Liqui-Cel®

Membrane Contactor System is installed at the Baltimore Gas and Electric, Calvert Cliffs Nuclear Power Plant

Liqui-Cel Membrane Contactors from Hoechst Celanese Corporation are being used to deoxygenate the high purity makeup water at BG&E Calvert Cliffs Nuclear Plant in Lusby MD. Ecolochem, Inc., headquartered in Norfolk Virginia, designed, built, and now maintains the make-up water treatment system under a service contract. Ecolochem specializes in water treatment service contracts for emergency, short term and long term needs. The complete water treatment system where Liqui-Cel Membrane Contactors are incorporated is outlined below.

BALTIMORE GAS AND ELECTRIC, Calvert Cliffs NUCLEAR POWER PLANT

System Design

Ecolochem customized the make-up water system to meet the stringent make-up water quality needs of BG&E. The 100-300 gpm make-up system was installed and started up in September of 1996. The water treatment system consists of a two pass, polyamide membrane RO system, three step ion exchange polishing and a state-of-the-art deoxygenation system (see fig 1).

The deoxygenation system consists of three Liqui-Cel Membrane contactors. The contactors contain thousands of microporous hollow fiber membranes. The hydrophobic membrane acts as an inert support structure that allows the gas and liquid phase to come into contact at the membrane's pore. By altering the concentration and pressure of the gases in contact with the water, gases can be selectively dissolved or removed from the water.

The contactors on the system are valved so that they can be operated in a two in parallel feeding one in series configuration or a three in parallel configuration. Both configurations are designed to operate under vacuum. Vacuum is drawn on the bottom lumen side port of each contactor (see fig 2). In this custom design, the dissolved oxygen and TOC levels are routinely lowered to less than 100 ppb. The contactors are followed by Ecolochem's patented catalytic DEOX® process. This process lowers the dissolved oxygen to less than 1 ppb. This design represents one of many ways Liqui-Cel can be incorporated into a hybrid deoxygenation system.

Benefits

By lowering the dissolved oxygen level into the catalytic DEOX system, the size of the catalytic system is reduced. The hydrazine usage and cost at the plant is also reduced. This has minimized hydrazine handling and reduced the amount of hydrazine required on site. Furthermore, there is an added benefit of CO_2 reduction which reduces the frequency of off site regeneration of the downstream ion exchange demineralizers.

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Ecolochem currently includes Liqui-Cel Membrane Contactors in every service contract that requires deoxygenation. The modular design, ease of operation and minimal space requirements provide economic benefits to Ecolochem and endusers.

Liqui-Cel Membrane Contactors have ten times the surface area compared to a conventional degasing technology and can also be used as the sole degasification device on a water system. Currently the contactors are installed on a variety of systems ranging from 0.5 gpm to over 2500 gpm. They routinely deliver less than 1 ppb dissolved oxygen.

Figure 1:

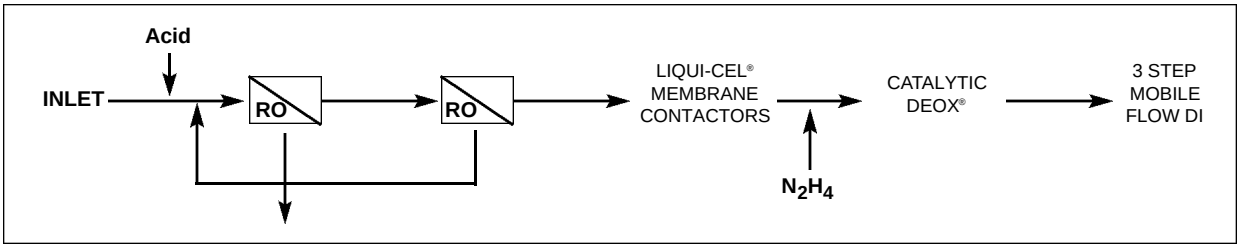
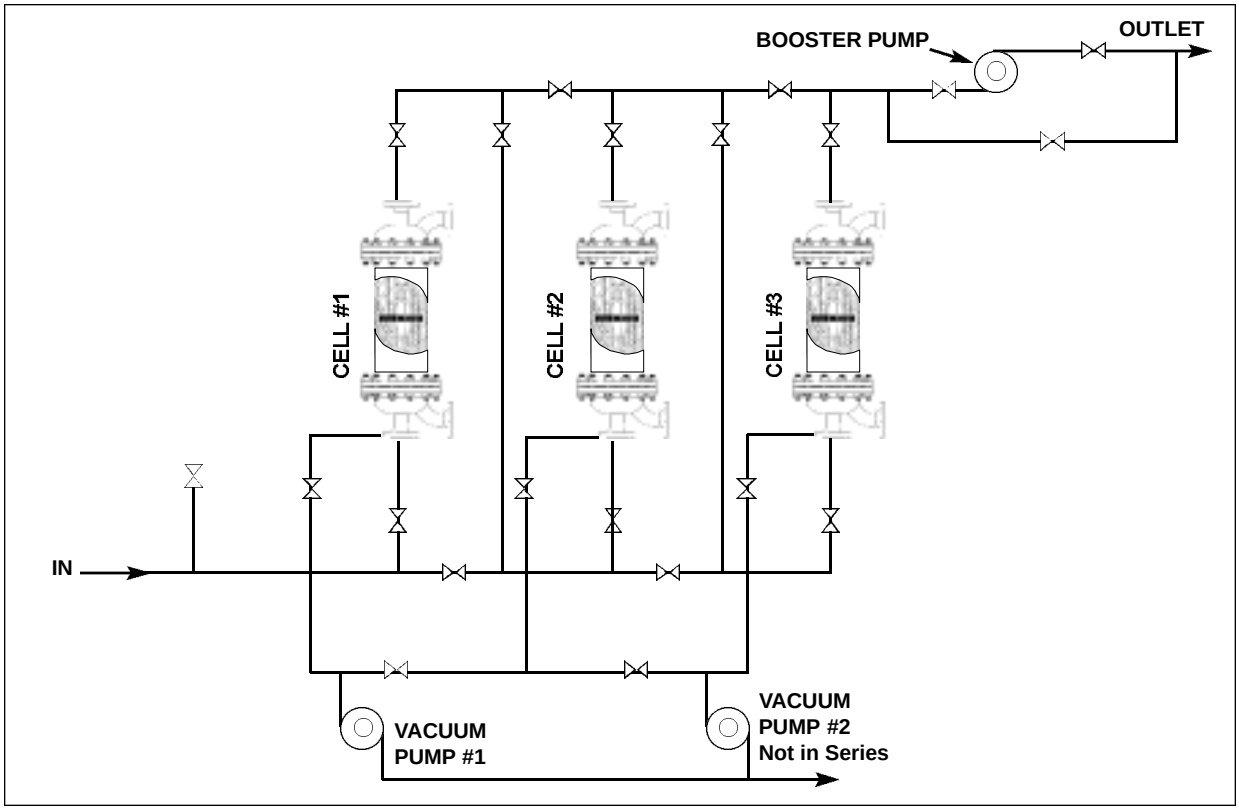


Figure 2:



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Membrane Contactor

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