Water Solutions

DUPONT

Zero Liquid Discharge (ZLD) Optimization at ArcelorMittal's Plant

Mining & Steel

Next-generation reverse osmosis technologies boost efficiency and reduce downtime at South African steel factory

Background

South African legislation requires that the mining and mineral processing industries have as little impact on the environment as possible, placing strategies like Minimum Liquid Discharge (MLD) and Zero Liquid Discharge (ZLD) high on the water management agenda. However, with high levels of metals, organics and salinity to deal with, such systems come under intense strain, often resulting in costly downtime events, which can lead to non-compliance fines and loss of manufacturing time.

Plants require reliable, energy-efficient technologies for wastewater reuse that are able to cope with a wide variety of feedwater conditions, drive higher recovery rates, and reduce cleaning frequency. By taking this approach, operators can collectively reduce dependence on freshwater resources, especially in a region facing water scarcity and drought conditions.

The Challenge

ArcelorMittal South Africa, Africa's largest steel producer with an annual capacity production of 6.1 million tonnes of liquid steel, had been experiencing operational inefficiencies associated with the reverse osmosis (RO) section of its existing ZLD plant at Vanderbijlpark, South Africa. They were looking for a solution to improve performance reliability in the system and reduce the need for costly shutdowns and cleanings.

With significant restrictions on the feed pump curve, it was essential to find a solution that could offer high recovery, as well as drive down energy usage and cleaning frequency. Suspended solids, colloids and pathogens from feed water were removed by Water Solutions' ultrafiltration technology, enabling significant protection to the downstream RO system. However, the filtrate water still experienced high levels of fouling, potentially due to elevated levels of dissolved organics.

Fast facts

Project:	ArcelorMittal ZLD Plant
Location:	Vanderbijlpark, South Africa
End user:	ArcelorMittal
OEM:	Veolia
Source:	Wastewater
Application:	Minimum Liquid Discharge/ Zero Liquid Discharge
Market:	Steel Industry
Key Solutions:	FILMTEC™ FORTILIFE™ CR-100 FILMTEC™ ECO PRO-400

Key benefits

- High fouling resistance
- Significant economic savings
- Low CIP frequency
- High flux performance

The Solution

Working alongside Veolia Water Technologies, Water Solutions recommended a two-stage approach using its latest generation, fouling-resistant RO membrane technology: FILMTEC™ FORTILIFE™ CR-100 membranes for the first stage, followed by FILMTEC™ ECO PRO-400 membranes for the second stage.

A competitor recommended its own similar products. Each supplier installed their membranes into two different operational RO trains to conduct a side-by-side test. After one year, the following results and economic evaluation of the two tested trains was generated:

Metrics	Units	Competitor	Water Solutions
Feed Flow	m3/h	67.4	81.6
RO System Flux	LMH	14.9	20.2
Feed Pressure	bar	13.25	12.74
Stage 1 DP	bar	1.20	1.04
RO Recovery	%	54.4	60.8
CIP Frequency	Per year	14	10

Metrics	Units	Competitor	Water Solutions
Specific energy	kWh/m3	0.85	0.65
Energy cost per element	USD/Yr	$510	$390
Cleaning cost per element	USD/Ele	$141	$101
Total Savings per element	USD/Yr	-	$160

*Costs are distributed over a single year of operation (length of trial)

Tests showed the following key performance differences between the two options:

- Despite significantly higher flux (throughput), FILMTEC™ FORTILIFE™ CR-100 demonstrated higher performance, particularly in recovery rates.
- A significantly lower cleaning frequency rate was required despite higher throughput from the plant.
- Even with a reduced cleaning frequency rate and notably higher flux and recovery, the differential pressure was lower.
- The train incorporating FORTILIFE™ CR-100 and ECO PRO-400 processed 45 percent more effluent than the competition throughout the year.

The Benefits

Working alongside Veolia Water Technologies, Water Solutions helped ArcelorMittal to improve the performance of their RO with the latest generation FILMTEC™ membrane solutions.

Water Solutions' technologies provided ArcelorMittal with significant savings over the incumbent competitor. Despite dynamic feedwater qualities – averaging over 6000 µS/cm and high TOC – the FILMTEC™ membranes proved capable of withstanding fluctuations, providing consistency in operation and generating savings in energy and cleaning costs, concurrently.

FILMTEC™ FORTILIFE™ and FILMTEC™ ECO technologies reduced cleaning frequency requirements and increased water recovery, while improving energy efficiency – proving that by applying tailored, high performance technologies to inefficient systems, the reliability of operations and total water costs can be transformed.

Long-Term Achievement

This customer success story demonstrates the importance of carefully selecting reliable, efficient technologies for water reuse systems that can withstand challenging feedwater conditions, which boosts operational performance and cost-savings.

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Have a question?
Contact us at:
dupont.com/water/contact-us

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