Case Study: Flocon® 135

Category:

Industry: Membrane
Sub-Industry: Desalination
Application: Scale Control

Solution – Key Parameters

- Improved Recovery Rate
- Reduced Total Cost of Operation
- Membrane life extension

01 FLODOSE®
Comprehensive prediction and Flocon® product dosage recommendation
Improve recovery and permeate output of Reverse Osmosis operation

02 FLOCON®
High performance Flocon® antiscalants, biocides & cleaners for Reverse Osmosis operation
Improve Reverse Osmosis system

03 FLOTRAK™
Real time accurate monitoring for the control and efficient use of Flocon® antiscalants
Reduce overall operating cost
**Ridgewood - Company Overview**

Ridgewood was previously an affiliate of Ridgewood Energy (USA) which has been investing in independent water, power and other environmental projects since the late 1980s. Ridgewood Energy has an operating capital exceeding USD 2.3 billion.

In early 1999, Ridgewood was established to provide infrastructure requirements; mainly water and power, on a ‘Build, Own and Operate’ basis. In less than 18 years Ridgewood became the pioneer privately owned company in the sector of water desalination, working on this particular basis, with an investment exceeding EGP 700,000,000.

Ridgewood has over 80 Desalination plants, with capacities ranging between 500 and 20,000 cubic meters, which serve more than 150 resorts and tourist projects. The company currently has an operating and ‘under completion’ desalination capacity of **85,000 cubic meters per day**. Ridgewood also has 6 electric power generation plants, with capacities ranging between 2 to 10 megawatts.

For 20 years Ridgewood has manufactured and sold its own brand name water desalination equipment that has been used in the company’s expansion. The equipment has demonstrated high reliability, dependability and value.

**Plant Overview**

The plant is set up to operate on a brackish feed water source pumped out from 2 deep wells of depths approximately 80 meters. However the raw water is showing high concentrations of both calcium and sulphate ions which results in a high concentration of total hardness, up to 8000 mg/l as CaCO3.

Water of hardness greater than 300 mg/l as CaCO3 is considered to be ‘very hard’, therefore the plant has a concentration which is approximately 160 times the accepted level for safe usage.
Scaling due to high water hardness may be in several forms:

- **Limestone**: CaCO₃
- **Dolomite**: CaCO₃ – MgCO₃
- **Gypsum**: CaSO₄.2H₂O [Orascom Scale]

The most severe type of scale is calcium sulphate known as gypsum (CaSO₄.2H₂O), that kind of scale is dominant in the Orascom plant. The problem caused by calcium sulphate is the presence of needle shaped scales that cannot be removed via conventional chemical cleaning procedures. This type of calcium scale can rupture the membrane surface.

**Challenge**

The membrane plant was installed in 2014 and consists of 3 reverse osmosis plants with capacities of 1,500 m³pd, operating with borehole feedwater.

From installation the system operated at a recovery rate of 60%. After 3-4 years, calcium sulphate challenges reduced the achievable recovery rate to 29%.

This resulted in additional costs associated with membrane replacement, chemical usage and downtime which reduced the availability of water for sale. In fact, the scaling issues were so severe that cleaning was not undertaken, membranes were just replaced.
BWA Water Additives were asked to review the operation and propose a solution to reduce the Total Cost of Operation (TCO), to lower membrane replacement costs and to increase water recovery rates.
BWA introduced their Total Membrane Solutions concept in order to identify opportunities for improvement/cost benefits.

Initially, the on-line Flodose® projection tool was used to establish theoretical improvements in plant operation based on fresh, representative water analyses obtained in site audits.

From this work Flocon® 135 was identified as the required chemistry to manage the calcium sulphate scaling risk potential, whilst improving recovery rates from 29% to 31.6%, after chemical cleaning it reached 38.3%.

The end user then agreed the trial with specific operation Key Performance Indicators (KPIs) to prove the benefits suggested.
The trial was conducted, following membrane CIP, and it confirmed the increase in recovery rate. Normalised data was reviewed and showed KPIs to be in line with expectations with no evidence of scaling.

Results

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<thead>
<tr>
<th>ELEMENT</th>
<th>CUSTOMER BENEFIT</th>
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<tbody>
<tr>
<td>Energy</td>
<td>Less scaling means reduction in deltA across membranes from 70psi to 30psi</td>
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<tr>
<td>Water</td>
<td>Higher plant availability increased water for sale by 22%</td>
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<tr>
<td>Asset Integrity</td>
<td>A decrease in scaling reduced membrane replacement from 30 % to 5% per annum</td>
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<tr>
<td>Environment</td>
<td>Reduction in dose rate from 3.5ppm to 1.5ppm with excellent operational performance</td>
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<td>Reduction in chemical cleaning by 75%</td>
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<tr>
<td>Cost</td>
<td>Membrane replacement costs reduced by 33%</td>
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