Project Profile

Hinduja Power - Visakhapatnam, India
Ultrafiltration Membranes (Q-SEP®)

QUA®

About QUA

QUA is an innovator of advanced membrane technologies that manufactures and markets filtration products to address the most demanding water challenges.

Headquartered in the USA, QUA enables OEM partners to provide cutting-edge systems and solutions to end users in industrial and infrastructure markets throughout North America and worldwide.

Our filtration products:

- Improve plant design economics and reliability
- Reduce fouling
- Simplify cleaning
- Lower total installed cost
- Reduce footprint of overall wastewater treatment

Committed to ongoing innovation, QUA manages the entire life-cycle and manufacturing chain of its products. From the initial concept to manufacturing with rigorous standards, QUA's products are developed in a state-of-the-art facility with continuous monitoring.

Q-SEP Ultrafiltration

Q-SEP® hollow fiber ultrafiltration modules contain membranes manufactured with QUA's innovative patented "Cloud Point Precipitation" method. This process ensures a high pore density along the length of the fiber and uniform narrow pore size distribution in the membrane. Q-SEP modules deliver superior performance characteristics and product water quality that surpass the quality from conventional UF modules. The narrow pore size distribution allows the membrane to produce water with a low silt density index (SDI). The lower product SDI leads to less frequent and easier cleaning of downstream RO membranes. In addition , the Q-SEP membranes provides an excellent rejection of bacteria and viruses.

Q-SEP UF membranes are made of modified hydrophilic polyether sulfone (PES) material that offers high fiber strength and excellent low fouling characteristics, resulting in higher membrane productivity. These hollow fiber membranes operate under a low transmembrane pressure in an inside-out flow configuration for superior performance. Applications of Q-SEP UF include pretreatment to RO systems (brackish and seawater applications), purification of surface and well water for potable applications, filtration of industrial water, and wastewater recycle and reuse.

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Customer: Hinduja National Power Corporation
Location: Visakhapatnam, India
Product: Q-SEP 6008 (Total of 390 membrane modules)
Capacity: 5 x 1441 gpm (5 x 327 m^3/hr)
UF Product Water: Turbidity <0.1 NTU, SDI <1
Application: Seawater RO Pretreatment

Overview

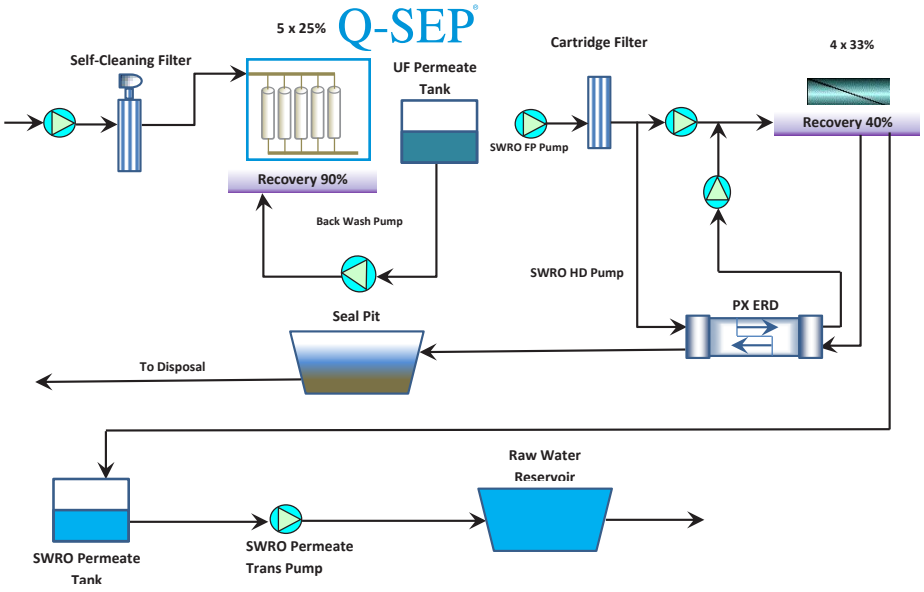
Visakhapatnam (also known as Vizag) is a city located in the state of Andhra Pradesh in India that has a growing need for a wider electricity network to serve its citizens and industrial activity. To address this need, Hinduja Power decided to build a 1040 MW coal fired power plant to provide power not only to Visakhapatnam, but also throughout the state and to other states in the southern India through an interstate transmission system.

The Hinduja Power Plant is located on the coast of the Bay of Bengal, and because of this, HNPCL decided to use seawater desalination to treat water for all of the plant's purposes. The desalination system consists of a self-cleaning cartridge filter, ultrafiltration, biofoulant removal filter, and seawater reverse osmosis (RO). The plant is unique in its low-energy desalination design due to effective pretreatment steps. The system process diagram, as well as the feed and treated water quality analysis is shown below.

Feed Water Quality	
pH	7.79
Turbidity (NTU)	<5
TDS (mg/l)	35,780
BOD (mg/l)	3
COD (mg/l)	18
Oil & Grease	<1
Temp Design Max	22º - 29º C

Treated Water Quality	
Turbidity (NTU)	<0.07
SDI_{15}	<3

System Flow Diagram



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UF Solution

In order to ensure that the plant had low energy consumption, steps were taken to ensure that the RO membranes were performing as expected, not under fouled conditions. A combination of ultrafiltration membranes and cartridge filters were chosen as pretreatment to the RO membranes. HNPCL evaluated its seawater reverse osmosis pretreatment options and decided to choose QUA's Q-SEP membranes due to their ability to produce higher quality effluent water than conventional ultrafiltration membranes.

The primary goal of the UF pretreatment step is to reduce suspended solids, turbidity, and SDI to a point where RO membrane cleaning is minimized. Since seawater has the presence of biofoulants that affect the long-term performance of the RO membranes, careful consideration was taken to assess the best solution for their removal. Combining the Q-SEP ultrafiltration membrane with a biofoulant removal filter reduced the biofoulant load on the downstream RO. This pretreatment increased the life expectancy of the RO and kept the RO pump power consumption low.

The Q-SEP ultrafiltration system was designed based on results of a pilot testing carried out with a backwash flux of 200 l/m2/hr. The Chemically Enhanced Backwash (CEB) is done using Sodium Hypochlorite, Sodium Hydroxide and Hydrochloric Acid. The backwash and CEB system is common for all the streams.

System Performance

Since its installation, the Q-SEP system at Hinduja Power has been running successfully and providing low turbidity water as inlet water to the RO unit. The UF permeate has an SDI of less than 3 (and often between 1 and 2). As can be seen in figure 1, the UF transmembrane pressure (TMP) has been below 0.5 bar (7.3 psi) on average over a year period. The product turbidity has been below 0.07 NTU on average over a year period, as shown in figure 2. This demonstrates about a 99% removal of turbidity, which exceeds the plant's expectations.

The Q-SEP membrane cleaning is done by regular backwashes and CEBs. CIP has not been required since startup of the UF membranes and the RO membranes are cleaned every 3-4 months. RO cleaning is done as part of the plant operations and not due to fouling of the membranes (as shown by the low UF TMP values). This is an improvement compared to the average CIP every 1-3 months for RO membranes following standard ultrafiltration membranes using treated seawater as feed. Due to its key membrane characteristics, QUA's Q-SEP UF membrane system has increased reliability and quality of the feed water for the Hinduja seawater desalination system. The Q-SEP UF system has successfully handled challenging seawater and exceeded the Hinduja project expectations to provide a low-energy and high quality solution.

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Figure 1: Average TMP Over One Year of Operation

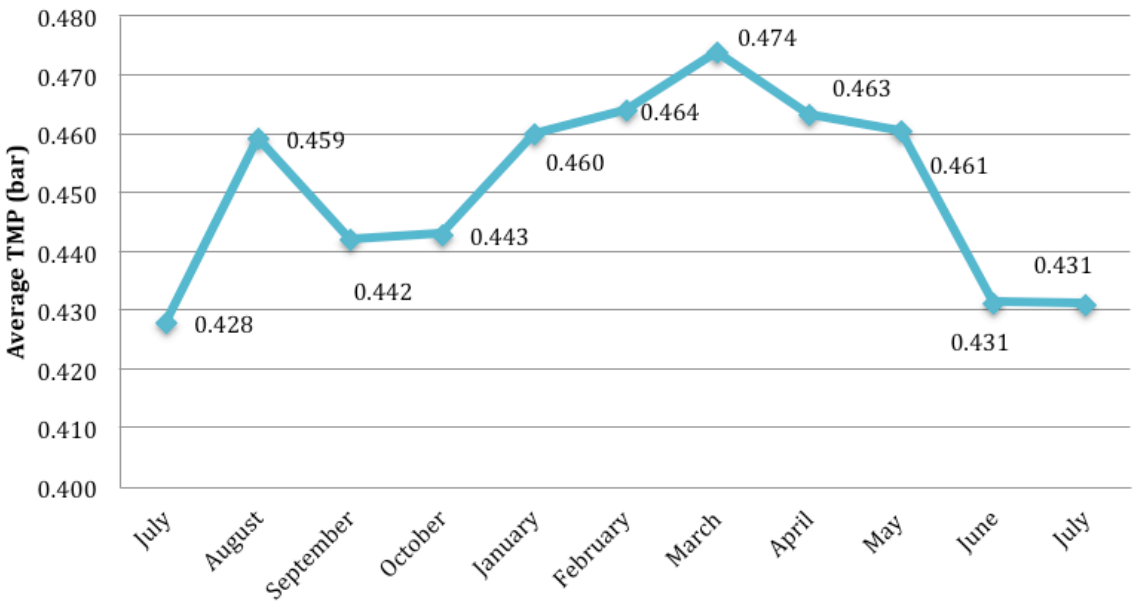

Figure 2: Average Turbidity Over One Year of Operation