



# Integration of Dow Components Enable the supply of 50,000 m<sup>3</sup>/day of drinking water to the island of Cyprus



Air view photograph of Limassol Desalination plant. Courtesy of MN Limassol Water Co



Photograph of a UF and RO train from Limassol Desalination plant. Courtesy of MN Limassol Water Co

A highly efficient process to desalinate seawater has been installed at the Limassol desalination plant using the latest innovative technology from The Dow Chemical Company (“Dow”). The facility uses DOW™ Ultrafiltration and DOW FILMTEC™ Reverse Osmosis membranes as core desalination technology and AMBERLITE™ PWA10 Boron Selective Resin as a polisher to help meet the strict Boron quality requirements.

In addition, Limassol has other, state of the art design features, such as iSD (internally Staged Design), partial RO permeate split and AMBERPACK™ technology to consistently, reliably and sustainably produce 50,000 m<sup>3</sup>/day of potable water.

### Fast Facts

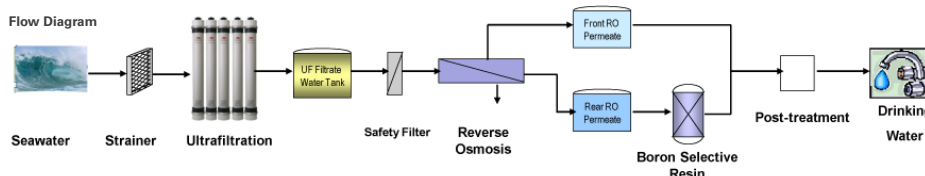
Location:	Limassol, Cyprus
Construction:	MN Limassol Water Co. (Consortium formed by Mekorot Development & Enterprise Ltd. and Netcom Ltd.) Sub-contractors: - Nirosoft Industries Ltd. (UF/RO system design and construction) - Treitel Chemical Engineering Ltd. (Boron Selective Resin system design and construction)
Operation:	MN Limassol Water Co.
End-user:	Water Development Department of Cyprus
Water Source:	Seawater – Open Intake
Plant Capacity:	50,000 m <sup>3</sup> /day drinking water
Start-Up:	2013

### Water characteristics and quality requirements

Raw water quality			Specified product water quality*	
Parameter	Unit	Raw Water	Parameter	Concentration
Temperature	°C	16 – 30	Boron	≤ 0.5 mg/L
TDS	mg/L	41,000	TDS	≤ 420 mg/L
pH	-	8.1		
Boron	mg/L	5.1		
Turbidity	NTU	< 15		
TSS	mg/l	< 15		

\*Blended product water after Boron Selective Resin and Reverse Osmosis System

### System Information





Photograph of the Boron Selective Resin system. Courtesy of MN Limassol Water Co

**Pretreatment - Ultrafiltration:**

An advanced pretreatment using DOW™ Ultrafiltration technology has been installed ahead of the Reverse Osmosis system. Ultrafiltration ensures a reliable and constant high quality RO feed water supply, ensuring stable operation and extending Reverse Osmosis service life.

The UF system contains a total of 1,056 DOW™ Ultrafiltration SFD-2880 modules arranged in 6 identical trains. The system is designed to operate at a flux<sup>a</sup> of 65 l/h/m<sup>2</sup> and a recovery<sup>b</sup> of 94%.

**Key features of DOW™ Ultrafiltration technology:**

- Asymmetric hollow fiber membranes
- Outside-In flow configuration allowing low energy consumption and stable operation
- Hydrophilic PVDF hollow fibers providing superior physical strength and chemical resistance and low fouling tendency
- Uniform ultra-fine pores (0.03mm nominal) ensuring excellent filtrate quality
- High active area (77 m<sup>2</sup> per module) enabling low footprint and low capital expenses

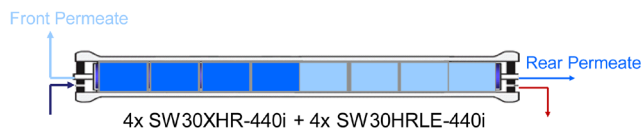


**Reverse Osmosis:**

A total of 4,800 DOW FILMTEC™ Reverse Osmosis membrane elements are installed in 4+1 trains. The system is designed to operate at 45% of recovery.

**Optimized RO system design featuring:**

- 440 ft<sup>2</sup> area of membrane per element
- Internally Staged Design (ISD) combining FILMTEC™ SW30XHR-440i and FILMTEC™ SW30HRLE-440i elements within the pressure vessel
- Permeate Split Design



**Boron Selective Resin:**

An Ion exchange resins system is installed to further polish the rear permeate stream from the RO system enhancing the boron removal of the system.

The system will contain 54 m<sup>3</sup> of AMBERLITE™ PWA10 and will treat a flow between 12,000 – 25,000 m<sup>3</sup>/day (depending on the water temperature).

AMBERLITE™ PWA10 resin features very high selectivity for boron and low risk of interference with other salts which makes it highly suitable for removal of boron from RO permeate water.

<sup>a</sup> UF operating flux of all six UF trains on duty:  
Instantaneous filtrate flow (L/h) / total active area (m<sup>2</sup>)

<sup>b</sup> UF recovery (related to UF feed)% of all six UF trains on duty:  
UF filtrate net flow / UF Feed flow x100%