

Petrochemical Application

Produced Water Treatment

Produced water may contain high concentrations of suspended solids, organic compounds and heavy metals, which require reduction to very low levels before discharge to a water course.

The Esmil philosophy for Produced Water Treatment utilises conventional separation processes for the removal of bulk contaminants, followed by state of the art membrane separation and absorption processes to achieve very low levels of contaminants in the treated effluent (Figure 1). This philosophy enables the plant to function reliably, even with wide ranging variations in feed quality.

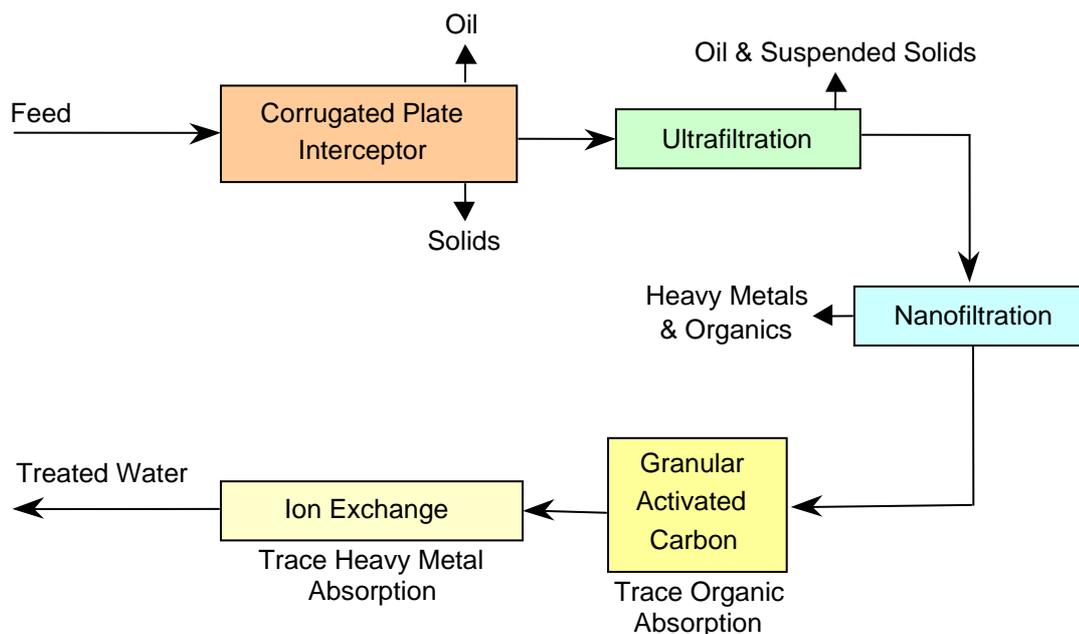


Figure 1. Esmil Produced Water Treatment Plant Schematic

Conventional pre-treatment, such as corrugated plate separation, hydrocyclones, air flotation or sand filtration is used to remove the bulk of the oil and suspended solids.

The 'clarified' water is physically polished by membrane Ultrafiltration, which reduces oil concentration to less than 0.3 mg/l, and suspended solids to below the limits of detection. The Ultrafiltration membranes utilise a modified polyacrylonitrile chemistry, which has been developed to be extremely oleophobic and thus resistant to free-oil fouling.

The oil and suspended solid free water is treated using membrane Nanofiltration, which removes the bulk of heavy metals and organic compounds. Nanofiltration provides negligible resistance to the passage of monovalent ions such as chlorides, so it is able to operate on high salinity waters where the inefficient productivity of Reverse Osmosis would render it uneconomical.

Trace organics and heavy metals in the Nanofiltration permeate are removed by Activated Carbon absorbers and selective Ion-Exchange resin. The pre-treatment by Nanofiltration significantly increases the bed life of these two media. Table 1. shows typical specifications for feed and treated effluent streams from a gas field produced water.

Table 1. Typical specification for feed and treated produced water.

Parameter	Feed	Treated
Suspended Solids	100 mg/l	< 0.1 mg/l
Oils, Fats and Greases	15 mg/l	< 0.3 mg/l
Mercury	1 mg/l	0.0005 mg/l
Lead	0.5 mg/l	0.005 mg/l
PAH	1 mg/l	0.0002 mg/l
Iron	185 mg/l	1 mg/l
Sulphate	4093 mg/l	< 50 mg/l
Chromium	0.5 mg/l	0.1 mg/l
Zinc	25 mg/l	0.1 mg/l

Where does it all go? Ultrafiltration reject is recycled to the front end of the process and the concentrated oil is reclaimed on site. The various sludge and aqueous waste streams are combined before undergoing precipitation, flocculation and filtration, to produce a 'cake' for landfill, and a filtrate that can be recycled through the process. The degree of treatment is designed to meet client specified limits such that the treated water is suitable for re-use on site or discharge to water course.