McLean Thermal reduces water, energy use and avoids one-time SAC and WAC fees

A Champlin, Minnesota, manufacturer was facing one-time service availability and water access charges. They worked with a MnTAP intern to determine the best way to avoid those changes and reduce water and chemical use.

Company Description

McLean Thermal of Champlin, Minnesota, designs and manufactures cooling systems for electronic enclosures.

Incentives for Change

During 2006, McLean Thermal was given the opportunity to avoid one-time service availability (SAC) and water access charges (WAC) of $23,500 if they reduced water usage by at least 700,000 gallons per year. The company also was facing increased chemical and labor costs associated with the frequent replacement of their cleaning chemicals. McLean determined that the costs of not reducing water and chemical usage were too great and contacted MnTAP for assistance.

Process Description

In order to increase corrosion resistance and provide a foundation for painting, McLean currently operates two multi-staged iron phosphatizing pretreatment systems.

- Stage 1 is an alkaline cleaning solution used for washing incoming parts
- Stage 2 is a city water rinse
- Stage 3 is an iron phosphatizing step
- Stage 4 is a city water rinse

Kyle Dullinger, a MnTAP intern, worked with McLean Thermal to reduce their water and chemical use in their cleaning process.

- A deionized (DI) water halo spray is used as a final rinse immediately after stage 4
- Stage 5 is a sealant that is sometimes used for parts that do not require painting

As the parts pass through each of the stages, the solutions in the tanks are sprayed through nozzles onto the parts. Drainage from the parts is directed back into the tank from which it was sprayed.

The alkaline cleaning process results in the accumulation of soils that can cause plugged nozzles, equipment wear, and decreased washing efficiency. In the past, operators were required to clean the tanks frequently to combat the rapid accumulation of the soils. The frequent cleanings required the purchase and replacement of chemicals and water while using approximately 100 hours of labor to clean the tanks.

Benefits at a Glance

	(reduced)
gallons of chemicals used	1,380
gallons of water used	1.9 million
therms of natural gas used	2,600
one time SAC and WAC charges	$25,000
annual cost savings	$20,000

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Waste Reduction Project

In 2007, McLean hosted a MnTAP intern who researched ways of reducing heat, chemical and water waste on the paint line pretreatment processes. McLean believed that finding a better system to handle the soils accumulation in the cleaner stage would reduce the frequency of the tank cleaning and extend the life of the cleaner. Additionally, finding a better use of the rinse water also had potential to reduce water and sewer costs.

Water Savings

McLean's paint pretreatment rinse stages previously consumed 3.5 million gallons of city water per year in the form of continuous overflows. An additional 140,000 gallons of city water were used per year for the weekly cleaning and refilling of the rinse stages.

A recommendation was made for McLean to discontinue the addition of city water to each of the stage 4 rinse tanks. Instead, waste drainage from the DI halo spray was directed to the stage 4 rinse tanks to maintain an overflow of water. Not only did this reduce the amount of city water being used, but also provided stage 4 with purer water. The company was able to implement this change and the intern continued to monitor the rinse water purity throughout the project using a portable conductivity / total dissolved solids (TDS) meter purchased by the company.

The next suggestion was to reuse the relatively clean water from the stage 4 overflows for stage 2 rinse water. When compared with the fresh city water being used in stage 2, the stage 4 overflows were as clean or cleaner. As a result, the stage 4 overflows are now used as the stage 2 supply without degradation in product quality. This change has also resulted in less scaling buildup on stage 2 tank and spray nozzles. Making this change required that McLean install two flow meters, a flow regulator valve, and a new water pipe for each of the paint lines.

While monitoring the conductivity/TDS of the rinse tanks, it was determined that the frequency of rinse tank cleanings could be reduced. Instead of scheduling a rinse tank changes each week, operators were instructed to perform weekly tests of the rinse stages using the conductivity/TDS meter and use the results of those tests to determine the proper time for dumping the rinse tanks. Operators have reduced the tank cleaning frequency from weekly to monthly, which is saving water and labor with no loss in rinse quality.

Bath Life Extensions

The first stage in McLean's paint pretreatment system involves the use of spray nozzles to clean soiled metal parts. The soils from this wash step drain back into the tank, resulting in an accumulation of particulate that coats the equipment, plugs nozzles, and collects on the bottom of the tank. In order to prevent equipment failure and maintain quality, frequent tank cleanings are necessary.

The intern worked with the chemical supplier and company engineers to investigate methods of removing these solids from the wash tanks in order to increase the bath life and reduce the number of cleanings required. A filtration system was installed which purifies the cleaning solution by pumping it through a bag filter and returning it to the tank.

New automatic bath level sensors, along with the accompanying solenoid valves, were also installed on the south paint line which will result in more control over the bath levels in the heated chemical stages. This prevents the overflow of the chemical tanks and warns of low solution levels which could damage pumps and heating equipment.

Reduced Heat

The temperature of the iron phosphatizing bath on the north pretreatment line previously operated at 120ºF, but a report from the chemical supplier revealed that a range of 113-118ºF was more desirable. The chemical supplier performed tests that indicated the desired coating weight of 35 mg/ft^2 was still being achieved at a lower operating temperature. The bath operating temperature was lowered to 115ºF using the remote electronic controller.

Benefits

By implementing the procedural and equipment changes from the MnTAP intern project, McLean Thermal anticipates an annual reduction of 1,380 gallons of chemicals, nearly 1.9 million gallons of water, and 2,600 therms of natural gas. Additionally, the company will avoid one-time SAC and WAC charges of nearly $25,000 and will continue to realize an annual cost savings of $20,000.

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 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 2007 by MnTAP intern, Kyle Dullinger, a chemical engineering junior at the University of Minnesota.