



Drinking water treatment plant for supplying Calahorra – La Rioja

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This is a drinking water treatment plant designed to convert 21,600 m³/day of underground water from an aquifer on the River Ebro into drinking water to supply the town of Calahorra. The plant was designed with advanced filtering treatment using active carbon and reverse osmosis membranes since the water is polluted with herbicides, due to the high agricultural activity in the area.

Location	Calahorra (La Rioja)
Developer	Calahorra Town Council
Starting date	December 2007
Finishing date	May of 2009
Capacity	21,800 m ³ /day
Technology	Activated carbon filtration Reverse Osmosis

The water for the treatment plant supplies drinking water to the city of Calahorra is located in the aquifer of the Ebro River. This aquifer is greatly influenced by the agricultural activities of the area having detected the presence of atrazines (herbicides used for farming) in concentrations above those permitted by the new law RD 140/2003.

Given that the water was also very hard, it was decided to build a treatment plant with the following characteristics:

Description of the process

The plant is laid out in two parallel lines so that 50% of the treated water flow is obtained by filtration with activated carbon and the other 50% by reverse osmosis, after filtration through sand and cartridges.

The water resulting from the mixture meets the requirements established in Law RD 140/2003 of February 7 setting the criteria for the quality of water for human consumption. The raw water is obtained from the four existing wells.

On the one hand, two 450 m³/h self-priming horizontal centrifuge, split chamber pumps (1+1) pump the water through galvanized steel pipes to the activated carbon filtering system with a by-pass prepared leading to the treated water tank. On the other hand, two (1+1) 545 m³/h pumps of the same type pump the rest of the raw water to the reverse osmosis line.

The activated carbon filtering system consists of 6 closed vertical filters, pressurized, each with a 3.50 meter diameter and a bed 1.50 meters thick. The operation of these filters is totally automatic and the water produced goes directly to the treated water tank.

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The filters are backwashed for cleaning.

There are three independent lines for the reverse osmosis process, each with a flow of 180 m³/h.

At the head of each line is a pressurized horizontal sand filter with a surface area of 22.6 m² and a filter bed with two layers, the first being silica sand 0.60 meters thick and an effective size of 0.90 mm; the second layer being 0.70 meters thick and an effective size of 2 mm. The water filtered is conveyed to a reverse osmosis line after passing through cartridge filters with a filtering grade of 5 microns.

The filters are cleaned by washing them with water and air. The two blowers (1+1) for the washing system are located in the raw water collection tank room.

The agents are added to the water line at the outlet from the sand filters and before filtration by cartridges. These agents are: sulphuric acid to acidify the effluent, and a dispersant in order to prevent the sulphuric salts from precipitating when the filtered water is concentrated in the membranes.

At the outlet from the cartridge filters, the water is pressurized by a pumping station with four (3+1) high pressure, horizontal centrifuge pumps. There is the possibility of adding sodium bisulphite at the point of suction or impulse of these pumps in order to eliminate the residual chlorine carried in the water.

The reverse osmosis was designed with a conversion factor of 83%. Each osmosis line is structured in two stages. The first stage has 14 racks (plus two on stand-by), and the second stage is formed by a column of 7 racks (plus another on stand-by). Each rack houses 7 membranes, with a size of 8" x 40" and eliminating 99.5% of the salts.

The water released from the reverse osmosis process goes directly to the treated water tank; the reject goes directly to a second tank of treated water next to the dirty water from washing the sand and activated carbon filters.

Furthermore, the osmosis system is provided with the corresponding washing and displacement system, with a 5000 litre tank, two (1+1) centrifuge pumps and a cartridge filter identical to those installed in microfiltration.

The treated water tank has a total volume of 1,400 m³ and is located under the newly built industrial bay. It will be possible to add specific doses of sodium hypochlorite to it to adjust the disinfection of the water product.

The tank for reject and dirty water from the washing processes holds 256 m³. From there the water is dumped directly into the river, after being diluted, since the Ebro River Hydrographic Confederation has demonstrated that the concentrations of brine foreseen meet the minimums set by current legislation.

Design data

Below is a list of the design flows used to size the treatment plant.

Design flows	
Flow to the activated carbon filters	125.00 l/s 450.00 m ³ /h
Input flow to Reverse Osmosis	150.60 l/s 542.17 m ³ /h
Outlet flow from Reverse Osmosis	125.00 l/s 450.00 m ³ /h
Rejection in Osmosis (%)	83.00
Total raw water inlet flow	275.60 l/s 992.17 m ³ /h
Total treated water outlet flow	250.00 l/s 900 m ³ /h