Al Dur

seawater **reverse osmosis** **desalination** plant

Located in the South-West Coast of the Kingdom of Bahrain, Al Dur seawater reverse osmosis desalination plant has been designed and built by SUEZ, sub-contractor of Hyundai Heavy Industries Korea (HHI), in charge of Engineering, Procurement and Construction (EPC) of the plant.

Al Dur desalination plant is part of larger BOO project contracted by Al Dur Power and Water Company (ADPWC) to Engie/GIC Consortium, combining electricity production (gas plant generating 1,234 MW) and desalinated water production.

With a daily capacity of 218,000 m^3 the seawater desalination plant delivers high quality potable water and satisfies the high requirements in terms of pre and post treatment taking into account the quality of Persian Gulf waters (high concentration of organic materials and red tides due to algae bloom). The Al Dur pretreatment was conceived to manage such situation and maintain a low index of clogging to preserve the reverse osmosis membranes.

suez

Al Dur SWRO plant: a double challenge for pre- and post-treatments

The Al Dur RO plant was designed with an efficient two-step pretreatment process: a flotation step, including an enhanced coagulation stage, and a filtration step. In parallel, to assess the seawater variability and demonstrate the performances of the selected pre-treatment line, a pilot study was carried out on-site during on year.

The Al Dur drinking water objectives were particularly challenging and the design had to incorporate challenging and unusual guarantees such as an Silt Density Index below 3.0% min., a turbidity below 0.2 NTU and Langelier Saturation Index between 0.1 and 0.3.

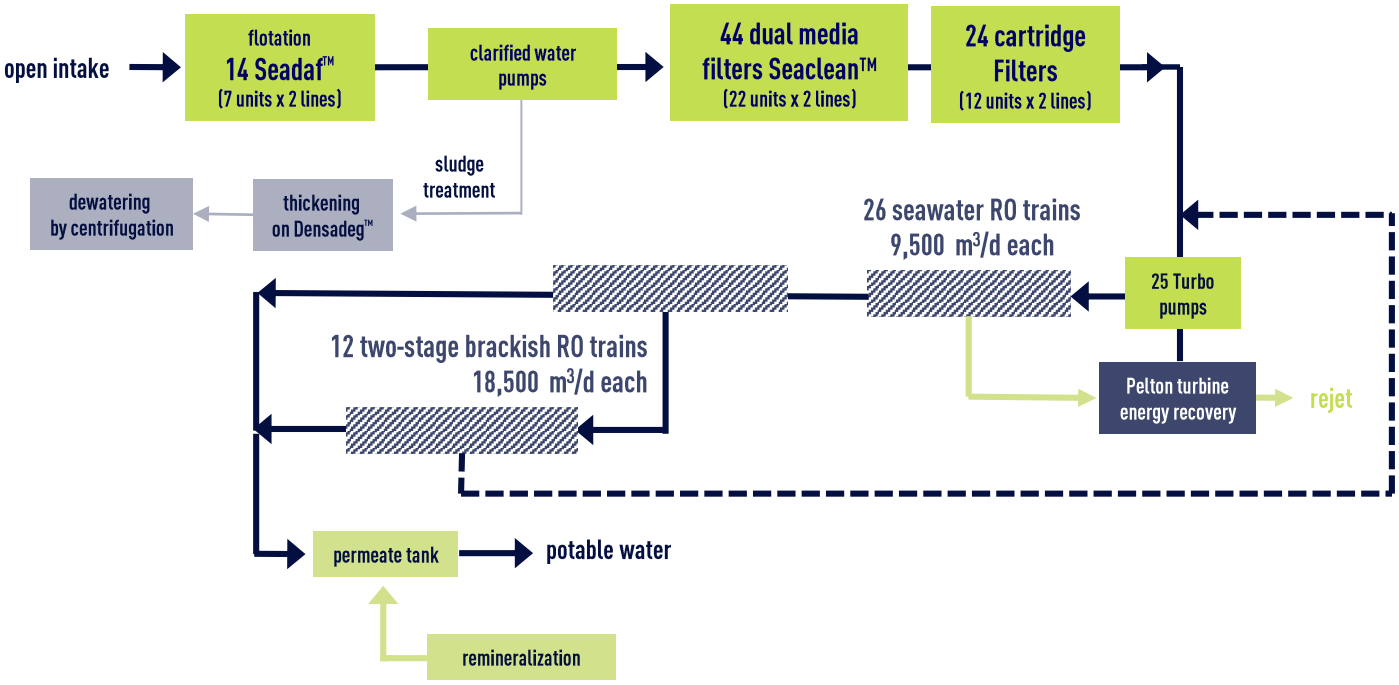
As a consequence, to comply with both the Bahraini drinking water standards and the tender specification, the design of mineralization unit included a high velocity lime water saturator and a lime water filtration unit.

During one year, the pretreatment line has demonstrated that the selected process was adapted to the quality of seawater and that the objectives of the filtered water quality were met. The efficiency of and the key role of the Seadaf™ have to be underlined as well as the importance of enhanced coagulation, to remove various pollutants and achieve a suitable quality of the pretreated water.

As regard to the post-treatment, the design was specially adapted to meet the challenging objectives and the drinking water guarantees of the project. The design was particularly innovative and a specific automation system (scada) was included in the plant, so as to make the post-treatment step fully automatic, even in case of temperature variations.

This pilot phase also led to the elaboration of some recommendations towards the plant Operation & Management.

RO desalination plant process



design

water treatment

seawater intake

The seawater source is an offshore open intake located at a distance 1,500 m from the coast, at a depth of 6-8 m, dependent of the tide. Four independent intake lines, equipped with manholes every 200 m for maintenance purposes, feed the sea water intake tank, common to the power and the desalination plants. Each line is equipped with a full chlorination system.

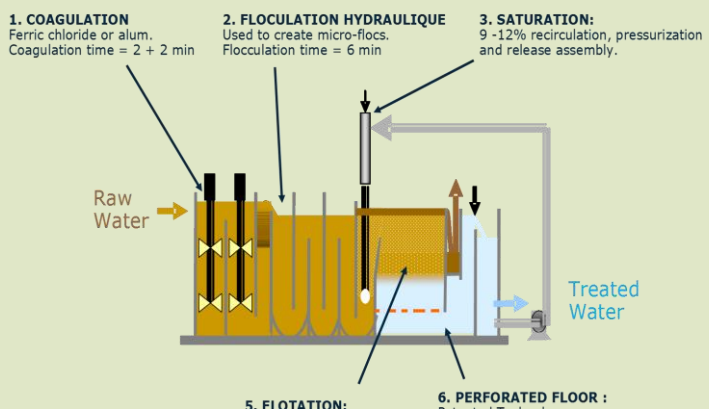
pretreatment

The selected pretreatment is highly robust and reliable, comprising both a clarification and a filtration process, coupled to an enhanced coagulation system that has been designed to face the rough seawater in the Gulf sea.

The pretreatment is divided in **2 independent lines**, housing each the following facilities and equipment:

- Chemical dosing system
- **7 Seadaf™ high rate units** (flocculation/flotation), which is the most suitable and proven technology to face the treat of potential algal blooms and the high fouling potential of the Gulf seawater
- **22 pressurized dual-media filters**
- Polishing step consisting **12 cartridge filters** with 360 cartridges of a 5-micron each.
- Chemical dosing system

Seadaf™ : operating principles



reverse osmosis

As the maximum boron concentration that is required to be present in the final drinking water is 1 mg/L, the Reverse Osmosis step incorporates a double-pass system as follows:

- **1st pass: 26 trains with a recovery rate of 42%.** The Toray Membranes and the Pelton turbines as energy recovery device were selected.
- **2nd pass: 12 two-stage trains and a recovery rate of 90%** (Toray Membranes)

post-treatment

remineralization

The post treatment step consists of 2 independent lines, each one being composed of on hydrated lime silo, on lime milk preparation tank and a transfer line to the saturator. From the saturator, the lime water is stored, and finally filtrated on dual-media filter before being closed into the permeate so as to reach the correct level of remineralization.

sludge treatment

- Thickening on 2 Densadeg™
- Dewatering by centrifugation (2 centrifuges)

treated water quality

pH	7 – 8
Turbidity	Max 0.2 NTU
Total Hardness	70 -200 mg/L as $CaCO_3$
Total Alkalinity	70 -200 mg/L as $CaCO_3$
Chloride	Max 50 mg/L
Free chlorine	04. - 0.6 mg/L
Total Dissolved Solid TDS	Max 200 mg/L
Boron	Max 1 mg/L
Langelier Saturation Index (LSI)	+ 0.1 - + 0.3
Fluoride	0.5 – 1 mg/L
Conductivity	250 – 500 µ S/cm
SDI	Max 3 %/min
Total Organic Carbon (TOC)	Max 0.5 mg/L as C
Colour	Max 1 mg/L pt Co

key dates

- **signature of contract**
  September 2008
- **notice to proceed**
  April 2009
- **plant commercial operation**
  February 2012

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Since March 2015, all the Group brands (Degrémont, Ozonia, Aquasource, Ondeo IS, Ameriwater, Infilco, Poseidon…) became SUEZ.

Meanwhile, from now own, the technologies and know-how of our Treatment Solutions offer will be distinguished with the label degrémont®.