

PROJECT PROFILE SERIES #46

SEA WATER DESALINATION FOR SAGUNTO, SPAIN



The Problem

The Sagunto locality is situated in the region of the Camp of Morvedre in Spain. In recent years, a strong industrial growth has been anticipated in the zone. This has provoked a growing requirement for water in the Municipal Region of Sagunto. For this situation, the Sagunto Council planned to cover part of the future hydraulic deficit for short and long term with the construction of a Seawater desalination plant.

The Facility

The combined cycle power plant (1200 MW) of Union Fenosa Generacion SA, in the vicinity offered its collaboration so that they could use the potential synergies derived from its project, in the design and construction of the Desalinating Plant.

The joining of the desalinating plant of Sagunto to the installations of inlet and draining of the Combined Cycle Power Plant implied some inconveniences. The characteristics of the water in the inlet of the desalinating plant are principally worse than those considered in case of making the inlet through wells excavated at the side of the coast. For this a very powerful pre-treatment before desalination is specified. The pre-treatment has to eliminate dissolved or suspended solids, Sand or dissolved mud as well as the corrosive products, scaling, for treatment, additives and organic materials present in water.

Besides, the raw water coming from the inlet can contain a considerable quantity of grease, oils and cargo oils due to its location, which must be treated through a physico-chemical process (coagulation-flocculation-floating) before desalination.

The Solution

Pre-treatment

The pre-treatment of raw water is provided to perform the following functions:

- To eliminate turbidity and excess solids in suspension
- To eliminate oil & grease contents in the raw water
- To inhibit biological growths in the system
- To adjust and control pH

-To inhibit or control the formation of compounds that can precipitate on membranes

-To achieve SDI < 5 of the supply water to the membranes

The Pretreatment after the intake pumps consists of the following scheme:

Dosing of Hypochlorite

Coagulation and flocculation

Decantation/floatation

2 stage filtration on anthracite & sand media.

Filtration on cartridges

Reverse Osmosis

The desalination of sea water is achieved through reverse osmosis process with spirally wound type membrane elements. The sea water RO streams have been designed for a recovery of 47% in single stage configuration. An interpass suckback tank is installed per RO stream.

Also, to achieve boron limits of < 0.5 ppm in the permeate water at all temperature conditions between 14 deg cel to 25 deg cel, a second pass permeate RO is provided. A provision to bypass part of the flow in low temperature application and use the entire flow at high temperature applications is also provided in event of lower Boron content in the feed water.

Before pumping the 1st pass RO permeate to the second pass RO, pH of the water has to be raised to achieve good rejection of boron to below desired limits.

The piping and valves of high pressure feed and reject lines are made of Duplex stainless steel 2205. The product collector pipes, connections of product for the modules and general piping for conduction of the product to the tanks are of PRFV & those of small diameter of PP or polyester.

Energy Recuperation Systems for Brine using Pressure Exchangers

For the recuperation of energy, pressure exchanger based device is offered. These are patented units and they are supplied as per manufacturer's standards.

Post-treatment

Post treatment consists of carbon dioxide dosing followed by lime dosing. Dis-infection with hypochlorite is done prior to supply.

Treatment & Disposal of Effluents of Effluents Generated

The sludge from the floatation system shall be taken to the sludge tank from where it will be pumped by means of submersible pumps to the coagulation and flocculation chamber. This will be followed by a sludge thickener which will be used to thicken the sludge to a higher concentration. The overflow from the thickener shall be disposed along with the excess reject and the filter backwash waste.

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Feed Sea Water Analysis

Parameters	Units	Values
pH	u. pH	8.1
Design Temperature Range	Deg Cel	14 – 25
Conductivity at 25°C	ms/cm	53000
Total Dissolved Solids	mg/l	33920
Suspension Solids	mg/l	65
COD Value	Mg/l O ₂	<250
Oils & Greases	mg/l	10.4
Turbidity	UNF	2.93
Scent		No
Color	u.Pt-Co	<5
Carbonates	mg/l CO ₃	<6
NO ₂ -	mg/l	<0.2
NH ₄ ⁺	mg/l	<0.2
NO ₃ -	mg/l	<10
Nitrogen	mg/l	<2
Cl-	mg/l	21300
SO ₄ ⁻	mg/l	3150
PO ₄ ⁻	mg/l	<1000
S	mg/l	<0.02
SiO ₂ Soluble	mg/l	<2
SiO ₂ Colidal	mg/l	<2
C ₆ H ₅ OH	mg/l	0.8
Tenzoactives	mg/l LSS	1.71

Design Parameters for RO Units

Toxic Substances	ppm	Organic Material & Others	ppm
Arsenic	0	BDO5	0
Cadmium	0	DQO	70
Boron	5.4	Protein Nitrogen	17.5
Mercury	0	Phenolic Compounds	0
Selenium	0	Oils and Greases	10.4
Lead	0	Detergents	1.57
Chrome (total)	0	Cargo Oils	0
Chrome vl	0	Solids in Suspension	65

Guaranteed Permeate Water Analysis

Substance or Characteristic	Value
pH value	6.5 – 9.5
Total Dissolved Solids mg/l, max	<400
Chlorides mg/l, max	<200
Sodium mg/l, max	<150
Alkalinity as mg/l CaCO ₃	50 – 65
Hardness as mg/l CaCO ₃	50 – 65
Boron (as B) mg/l, max	0.5
LSI	+/-0.5

