Water Technologies & Solutions
case study

SUEZ provides a full plant E-Cell* EDI conversion for Arkansas Electric Cooperative Corporation

AECC Magnet Cove receives a 14-stack plant conversion from E-Cell MK-2 to MK-3 EDI technology

Application: Combined Cycle Power Plant
Product: E-Cell MK-3 EDI
Average Flow: 140 gpm, 32 m^3/h
Location: Malvern, Arkansas USA

Figure 1: AECC Magnet Cove Generation Station

challenge

The Arkansas Electric Cooperative Corporation (AECC) Magnet Cove Generation Station is a 660-megawatt combined cycle natural gas-fired power plant. As an electrical utility company, AECC is responsible for providing a reliable and affordable power supply to Arkansas' 17 electric distribution cooperatives.

Operating since 2006, the Magnet Cove power plant has utilized a SUEZ E-Cell MK-2 electro deionization (EDI) system to polish permeate travelling from the reverse osmosis (RO) units. After the useful life of the 14-stack system was reached, AECC Magnet Cove required a full plant replacement in order to continue efforts in polishing the RO effluent referenced in Table 1.

In addition to the plant conversion, Magnet Cove requested a new rectifier to accompany the replacement E-Cell stacks. A rectifier converts alternating current drawn from a power supply into direct current.

Table 1: EDI Influent water quality at AECC Magnet Cove

Parameter	Measurement	
Normal Temperature	50 – 72 F	10 – 22 C
CO_2	7 ppm	
TOC	< 1.00 ppm	
Turbidity	< 1 NTU	
Total Alkalinity	< 5.0 ppm	
Conductivity	3.90 µS/cm	
pH	6.95	

solution

Based on past experience with SUEZ's expertise and quality of service, AECC Magnet Cove contacted SUEZ to provide the full plant 14 stack E-Cell conversion and replacement of both the E-Cell MK-2 EDI system and rectifier.

The solution was to convert the existing MK-2 EDI configuration to an E-Cell MK-3 stack system (Figure 2) in conjunction with an upgraded rectifier.

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Figure 2: E-Cell MK-3 Stacks and MK-3 System

A feed water analysis was conducted on a sample of RO permeate to ensure proper system operation once the 14 E-Cell MK-3 stacks were installed. It was found that high levels of iron (38 ppb) were present due to the carbon steel piping system used by Magnet Cove. As a result, the SUEZ technical team advised Magnet Cove to replace the carbon steel piping to either stainless steel or chlorinated polyvinyl chloride (CPVC) piping. Altered by a free-radical chlorination reaction, the chlorine content in CPVC exceeds that of ordinary PVC; this difference in chemistry allows CPVC to tolerate corrosive water at a wider range of temperatures, and is significantly more ductile than PVC. Under those circumstances, sustaining the iron content below the maximum allowable concentration of 10 ppb would be possible.

The concern with high iron concentrations is the difficulty of passing the metal through the E-Cell to the concentrate waste stream because it ultimately fouls the resin. As a consequence, it then becomes more difficult to remove from the resin; thus, frequent cleaning would be required and a reduced product life would follow. Fortunately, the issue was identified in the early stages of the project, with the intention of preserving the integrity of the E-Cell stacks.

results

The full 14 stack MK-2 E-Cell EDI system was swapped out for the MK-3 product and an upgraded rectifier accommodated the full plant conversion. The effluent quality of the system is referenced in Table 2.

Table 2: MK-3 Effluent quality at AECC Magnet Cove

Parameter Description	Value	
Design Effluent Flow	140 gpm	32 m^3/h
Max Effluent Flow	210 gpm	48 m^3/h
Pressure (min.)	52 psig	359 kPa
Projected Resistivity	16 MΩ•cm	
Silica as SiO_2	< 10 ppb	

Furthermore, AECC Magnet Cove is aware of the issue concerning the high iron concentration, and is budgeting for the replacement of the carbon piping with either stainless steel or CPVC.

Lastly, the project was installed in May 2015 during a scheduled outage, meeting AECC Magnet Cove's requirements, and minimizing plant downtime.

E-Cell MK-3 stack

E-Cell MK-3 stacks (as shown in Figure 2) are EDI stacks which use electrical current to deionize and polish RO permeate water. The product water for the MK-3 is at an ultrapure level required in today's most demanding applications.

The E-Cell MK-3 is designed to:

- Provide ultrapure water for industrial applications including Power, Semiconductor, and General Industry.
- Produce mixed bed quality water on a continuous basis.
- Require no caustic or acid for regeneration of ion exchange resin within the stack.
- Be leak free, guaranteed.
- Eliminate brine injection and concentrate recirculation, simplifying system design.

Table 3: E-Cell MK-3 product performance

Product Quality		
Resistivity	> 16 MΩ•cm	
Sodium	< 3 ppb	
Silica (SiO_2) Removal	Up to 99% or < 5 ppb	
Boron Removal	> 95%	
Operating Parameter		
Recovery	Up to 97%	
Concentrate Flow	Countercurrent, hardness >0.10 ppm as $CaCO_3$	
Product Flow	Cocurrent, hardness ≤0.10 ppm as $CaCO_3$	
Voltage	0 – 300 VDC	
Amperage	0 – 5.2 ADC	
Inlet Pressure	3.1–6.9 bar	45–100 psi
Pressure Drop	1.4–2.8 bar	20–40 psi