

Fujairah SWRO — management of membrane replacement

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ABSTRACT

Fresh water shortage is a growing problem facing the world, especially in the Middle East. With the rapid increase in fuel price, seawater reverse osmosis (SWRO) is increasingly becoming a popular option for water supply. To date several seawater reverse osmosis desalination plants have been built in the United Arab Emirates (UAE) to meet the growing demand for fresh water in the country. The Fujairah Water and Power Plant was acquired in 2006 by a joint venture company between the Abu Dhabi Water and Electricity Authority and Sembcorp, forming the Emirates Sembcorp Water and Power Company (ESWPC). The plant is operated under agreement by Sembcorp Gulf O&M Company (SGOMC). The Fujairah Water and Power Plant is comprised of a hybrid system with a configuration of 37.5 MIGD reverse osmosis and 62.5 MIGD of multi stage flash desalination capability, and it is the largest SWRO plant in the UAE and second largest in the world. The plant has been in successful operation since June 2003. SGOMC started maintenance and operation of this plant on 26 September 2006. Initially, there was some apprehension in operating such a large SWRO plant as there were concerns regarding the design of the systems upstream, operation of systems upstream and proper monitoring of membrane performance with timed countermeasures. After review of the current operating performance and conditions, it was decided that 25% of the membranes would be replaced to improve the operation of the plant. Hydranautics (HN), the world's leader in membrane technology, initially provided 17,136 SWC3 membranes for this installation and 4,088 ESPA1 elements for partial second pass. Since the plant start up and initial tuning of the system, membranes are performing to expectation and providing the required quality as well as quantity of product water. The decision for replacement was critical in view of selecting of the right membranes for replacement and identifying the right membranes to be rejected. Finally the decision was made to select the highest rejection membrane, the SWC4+. The new membranes offer a nominal salt rejection of 99.8% and 93% boron rejection when operated at standard test conditions with a pH of 7. After 5 years of operation with almost zero replacement in the Fujairah SWRO plant, SGOMC and Hydranautics chose to gradually replace some of the SWC3 elements with new higher rejection and higher area SWC4+ membranes which provide advantages for plant operation such as operation at increased recovery and increased train capacity while producing better product water quality. A detailed account of the reasons for this change and the approaches to membrane replacement will be discussed and explained in the course of this paper. The authors hope further that this paper can be a useful reference for future development of SWRO plants, membrane selection and membrane replacement management in the Middle East as well as globally. Fujairah SWRO offers an excellent example where close cooperation between the plant management and the membrane supplier, together with optimization of individual process units upstream of membranes contribute significantly in the reliable and successful long term operation of an RO plant.

Keywords: Fujairah SWRO; Plant management; Membranes

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