Green Cleaning

Saving money and the environment.

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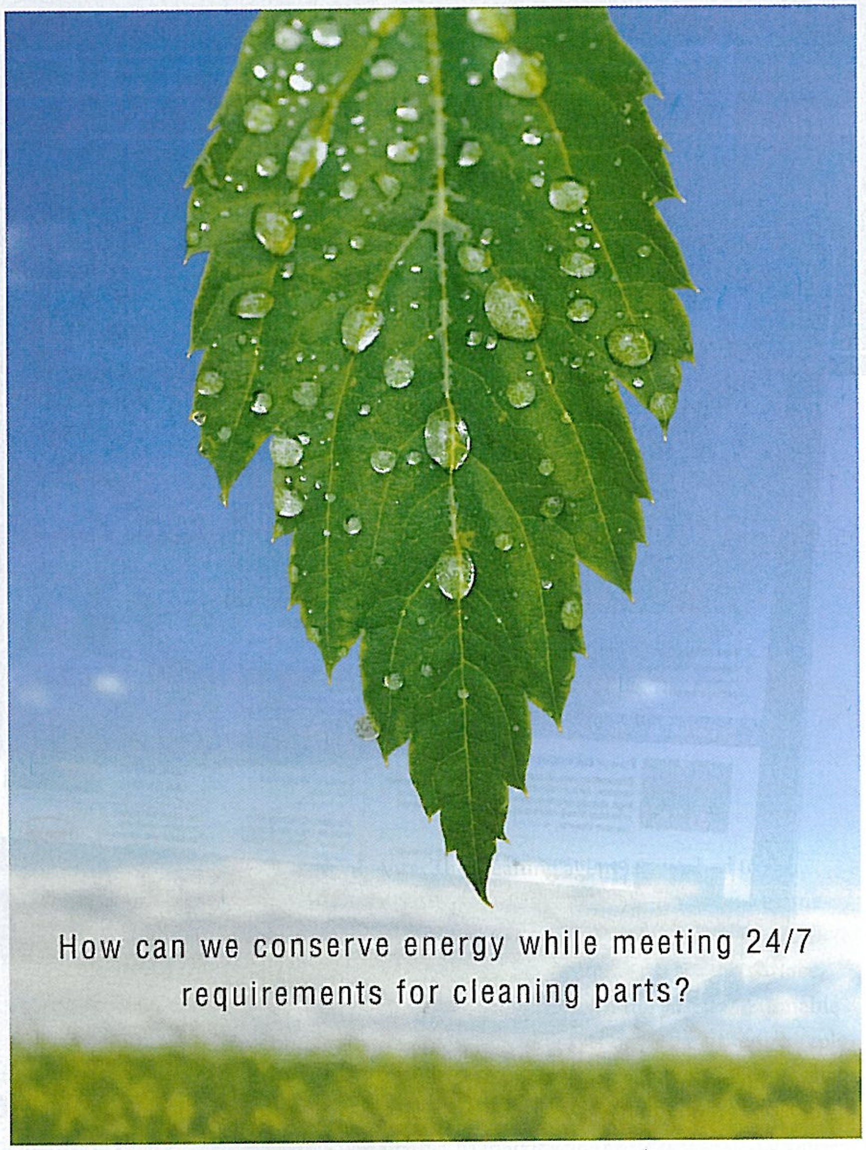
Ford Motor Co.'s Sharonville, Ohio, plant has long been a proponent of environmentally conscious manufacturing practices. A supplier of automotive transmissions and transmission parts, the plant has invested in a sophisticated parts cleaning system that effectively recycles the cleaning solution.

A top priority at the plant is production of quality parts, which equates to no transmission failures for the end-consumer. To reach this goal, parts must be shipped with little oil and metal particulate, and proper rust inhibitor, all measured in less than 1 mg per part. Cleaning the parts in a cost-effective, environmentally friendly process has been a continuous mission for the company. That mission and the cleaner recycling investment led Ford Motor Sharonville to be innovative in addressing these specific production-improvement questions:



PROBLEM The need to conserve more energy and improve worker health/safety within the existing cleaning infrastructure

SOLUTION The addition of a non-toxic additive to the cleaning chemistry and a microbial control system to eliminate odor and control anaerobic bacteria

RESULTS More than $750,000 in annual savings through energy conservation and reduced filter bag usage

- How can we conserve energy while meeting 24/7 requirements for cleaning parts?
- How can we eliminate the need for bag filtration?
- How can we improve worker health and safety?
- How can we avoid repeated discharging of cleaner fluid?

Ford teamed with research specialists from LCP Tech Inc. to design and implement improvements to the cleaning process, achieving practical, cost-effective answers for all of these questions.

The Former Aqueous Washing Operation

The company's manufacturing process upstream includes grinding, machining, heat treating, broaching, burnishing and laser welding. Its centralized parts washing system, which operates 24 hours per day, seven days per week, cleans 30,000 parts per day, each coated in a mixture of oils (broaching, soluble and light mineral oils) and metal particulate before entering the washing process. The system, which maintains and supplies cleaning fluid to 17 individual washers, is supported by a 10-gpm reverse osmosis (RO) and ultrafiltration system with a filter canister containing 12 individual filtration bags using indexing media filters at 200 microns. The system is maintained by one pipe fitter per shift and is supported by process engineering. It is cleaned twice a year during normal plant maintenance with a "new charge" of 12,000 gallons of fluid, which are heated continuously to 140°F using a 5,000,000 Btu/hr gas heater.

Project Improvement Approach

Because of the significant investment made in this integrated system, a key constraint for the project team was to use the existing infrastructure with little or no additional capital costs. Additionally, testing could not affect the quality of the parts shipped during the project.

Starting with simple questions, the team attempted to address three of the highest user-intervention activities using a four-phase approach:

- Can the ultrafiltration cleaning cycle be extended from every three days?
- Why are bag filters being changed every three hours?
- Can we reduce the frequency and volume of cleaning-fluid additions?
- Can we eliminate the heat necessary to control the growth of bacteria?

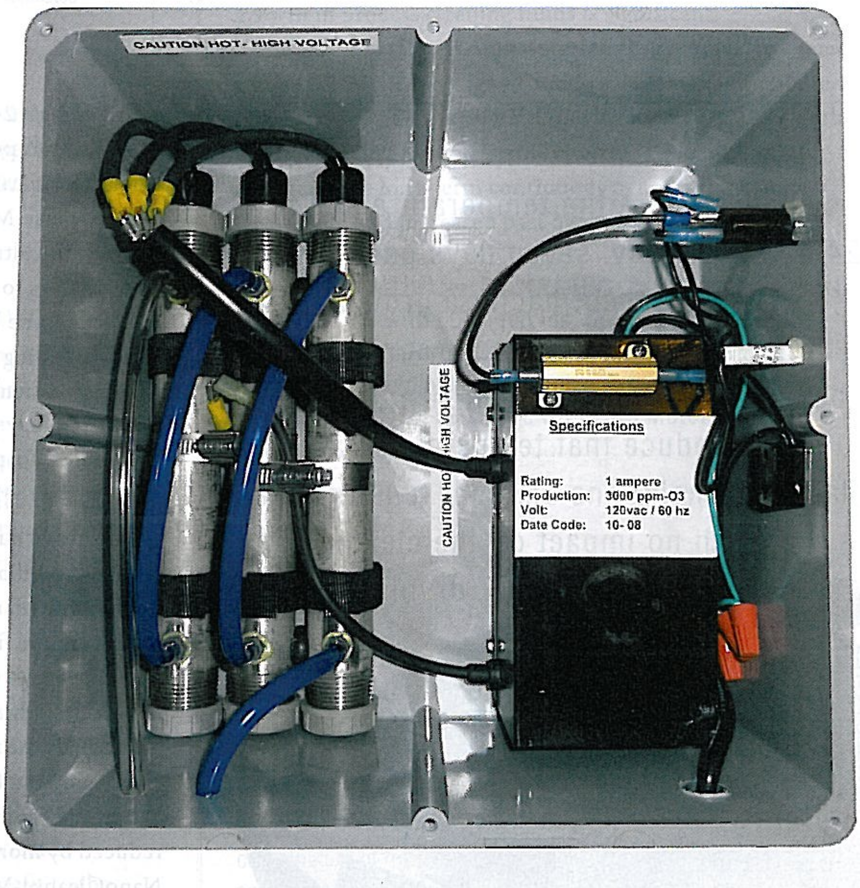
Phase 1: Improving Ultrafiltration

The least disruptive method of improving the ultrafiltration cycle came from changing the chemistry of the base cleaning fluid to include a non-toxic additive from LCP Tech called Nanocleanse-SRB that is designed to eliminate odor and control anaerobic bacteria. The additive prevents the SRB bacteria from converting sulfates in the water and oil to sulfides, but it is non-toxic and does not kill the bacteria. The bacteria die naturally due to their inability to convert sulfate to sulfide, which is needed for their survival and growth. The bioconversion of sulfate to sulfide is a major cause of odors (hydrogen sulfide) in cleaning tanks and also results in corrosion within engine parts and machinery.

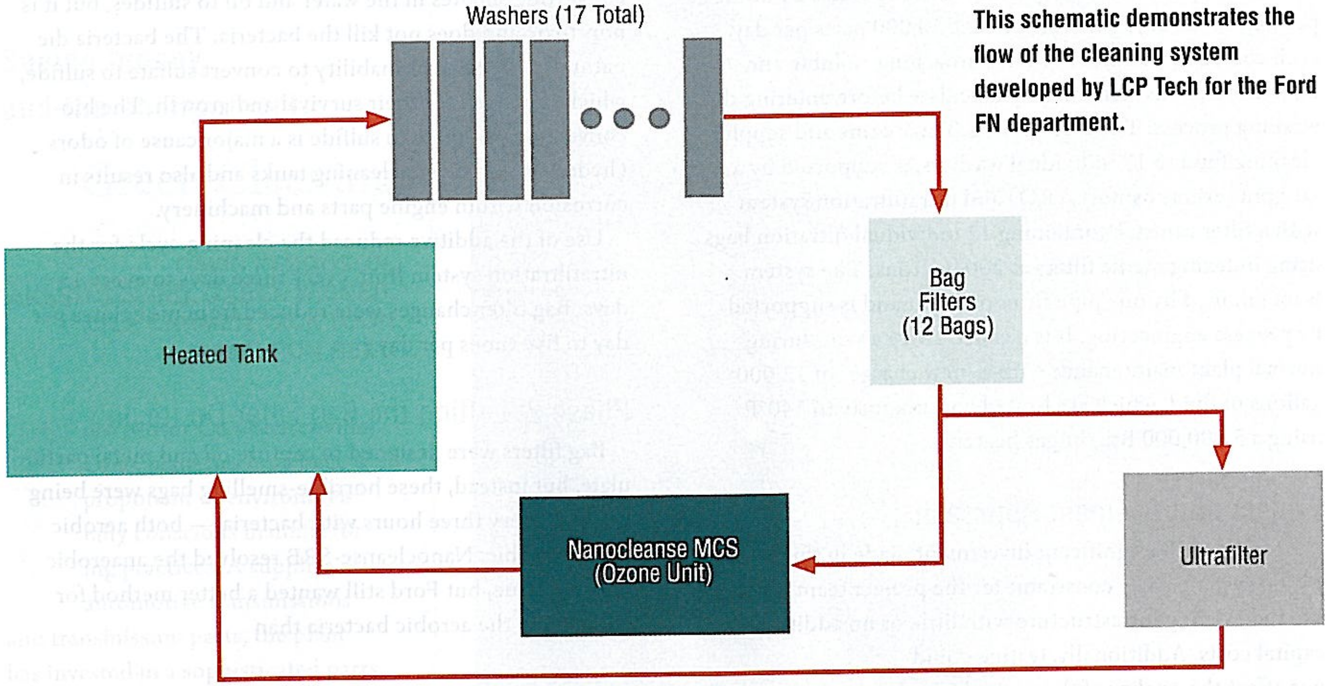
Use of the additive reduced the cleaning cycle for the ultrafiltration system from every three days to every 15 days. Bag filter changes were reduced from nine times per day to five times per day.

Phase 2: Letting the Bag Filter Do Its Job

Bag filters were designed to capture oil and metal particulate, but instead, these horrible-smelling bags were being clogged every three hours with bacteria — both aerobic and anaerobic. Nanocleanse-SRB resolved the anaerobic bacteria issue, but Ford still wanted a better method for controlling the aerobic bacteria than



This ozone-generating unit is part of the microbial control system from LCP Tech that Ford uses to reduce the aerobic bacteria count in its cleaning tank. The ultrafiltration cleaning cycle has been extended from 15 days to 25 days.



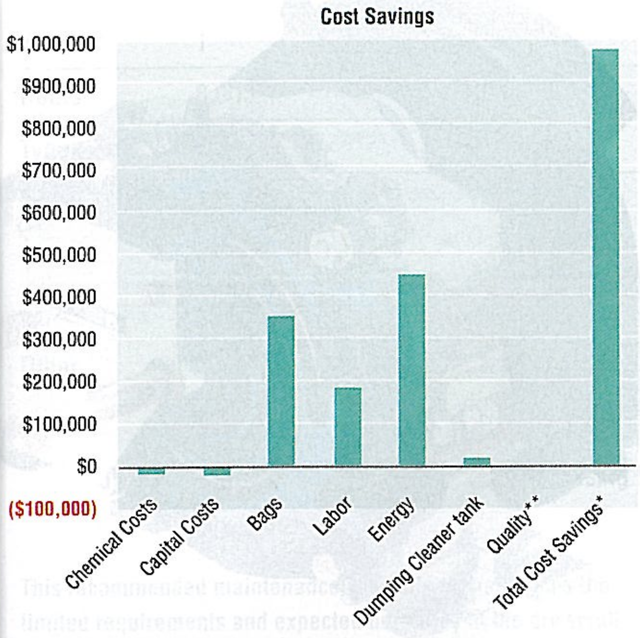
This schematic demonstrates the flow of the cleaning system developed by LCP Tech for the Ford FN department.

Ford was spending more than $450,000 annually to maintain the central system's operating temperature at 140°F 24 hours per day, seven days per week, to prevent bacteria growth. Once bacteria growth was under control using new chemistry and proper filtration, Ford could reduce that temperature, and the plant now maintains ambient temperatures with no impact on the cleaning and drying process.

maintaining a 24/7 operating temperature above 140°F. LCP Tech proposed a method of reducing the aerobic bacteria count in the cleaning tank by using its ozone-based NanoCleanse-MCS microbial control system. Within two months, the ultrafiltration cleaning cycle was extended from 15 days to 25 days, and the bag filter changes were reduced to one bag change every three days. Finally the bag filter was doing the job it was originally designed to do — filtering particulate, not bacteria.

Phase 3: Conserving and Extending the Life of Cleaning Fluid

The heavy build-up of black sludge (microbial slime layers) caused by bacteria in the bottom of the central heating system needed to be removed every six months to prevent the fire tube (heating elements) from burning out. The entire 12,000-gallon system was discharged and the black sludge removed from the bottom of the tank. Sometimes the fluid needed to be discharged again within three months of cleaning. After using Nanocleanse-SRB for a year, the volume of slime at the bottom of the tank was reduced by more than 50 percent. With the addition of the NanoCleanse-MCS, the mandatory six-month cleanout was extended to one year, and the sludge volume was reduced by more than 75 percent. Bi-annual discharge of the cleaning tank is now optional.



** Does not include savings from quality improvements*

*** No quality degradation—quality improvements were not estimated*

While the cost savings of the new system (well over a half million dollars) far exceeded the company's expectations, many feel the biggest benefit came in the positive effect on the employees and the environment.

Phase 4: The Homerun—Energy Savings

Ford was spending more than $450,000 annually to maintain the central system's operating temperature at 140°F 24 hours per day, seven days per week, to prevent bacteria growth. Once bacteria growth was under control using new chemistry and proper filtration, Ford could reduce that temperature, and the plant now maintains ambient temperatures with no impact on the cleaning and drying process.

Small Costs Yield Large Savings

With capital costs of less than $19,000, no infrastructure change and no additional worker maintenance time, Ford's realized cost savings were beyond the company's expectations. The most significant savings came in energy consumption ($450,000) and the filter bags ($353,000).

The intangibles—odor control, extended cleaner use and lower energy usage—are of most benefit to the environment and the employees. And all four phases were performed without interruption to production and degradation of quality specifications.

Putting the Pieces Together

Key to the success of a project such as this is a team dedicated to the principles of sustainable environmental improvements. Several other factors also were critical to the project's success.

Too often, a costly technology is used to solve both complex and simple problems. In restructuring its processes, Ford was able to match each process to the correct technology. The paper filter bags perform as designed, the ultrafiltration eliminates only what it was designed to remove, and the heat is used only for drying.

Nanocleanse-SRB was the "drop-in" technology that assisted at each point in the filtration process. It can be a tank-side additive or, in the case of this study, it can be incorporated into the cleaner formulation. Its non-toxicity and continuous use (vs. using no additives or using biocide additives) provide a consistent and sustainable cleaner mixture. The use of NanoCleanse-MCS to control aerobic bacteria created significantly less fouling of the ultrafilter and the 200-micron bags. The negative effect of microbial growth in process cleaning fluids is significant.

Environmentally friendly solutions to complex problems can be researched, designed and implemented with limited resources. Working with fluid specialists such as LCP Tech can help to determine a plant's most suitable methods for achieving the long-term continuous benefits of extended cleaner life and increased part quality. PC

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