International Sanitary-standard Compliant Reverse Osmosis (RO) System for PepsiCo's Bottling Plant (Dongnai Province, Vietnam)

Background
Expansion of facilities. And more.

The project was intended to expand the existing process water treatment facilities' capacity from 100m³/hr to 150m³/hr at PepsiCo's bottling plant in Dongnai Province, Vietnam. Overall, the scope of supplies included new Multimedia Filters (MMF), Activated Carbon Filters (ACFs), a 50m³/hr RO system, UV sterilisers and others, and all installation works at site.

Our scope of supplies and works, however, involved mainly the process and engineering designs, fabrication of a sanitary-standard compliant RO system on skid, HMI-control panel and testing and commissioning of the RO system upon site installation.

Key Technical Considerations
Stringent standards. And constraints.

The sanitary standards and specifications for water applications in the food and beverage industries are some of the most stringent worldwide. There were also other key constraints arising from the existing site and equipment we had to take into consideration.

Our RO system was designed to meet the following requirements and more:-

■ All metal materials and parts and components were of stainless steel including the control panel.

■ All weld-joints of SS316L pipes were to be boro-scoped to ensure unrestricted water flow along the inner surface of the pipes to prevent any

potential drag and stagnation of water - to prevent bacteria growth.

- Zero dead-lag in all pipe instrument such as valves, flowmeters, pressure gauges etc, apart from the piping works, to prevent bacteria growth.

- Our RO system was required to work in tandem with 2 existing RO systems at site, and our control panel was to be the central control of all 3 RO systems.

- Space availability of the existing site was a big issue.

- Client was looking to high water recovery.

Water In and Out
Stringent permeate fit for production.

The existing water intake at the client's factory was of city water supply. Apart from all pre-treatment processes, we were to design and assemble our RO system to produce very high-grade permeate/product water fit for the client's production purposes. Table below shows the feed water qualities and the qualities of the RO permeate required:-

Parameters	Feed Water Quality (mg/L)	Permeate Quality (mg/L)
pH	6.5	5.0 - 9.0
TDS	86	2.14
Chloride	3.6	< 0.01
Sodium	10.0	< 0.3
HOC_3	46.4	< 1.3
Nitrate	2.2	0.4
Sulfate	0.6	0.0
Magnesium	2.0	0.02
Calcium	8.0	0.09
Silica	0.5	0.01

Process Designs & Configuration
Producing more with less.

With thorough analyses of the feed water data and permeate quality requirements, our team had determined to adopt a 2 stage-RO process configuration to attain up to 80% recovery meeting the client's expectations.

Some of the essential design criteria and our proposed design specifications were as follows:-

Design Data	Specifications
Feed flow rate	62.5 m³/hr
Feed pressure	8.84 bar
Feed water design temperature	25°C
Pre-treatment process	MMF & ACF
Permeate flow rate	50 m³/hr
Design recovery	80%
Process configuration	2-stage RO
Membrane type	Dow HRLE-400i
Permeate conductivity	<3.75µS/cm
RO skid dimension	7m(L)x1.6m(W)

Despite a 2-stage RO process configuration, our team had cleverly configured the entire RO system to fit into a very constrained space provided by the client. With careful review and analyses of the data and information from the client's documents and various site visits, our team was able to integrate the process control of the client's 2 existing RO systems with our new one exceptionally well, working with all existing equipment in tandem and the efficiency of the whole water production line further optimised.

Apart from the process designs, all parts and components and pipe-work quality meeting the international sanitary standards for food and beverage industry, our RO system was able to achieve up to 88% recovery of water upon optimisation at the project site upon testing and commissioning, surpassing the recovery rate expected by the client.