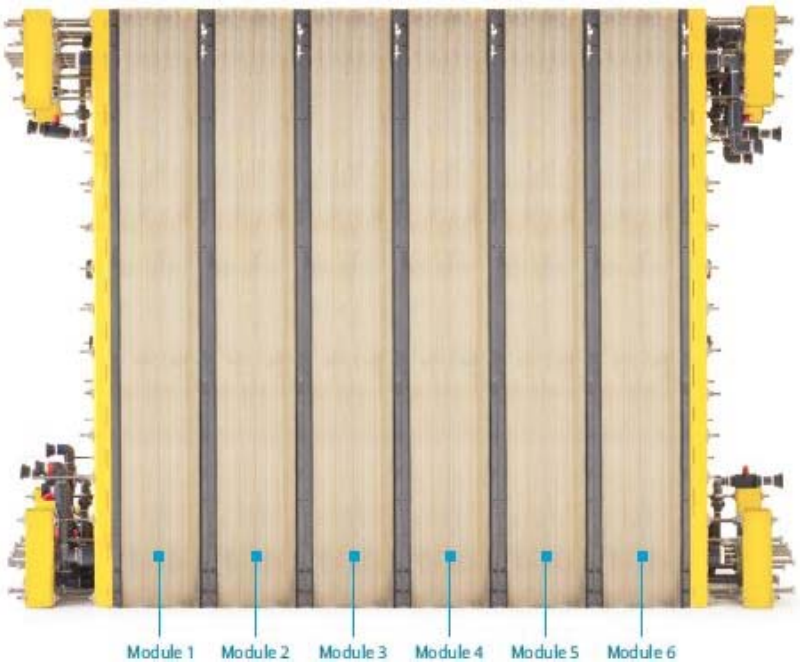
- Treat mine run-off and tailings waters at active mine sites for extreme recoveries (low brine volumes), low cost, and less chemicals (no lime softening)
- Full scale commercial modules employed @ site
- Meet discharge requirements including fish mortality tests
- Four pilots: all successful in meeting reliability and economic objectives

The ElectroChem RO Brine Concentrator Technology:

- Proven electrodialysis technology with electrode protection
- Hybridize with reverse osmosis for high recovery
- Chemical free treatment
- Robust IonFlux Ion Exchange Membrane

ElectroChem RO Brine Concentrator

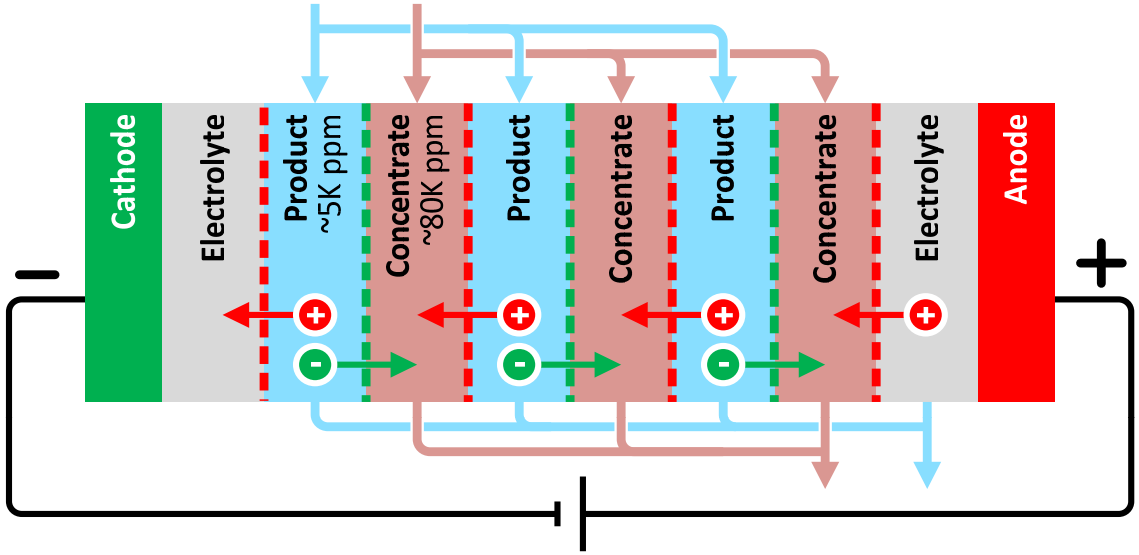
- Based on well established electrodialysis (EDR) technology: 50 years of implementations
- Saltworks' patented electrode fouling protection
- Low pressure operation (<20 psi)
- Self "cleaning" through reversal
- Desalt to any concentration
- Removal of multivalent ions
- Modular



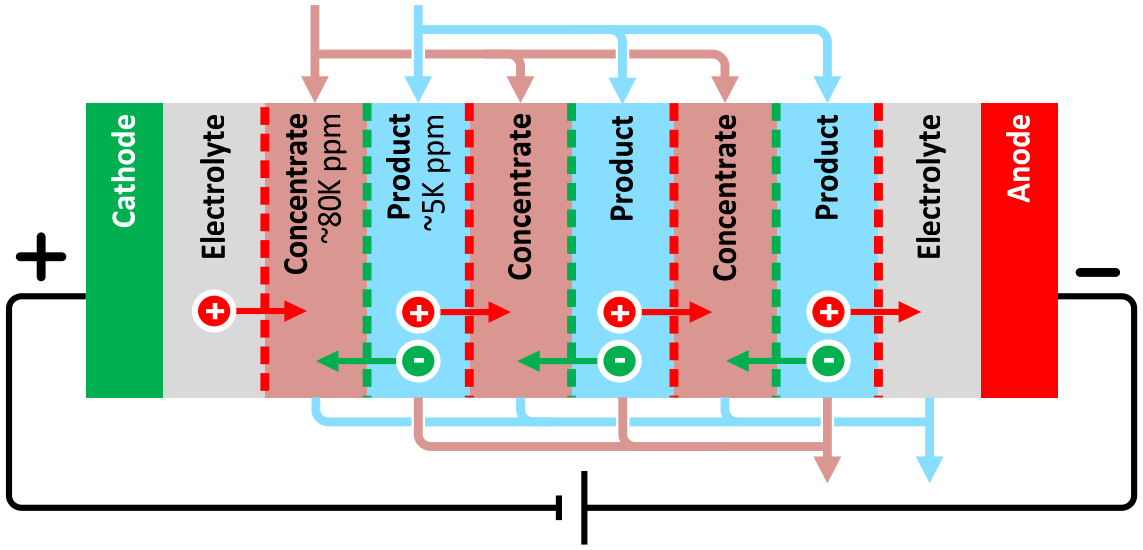
Saltworks Modular ElectroChem RO Brine Concentrator Stack

ElectroChem RO Brine Concentrator Stack Self Cleaning

Forward Mode

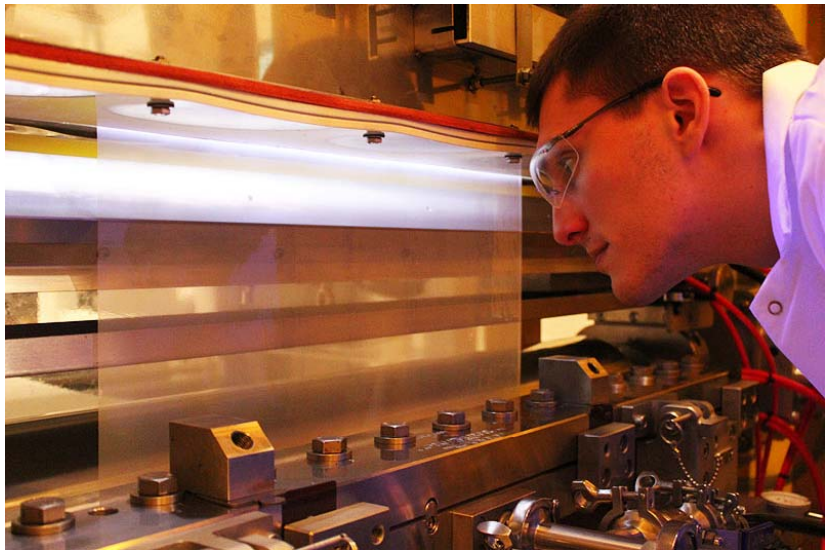


Reverse Mode

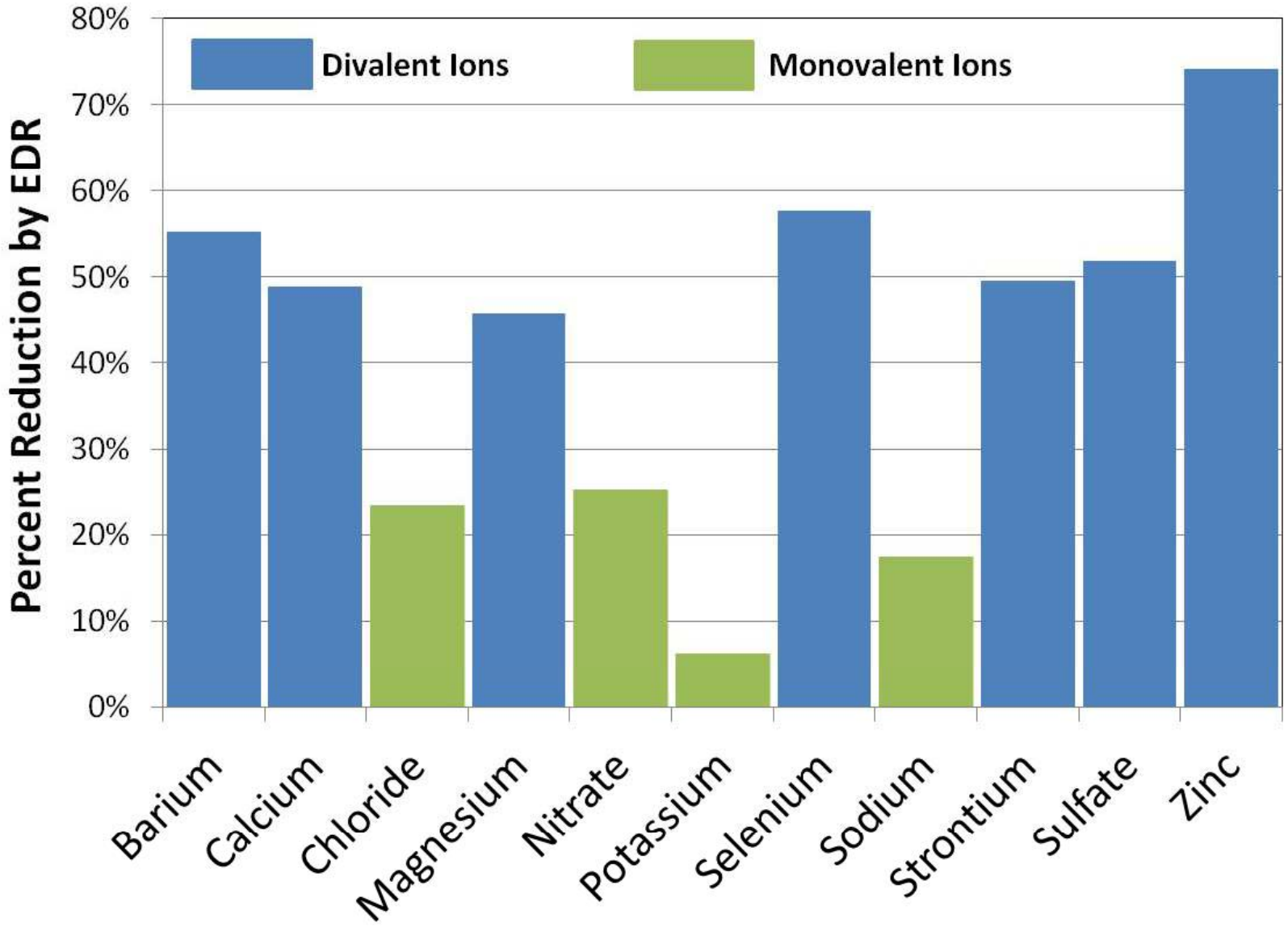


IonFlux Ion Exchange Membrane

- Ductile and conductive base polymer
- pH 0-12, 0-60^{o}C
- 1/10th thickness of traditional membranes, but tougher and smoother (less fouling potential)
- High multivalent ion transport, high selectivity
- Selective ion removal

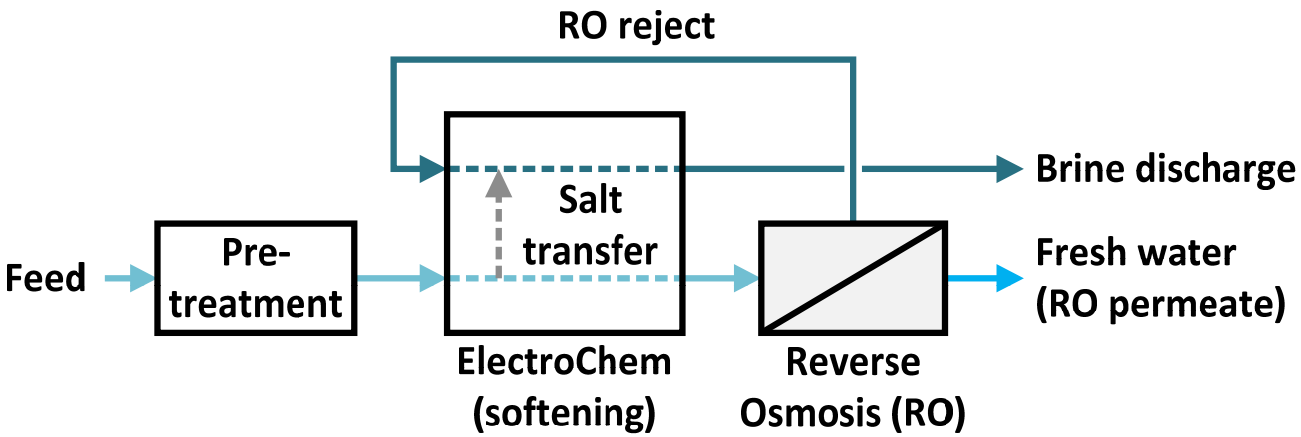


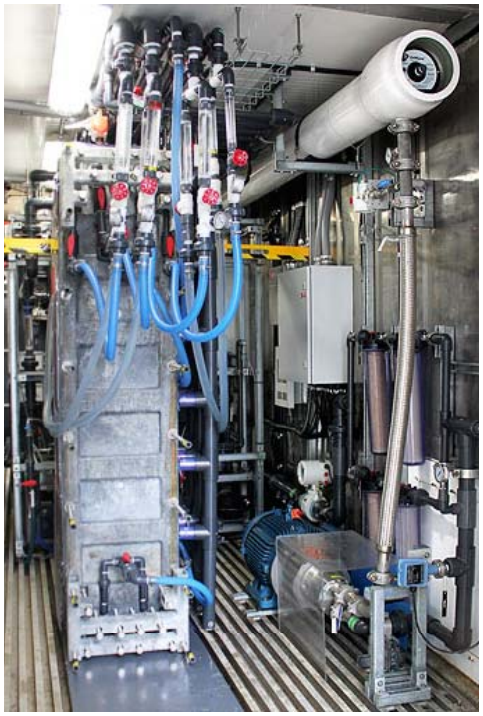
ElectroChem - Chemical Free Softening



ElectroChem RO Brine Concentrator

- Leverage RO strengths, overcome drawbacks
- ElectroChem softens RO inlet and concentrates RO reject
- Typical 50% RO reject volume reduction over lime-RO
- Increased RO reliability – RO operates mostly on NaCl
- Remove or reduce lime softening

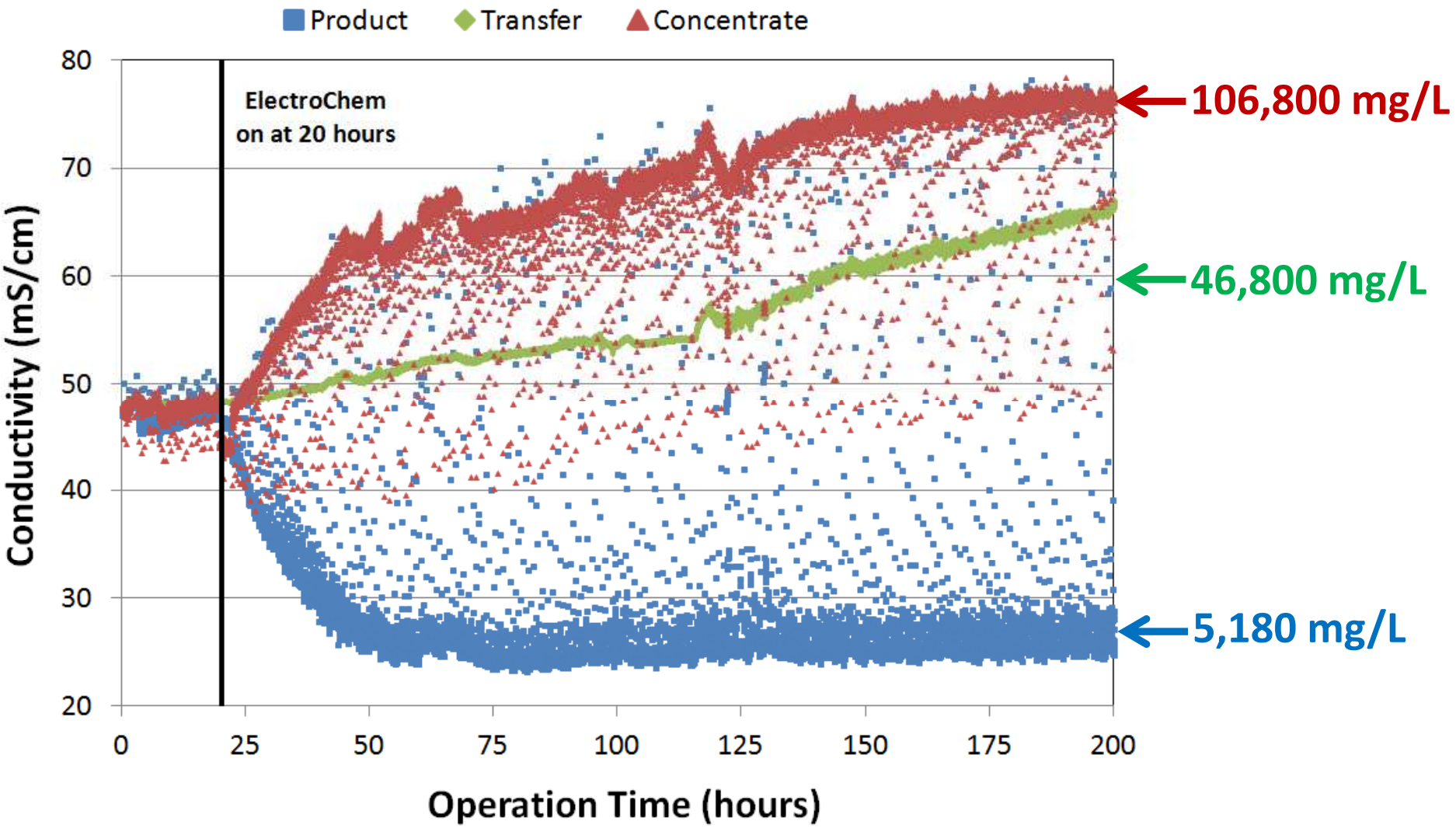




ElectroChem RO Brine Concentrator

ElectroChem RO Brine Concentrator

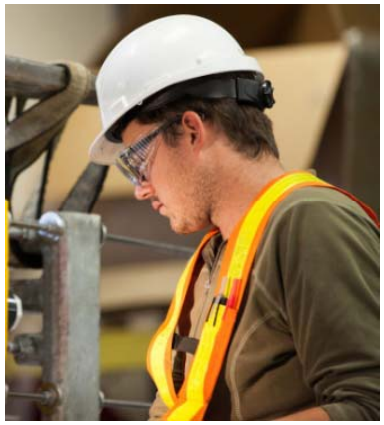
- Plant Feed 22,100 mg/L TDS concentrated to 106,800 mg/L



Commercial Production & Services

- 15,000 ft^2 ElectroChem RO Brine Concentrator development, production, and support facility

ElectroChem Brine Concentrator Stack Production and Assembly



Quality Assurance

Customer Training Center

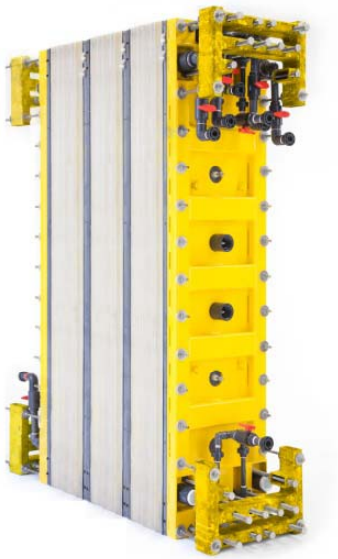
24/7 Remote Customer Support

Mine Water Treatment Projects

Project	Technology	Objective
Coal Runoff	EDR-RO	Selenium, heavy metals
Zinc Tailings	EDR	Heavy metals
Copper Tailings	EDR	Sulfates, heavy metals
Oil Sands Mining	EDR-RO	Brackish mine water

Micro Stack

Micro Pilot



Modular Full-Scale Stack

ElectroChem RO Brine Concentrator Pilot

- Up to 50 m3/day containerized plant
- Pre-treatment: clarification, media filters, MF, UF
- Desalination: ElectroChem RO Brine Concentrator
- Automated: data acquisition, self cleaning, auto start/stop

Multimedia Filtration

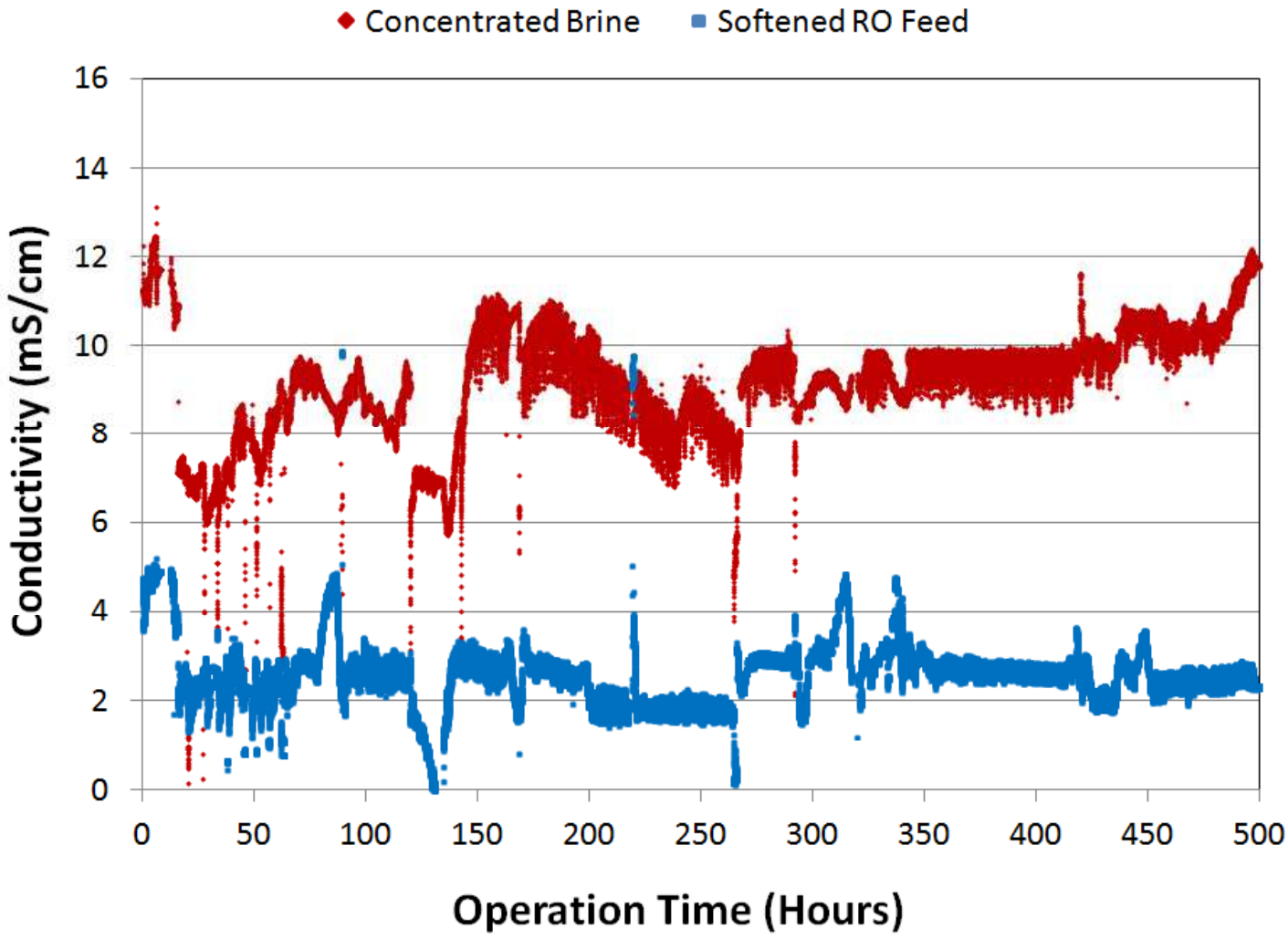
Microfiltration

Containerized Plant

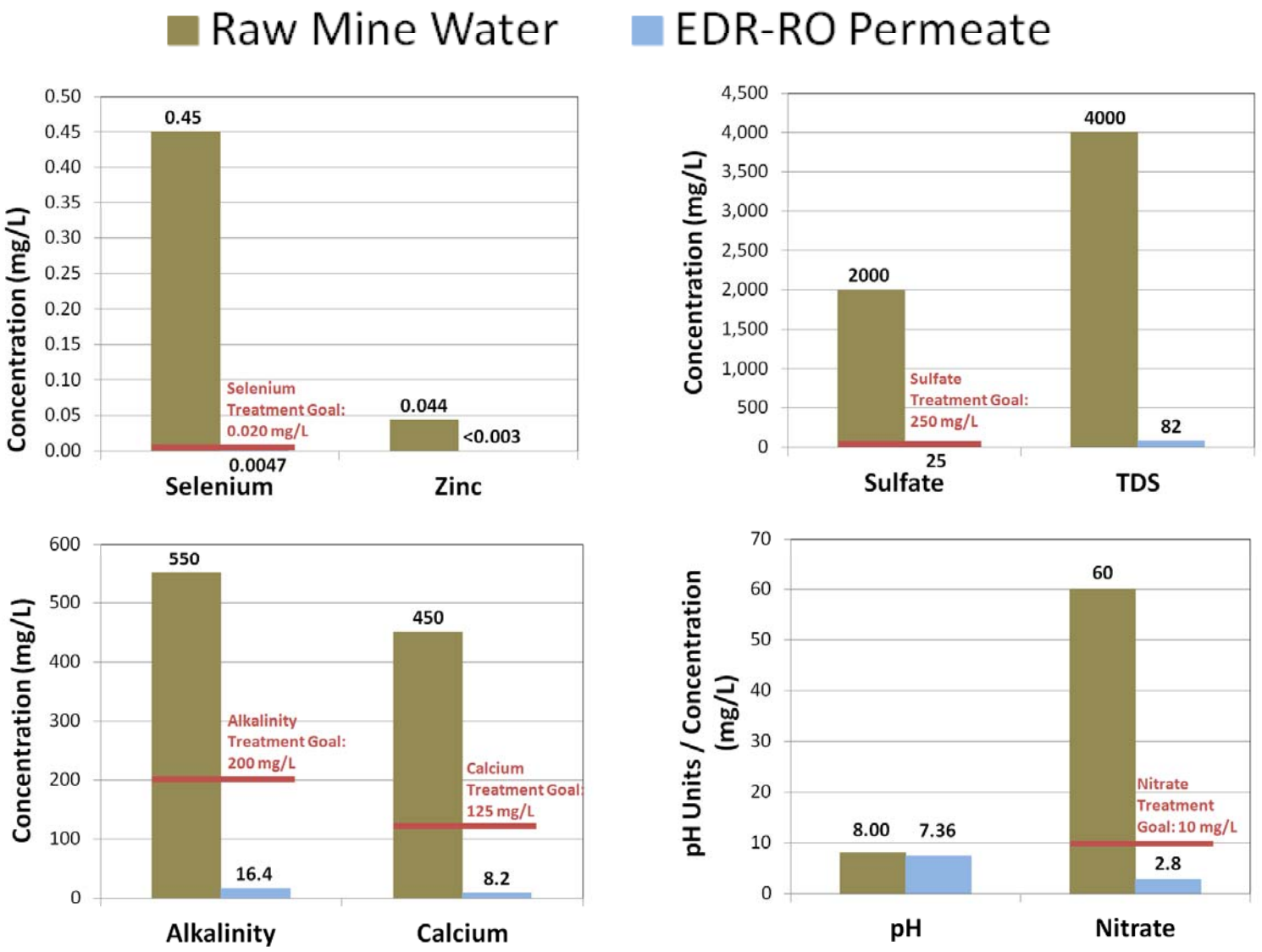
Automated Controls

Reliable Operation & High Recovery

- ElectroChem RO Brine Concentrator achieved 80% recovery
- Lime-RO achieved 60% recovery



Coal Mine: Met All Discharge Limits



Zinc Tailings: TDS Results

- Technology: ElectroChem RO Brine Concentrator

Parameter	TDS (mg/L)
Raw water	5,440
Discharge Goal	< 1,500

Parameter	TDS (mg/L)
Brine	**13,200**
Freshwater	**1,200**
Recovery	**66%**

Copper Tailings: TDS Results

- Technology: ElectroChem Wastewater Desalter

Parameter	TDS (mg/L)
Raw water	2,460
Discharge Goal	< 1000 (SO4 < 500)

Parameter	TDS (mg/L)
Brine	**9,730**
Freshwater	**700**
Recovery	**81%**

YOUR PROJECT?

- Contact us with your project needs: projects@saltworkstech.com
- Desktop studies (free), pilots, full scale plants: we deliver them all

ElectroChem RO Brine Concentrator Micro Stack

ElectroChem RO Brine Concentrator Micro Pilot

ElectroChem RO Brine Concentrator Full-Scale ElectroChem Stack

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