

Arctic Cat Inc. reduces water, energy, and chemical use with assistance from a MnTAP intern

Arctic Cat Inc. of Thief River Falls, Minnesota, designs, engineers, manufactures, and markets snowmobiles and all-terrain vehicles.

As a manufacturer of recreational vehicles, Arctic Cat needs to find ways to stay competitive. Therefore, the company evaluated its efficiencies and costs to determine where improvements could be made. The company discovered two areas that needed attention: water and chemical use in the conversion coating system and energy use in the compressed air system. Arctic Cat then applied to MnTAP's intern program to get site-specific pollution prevention and energy efficiency solutions for these areas of the facility.

Water and Chemical Use in the Conversion Coating System

The conversion coating system at Arctic Cat consists of eight tanks: two alkaline cleaner tanks, a water rinse tank, an iron phosphate tank, another water rinse tank, a seal tank, a de-ionized water (DI) rinse tank, and a halo rinse tank. The two 2,000 gallon alkaline cleaner tanks contain a phosphate-free, low-temperature cleaner that operates at 110°F. The first rinse tank has a total capacity of 1,500 gallons. The iron phosphate tank has a capacity of 2,000 gallons and uses a 4% concentration of the iron phosphate chemical while operating at 130°F. The second rinse tank also has a capacity of 1,500 gallons. Following that tank, there is a 320-gallon non-chrome seal tank and a DI rinse tank with a 680-gallon capacity. The final tank is the halo rinse tank.

The MnTAP intern evaluated the conversion coating system for improvements and determined



MnTAP intern, Zain Sutarwala, checks for compressed air leaks to improve compressed air efficiency at the Arctic Cat facility.

that Arctic Cat could reduce waste and save money by reusing water within the line and reducing the phosphorus being discharged to the sewer.

Water Reuse

The conversion coating line at Arctic Cat has two rinse stages that pull in city water and overflow four million gallons of wastewater back into the sewer. The company believed that this quantity of water would ensure that the total dissolved solids (TDS) in both rinse tanks stayed below 1,000 ppm. The city water entering the system has a TDS level of approximately 400 ppm.

The first rinse tank is fed with the city water at a flow rate of 7.5 gpm to ensure that the TDS level remains below 1000 ppm. The second rinse tank, which has a TDS level of approximately 330 ppm, is fed with city water as well as water from a DI rinse tank, which is the seventh tank in this line. The DI tank has an approximate TDS level of 9 ppm. Therefore, whenever the second rinse tank was drained and refilled, the TDS level rose above 330 ppm. Overall, these rinse stages cost the company \$12,000 annually in water and sewer costs.

The MnTAP intern and the paint operations manager at the facility investigated the possibility of reusing the wastewater from the second rinse stage by piping it back to the first rinse. After completing water quality tests and consulting the

Benefits Overview

Waste Reduction Option	Waste Reduced/ Materials Savings	Annual Cost Savings
Reusing 2nd City Rinse Into 1st City Rinse	2,430,000 gal. water	\$7,200
Lowering the Concentration of Iron Phosphate chemical (4%-3%)	560 gallons of chemical 150 pounds of phosphorus	\$5,100
Fix leaks in Compressed air lines	130,000 kWh	\$6,400
Turning off Compressor at night	260,000 kWh	\$15,000

company's chemical supplier, the intern determined that reusing the water from the second rinse stage in the first rinse stage would not cause problems and might help neutralize the higher pH of the first rinse.

After the facility implemented this change, the MnTAP intern tracked the TDS levels and pH of the rinse tanks. He found that although the TDS in the first rinse tank increased to a level between 600 ppm and 700 ppm, it remained within the chemical supplier's 1000 ppm limit. The TDS level in the second rinse tank remained between 300 ppm and 400 ppm. This project cost approximately \$600 to implement, which included the construction of a small tank from scrap metal, piping, and a 1/3 hp sump pump. Overall, Arctic Cat is saving \$7,200 and 2,430,000 gallons of water annually.

Phosphorus Reduction

Prior to the intern project, Arctic Cat was discharging wastewater that exceeded the City's proposed phosphorus limit of 10 mg/L. Therefore, the MnTAP intern worked with Arctic Cat's chemical supplier to determine ways to reduce the phosphorus levels.

The chemical supplier suggested reducing the phosphorus concentration in the iron phosphate stage of the conversion coating line. Reducing the phosphorus concentration in this stage would reduce the amount of phosphorus being carried over to the rinse stages. Using a lower concentration would also allow Arctic Cat to reduce the quantity of chemicals purchased and added to the line.

The phosphorus concentration was reduced from 4% to 3% in the iron phosphate stage. This was accomplished by limiting chemical additions to the system and using just the chemical that was already in the tank. The company's chemical supplier ran multiple tests on the reduced concentrations to verify the quantity of the phosphate coating applied. The tests were verified before permanent changes were made to operating procedures.

By making this change, Arctic Cat reduced the amount of iron phosphate purchased by 560 gallons per year. The new procedures have resulted in a reduction of 150 lb of phosphorus going to the sewer and \$5,100 in cost savings annually.

Compressed Air System Efficiency

Arctic Cat has three 200 hp and one 30 hp rotary screw compressors that provide compressed air for a variety of purposes. Two of the three 200 hp compressors are required to run at 105 psi every day to fulfill the company's need for compressed air. Running these compressors costs the company approximately \$105,000 annually. The 30 hp compressor runs for 24 hours a day throughout the week in the engineering department, but is not connected to the main compressed air system. In addition to the compressors, Arctic Cat has one

storage tank in the main plant that only serves one powder coating booth

The company determined that there were inefficiencies linked to the compressed air system. The MnTAP intern evaluated the system and determined that Arctic Cat could save energy and money by fixing leaks in the system and changing the shut-down procedure.

Compressed Air Leaks

To reduce the load on the compressors and save energy, the MnTAP intern determined that the compressed air supply lines should be examined for leaks. Through two methods, over 400 leaks were identified and then repaired. First, an Arctic Cat employee used a spray bottle filled with soapy water to test connections for leaks. Second, the intern tested additional areas using an ultrasonic leak detector available through MnTAP. The intern estimated the leak sizes and used the U.S. Department of Energy standards to calculate the cost of the leaks. Overall, the leaks were estimated to cost Arctic Cat \$6,400 and reduce their energy use by 130,000 kWh annually. Since completing the project, Arctic Cat has purchased an ultrasonic leak detector to better monitor the air supply lines. Staff members in each department monitor the compressed air system for leaks as part of their equipment maintenance plan.

Compressor Shut-down Procedure Change

To further increase the efficiency of Arctic Cat's compressed air system, the MnTAP intern studied the compressors to determine when each one was running at full load or running unloaded. The electric amperage draw data the intern gathered from data loggers indicated that one of the 200 hp compressors continued to operate after the second shift had ended. The intern conservatively estimated that there were five hours between the last need for compressed air need during second shift and the first compressed air needed by the first shift. Therefore, the compressor could be shut-down for that five hour period. Arctic Cat has implemented a new procedure that requires staff members to shut off the compressor at the end of the second shift including a security check each night to verify the compressors were shut off. Shutting off the compressors will save the company an estimated 260,000 kWh and \$15,000 annually.

Benefits

By implementing the changes recommended by the MnTAP intern, Arctic Cat was able to reduce its annual water use by 2,430,000 gallons, its electrical energy use by 390,000 kWh, its chemical use by 560 gallons, and costs by nearly \$34,000. Additionally, the company has reduced their phosphorus loading to the wastewater treatment facility by approximately 150 lb.



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.