

Water success at Rijnmond energy center

Raw water with high and variable amounts of total dissolved solids, total suspended solids and periodic oil contamination, were just some of the challenges facing engineers as they designed the water treatment system at Rijnmond Energy Center in the Netherlands. Meeting the challenges head on, the team of Bechtel-Enka and USFilter designed and constructed a successful treatment plant that has been producing high quality water since November 2003.

The 1288 m³/h system supplies clarified cooling tower water and high purity boiler feed water at the new gas fired plant. The first plant built in the Netherlands by an independent power producer, Rijnmond will be one of the most efficient power facilities in Europe.

The raw water supply for the plant comes from a canal on the tidal Maas River. The total dissolved solids (TDS) level in the canal can fluctuate widely depending on the season, the tides from the Rhine, and the amount of water from the North Sea that ends up in the Maas River. In fact, the conductivity of the water ranges between 3000 and 10 000 mS/cm and changes between these extremes within a matter of days. The raw water intake is 20 m from a petroleum unloading pier in the Shell Oil Refinery. The ships and barges pulling in and out of the dock to support the unloading, stir up the bottom of the river.

"These conditions created an incredible challenge to us in designing the pretreatment portion of the system," said Bill Willersdorf, director of corporate projects at USFilter in the US.

Four packaged steel clarifier systems were coupled together to handle a substantial flow rate, 1000 m³/h, to feed the cooling tower for the 790 MW combined cycle power plant.

Meeting the challenge

The raw water treatment includes intake screening and pretreatment consisting of the four clarifiers and

particulate and oil-absorbing cartridge filters. The high purity water treatment portion of the system consists of dual cartridge filters, two trains of double-pass reverse osmosis (RO) systems and two CDI-LX continuous electrodeionization systems with IP-LX modules from Ionpure Technologies. Other equipment includes a pre-coat condensate polishing system,

chemical feed systems, solids dewatering systems, and associated pumps, tanks and controllers.

The intake screening system from USFilter Envirex Products removes rubbish and debris such as grass, seaweed and plastic bags from 27 m³/min of brackish water from the canal.

Tom Patterson, Rijnmond Energy

Center project manager at Bechtel-Enka said, "USFilter combined a lot of the technologies it offers and coordinated with a number of suppliers in North America and Europe. Its success in this effort has contributed to the overall success of the Rijnmond plant."

Besides handling the difficult intake water, the treatment plant also had to



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CDI system skid



The location of the energy centre presented many factors for consideration

be designed with environmental considerations in mind. Due diligence was followed to protect the environment. In Europe, companies are self-reporting, which means that they, rather than regulatory agencies, are responsible for ensuring that the environmental protections are in place.

Another design consideration was the fact that the power plant had to export steam to Shell's Pernis refinery, located next door. The treatment

system had to meet normal plant water needs for the majority of the year and then ramp up production for steam host mode. The system is designed to operate as two independent high purity trains, with one train remaining on standby until needed.

The CDI system skids at Rijnmond are high-flow, multiple-module systems consisting of 25 IP-LX modules per skid with a capacity of 85 m³/h each.

Exceeding specifications

The water treatment plant was started up in various stages beginning in November 2003, with the process completed in April 2004. Interger, a Shell-Bechtel venture, declared commercial operation of the plant on June 20, 2004.

Water quality from the high purity RO/CDI system is exceptional, with conductivity averaging less than 0.07 mS/cm. The sodium concentration in

the RO/CDI product water is about 5 parts per billion (ppb) and the silica concentration is below 3 ppb. The system's performance significantly exceeds the water quality specifications, which require conductivity of less than 0.10 mS/cm and sodium and silica concentrations of less than 10 ppb.

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Table 1. Water quality specifications and product water quality November 2003 - May 2004

Parameter	Range	Specification
Conductivity (µS/cm)		
Raw Water	2000 to 10 000	8580 max
1st Pass RO Product Water	30 to 120	NA
2nd Pass RO Product Water	3.5 to 4.5	NA
CDI-LX Product Water	0.06 to 0.09	< 0.010
Silica (ppm)		
Raw Water	5 to 12*	23 max
CDI-LX Product Water	0.001 to 0.005	< 0.010
Sodium (ppm)		
Raw Water	38 to 590*	1770 max
CDI-LX Product Water	0.003 to 0.007	< 0.010

*Range in table was provided in the contract specifications.

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