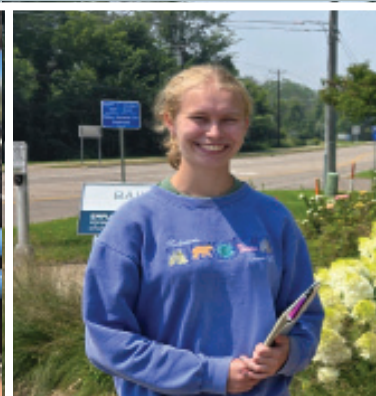
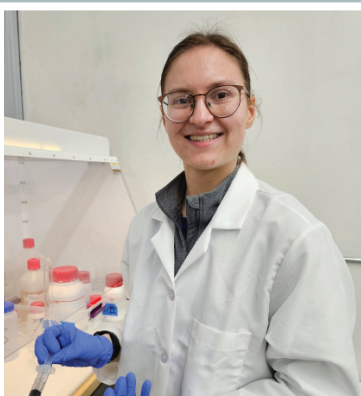




**Mn
TAP**

SOLUTIONS

2025 MnTAP Intern Program



"I gained an extensive set of useful skills that I don't believe I could have developed through any other experience."

**~ Clare Heupel, Bioproducts & Biosystems Engineering,
University of Minnesota Twin Cities**

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Intern Projects

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Project Focus Key



Chemicals



Electricity/
Natural Gas



Water



Waste



Greenhouse Gas
Emissions

MnTAP thanks our generous partners who make this vital work possible. Each of these organizations contributed financially to the intern program in 2025. Their support helps maintain our continuing pollution prevention, energy efficiency and water conservation work.



“There was a wonderful variety of projects featured among the 17 interns that made up this year’s cohort. It was great to see the solutions the interns found for some seemingly vexing problems as well as a good reminder of how even simple changes can add up to really significant savings! I encourage any business or organization leader to explore how MnTAP’s intern program can help solve your waste and environmental challenges.”

~ Mark Snyder, Pollution Prevention Lead,
Minnesota Pollution Control Agency



Grant Number: 00E05100

“MnTAP and the leadership it provides under its internship program to develop our next generation of sustainability leaders have been critical in supporting EPA’s Pollution Prevention program. We have benefitted greatly from the contributions of MnTAP interns through their technical assistance visits in helping small businesses and manufacturers become greener by tackling the source of pollutants. Not only are interns learning how to identify pollutant sources for reduction opportunities and track and measure these results, but they are also learning the value in documenting best practices and lessons learned along the way, which are equally important in shaping our next generation of environmental leaders.”

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



“Several areas of the metro region are facing major water supply challenges to meet their current and projected water demands. MnTAP, through its internship program, is working effectively to identify and implement significant water saving improvements at industries to help preserve the region’s critical water resources while saving costs for the industries and their customers. MnTAP’s efforts to optimize use of resources, improve public health and the environment, and reduce energy use and costs have aligned with the goals and objectives of the Metropolitan Council. As a result, Metropolitan Council’s partnership with MnTAP has been successful and beneficial to the entire metro region.”

~ Greg Johnson, PE, Principal Engineer,
Water Resources , Planning, Metropolitan Council



“Xcel Energy values our partnership with MnTAP because customers get value from the intern’s innovative ideas and recommendations. Their studies identify energy saving opportunities along with estimated savings and paybacks which help customers build a business case to be able to implement opportunities. This collaboration supports our mission to reduce carbon emissions and inspires future industry professionals.”

~ Kim Lidbeck, Senior Product Portfolio Manager,
Xcel Energy, Inc.

2025 Intern-Proposed Solutions

Recommendation	Reduction	Cost Savings	Equivalents
Water Conservation	141,000,000 gal	\$86,300	Water for 6,200 Minnesota residents
Waste	1,800,000 lbs	\$1,170,000	Annual waste from 900 Minnesota residents
Chemicals	216,000 lbs	\$294,000	More than 430 55-gallon drums
Electricity	1,930,000 kWh	\$200,000	Electricity for 200 Minnesota homes
Gas	593,000 therms	\$357,000	CO2 emissions from 660 passenger vehicles
GHG Emissions	524,000 lbs CO2e	\$4,900	CO2 emissions from 52 passenger vehicles
Production Impacts	---	\$307,800	---
Total Potential Cost Savings	---	\$2,420,000	---

All table values for Reduction, Cost Savings and Equivalents refer to annual impacts.

Be Part of the 2026 Intern Program

Students:

- Gain hands-on project management experience.
- Use classroom knowledge in a real-world setting, applying your own creativity.
- Learn from host-site and MnTAP staff mentors.
- Make a difference by reducing resource consumption and improving business processes.
- Earn \$19.00/hour working 40 hours a week during a three-month project.
- Receive a \$1,500 stipend upon successful completion of the project.

Student applications accepted from January through March 2026.

Learn more and apply at:

<http://www.mntap.umn.edu/interns/student/>

Businesses:

- Work with MnTAP engineers and scientists to scope and tailor a project to your needs.
- Discover process improvement opportunities that impact waste, water and energy efficiency.
- Receive co-supervisory support from a MnTAP engineer or scientist throughout the summer.
- Reduce resource use and cut costs.
- Pay just \$4,000 for the 3-month project including follow-up assistance from MnTAP staff.

Proposals accepted through January 16th, 2026.

Learn more and apply at:

<http://www.mntap.umn.edu/interns/business/howtoapply/>

For any questions and general information on the MnTAP Intern Program, contact Intern Program Manager Matt Domski at 612-624-5119, mdomski@umn.edu or <http://www.mntap.umn.edu/interns/>



Abbott Northwestern Hospital



Kayla McMayer
Environmental Studies
St. Olaf College

Organization Background

Abbott Northwestern Hospital (ANW) is a 686-bed care facility located in Minneapolis, Minnesota. As the largest hospital in the Allina Health system, ANW provides quality care for more than 200,000 patients each year. ANW's expansive campus provides ample space for the health needs of the community.



"I am so grateful for the knowledge and connections gained throughout this MnTAP internship experience at ANW. I've thoroughly enjoyed exploring solid waste reduction and sustainability in a healthcare setting through data collection, process analysis, and inter-department collaboration. I'm greatly appreciative of the support and guidance shown by MnTAP and Allina Health staff." -KM

Project Background

To demonstrate their commitment to sustainability, Allina Health hopes to divert 50% of solid waste from landfills and incinerators by 2030. Due to its size, ANW generates a substantial amount of solid waste annually and is a major contributor to Allina Health's total solid waste output. ANW aims to reduce its contribution and increase waste diversion by exploring various waste reduction strategies for organic material, single-use medical device reprocessing, and other medical equipment reuse.

"Our intern applied impressive analytical and interpersonal skills to expand the impact of our green team. She launched an organics collection program, facilitated redeployment of over 50,000 pounds of medical equipment, and developed recommendations that will guide waste reduction projects at the hospital through the coming year."

*~Suzanne Savanick Hansen, Ph.D.,
Environmental Sustainability Manager and
Joyce M. Fitzgerald, Administrative Assistant,
Facilities Management, Allina Health*

SOLUTIONS

Implement Facility-Wide Paper Towel Composting Program

ANW piloted a paper towel composting program to assess its feasibility before scaling up. With support from a Hennepin County grant, ANW introduced paper towel composting infrastructure to 4 restrooms experiencing the highest traffic. After monitoring and addressing any challenges that arise during implementation, ANW could expand this program to the entire facility. A facility-wide composting program at ANW will divert an estimated 44,000 pounds of paper towel waste from the landfill and save around \$3,500 per year.

Implement Kitchen Food Waste and Organic Material Composting Program

By installing 3-stream waste receptacles in high-traffic areas, like waiting areas or the cafeteria, ANW will divert food scraps and other disposable compostable material from landfills. Similarly, ANW could increase organics collection by installing composting infrastructure in their kitchen facilities. Other Allina Health facilities with existing composting systems could serve as a resource or reference for ANW during this implementation process.

Solutions

This recommendation will divert an estimated 370,000 pounds of organic waste and will save approximately \$30,000 per year.

Optimize Reprocessing Program Through Goal Setting

Identified as one of the most effective strategies used to increase reprocessing rates of single-use medical devices (SUDs), goal setting guides the implementation process through setting specific and measurable goals. To achieve their goal of increasing reprocessing rates by 10%, ANW should consider strategies such as introducing a new SUD for reprocessing, mirroring the current program in other departments, providing continual training for clinical staff, and renegotiating supply contracts. By implementing this recommendation, ANW will divert an estimated 53,000 pounds of waste and will save approximately \$139,000 per year.

Utilize Reuse Strategies

ANW utilizes three primary reuse platforms and strategies (MATTER donations, Rheaply, and Clinical Engineering Services [CES] redeployment resources) to divert solid waste from landfills. In July of 2025, ANW partnered with MATTER to donate 93 beds and stretchers, some being over 20 years old. To prevent further buildup of medical equipment, ANW staff should hold formal, biannual meetings to decide if equipment could be redeployed or donated. During the course of the MnTAP internship,

ANW also used the Rheaply online platform to divert surplus office materials from landfills and processed medical equipment through CES resources. These combined recommendations will divert approximately 49,000 pounds of waste from landfills and save an estimated \$3,900.



Recommendation	Annual Reduction	Annual Savings	Status
Implement facility-wide paper towel composting program	44,000 lbs. waste	\$3,500	Partially implemented
Implement kitchen food waste and organic material composting program	370,000 lbs. waste	\$30,000	Planned
Optimize reprocessing program through goal setting	53,000 lbs. waste	\$139,000	Recommended
Establish regular communication system to determine item redeployment or donation	4,000 lbs. waste	\$300	Recommended
Utilize Allina Health reuse platforms	45,000 lbs. waste	\$3,600	Implemented

MnTAP Advisor: Logan Wikstrom, Associate Engineer



Alkali Earth



Cassie Christian
Biochemistry
University of Wisconsin River Falls

Organization Background

Founded in 2022, Alkali Earth, Inc. is a carbon dioxide removal (CDR) startup in Dundas, Minnesota that uses steel slag, a byproduct of steelmaking, to remove carbon dioxide (CO₂) from the atmosphere for permanent storage. Verified permanent removal of CO₂ results in carbon credits that can be sold to help companies meet their carbon footprint goals. Due to industrialization challenges, Alkali Earth decided in July 2025 to wind down operations and spend their final months documenting and sharing what they had learned with the CDR community.



“Working with Alkali Earth, Inc. has given me valuable insight into the challenges of taking the research of a concept and the industrialization of it to a profitable product. With my goals to work in R&D in Biotech, this knowledge has given me an edge to truly understand the launch of products in the industry, especially taking into consideration various environmental consequences.” ~ CC

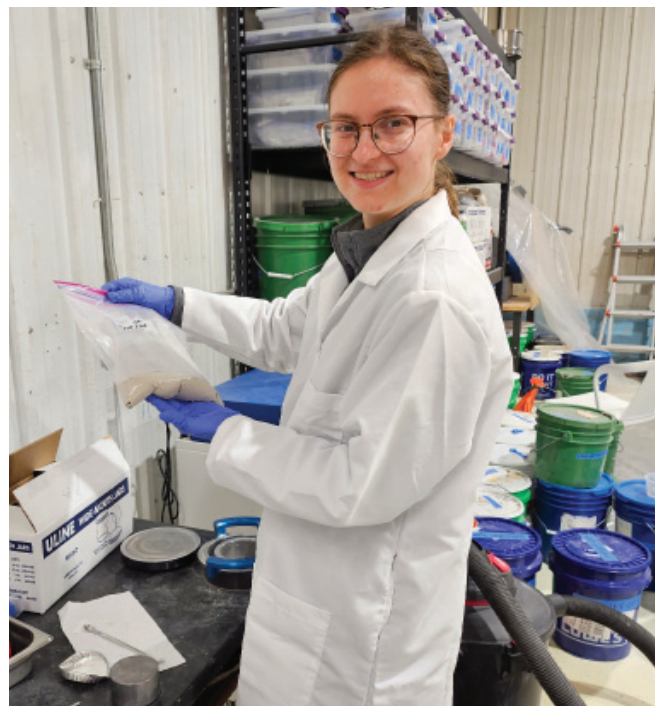
Project Background

This is MnTAP’s second annual “sustainable chemistry” internship sponsored by the Minnesota Pollution Control Agency (MPCA). This project compared the safety and efficiency of potential reagents used in the CDR process.

Chemical additives increase calcium leaching, or the dissolution of calcium ions into solution, from steel slags. Leaching is an indication of CDR potential and the subsequent precipitation reaction required to reach permanent carbon storage. Finding additives that leach more calcium than a water-only baseline would decrease the amount of solvent per ton of CO₂ necessary for CDR. However, the carbon footprint and disposal challenges associated with reagent use decrease the net carbon removed and potentially lower CDR viability.

To explore suitable reagents for calcium leaching, a reagent screening procedure was conducted by mixing steel slag with water-based reagents in a KitchenAid® mixer while monitoring calcium and pH measurements over time.

Reagents achieving higher calcium leaching than the water-only baseline were tested further to optimize their concentration.



Solutions

We were happy to have Cassie help us as we navigated some challenging and important decisions. Cassie focused on assessing the potential of different reagents to enhance steel slag dissolution reactions, with an ultimate aim of maximizing carbon dioxide removal via these reactions. We were very pleased with her work and impressed by her enthusiasm. Thank you MnTAP for providing us with this valuable collaboration."

*~ Sonia Naidu, Senior Scientist,
Alkali Health*

Triethanolamine (TEA)

TEA is an alkanolamine that also performed better than water alone. Experiments explored 0.2 moles/L (M), 0.5 M, and 1 M concentrations after previous success with 0.1 M prior to the internship. As the concentration of TEA increased, so did the calcium leaching. Leaching with 1 M TEA required 247,000 liters of solvent per ton of CO₂, which is 896,000 liters per ton less than the water-only baseline. TEA is designated with a yellow triangle on the SCIL, which means that while it is among the safest materials available for its function, it poses some human health and environmental hazards. It has the signal word 'warning' and can be toxic to aquatic organisms. These EHS considerations may make it more beneficial to use lower TEA concentrations.

Sodium Formate (NaFo)

NaFo is a sodium salt that promotes greater leaching than water alone. Concentrations of 1 to 10 weight percent (wt.%) were tested, with 5 wt.% and 10 wt.% fully saturating the system. 5 wt.% is recommended due to it fully saturating the system while using less reagent. Leaching slag with NaFo at 5 wt.% would require 664,000 liters per ton of CO₂ versus about 1,140,000 liters of solvent per ton of CO₂ for the water-only baseline, or a reduction of 478,000 liters of solvent per ton. Additionally, NaFo is low cost and is designated with a green circle, which indicates it is verified to be of low concern on the EPA's Safer Chemical Ingredients List (SCIL).

Further Investigation Needed

While NaFo and TEA were some of the most promising reagents tested for leaching steel slag for CDR, further research is necessary to fully understand whether these are the best reagents and what would be optimal conditions for an industrial reactor system. Recommended next steps include replication to verify calcium leaching and CDR potential, tests using additional reagent concentrations and different types of slag, and additional precipitation reactions to quantify actual CDR achievable.

Recommendation	Max Calcium Leaching Mill B (mg/L)	Liters of solvent per ton of CO ₂	Kg of CO ₂ per ton slag	Status
Sodium Formate	1,330	664,000	7.5	Requires further study
Triethanolamine	3,690	247,000	20.3	Requires further study

MnTAP Advisor: Jane Paulson, Senior Engineer



Aveda Corporation



Benjamin Davis

Bioproducts & Biosystems Engineering
University of Minnesota Twin Cities

Organization Background

The Aveda Corporation (Aveda), a branch of the Estée Lauder Companies Inc., is a cosmetics company that produces hair and skin care products. The 280,000-square-foot Blaine facility houses a production floor and office spaces, as well as dedicated space for research and development. Aveda is committed to environmental stewardship and is a Certified B Corporation. Aveda has also set goals to reduce their absolute scope 1 and 2 emissions at the Blaine facility by 50% by 2030 using a 2018 baseline.



"The MnTAP program has been an incredible opportunity, and I feel so lucky to have been a part of this year's cohort. Getting to work side by side with company professionals, learn about different industrial processes, and work with an assortment of tools to find reduction solutions have been invaluable experiences that I will use for the rest of my academic and professional career." ~ BD

Project Background

The Blaine facility averages 5.4 gigawatt hours (GWh) of energy per year at a cost of \$627,000. Reducing energy use saves money and helps make progress on their internal scope 1 emission goal and energy reduction goals as a member of the Department of Energy's Better Plants Program.



SOLUTIONS

Reduce Office HVAC Operating Hours

Approximately 120 heat pumps regulate the Aveda office's temperature. The office's HVAC schedules have not been adapted to occupancy changes associated with hybrid work schedules after COVID-19. Updating HVAC schedules based on current occupancy data reduces their operating hours and energy use for running fans and cycling compressors. Using optimized start and stop, an algorithm that automatically adjusts based on a 30-day learning period, helps ensure spaces reach their desired temperatures on time. Implementing this would save 74,800 kWh and \$8,850. This corresponds to a reduction of 30.4 equivalent metric tons of carbon dioxide emissions (MTCO_{2e}) per year.

Reduce Production Heatex, Gowning, and Filling Heat Pump (HP) Operating Hours

Several large roof-top and make-up air units provide outside air and regulate temperature for many spaces on the Aveda production floor. Three of these units (the Heatex unit, gowning unit, and 10 filling heat pumps) are

Solutions

currently running night and day. Since the production floor is empty on weekends, ramping down these units on weekends will save significant energy. Implementing this will save 141,000 kWh, 4,930 therms, and \$20,400. This corresponds to a reduction of 84.2 MTCO_{2e} emissions per year.

Reduce Pre-Weigh Venmar Operating Hours

Ingredients for Aveda products are measured and prepared in the Pre-Weigh department. This area houses a large HVAC unit that supplies clean air to the room and maintains a pressure differential for the fume removal arms. Shutting this unit down over the weekends, when this area is not staffed, would save 47,900 kWh, 2,060 therms, and \$7,200. This corresponds to 30.7 MTCO_{2e} emissions per year.

Redirect Sensor Effluent to Barrel Washer

The 55-gallon barrels, which store ingredients, need to be washed before recycling or reusing for further storage. The barrel washer has three different wash cycles and uses approximately 51,800 gallons of water per year. This project identified a sensor effluent stream coming from Aveda's pharmaceutical-grade water system that could serve as an alternative water source for this washer. Using this alternative source would reduce the city water use by 51,800 gallons and save \$600 per year.

Improve Tank Heating and Cooling Efficiency

Mixing tanks for manufacturing Aveda products are heated by steam and cooled by chilled water. In recent years, staff have noticed it takes longer and there is more variability in heating and cooling times for batches. Analysis of the chiller, steam traps, and vacuum breakers revealed consistent heating trends with noticeably low cooling trends. Additional sensing equipment, like pressure and temperature sensors on the steam boilers and tank outlets, will facilitate data-driven analysis to improve heating times. Replacing the current chiller with a more efficient model will reduce and energy use.

"MnTAP's program helps Aveda take action on projects that reduce energy consumption, conserve water, and enhance efficiency, all while providing their interns with manufacturing and problem-solving experience."

*~ Bethany Barlow, CSP
Associate EHS Manager*

Recommendation	Annual Reduction	Annual Savings	Status
Reduce office HVAC operating hours	74,800 kWh	\$8,850	Planned
Reduce production heatex, gowning, and filling HP operating hours	141,000 kWh 4,930 therms	\$20,400	Planned
Reduce pre-weigh Venmar operating hours	47,900 kWh 2,060 therms	\$7,200	Further Investigation Needed
Redirect sensor effluent to barrel washer	51,800 gal water	\$600	Recommended
Improve tank heating and cooling efficiency	TBD	TBD	Further Investigation Needed

MnTAP Advisor: Laura Sevcik, Engineer



Bailey Nurseries



Clare Heupel

Bioproducts & Biosystems Engineering
University of Minnesota Twin Cities

Organization Background

Bailey Nurseries is a family-owned, fifth-generation wholesale nursery company. Headquartered in Woodbury, Minnesota, Bailey has facilities in multiple locations in the Twin Cities as well as in Georgia, Illinois, Oregon, and Washington. This project investigated facilities that cover approximately 17 million square footages and produce millions of plants a year. As one of the nation's largest growers and breeders, Bailey Nurseries has established itself as a trusted source of diverse and unique plant species.



"Working at Bailey through the MnTAP internship has been incredibly rewarding. I gained an extensive set of useful skills that I don't believe I could have developed through any other experience. Everyone at MnTAP and Bailey was a pleasure to work with, and I will look back on this project fondly." ~ CH

Project Background

The facilities of interest are using 483 million gallons of water and 7.8 million kilowatt-hours (kWh) per year. Bailey's sustainability team identified water and energy use as major areas of improvement for the company. This project aimed to increase resource use efficiency by investigating ways to reduce water and energy consumption without impacting production.

"Clare was a fantastic addition to the team and brought great energy, a strong work ethic, and a real eagerness to learn. Whether she was working at her desk crunching numbers or collecting data in the very hot greenhouses, she approached each task with enthusiasm and professionalism. Her water conservation project will lead to major savings and lasting impact on Bailey's resource management."

*~ Ryan Goodmanson, Potting Foreman,
Bailey Nursery*

SOLUTIONS

Irrigate Precisely to Pot Size

At the container field, most plants, regardless of size, are watered for two hours on average at a time. This results in some plants being overwatered, and some plants being underwatered. Adjusting irrigation settings to address the needs of various pot sizes will ensure that all plants receive the optimal level of water drainage. This will save 115.7 million gallons of water a year and \$3,100 in pumping energy.

Install Wireless Irrigation System

The irrigation team at the Container East facility manually operate valves on lines and pumps for between 30 minutes to 2 hours each day. Installing the wireless irrigation system would allow valves to be operated wirelessly and irrigation settings to be scheduled ahead of time. This would allow for greater precision when irrigating and save an estimated 398.5 hours of labor and \$9,960 each year.

Solutions

Limit Boom Overspray

At the Nord Farm, booms are currently spraying water around 35 inches past the ends of the plant rows. To prevent this extra overspray, growers should program the booms with fan nozzles to stop no further than 3 inches past the plants and 24 inches past the cone nozzles. This has no implementation cost and will save 316,000 gallons and \$9 in pumping energy a year.

Reduce Greenhouse Irrigation Settings

Growers at Nord Farm follow general guidelines of how much water each size tray of plants should be getting per irrigation setting. These guidelines have remained the same for many years and have not been reevaluated to ensure plants still receive the proper amount of water. Evidence suggests reducing watering by 20% in plants may not affect plant health. Applying this reduction to all irrigation settings will save 4.8 million gallons and \$136 from reduced energy use a year.



Recommendation	Annual Reduction	Annual Savings	Status
Irrigate precisely to pot size	115.7 million gal water	\$3,100	Recommended
Install wireless irrigation system	398.5 labor hours	\$9,960	Recommended
Limit boom overspray	316,000 gal water	\$9	Recommended
Reduce greenhouse irrigation settings	4.8 million gal water	\$136	Recommended

MnTAP Advisor: Jon Vanyo, Senior Engineer



Beacon EmbeddedWorks



Nina Mirfakhraie
Chemical Engineering
University of Minnesota Twin Cities

Organization Background

Beacon EmbeddedWorks (Beacon) was founded in 1960 in Minneapolis, Minnesota. Today, Beacon is in Eden Prairie, Minnesota and employs 80 people at a 50,000 square-foot facility. Beacon designs, manufactures, and continuously supports custom System-on-Modules, or small computer boards used for processing, graphics, memory, and WiFi and Bluetooth connectivity. These boards primarily serve the medical, aerospace, and defense industries.



"This internship has been an incredible opportunity for me, and I am so grateful to everyone at MnTAP and Beacon for all the support they provided. I learned a lot about manufacturing and it's exciting to know that some of my projects have been, or will be, actually implemented at Beacon." ~ NM

Project Background

Beacon is a member of the discoverIE Group, which aims to reduce natural gas consumption and lower Scope 1 and 2 emissions as part of its sustainability goals. The project investigated strategies for reducing energy consumption and emissions to achieve these objectives. In addition, Beacon seeks to reduce water use in manufacturing to ensure their water storage tank can supply humidification and the multistage board washer. With bathroom renovations scheduled for late August 2025, there is also an opportunity to install low-flow fixtures.

SOLUTIONS

This project identified more recommendations than could be covered in this executive summary. Please see the table for the full list of recommendations.

Shut Off Final Rinse Automatically

Beacon's multistage board washer should turn on and off automatically when it senses boards on the conveyor belt. However, water was flowing continually in the final rinse stage of the washer even when boards were not in the machine. An automatic shutoff setting was enabled to prevent the unnecessary flow of heated water and save 190,000 gallons of water, 11,500 kilowatt-hours (kWh), and \$1,800 per year. The reverse osmosis (RO) flow rate was increased by 43% to better meet the washer's water needs

without increasing overall water use since the RO reject rate remained unchanged.

Install Irrigation Rain Sensor

Beacon installed a rain sensor on their irrigation system to prevent irrigation when rainfall has already met the lawn's watering needs. The sensor was set to prevent irrigation after a half inch of rain and continue preventing automatic watering until the sensor was dry. If new grass is not planted in future summers, Beacon can adjust the sensor to shut off after a quarter inch of rain to achieve greater water savings. The half-inch rain sensor settings will save 20,100 gallons and \$115 per year.

Install Low-Flow Bathroom Fixtures

The bathrooms have never been cohesively renovated and have older fixtures, meaning some fixtures use more water than current standards. Installing WaterSense 1.28 gallons per flush (gpf) toilets and 0.5 gpf urinals are recommended. Since measurements revealed that faucets averaged 1.4 gallons per minute (gpm), or 0.1 gallons gpm below the WaterSense rating, Beacon should choose a lower-flow 0.5 gpm replacement to avoid increasing faucet water use. Implementing both will save Beacon 150,000 gallons, 1,220 kWh and \$930 per year.

Purchase Renewable Electricity

To align with discoverIE Group's goal to reduce Scope 2 emissions, Beacon was interested in exploring ways to reduce carbon dioxide (CO₂) emissions associated with

Solutions

generating the electricity it uses. By purchasing renewable electricity through Xcel Energy's Renewable*Connect program, Beacon could reduce or eliminate Scope 2 emissions by up to 237 metric tons of carbon dioxide equivalent (MTCO₂e) annually.

Install Dual Fuel RTUs

Some of Beacon's rooftop units (RTU) are set to be replaced this year. Beacon can choose to replace these RTUs with dual fuel RTUs that use an air source heat pump during moderately cold temperatures and switch to natural gas during extreme cold. This would lower natural gas use for heating, though savings would vary depending on the temperature at which natural gas replaces the air source heat pump.

Repair Compressed Air Leaks

A compressed air study performed by a contractor identified 10 compressed air leaks. An Xcel Energy rebate covered the cost of the compressed air study. Beacon is currently repairing these leaks for total savings of 14,400 kWh and \$1,500 per year

"Nina brought smiles to Beacon staff with her positive attitude and willingness to get involved and learn. For each project, Nina successfully worked with staff and external suppliers, galvanized actions, assumed responsibility, and delivered strategies to save water, energy, and real dollars. I can't encourage other companies enough to take part in the MnTAP intern program. We're a better organization for having gone through it with Nina."

*~ John Bolduc,
Senior Manufacturing Manager*



Recommendation	Annual Reduction	Annual Savings	Status
Shut off final rinse automatically	190,000 gal water 11,500 kWh	\$1,800	Implemented
Install irrigation rain sensor	20,100 gal water	\$115	Implemented
Install low-flow bathroom fixtures	150,000 gal water 1,220 kWh	\$930	Planned
Purchase renewable electricity	237 MTCO ₂ e	NA	Recommended
Install dual fuel RTUs	TBD	TBD	Further investigation needed
Repair compressed air leaks	14,400 kWh	\$1,500	Implementing
Change irrigation billing	NA	\$475	Implemented
Install demand control ventilation	2,360 kWh 3,350 therms	\$3,200	Tentatively recommended
Improve reverse osmosis system and add softening	1,450 gal water	NA	Recommended

MnTAP Advisor: Laura Sevcik, Engineer



Ever-Green Energy



Joseph Morphey
Physics & Economics
University of Minnesota Duluth

Organization Background

Ever-Green Energy advances and operates energy and water systems across five states and has a deep commitment to financial and environmental stewardship. Collaborating across sectors, Ever-Green Energy works to enhance the resilience of energy systems. One example is the Hennepin County Energy Center (HCEC) in Minneapolis, Minnesota. HCEC provides steam and chilled water to downtown Minneapolis buildings, like Hennepin County Medical Center and government facilities, for heating, cooling, hot water, sterilization, and humidity control.



"My MnTAP internship with Ever-Green Energy was one of the most fascinating and rewarding experiences I have had. Learning about the intricacies of district energy infrastructure systems was a great way to see the real-world implications of what I study in the classroom. I am very grateful to MnTAP and Ever-Green Energy for the opportunity and their support~ JM

Project Background

This project investigated potential energy and water efficiency improvements at HCEC's central plant. The primary resources used at HCEC annually are water (56,000,000 gallons), electricity (11,700,000 kilowatt-hours [kWh]), and natural gas (5,590,000 therms).

Reliability is Ever-Green Energy's top priority. As a crucial energy infrastructure facility that supplies steam and chilled water for climate control to the Hennepin County Medical Center and Government Center, HCEC must ensure uninterrupted reliability. Other goals include improving efficiency and reducing the plant's carbon footprint.

"Joseph's work this summer delivered clear, actionable recommendations that will result in real emissions, water, and cost savings for HCEC. He jumped right in and offered a fresh, bright perspective, quickly narrowing in on effective solutions. It was a pleasure working with him."

*~ Ryan Johnson, Senior Engineer
Ever-Green Energy*

SOLUTIONS

Install Feedwater Economizers

Economizers are heat exchangers that improve boilers' efficiency by heating incoming feedwater with recovered energy from flue gases. Installing economizers on all three stacks connected to HCEC's boilers will save \$239,000 by reducing fuel use by 405,000 therms annually.

Install Variable Frequency Drives on Four Cooling Tower Fans

HCEC uses six large fans to cool water in cooling towers during the summer. Two of these fans use variable frequency drives (VFDs) to allow them to run at 80% rather than 100%. This results in substantial electricity savings as higher fan speeds lead to linear increases in flow and exponential increases in electricity usage. Currently, four fans lack VFDs. Installing VFDs on these remaining fans will reduce HCEC's electricity usage by at least 246,000 kWh and \$22,800 annually.

Solutions



Reuse Vacuum Seal Water

Water from the vacuum seals on the steam-turbine-driven chiller is discharged to the drain after use. Reuse of this water is possible by piping the discharge location into the cooling towers. Implementing this would reduce the need for makeup water and save 532,000 gallons of water and \$6,330 per year.

Optimize Boiler Use

HCEC's boilers are often kept in warm standby to serve as on-demand backup boilers, meaning they are kept warm but do not produce steam. Instead of simply keeping them warm, using backup boilers to produce steam will save the facility around \$4,050 and reduce natural gas use by 6,870 therms per year at zero cost.

Recycle Chlorine Test Water

Cooling tower water that is tested for chlorine is then discharged into the sewer. A simple modification could send this water back up to the cooling towers and save 432,000 gallons and \$5,270 annually. However, this action is not recommended because chlorine test water is sampled from the cooling tower blowdown and recirculating it would increase conductivity in the cooling towers.

Recommendation	Annual Reduction	Annual Savings	Status
Install feedwater optimizers	405,000 therms	\$239,000	Recommended
Install variable frequency drives on four cooling tower fans	246,000 kWh	\$22,800	Recommended
Recycle vacuum seal water	532,000 gal water	\$6,330	Recommended
Optimize boiler use	6,870 therms	\$4,050	Recommended
Recycle chlorine test water	432,000 gal water	\$5,270	Not Recommended

MnTAP Advisor: Gabrielle Martin, Engineer



Hennepin Energy Recovery Center



Xavier Dante

Sustainable Systems Management
University of Minnesota Twin Cities

Organization Background

The Hennepin Energy Recovery Center (HERC) is operated by the Great River Energy (GRE) for Hennepin County and is a waste-to-energy facility in downtown Minneapolis that has been converting municipal solid waste into energy since 1989. HERC processes over 365,000 tons of waste annually to reduce landfill use and generate electricity. The facility generates enough electricity to power over 25,000 homes and steam for local uses, such as Target Field and other downtown buildings.



GRE HERC Services, LLC

"My MnTAP internship has been a valuable and rewarding experience. I developed a strong understanding of cooling tower operations while working on projects that can save water and money for the county. I gained firsthand insight into how sustainability can apply to any industry while strengthening my problem solving and communication skills. I am grateful to MnTAP and the team at HERC for helping me to have a wonderful experience this summer." ~ XD

Project Background

Waste-to-energy facilities consume significant amounts of fresh water. HERC uses around 200 million gallons of treated water every year, and 85% of that water is dedicated to operating the cooling tower. This water's purpose is to remove heat from various processes around the plant through evaporative cooling. This project's goals were to maximize the cooling water's efficiency and find other water reuse options that could provide a source of water for the cooling tower.

"We had a great experience with the MnTAP internship program, and Xavier did an excellent job. We are putting final touches on the cooling tower acidification project, and the water reuse projects are also in process. We hope to see significant water savings. Thanks to Xavier and MnTAP for the assistance."

*~ Dan Fish, Plant Manager,
Hennepin Energy Recovery Center*

SOLUTIONS

Increase Cooling Tower Cycles of Concentration Through Acidification

Cycles of concentration refer to the number of times the cooling tower cycle and evaporate city water before needing to discharge. With each cycle, minerals and impurities in the water can increase in concentration and lead to heat exchangers experiencing scale buildup. To increase cycles without raising scaling risk, the pH of the cooling water loop should be decreased by adding high-strength sulfuric acid through daily dosing. This will allow scale forming compounds to be suspended in water for longer and allow the cycles of concentration to be safely increased from 4.5 cycles to 6 cycles on average. This solution will save 12.4 million gallons of city water, 50,000 pounds of bleach, and \$50,000 in water savings per year.

Solutions

Supplement Cooling Tower Makeup with Stormwater

In 2013, HERC installed the Interchange Stormwater Reuse Project under the Target Field Station to capture rainwater and snowmelt from 95,000 square feet of surrounding area. Between 600,000 to 1.4 million gallons of usable water per year is stored in two 20,000-gallon cisterns and piped into the HERC for facility use. Prior to this project, the tank's limited capacity caused water to overflow into the sewer. To maximize water usage and save on city makeup water, stormwater should be rerouted to the cooling tower water loop. This water must pass through a sand filter, which is cleaned with bleach to remove any bacteria or solids that might be in the stormwater. If implemented, this system will save an average of 930,000 gallons of city water and \$3,700 per year.

Reuse Chute Cooler Blowdown Water

HERC's chute coolers keep the chute temperature around 100 degrees to prevent waste from catching on fire prematurely. In 2025, the newly installed chute cooler system used around 5,500 gallons per day in the summer or more water than expected. Warm water was blown down into the quench tank, which was already at maximum water storage capacity, and the excess water from the chute coolers was overflowing into the storm sewer. This project proposes rerouting the chute cooler blowdown water to a new holding tank that can then be pumped into the cooling water loop. This will save about 1.1 million gallons of water and \$4,400 each year.



Recommendation	Annual Reduction	Annual Savings	Status
Increase cooling tower cycles of concentration through acidification	12.4 million gal water 50,000 lbs. bleach	\$50,000	Implementing
Supplement cooling tower make up with storm water	930,000 gal water	\$3,700	Implementing
Reuse chute cooler blowdown	1.1 million gal water	\$4,400	Implementing

MnTAP Advisor: Jon Vanyo, Senior Engineer



Liberty Packaging - Brooklyn Park



Cole Rossman

Chemical Engineering
University of Minnesota Twin Cities

Organization Background

The Liberty Packaging facility in Brooklyn Park produces over 600,000,000 square feet of corrugated board for boxes yearly. The 300,000-square-foot facility employs 114 people and is led by the Plant Manager, Shon Foley.



"I had a great experience working at Liberty Packaging through MnTAP this summer. I learned a lot about manufacturing. It was amazing to apply my education and learn more through research and from the people around me. It was a great experience, and I am very happy I did it." ~ CR

Project Background

This plant partnered with MnTAP to reduce its water and energy consumption. This involves creating a water map, working with a vendor to complete a compressed air audit to identify air leaks, and analyzing steam usage. These revealed that steam leaks were a major conservation opportunity due to accounting for 25% of the facility's non-irrigation water usage and 20% of the natural gas usage. Improving equipment reliability and minimizing downtime will give Liberty Packaging an edge in the corrugated box industry, which operates on rapid turnarounds due to rising consumer demand for two-day or less online shipping.

Liberty Packaging aims to further strengthen its robust paper recycling infrastructure by reducing water and energy usage to enhance operational sustainability and environmental consciousness.

"The professionalism of the MnTAP team throughout the planning and execution of the summer internship program was outstanding! Partnership between Liberty and MNTAP was a fantastic experience for our team to identify opportunities for improvements in our steam, water and air supply systems. Thank you again for a great experience!"

*~ Tom Deuser,
Environmental, Health, and Safety Manager*

SOLUTIONS

Insulate Piping

Adding insulation to the steam and condensate piping will reduce heat loss to the ambient air. Besides improving workplace safety, this added insulation will decrease the facility's temperature in the summer and lead to annual savings of 7,400 therms and \$4,400.

Repair Steam and Condensate Leaks

While the facility has many types of steam leaks, this project focused on the following recommendations: changing the valves on blowdown piping, replacing the connections on the single facer carts, and installing a connection between a steam trap and the condensate return. Fixing these steam and condensate leaks will lead to annual reductions of 670,000 gallons of water, 59,000 therms of natural gas, and 4,600 pounds of softener salt along with annual savings of \$42,000.

Solutions

Replace AODD Pumps

Air operated double diaphragm (AODD) pumps are used to transport the starch in the production of corrugated boards. These AODD pumps are inefficient when compared to electric pumps. By replacing two AODD pumps with electric pumps, electricity consumption will be reduced by 65,000 kWh and \$4,800 yearly.

Update Rainwater Sensor for Irrigation System

Irrigation accounts for 40% of total water use at this facility. Updating the rainwater sensor system can decrease water usage by 430,000 gallons and costs by \$2,000 per year.

Repair Air Leaks

This facility uses compressed air extensively; a compressed air audit found 28 air leaks. Repairing these will decrease electricity use by 126,000 kWh and save \$10,000 yearly.

Install Capacitor for Power Factor Correction

Xcel Energy applies charges to industrial locations, like Liberty Packaging, for a power factor below 90%. This charge is a monthly increased demand charge. Liberty Packaging currently spends a total of \$12,000 per year, or about \$1,000 per month, on this increased demand charge. Installing a capacitor that is sized to achieve a 95% power factor will eliminate this annual expense while allowing room for the facility to expand before another capacitor installation is needed.



Recommendations	Annual Reduction	Annual Savings	Status
Insulate piping	7,400 therms	\$4,400	Recommended
Repair steam and condensate leaks	59,000 therms 670,000 gal water 4,600 lbs. salt	\$42,000	Recommended
Replace AODD pumps	65,000 kWh	\$4,800	Planned
Update rainwater sensor for irrigation system	430,000 gal water	\$2,000	Recommended
Repair air leaks	126,000 kWh	\$10,000	Implementing
Install capacitor for power factor correction	NA	\$12,000	Recommended

MnTAP Advisor: Gabrielle Martin, Engineer



Liberty Packaging - Golden Valley



Lucas LiaBraaten

Applied Physics - Engineering
Hamline University

Organization Background

Liberty Packaging is a company that produces corrugated packaging, and each location has its own package producing capabilities. The Golden Valley site manufactures single, double, and triple wall boxes in a variety of sizes and prints.



"My time at Liberty Packaging will prove invaluable to my career. Getting hands-on engineering experience and applying my education to benefit a Minnesota company and the environment was a dream come true. I am incredibly grateful to Liberty and MnTAP for the opportunity to do this work" ~ LL

Project Background

This project investigated opportunities to improve efficiency and cost savings by reducing water, compressed air, and steam usage at the Liberty Packaging Facility in Golden Valley, Minnesota. Compressed air leaks were located and mapped to assess the potential for savings if repairs are made. By quantifying steam leaks, it was possible to determine energy and water losses. This project also investigated power factor correction, irrigation, bathroom sink fixtures, and pipe insulation.

"The professionalism of the MNTAP team throughout the planning and execution of the summer internship program was outstanding! The partnership between Liberty and MNTAP was a fantastic experience for our team to identify opportunities for improvements in our steam, water and air supply systems."

*~ Tom Deuser,
Environmental, Health, and Safety Manager*

SOLUTIONS

Fix Compressed Air Leaks

An ultrasonic leak detector was used to find compressed air leaks to determine the magnitude of opportunity. Because several leaks were found, a compressed air auditor later conducted a comprehensive compressed air study and identified 31 leaks, which cause a loss of 146,000 kilowatt-hours (kWh) and \$11,500 per year. These leaks are currently being fixed.

Install a Capacitor Bank

An analysis of electricity bills revealed that one section of the plant had a poor power factor, which resulted in additional costs from Xcel Energy. Installing a capacitor bank will improve the power factor and save \$9,200 per year.

Change O-ring Type for Steam Hookups

The corrugator has been experiencing persistent issues with poor sealing at the hookups. To reduce leakage, Liberty should experiment with O-Rings that are specifically designed for steam applications, can seal better, and can last longer. If reliable seals are found,

Solutions

Liberty could save 100,000 gallons of water, 11,000 therms of natural gas, and up to \$8,800 per year.

Install Rain Sensor for Irrigation System

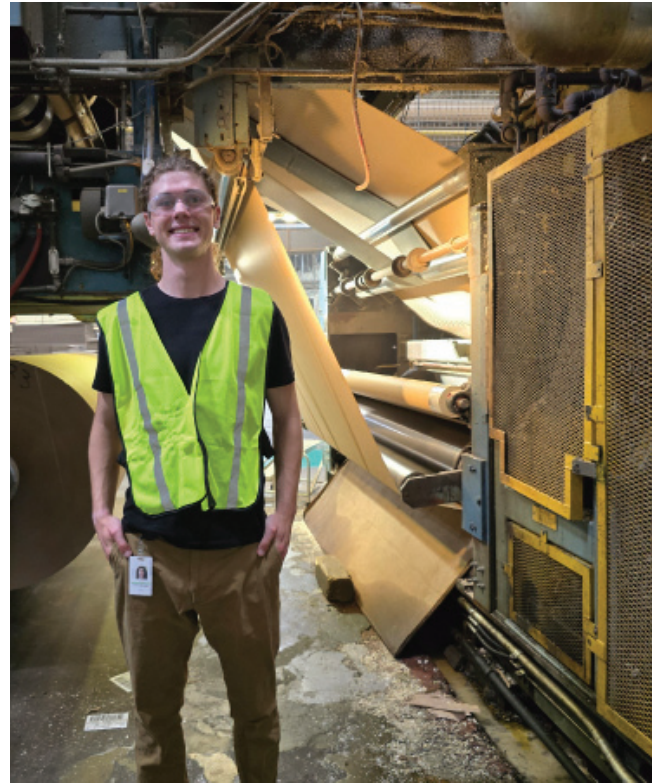
A comparison between the irrigation bills from the 2024 watering season and recorded rainfall totals suggested the facility could reduce irrigation rates. Installing rainfall sensors can allow the watering schedule to adjust according to rain levels. This change could save up to 455,000 gallons of water for irrigation and \$3,500 per year.

Install Low-Flow Sink Aerators

An audit found that many of the facility's bathroom sinks had high flowrates, with an average flowrate of 1.48 gallons per minute (gpm). Installing low-flow sink aerators will reduce water flow to 0.5 gpm and save 22,000 gallons of water, 1,600 kWh from the water heater, and \$440 per year.

Insulate Steam Line

An infrared camera photographed steam lines at the facility to find uninsulated lines and assess their temperatures. A 26-foot line was measured at 350°F. Insulating this line would not only reduce the temperature of the surrounding area but also save 400 therms of natural gas and \$260 per year.



Recommendation	Annual Reduction	Annual Savings	Status
Fix compressed air leaks	146,000 kWh	\$11,500	Implementing
Install a capacitor bank	NA	\$9,200	Recommended
Change O-ring type for steam hookups	11,000 therms 100,000 gal water	\$8,800	Recommended
Install rain sensor for irrigation system	455,000 gal water	\$3,500	Recommended
Install low-flow sink aerators	1,600 kWh 22,000 gal water	\$440	Recommended
Insulate steam line	400 therms	\$260	Recommended

MnTAP Advisor: Gabrielle Martin, Engineer



M Health Fairview



Fanuel Akakpo Ayewanou
Public Health
University of Iowa

Organization Background

M Health Fairview University of Minnesota Medical Center – East Bank is located in Minneapolis and is the state’s only university-affiliated academic medical center. The facility is owned and operated by Fairview and supports medical education, research, and advanced clinical cases. In recent years, sustainability—especially reducing the environmental impact of operating rooms (ORs)—has become an important institutional priority.



“During my internship, I enjoyed exploring the environmental challenges within hospital operations and learning how to integrate sustainability into healthcare. This experience strengthened my knowledge of sustainable practices in clinical settings and prepared me to drive impactful changes in future healthcare environments. I’m deeply thankful to MnTAP and M Health Fairview Hospital for the opportunity to contribute and grow.” FAA

Project Background

ORs are one of the most resource-intensive areas in healthcare and generate significant amounts of medical waste, stemming from surgical kits, drapes, packaging, and anesthetic gases. M Health Fairview – East Bank partnered with MnTAP to investigate opportunities to reduce OR waste and improve efficiency. MnTAP chose Coronary Artery Bypass Graft and Robot-Assisted Hysterectomy procedures as representative cases to evaluate waste generation, identify recyclable materials, and assess resource optimization and waste management strategies.

“The focus for our MnTAP intern, Fanuel, was one of great complexity within our organization. Her ability to collaborate across teams, document current practices, and evaluate both the resources required and the potential benefits provided valuable insights to guide our priorities for sustainable waste and energy reduction. This was the second MnTAP intern our organization has hosted, and we continue to be highly impressed with the quality of the program and the guidance provided by MnTAP advisors.”

*Sandy Laffan, MBA, Vice President,
Fairview System Facility Services*

SOLUTIONS

Replace Disposable Gowns and Drapes with Reusables

Disposable surgical gowns and drapes make up a significant share of OR solid waste. Over 4,100 pounds of waste, including from gowns and three types of drapes alone, were estimated based on visual observations of procedures, weighing of total waste volume, physical sorting of waste streams, and analysis of supply chain purchasing records to estimate annual usage volumes. In collaboration with the Health Service Cooperative Laundries (HSCL), reusable alternatives were evaluated, and a cost analysis revealed higher expenses from laundering and replacement costs being factored in. Staff also expressed concerns over infection control and workflow changes. To address these, a phased pilot project focused on specific procedures is recommended to test feasibility, collect staff feedback, and monitor environmental impact before broader adoption. In general, greater adoption of reusable alternatives could lower HSCL costs through economies of scale. If implemented, this could save 4,100 pounds of waste per year.

Solutions

Promote Better Separation and Recycling of Soft Plastics

A waste audit revealed that clean, non-contaminated plastics (e.g., irrigation bottles, trays, and medical packaging film) are often discarded as trash even though they are recyclable. After systematically sorting plastics, it was estimated that approximately 65,400 pounds could be recycled annually. Expanding the hospital's existing partnership with Merrick, Inc. could divert these plastics at no added cost as Merrick can process soft plastics. Fostering staff engagement through creating clear sorting guides and pre-operative reminders will be key to success. The program has the potential to divert 65,400 pounds of waste from the landfill and save \$3,300 per year.

Optimize Air Exchanges in the ORs

ORs must always maintain high ventilation rates to meet infection control standards, but this results in significant wasted energy in unoccupied spaces. Three optimization scenarios that reduced air changes per hour (ACH) during unoccupied periods were evaluated. Of the three, the moderate approach is the most ideal due to balancing significant energy savings with operational feasibility and safety. Motion-sensor controls would detect room occupancy and automatically restore full ventilation when staff or patients enter, ensuring infection prevention requirements stay intact. This moderate strategy would save 550,000 kWh of electricity, 33,500 therms of natural gas, and \$113,000 annually.



Recommendation	Annual Reduction	Annual Savings	Status
Replace disposable gowns and drapes with reusables	4,100 lbs. waste	NA	Recommended
Promote better separation and recycling of soft plastics	65,400 lbs. waste	\$3,300	Recommended
Optimize air exchanges in ORs	550,000 kWh 33,500 therms	\$113,000	Recommended

MnTAP Advisor: Logan Wikstrom, Associate Engineer



Metro Transit



Alex Goers

Sustainable Systems Management
University of Minnesota Twin Cities

Organization Background

As a leading transportation resource for the Twin Cities region, Metro Transit offers an integrated network of buses, light rail, commuter trains, and Microtransit along with resources for those who carpool, vanpool, walk, or bike. Established in 1967, Metro Transit joined the Metropolitan Council in 1994 and delivered nearly 45 million rides in 2023.



"This program gave me practical experience in my field, strengthened my skills, and deepened my understanding of sustainability in practice. During my time at Metro Transit, I built my professional toolbox, developed new problem-solving strategies, and expanded my network. None of this would have been possible without the guidance and encouragement of my advisors, whose support helped me make the most of this experience." ~AG

Project Background

Metro Transit receives about 63,640 pounds of pallets each year from vendor shipments and processes 52,000 pounds of tempered glass for disposal each year, resulting in over \$12,000 in contamination fees. This project focused on pivoting to more circular waste streams of reselling, reusing, and recycling materials to optimize their value within relevant markets.

"Managing the wide variety of material types in our waste system proved more challenging than we could dedicate staff time to. Not only did Alex deliver actionable solutions on pallets and broken glass, which will positively impact our operations and improve the economics, but also fostered an awareness of action that spread throughout our organization."

*~ Jeff Freeman, Sustainability Manager,
Metro Transit*

SOLUTIONS

Resell and Reuse Pallets

In the short term, pallet management can be improved through standardization, signage, and designated sorting areas. Three centralized collection sites were proposed to streamline logistics. Facilities with low monthly pallet volumes can return pallets using delivery trucks from main receiving sites for recycling or third-party pickup. In Minneapolis, a designated building will serve as the central collection hub, while another site outside the city will manage pallets from surrounding facilities. A third location will temporarily maintain a construction and demolition (C&D) dumpster. In the long term, C&D roll-offs will be phased out entirely as pallet disposal shifts to third-party pickup and a dedicated site for raw biomass collection. This approach will increase economic opportunities through resale, reduce contamination in waste streams, and divert usable wood from landfills. Both long-term and short-term recommendations would divert 63,640 pounds of waste from landfills and save \$48,660 per year.

Solutions

Recycle and Sell Tempered Glass

Tempered glass from damaged transit station glass panels accounts for approximately 52,000 pounds of Metro Transit's annual waste. Disposing glass as trash can damage on-site compactors, and with each panel averaging 40 to 50 pounds, they contribute significantly to landfill hauling costs. Using a local hauler for recycling tempered glass was determined to be the most cost-effective option. While hauling fees still apply, vendor disposal is free, and recycling could generate up to \$30 per ton if the material stream is kept at 95 percent cleanliness or higher. Consistent training and accountability for facility workers handling glass are necessary to achieve this goal. A retraining program was being developed at the time of project completion. If implemented, this recommendation would divert 20,000 to 52,000 pounds of tempered glass and save \$4,620 per year.

Implement Signage and Education

Processes for segregating and disposing of recyclable and non-recyclable materials were not standardized across Metro Transit's system. Non-recyclable bags that held recyclable materials ended up in recyclable dumpsters instead of being disposed of as trash. As a result, the improper disposal of non-recyclable materials, including over a thousand bags, in recycling dumpsters cost Metro Transit \$12,984 in 2024. Installing clearly labeled signage at each facility and holding annual training for waste handling staff will standardize waste handling across all custodial teams within the organization.



Recommendation	Annual Reduction	Annual Savings	Status
Resell and reuse pallets	63,640 lbs. waste	\$48,660	Planned
Recycle and sell tempered glass	20,000~52,000 lbs. waste	\$4,620	Planned
Implement signage and education	1,000+ bags waste	\$12,984	Implementing

MnTAP Advisor: Kevin Philpy, Senior Engineer



Michael Foods - Gaylord



Melanie Merkel
Environmental Studies
St. Olaf College

Organization Background

Michael Foods Inc., established in 1987, is a Minnesota-based company that specializes in producing eggs and potatoes. Michael Food's Gaylord facility produces liquid and cooked eggs for foodservice and food manufacturing.



"My experience working for Michael Foods and MnTAP has been incredible! I've enjoyed getting to know operators and making a difference in their work lives. I genuinely hope my recommendations benefit those at the wastewater treatment plant and at the processing plant. I have gained extremely valuable insights in the operations of a wastewater plant and in waste reduction within a food processing plant." ~ MM

Project Background

The wastewater treatment plant (WWTP) is projected to have an annual influent increase of 75,000 gallons per day due to the opening of a second facility. Therefore, the focus was on reducing egg, chemical, and water losses at the currently operating facility. Annually, the WWTP spends approximately \$67,000 per year on 25,000 gallons of ferric chloride to treat the high phosphorus load from liquid eggs that are discharged down the drain. The equalization (EQ) tank has a high pH from the alkaline cleaning solutions used at the processing plant. A high pH affects key processes in wastewater treatment, such as microorganism growth and chemical reactions.

"Melanie showed a great attitude and work ethic to find ways to reduce our water, chemical and product loss. She took ownership of projects and collaborated with our on-site operations and management teams to implement projects. She did an exceptional job of modeling her findings to meet our unique operational process and requirements. Her analysis revealed significant water and chemical use reductions."

*~ Darren Reid, WWTP Manager,
Collin Grams, WWTP Operator*

SOLUTIONS

This project identified more recommendations than could be covered in this executive summary. Please see the table for the full list of recommendations.

Install Troughs and Train Operators

In raw receiving, 1.2 million pounds of eggs are lost when the transfer line is disassembled and cleaned, and the plant uses 90 gallons of ferric chloride per day. To capture the egg loss, the facility should consider installing troughs and training operators to remove all the eggs from the transfer hose. Selling the excess egg to animal feed companies will potentially generate \$23,000 annually. These measures will save 98,000 pounds of liquid eggs processed within the facility and 504,000 pounds of eggs potentially sold as animal food along with annual decreases of 1,030 pounds in phosphorus load and 5,400 pounds in ferric chloric usage. In total, annual savings are projected to be \$93,400.

Follow the Recommended Flush Rate for Tanker Bay Pumps

The tanker bay pumps used to transfer egg and clean-in-place (CIP) tankers are receiving an average of 25

Solutions

gallons per hour, which exceeds the manufacturer's recommendation of 1 to 2 gallons per hour. One option is to reinstall the currently disabled solenoid and flow controls and set the flush rate at 1.5 gallons per hour. This will save 440,000 gallons of water and \$1,100 annually. Alternatively, the company could install an automated flow control that stops the water flush when the pumps are not in use. This will save 450,000 gallons of water and \$1,100 annually.

Reduce Number of Spray Nozzles in Breaking

Prior to cracking eggs from the chicken barns, they are cleaned and disinfected using nozzles that spray water and sodium hypochlorite. The problem is they spray parts of the conveyor belt that do not have eggs. By reducing the number of spray nozzles on the conveyor belt, the facility saves 330,000 gallons of water, 2,200 pounds of sodium hypochlorite, and \$8,600 per year.

Reduce COP Tanks' Chemical Use

Removable equipment, such as pipes and manhole doors, are cleaned in clean-out-of-place (COP) tanks using sodium hydroxide. At the tanks, no measuring tools are

provided for operators to add the correct quantity of sodium hydroxide. The facility should put infographics with correct water and sodium hydroxide quantities at each tank, provide pitchers with pre-marked fill lines, and add pre-marked fill lines to the COP tanks. The savings are 3,400 pounds of sodium hypochlorite and \$4,100 per year.



Recommendation	Annual Reduction	Annual Savings	Status
Install troughs and train operators	98,000 lbs. liquid eggs 504,000 lbs. of eggs used as animal food 1,030 lbs. phosphorus 5,400 lbs. ferric chloride	\$93,400	Implementing
Re-install solenoid and flow controls for pumps	440,000 gal water	\$1,100	Implementing
Install automated flow control for pumps	450,000 gal water	\$1,100	Planned
Reduce number of spray nozzles in breaking	330,000 gal water 2,200 lbs. sodium hypochlorite	\$8,600	Implementing
Reduce COP tanks' chemical use	3,400 lbs. sodium hydroxide	\$4,100	Implementing

MnTAP Advisor: Kevin Philpy, Senior Engineer



Minncor - MCF Faribault



Richard Bui
Aerospace Engineering
University of Minnesota Twin Cities

Organization Background

The Minnesota Department of Corrections (DOC) created Minncor Industries (Minncor) in 1994 to unify facility programs across all DOC locations into one business that could be less reliant on government funding. The DOC also created Minncor to provide incarcerated people job skill training, meaningful employment, and opportunities to practice proper work habits. They currently offer laundry services for 27 accounts, which range from other DOC facilities to veterans homes and schools. The facility can process 3.5 million pounds of laundry yearly.



"This summer I had an amazing opportunity to work with Minncor Industries through MnTAP. I employed my skills for sustainability work and optimizing resource usage in an industrial laundry facility, and I learned about steam systems. I will be forever grateful for my summer experience and want to thank MnTAP and DOC staff for a wonderful internship!" ~ RB

Project Background

This project focused on the steam condensate recovery system and laundry equipment. The laundry facility's steam condensate system is venting approximately 3.7 million pounds of low-pressure steam to the atmosphere, which can be recaptured as a source of water and heat. In addition, the facility is interested in upgrading the laundry equipment to increase processing time and efficiency.

The DOC and Minncor are seeking to reduce resource usage and waste by 10% and increase laundry processing by 10%.



SOLUTIONS

Replace Broken Heat Exchanger

Reintroducing a low-pressure, steam-to-water heat exchanger will reduce low-pressure steam venting. The recaptured heat can then preheat water for the facility's water heater while the collected condensate can be reheated to steam. Excessive pressurization of water tubes has caused the facility's old heat exchanger to fail. To recapture low-pressure steam, Minncor should replace the heat exchanger, add more safety valves, and update the controls for steam demand. Implementing these steps will save 444,000 gallons of water, 32,700 therms of natural gas, 1,100 kilowatt-hours (kWh), 7,000 pounds of chemicals, 4,700 pounds of softening salt, and \$32,000 per year.

Replace Two-Stage Press with One-Stage Press

The facility processes 43,399 loads per year. The current two-stage extraction press' maximum load weight limit is 90 pounds, while the weight limit of the batch washing line is 110 pounds. Minncor will switch to a new press in Fiscal Year 2026. The recommended one-stage press will still have a maximum weight limit of 110 pounds. Matching the batch wash weight with the press weight will allow a 22% increase in weight per load with potential to decrease yearly loads to 33,874. This will save the facility 322,000 gallons of water,

Solutions

12,000 therms of natural gas, 8,400 pounds of laundry chemicals, 6,500 pounds of softening salt, and \$11,800 per year.

Install Two Smaller Washers to Replace Broken Washer

Commercial washers are being underfilled at an average fill ratio of 58% of the rated capacity for all washers and 49% for the 275-pound washer-extractor. Washers are set at the highest water and chemical settings for ease of use and to minimize rewashing, but this leads to overuse of resources per wash. Since Minncor is planning to upgrade washers in Fiscal Year 2026, it is recommended to replace the 275-pound washer with two 130-pound washers to increase loading efficiency to 73%. This will save 540,000 gallons of water, 2,200 therms of natural gas, 30,000 kWh, 3,500 pounds of laundry chemicals, 11,000 pounds of softening salt, and \$11,900 per year.

Program and Run Automatic Drying Settings

All 120-pound commercial dryers dry at fixed times based on garment type. Since loads are usually underfilled, drying times are taking longer than needed. Commercial dryers' automatic settings use moisture sensors to detect when clothes are dry. After testing automatic dryer settings, the underweighted drying times are now proportional to the weight of each load, and thus, take less time to dry. If fully

implemented, this will save 8,500 therms of natural gas, 5,200 kWh, and \$4,500 per year.

Install Exhaust Sensors and Software for Automatic Drying

The 240-pound, batch washing line's natural gas dryers dry at fixed times based on garment type. Exhaust sensors, which measure the outgoing temperature of the exhaust to determine when loads are fully dry, are installed in dryers. Since the facility has not finished setting up all exhaust sensors, processing times are taking longer due to loads being overdried or still wet. With the new press raising the weight load from 180 to 220 pounds, installing exhaust sensors will facilitate reprogramming of drying times. This will save 3,400 therms of natural gas, 6,000 kWh, and \$2,900 per year.

"Our MnTAP intern did a fantastic job, giving us some great cost-saving insight."

*~ Scott Ewest, Power Plant Chief Engineer,
MCF - Faribault*

This table shows only the largest annual reduction per recommendation. For all annual reductions, refer to the text.

Recommendation	Annual Reduction	Annual Savings	Status
Replace broken heat exchanger	444,000 gal water	\$32,000	Recommended
Replace two-stage press with one-stage press	322,000 gal water	\$11,800	Recommended
Install two smaller washers to replace broken washers	540,000 gal water	\$11,900	Recommended
Program and run automatic drying settings	8,500 therms	\$4,500	Implemented
Install exhaust sensors and software for automatic drying	6,000 kWh	\$2,900	Recommended

MnTAP Advisor: Jon Vanyo, Senior Engineer



MN Direct Care & Treatment



Sining Liu

Sustainable Systems Management
University of Minnesota Twin Cities

Organization Background

Minnesota Direct Care and Treatment (DCT) is a state operated health care system that provides care to individuals with mental illness, substance use disorders, and developmental or intellectual disabilities. DCT operates across 150 sites statewide, serving both the Twin Cities Metro and Greater Minnesota. Each year, DCT serves approximately 12,000 patients and employs around 5,000 part-time and full-time staff.



“This internship gave me valuable waste audit experience and the chance to see different parts of the state, which really broadened my understanding of how waste management looks in different facilities. The experience strengthened my ability to balance sustainability goals with operational and safety needs.” ~ SL

Project Background

DCT generated approximately 2.1 million pounds of solid waste in 2024. To align with the state’s goal of diverting 75% of solid waste by 2030, waste audits were conducted at three major DCT sites: Anoka-Metro Regional Treatment Center (AMRTC), St. Peter Regional Treatment Center (SPRTC), and Minnesota Sex Offender Program (MSOP) Moose Lake. Audits focused on kitchens and patient units since they account for nearly 90% of the total waste generated. By sorting and weighing trash samples on site, the MnTAP team categorized materials and extrapolated facilities’ annual amounts to provide data-driven insight for recommendations.

“Sining and MnTAP helped DCT understand our waste footprint and offered guidance on how to meet the governor’s sustainability goals. Sining’s professionalism, focus, and knowledge of best practices were valuable, and she offered a fresh set of eyes on our current waste management processes.”

*~ Svetlana Jones, Facility Program Manager, DCT
and Patrick Cotter, Asset Coordinator*

SOLUTIONS

This project identified more recommendations than could be covered in this executive summary. Please see the table for the full list of recommendations.

Repurpose Surplus Assets with Flowcharts

Piling up surplus items is common, and an estimated 5% of DCT’s total square footage is used for storage. A visual flowchart was created to break the policy language into simple steps with the following embedded tools: a recipient list of eligible agencies and organizations, a filter for locations to easily identify nearby donation sites, and any request forms that need to be submitted for approval. The flowchart helps the user identify the most appropriate option, and up to \$2.7 million of lease equivalent square footage could be saved. The Agency’s goal is to reduce 30% of its square footage holding items in the next ten years.

Reduce Excess Food and Donate Unopened Excess Food

The audit showed a portion of waste came from back-of-house excess food. This project recommended adjusting portion sizes, asking patients for their food preferences, encouraging kitchen managers to conduct daily checks on

Solutions

food preparation and leftovers, and donating unopened items (like yogurt and milk). Implementing these could reduce 31,500 pounds of food waste and save up to \$23,800 per year.

Set Up Pig Feed Diversion Program

AMRTC's location in the Twin Cities Metro Area makes it eligible to divert patient food waste through a local pig feed program. Implementing this can reduce 73,700 pounds of food waste and save \$15,900 per year.

Set Up Organic Recycling

Establishing an organic recycling program was found to be feasible and cost-effective at one large site. Despite upfront costs from purchasing a food waste pulper and cooler storage, the program could reduce 119,000 pounds of food waste and save \$120,000 per year.

Avoid Contamination for Recyclables

At one facility, campus security prevents staff from opening bags to provide loose recyclables as required by the hauler. Consequently, recycling bins were frequently contaminated by trash. By negotiating a contract that can accept bagged recyclables, the facility could reduce fees and save up to \$56,200 per year



Recommendation	Annual Reduction	Annual Savings	Status
Repurpose surplus assets using flowchart guidance	TBD	Up to \$2.7M	Planned
Reduce excess food and donate unopened excess food	31,500 lbs. waste	\$23,800	Recommended
Set up pig feed diversion program	73,700 lbs. waste	\$15,900	Recommended
Set up organic recycling	119,000 lbs. waste	\$120,000	Recommended
Avoid contamination for recyclables	NA	\$56,200	Planned
Repurpose yard waste as mulch	3,900 lbs. waste	\$3,900	Planned
Adjust unit bag collection frequency	NA	TBD	Recommended

MnTAP Advisor: Jon Schroeder, Sustainable Materials Management Specialist



Samuel Edlund

Mechanical Engineering
University of Minnesota Twin Cities

Organization Background

OlymPak Printing and Packaging (OlymPak) is the packaging division of MinMor Industries. OlymPak produces 400 million items of paper packaging, such as kids' meal bags and paper boxes, per year. Located in Mora, Minnesota, OlymPak has 130 employees.



"This project was great; it allowed me to gain useful experience in system and financial analysis. I learned so much about interacting with distinct levels of organizations and translating the information on the floor into information that management can act on." ~ SE

Project Background

OlymPak's sources of waste include planned waste, such as from die cutting, and unplanned waste, including defective products that are discarded to maintain quality standards. This project also focused on finding ways to optimize material, electricity, and oil usage. Electricity provides energy for all operations at the facility, including compressors supplying compressed air to most machines and direct electrical power for equipment like conveyors and fans. Oil is also used to lubricate many larger machines, such as printers and die cutters.

"While at OlymPak, Sam was able to identify many efficiency improvements and waste reduction opportunities. He helped our leaders understand the impact of each opportunity by quantifying the ROI of each improvement and how that could impact the bottom line. He did a fantastic job and left our team with the knowledge to continue looking for other areas for us to improve on."

*~ Matt Miner,
Vice President at OlymPak*

SOLUTIONS

This project identified more recommendations than could be covered in this executive summary. Please see the table for the full list of recommendations

Reuse Wasted Sheets on Printer Startup

When printers are idle, the ink settles. After restarting, it takes 500 printed sheets for color accuracy to return. This issue can be resolved using an existing method from the printer preparation process. Operators should move already printed sheets from the bottom of the printed skids and place them on top of the next skid to reduce unnecessary paper waste. Implementing this will save 23,000 pounds of paper and \$14,000 per year.

Filter Oil in Machines with Large Oil Reservoirs

Oil functions as a lubricant or hydraulic fluid for many large machines in the plant. A significant quantity of oil is used annually during oil changes. Purchasing an oil filtration system that is compatible with all oils being used could greatly diminish OlymPak's oil usage. Filtering most of this oil will save 220 gallons of oil and \$3,600 each year.

Solutions

Divert Unused/Unsold Items

Over the years, OlymPak has acquired many different items that are no longer in use. Among these include robotic arms, conveyers, small die cutters, and a large amount of unsold merchandise. OlymPak could sell these items to free up floor space and recoup some value through various channels, such as selling machinery through the Minnesota Materials Exchange which is operated by MnTAP. Sales of an estimated 25,000 pounds of unused equipment could generate up to \$335,000 in additional revenue.



Recommendation	Annual Reduction	Annual Savings	Status
Reuse wasted sheets on printer startup	23,000 lbs. paper	\$14,000	Recommended
Optimize roll widths to reduce sheeting and die cut waste	12,000 lbs. paper	\$48,000	Recommended
Improve waste sorting at the waste sources	19,000 lbs. paper	\$1,300	Recommended
Standardize operating procedures on the Gietz	2,000 lbs. paper	\$2,500	Recommended
Add waste guide to vaccuums on machines	580 lbs. paper	\$810	Recommended
Filter oil in machines with large oil reservoirs	220 gal. oil	\$3,600	Planned
Recirculate oil in the press machine	18 gal. oil	\$370	Recommended
Fix compressed air leaks	230,000 kWh	\$17,000	Recommended
Implement maintenance schedules for all machines	1,500 hours	\$220,000	Recommended
Add motion detectors to warehouse and restrooms	11,000 kWh	\$810	Recommended
Divert unused/unsold items	25,000 lbs. of equipment	\$355,000	Planned

MnTAP Advisor: Jon Schroeder, Sustainable Materials Management Specialist



Rust-Oleum



Ruby Browning

Chemical Engineering
Rose-Hulman Institute of Technology

Organization Background

Rust-Oleum is a consumer brand under the parent company RPM International. Rust-Oleum manufactures high-performance surface coatings, paints, cleaners, primers, and wood care products sold at large retailers, such as Fleet Farm and The Home Depot. Its Brooklyn Park facility opened in 2018 and produces an average of 775,000 gallons of product per year. The 110,000-square-foot facility employs 102 people in total.



"My time at Rust-Oleum introduced me to working in manufacturing and deepened my understanding of sustainability in large-scale industry. I gained understanding of the complexities of equipment testing and waste treatment while acquiring transferable skills for my transition to the workforce. I am thankful for the help and support provided by the MnTAP and Rust-Oleum staff." ~ RB

Project Background

In February 2025, employment and production increased significantly at the Brooklyn Park facility. This added to existing waste streams and introduced new ones, such as wash water containing metals from metallic and patina products. The goals of this project were to prevent steel pigment drums from being landfilled, conserve water in the tank washing process, and identify an effective procedure to treat the wash water.

"MnTAP did an excellent job of matching our needs to the intern. Ruby asked exceptionally good questions and was tenacious at pursuing answers. Those questions led to discovering the "invisible obvious" on how we could make simple changes to improve our processes. Going to miss having her around! Great experience for us, leading to some very actionable results."

~ Chuck Jensen, EHS Manager, Rust-Oleum

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Change Tint Packaging

The tints used in Rust-Oleum's products are purchased in 55-gallon steel drums, which cannot be easily emptied and are thus not accepted by drum reconditioners. Since they are non-hazardous but difficult to clean or repurpose, approximately 15 tons of these steel drums would be sent to the landfill, costing \$13,200 per year. A molded polyethylene drum liner could be added to the tint drums by the supplier so that only the liner and tint residue will be landfilled, and the drum can be reused or recycled. This will reduce landfill waste by 14 tons and save \$7,700 per year, supporting RPM International's goal of reducing landfill waste by 10%.

Reuse Empty Drums as Waste Containers

Each year (on average) 393 steel drums are used to package waste for disposal. It is recommended that the empty tint drums be reused to package this waste. Prior attempts were made, but the presence of tint residue and the need to sort and match drums with compatible waste streams added labor and complexity to the reuse process.

Solutions

Using drum liners would greatly simplify the reuse process by eliminating any concerns about waste compatibility. Reusing tint drums for waste packaging would eliminate the need for 7.7 tons of new drums and save the purchase cost of \$22,100.

Send Metallic Water to Waste Handler

Production of multiple metallic and patina products was recently transferred to the facility, and any water used to wash these products' mixing tanks will contain residual metals. Initially, this wash water was slated to be sent to a treatment facility. An investigation revealed that the waste handler that Rust-Oleum already uses can accept the metallic residue in the water as is and eliminates the need to send it to a specialized facility. The metallic wash water should be combined with the existing water-based waste stream and sent to the waste facility during the routine scheduled waste pickups. This would save \$4,850, prevent 1,700 pounds of carbon dioxide (CO₂) from being released, and eliminate the labor and time costs associated with segregating the wash water.

Optimize Tank Washers

The water-based automatic tank washer has operated at its default setting since installation, using 100% recirculated water for the wash cycle and fresh water for the 120-second rinse. Tests were run at differing rinse

cycle times and revealed that the rinse cycle can be reduced to 35 seconds with no impact on performance. This will lead to a 71% reduction in water use and save 3,610 gallons of water and \$19,800 annually. After the same tests were carried out on the dibasic-ester-based washer, it was determined that a 15-second rinse time is just effective as the original 20-second rinse. Switching to the 15-second rinse time will save 12,400 pounds of dibasic ester (DBE) and \$15,100 annually.



Recommendation	Annual Reduction	Annual Savings	Status
Change tint packaging	14 tons landfill waste	\$7,700	Recommended
Reuse empty drums as waste containers	393 new drums (7.7 tons drum)	\$22,100	Recommended
Send metallic water to waste handler	1,700 lbs. CO ₂ e	\$4,850	Implemented
Optimize tank washers	3,610 gal water 12,400 lbs. DBE	\$34,900	Implemented

MnTAP Advisor: Jane Paulson, Senior Engineer



Silgan Containers



Evin Corrigan
Chemical Engineering
University of Minnesota Duluth

Organization Background

Silgan Containers is a subsidiary of Silgan Holdings Inc. and one of the largest suppliers of steel and aluminum food and non-food cans in North America. The company operates more than 20 manufacturing plants across the United States, serving major brands and food producers. The facility at Savage, Minnesota manufactures coated metal sheets for sister facilities and cans for products, such as Spam and canned vegetables.



“Being part of meaningful environmental impacts through MnTAP has been an incredibly rewarding experience, and I am truly grateful to the team at Silgan Containers for working with me. I am proud to see a company dedicated to making a positive environmental impact.” ~ EC

Project Background

The Savage facility sought MnTAP’s assistance on how to reduce waste, improve efficiency, and lower hazardous solvent use. The project’s key focus areas included reducing scrap rates and solvent use during cleaning operations. Scrap disposal generates high disposal costs, and the facilities’ solvent use classifies it as a Large Quantity Generator (LQG) of hazardous waste.

“At Silgan Containers, we’re incredibly grateful for the dedication and insight Evin brought to investigating waste throughout the summer. His work has made a meaningful impact and helped us move closer to a more efficient and sustainable operation. We highly recommend MnTAP to any company looking to improve efficiency and reduce waste.”

*~ George Hayducsko, former Plant Manager,
Silgan Containers Manufacturing Facility at Savage*

SOLUTIONS

Switch to Disposable Blades to Stop E-30 Wash

While switching to disposable blades may seem less sustainable, the reusable blade system generates nearly 12,120 gallons of hazardous waste annually. An investigation in the coating room identified the scraper blade systems used to clean the chiller roller as a major source of scrap and solvent use. The facility is now planning to convert the reusable blade system to a disposable system. This change would lead to reductions of 80% in E-30 solvent use, 69% in hazardous waste, and 20% in scrap on Line 2 of the coating operation. It would save 45 tons of E-30, 64.6 tons of sheets, and \$325,000 in hazardous waste and scrap.

Install Permanent Chemical Wash Basin

In the coating room, full deep cleanings sometimes occur when switching between enamel types, and this accounts for about 2,880 gallons of solvent annually. Of this amount, 960 gallons of solvent (used when trays are cleaned in a movable wash basin) must be drained. A permanent wash basin would limit draining, save E-30 solvent, and help the facility lower its generator status away from LQG. Since other options exist to reduce 960 gallons (or \$15,500 annually) without requiring permanent equipment changes, this remains a recommendation.

Solutions

Fix Compressed Air Leaks

Compressed air is used across multiple production lines for cans and can ends. Leaks significantly increase compressor load and energy consumption. The Fluke ii910 Acoustic Imager located several leaks, ranging from small fitting leaks to larger line losses, at the Savage facility. Repairing these leaks would reduce unnecessary compressor energy demand, lower electricity costs, and improve overall system efficiency. This recommendation would save 150,000 kWh and \$10,000 annually.

Repair Oven

The curing oven's second story has cracked glass panels that can cause heat loss and results in greater gas consumption to maintain curing temperatures. Beyond higher energy use, inconsistent oven temperatures can affect enamel quality and contribute to higher scrap rates if sheets are improperly cured. Replacing the cracked glass panels with insulated steel plates will lower wasted energy and natural gas consumption through better insulation and more stable oven performance. It will also reduce operating costs and support the Safe Quality Food (SQF) certification standards by maintaining reliable equipment and consistent product quality. This change would save 685 therms and \$500 per year.



Recommendation	Annual Reduction	Annual Savings	Status
Switch to disposable blades to stop E-30 wash	45 tons of E-30 64.6 tons of sheets	\$325,000	Planned
Install permanent chemical wash basing	960 gal E-30	\$15,500	Recommended
Fix compressed air leaks	150,000 kWh	\$10,000	Planned
Repair Oven	685 therms	\$500	Implemented

MnTAP Advisor: Ashwin Nambudiripad, Associate Engineer



SOLUTIONS

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.

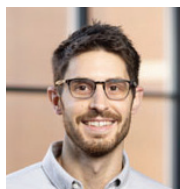
MnTAP provides technical assistance tailored to each business. By reducing waste and increasing efficiency, businesses in Minnesota can save on disposal and raw material costs, decrease regulatory compliance burdens,

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

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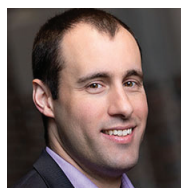
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