Almoguera-Algodor WTP in Madrid
Increasing hydraulic resources
1/2

Due to the need to supply water to the southern part of the Greater Madrid Community and the possibility of taking advantage of the installations that the Tagus River Hydrographical Confederation is going to build to supply Tarancon, Algodor and surrounding areas, the Almoguera-Algodor Drinking Water Treatment Plant was planned collecting water at km. 10 of the Tagus River Royal Irrigation Canal with the corresponding pump station.

Location	**Colmenar de Oreja (Madrid)**
Customer	**Canal de Isabel II**
Start-up date	**April 2007**
Duration	**27 months**
Capacity	**2,400 l/s**
Technology	**Ultrafiltration and reverse osmosis**
Membranes	**Ultrafiltration: Polyvinylidene Fluoride-PVDF** **Reverse osmosis: fine polyamide film**
Modulation	**Four lines**
Treated water quality	**TDS < 600 mg/l. Sulphates < 250 mg/l** **USE: Drinking water**

The drinking water treatment plant located approximately 500 meters from the right bank of the Tagus River, has a treatment capacity of 2,400 l/sec and the treatment line will be adjusted according to the quality of the raw water.

Description of the installations

The water treatment line foresees the following: water collected from the Tagus River Royal Irrigation Canal, a pump station with 1600 mm pipe to the untreated water tank with a capacity of 20,000 m^3, pre-ozonization by liquid oxygen, pre-chlorination by gas chlorine, eventual administration of chlorine dioxide produced from Sodium Chlorate, addition of potassium permanganate, physical-chemical treatment by adding poly-aluminium chloride or aluminium sulphate and polyelectrolite, lamellar decantation, ultrafiltration (with submerged membrane), reverse osmosis treatment (for the part of the flow that guarantees that the final content of sulphides will meet the legal requirements for drinking water), piping for rejects from the R.O. process to the Tagus River, pH stabilization, disinfection by monochloramines, 20,000 m^3 treated water tank and pumping to the supply mains.

The following installation has been foreseen for sludge treatment: 364 m^3 sludge homogenization tank for sludge from lamellar decantation unit with two 1.50 kW submergible mixers, pumping of sludge to the thickening unit, thickening by flotation, pumping of the thickened sludge to the drying unit, dehydration by two spinners and storage of dehydrated sludge. The addition of polyelectrolyte to flotation and dehydration is foreseen.

The water collected from the Tagus River Royal Irrigation Canal is conveyed to an input pumping until where it passes through a trash rack and a 100 micra screen for fines. It is emptied by four 600 l/s horizontal centrifuge pumps

Four power actuated butterfly valves and four flow meters will be installed to measure and control the flow of the four treatment lines.

Almoguera-Algodor WTP in Madrid
Increasing hydraulic resources
2/2

Pre-ozonization area

Reverse osmosis foundation

The treatment lines are fed by DN 800 mm pipes. The water treatment plant consists of ozonization, mixing, flocculation and decantation.

The pre-ozonization chambers are divided into 3 compartments. The water inlet to each chamber has a motorized AISI-316 L stainless steel wall gate. The ozone will be produced in two oxygen generating reactors.

Each mixing pit has a 2.2 kW quick mixer and a powered bottom inlet gate.

There will be four flocculation chambers, each provided with a 0.75 kW slow mixer.

The lamellar decanters are rectangular, fed by submerged canal, with Tubedek type polypropylene lamellas. The sludge will be collected by a longitudinal, eccentrically sweeping process. The sludge is dragged into four sumps by a mechanism with a coming and going action and removed by a 150 mm diameter pneumatic equilibrium valve.

The ultrafiltration process consists of 7 membrane tanks, one with 522 membrane modules, obtaining a flow of 42.42 l/m^2/h, that is pumped by 7 permeated pumps to the ultrafiltered water tank. The membranes are normally cleaned by backwashing them with water and air (using 2 backwash pumps and 2 blowers with rotating plungers), storing the wash water in a recovery tank from where it is conveyed by three submergible pumps.

The chemical washing of the membranes is done using a CIP tank, 2 centrifuge pumps and adding agents (sodium hypochlorite, caustic soda, phosphoric acid and sodium bisulphite). With this system a greater flow of ultrafiltered water is obtained (SDI below 3) that is more adequate for feeding the reverse osmosis membranes. Not only can the plant be smaller but it has to be stopped less frequently for cleaning the membranes. This system also noticeably reduces water turbidity, suspended solids and coliforms (faecal and total).

The reverse osmosis will be installed in 12 racks with 420 membranes each. The advantages of this system with respect to nanofiltration are: 85% conversion (less water is lost), the quality of the water is slightly better (reverse osmosis needing less design flow) and there is greater rejection of any ion which makes it possible to treat water with high conductivity due to any type of ion. The agents used in the process include sodium bisulphite, sulphuric acid and others to inhibit crusting as well as the eventual use of cleaning agents for the membranes.

The treated water tank holds 20,549 m^3. From there the water is pumped by five 2,160 m^3/h pumps at 116 m.c.a. to the Palomar tank.

The auxiliary installations include a system for drainage and evacuation, a brine drainage system, a transformer building, a control building, a staff building and a building for storing and dosing agents.

The foundations are built of a continuous reinforced concrete slab. The buildings are finished with prefabricated elements well adapted to the environment and the roof of the control building has an ecological design.