Medical Device Manufacturer incorporates new technologies to expand production and reduce water consumption

Real Challenge

A medical device manufacturer in the United States wanted to expand production capacity without exceeding discharge limits that could result in crippling financial penalties. A city mandate of 10% reduction in water consumption for industrial users challenged the plant's desire to expand as water discharged from its operations was already rapidly approaching discharge limits. Additionally, it wished to drastically reduce its raw water requirements and waste disposal cost of operation.

The plant was producing a waste stream of 375 gallons per minute (GPM) containing organic and inorganic manufacturing by-products, which contaminated the process waste stream. Historically, this process waste stream would be sent to a waste treatment and disposal process. A significant reduction of this waste stream was required to facilitate plant growth without expanding the waste discharge.

The specifics for this water system include:

- 300 GPM make-up water requirement
- Operation: 7 hrs/day, 5 days/wk, 50 wks/yr
- Feed water cost: $1.33/1,000 gallons
- Wastewater discharge cost: $2.77/1,000 gallons
- Electrical cost: $0.05 kWh

Additional Project Goal Requirements:

- Recover water stream at a higher quality than the plant's feed water, for use as feed water
- Reduce organic contaminant #1 (proprietary) to less than 1 part-per-million (ppm)
- Reduce organic contaminant #2 (proprietary) to less than 5 parts-per-billion (ppb)
- Reduce the bacteria to less than 100 colony forming units (cfu) per milliliter

Real Depth of Solutions

Siemens Water Technologies was chosen for this project based on its extensive process knowledge, piloting capacity and full complement of filtration technologies to allow a comprehensive, integrated treatment package. Of five membrane design options provided by Siemens, a nanofiltration design was selected for piloting based on specific organic and ionic rejection characteristics and cost-efficiency of operation.

The design included the following:

- Activated carbon to remove chlorine and specific organic #2
- Nanofiltration to remove specific organic #1 without removing selective inorganic compound
- Sanitization station for microbial control
- Storage/distribution of water
- Ozonation for organic and microbial control

The design solution was piloted for an extended period of time to verify its capability to effectively remove the organic compound, maintain acceptable operating characteristics and avoid excessive cleaning or fouling. Additionally, the system would selectively pass a specific inorganic compound that was injected upstream and utilized for manufacturing. By not removing this inorganic constituent, the company could avoid the cost and complexity of re-injecting this pretreatment chemical.

Real Results for Real Impact

After installation and piloting, the nanofiltration system proved to be the best-suited technology for this wastewater stream recovery and reuse, performing exactly as designed and predicted.

The new system successfully recovers 80% (300 GPM) of the 375 GPM complex waste stream, producing a new permeate stream that is superior to the plant's feed water system. This eliminates 300 GPM of feed water requirements and the need to dispose of 300 GPM of a complex waste, saving the plant over 52 million gallons of feed water per year and lowering waste disposal by more than 52 million gallons per year. These improvements allow the plant to achieve its requirements to reduce water consumption by 10%, while still expanding production of medical device products.

The plant's water reuse system saves approximately $3.36 million over a 10-year period. These savings do not include the regulatory penalties avoided or the financial impact of the facility's inability to grow in production capacity.

The tremendous success of this system has resulted in multiple duplicate or closely related system designs around the globe for this progressive pharma manufacturer.

Project Profile

- **Application/Goal**
  Healthcare device manufacturer water treatment technologies integrated for more production capacity, less water consumption
- **Capacity**
  375 GPM
- **Commissioned**
  2007
- **Key Technologies Selected**
  Activated carbon, nanofiltration, sanitization station, storage/distribution, ozonation

Reuse Approach

Siemens' integrated reduction, reclaim, reuse approach can provide significant cost savings while promoting a gentle global footprint. Reuse can be defined as the treatment of a waste stream to sufficient levels to enable its return to the system as feed water. The treated waste stream is often of better quality than the original feed water, improving overall quality performance.

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