Lessons learnt from the operational performance of SWCC MSF desalination plants

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ABSTRACT

Around 88% of water production by the Saline Water Conversion Corporation (SWCC) is provided by large MSF desalination plants which operate as power/water cogeneration plants. Despite the fact that the majority of SWCC MSF plants have been operating for more than two decades, their availability and water production as well as energy efficiency are still maintained within—or even sometimes higher—than the original design values. This is attributed to SWCC strict requirements of operation and maintenance which resulted in extending the life of the plants to more than thirty years.

In this paper, the energy efficiency of SWCC existing MSF desalination plants will be assessed. SWCC successful economic implementation of scale control techniques and the use of appropriate corrosion resistant materials will be highlighted. Benefits obtained from operating SWCC MSF desalination plants within the context of dual purpose plants employing either back pressure or extraction condensing turbine for the simultaneous production of water and electricity will be identified. Experience gained from the operational performance of SWCC MSF desalination plants will be effectively utilized to identify areas where savings in operating and capital cost could be realized in new MSF plants.

Keywords: SWCC; MSF; Operation; Performance; Experience

1. Historical background

The first two large long tube MSF plants which were built by SWCC in the early seventies, were Jeddah Phase-I (1970) and al-Khobar Phase-I (1974). Both plants were designed to operate at high top brine temperature of 121°C employing acid treatment. The distiller production capacity of each plant was 2.5 MGD. The major materials of construction, top brine temperature and general design philosophy of both plants were the same. A number of operational problems were experienced which resulted in very short life of both plants. Jeddah Phase-I was commissioned in 1970 and put out of service in 1980 after approximately ten years service. While Al-Khobar Phase-I was commissioned in 1974 and decommissioned in 1982 after approximately 8 years service.

Jeddah Phase-I apparently suffered from an undersized decarbonator [1]. This would have overloaded the deaerator with CO₂ reducing its air removal efficiency. Not only would the oxygen introduced to the recycle stream accelerate corrosion, but the CO₂ would lower the pH and lead to reduce acid addition (since the pH was monitored and controlled) and subsequently more CO₂ in the recycle stream. Such conditions did not provide satisfactory scale control. Although, operating at lower temperature (115°C) helped to extend the