TechBrief

Liqui-Cel® MEMBRANE CONTACTORS

Rokeby Generating Station Saves 50% in Capital Expense by Using Liqui-Cel® 14x28 Membrane Contactors to Remove CO_2 to Extend Mixed Bed Resin Life

Lincoln Electric Systems (LES) recently commissioned a membrane decarbonation system using Liqui-Cel® 14x28 Membrane Contactors to remove CO2 prior to their mixed bed deionizers. The system was installed at the Rokeby Generating Station (RGS) in Lincoln, Nebraska.

Background

The Rokeby Generating Station is LES' primary peaking power station, totaling 255 MW and consisting of 3 duel fuel combustion turbines. The existing DI water system consisted of two single-pass, two-stage RO skids followed by a 31 ft^3 (0.87 m^3) mixed bed deionizer and two 250,000-gallon (943 m^3) storage tanks.

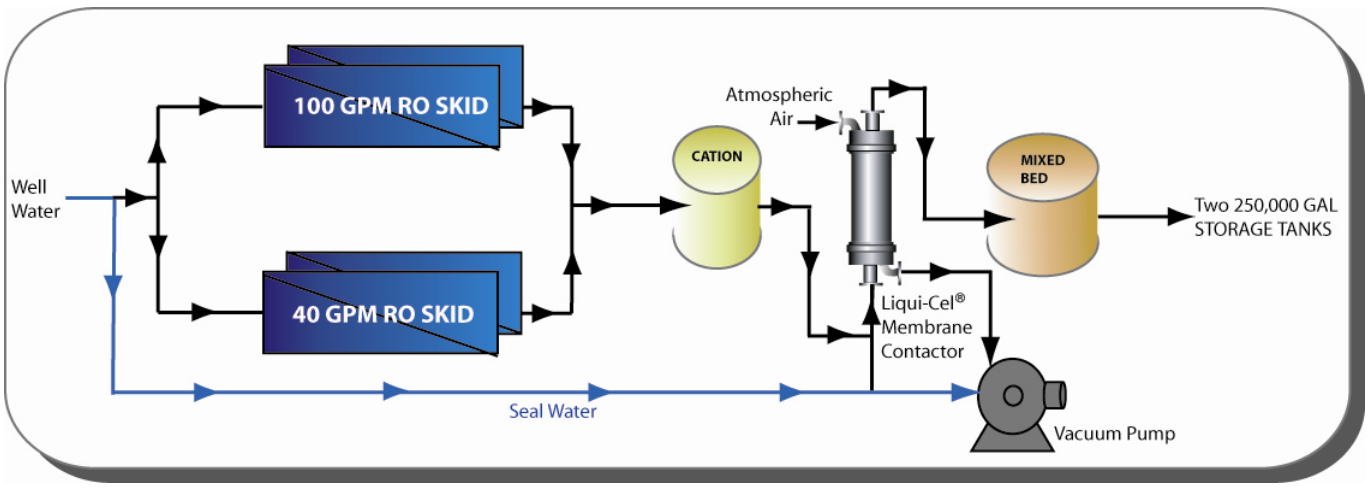
LES determined that the mixed bed unit was producing only 30% of its expected capacity (90,000 gallons actual vs. 300,000 gallons expected or 341 m^3 actual vs. 1136 m^3 expected). It was determined that the cause of the decreased capacity was due to dissolved CO2 in the water, which was overloading the anion resin. As the power capacity demand increased, LES had to act quickly to update their winter contingency plans.

Treatment Options

Multiple treatment options including chemical treatment and the installation of a forced draft degasifier were considered. Ultimately, chemical treatment was considered too risky because of its negative impact on increasing scale on the RO membranes. A forced draft deaerator was also considered impractical due to the large capital expense and size constraints at LES.

System Design

In 2005, LES began engineering a membrane decarbonation system using Liqui-Cel 14x28 Membrane Degasifiers. The system was designed to treat the combined water flow from both RO skids, approximately 150 GPM (0.6 m^3). The goal was to achieve approximately 90% reduction of dissolved CO2. Additionally, the system was designed to operate with vacuum assisted air sweep, using a liquid ring vacuum pump to draw atmospheric air through the Liqui-Cel Contactors.



Since the LES staff was able to design, fabricate, and install the Liqui-Cel degassing system, the total capital cost was approximately 50% less than the cost of a forced draft degasifier. The compact design also allowed LES to build the system inside of an existing building with minimal modification. The low system pressure drop through a Liqui-Cel Membrane Contactor system also eliminated the need for a re-pressurization pump further lowering operating costs for LES.

The degas skid was installed downstream of the RO skids and before the mixed bed. In order to maximize efficiency, a cation bottle was installed between the RO skids and the degas skid to reduce the pH and convert the HCO3 to free CO2 gas. *(See Fig. 1)*

Test Set Up

LES temporarily installed three 3.3 ft^3 (0.09 m^3) mixed bed bottles downstream of the degas skid. The bottles were installed in parallel for a total capacity of 9.9 ft^3 (0.28 m^3). During the test, only one of the RO units was operated, resulting in water flow of 40 GPM.

LES expected to achieve 138,000 to 168,000 gallons (522 m^3 – 636 m^3) throughput with this design. They actually achieved 191,000 gallons (725 m^3). Specific conductivity was 0.5 μS/cm and silica was 7.5 ppb. LES estimates the full-scale capacity will be approximately 617,000 gallons [(32 ft^3 / 9.9 ft^3)*191,000 = 617,374 gallons (2337 m^3)]. This represents an increase in the total capacity of the system by a factor of 5.9.

Summary

Liqui-Cel Membrane Contactors offer a cost-effective, efficient option for removal of carbon dioxide from process water. Removal of carbon dioxide prior to the mixed bed resins *significantly* improves regeneration times, thereby reducing operating costs and improving overall efficiency by minimizing downtime.

If you would like a Membrana representative to size a Liqui-Cel Membrane Contactor system for your application, please visit www.liquicel.com and click “contact us”, or call us at the numbers listed below.

ISO 9001:2000
ISO 14001:2004

Membrana – Charlotte
A Division of Celgard, LLC
13800 South Lakes Drive
Charlotte, North Carolina 28273
USA
Phone: (704) 587 8888
Fax: (704) 587 8585

Membrana GmbH
Oehder Strasse 28
42289 Wuppertal
Germany

Phone: +49 6126 2260 - 41
Fax: +49 202 6099 -750

Japan Office
Shinjuku Mitsui Building, 27F
1-1, Nishishinjuku 2-chome
Shinjuku-ku, Tokyo 163-0427
Japan
Phone: 81 3 5324 3361
Fax: 81 3 5324 3369

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