Membrane bioreactor systems safeguard Kashagan's service water

Kazakhstan has imposed tight discharge restrictions on offshore activity in its sector of the Caspian Sea. The area around Agip-KCO's shallow water Kashagan development is also a nature reserve, housing breeding grounds for the protected sturgeon population.

All drilling barges and accommodation facilities on the Kashagan field therefore must incorporate specialized waste water/sewage treatment systems. Treated water must emerge colorless, odorless, and at a temperature no more than 2° C (36° F) higher than the surrounding seawater, with only minimal traces of nitrogen or phosphate. It also must be reused as much as possible at the offshore facility to limit the risk of contamination.

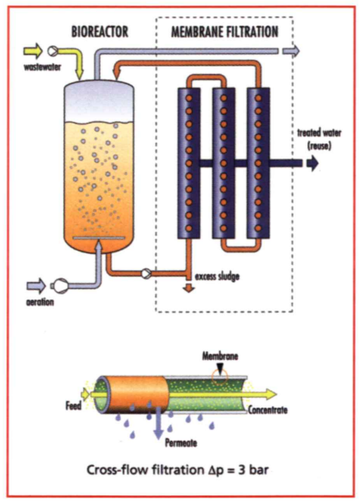
One beneficiary of this regime is Wageningen-based process contactor Triqua, which since 2001 has supplied its membrane bioreactor technology (MemTriq) to various contractors working in partnership with Agip-KCO. These include drilling groups Sunkar, Parker Drilling, and Deutag, and offshore accommodation providers Consafe, Emtunga, and Rosetti Marino.

The principles behind membrane bioreactors derive from a conventional activated sludge process, but separation of microorganisms is achieved by membrane filtration. This ensures that treated water emerges free of suspended solids and microorganisms.

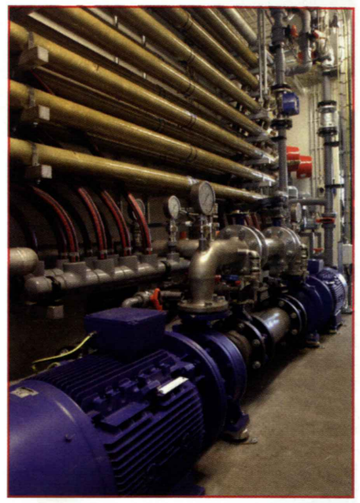
Other benefits of membrane bioreactors, Triqua claims, include:

- Compact design due to high biomass concentrations
- Low excess sludge production
- Stable process operation (no build-up of bulk sludge)
- High sludge age, facilitating degradation of complex compounds
- Membranes retain long-chained polymers to promote degradation.

With the MemTriq system, separation of microorganisms is effected via cross-flow filtration. The membrane modules are outside the bioreactor in a pressurized circulation loop. Shear forces created by the cross-flow prevent fouling of the membranes. The system is used mainly to treat high-strength waste water and in applications where small pore sizes are demanded.



MemTriq schematic.



Membrane stacks.

For Kashagan, the post-treatment discharge standards require the equipment to handle biological oxygen demand (BOD) of up to15 mg/liter and chemical oxygen demand (COD) of up to 30 mg/l, and to treat suspended solids (TSS) at a rate of up to 15 mg/l.

On the surface facilities, waste water is collected from showers, baths and lavatories; rinse water from household use containing detergents; and water from laundries. The latter also contains residual oil from overalls.

To ensure the treated water emerges colorless and odorless, Triqua adds a final polishing step that involves aeration injection followed by activated coal peroxide filtration. The purified end-product is recycled as flush water, laundry water, and residual water for drilling operations.

Produced sludge undergoes further dehydration in a specialized treatment system which Triqua normally also provides on the offshore facility. This reduces the sludge volumes to around 22% DS. The remainder is burned on the barges with other waste from household items such as paper and plastics.

The MemTriq systems are installed in containers, and are designed to function in extreme temperatures, which in this region can range from +45° C (113° F) in summer to -40° C (-40° F) in winter. They are fitted with heating and ventilation/air conditioning equipment to ensure uninterrupted operation. Triqua also provides 24-hour remote surveillance of the water treatment process on each installation from its laboratory in Wageningen.

Elsewhere in the Caspian, Triqua recently supplied a membrane bioreactor system to McDermott to treat domestic water on a pipelay barge operating for BP off Azerbaijan.

An artificial drilling island on Kashagan.

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