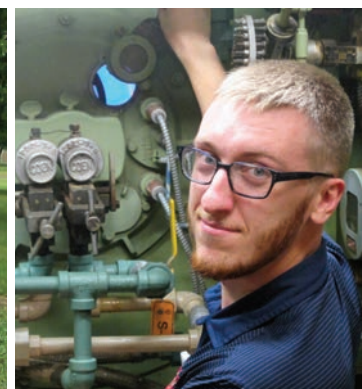
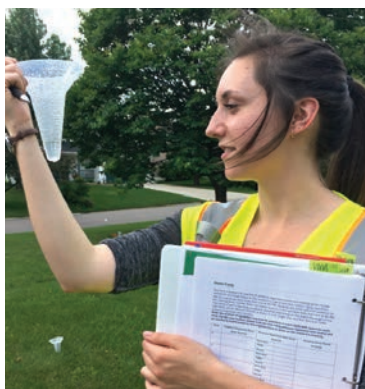


**Mn
TAP**

SOLUTIONS



2018 MnTAP Intern Program



“The 2018 MnTAP Interns demonstrated yet again the value of the program for developing Minnesota’s future technical leaders and providing SOLUTIONS with environmental and economic advantage for Minnesota businesses today.”
~ Laura Babcock, MnTAP Director



2018 Intern-Proposed Solutions

Recommendation	Reduction	Cost Savings	Equivalents (annual)
Waster Conservation	58,00,000 gallons	\$347,000	Water for 1,760 Minneapolis residents
Waste	606,000 lbs	\$153,000	Weight of almost 6 Metro Transit light rail cars
Chemicals	150,000 lbs	\$118,000	Approximately 300 55 gallon drums
Electricity	5,970,000 kWh	\$421,000	Electricity for over 600 Minnesota homes
Gas	337,000 therms	\$128,000	CO2 emissions from 400 passenger vehicles
Production Impacts	---	\$330,000	---
Total Potential Cost Savings	---	\$1,497,000	---

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MnTAP thanks our generous partners who make this vital work possible. Each of these organizations contributed financially to the intern program in 2018. Their support helps maintain our continuing pollution prevention, energy efficiency and water conservation work.



"MnTAP's internship program gives students the opportunity to gain vital experience while helping to protect human health and the environment. The program has been invaluable in supporting EPA's mission and in achieving its pollution prevention goals."

~ Christine Anderson
Pollution Prevention Coordinator, U.S. EPA, Region 5



"Xcel Energy is proud to continually be involved with an organization like MnTAP. We

specifically value the MnTAP Intern Program which brings students and local businesses together to make a positive impact by developing solutions to reduce energy and other waste. The high-quality projects that interns identify every year continue to allow our customers to reach their energy reduction goals."

~ Leah Piotraschke
Xcel Energy Customer Solutions



"CenterPoint Energy has been a strong supporter of the MnTAP Intern Program for several years. Our

customers see great value in working with these young professionals and they appreciate the fresh perspective the interns often bring to their organizations. The program is a great partnership that benefits both the businesses and the students through a real-world learning experience."

~ Todd H. Berreman
Director of Energy Efficiency, CenterPoint Energy



"Washington County was pleased to continue their partnership with MNTAP in 2018. The work of MNTAP staff and interns, in the area of

water efficiency, provided best practices and recommendations that will allow communities to realize water savings and protect this important resource for future generations."

~ Stephanie Grayzeck Souter
Senior Planner, Washington County



"Minnesota Energy Resources proudly supports the MnTAP Intern program. The program not only

produces viable energy efficiency projects that provide tangible benefits for our valued customers, but is also cultivating vital engineering talent for the future."

~Jim Phillippo
Minnesota Energy Resources, Manager of CIP Programs



"The MnTAP program is a fantastic way to connect students to real-life problem-solving experiences.

While learning from knowledgeable resources, they identify projects that help businesses and utilities meet their energy goals and push forward Franklin Energy's vision to help all people use our world's precious resources more efficiently."

~ Rose Shannon
Program Manager, Franklin Energy



Anoka County
MINNESOTA

"The assistance provided to businesses in Anoka County by MnTAP interns helps

conserve resources and increase efficiencies within their operations. The businesses and interns learn a great deal from the partnership. Anoka County is delighted to be a part of this work."

~ Amy Ulbricht
Commercial Waste Management Specialist, Anoka County

Be a Part of the 2019 Intern Program

A History of Success

For almost 35 years, MnTAP has been coordinating an intern program that places highly qualified students in facilities for three months to focus on pollution prevention and energy efficiency solutions. The goal of the program is to provide benefits to companies and students while extending MnTAP services to businesses around the state.

Participating businesses work with, at low-cost, an intern to research and provide solutions for pollution prevention and energy efficiency which are designed specifically for the facility.

Often, the savings realized from implementation far outweigh a company's cost-share, and interns gain hands-on experience that they often credit for enhancing their education and preparing them for careers.

Interns Have Far-Reaching Impact

The interns' impact reaches far beyond the walls of the facilities; many of the solutions identified during their projects have been applied to other companies, increasing the impact of the program.

Companies Reap Rewards

More than 300 companies have been served by the program. Interns have worked with industries such as hospitality, healthcare, manufacturing, and food processing. **Since 1985, all intern recommended solutions would save Minnesota companies:**

- 515 million gallons water
- 46 million kWh
- 3.5 million therms
- 111 million lbs waste
- \$13.5 million annually!

The bottom line is MnTAP intern projects result in solutions that positively impact a business and reduce its environmental footprint.

Sign Up Now

Do you have a pollution prevention or energy efficiency project that you'd like to tackle, but are pressed for time? Would you like to help a science or engineering student advance their technical skills while providing them

with a real-world opportunity to use their classroom knowledge?

Now is the time to start thinking about developing a project for the summer of 2019. Applications are accepted until **February, 2019**. Complete an online project proposal or call MnTAP today.



www.mntap.umn.edu/interns/business



"MnTAP continues to provide multiple wins for Minnesota: millions of gallons of water saved annually, thousands of dollars in operational cost reductions for businesses, and, importantly, real-world training for the engineers and scientists who will lead these efforts through the twenty-first century."

*~Brian Davis, Senior Engineer
Metropolitan Council Environmental Services*



"The MnTAP intern program always produces impressive results and this year was no exception. One project that stood out was Lamb Weston, where the intern identified solutions that could be immediately implemented with savings reaching ten times the company's cost share. Talk about a return on investment!"

~ Mark Snyder, Pollution Prevention Coordinator, MPCA

For more information and applications, contact Paul Pagel, Intern Coordinator, at 612-624-4638, ppagel@umn.edu, or at mntap.umn.edu/interns/student



Aveda Corporation



Meghan Pieper

Bioproducts & Biosystems Engineering,
University of Minnesota Twin Cities

Company Background

Aveda is a division of Estée Lauder Companies with a production facility in Blaine, MN. The location produces a variety of cosmetics, beauty, and personal care products for Aveda as well as other company brands, including hair color, lotions, shampoos, make-up, and many other products. The products are then sent to the Midwest Distribution Center, also in Blaine, for distribution to retailers across the country and around the world.



"Working with MnTAP has been an amazing experience. I've learned so much about working in industry, and I've broadened my skills to cover multiple types of engineering. I feel like I've been able to truly make an impact at Aveda, which could have a lasting impact on the community and environment as well." ~ MP

Project Background

The project goal was to reduce water consumption and waste, with focus on clean-in-place operations (CIP), and the use and generation of purified water.

Incentives to Change

Aveda uses 22 million gallons of water annually at a total cost of \$283,000 per year, with 20% of the volume and 55% of the cost associated with the production of purified water for use in products and some cleaning steps. In addition, Aveda has important corporate goals to reduce environmental impacts of their operations.

"The MnTAP program has helped Aveda with a focused effort to find opportunities for water, energy, and material reductions throughout the facility. Aveda's mission to 'care for the world we live in' is closely aligned with MnTAP's values, which has made it possible for us to realize our opportunities and achieve our goals."

*~ Dan Berry, Director of Facilities
Aveda Corporation*

SOLUTIONS

Sanitation Room Cleaning

The North Sanitation Room consumed 15% of facility water with just under half of that consumed by the ingredient bucket pre-rinse operation. Using more efficient nozzles for the pre-rinse will reduce water use by 640,000 gallons per year (40%), energy for heating water and speed up the process.

An improved spray ball installed to clean portable tanks, will reduce water use by 756,000 gallons per year (75%) as well as reducing energy for hot water.

Purified Water System Upgrades

Adding a variable speed reverse osmosis (RO) pump to the existing USP water purification system will lower the operating pressure until the whole system is replaced. This change will save 24,000 kWh per year and pay for itself in less than 2 years.

Aveda plans to replace the 18-year-old USP system because it is nearing its useful life from an equipment and technology standpoint. New system proposals were identified and evaluated that: double system capacity; adjust to demand to save energy; eliminate pH adjustment; and provide redundancy. The new system will reduce water consumption by nearly 1.5 million gpy and save

Solutions

32,000 kWh doing it. These savings would pay for the system in 18 years, not including productivity gains that are the main driver for replacement.

CIP Improvements

16 tanks have CIP water volumes determined by the location of the temperature probe that controls both CIP and batch temperatures. Adding a temperature probe to the recycle line on eleven tanks would reduce water use by 284,000 gpy and detergent use by 35,000 lbs, paying off the cost of change in 1.6 years. Payback is slower for the remaining 5 tanks.

Implementing new Gamajet nozzles on eleven tanks with manual CIP procedures should save 600,000 gpy, 35,000 lbs of detergent, and 4,900 hours of cleaning time that would then become available for production. This change would require installation of a



high-pressure USP water distribution loop, estimated at \$510,000. Water and detergent savings should be close to \$43,000 resulting in a payback of 12 years. The value of production time gained is expected to drive this change, but this was not quantified.

Water Softening

Replacing the current water softening system with a more efficient counter-current system should reduce water used for regeneration by 692,000 gpy and salt by 78,000 lbs per year. This would reduce costs by \$11,700 per year and payback the system cost in 7.3 years. The reduction in salt use would also reduce chloride releases to the environment – an emerging water quality issue.

Recommendation	Annual Reduction	Annual Savings	Status
New nozzle on sanitation room bucket washer	640,000 gallons 3,400 therms 31,000 kWh	\$6,900	Implemented
New tank washing nozzle in sanitation room	756,000 gallons 3,900 therms 25,000 kWh	\$13,000	Implementing
Add VFD pump to USP RO	24,000 kWh	\$2,500	Implementing
USP system upgrade	1.5 million gallons 32,000 kWh 11,000 lbs NaOH	\$37,000 + capacity	Planned
USP waste stream reuse	1.25 million gallons	\$6,600	Planned
Temperature probes in CIP recycle line (Part A)	284,000 gallons 26,000 lbs detergent	\$27,400	Recommended
New CIP cleaning recipe with Gamajet (Part B)	600,000 gallons 9,000 lbs detergent 4,900 hours	\$43,000 + capacity	Further investigation needed
Countercurrent water softener	692,000 gallons 78,000 lbs salt	\$11,700	Recommended

MnTAP Advisor: Karl DeWahl, Senior Engineer



AWT Labels & Packaging



Joshua Kirk

Environmental Engineering
University of Minnesota, Twin Cities

Company Background

AWT Labels & Packaging is a flexographic printing company based out of Minneapolis, MN. The company came about as a result of a merger between Web Label and Advanced Web, founded in 1991 and 1976. Facilities were combined in May of 2006 and now employ 164 people. A second facility in South Elgin, Illinois was acquired in the fall of 2011. AWT produces high quality labels and flexible packaging for some of the largest consumer goods manufacturers in the nation.



"This experience has been invaluable to me. It has been a welcome departure from school, where I only interact with my peers. Through this program, I have had the opportunity to learn from press operators, maintenance staff, plant managers, supervisors, technicians, executives, all who have diverse experiences much different from my own. I have made connections with mentors and professionals who know how to operate effectively in a professional work environment." ~ JK

Project Background

The project at AWT Labels & Packaging this summer was focused around two major aspects of the printing process: process waste and cleaning solvents. AWT had previously examined waste created while preparing for a printing job, as well as after a printing job in the rewind process, but waste generated during the actual run of the printing presses had yet to be explored. Cleaning solvents are used at work stations throughout the facility to clean printing press components. These solvents contain volatile organic compounds (VOCs) that are a hazard to the environmental and human health. A better understanding of run waste and exploring safer solvents was desired.



Incentives To Change

In the first six months of 2018, AWT produced nearly 3,400,000 feet of run waste on their four Mark Andy P-Series presses. This adds up to more than \$500,000 annually, not including disposal fees, energy, and production time. Run waste on the four P-series presses is a complex category of waste that was a good fit for an intern to use analysis and lean manufacturing tools to gain insight on what reduction might be possible. In 2017, AWT used more than 16,000 lbs of solvents that are among the safest in the industry. While solvents are necessary for production, examining cleaning effectiveness and creating standard work would reduce VOCs and keeps costs low.

"The MnTAP Intern Program provided us a resource with a fresh set of eyes, to focus attention on one area of our business in an effort to reduce our impact on the environment. The intern was given the scope of the project and ran with it with minimal supervision, while providing clear, concise updates to the team throughout the project."

~ Ann Warzecha

AWT Continuous Improvement Project Manager

Solutions

Create Standard Procedure for Roll Change

Currently there is no standard operating procedure for roll changes; even though they occur nearly 300 times a week on the P-series presses and involve both downtime and material waste. The roll change standard work procedure outlines the efficient practices that can be integrated to make roll changes quicker and wastes less material. In addition, the roll change standard work procedure helps bridge the gap between the performance of experienced versus inexperienced operators by providing a format that can be followed and executed effectively at all levels. In total, if the roll change standard work procedure is fully implemented on these presses, a full minute could be saved on every roll change; compounding to more than 240 hours of press runtime gained annually.

Manually Stop Press at End of Material Roll

Currently, the P-series presses use ultrasonic sensors to determine when base stock cores are expended. The operators will set a minimum outside diameter that corresponds to approximately the diameter of the cardboard core in the interior of the roll. However, the sensors are not infallible and often the cores are not perfect cylinders. Therefore, the operators will tend to set the minimum outside diameters liberally to prevent the roll from being completely exhausted before the sensor trips. This is critical because if the web were to be drawn into the press, the operators would be required to re-web the entire system, which is a time-consuming and arduous process. Concern over this situation causes the amount of material left on the core to be 63 feet on average. Instead, the operators could use the sensors more as a backup rather than a frontline by manually stopping the press at the end of rolls. This would require the operators to

be more attentive when changing rolls, but also has the potential to significantly reduce the quantity of material left on the expended cores.

Engage Helper for Multiple Roll Changes

Currently operators on the P-series presses must perform roll changes independently, no matter the complexity. However, about 25% of roll changes where a base stock is changed also involve at least two other rolls. A press helper could intervene, and assist the primary operator during these multi-roll changes by focusing on changing simple components such as a waste-wrap-up or a laminate roll. This would divert a press helper from other tasks, but overall the savings from getting the press back online faster would justify the diversion.

Standardize Current Cleaning Product Use

Currently, AWT uses six cleaning solvents at the press for cleaning components. Use of these chemicals is inconsistent between operators and jobs. Often, a VOC-intensive solution is used when a more benign solvent could be used with similar efficacy and result. Glycol Ether PM and N-Propyl Alcohol are two of these VOC-intensive solvents that have potential to produce significant quantities of ozone when released into the atmosphere. For UV and solvent-based inks, isopropyl alcohol has proven just as effective in cleaning up jobs as both Glycol Ether PM or NP Alcohol. This substitution would result in addition savings.

Recommendation	Annual Reduction	Annual Savings	Status
Create standard procedure for roll change	9,300 kWh 3,000 lbs 240 hours in downtime	\$130,000	Implementing
Manually stop press at end of material roll	20,000 lbs	\$66,000	Implementing
Engage helper for multiple roll changes	2,400 kWh 62 hours in downtime	\$25,000	Recommended
Standardize current cleaning product use	16,000 lbs hazardous solvents replaced	\$14,000	Recommended

MnTAP Advisor: Michelle Gage, Engineer



Carley Foundry



Aaron Carlson,
Environmental Engineering & Chemistry,
University of Minnesota, Twin Cities

Organization Background

Founded in 1955 by Frank and Lois Carley, Carley Foundry has grown quickly from its beginnings as a family owned commercial casting supplier to local machine shops in Minneapolis, to now supplying castings throughout the world.

Carley Foundry has always strived to deliver premium quality castings for a diverse and demanding customer base. Now located in Blaine, Minnesota, Carley Foundry produces castings for customers in the markets of aerospace, medical, recreational vehicles, defense, and more. Carley Foundry employs 400 employees and is in its third generation of Carley ownership. Carley Foundry strives to be innovative leaders in tooling development, casting production, engineering design assistance, and testing methods.



"MnTAP has been an incredible experience that has provided me with the tools and experience to tackle future problems in my professional career. I thoroughly enjoyed my summer internship with MnTAP and the work that I accomplished was incredibly rewarding." ~ AC

Project Background

Carley foundry wanted to reduce energy consumption, power demand, and production costs in the aluminum foundry. While foundry staff had ideas for saving energy, they didn't have time during the busy production schedule to really dig into the opportunities and solutions. Carley and MnTAP kicked off the project by outlining opportunities; including staggering heat-treat oven use, considering furnace set-back temperatures and insulation, and repairing compressed air leaks. The summer was spent analyzing the feasibility of these and other opportunities that would save the foundry energy.



Incentives To Change

With increasing costs of energy and aluminum, Carley Foundry is attempting to reduce energy costs to stay ahead of competition. By reducing energy waste in a variety of production steps, Carley aims to reduce their energy costs by 5-10%. Furthermore, Carley wants to reduce their own carbon footprint and waste streams to produce more environmentally responsible castings. The project will improve current practices concerning both furnace and air compressor usage, while also providing operating cost information to both the accounting departments as well as floor managers who had little knowledge of operational energy costs prior to the project.

"As a foundry, we are a large user of energy. I suspect like many companies, we tend to gravitate to our core competencies when looking for cost savings or a better process, as opposed to utilities. Our MnTAP intern however, has provided us with the technical horsepower and investigative effort to look into energy savings ideas we just never seem to have the time to do. The payback was tremendous! We will now save a significant sum of money, have a much better understanding of how energy is consumed throughout the facility, and potentially increase worker comfort as we reduce heat load and plan a future ventilation system."

*~ Randy Oehrlein
VP Engineering, Carley Foundry Inc.*

Solutions

Use Overnight Setback Temperatures for Furnaces

The typical pour temperature of aluminum within an aluminum foundry is 1,400 F. The melt temperature of aluminum is 1,221 F. Before this project, it was standard practice to hold metal at the pour temperature. This is reasonable when metals are being melted and immediately poured, but at a large foundry like Carley, metals are commonly melted and then held for extended periods of time. Through experimentation with one furnace, MnTAP and Carley found the differences in energy consumption associated with holding aluminum at 1,400 F compared to 1,300 F and 1,225 F. The result was potential savings of over 2 million kWh per year by using overnight setback temperatures. The foundry chose to use 1,280 F as a starting overnight setback point. The foundry was also pleasantly surprised to find that their relatively new furnaces had setback timers built-in. MnTAP and Carley learned how to program the setback, and started saving energy immediately. With current setbacks, Carley is on pace to save \$80,000 in energy in the first year.

Reduce Furnace Temperatures During Production when Not Pouring

This is the natural extension to the first project. Temperatures were first turned down overnight; the

next step was to turn them down when furnaces are not pouring. This was implemented by programming two different setpoints into the furnaces, holding and pouring. These setpoints can be changed using a simple switch. To implement this change, furnaces are by default held at the holding point. Shift leads are responsible for flipping the switch on furnaces that will be poured during their production shift. By the end of the intern project, this strategy had been implemented with predicted energy savings results of \$30,000 per year.

Replace Pneumatic Cabinet Coolers with Electric Cabinet Coolers

In looking for additional energy savings opportunities, MnTAP and Carley noticed 12 electrical cabinet cooling units that were cooling using compressed air. Compressed air is a notoriously expensive utility – the conversion of energy into compressed air typically result in 10% of the useful work that would be attainable through an equivalent electric piece of equipment. In the case of these vortex cabinet coolers, there is an estimated total savings of 350,000 kWh and \$26,000 per year in savings by switching to a non-pneumatic equivalent. Carley is currently testing one new cooler and is planning to replace the remaining coolers after testing is successful.

Recommendation	Annual Reduction	Annual Savings	Status
Use overnight setback temperatures for furnaces	2,112,000 kWh	\$104,000	80% Implemented
Reduce furnace temperatures during production when not pouring	220,000 kW demand 100 kW demand	\$30,000	Implemented
Fix compressed air leaks	460,000 kWh	\$35,000	75% Implemented
Replace pneumatic cabinet coolers with electric cabinet coolers	350,000 kWh	\$26,000	10% Implemented
Turn off quench tanks overnight when not in use	400,000 kWh	\$20,000	Planned
Repair furnace insulation and lids	174,000 kWh	\$18,000	10% Implemented
Stagger heat treat oven power draw	60 kW demand	\$10,000	Planned
Replace pneumatic rod cooler with electric	126,000 kWh	\$10,000	Planned
Optimize lid controls & keep lids closed	70,000 kWh	\$6,000	Planned

MnTAP Advisor: Jon Vanyo, Engineer



Center for Energy & Environment



Nicholas Michalik
Chemical Engineering,
University of Minnesota

Organization Background

Center for Energy and Environment is a non-profit organization headquartered in Minneapolis whose mission is “to promote energy efficiency, to strengthen the economy, and improve the environment.” To accomplish this, CEE employs staff dedicated to promoting and implementing long lasting, effective solutions to energy efficiency problems ranging from residential to industrial application. Research and development, programs, technical engineering assistance, community engagement, and policy change proposals at a state level are some of the many tools CEE uses in order to promote energy intelligence today, and strive to make a cleaner tomorrow.



“The Energy Intelligence program offers a unique experience for an internship. Because the internship occurs across four companies over the course of the summer, it exposed me to a variety of energy uses. I now better understand how to find and quantify the biggest uses of energy in varied facilities.” ~ NM

Project Background

The goal of the Energy Intelligence Program (EI) at CEE is to motivate small- to medium-sized businesses to make small or no cost energy efficiency changes to their process or facility. To accomplish this, the program installs pulse meters at the facility, which allow for real-time viewing of trends in demand throughout the day. With this load profile, EI can parse out the energy use of the facility, including baseloads, production energy, and peaks. This information helps the business understand their energy usage distribution in the facility.

The main project was composed of four two-week long site visits where energy measurements of all significant operating and process equipment would be taken and

quantified. With this information, EI is able to find potential areas of improvement to the process and quantify the energy savings from changes within the process. From this, a report is generated at CEE that details the energy use and recommendations for each facility. The report is then presented to the company. After the first presentation of the information, there is a follow-up meeting with each company to verify the recommendations are being implemented and to address any potential hurdles with implementation.

Incentives To Change

CEE’s Energy Intelligence program, funded by Xcel Energy’s Conservation Improvement Program (CIP), looks to inform small- and medium-sized businesses of savings opportunities through energy saving practices coupled with helping the company break down their bill and understand where their energy consumption goes within the business. Through quantification of both current energy usage and the savings from changing usage habits, the business is shown in easy-to-understand terms what energy efficiency will do for them. Along with actionable recommendations, this helps the business pursue energy efficient options, and motivates them through energy and cost savings. Each business enrolled in the EI program does so for different reasons, but each has the common theme of believing a more energy efficient today leads to a better tomorrow.

“Building on the strengths of CEE’s Energy Intelligence program, Nick added capacity and insights to help deliver even deeper energy assessments to the businesses he visited. Small- to medium-sized businesses can be hindered by lack of time or expertise to focus on energy efficiency, and our intern helped eliminate those barriers though his thoughtful investigation of energy savings opportunities.”

*~ Nicole Kessler, Program Manager
Energy Intelligence, Center for Energy & Environment*

Solutions

The four businesses in this study benefited from specifically tailored solutions including:

- Compressed air leak audits
- LED lighting audits
- Standard ventilation assessments
- Steam trap audits
- Process efficiency audits

Lofton Label Recommendations

Recommendation	Annual Reduction	Annual Savings	Status
Implement new waste disposal system	102,000 kWh 1,800 therms	\$12,000	Implementing
Repairing compressed air leaks	69,400 kWh	\$4,500	Implementing
Lighting changes	13,500 kWh	\$1,500	Implementing
Heat tunnel management	11,000 kWh	\$700	Recommended
Line controls	5,300 kWh	\$300	Recommended

Mississippi Mushrooms Recommendations

Recommendation	Annual Reduction	Annual Savings	Status
Lighting changes	167,200 kWh	\$11,400	Recommended
Steam trap replacement	4,600 therms	\$2,900	Planned
Energy recovery ventilation	32,400 kWh	\$2,400	Planned
Insulating ventilation	25,300 kWh	\$1,600	Recommended
Repairing compressed air leaks	13,100 kWh	\$1,100	Planned
Reducing growing medium mixer motor	100 kWh 6 kW demand	\$950	Recommended

Site C Recommendations

Recommendation	Annual Reduction	Annual Savings	Status
Lighting	133,900 kWh	\$10,200	Planned
HVAC system	95,000 kWh 7,700 therms	\$9,400	Planned
Repairing compressed air leaks	46,000 kWh	\$2,900	Planned
Computer power management	31,500 kWh	\$2,000	Recommended
Compressor idle	22,800 kWh	\$1,400	Planned

Site D Recommendations

Recommendation	Annual Reduction	Annual Savings	Status
Repairing compressed air leaks	38,000 kWh	\$2,400	Implementing
Changes to clean room ventilation	26,500 kWh	\$2,200	Planned

MnTAP Advisor: Jon Vanyo, Engineer



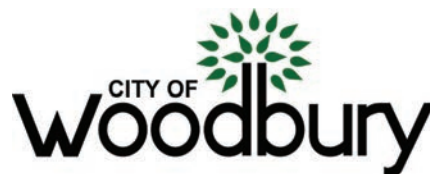
City of Woodbury



Lindsay Brown
Biology & Environmental Science,
Iowa State University

Organization Background

The City of Woodbury, established in 1967, is a suburb of the southeastern Twin Cities Metro area and is the largest community in Washington County with a population of 68,820 in 2016 according to the United States Census Bureau. Woodbury belongs to the Washington County Municipal Water Coalition and is a member of Minnesota Green Step Cities.



“Being an intern through MnTAP has provided me with many technical and personal experiences to improve water conservation in the City of Woodbury. I gained knowledge about city government and how to effectively manage my time and a project. I will be able to carry these experiences with me in my future career.” ~ LB

Project Background

The City of Woodbury is committed to improving water efficiency and created a goal to “strive towards flat total water use by 2030” in 2014. Two MnTAP summer intern projects were conducted with Woodbury in 2015 and 2016 to evaluate the effectiveness of smart irrigation technology on both commercial properties and residences.

As a continuation of the previous projects, a pilot study was conducted by a MnTAP Intern for the summer of 2018 on six randomly selected residential homes by implementing pressure-regulated sprinklers to calculate the water savings potential between a traditional residential sprinkler system and an updated, pressure-regulated system. There is potential for a future program to be implemented for residents in Woodbury to receive pressure-regulated sprinklers at a discounted price and a contractor hired by the city to install the sprinklers. The project also involved creating educational resources for residents on irrigation best practices. Woodbury is working with Washington County to share these resources and evaluate the potential for project replication for other cities in the county.

Incentives To Change

Woodbury is a growing community and will need to provide more water than it is today to the additional

population. New wells or treatment and infrastructure of a surface water source will cost millions of dollars and increased rates to users.

Woodbury uses three times more water during peak times in the summer than it does in the winter. Non-essential water use for irrigation comprises 42% of total water use. Some cities in Washington County also have high non-essential water use for irrigation, like Cottage Grove, Lake Elmo, Oakdale and Stillwater. These cities seek to replicate program success from the pilot study in Woodbury.

Most of Woodbury has a higher water pressure than what is optimal for an irrigation system. The installation of

“By partnering with MnTAP, we have a better understanding of where water is being wasted in our community, how the city could implement an efficiency program for sprinkler heads and how much we’ll need to budget to do so. This project was challenging and required specific attention to gather the depth of information required to make a recommendation, which could not have been done without the talent and guidance provided by the MnTAP intern and staff.”

*~ Kristin Seaman
Environmental Resources Specialist,
City of Woodbury*

Solutions

pressure-regulated sprinklers is one solution to the water waste associated with traditional sprinklers. When water pressure in an irrigation system is too high, the sprinkler will mist or fog the lawn with small water droplets. This leads to increased evaporation, more water carried away with the wind, poor distribution uniformity, and a potential increased need for irrigation system maintenance. As a result, system run times are set longer to compensate, and more water is used.

Pressure-regulated technology decreases the pressure before water outlets from the head, creating larger and more evenly-sized droplets. This correlates to improved distribution uniformity and water conservation.

Install Pressure-Regulating Spray Sprinklers*

By implementing pressure-regulated spray sprinklers on residential properties, there is an average reduction of 0.5 gallons used per minute per spray sprinkler when compared to traditional sprinkler systems.

Install Pressure-Regulating Rotor Sprinklers*

By implementing pressure-regulated rotor sprinklers, there is an average reduction of 1 gallon used per minute per rotor sprinkler when compared to traditional sprinkler systems.

Implementation Cost

The cost of implementation, per household would be \$830, or, \$83,000 per 100 households.



Before
without a pressure-regulated spray head



After
with a pressure-regulated spray head

Recommendation	Annual Water Savings (per household**)	Annual Water Savings (per 100 households)	Consumer Savings (per 100 households)
Install pressure-regulating technology	32,000 gallons	3,200,000 gallons	\$4,000

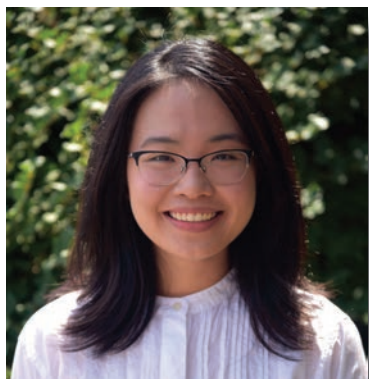
* Both reduction potentials are based off of manufacturer specified reduction rates

** Based on pilot study results; assumes 10 spray sprinklers and 18 rotor sprinklers per property

MnTAP Advisor: Nathan Landwehr, Waste Reduction Specialist



KapStone Container Corp.



Ngan Tran
Chemical Engineering,
University of Minnesota

Organization Background

KapStone Container Corporation is a manufacturer of corrugated packaging products in Fridley, MN. The plant makes a variety of cardboard from paper stock and converts it to boxes designed, sized, and printed to customer specifications. The plant has served the upper Midwest market since 1962, and ships to over 30 states, Canada, and Mexico. The corporation is currently in the process of being purchased by Westrock.



"Working at MnTAP gave me the opportunity to gain hands-on experience in an industrial setting. The project was challenging, but the guidance and support from MnTAP and Kapstone staff helped me understand its complexity and develop solutions to the problems. In addition to the fundamental engineering skills I got from this experience, the valuable feedback contributed tremendously to my personal growth and development." ~ NT

Project Background

Large volumes of water are used for cooling in corrugated cardboard production and for cleaning related to printing operations. Large amounts of paper waste is generated from equipment, operational problems, changes in paper properties, as well as unavoidable trim. This project attempted to identify specific causes for some of the waste and then identify solutions.

Incentives To Change

KapStone Container has the third highest water consumption in the city of Fridley, consuming 10 million gallons of water in 2017 at a cost of \$100,000 per year. The plant also generates about 9 million pounds of paper waste per year, and has a goal to reduce manufacturing paper waste from 14.5% to 12.5% of the total amount of paper purchased. Paper waste currently costs about \$2,700,000 per year.



Solutions

Six water reduction options were evaluated. One has been implemented, three are recommended, and one needs more investigation. Paper waste investigations clarified material handling root causes, and identified one option which needs more investigation.

Repair Leaking Valves

Leaky water valves were identified and repaired on the Bobst 200, a converting machine which cuts, folds and prints corrugated sheets. This saves approximately 250,000 gpy and \$1,800 per year.

Implement Flow Reduction with Pressure Regulator and Flowmeter (70° closed)

Reducing water flow by manual valve adjustment through the Paser water jackets by 2.7 million gallons per year should not raise the starch temperature in the tray. Further water reduction may be possible with additional valve adjustment, or may be almost entirely eliminated by adding a chiller to close the water cooling loop saving 4.6 million gpy.

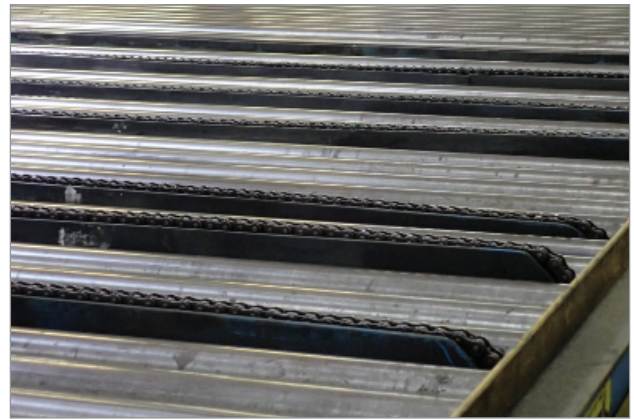
Modify Cleaning Procedure in Bobst 200

A modified cleaning procedure for the Bobst 200 to shorten the cleaning step while making sure all ink coated surfaces are washed should reduce water by 520,000 gpy. Preventing water buckets from overflowing on the Bobst 200 should reduce water use by another 500,000 gpy.

The water reduction potential of these three recommendations is 3.7 million gallons per year, with corresponding savings of \$37,000, and requiring about \$1,300 to make the changes.

Adjustment of Sewer Bill

The current sewer bill is based on water purchases and does not account that water used for starch formulation is not sewer. If an acceptable method of accounting for starch water is worked out with the City, the sewer portion of the water bill could be reduced by \$1,700 per year.



Recommendation	Annual Reduction	Annual Savings	Status
Repair leaking valves	250,000 gallons	\$1,800	Implemented
Flow reduction with implementation of pressure regulator and flowmeter to Paser waterjackets (Option A)	2.7 million gallons	\$24,000	Recommended
Add chiller and closed loop cooling to the Paser water jackets (Option B)	4.6 million gallons	\$37,000	Recommended
Modified cleaning procedure in Bobst 200	520,000 gallons	\$4,500	Recommended
Implementation of solenoid valve and float switch in Bobst 200 for bucket filling	500,000 gallons	\$5,300	Recommended
Adjustment of sewer bill	N/A	\$1,700	Discussion with city
Rotational control on the clamp truck	N/A	N/A	Needs further investigation

MnTAP Advisor: Karl DeWahl, Senior Engineer



Lamb Weston / RDO Frozen



Micah Calderon

Mechanical Engineering,
North Dakota State University

Company Background

The Lamb Weston/RDO Frozen Foods plant in Park Rapids produces quality potato products that are distributed to restaurants and retail grocery stores throughout North America. The plant, which employs 480, was originally constructed in 1981 and has been expanded several times.



"The MnTAP internship was a great opportunity to combine school with valuable real-world experience. Building project management, communication, and troubleshooting skills were just a few of the benefits" ~ MC

Project Background

This project contributes to efforts aimed at water, energy and GHG emissions reductions for Lamb Weston. The intern worked with MnTAP and Lamb Weston/RDO Frozen staff to evaluate the potato blanching process for potential improvements. An additional aspect of this project assessed opportunities to optimize the use of processing aids.

Incentives To Change

Efficient resource usage reduces costs and allows the plant to engage in larger opportunities. The potato blanching process is one of the larger water users in the plant. Using hot water more efficiently reduces demand on well-water supply, boilers and the wastewater treatment system. The MnTAP intern project objectives of improving the efficiency of water, chemical and energy usage align well with Lamb Weston/RDO Frozen's sustainability goals.



"From our experience, having a MnTAP internship really opened our eyes to potential opportunities that we had not previously recognized or improved. Additionally, learning how the MnTAP internship partnerships worked increased our future dynamics with internships! We look forward to more opportunities with MnTAP."

*~ Justin Mittenness
Plant Quality Manager, Lamb Weston/RDO Frozen*

Solutions

Optimize Blancher Flush Rates

The blanching process uses hot water to remove excess starches and sugars from the cut potatoes. The intern monitored turbidity of multiple stages of the blancher water with the quality assurance team. Flush rates of the system were varied and additional data was collected on a wide variety of products. These tests show that flow rates could be varied on select products which would save nearly 10 million gallons of hot water a year. An automated sensor and control system is also possible, however additional testing will be required.

Optimize Sanitizer Stations

Foaming foot-sanitizing stations operate at each of the 10 entry points to the production areas. The intern monitored and adjusted the length of time the foam was applied and the time between applications. Optimizing the settings assured suitable foam coverage and minimized the use of sanitizing chemicals. This change minimized the amount of chemical being washed to the on-site wastewater treatment plant and reduced the time mixing and delivering the materials to the stations.

Return Product Samples to Production Line

Currently, product in 5 or 6 lbs packages is taken off of the production line to run the quality assurance tests. Testing only requires 4 pounds which leaves 1 or 2 lbs left over to be sent off-site as cattle feed. Procedures were proposed to reintroduce left over samples to the production line with estimated savings of 42,000 lbs valued at \$13,000.

Install LED Lighting

The plant has 374 high bay lighting fixtures that could be upgraded to LED technology. Options were researched with the help of the electric utility, consultants and the company electrical contractor. Several sample fixtures were installed and one selected for locations requiring enclosed fixtures suitable for cleaning in the food process cleaning areas. New LED light fixtures would save 33% on the electricity costs and reduce demand as they are usually on 24/7, however the reduced maintenance cost of labor is very significant in justifying the change.

Install VFD on Boiler Feed Water Pump

The current 150 horsepower boiler feed water pump runs at one speed. When the water demand drops, the excess water is recirculated to the de-aerator tank. Studying the water demand, measuring amperage required to pump only the amount needed, and calculating the potential savings results in 340,000 kWh. Motor control center and automation programming costs require further analysis in order to justify the change.

Reuse RO Reject Water

The current reverse osmosis (RO) filtration system operates at a 3:1 efficiency and rejects 6,300,000 gallons of water per year. Rejected water has a high mineral content and high conductivity. It is currently sent to the on-site wastewater treatment plant. Alternative uses for this water were evaluated. The potato receiving area is the most likely opportunity for reject water reuse, however, the cost of piping and additional disinfection limit the cost effectiveness of this suggestion at this time. Additional analysis is required.

Recommendation	Annual Reduction	Annual Savings	Status
Optimize blancher flush rates	59,000 therms 9,900,000 gallons	\$41,000	Recommended
Optimize sanitizer stations	3,200 gallons 5,000 lbs of chemical	\$11,000	Implemented
Return product samples to production line	42,000 lbs of product	\$13,000	Recommended
Install LED lighting	246,000 kWh 240 labor hours 300 lbs lamps/ballasts	\$41,000	Recommended
Install VFD on feed water pump	340,000 kWh	\$31,000	Investigating
Reuse RO reject water	6,300,000 gallons	\$11,000	Further investigation needed

MnTAP Advisor: Paul Pagel, Senior Engineer



Minnesota Correctional Facilities



Maggie Kristian,
Environmental Science &
Applied Economics,
University of Minnesota

Company Background

The Minnesota Department of Corrections is a state agency that operates 10 prisons around the state. The facilities are located in Faribault, Lino Lakes, Moose Lake/Willow River, Oak Park Heights, Red Wing, Stillwater, Togo, Saint Cloud, Shakopee, and Rush City. Correctional facilities house, feed and provide medical care to offenders as well as providing treatment, education, and employment through internal industry and maintenance of facility operations.



"My experience at the Department of Corrections taught me how to solve problems both on the ground and at an institutional level. Understanding how to translate individual solutions into department-wide best management practices will help me continue to develop economically viable solutions to sustainability problems throughout the rest of my career." ~ MK

Project Background

The Lino Lakes project was focused on determining waste streams throughout the facility, how they moved through the facility, and where were the best opportunities for waste reduction. Understanding what waste streams exist, how they move, and how much they cost will serve as a basis for recommending waste and cost reduction solutions at the facility. Findings from the Lino Lakes project were incorporated into a waste management toolkit that details best practices for prison waste reduction to be used by all other correctional facilities in the state.

Incentives To Change

The Governor's Executive Order 17-12 passed in 2017 and requires all state agencies to achieve a 75% recycling rate by 2030 and report annual recycling data to the Minnesota Pollution Control Agency (MPCA). Department of Corrections facilities began collecting data on their recycling rates and streams in 2015 in compliance with state statute 115A.15. According to this data, the Lino Lakes facility currently has a recycling rate of 43%.

"The Minnesota Department of Corrections is committed to reducing our impacts on the environment. The MnTAP internship program provided a focused look into our current products, processes and waste streams. The tools Maggie has developed will assist us to standardize our Waste and recycling approach throughout the Minnesota Department of Corrections. Maggie's adaptability, enthusiasm and ability to gain support from staff was a great asset to our project. We appreciate all the work that Maggie has provided and know that she will be successful in her future endeavors".

*~ Alice Remillard
State Program Administrator Principal
Minnesota Department of Corrections*

Solutions

Re-design Offender Tray Return

Organic waste generated in the kitchen department is the highest contributor to landfill waste at Minnesota Correctional Facility-Lino Lakes (MCF-Lino Lakes). Most of this landfill waste is disposed of in a landfill because it is commingled with non-organic waste on offender trays. By sorting non-organics from organics when trays are returned, MCF-Lino Lakes can divert 400,000 lbs of organic waste from landfills and increase the recycling rate by 30%.

Standardize Recycling Bins

Standardizing waste bins throughout a facility can make it easier for departments with diverse waste streams to properly sort and dispose of waste. MCF-Lino Lakes has been awarded a grant from Anoka County for \$20,000 to better dispose of waste, which can be used to purchase standard bins. Diverting recyclable materials using this system can increase the recycling rate by 7-9%.

Account for Un-recorded Waste Streams

MCF-Lino Lakes uses a service that collects and reuses pallets. This method of recycling was previously unrecorded. Now that it is recorded, this recycling method increases the recycling rate by 1-2%.

Reduce Compactor Pickups

Waste Management charges the facility both by waste weight and per pickup of each compactor. Currently, when picked up, most compactors are less than half full. By reducing compactor pickups, the facility can save \$14,500 annually.

Introduce Plastic Film Collection

The warehouse department receives large shipments of products daily. These products are wrapped in plastic film that was previously being thrown away. By introducing a plastic film recycling program, the facility can save \$400 and recycle 8,000 lbs of plastic annually.

Eliminate Small Can Liners

Facility waste in small bins is not wet or difficult to manage. Therefore, small can liners are not necessary. Eliminating small can liners can save the facility \$7,400 annually.



Recommendation	Annual Reduction	Annual Savings	Status
Re-design offender tray return	400,000 lbs	\$24,400	In progress
Standardize recycling bins	95,000 lbs	\$4,000	Recommended
Account for unrecorded waste streams	33,000 lbs	N/A	Implemented
Reduce compactor pick-ups	N/A	\$14,500	Recommended
Introduce plastic film collection	8,000 lbs	\$400	Implemented
Eliminate small can liners	800 lbs	\$7,400	Recommended

MnTAP Advisor: Nathan Landwehr, Waste Reduction Specialist



North Memorial Health



Christopher Leppla
Mechanical Engineering,
University of Alabama

Company Background

North Memorial Health is a series of hospitals and clinics that provide medical care. They were founded in 1954 and now have locations all over the metro area. North Memorial Health Hospital in Robbinsdale has 3,500 full time employees and more than 350 beds. Maple Grove Hospital was founded as a partnership between North Memorial Health and Fairview in 2009. They have 350 full time employees and 130 beds.



"Throughout the summer at North Memorial Hospital, I learned about many different processes that I would never have otherwise thought about. Lacking a background in some of the processes, it was a great way to learn and fun to find information about them. It was also fun to see how a hospital operates behind the scenes." ~ CL

Project Background

Management at North Memorial Health was aware of MnTAP's past success in reducing water consumption at hospitals. After using a combined 56 million gallons of water at North Memorial Health and Maple Grove Hospitals in 2017, they enlisted the help of MnTAP. At both of these locations, outdated equipment and processes were contributing to excess consumption of water and energy. There were also many processes where slight changes could save a great deal of water and energy.



Incentives To Change

North Memorial Health has been trying to find ways to reduce their environmental impact. At North Memorial Health Hospital, over 38 million gallons of water, 1 million therms of natural gas and 17 million kWh of energy were used in 2017. At Maple Grove Hospital, they used over 18 million gallons, 50,000 therms and 8 million kWh. They were looking for different ways to improve the many systems throughout both of these hospitals in order to use less water and energy, and reduce operating costs.

"Our MnTAP intern worked diligently on investigating water savings for our hospital and provided us with opportunities we had not identified. His work with the plant staff and vendors provided us with ideas to save water through operational changes and adding equipment to our systems that had an attractive ROI. The intern's presentation to senior management resulted in funding added to next year's budget to accomplish the savings. This was our first experience working with MnTAP and we look forward to working with them again."

*~ Bob Johnson
Manager of Engineering Services,
North Memorial Health Hospital*

Solutions

Install Closed Loop on Condensers

The kitchen has four industrial refrigerators/freezers. The condensers used to cool these units are cooled by a single pass of domestic water that goes directly down the drain. By installing a pump and a heat exchanger attached to the water loop, this can be made into a closed loop. This solution will save over 2.6 million gallons of water per year.

Install New RO System

The current reverse osmosis (RO) system operates with one gallon made for every two rejected. A new system would create three gallons for every one that is rejected. The current system is also not operating up to standards needed for the lab and sterilizers, resulting in duplication of systems. This solution will save 764,000 gallons of water per year.



Install Weather Sensors for Irrigation

At Maple Grove Hospital, the current irrigation system is only changed seasonally, which may result in overwatering during rainy periods. Overwatering can occur at North Memorial Health Hospital as well, although the clocks for watering are monitored and changed to account for weather. At both locations, installation of weather sensors can save time and water. This solution will save 162,000 and 360,000 gallons of water per year at North Memorial Health Hospital and Maple Grove Hospital, respectively.

Install Solenoid Valve on Trough

Beneath the soup kettles in the kitchen is a trough with a flow of water to help wash away any excess fluids that are drained. This flow could be left on for an entire day and even overnight at times. A solenoid valve and timer were installed to limit the amount of time this flow is on each day and to guarantee it is only on when needed. This solution will save 1.4 million gallons of water and 7,000 therms of natural gas per year.

Install New Dishwashers

The current dishwasher unit at North Memorial Health Hospital is fourteen years old, which is at the end of its effective life span. There are two different new units to consider. At Maple Grove Hospital, the current unit is only nine years old but has had some maintenance issues. This solution will save 170,000 gallons and 145,000 kWh at

North Memorial Health Hospital and 176,000 gallons and 166,000 kWh at Maple Grove Hospital per year.

Install Linkage-less Controls on Boilers

The high pressure steam boilers currently have linkage controls which can have leaks and cause them to require more maintenance. With linkage-less controls, there are fewer parts that can malfunction and fewer places for leaks to form. This solution could save an estimated 79,000 therms per year.

Recommendation	Annual Reduction	Annual Savings	Status
Closed loop on condensers	2,600,000 gallons	\$24,000	Recommended
Install new RO system	764,000 gallons	\$7,000	Further investigation needed
Weather sensors for irrigation	522,000 gallons	\$3,000	Recommended
Solenoid valve on trough	1,400,000 gallons 7,000 therms	\$13,000	Implemented
New dishwashers Less detergent	346,000 gallons 311,000 kWh 1,400 lbs detergent	\$36,000	Recommended
Linkage-less controls on boilers	79,000 therms	\$7,200	Further investigation needed

MnTAP Advisor: Jane Paulson, Senior Engineer



Phillips Distilling Company



Eleanor Green
Chemical Engineering & Chemistry,
University of Minnesota

Company Background

Phillips Distilling Company is one of the oldest family-owned alcohol manufacturers in America. Starting as a candy and newspaper wholesaler in 1912 and is now 106 years old. The company produces over 2,000 SKUs, but its most popular brands are UV Vodka, Prairie Organic Spirits, and Revel Stoke Whiskey. All product blending and processing take place at its headquarters in Princeton, MN; a one million square foot facility with about 250 employees.



"During my time at MnTAP, I got to experience working in a manufacturing industry. It was great to see how everything and everyone works together; the Phillips Distilling Company really feels like a family-owned company. In addition to technical skills, I was able to learn more about critical thinking, problem solving, and asking questions." ~ EG

Project Background

At Phillips, the most important use for water is to create products. However, the production processes use large amounts of water for cleaning, as water is used for washing and rinsing after nearly every step. Disposal of this wastewater is challenging, due to its high chemical oxygen demand (COD) caused by sugar and alcohol from products. This project focused on identifying where all the water is being used and ways to use it more efficiently.

Incentives To Change

Since the inception of One Team G.R.E.E.N. (Growing Responsibly, Ethically, and Environmentally Now), Phillips Distilling's sustainability team, efforts have increased to reduce wastewater, energy use, and solid waste. The team's mission is to have a positive impact on the environment by working together with employees, partners, and the community. They have implemented systems to reduce energy consumption and landfill waste and have started programs to increase employee awareness of sustainability. MnTAP was brought in to assist with wastewater tracking, as water use and discharge are very high at Phillips. Reducing wastewater at their facility will help One Team G.R.E.E.N. with their mission and help make the company more sustainable.



"This is our 2nd year in a row using MnTAP to help us reduce costs and our impact on the environment. We tackled energy last year. This year we focused on reducing water usage and reducing or reusing wastewater. MnTAP once again helped find significant savings while helping us to reach our sustainability program goals. We hope to continue using this program for future initiatives."

*~ Larry Jurik
Manufacturing Technical Manager, Phillips Distillery*

Solutions

Shorten Storage Tank Washouts

After a product is blended together from its ingredients, it is kept in a storage tank until ready for bottling. In one year, there are about 3,000 storage tank washouts. Most of the storage tanks are washed out using attached spray balls. The current procedure indicates that 30-second rinses should be repeated 3-4 times until the water draining out is clean. However, the actual length and number of rinses varies by operator and product; some products are more difficult to wash out than others, and many rinses are over 40 seconds long. Testing indicates that 20 second rinses will clean out a tank sufficiently with the same number of rinses. Training operators with this updated procedure can result in significant water savings.

Install Aerators on Sinks

Employees working on the production floor wash their hands about four times a shift; once at the start, after two breaks, and lunch. There are three main handwashing stations located around the production floor with 2.2 gallons per minute faucets. Installing 1.0 gpm aerators will reduce the amount of water used by 54% with minimal costs. Further water savings will come from installing 1.0 gpm aerators on all 20 bathroom sinks throughout the facility.

Fix RO Drop Leaks

Several of the reverse osmosis (RO) drops around the facility have leaks. Over one year, 16,400 gallons of RO water are lost to these leaks. Either cleaning out or replacing the current valves to fix these leaks is

recommended. The cost of this process is still being investigated, as the RO system may have to be shut down.

Add Sprayers to Open-ended Hoses

Hoses used for cleaning in the blending areas of the facility have sprayers on the end to reduce flow and increase pressure. However, several hoses used for cleaning by the production lines are open-ended. These hoses are often used to rinse off product from the outside of bottle fillers and the floor. Replacing these hoses and adding sprayers on the end could reduce the water used by 60% and save time, as a higher pressure will wash more efficiently.

Reuse RO Reject for Irrigation

In 2017, over 1 million gallons of water each was used for irrigation and the RO system reject and rinses. Reusing wastewater from the RO system for irrigation will prevent about 1 million gallons of water from going down the drain. The viability of this solution is currently being tested.

Beneficial Reuse for Cream Byproducts

Unsalable cream product is poured out and stored in large plastic totes to keep separate from wastewater; the chemical oxygen demand is too high for normal disposal methods. This byproduct stream can be sent to the Saint Cloud WWTF for beneficial reuse. The high COD of these products make them a great feed for their anaerobic digesters to produce electricity. Transportation for the stored totes is being coordinated.

Recommendation	Annual Reduction	Annual Savings	Status
Storage tank washouts	157,000 gallons	\$19,700	Recommended
Production sink aerators	22,200 gallons 3,300 kWh	\$3,200	Recommended
Bathroom sink aerators	24,100 gallons 3,300 kWh	\$740	Recommended
RO drop leaks	16,400 gallons	\$1,800	Planned
Open-ended hoses	8,400 gallons 50 therms	\$1,100	Recommended
RO reject reuse	1,000,000 gallons	\$5,000	Planned
Cream by-product to Saint Cloud	4,000 lbs COD	\$1,800	Implementing

MnTAP Advisor: Michelle Gage, Engineer



Phillips Neighborhood Businesses



Emily Worman
Environmental Geography,
University of Minnesota

Company Background

Hope Community is a non-profit organization located in Phillips Community; a diverse and low-wealth area comprised of four neighborhoods in south Minneapolis. Dedicated to providing an alternative to gentrification, Hope works to improve the community through access to affordable housing and leadership development programs. The vibrant cultural corridors, thriving Midtown Global Market, and renovations of Peavey Park are symbols of the strength and resiliency of Phillips and the result of 40 years of revitalization work.



"I enjoyed working on this project because it allowed me to combine analytical and communication skills to make an impact on the community. Although small businesses usually don't have the time or resources to put into environmental projects, I was impressed by business owners' willingness to change their cleaning processes to improve worker and community health. It allowed me to sharpen my project management skills, learn how to effectively structure an outreach program, and coordinate with multiple people to accomplish tasks." ~ EW

Project Background

The objective of this project was to promote and support the adoption of safer janitorial products at a variety of buildings in Phillips, including apartment complexes, small businesses, and office buildings. The first phase of the project was to construct an outreach program, spread awareness about the project, and connect with interested business and property owners. Outreach was conducted to 37 business and housing complexes, with 15 businesses participating in the project. The second phase was an assessment of the cleaning products currently used in these facilities, followed by research and identifying safer alternatives. The third phase was a trial period for the businesses, during which time MnTAP provided free samples of the alternative products for maintenance staff to test, to make sure they meet the buildings' cleaning needs. Finally, to promote the use of safer products, MnTAP provided the first case of the new product to aid in the transition.

Incentives To Change

Intertwined with social and economic challenges are environmental ones. Land-use decisions have put Phillips residents at a higher risk for experiencing the adverse effects of poor air quality. Small businesses and housing complexes in Phillips had the opportunity to switch

to safer janitorial products to improve air quality and community health. Although the emissions of hazardous air pollutants (HAPs) and volatile organic compounds (VOCs) are lower in janitorial products than in other industrial products, they can still generate ozone that degrades local air quality and contain chemicals hazardous to human health. Small businesses and housing complexes typically do not have the time or resources to put towards environmental projects, but when given an opportunity to address the issue of air quality in an accessible and affordable way, many were interested in improving their cleaning processes to improve worker and community health.

"2018 was Hope's second year hosting a MnTAP summer intern and we could not have been happier with the results. Emily took a project that was only an idea and created her own road map, engaging lots of neighborhood housing owners and businesses and piecing together a very useful understanding of how decisions around cleaning products get made."

*~ Will Delaney
Associate Director, Hope Community, Inc.*

Solutions



MnTAP assessed the janitorial products used in each building and provided recommendations for alternatives when a product did not meet the criteria to qualify as a safer product, which was determined using MnTAP's Safer Janitorial Products flowchart. Reputable third-party certifications such as Green Seal, EcoLogo, and EPA Safer Choice signify that a product is not hazardous to environmental and/or human health. Non-certified products are considered environmentally safer if they contain no HAPs and generate less than 0.5 pounds of potential ozone per pound of product. Additionally, a chemical is not considered a threat to human health if it is classified as a best available chemical per the EPA's Safer Chemical Ingredients List, or if it is not a Chemical of Concern, Toxics Release Inventory Reportable, or Green Seal Prohibited substance.

Of the 133 total janitorial products analyzed at businesses in the Phillips neighborhoods, 84 met MnTAP's criteria for safer products. After testing and approving samples of alternative products, 26 substitutions were made, which will result in a replacement of 2,700 lbs of cleaning product with safer alternatives annually. Replacing these

products will lead to annual air emissions reductions of 105 pounds of HAPs, 155 lbs of VOC, with the potential to generate 385 lbs of ground level ozone.

The products most commonly replaced with safer alternatives were toilet cleaners, glass cleaners, and bleach. Toilet cleaners were often found to contain hydrochloric acid, which is a HAP. Manufacturers of many glass cleaners do not disclose the ingredients on the safety data sheet, which may hide unsafe materials. Bleach is a common disinfectant that is a TRI reportable chemical and linked to asthma.

In addition to working with businesses, MnTAP also prepared informational handouts in both English and Spanish to raise awareness of safer cleaning products and where to buy them among consumers in the Phillips Community. These were distributed to the public by apartment managers, community organizations, and through a booth at the Lake Street Open Streets event. Information about the project was also shared through articles in *The Alley* community newspaper.



Recommendation	Product	VOC Reduction	HAP Reduction	Status
Switch to safer janitorial products	2,700 lbs	105 lbs	155 lbs	Implemented

MnTAP Advisor: Jane Paulson, Senior Engineer



Science Museum of Minnesota



Danielle Ufheil
Biosystems Engineering,
Iowa State University

Company Background

The Science Museum of Minnesota, located in downtown Saint Paul exists to “turn on the science” by inspiring learning, informing policy, and improving lives. The museum provides hands-on learning experience to guests through its exhibits, programs, and the facility itself. The museum envisions a world in which all people have the power to use science to make lives better. It values science as essential literacy, fun accessible learning, authenticity and relevance, inclusion inside and out, remaining vital to its community, and leadership through collaboration.



**Science
Museum
of Minnesota®**

“I really enjoyed the additional educational outreach incentives that came with working at the Science Museum. Not only did I have to use my engineering skills when developing my recommendations, but I also had to use my creativity to incorporate educational components and incentives.” ~ DU

Project Background

The goal of the MnTAP project was to discover solutions that would lead to real savings for the Science Museum, with the added benefit of educating the public on the importance of water conservation. The intern project involved investigating water conservation opportunities that ranged from green space irrigation to rooftop rainwater capture.

Incentives To Change

Over the past 10 years, the Science Museum of Minnesota has not only advocated for, but also implemented within its facility sustainable, environmentally conscious practices in energy and waste management. With the 2017 launch of its “Water Planet Initiative,” the Science Museum has turned its attention to water conservation and reuse, making it an optimal time to bring in a MnTAP intern to investigate potential solutions.

“Having a MnTAP water efficiency intern at the Science Museum of Minnesota in summer 2018 made possible the investigation of how much water the museum uses, where and when to a degree and sophistication that museum staff would never have had the time to accomplish on their own. The museum now has the data and recommendations on which to base both its immediate and long-term water efficiency actions.”

~ Patrick Hamilton, Science Museum of Minnesota

SOLUTIONS

Switch to 1 GPM Aerators on Non-automated Faucets

Science Museum staff restrooms employ manually operated faucets that were previously outfitted with 2 gallons per minute (GPM) aerators. Based on the function of these various sinks, it was deemed appropriate to replace the aerators with 1 GPM versions, resulting in an estimate annual savings of 58,000 gallons of water.

Install Flow-reducing Flushometers and Dual-flush Toilet

Flushometers provide a cost-effective way to update toilets without replacing entire fixtures. Along with flow reduction, it is also recommended that the Science Museum install dual-flush options for some of its toilets. The dual-flush toilets give the option of 1.6 or 1.1 gallons per flush. This provides an option for a larger volume of water to be used if necessary. This will help prevent pipe clogs and associated maintenance costs. Most of all, this is a great way to involve the public in actively practicing water conservation while they visit the museum.

Modify the Lawn Irrigation Schedule

It was recommended that the Science Museum re-program the system controllers to a new irrigation

Solutions

schedule. The new schedule will reduce total number of days per week the system operates, reduce the number of cycles per day, reduce the amount of time per station, change the start times, and eliminate unnecessary stations. With guidance from the irrigation contractor and University of Minnesota irrigation specialists this is a start to reducing water used for irrigating the various green spaces at the museum.

Install Irrigation Smart Controllers

Irrigation smart controllers will allow the museum maintenance staff to monitor the system more closely and make changes to the schedule from their smart phones at any location. This upgrade would give staff the ability to make immediate schedule changes dependent on daily weather conditions, which will further impact water conservation.

Install Rainwater Capture System with Roof Renovation

Implementing a roof rainwater catchment system is a unique way for the museum to practice water reuse and reduce its use of purchased water for irrigation. The system could also serve as an educational opportunity for



the public, fitting in with Science Museum's goals to lead by example in terms of water conservation.

Implement Faucet Greywater Reuse

Another option to conserve water and create a new exhibit is to implement faucet greywater reuse in selected restrooms. The system would utilize handwashing sink water, that would be filtered and piped to reserve for flushing toilets. A system like this could save approximately 375,000 gallons of water per year from flushing toilets.

Install Snow Melt and Water Capture on Kellogg Plaza

The Science Museum's Kellogg Plaza requires snow removal and salt

application to keep the walkway safe in winter months. It is recommended that the museum explore the option to install a low-temperature snow-melt system when it is time to replace the surface of the plaza. Savings from reduced salt chemical usage and staff time in snow removal are to be determined. The system may provide an opportunity to collect additional rainwater and melted snow to store for reuse.

Recommendation	Annual Reduction	Annual Savings	Status
Switch to 1 GPM aerators on faucets	58,000 gallons 220 therms	\$650	Implemented
Install flow-reducing and dual-flush toilet flushometers	1,360,000 gallons	\$13,000	Recommended
Modify irrigation schedule	860,000 gallons	\$8,000	Recommended
Install irrigation smart controllers	300,000 gallons	\$3,000	Recommended
Roof rainwater capture	970,000 gallons	\$9,000	Further investigation needed
Reuse of greywater from faucets	375,000 gallons	\$3,600	Further investigation needed
Implement snowmelt system and water reuse on Kellogg Plaza	1,900,000 gallons	\$18,000	Further investigation needed

MnTAP Advisor: Matt Domski, Waste Reduction Specialist



SensoryEffects by Balchem



Wesley Graham,
Mechanical Engineering,
Iowa State University

Company Background

SensoryEffects is a food manufacturing company that works with customers to create innovative product concepts designed specifically for their target market, as well as producing this product on a large scale. The Sleepy Eye plant specifically produces and distributes dry powders all over North America. The plant is versatile in its ability to produce a variety of powders for various certifications to meet the needs of its customers.



"This summer I got to put things that I learned in class to use in a way that I never expected. The experiences I had this summer will shape the decisions I make for many years to come." ~ WG

Project Background

In development of the MnTAP project, staff at SensoryEffects in Sleepy Eye, MN recognized potential to reduce their consumption of water and energy, as well as examine chemical usage. The project aimed to better understand the use of these resources and to identify opportunities for improvement. Recommendations would serve to reduce costs, conserve resources and contribute to Balchem/SensoryEffects mission to lessen their environmental impact.

Incentives To Change

Since Balchem purchased SensoryEffects in 2014, the company has been rapidly growing. SensoryEffects strives to be environmentally responsible while also reducing costs associated with water, gas, and electricity use. Findings from this project will help SensoryEffects continue its competitiveness in the market as the facility adapts and grows.



"It was great to be able to use MnTAP Resources to help Balchem focus on future energy savings projects."

*~ Byron Currier
Plant Manager, Balchem Corporation*

Solutions

Install Solenoid Valves on Cooling Lines

Cooling water line usage can be optimized by installing solenoid valves. This reduces excess water used for cooling equipment.

Reuse Cooling Water

Some processes that are run in the plant require water for cooling, which is then sent to the drain. An opportunity to reuse the water in a non-potable environment was discovered where it would replace the need for additional water and help recapture heat.

Add Piping to Process Water

A few opportunities for water savings were discovered during normal operating conditions. Adding hard pipe delivery systems to certain processes helped reduce waste water spillage at a few locations to conserve more water.

Continue Installation of New LED High Bay Lights and Adding Motion Sensors

Savings were calculated on current and future LED light replacements. In addition, the possibility of adding motion detection within the plant was investigated for even more potential savings. Working with management and production staff, the proper placements of lighting were identified to maximize both safety and savings.

New Mats for Foot Sanitizing Powder

Changing the style of mats used within the plant saves on chemical use without reducing the effectiveness of footwear sanitation.

Evaluate Heat Recovery

Heat balances and design parameters were investigated to evaluate an installation of heat recovery systems on process equipment. The savings on gas usage was evaluated against the added electrical operating and installation of equipment costs. The savings accrued over the expected life of the equipment would not cover installation costs and the project was not recommended.



Recommendation	Annual Reduction	Annual Savings	Status
Solenoid valves on cooling water lines	240,000 gallons	\$800	Implemented
Reusing cooling water	575,000 gallons 3,000 therms	\$3,500	In progress
Piping process water	24,000 gallons	\$130	Implemented
LED lights and Motion Sensors	47,000 kWh	\$4,400	In progress
Foot sanitizing powder mats	600 lbs chemicals	\$3,800	In progress
Dryer exhaust heat recovery	93,600 therms	\$50,000	Not planned

MnTAP Advisor: Matt Domski, Waste Prevention Specialist



Thomson Reuters



Andrew Mahoney
Mechanical Engineering,
North Dakota State University

Company Background

Thomson Reuters began as West Publishing in 1872 in Saint Paul. The Eagan campus was opened in 1992 and now employs 7,000. Thomson Reuters operates 1.1 million square feet of manufacturing and warehouse using offset, inkjet, and toner printing. Key book genres published include legal, educational, culinary, tax and accounting, and professional. Each year the facility prints 18 million books or 10 billion pages.



THOMSON REUTERS

“Once data is gathered, solving the engineering problem itself is sometimes comparatively simple. Often it is determining what information is needed, how much, and the best source of that data that can prove to be the greatest challenge.” ~ AM

Project Background

Each year Thomson Reuters uses about 30 million gallons of water purchased from the city of Eagan. This water is used both industrially and domestically. Therefore, the search for conservation opportunities took place not only in buildings that house production and warehouse activities, but also in office buildings. An area of 2.7 million square feet provided ample opportunities to conserve water.

Incentives To Change

Thomson Reuters has a history of environmental stewardship dating back to its inception. Waste reduction is a key element of Thomson Reuters’ manufacturing. On the Eagan campus alone, 4,500 tons of paper and 1,300 tons of books were recycled in 2015. Initiatives to reduce corporate carbon footprint have seen the metric fall by 30% since 2011. Water conserving implementations have already been enacted in some areas of the Eagan campus, but being the largest water customer in the city of Eagan, Thomson Reuters still recognizes opportunities for continued improvement.



“Having a MnTAP intern onsite not only assisted us in finding new opportunities for improvement, it brought back some old, forgotten items we can now address. It was great to have a fresh set of eyes find these opportunities in places where our vendors regularly work. It is a reminder to us all not to become complacent and keep digging for opportunities to drive change and make our facilities as safe and efficient as possible.”

*~ Alex Davis
VP - Senior Facilities Manager
JLL - Corporate Solutions, Thomson Reuters Account*

Solutions

Decrease Cafeteria Trough Rinse Water Volume

A rinsing system underneath the dish return carousel in the cafeteria was running 15 gallons per minute for all hours of the day. By leaving this flow off and replacing trough rinsing with a manual procedure, over 7,900,000 gallons of water use can be reduced for a net savings of \$54,000 per year.

Replace Dish Room Solenoid Water Valve

Prior to the dishwasher, dishes are rinsed using a food rinser/soaker/disposal equipment with warm, flowing water. Although most of the equipment's water flow is recirculated, fresh, warm water is added. The intern discovered that water was continually flowing to the drain after the machine was turned off due to a failed solenoid valve. Replacing this valve will save 1,200,000 gallons of water and 5,600 therms annually, resulting in \$10,000 of yearly savings.

Update Dish Room Standard Operating Procedures

The intern was able to observe dish room operating procedures and equipment run-times in the two main cafeterias. One improvement adds movable soak sinks for cookware to soak while leaving the dish rinse/soak equipment off during much of the shift. This suggestion reduces the power for three electric motors and the use of warm water. Another improvement reduces the hot water used during the trough cleaning by changing the cleaning rinse methods. Hot water can be saved by manually filling small containers as needed to wash down the surface.

Replace and Maintain Laminator Heat Exchanger Thermostat

Interviews with bindery employees and maintenance staff pointed the intern toward a cooling water line on the laminator. Upon closer examination, it was determined that a thermostat had malfunctioned and was stuck open allowing softened cold water to run continually. Maintenance staff cleaned the equipment and replaced the thermostat. It is suggested that the laminator be added to the preventive maintenance schedule and the bindery team is instructed on monitoring the cooling water discharge pipe for unusually high flow.

Move from Steam to Fogging Humidification

Industrial humidification on campus is supplied by two natural gas boilers. Instead of boiling water for moisture, fogging systems atomize high pressure purified water with nozzles using a variable frequency drive pump. Evaporation of this water also produces a cooling effect, resulting in potential summer energy savings. Installation of a high-pressure fogging system would eliminate this use of natural gas boilers, feedwater treatment chemicals, and reduce maintenance time and cost. Total savings include 67,000 therms of natural gas and \$41,000 per year.

Recommendation	Annual Reduction	Annual Savings	Status
Decrease cafeteria trough rinse water volume	7,900,000 gallons	\$54,000	In progress
Replace dishroom solenoid valve	1,200,000 gallons 5,600 therms	\$10,000	In progress
Update dish room Standard Operating Procedures	350,000 gallons 1,200 therms 2,000 kWh electricity	\$3,000	Recommended
Replace, maintain laminator heat exchanger thermostat	1,100,000 gallons	\$7,000	In progress
Move from steam to fogging humidification	67,000 therms 135 labor hours	\$41,000	Recommended

MnTAP Advisor: Paul Pagel, Senior Engineer



Washington Cty Car Washes



Kyra Newburg

Bioproducts & Biosystems Engineering
University of Minnesota

Project Background

MnTAP hired a student researcher in May 2018 to evaluate best practices to conserve water in the car wash industry. The 45 car washes in Washington County collectively use about 35 million gallons of water annually, which makes them one of the top water using industries. With support from Washington County Public Health and Environment, this year-long effort involves a comprehensive literature review, site visits to various types of car washes, and the establishment of key best-practices and their associated water conservation potential.



Why Reduce Water Use?

Water and sewer costs make up a large portion of the utility costs for car wash businesses, and the prices continue to rise. There are multiple water-saving measures that apply to all types of car washes. Recycling water and maintaining or upgrading equipment are some ways that car washes can reduce water usage and save on their sewer and water supply fees. These efficient practices not only help save water, but aid in their business efforts to stay competitive in the car wash industry.

Project Goal

The main goal is to inform car washes on their water saving opportunities. Specific goals include:

- Evaluating literature on the car wash systems and water saving recommendations.
- Contacting car wash professionals to gain insight on water use and conservation in car washes
- Reaching out to car wash operators in the county to inform them about their opportunities to conserve water
- Gathering data on the types of car wash systems in the county and their water usage
- Visiting car washes to learn about the operations and offer water saving recommendations when possible
- Developing technical resources for the county and other communities

Key Research Findings

The main concern for car wash operators is to have their systems running smoothly and to clean cars in a cost-effective manner. Saving water may not be high on their to-do list, but high sewer costs give them an incentive to use less water.

Soft-touch/friction wash methods are the most effective means of cleaning the cars, and they generally use less water than touch-free methods. However, customers prefer to have the choice of a touch-free wash.

Some states in the US offer certification programs to incentivize car washes to use less water in their wash. This is an approach that may appeal to consumers and help drive conservation as a whole for the industry in Minnesota.

Recommendation	Average Cost	Water Reduction
Water reclaim system	\$50,000	50-90%
RO reject water reuse	\$2,000	10%
Upgrade nozzles	\$5,000	15%
Rainwater recapture	\$6,000	5-10%
Repair leaks	\$300	0-10%

MnTAP Advisor: Matt Domski, Waste Reduction Specialist

Join the MnTAP Intern Program

Students See Success

MnTAP is seeking junior and senior-level college students to work on water conservation, energy efficiency, lean manufacturing, source reduction, and pollution prevention projects at companies in Minnesota. The projects are located at companies in a variety of industries around the state.

As with many internships, the MnTAP intern program provides students with an experience that helps prepare them for their future careers. Past interns have attributed their experience in the MnTAP program to their career successes.

MnTAP internships not only provide hands-on experience in a variety of facilities, but also provide students with the opportunity to manage a project, develop and test ideas, and often see their solutions implemented. When asked about their experiences, past interns credit the MnTAP intern program with providing a variety of opportunities.

Interns have represented 28 different majors and more than 27 colleges and universities. In total, 264 students have gained experience through a MnTAP internship over the past 34 years.

Student Benefits

Positively impact a facility's environmental footprint

- Gain hands-on project management experience
- Use your classroom knowledge in a real-world setting
- Earn \$16.00/hr and work 40/hrs a week

Applications are being accepted for summer 2019 internships. Interviews will be held January, 2019 through March, 2019. Selected applicants will be matched to a project based on academic background and performance, relevant experience, and technical skills.

To apply, complete the online application form.

www.mntap.umn.edu/interns/student



2018 Interns

Front, L-R: Emily Worman, Maggie Kristian, Danielle Ufheil, Meghan Pieper, Lindsay Brown, Eleanor Green, Ngan Tran
Back: Christopher Leppla, Joshua Kirk, Micah Calderon, Andrew Mahoney, Wesley Graham, Aaron Carlson, Nicholas Michalik



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About MnTAP

MnTAP is an outreach program at the University of Minnesota that helps Minnesota businesses develop and implement industry-tailored solutions that prevent pollution at the source, maximize efficient use of resources, reduce energy use, and reduce costs to improve public health and the environment.

MnTAP provides technical assistance tailored to each business. By reducing waste and increasing efficiency, businesses in Minnesota can save on disposal and raw material costs, decrease regulatory compliance burdens,

and make working conditions safer for employees. Services in addition to the intern program include site visits, team facilitation and phone assistance.

MnTAP is funded by a grant from the Minnesota Pollution Control Agency's Resource Management and Assistance Division to the University of Minnesota School of Public Health, Division of Environmental Health Sciences and other grant and partner sources. MnTAP has no regulatory responsibilities or obligations and our work is confidential.



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