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Liqui-Cel® Membrane Contactors

TechBrief

Deoxygenation of Make-Up Water Using Gas Transfer Membranes (GTM®)

Corrosion control in piping, boilers, and associated equipment is an important issue with power generation facilities. The presence of dissolved oxygen in process waters coming into contact with this equipment is one of the major sources of corrosion. In order to minimize this corrosion source, power generation plants remove virtually all dissolved oxygen in process water. Typically as raw make-up water enters the plant, it flows through various treating steps including mechanical and/or chemical means to remove dissolved oxygen. This treated make-up water is commonly held in a large storage tank of sufficient capacity and design to handle variations in the power facility's needs. Often these storage tanks are vented to the atmosphere. One major drawback to a vented storage tank is that it allows oxygen from the atmosphere to come into contact with deoxygenated water stored in the tank. Therefore water exiting the tank will show increased levels of dissolved oxygen as compared to that of the incoming water. Depending on the length of time that the water is in the tank, exit dissolved oxygen concentrations can become quite high.

DI Water Storage

A deionized (DI) water storage tank as described above is used at a nuclear power generation site in the United States. As a result, dissolved oxygen concentration in the plant make-up water was above specification.

Retrofitting an existing vented tank to eliminate the vent and supply an inert gas blanket or mechanical seal is very expensive. Storage tank replacement can also be costly and may not be practical in terms of downtime and other factors. Because of these issues a GTM® system provided by Ecolochem, Inc. was installed to solve this problem.

Ecolochem GTM systems utilize Liqui-Cel® Membrane Contactors manufactured by Celgard, LLC to remove dissolved gases from water streams.

Make-up Water Specifications

Water specifications at this power facility require that dissolved oxygen be at 100 ppb or below. The process flow schematic prior to installation of the GTM system is illustrated in Figure 1. As shown in this diagram, the dissolved oxygen content in the make-up water supply was not meeting specifications due to oxygen picked up in the vented storage tank. Figure 2 shows the GTM installation. A 10x28 Liqui-Cel Membrane Contactor was placed downstream of the storage tank pump. The complete GTM system consists of one membrane contactor, a small vacuum pump, and miscellaneous valves and piping. The storage tank pump continuously recirculates water from the tank, through the GTM system, and back into the tank. Facility water volume requirements are met while continuously deoxygenating the water. At low water demands,

Figure 1 - Process Schematic Before Installation of GTM® System

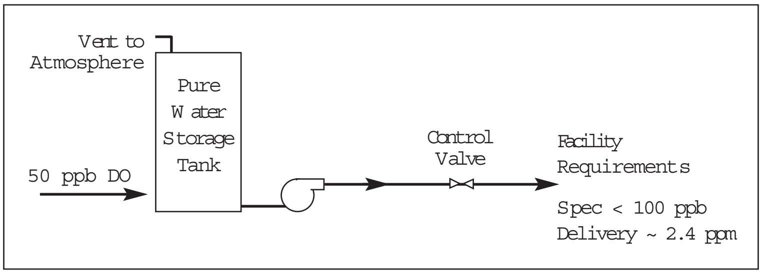
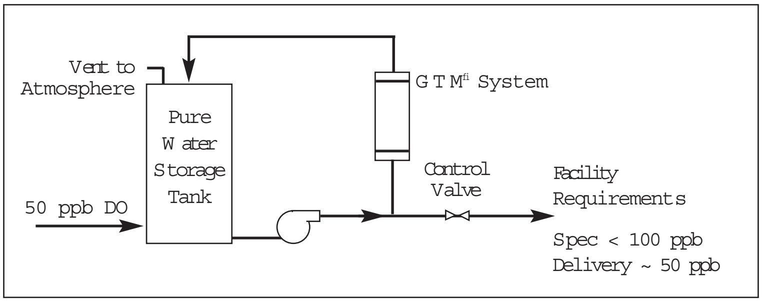


Figure 2 - Process Schematic After Installation of GTM® System



essentially all of the pump discharge is diverted through the GTM by the control valve. At higher water demands, a slipstream is sent through the GTM system by the control valve.

System Performance

Figure 3 illustrates the effectiveness of the GTM system in removing dissolved oxygen. Upon placing the GTM system in service, an almost immediate drop in dissolved oxygen content from 2,500 ppb to approximately 750 ppb can be seen. Continuing to recirculate storage tank water through the GTM system further reduced the dissolved oxygen level in the stored water to <50 ppb and within specifications. The GTM system maintains this dissolved oxygen level thereby providing the facility a consistent water quality.

Features and Benefits

Installation of the GTM system provided several operational and economic advantages. GTM systems are inherently modular. This modularity allows systems to be easily and economically adjusted to match process changes. The small foot print of a GTM system allows for easy installation within existing water treatment process loops. A vacuum degasifier column had been previously installed to deoxygenate make-up water. The vacuum degasifier had proven to be ineffective. Replacement of this column would require re-engineering and significant field installation. Because of the compact size of the GTM system, a prefabricated skid could be delivered to the plant site within days. This skid required no special foundation and only minimal piping work to be installed.

Significant cost savings were achieved by using existing equipment such as the storage tank, pump, and associated piping. Because the existing tank does not require inert gas blanketing, additional utilities for supply of this gas would be required. Other advantages of a GTM system are that virtually no instrumentation is required, nor maintenance such as cleaning, chemical addition, etc. Therefore a GTM system provided the nuclear power facility an easy, cost-effective means for retrofitting their system.

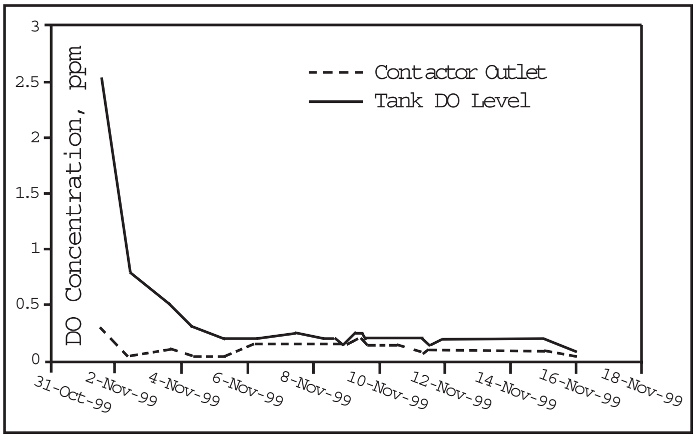


Figure 3 - Dissolved Oxygen Concentration in storage tank GTM effluents.

From the application described above, it can be seen that the GTM systems provide a simple and effective means for deoxygenating a water stream. In addition to providing customers a very simple means for retrofitting an existing water treating facility, a GTM system offers many advantages over conventional systems.

MEMBRANA Underlining Performance

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