

Lifecore Biomedical saves by reducing water and sewer costs

Lifecore Biomedical Inc. removed unnecessary equipment and repaired water valves to reduce water use by 3.86 million gallons a year, saving \$69,000 a year plus an anticipated \$157,000 in one-time SAC fees.

Lifecore Biomedical is a leading manufacturer of dental implant systems, tissue regeneration products and medical grade hyaluronan, a material with many uses in health care. Lifecore manufactures medical grade hyaluronan (also known as hyaluronic acid or sodium hyaluronate) using a fermentation process that requires purified water, both as an ingredient and for critical cleaning tasks. The Chaska plant used between 40,000 to 55,000 gallons of water per day.

Incentives for Change

A new family of products gained U.S. Food and Drug Administration (FDA) approval in 2001. As Lifecore increases production, the facility's water use will increase. Increased water use will cost the company in price per gallon and in charges for increased wastewater volume from both the Metropolitan Council Environmental Services (MCES) and the City of Chaska.

MCES assesses a one-time Service Availability Charge (SAC) on increases in baseline water use in order to fund expanded capacity in the sewer network. Because Lifecore expected SAC charges to cost in the 100s of 1,000s of dollars, the company requested a MnTAP intern to identify ways to reduce water use and minimize the SAC fees.

The intern determined that the City of Chaska had Basic Equivalent Unit (BEU) charges that were 2.5 times higher than the SAC fees. BEUs are similar to SAC, but they primarily support building infrastructure for distributing freshwater. BEU charges are one-time costs.

Producing sterile, purified water at Lifecore is expensive. It costs roughly 25 to 30 times the water and sewer costs—as much as the SAC and BEU combined but on a recurring basis.

Steam Generators

Pure-steam generators produce sterile steam from high purity water for cleaning fermentation tanks and other production equipment that comes in contact with the product. One generator had a condensing coil to make steam sampling easier for quality control. This coil used a 1.3 gallon-

per-minute (gpm) continuous, high purity water stream to condense a small, steam purge. To lower the temperature before entering the polyvinyl chloride (PVC) sewer line, a 1.0 gpm stream of city water was mixed with the condensate wastewater. Lifecore wondered if the coil could be removed from service because the second generator operated without a condensing coil.

The intern found that quality control staff had changed procedures and were taking samples at the steam's points of use, making samples at the generators unnecessary. Next, the intern investigated whether the coil's operating parameters were embedded in the software programming of the generator controls. The maintenance staff was manually adjusting the controls and could be removed without impacting how the generator operated. The coil was removed in less than one hour for a total cost of \$20.

Cutting off the two continuous water streams saved 1.2 million gallons per year (gpy) and cut utility costs by \$58,000 for high purity water and \$1,800 for city water. This reduction should reduce future SAC and BEU liabilities by \$49,000 at 2002 rates.

Autoclave

Two autoclaves were used to sterilize production equipment. Both autoclaves were kept in standby mode when not in use, where steam continued to warm the autoclave jacket and a continuous flow of city water cooled the steam condensate. Standby mode used 2.4 gpm of water on one autoclave and 3.6 gpm on the second. The autoclaves were kept on standby rather than turned off, in part for convenience and because previous experience showed that thermal contraction and expansion during startup and shut down led to increased maintenance for steam leaks.

The intern measured the temperature of wastewater at the drain during standby. Because the water temperature (56°F) was cooler than it needed to be for the PVC piping—rated to 150°F—the intern determined that the volume of cooling water could be reduced.

Initial review of the plumbing and flow control system found three opportunities for improvement.

1. A solenoid valve, that controlled flow to the aspirator used during the evacuation steps of the sterilizing cycle, leaked badly. The solenoid valve was repaired.
2. One autoclave used a manually-set needle valve to control standby flow. A temperature regulating valve replaced the needle valve, cutting off the continuous cold water flow when it was not needed to reduce wastewater temperature.
3. One autoclave using a newer temperature regulating valve was suspected of malfunctioning. The valve was repaired by replacing a missing orifice plug.

Repairs and modifications took about seven hours of labor (cost \$175) and cost about \$500 in valves and repair supplies. Wastewater flows during standby were reduced to drips and trickles of less than 0.03 gpm each. Savings were \$8,600 per year in water and sewer fees, and possibly \$98,800 in avoided future SAC and BEU charges.

Evaporation Losses

The building air conditioning system included a cooling tower. This cooling tower used an average of 2,000 gpd of water over the six-month cooling season. The company did not know how much of this evaporated and how much was sewerage as blow-down to control scale formation and the buildup of dissolved solids.

The intern examined the cooling tower's control system, which was controlled by a flow meter on the makeup water feedline. The water was purged from the system to the sewer periodically. Using this information, the intern determined how much makeup water was added between purges and calculated evaporation rates.

The intern conservatively calculated 1.3 gallons of blow-down for every 47.1 gallons of makeup water. MCES approved the calculations for evaporation rates based on the number of purges recorded. While water use did not change, excluding evaporation losses will cut Lifecore's sewer bill by \$870 a year in sewer fees and may avoid \$9,100 in future SAC charges.

Other Options

Lifecore was also considering proposals to:

- Add programmable controls to the fermentation process to reduce variability in water use between batches
- Optimize or eliminate condensate cooling
- Improve the steam yield from the steam generators
- Recycle off-spec high purity water to the feed side of the water purification system.

Application to Other Companies

Measuring flow was critical to understand water use in Lifecore's complex system. Because the company had numerous locations that did not have permanent flow meters installed, it rented two Panametric clamp-on flow meters that used an ultrasonic signal to track flows over time. Rented at \$7,400 for six weeks, the meters were expensive but allowed the company to easily monitor flows.

Consider including flow meters in the design of new processes or when significantly modifying existing processes. Turbine meters are much cheaper to purchase. They are permanent and install as part of the pipe, tracking flow by a turbine that spins as the flow pushes past. Turbine meters require more effort to install as a retrofit.

Rotometers are among the simplest, most reliable and least expensive flow meters. They do not track flow over time but provide visual feedback to operators on flow level. Like other permanent meters, rotometers are more difficult to install as retrofits.

The following clues helped Lifecore uncover opportunities to reduce its process water use. Look for them in your facility too.

- Similar equipment using different water volumes
- Visible flows that look larger than necessary or are present when they should not be (i.e., continuous flows when equipment is not running)
- Cool temperatures on drain lines from cooling applications. If you are trying to remove heat from a process, the used cooling water should be noticeably warmer after its use. A simple test is to feel if the outflow pipe is warm.

Impact at Lifecore

Water was reduced by 3.86 million gallons a year by removing a condenser coil that was no longer needed and by repairing water valves on two autoclaves. These changes reduced water and sewer fees by \$69,000 a year. As increased production raises water use, the one-time SAC and city BEU charges are expected to be \$157,000 lower.

The changes cost \$500 in supplies, \$7,400 to rent two strap-on ultrasonic flow meters, seven hours of maintenance labor and 500 hours of a student intern's labor to analyze a complex water distribution system and research reduction options.



For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency, and reduce costs. Our information resources are available online at <mntap.umn.edu>. Please call MnTAP at 612.624.1300 or 800.247.0015 for personal assistance or more information about MnTAP's Intern Program.

This project was conducted in 2002 by MnTAP intern Leslie Koessler, a senior in chemical engineering at the University of Minnesota.