Bottled drink manufacturer saves 70 million gallons of water and realizes energy savings of 800 MWh annually

NALCO Water
An Ecolab Company

CASE STUDY – FOOD AND BEVERAGE

CH-1488

BUSINESS SITUATION

A leading bottled drink manufacturer had high energy and operating costs associated with the reverse osmosis operation that provides all makeup water to the plant.

After a comprehensive audit of the reverse osmosis trains, a number of issues were identified. These issues included the fact that recovery was being maintained at a value well below the saturation limit for the water, and significant amounts of energy were being wasted through throttling valves downstream of the high pressure feed pumps.

BACKGROUND

This facility has high TDS in the city water and requires the use of reverse osmosis for dissolved solids reduction so that a consistent product can be manufactured. Seven systems are used to provide this water. On the date that Nalco Water audited the operation, all systems were operating in a single pass configuration at an estimated recovery of 73%. One of the systems had the capability of operating as a concentrate recovery system. It wasn't being operated in this manner due to operational issues and short membrane life. Through discussions with the management team, we learned this was typical for this facility.

The newest systems are approximately six years old with the oldest being around fifteen years old. All systems are designed with fixed speed pumps and throttle valves that are manually modulated to provide flow control. On two of the systems, the pumps were operating at over 400 psi of boost pressure and throttling down to a boost pressure of approximately 150 psi. If the recovery of the system could be increased and a variable frequency drive (VFD) installed on each unit, significant amounts of water and energy could be saved.

PROGRAM DESIGN

Nalco Water recommended new low pressure RO membranes, 3D TRASAR™ Membrane Technology continuous monitoring, installation of VFD's on the feed water pumps and re-configured

Customer Impact	eROI℠	Economic Results
70 million gallons of water saved annually	WATER	$540,000 water savings annually
Annual energy savings of 800 MWh annually	ENERGY	$44,000 saved annually

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.

system operation. The annual savings were estimated at project inception to be:

- 56 MGY of water savings at $5.40/kgal ($302,000)
- $41,000 (748,000 kWh) of energy at $0.055/kWh
- $82,000 rebate from the local utility towards VFD installation

System operational changes

Nalco Water recommended that the system operation be changed to operate at ~90% recovery. The systems were already set up to operate with six systems as a first pass with the seventh operating as a concentrate recovery system. A concentrate recovery system uses the concentrate, or waste water, from the other systems as feed water. The first pass systems were specified at 80% recovery with the recovery system specified at 50% recovery.

Operation at these recovery levels requires continuous attention, as loss in antiscalant feed or even minor errors in flow instrumentation can result in catastrophic failures. 3D TRASAR Membrane Technology was specified to mitigate this risk.

Normalization

Normalization is required to remove variation in the data that occurs with small changes in recovery as well as changes in feed water, TDS and temperature.

Operational data from when the system was known to be clean is collected and saved as the reference data. Subsequent data sets are run through normalization equations and compared to the reference data. Any differences from the reference data are noted, graphed and provided to the customer. Once these differences reach industry accepted targets, cleaning is recommended.

Once cleaning has been performed, effectiveness of cleaning is evaluated.

3D TRASAR Membrane Technology

3D TRASAR Membrane Technology continually monitors the system with System Assurance Center, controls antiscalant feed and continuously normalizes data remotely. Benefits to the customer include:

- Continuous antiscalant level monitoring and logging
- Dry contact connect to machine interlock to shut down in the event that antiscalant feed is lost
- Continuous normalization so that downtime can be scheduled
- Cleaning at the correct time to increase membrane life
- Immediate notification of catastrophic issues that would adversely impact membrane life and product quality

Low Pressure Membranes/Variable Frequency Drives

This system had been designed using standard reverse osmosis membranes. Low pressure membranes were specified to further decrease the pressure requirement.

Variable frequency drives were recommended to decrease the pressure output from the high pressure feed pumps and to save energy.

ENVIRONMENTAL AND ECONOMIC PROGRAM RESULTS

All of Nalco Water's recommendations were implemented. As a result, water and energy savings have been significant. All of the following values have been extrapolated to annual values based on data from the first six months of operation.

- 70 MGY of water at $7.72/kgal ($540K per year)
- $88,000 rebate from local utility
- $44,000 in energy savings
- Total – $584,000 per year saved

CONCLUSION

Proper system evaluation and Nalco Water's 3D TRASAR Membrane Technology made it possible to safely operate a reverse osmosis system closer to the limits of the water chemistry. This program will remain viable and continue to deliver these savings with the System Assurance Center team continuously monitoring the system.

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