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Water Scarcity, ESG and Rising Costs: Rethinking Zero Liquid Discharge with a One-Step Approach

Unlocking water recovery from high-salinity mining streams while reducing complexity and project risk

Presented by Alan Tan, Manager, Treatment Solutions



Mining's Growing Water Challenge

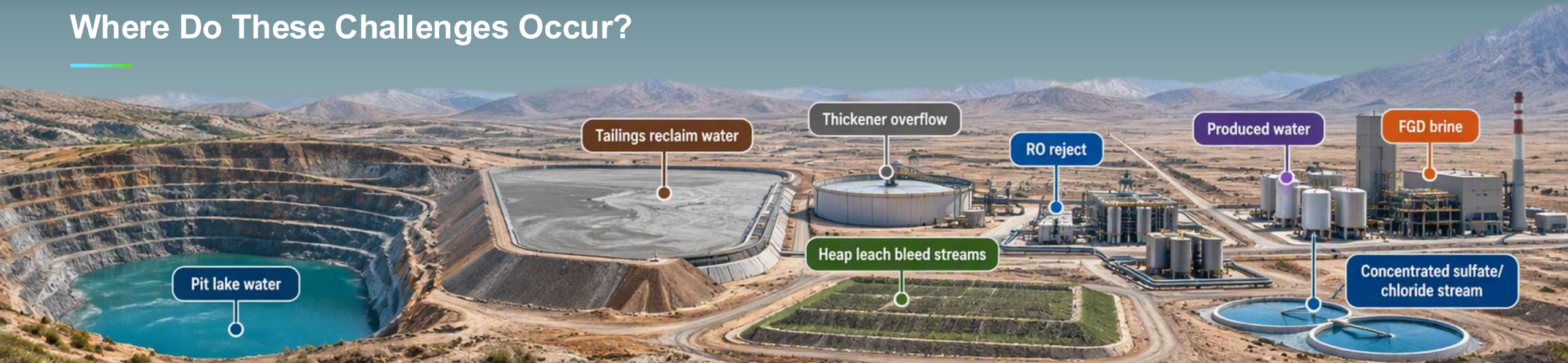
Water is a critical input for mining – and a scarce resource.
Finding smarter ways to manage, recover and reuse water is essential for a resilient and responsible future.

Key Drivers

- **Water Scarcity**
- **ESG & Compliance**
- **Water Recovery**
- **Disposal Cost**

"Conventional treatment often reaches a practical recovery limit before scaling and fouling become unmanageable."

Where Do These Challenges Occur?



Unlocking Water Recovery from Challenging Mining Waters

A **modular, high-recovery ZLD technology** for tailings water, process brines and mine-affected water



Pretreat

↓

Concentrate

↓

Recover water

↓

Create solids

↓

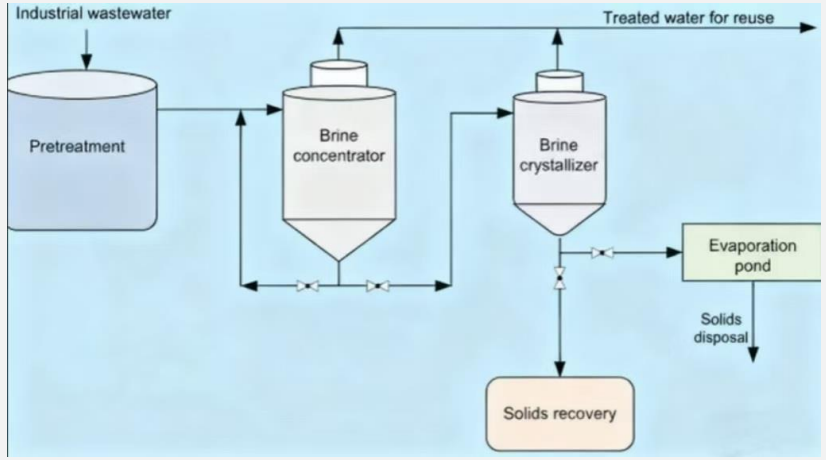
Enable reuse

A Simpler Path to Zero Liquid Discharge

Conventional ZLD often becomes increasingly complex

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Conventional ZLD treatment train

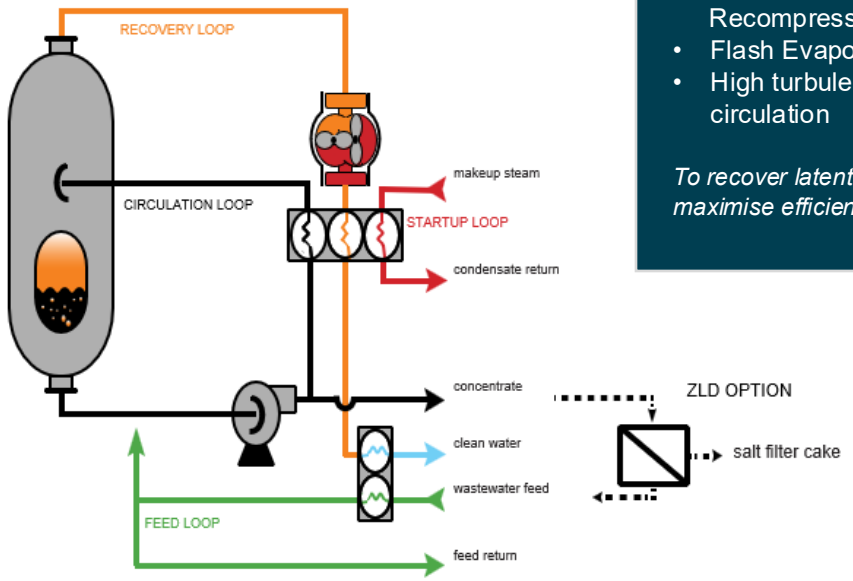


Traditional process
Pretreatment → Evaporator → Crystalliser → Dewatering

Multiple systems	Longer commissioning
High CAPEX & high Energy Consumption	Chemical-intensive pretreatment
Large footprint	Frequent Cleaning/ Downtime

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VACOM One-Step ZLD



Technology

- Mechanical Vapour Recompression (MVR)
- Flash Evaporation
- High turbulence circulation

To recover latent heat & maximise efficiency

Single integrated process	Faster deployment
Compact modular design	Reduced pretreatment
Self-scouring operation	

Experience Across Complex Industrial Water Streams

Proven Application	Water Characteristics	Similar Mining Stream
 **FGD Brine** (Power Generation)	**High chlorides, sulfates, scaling salts**	 **Mine Brine** (e.g. process brines, desalination concentrate)
 **Produced Water** (Oil & Gas)	**High TDS and organics**	 **Produced Water** (high TDS, organics)
 **Automotive Wastewater** (Manufacturing)	**Oils, metals, salts** >	 **Automotive Wastewater** (e.g. plant effluent, equipment washdown)
 **Manufacturing Wastewater** (Various Industries)	**Metal contaminants**	 **Manufacturing Wastewater** (metal-bearing process water)
 **Power Industry** (Conventional & Renewables)	**High scaling potential**	 **Power Industry** (thickener overflow, TSF reclaim water)

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RO Brine Reduction Case Study

Transforming Battery Wastewater (RO Reject) into a Water Reuse Resource

Operating conditions

Application
Battery Plant Reject Water
RO reject stream from UPW generation

Industry
Semiconductor/ Battery Recycling

Flow Rate
16,000 GPD

Goals

Concentrate brine and reuse the distillate

How Vacom ZLD Works

Evaporation + Crystallisation in a Single Process

Feed Water (Brine)

Capacity
60 kL/ day



Recovered Distillate
High quality water for reuse

Concentrated Brine (solid)

Capacity
1.44 kL/ day

Results

>96% reduction.
Zero Liquid Discharge.

40x
Concentration Factor

Crystal Salt (concentrate) is disposed of

Solid Waste
Reduce solid waste volume to reduce disposal cost

Distillate (recovered water) is used for

UPW Makeup
High-quality water for plant operations

Produced Water Case Study

Demonstrating high-recovery water reuse on complex high-TDS streams

Operating conditions

Application
Produced Water Treatment

Industry
Oil & Gas

Flow Rate
240,000 GPD (≈ 910 m³/day)

Key Challenges

- High TDS
- Hydrocarbons (oil)
- Disposal costs
- Water scarcity
- Increasing regulatory pressure

How Vacom ZLD Works

Evaporation + Crystallisation in a Single Process

Feed Water
- Oil: 1,000 mg/L
- TDS: 20,000 mg/L



Recovered Distillate
High quality water for reuse



Concentrated Brine

Oil
20,000 mg/L
TDS
400,000+ mg/L

Mining Relevance

Many mining water challenges **share similar characteristics**, including **high salinity, scaling potential, disposal constraints, and the need for water recovery**.

Produced Water Challenge	Mining Equivalent
High TDS	Tailings reclaim water
Organics (oil, hydrocarbons)	Pit dewatering water
Scaling salts	Mine brines
Disposal cost	TSF water management
Water recovery	Site water security

Results

20x
Concentration Factor

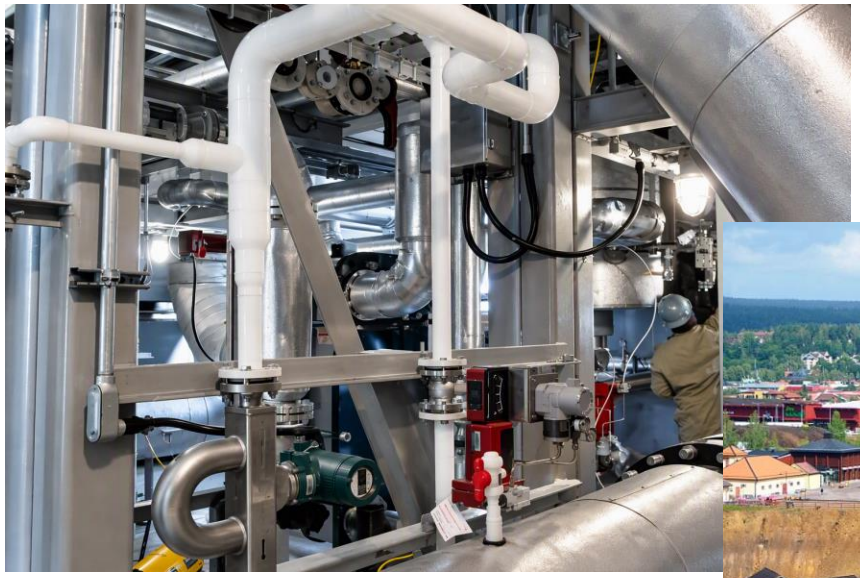
Significant volume reduction

Water recovered for reuse

Minimised liquid disposal

Stable operation on high salinity water

Mining Acid Wastewater | Recomet AB





Challenge & Solution

Located at Sweden's historic **copper mine**, a designated UNESCO World Heritage Site.

Acid and ferric sulfate backwash from the ion-exchange resin is processed in an **evaporator.**

The **high-value concentrate is recovered for sale**, while the **distillate is discharged directly to the river.**

Key Outcome

- Recover value
- Reduce waste volume
- Return treated distillate to the river

Case study: Mining
Sweden



Operating conditions

ION Exchange backwash water

32,000 GPD
Flow

6 Years
In Service

25,000 mg/LTDS
Backwash Water Inlet

400,000+ mg/L TDS
Concentrate

16×
TDS Concentration

20%
Lower Polymer Consumption

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Complex, metalworking, auto parts manufacturing oily wastewater

High-Recovery Treatment of Complex Industrial Wastewater

Customer	Challenge	Solutions	
		Oil	TDS
AISIN	• 30,000 GPD of Wastewater • Oily Emulsions, Coolants, Acids, Heavy Metals • 10,000 mg/L Oil • 3,000 mg/L TDS	800,000 mg/L	240,000 mg/L
		ZLD – 80x concentration	
CATERPILLAR	• 20,000 GPD of Wastewater • Spent Oil, Oily Emulsions, Coolants, Heavy Metals • 50,000 mg/L Oil • 10,000 mg/L TDS	800,000 mg/L	160,000 mg/L
		ZLD – 16x concentration	
EATON	• 25,000 GPD of Wastewater • Coolants, Emulsions, Metals, Salts • 25,000 mg/L Oil • 2,000 mg/L TDS	800,000 mg/L	64,000 mg/L
		ZLD – 32x concentration	
TOYOTA	• 40,000 GPD of Wastewater • 2,000 mg/L • Oil10,000 mg/L TDS	60,000 mg/L	300,000 mg/L
		ZLD – 30x concentration 1,300-1,500 GPD	

Results

Revenue recovery
Waste oil sold as fuel

Significantly reduces waste volume

Cuts freshwater demand

Tight, manageable waste stream

Real-World Installations

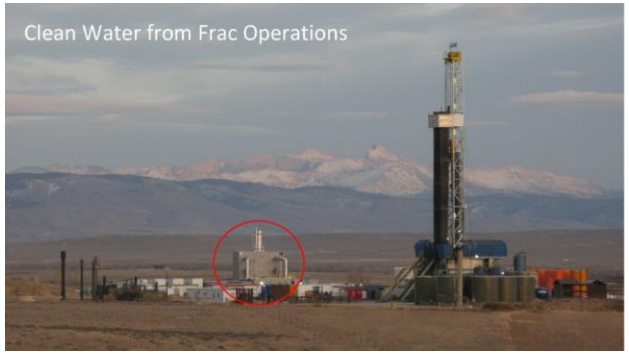






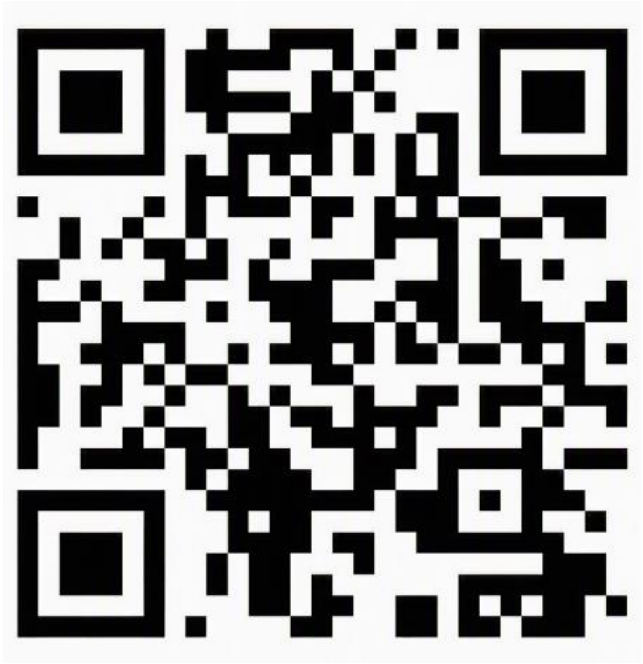






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