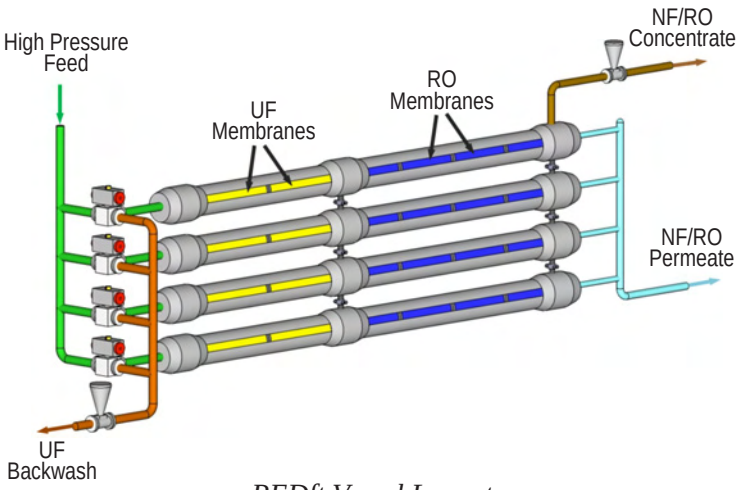
Pretreat and Desalt in the same vessel

Dual membrane systems combining low pressure MF/UF pretreatment systems with higher pressure NF or RO systems have become fairly commonplace. In fact, these arrangements are considered to be the 'standard' for water reuse applications and are now being applied on large-scale seawater RO systems. However, even when the systems are configured so that the UF filtrate is fed directly to the RO system without a break tank or cartridge filters, they are operated separately and at different pressures.

A new arrangement developed by Scotland's H2Oil & Gas has taken this integration a step further by combining UF elements in the same pressure vessel as the NF or RO elements, with both sets of membrane elements operating at the same feed pressure. The configuration — called REDft for *reduced footprint* — can reduce plant area by up to 35 percent, something of particular importance for the offshore oil and gas platforms that require sulfate removal systems.

H2Oil & Gas' Arno Theron told *WDR* that feedwater first undergoes coarse, 200 μm screening, before being pressurized to the full system operating pressure. The high pressure feed is then directed to the UF (or MF) membrane and the filtrate is fed directly to the downstream spiral–wound NF (or RO) elements within the same vessel. As the level of fouling increases on the UF element, the transmembrane pressure (TMP) increases, resulting in an automatic on-line backwash.



REDft Vessel Layout

Parallel vessels in a vertical bank are connected to each other at the center, forming a filtrate manifold. As vessels are individually backwashed, the flux of the UF elements still in service increases to compensate, meeting both the backwash demand and the normal feed requirements for the downstream NF elements to maintain the system production capacity.

The UF membrane's TMP is the system's key controlling parameter, and both the feed–filtrate and the filtrate–backwash TMPs are closely monitored and controlled to ensure smooth transition and element integrity. With these two parameters closely monitored, the concept can be applied with most NF and RO membranes.

Theron said, "The control system and valve sequencing are the most critical aspects of a REDft system's operation. It is important that the valves are carefully opened and closed to control the differential pressure when the UF is backwashed to prevent damage to the UF and RO membranes. As long as the forward and backwash TMP is controlled, it is possible to operate at pressures to 70 bar (1015 psi)."

He presented a paper at last month's Water Institute of South Africa (WISA) conference that described the results of a recent 5m^3/hr (22 GPM) REDft pilot study. The test was conducted on the South African coast using a hollow fiber, inside-out UF membrane and the same spiral wound NF membrane used in the company's seawater sulfate removal systems. Both membranes operated at a 15 bar (218 psi) feedwater pressure for the test.

According to Theron, the tests verified the REDft concept and showed that it is possible to bridge the pressure boundary between UF and NF membranes placed in series in a system.

A full–scale installation — with 8m (26 ft) long pressure vessels, each containing two UF elements and four RO elements — could be in operation next year.