Procter & Gamble

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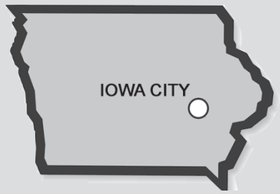


Procter and Gamble, headquartered in Cincinnati, Ohio, was founded in 1837 by William Procter and James Gamble. The company manufactures a wide array of products ranging from paper towels to coffee.

The Procter and Gamble Plant, located in Iowa City, is responsible for the production of over twenty different shampoo brands and also various flavors of mouthwash. The facility produces Scope® for the entire North American continent. Shampoo brands manufactured at the plant include Pert Plus® and Clairol Herbal Essences®.

Project Background

The facility requires reverse osmosis (RO) water for the following: process water, equipment cleanouts and boiler feed water. The current system operates 13 hours a day, 5 days a week, and several hours on the weekends. The system consists of three RO making units, one for cold RO water and two for hot RO water. Each one of these units operates at an overall recovery of 75 percent and a feed flow rate of 200 gallons per minute.

Incentives to Change

For every four gallons of water that enters each of the RO units, one gallon is rejected and sent to a 500-gallon storage tank. The contents of this tank are utilized by the HCl scrubbing towers which operate 24 hours a day, 5 days a week. However, the amount of RO reject water produced almost always exceeds the demand of the HCl scrubbing towers. This leads to the diversion of the RO reject from the storage tank to the municipal sewer via an overflow pipe. Due to this supply and demand mismatch it is estimated that 30 million gallons of RO reject are sent to the municipal sewer each year. The rejected water simply enters the facility and goes down the drain without ever being utilized. This practice costs the company approximately $250,000 per year.

Results

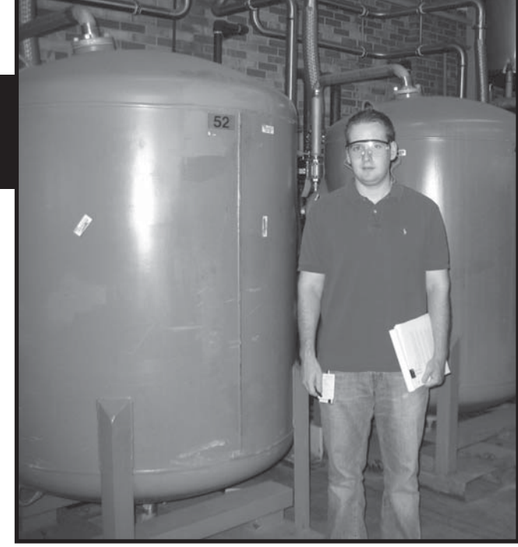
The amount of RO reject produced is a function of water use and overall system recovery. Plant personnel have begun to enact procedures to significantly reduce the amount of water consumed. The manner in which equipment cleanouts are performed has been amended to allow for 60-70 percent reductions in water consumption related to this activity. Due to project time constraints and plant personnel proactively implementing water conservation practices, it was decided that overall system recovery and recycling alternatives be investigated.

The four primary options that were researched regarding overall system recovery and recycle of RO reject water are listed below:

- Construct a 50,000-gallon storage tank so that the reject water may be utilized for cooling tower make-up water in addition to HCl scrubbing tower water.
- Evaporate and condense the RO reject water so that the distillate could be used for process water.
- Construct a recycle line on the system itself to reintroduce the reject at the entrance of the system so that it may pass through the system one more time.
- Replace the current saltwater membranes with brackish water membranes.

The first option is not feasible because it requires costly construction of a large storage tank without significant return on investment. The second option is also not feasible because it necessitates purchasing expensive equipment, construction of a building to house the equipment and an inordinate amount of energy. The third option is not possible due to the company's standard operating procedure which does not allow for water to be recycled and reintroduced to the entrance of a reverse osmosis system. The reason for this is because the reject may potentially contain large amounts of bacteria which would contaminate the RO system.

The last option is the most technically and economically feasible option. Replacing the saltwater membranes with brackish water membranes is the most viable option because RO reject can be reduced by 10 million gallons per year. These membranes operate at lower pressure and thus require less energy, very little capital investment is required, no construction is necessary, and the replacement membranes are $250 less per membrane than the current membranes. There will be no appreciable drop-off in permeate quality if the brackish water membranes were to be installed. Due the advantages stated above, membrane replacement is thus recommended.



Air Pollutants Diverted in Tons

	Total for all sectors
SO2	0.54
CO	0.03
NOX	0.243
VOC	0.002
LEAD	0.0
PM	0.01

Green House Gases Diverted in Tons (CO2 Equivalent)

	Total for all sectors
CO2	97.9
CH4	0.02
N2O	0.65
CFCS	1.20

Project	Annual Cost Savings	Environmental Results	Status
CONSTRUCT 50,000 GALLON STORAGE TANK FOR HCL SCRUBBER WATER AND COOLING TOWER MAKE-UP WATER	$80,000	25 million gallons of water	Not Recommended Not Feasible
EVAPORATE AND CONDENSE	$20,000	20 million gallons of water	Not Recommended Not Feasible
CONSTRUCT RECYCLE LINE	$130,000	16 million gallons of water	Not Recommended Not Safe
REPLACE MEMBRANES	$330,000	10 million gallons of water & 330,000 kWh	Recommended