WORKING TOGETHER TO ACHIEVE ECONOMIC AND ENVIRONMENTAL RESULTS

2021 POLLUTION PREVENTION SERVICES

INTERN PROGRAM CASE SUMMARIES

pollution prevention services

pollution prevention services

www.iowap2services.com

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DIRECTOR'S NOTE

Improving operational practices and increasing efficiency are critical for upholding a competitive edge in today's economy. Technical assistance is available to Iowa companies through the Pollution Prevention Intern Program. The program pairs each participating company with an upper level engineering student, who applies their technical and analytical skills to compile data, research solutions and quantify impacts. Before concluding their project, each intern summarizes their recommendations in a comprehensive final report, providing the participating company with in-depth information for making informed environmental decisions.

The global pandemic has brought about many challenges as well as opportunities in the last couple of years, prompting companies to seriously consider their environmental impacts as well as their effects on employee health and safety. After evaluating efficiency measures, companies are identifying methods to reduce their use of water, energy, and hazardous materials. By applying P2 principles to processes and waste management procedures, companies are making better use of their resources and reducing solid waste generation, easing the burden on our landfills. All of these reduction goals help companies use their resources more efficiently while saving money.

Companies, governments and organizations have developed and instituted new protocols for the health and protection of staff and the public. Interns with the Pollution Prevention Intern Program assisted in developing and implementing new programs, policies and procedures which have made these facilities safer in light of the ongoing pandemic.

Since 2001, the Pollution Prevention Intern Program has partnered with Iowa businesses and organizations to conserve and protect our natural resources through environmental improvements, and improve the quality of life for all Iowans. Participating companies have cumulatively reported more than $111.8 million in savings after implementing their interns' recommendations. These successes are highlighted in the charts below. I wholeheartedly commend each of the participating companies, the top-level interns, and the Pollution Prevention Services team for their ongoing dedication to improving the quality of life in Iowa and ensuring a legacy for future generations.

-Kayla Lyon, Director
Iowa Department of Natural Resources

TOTAL IMPLEMENTED SAVINGS 2001–2021

POLLUTION/WASTE REDUCTION & COST SAVINGS FROM IMPLEMENTED INTERN PROJECTS

CATEGORY	REDUCTION	UNITS	COST SAVINGS
WATER CONSERVATION	5,774,805,611	gallons	$15,916,745
SPECIAL WASTE	76,025	tons	$1,383,340
SOLID WASTE	182,695	tons	$17,353,034
CHEMICAL USE AND HAZARDOUS WASTE REDUCTION	10,016	tons	$18,352,995
ENERGY	504,222,258 3,953,795 22,228,840	kWh *MMBtu therms	$28,664,794 $16,025,731
MERCURY ABATED	42,817	grams	
OTHER			$14,112,357
			TOTAL: $111,808,996

*MMBtus are calculated from kWh and therms for special reporting only. All dollars and actual energy saved are reported under therms and kWh.

2001–2021 GREENHOUSE GASES & CONVENTIONAL AIR POLLUTANTS FROM IMPLEMENTED PROJECTS

CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS							GREENHOUSE GASES DIVERTED IN METRIC TONS				
NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO	VOC	CO_2	CH_4	N_20	CFC	$MTCO_2e$
11.07	657.43	109.45	72.49	1,193.22	376.02	126.61	303,486.86	73,665.65	3,912.06	2,079.51	392,032.46

> Air emissions and greenhouse gases shown are Life Cycle estimates and include external activities such as purchasing utilities. Totals do not solely represent emissions generated at the plant sites.

2021 EXECUTIVE SUMMARY

The Department of Natural Resources teamed with seven upper-level engineering students in the 2021 Pollution Prevention (P2) Intern Program to assist participating companies in meeting their environmental objectives.

In this program, interns experience a unique partnership between academia, business, and government, all working together to achieve economic and environmental results. The work of the interns and their P2 advisers creates tangible benefits for participating companies. This year's projects addressed water and energy usage, resource recovery and reuse opportunities, hazardous material usage, process efficiency and quality assurance. After conducting an analysis and establishing a baseline, the interns developed recommendations for improvements, which have the potential to annually save the participating companies more than $1.5 million. From these recommendations, the interns initiated projects that are estimated to save more than $325,000 in their first year of implementation.

In 2019, a 24-week project at Cobham explored source reduction opportunities for chemical and solid waste streams and provided implementation support for approved solutions. Since the P2 Intern Program was suspended in 2020, the final results of this project are included in this publication. Interns committing to 24-week projects are able to conduct more in-depth research, and evaluate systems through varying climates and conditions. These extended internships also allow more opportunity for interns to evaluate the impacts of process changes and make adjustments as needed.

The intern program is an extension of DNR's Pollution Prevention Services, a non-regulatory program that offers confidential technical assistance to Iowa businesses. The interns bring a fresh perspective and innovative solutions while gaining valuable experience. These 2021 case summaries show that outstanding results are possible when companies, students and the DNR work together to achieve environmental goals.

2021 ENVIRONMENTAL SAVINGS

ACTUAL POLLUTION/WASTE REDUCTION & COST SAVINGS FROM INTERN PROJECTS

CATEGORY	REDUCTION	UNITS	COST SAVINGS
WATER CONSERVATION	47,191,203	gallons	$154,831
SOLID WASTE	585.78	tons	$9,130
HAZARDOUS WASTE	11.50	tons	$441
ENERGY	2,339,334 7,984	kWh **MMBtu	$150,474
OTHER			$13,500
TOTAL			$328,376

*MMBtus are calculated from kWh and therms for special reporting only. All dollars and actual energy saved are reported under therms and kWh.

TOTAL REPORTED FROM 2021 PROJECTS THROUGH AUGUST

CONVENTIONAL AIR POLLUTANTS DIVERTED IN METRIC TONS

NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO
0.062	3.145	0.544	0.352	6.059	0.563	1.163

GREENHOUSE GASES DIVERTED IN METRIC TONS

CO_2	CH_4	N_20	CFC	$MTCO_2e$
1506.346	146.557	24.122	10.077	1754.413

NOTE:

> Air emissions and greenhouse gases shown are Life Cycle estimates and include external activities such as purchasing utilities. Totals do not solely represent emissions generated at the plant sites.

> Greenhouse gas estimates for solid waste reduction projects are derived from U.S. EPA, Waste Reduction Model (WARM), Version 15, available at: http://www.epa.gov/warm

> Life cycle air emissions and greenhouse gas estimates for all sectors except solid waste are calculated using Carnegie Mellon University Green Design Institute, Economic Input-Output Life Cycle Assessment (EIO-LCA), US 2002 Industry Benchmark model [Internet], available from: http://www.eiolca.net

WHAT IS POLLUTION PREVENTION (P2)?

Pollution Prevention (P2) was created by Congress in 1990. The P2 Act focused public attention on reducing the amount of pollution in our air, water, and soil. Government implemented policies to effect change. Business, industry, and individuals started making cost-effective changes in production, operations, raw materials use, and waste management to reduce the pollution being generated and become better stewards of their environment.

P2 is the **reduction** or **elimination** of wastes at the **source** (source reduction) or a beginning of a process, instead of at the end-of-the-pipe or stack. So when employing P2 you are looking at the entire process to identify how and where the waste is generated and find ways to more efficiently use your resources. When applying P2 methods, you are also looking at ways to reduce or eliminate hazardous materials.

Seven P2 strategies that categorize most improvements include:

- Input substitution
- Equipment modifications
- Process modifications
- Product reformulation
- Raw material use & handling
- Material tracking & inventory control
- Improved housekeeping & maintenance

When using one or more of these P2 strategies to implement an environmental project you can almost always save your facility money. The project summaries in this document provide an example of how companies can implement environmental projects and at the same time save money.

POLLUTION PREVENTION: COMPANY APPLICATION PROCESS

FOR COMPANIES WISHING TO MAKE A PROJECT REQUEST

Pollution Prevention Services is currently accepting requests for 2022 intern projects. Companies must submit a project request that identifies a focus project and outlines the desired objectives and impacts. Company project requests must be submitted by December 1, 2021 to be considered for a 2022 intern placement.

Project requests will be reviewed upon receipt and companies contacted within two weeks for review, clarification and further development, if needed. Final determination of acceptance will be made within 30 days after project review and clarification of details is completed. Intern assignments for finalized projects will begin in January of 2022.

» SUBMIT PROJECT REQUESTS TO: P2Services@dnr.iowa.gov

Project request forms are available at **www.iowap2interns.com**

Please note: Students are not trained in or qualified to assess regulatory compliance issues.

Pollution Prevention Services

For three decades we have provided confidential, non-regulatory assistance to business and industry. We serve Iowa business and industry through the following:

OPPORTUNITY & FOCUSED ASSESSMENTS
A brief site visit to identify opportunities or an in-depth analysis of a single media or process within a facility providing specific recommendations with data to make cost effective decisions.

TECHNICAL ASSISTANCE SUPPORT
Support is available to answer specific questions whether in person, on the phone or in email.

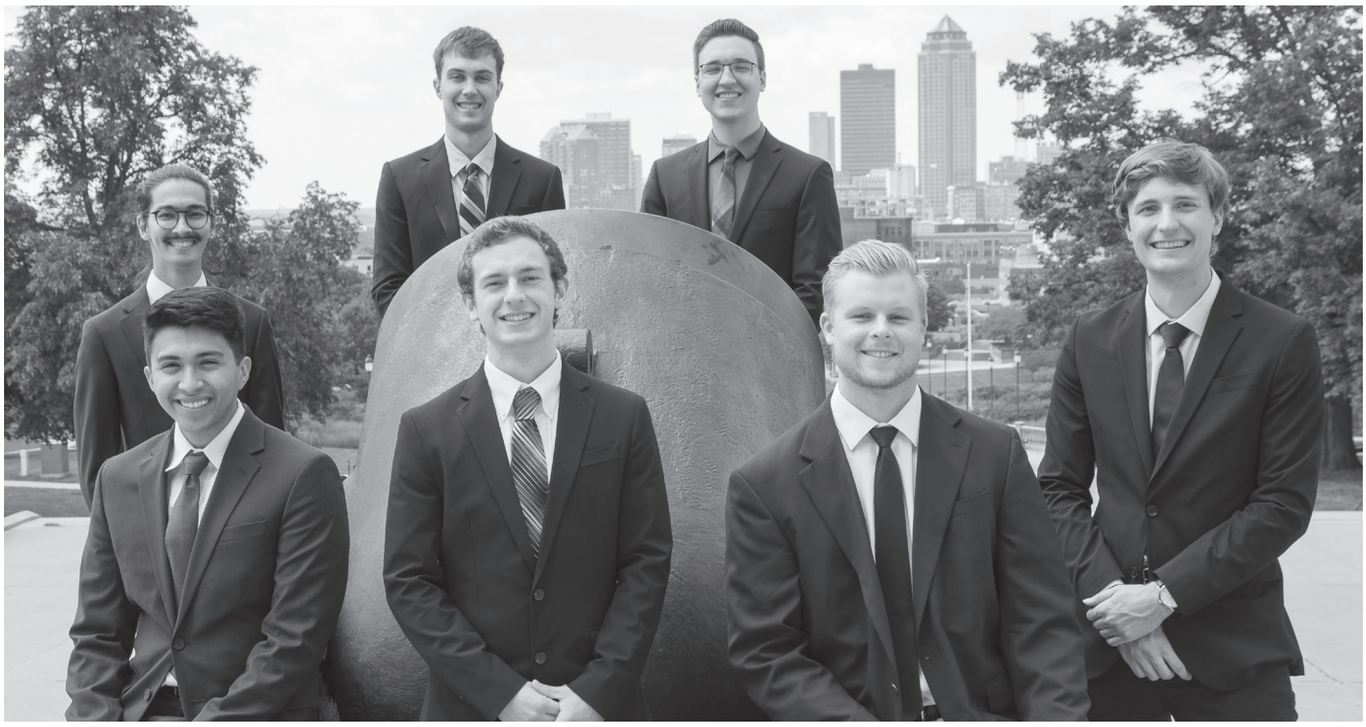
P2 RESOURCE LIBRARY & P2 INFOHOUSE
Our electronic reference library and searchable database of P2 best practices and new technologies is available for continued resource conservation and impact reduction.

ENVIRONMENTAL MANAGEMENT SYSTEMS ASSISTANCE (EMS)
An EMS is an organized formal approach to managing environmental issues. We can assist in implementing your EMS.

WORKSHOPS
Workshop, webinars and training events offer companies an opportunity to exchange ideas, transfer best management practices and new technologies, and discover innovative source reduction ideas and strategies.

POLLUTION PREVENTION INTERN PROGRAM
Companies submit project requests to obtain an upper-level undergraduate or graduate student to identify, evaluate and implement P2 projects in their facilities.

Iowa businesses working with P2S to implement projects have saved, collectively, more than $111.8 million dollars and become better stewards of their environment. Companies have taken major steps to reduce energy usage, water consumption, waste generation, CO2 emissions, and operating expenses.



2021 POLLUTION PREVENTION INTERNS

IS A P2 INTERNSHIP THE OPPORTUNITY FOR YOU?

As an intern in the nationally recognized Pollution Prevention Intern Program, you will work on-site at a company or institution dedicated to protecting the environment and saving money through projects aimed at reducing or eliminating waste and inefficiencies.

GARRET TAYLOR
JBS SWIFT PORK

"This has easily been the most in-depth project I have ever worked on in terms of technical, practical, and hands-on application. Through this, I have been able to extensively learn about industry fields such as water quality, industrial engineering, wastewater, and food-processing I simply could not learn in the classroom."

CONNOR NYGAARD
JBS USA

"The pollution prevention internship allows you to gain a broad understanding of the industry you are placed in and it gives you a lot of experience in leading your own project."

JOE KRANZ
CNH INDUSTRIAL AMERICA, LLC

"This program is not like any other. You gain real hands on experience and get to tackle problems that most couldn't imagine. Although help is always available, the outcome is purely in your hands."

AMANGELDY UNGAROV
WOODHARBOR CUSTOM CABINETRY

"The amount of experience and confidence that I gained from this internship is incredible. There's a lot more autonomy and responsibility compared to other internships. It's very rewarding."

JOEY ROMO
NSK CORPORATION

"This internship submerses you in a professional engineering environment, where you are free to express your creative ideas, and control the direction of your project."

NICK STREIT
TYSON FOODS INC. HILLSHIRE BRANDS

"I found this internship incredibly rewarding when talking with the managers and team members and realizing that I could implement my research ideas and have a positive impact on the environment."

KEVIN DIAL
TPI COMPOSITES INC.

"You are given ownership of a meaningful project from its start. The hands-on introduction to project management and opportunity to work in a professional engineering environment provide a meaningful experience in a consultant's role."

POLLUTION PREVENTION: INTERN APPLICATION PROCESS

STUDENTS! JOIN THE P2 INTERN PROGRAM IN 2022!

Graduate and junior or senior-level undergraduate engineering students should submit the following documents for consideration:

- ☐ Application Form
- ☐ Résumé
- ☐ Cover Letter
- ☐ Unofficial copy of transcripts
- ☐ List of Fall 2021 and Spring 2022 classes

Selection of 2022 interns will begin in November and continue into the spring until project assignments are finalized. Students with the Pollution Prevention Intern Program will commit to a twelve week internship from May 23, 2022 through August 12, 2022. Selected applicants will be matched to a project based on academic performance, relative experience and technical skills.

Application forms are available online at:
www.iowap2interns.com.

» SUBMIT APPLICATIONS TO: Danielle Roseland

The Iowa Department of Natural Resources is an EEO/AA Employer.

Danielle Roseland | Pollution Prevention Intern Program Coordinator

Danielle.Roseland@dnr.iowa.gov

(515) 217-0010

FAQ: Frequently Asked Questions

WHAT IS POLLUTION PREVENTION?
Pollution Prevention is the act of changing client processes to reduce or eliminate waste and pollutants at the source, minimizing the need for treatment or disposal.

WHO IS ELIGIBLE FOR AN INTERNSHIP?
Upper-level undergraduate students and graduate program candidates are eligible. Selected applicants will be matched to a project based on academic performance, relevant experience, and technical skills. Up to 15 internships will be funded in 2022.

HOW DO PROJECTS WORK?
Interns report to a company supervisor who provides on-site resources and garners management support. They also report to a P2 program advisor who provides technical support. The intern will assess a process, research options, evaluate feasibility, and develop cost comparisons for their assigned project. Interns will also initiate implementation of their recommendations at their host company. Deliverables include a final report documenting results, a case summary of the project, and a presentation to host company management.

WHAT SUPPORT WILL I HAVE?
Internships will begin on May 23rd with a week of training. Interns will learn how to complete an assessment and identify inefficiencies, how to apply P2 methodologies to improve performance and reduce waste, and how to quantify economic and environmental savings. Interns serve as project managers at their host companies and receive technical support from Iowa Department of Natural Resources' Pollution Prevention Services engineers.

BACKGROUND
Pollution Prevention Services is a team of DNR experts offering non-regulatory environmental technical assistance to business and industry, institutions, and government agencies. The internship program matches host companies with students, refines project goals, helps to generate ideas, and keeps projects focused on pollution prevention.

Joe Kranz

Major: Mechanical Engineering
School: Western Illinois University

CNH INDUSTRIAL AMERICA, LLC

BURLINGTON

COMPANY PROFILE

In 1999, Fiat Group acquired Case Corporation and merged the company with New Holland NV, creating CNH Industrial America. Since then, CNH has become a global leader in both construction and agricultural equipment with more than 64,000 employees, 66 manufacturing plants, and 57 research and development centers worldwide. One of the 11 plants in North America is in Burlington, Iowa. The Burlington plant employs more than 400 people and manufactures dozers, tractor loader backhoes, tractor loaders, rough terrain forklifts, and three types of combine headers – corn, draper, and auger.

PROJECT BACKGROUND

The intern focused on two systems throughout the summer. The primary project was to find a heat recovery solution for the powder coat cure oven. Within this project, other ovens throughout the facility were to be prioritized for implementation and expansion. The secondary project was to evaluate different improvements for the shutdown program with the goal of reducing energy consumption. Like the heat recovery project, prioritization of other high energy consuming equipment would be completed to optimize the impact of improvement efforts.

INCENTIVES TO CHANGE

CNH Industrial uses a program called World Class Manufacturing (WCM) which provides guidance for continuous improvements of operations. The goal of WCM is to eliminate all waste within the company, whether it be material, time, or, in this case, energy. Additionally, the Burlington plant is certified to International Organization for Standardization (ISO) 50001, which provides a framework for energy improvements.

This project demonstrates how environmental improvements can reduce utility costs and associated emissions.

RESULTS

Heat Recovery- Powder Coat Cure Oven: For the powder coat paint system, a large amount of exhausted heat and energy is released into the atmosphere. The main source of exhausted energy in this paint system is the cure oven. The cure oven uses a variable speed exhaust fan, which causes the air flow and temperature leaving the stack to vary. With temperatures ranging up to 360 degrees Fahrenheit, heat from this stack was prioritized for recovery and reuse elsewhere in the plant.

It was determined that a heat exchanger, installed on the cure oven exhaust system, could capture the heat before it entered the atmosphere and then transfer the energy to the nearby hot

water boiler return system. Using the forces of gravity or a small transfer pump, the return water could be pumped through a coil system in the heat exchanger. The high temperature exhaust gases would move in a crossflow pattern with the exchanger coils allowing the water to absorb the maximum amount of heat. This heat recovery system could be used year-round, reducing costs, natural gas usage, and CO_2 emissions associated with heating water.

Heat Recovery Expansion: Other oven systems throughout the facility provide opportunities for expansion of the heat recovery initiative. The electrocoat (ecoat) bake oven is the largest oven in the plant. A heat recovery system as described above could be replicated on the ecoat oven and integrated with the wastewater boiler. Adding a heat recovery system to the ecoat oven could reduce energy usage and associated emissions.

Shutdown Program- 2nd Shift Ecoat Ovens: The ovens on the ecoat paint line are large contributors to energy usage during first and second shift. Currently, the ovens are left on overnight although there is a period of five hours where production is halted. Being that the two largest consumers of energy in this paint line are the bake oven and the Haden oven, useless energy is being consumed. Turning the ovens off overnight after second shift could result in significant energy savings.

Shutdown Program- Drum Fans: Many fans are left on overnight throughout the plant including ceiling fans, personal fans, and drum fans. Within construction equipment (CE) assembly, 30 large drum fans are constantly left on. One reason for this is that the on/off switches are hard to reach. A short-term solution would be to centralize the on/off switches for a group of 10 drum fans throughout CE assembly. This would make it easier for employees to turn the fans on and off, saving energy. Ideally, occupancy sensors would be installed to provide the most reliable, long-term solution, reducing the need for manual operation.

Shutdown Program- Double Ender: Another piece of equipment left on overnight is a double ended lathe used for dozer fabrication. The total horsepower (hp) for this machine is 62hp. While the two 30hp motors get turned off, often a 2hp oil pump motor is left on, leading to unnecessary energy consumption. To ensure this motor gets turned off, a recommendation for a standard operating procedure is being made. This will ensure employees are familiar with how to turn the device off. Behavior practices can be modified using training and awareness to save electricity.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
HEAT RECOVERY- POWDER COAT CURE OVEN	$1,998	6,891 therms 80,599 Lbs. of CO_2	RECOMMENDED
HEAT RECOVERY EXPANSION	$12,757	43,989 therms 514,730 lbs. of CO_2	RECOMMENDED
SHUTDOWN PROGRAM - 2ND SHIFT ECOAT OVENS	$27,739	95,653 therms	RECOMMENDED
SHUTDOWN PROGRAM - DRUM FANS	$4,562	48,020 kWh	RECOMMENDED
SHUTDOWN PROGRAM - DOUBLE ENDER	$722	7,600 kWh	RECOMMENDED

Garret Taylor

Major: Mechanical Engineering
School: Iowa State University

JBS SWIFT PORK

OTTUMWA

COMPANY PROFILE

JBS USA is a leading global food company, headquartered in Greeley, Colorado. JBS USA, the nation's second-largest producer of fresh pork, delivers high-quality food products to customers in 26 countries on five continents. The company operates five pork production facilities, including JBS Swift Pork in Ottumwa, Iowa. The Ottumwa plant employs more than 2,200 team members and is a major contributor to the international pork market with production numbers averaging 20,000 hogs per day.

PROJECT BACKGROUND

JBS Swift Pork utilizes water for a number of different cooling applications and systems throughout their production processes. The aim of this project was to conduct a full water usage analysis for plant cooling systems, identify water savings and reuse opportunities and to recommend feasible solutions. A goal of reducing water consumption by 11 gallons per unit harvested was established. Seven projects, with varying capital input and water savings, were recommended.

INCENTIVES TO CHANGE

Since 2015, JBS has reduced its water usage by more than 25 gallons per unit. In 2018 and again in 2020, JBS Swift Pork received the EPA Region 7 Pollution Prevention Award, in recognition of their efforts to reduce, eliminate, and prevent pollution at the source. By continuing to implement water-saving solutions, it is expected that JBS will not only reduce their operating costs but continue to lead the food processing industry with environmental excellence.

RESULTS

Reuse Spray Chiller Water: Chilled water is sprayed onto the hogs within the carcass bays to preserve product quality. The drained chilled water has the potential to be used as second-pass water within the plant's hot vapor air scrubbers. Elevated temperatures within scrubber systems can pose significant scaling risk and reduced system efficiency. Filtration and reuse of the chilled water within the rendering air scrubbers will help maintain lower internal temperatures, improve odor control, and generate water savings. Quotes for implementation and filtration have been forwarded to management for final approval.

Spray Chiller Nozzle Redesign: The spray chiller within the carcass bays uses a series of nozzle rows to maximize chilled water coverage on the product. The current deflection nozzles lining the outer rows of the bays produce nearly twice the flow with half the spray angle required. Installing a more efficient nozzle tip on the edge rows poses significant water savings. An associated energy savings may also be realized by decreasing the need to chill water, especially during warm months.

Common Sump on North Condensing Towers: JBS Ottumwa utilizes two evaporative condenser systems for the refrigeration and cooling systems within the plant. The western towers utilize a common sump that maintains the towers as a single system, whereas the northern towers operate on an individual basis. Due to condensers being controlled as individual units, the northern towers can be susceptible to water conductivity inconsistencies. The addition of a common sump system on the northern towers would allow the automated makeup system to regulate the towers as a singular system leading to increased cycles of concentration. A common sump tank will also be capable of holding the combined volume of the condensers during routine drainage, thus preventing excess water and treatment usage. Vendor quotes for implementing a common sump are being formed by the plant's utilities management team for review and approval.

Lock Bypass Systems: Two bypass valves are consistently left open over the intended automated systems in the live barns and dehair areas during regular operation. Bypassing these

systems creates a significant amount of water loss. Installing maintenance locks on these bypass valves would prevent associated water loss and create a simple accountability system.

Leak Repair within Carcass Bays: A number of leaks were discovered within the carcass bay spray chiller system, causing chilled water loss. The leaks are caused by a rotating coupler as the automated valves continually open and close. Repairing the leaks and purchasing an overstock of replacement parts will allow utilities staff to facilitate future repairs in a timely manner.

Reuse Treated Water: JBS has a long-term vision to reuse treated production water in their facilities. A full water quality analysis was performed in order to identify reuse opportunities and filtration needs to allow application within the plant's live barn misters and evaporative condensers. Installing an industrial sand filter as well as a reverse osmosis system could yield heavily-purified, non-potable water capable of exceeding treatment standards in the recommended systems. Future non-potable reuse opportunities will continue to be identified within the plant by JBS management. Once final flow rates and water quality requirements are established, equipment and filtration specifications can be further reviewed and finalized.

Overflow on Scald Zone 3: The scald tubs use a mixture of 140˚F water generated by the plant, fresh city water, and steam to maintain a consistent water temperature. Water inlets are manually utilized throughout operation when scald water levels decrease or temperature adjustments need to be made. Within the scald tubs, Zone 3 is most susceptible to overflow during normal operations due to its operation at the highest water level. Installing an overflow on Zone 3 that flows directly to the dehair tanks will allow the overflowing scald water to be reused for multiple passes within the dehair recycle system while also preventing water loss.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
REUSE SPRAY CHILLER WATER	$54,089	6,952,400 gallons	RECOMMENDED
SPRAY CHILLER NOZZLE REDESIGN	$58,720	4,447,677 gallons 271,150 kWh	IN PROGRESS
COMMON SUMP ON NORTH CONDENSING TOWERS	$63,805	7,781,617 gallons 1,167 lbs. treatment	RECOMMENDED
LOCK BYPASS SYSTEMS	$118,070	42,471,383 gallons	IMPLEMENTED
LEAK REPAIR WITHIN CARCASS BAYS	$3,592	272,143 gallons 16,591 kWh	IN PROGRESS
REUSE TREATED WATER	$278,894	35,847,635 gallons	RECOMMENDED
OVERFLOW ON SCALD ZONE 3	$2,910	373,629 gallons	RECOMMENDED

JBS USA, LLC

MARSHALLTOWN

COMPANY PROFILE

JBS USA, LLC is an American food processing company and a subsidiary of JBS S. A., one the world's leading producers of fresh beef, pork, and lamb products and byproducts. Headquartered in Greeley, Colorado, JBS USA has 40 processing facilities across the country. In 2020, the company exceeded $50 billion in sales and employed more than 230,000 people. In its Marshalltown, Iowa, pork facility, JBS processes 20,000 to 21,000 head per day with more than 2,000 employees.

Connor Nygaard

Major: Mechanical Engineering
School: Iowa State University

PROJECT BACKGROUND

The goal of this internship was to accurately map utility usage (electric, natural gas, and water) in the Rendering Department. JBS' Rendering Department produces lard, choice white grease, blood meal, and bone meal. Utility usage in this area is highly impacted by the upstream production processes. JBS sought to have the intern develop a dynamic, interactive calculator model using the baseline data that could allow for staff to input theoretical adjustments to run times, equipment, and other variables to see the resulting impacts on Rendering utility usage. Based on results of the baseline analysis, the intern worked to identify opportunities for utility savings and develop recommendations to improve conservation and efficiency.

INCENTIVES TO CHANGE

JBS' Marshalltown plant goal is to reduce the overall utility usage in the Rendering Department by 10 percent. Establishing the baseline is a critical first step to prioritizing opportunities and quantifying progress in meeting the 10 percent reduction. This plant goal is a part of a corporate-level effort by JBS to achieve net-zero greenhouse gas (GHG) emissions at each of their processing plants by 2040. In an effort to reach this goal, the company is investing more than $1 billion USD in emissions reduction projects across their facilities.

RESULTS

Development of Utility Usage Baseline: JBS Marshalltown recognized the importance of understanding their Rendering Department's utility usage at the equipment level, to strategically target increased utility efficiencies. Benchmarking utility usage in any facility operation is a valuable analysis, but in rendering operations it can be a particularly complex undertaking as multiple pieces of equipment work in harmony under heavy load. Operation of the system is interconnected – changing one piece of equipment has the potential to impact the performance of numerous other pieces. It is important to have an accurate measure of both the utility usage and the operating parameters of each individual piece of equipment, and how each one can vary, to measure true usage and cost.

Utilities included in the baseline analysis included electricity, water, steam, and natural gas. To obtain these usages, data was compiled using existing equipment records and company-available data, along with intern-compiled equipment records and measured or calculated usages. A variety of monitoring equipment was utilized to aid in data collection including data loggers, non-contact temperature scanners, and a portable flow meter. All collected data was further analyzed and various calculations were completed to assemble the completed baseline.

The baseline of utility usage in the rendering area, provides the necessary data for critical decision-making moving forward. The largest utility users can be identified and prioritized for further analysis of possible savings opportunities. Benchmarking will also allow for quicker identification of inefficiencies and the enhancement of maintenance procedures to optimize system performance. Immediate

valuation of the baseline deliverable is based on the intern's time invested in the study itself, but the true value is projected to be realized in subsequent projects and savings, stemming from the analysis results.

Utility Usage Calculator: Upon completing the Rendering Department baseline, a comprehensive calculator model was constructed to allow JBS to make theoretical adjustments to run times, equipment specs, and other variables, and project how changes could affect overall utility usage. The compiled baseline data was built into the calculator, along with current utility rates. Built in Excel, it utilizes numerous sheets to maximize user customizability.

The Tutorial Sheet includes all the essential information to navigate the calculator and add or remove equipment. The Equipment List Sheet includes the related data, along with an array of sorting features. Various utility sheets house all the equipment specs from which adjustments can be made. Finally, the Rates and Calculations Sheet contains utility rates and calculations that may be updated as necessary.

The sorting tools built into the calculator model allow the user to instantly categorize equipment by location, utility, and other sort parameters. This will enable JBS to quickly find high utility users or pinpoint equipment that may have unnecessary consumption. The calculator can be used to make theoretical changes to equipment specs, run times, and flow rates to determine combinations that will optimize consumption.

In conjunction with the populated calculator, a calculator template was also developed that follows the same build format. JBS can use this template across other department and plant locations to document utility usage, add in the resulting data, and generate similar model benefits. This calculator was shared with other production departments at the Marshalltown facility and will be shared with other JBS plant locations in the future.

Air-Cooled Condenser: The shell and tube water-cooled condenser that cools the rendering cooker is the largest water user in the plant. Hot water generated by the condenser is used throughout the plant for numerous cleaning processes. When more hot water is generated beyond what can be used, the excess gets directed to wastewater. It is recommended that an air-cooled condenser be installed to assist the current water-cooled condenser. When the water-cooled system generates enough hot water to fulfill the cleaning process demand, the system will switch to the air-cooled condenser, eliminating the excess water usage. A quote for the air-cooled condenser system has been obtained and implementation is being assessed by Rendering Department staff and plant engineers.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
DEVELOPMENT OF UTILITY USAGE BASELINE	$10,500 (one-time)	—	IMPLEMENTED
UTILITY USAGE CALCULATOR-DEVELOPMENT	$3,000 (one-time)	—	IMPLEMENTED
UTILITY USAGE CALCULATOR-APPLICATION	$27,500	144,522 kWh 34,412 therms 4,895,201 gallons	RECOMMENDED
AIR-COOLED CONDENSER	$220,320	81,600,000 gallons	RECOMMENDED

NSK CORPORATION

CLARINDA

COMPANY PROFILE

NSK Corporation, founded in 1916 in Japan, is a leading manufacturer of bearings, linear technology, automotive components, and steering systems. NSK has a presence in 29 countries and employs more than 31,500 people. The NSK facility in Clarinda, Iowa, focuses on manufacturing ball bearings, with 244 employees. NSK is driven to contribute to the well-being and safety of society and strives to protect the environment through its innovative technology. Motion Industries® recently named NSK their 2020 Supplier of the Year.

Joey Romo
Major: Mechanical Engineering
School: Iowa State University

PROJECT BACKGROUND

The objective of this project is to improve efficiency and reduce energy usage of the compressed air system at the NSK Clarinda campus. In this project, an in-depth analysis of the compressed air system and its corresponding applications was conducted with a focus on areas of the plant that utilize the most compressed air. This analysis revealed opportunities to reduce energy consumption with more efficient methodologies. Recommendations were presented to increase overall performance, curtail associated operational costs, and provide a starting point for future expansion.

INCENTIVES TO CHANGE

NSK Corporation is an ISO 14001 certified facility. As part of their environmental goals, NSK's Clarinda plant has developed a list of Environmental Objectives and Targets for the year of 2021. Reducing energy by increasing efficiency of the compressed air system is at the top of the list. Compressed air is a costly utility at the plant, making up almost 30 percent of the total electricity cost. This utility is used on the plant floor in various operations, with multiple areas dependent on a consistent supply of compressed air. The 2021 project will position NSK to meet its environmental targets within the plant's operation.

RESULTS

Electronic Flow Control: Compressed air is used to direct parts through a transport system via open-ended tubes. The intern proposed the installation of an electronic flow control (EFC), which regulates the compressed air so it would be used only when needed. An EFC utilizes a photoelectric sensor with a timing control that shuts off the air control valve when no part is present. One controller was purchased for a 30-day trial period. Its performance will be evaluated to confirm functionality and measure impacts. If the pilot is successful and renders the anticipated savings, this technology has the potential to significantly reduce energy usage in this application.

Engineered Air Nozzles: In various parts of the plant there are ¼ inch air tubes that flow constantly to push items onto transportation systems or through assembly processes. These

air tubes produce an average decibel (dB) level of 55 dB, which can be audible with hearing protection. Engineered air nozzles could minimize the airflow output and lower the decibel level of these tubes. The intern identified an air nozzle that is advertised to amplify airflow up to 25 times or more, while reducing the amount of cubic feet of air per minute (CFM). Five engineered air nozzles have been purchased to validate performance and efficiency prior to implementation throughout the remainder of the plant.

Repair Air Leaks: Air leaks have potential to put strain on air compressors and negatively affect equipment performance. Using an ultrasonic leak detector, the intern conducted a leak survey in the compressed air system and documented leak points for repair. Eliminating these air leaks has the potential to reduce energy usage and improve functionality on the plant floor. Repairing air leaks also provides fast returns on savings and reduces the overall plant decibel level. By fixing these air leaks, NSK could reduce associated costs of their compressed air usage at the plant by more than 15 percent.

On-going Leak Detection Program: Regularly scheduled leak detection is essential for optimal compressed air system performance. The intern developed a leak detection program to aid in repairing air leaks. This program includes a detailed procedure to guide NSK in leak detection, with a recommendation of purchasing appropriate equipment. Additionally, a guide for leak documentation and protocol was incorporated, along with a schedule, detailing when and where to conduct leak surveys.

Install Flow Meters: The intern recommended the installation of clamp-on flowmeters in order to measure CFM airflow output per compressor and the amount of CFM dispersed per department. This data could help maintenance staff identify leakage and inconsistencies within the system so that inefficiencies can be addressed quickly, keeping the compressed air system operating at optimum efficiency. Two flowmeters have been purchased and are ready to be installed to measure the output of the compressors.

Air Filters on Side Vents: The intake air vents of the compressor rooms often become obstructed, which can cause the compressor to work harder to intake air. This can also lead to having a large vacuum pressure across the compressor inlet and filters. Regularly scheduled cleaning of these air filters could allow for cleaner intake air and improve compressor efficiency.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
ELECTRONIC FLOW CONTROL	$15,674	261,243 kWh	IN PROGRESS
ENGINEERED AIR NOZZLES	$15,919	265,311 kWh	IN PROGRESS
REPAIR AIR LEAKS	$77,042	1,284,030 kWh	IN PROGRESS
ON-GOING LEAK DETECTION PROGRAM	$12,405	206,757 kWh	RECOMMENDED
INSTALL FLOW METERS	$4,952	82,541 kWh	IN PROGRESS
AIR FILTERS ON SIDE VENTS	$545	9,090 kWh	RECOMMENDED

Kevin I. Dial

Major: Chemical Engineering
Minors: Business Administration and Chemistry
School: The University of Iowa

TPI COMPOSITES, INC.

COMPANY PROFILE

TPI Composites, Inc. is a multinational corporation founded in 1968 as a composite powerboat body manufacturer. Headquartered in Scottsdale, Arizona, the company refocused to production of wind turbine blades with a mission of becoming the preferred global structural composites supplier in the wind energy and transportation markets. To this end, the company produces composite wind turbine blades and automotive bodies. TPI is committed to accelerating global clean energy growth by manufacturing competitive, innovative composite materials. Among its blade manufacturing facilities is the plant in Newton, Iowa, where TPI is the largest private employer within Jasper County.

PROJECT BACKGROUND

The host company sought the assistance of Pollution Prevention Services to work toward reducing hazardous waste generation, solid waste generation, and volatile organic compound (VOC) emissions, with a goal of reducing each metric by five percent based on the previous year's numbers. Project initiatives included waste stream analysis and standardization of new waste stream creation procedures. The intern's primary focus was on formulating solutions, which furthered TPI's VOC emission and hazardous waste reduction goals. In addition to pre-determined hazardous waste and VOC sources of the focus project, the intern's baseline assessment revealed further opportunities to assist TPI in reaching its environmental goals.

INCENTIVES TO CHANGE

Thorough analysis of solid waste sources and costs can reveal profitable material savings opportunities. Additionally, supply chain disruptions caused by the COVID-19 pandemic presented opportunities to reassess internal processes and the economic impacts of potential waste reduction improvements. Hazardous waste disposal can be highly expensive, and material substitution or recovery maximizes operating margins while minimizing negative environmental impacts. Positioning the Newton facility to meet its waste reduction objectives simultaneously ensures a holistic implementation of TPI's sustainability values on the global level.

RESULTS

Tackifier Pail Recycling: For fiberglass to adhere to a mold, a sticky substance known as tackifier must be applied to the surface. The material is delivered to TPI as a bulk liquid in unlined metal pails. Analysis of the tackifier waste stream revealed that the empty metal pails were being discarded and landfilled. By diverting the tackifier pails to TPI's existing metal drum recycling stream, savings will arise from avoided landfill costs. This waste stream diversion was successfully implemented and semi-regular internal inspections by EHS staff are planned to ensure continuation of the program and adherence to all relevant recycling guidelines.

Root Shavings Recycling: Metal and fiberglass shavings are generated during the milling process that shapes the root of the blade. These shavings were previously difficult to capture and quantify due to the indirect nature of the generation process. Through a process established by the intern, shavings are now immediately collected from the floor following completion of the root sanding process and diverted to a recycling partner. The economic benefit is represented as landfill cost avoidance. After successful implementation, the metal and fiberglass waste is now collected in drums bound for recycling.

Acetone Recovery: Composite manufacturing relies on the precise application of pastes in different areas of the blade. By their nature, these pastes undesirably adhere to the application tools. Tools must therefore be regularly cleaned to ensure proper reusability.

Acetone is a preferred solvent for general industrial cleaning. Accordingly, the largest portion of TPI's current hazardous

waste stream is an acetone slurry containing solid adhesive particles. A distillation solvent recycling system capable of recovering a high proportion of this spent acetone is recommended. Distillation systems evaporate the solvent and recondense it in an area separate from the undesired contaminants, allowing the solvent to be reused instead of having to continually purchase new supply. Indirect costs associated with handling acetone waste and ordering virgin solvent would be greatly reduced. Carried inventory of acetone would also significantly decrease. Labor costs to operate the system are minimal once the engineering department calibrates the optimal evaporation temperature.

The cost savings of implementing this system are generated from decreased acetone purchasing and disposal costs. Additionally, this recommendation dramatically reduces the volume of TPI's hazardous waste streams and introduces indirect environmental impacts of avoided carbon emissions from incinerated wastes. Updated disposal procedures to accommodate separated solid waste must be completed for future implementation to occur.

Mold Release Replacement: Blade skins and components must be released from their molds with minimal friction so that damage to their surface is avoided. To accomplish this, chemical products are applied to the molds to prevent costly repairs. The currently utilized chemicals are highly flammable and the rags used to apply them to the molds are disposed of as hazardous waste.

It is recommended that TPI substitute the current family of mold release agents with set of water-based alternatives. In addition to environmental benefits, the water-based alternatives have been shown to be more effective at achieving high quality demolds. Material consumption also decreases because water evaporates at a slower rate than the currently utilized organic agent. Water-based agents contain negligible VOCs and do not generate hazardous wastes due to their inflammability.

The financial savings of this recommendation stem from reduced chemical consumption due to better material retention on the molds and the ability to avoid applying mold release after every demold. Ongoing analyses to determine material consumption and effectiveness, cycle time impact, and supply chain considerations will be conducted throughout product trialing.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
TACKIFIER PAIL RECYCLING	$307	3.1 tons	IMPLEMENTED
ROOT SHAVINGS RECYCLING	$360	3.6 tons	IMPLEMENTED
ACETONE RECOVERY	$49,287	10.0 metric tons CO_2 14.5 tons hazardous waste	RECOMMENDED
MOLD RELEASE REPLACEMENT	$376,997	21.0 metric tons VOCs 11.5 tons hazardous waste	RECOMMENDED

Nicholas Streit

Major: Mechanical Engineering
School: Iowa State University

TYSON FOODS INC. HILLSHIRE BRANDS

STORM LAKE

COMPANY PROFILE

Originating in Arkansas in 1931, Tyson Foods Inc. is the largest protein-centered food company in the United States. Tyson Foods employs more than 139,000 team members worldwide in more than 100 processing plants. Within Tyson's portfolio is the Tyson Foods Inc. Hillshire Brands, a turkey processing plant located in Storm Lake, Iowa. The facility's 700 team members process 36,000 turkeys daily into bulk cuts of white and dark meats, and pre-blended sausage mixtures. The plant operates two eight-hour shifts and one sanitation shift five days per week.

PROJECT BACKGROUND

Compressed air is essential for the pneumatic machinery and sanitation processes at the Storm Lake plant. Compressed air is generated on-site by three air compressors and flows through pipes throughout the plant. The focus of this project was to perform an audit of the energy efficiency of the compressed air system and to suggest opportunities for optimization.

INCENTIVES TO CHANGE

In June of 2021, Tyson Foods announced its goal to achieve net-zero greenhouse gas (GHG) emissions by 2050, with an intermediate goal of reducing GHG emissions by 30 percent by 2030. With compressed air being almost 3 percent of the Storm Lake facility's direct energy bill, many systems are dependent on its supply. Optimizing the efficiency of compressed air has the potential to offer a significant gain towards Tyson Foods Inc. Hillshire Brands' environmental goal while providing opportunities for cost savings.

RESULTS

Air Leak Repairs: Air leaks in the plant arise when connections become loose or materials decay. In compressed air systems, air leaks are often cited as one of the most overlooked and costly aspects of plant operations. An ultrasonic leak detector was used to identify and document leaks throughout the plant. When comparing compressed air consumption with pneumatic equipment demand, leaks were found to be an appreciable demand within the system. An investment of labor and materials in detecting and repairing leaks is projected to yield immediate benefits and cost savings. Repairing leaks with a non-ferrous material in place of the standard galvanized steel could extend the part's lifespan and reduce future air leaks. Repairs of the documented leaks are being tracked on a spreadsheet and through a work order system.

Air Leak Preventative Maintenance: Leaks can surface at any time and can be very costly when undetected. Even a plant that is well maintained can have leaks that consume anywhere

from 10 to 20 percent of the compressed air created, inflating the electricity bill. Contracting a company to perform an annual air leak survey could combat leaks and prevent their potential buildup. In between surveys, it is recommended that quarterly inspections of individual machines suspected of generating leaks be conducted by maintenance staff to help maintain efficiency. The intern developed instructions for performing these inspections and quantifying the energy loss. An operating procedure describing the closure of air valves after every shift and during breaks was also provided, which may result in additional savings.

Air Compressor Resequencing: Enhancing the efficiency of Tyson's three air compressors presents considerable savings with the shortest time investment. Currently, a variable speed compressor generates most of the air with a fixed speed compressor that loads to trim when needed. Reversing the role of each compressor so that the variable speed drive motor is trimming could increase the operating efficiency of each compressor. Resequencing will significantly reduce inefficient unloaded motor energy consumption and allow the variable speed motor to operate in its ideal range. Implementing all recommendations will enable a reduction in line pressure by an estimated six pounds per square inch. Restricting excessive pressurization presents savings of 3 percent of the operating costs in motor electricity consumption. Indirect savings of reduced energy usage may also be realized by extending the lifespans of machinery while decreasing labor costs.

Engineered Air Nozzles: Two air wands are utilized by the sanitation shift to displace water beneath mezzanines located in processing areas. The air wands used for this purpose consume 8.4 cubic feet of air per minute. The intern identified an engineered air nozzle that could improve airflow by discharging it in a conical pattern, which creates a larger volume than the current open end. An increased air volume discharge will allow team members to work more efficiently while experiencing an additional benefit of reduced noise levels.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
AIR LEAK REPAIRS	$11,336	158,468 kWh	IN PROGRESS
AIR LEAK PREVENTATIVE MAINTENANCE	$2,700	38,369 kWh	RECOMMENDED
AIR COMPRESSOR RESEQUENCING	$8,089	133,376 kWh	RECOMMENDED
ENGINEERED AIR NOZZLES	$14	167 kWh	RECOMMENDED

Aman Ungarov

Major: Mechanical Engineering
School: Iowa State University

WOODHARBOR CUSTOM CABINETRY

MASON CITY

COMPANY PROFILE

Woodharbor Custom Cabinetry is a family owned business, originated by the Lewerke brothers in 1993. The company is housed in a state-of-the-art-facility in Mason City, Iowa. Woodharbor is a manufacturer of home, bath, and kitchen cabinetry as well as related millworks. All of the products are custom made and sold by 450 dealerships across the United States. With 210 employees, the company produces approximately 32,500 cabinets, annually.

PROJECT BACKGROUND

The primary aim of the project is to investigate and recommend a control system to actively monitor and regulate outgoing and incoming airflows in the facility. A secondary aim is to identify a more economical method for wood scrap disposal. The intern conducted a comprehensive analysis of the heating, ventilating and air conditioning (HVAC) system, solid waste management practices, and automatic finishing lines. Opportunities to reduce costs associated with energy usage and wood scrap management were presented to the company.

INCENTIVES TO CHANGE

To prevent contamination on product, Woodharbor Custom Cabinetry has taken steps to minimize dust and debris in the finishing room. Monitoring and assessment indicate that particles are entering the finish room through the airflow from the manufacturing area. The intern was tasked with seeking a solution for maintaining positive pressure in the finish room, resulting in reduced labor costs associated with reworking product. In addition, the intern explored methods for reducing wood scrap generation and diverting it from the landfill. An automated control system to reduce energy usage and improve the operating efficiency of the HVAC system was also evaluated.

RESULTS

Building Automation System (BAS): Most of the HVAC components at the facility are operated manually by the maintenance staff. The dust collection systems and majority of the make-up air (MUA) units are turned on 45 minutes before production starts and turned off up to an hour after it stops. Extended time of operation results in higher electricity and natural gas costs. The MUA unit settings are set based

on maintenance employees' predictions on the outside temperature. Implementing a BAS would result in energy savings due to proper scheduling of all of the equipment and increase system efficiency. Additionally, an ability to build positive pressure in the finish room should result in labor cost savings and wood waste reduction due to product contamination. Temperature and pressure sensors set up across the facility will help the company to monitor the current situation on the floor. The BAS would allow further expansion and improvements on the system based on company's needs.

Spray Booth Fan Operation Change: After a further look into the spray booth operations, the intern observed that exhaust fans are started before production and stay on constantly throughout the day. This is a preventative measure against the buildup of contaminants in the air. While there is a cost associated with electricity waste, the energy lost due to warm air removal during the winter presents a higher cost of natural gas use. Additionally, extended exhaust fan operation contributes to pressure loss in the finish room, increasing the chances of product contamination. Turning the fans on when production starts and shutting them off during breaks would reduce these losses, at no investment cost.

Two of the spray booths have control systems installed on them. The system recognizes when the spray gun is being used and runs the fans at their highest speeds. After a predetermined amount of time, the system drops the exhaust airflow down to 20 to 40 percent of the original output to conserve energy until the spray gun is used again. The control systems are installed at the spray booths with lower CFM values and are kept off due to a formaldehyde buildup in one of the booths. Moving the control panels onto booths with the highest CFM values would result in greater annual energy savings. Low investment cost and quick implementation time represent additional benefits of the recommendation.

Damage Prevention Training Video: A portion of the product contamination is caused by behavioral inefficiencies at the automatic finish lines. While spraying and drying of paint or finish occurs inside of the machine, the parts need to be scuffed and cleaned manually between each layer of coating. It is within this process that most of the inefficiencies related to part clean off and cart organization occur. Producing a training video for new employees was selected as a preventative measure. The video format has a low cost of production and will provide easy-to-digest content within a short module. This training should minimize the amount of dust contamination and the need for retraining, which reduces the labor cost associated with part repair. The training has the added potential to lower the risk of physical damages like dents and scratches.

Wood Scrap Diversion: Currently, all of the wood scrap is transported to a landfill, where disposal fees are incurred. The saw dust, however, is sent to a dairy farm for animal bedding at a much lower cost. Installing a wood grinder to shred the scrap and divert the chips to the dairy farm has the potential to eliminate waste disposal fees and lower transportation costs.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
BUILDING AUTOMATION SYSTEM	$27,616	201,153 kWh 4,393 therms	RECOMMENDED
SPRAY BOOTH FAN OPERATION CHANGE	$4,542	1,115 kWh 13,487 therms	RECOMMENDED
DAMAGE PREVENTION TRAINING VIDEO	$126	Time and material for rework	RECOMMENDED
WOOD SCRAP DIVERSION	$6,974	553 tons	IN PROGRESS

DAVENPORT

COBHAM

Chris DeBondt

Major: Chemical Engineering
School: Iowa State University

COMPANY PROFILE

Cobham Davenport is a manufacturer of aircraft components and systems for commercial and military aircraft, with headquarters in the United Kingdom. The products manufactured at Cobham Davenport are found in the air, on land and beneath the sea, with technologies that include oxygen systems, fuel tank inerting, aerial refueling and mechanical systems. The company's mission statement "Every Mission Matters" reflects the company's commitment to producing only the highest quality products.

PROJECT BACKGROUND

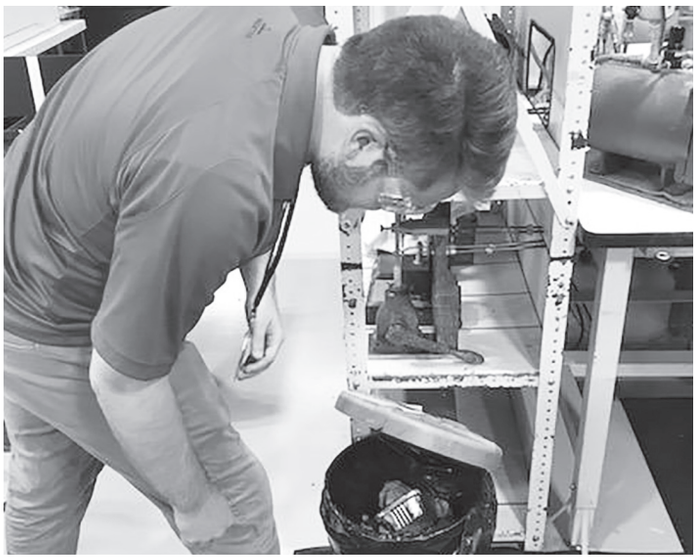
Cobham is investigating potential solutions to reduce solid and hazardous waste streams at the Davenport plant. As part of this intern project, potential source reduction and pollution prevention strategies were investigated to set the stage for achieving site waste reduction goals. A 24-week intern with the Pollution Prevention Program provided dedicated support to research opportunities, consider impacts, and develop solutions for reducing the challenging waste streams. Strategies researched in the hazardous waste category include solvent recycling, potential chemical substitutions, and strategic purchasing practices. The intern also evaluated online document storage and electronic documentation to reduce paper usage.

INCENTIVES TO CHANGE

Cobham strives to improve environmental awareness and reduce environmental impacts across all locations. Sustainability goals at the Davenport site include a ten percent reduction in paper usage and waste, and a two percent reduction of the hazardous waste stream. Material classified as hazardous is costly both to purchase and to dispose of. Reductions in the use or disposal of this waste stream can also reap significant benefits in compliance risk, employee health, lower insurance costs and transportation for disposal or treatment. Documentation is a critical part of Cobham's processes. Procedural improvements to reduce printing and paper use provides economic savings while also reducing environmental impact.

RESULTS

Solvent-Contaminated Wipes Exemption: The Resource Conservation and Recovery Act (RCRA) creates the framework for proper management of hazardous and non-hazardous waste and assigns authority to the U.S. Environmental Protection Agency (EPA) to make rules and determinations regarding the RCRA framework. Under a rule set by EPA,



certain solvent-contaminated wipes may be excluded from hazardous waste regulation, provided that the company meets specified management requirements.

The intern developed a program to segregate RCRA-exempt solvent-contaminated wipes from the hazardous waste stream. The project involved installing designated yellow bins and signage to collect only wipes that meet the RCRA exemption. An education program was developed to inform all affected employees of the procedural change and included training on exempt wipes and proper disposal procedures. In addition to the training, a process for regular auditing, and testing of the yellow bins was developed as part of the project's implementation plan. This monitoring is necessary to ensure ongoing conformity with EPA program guidelines. Employee education and audits will continue as part of this initiative in order for the site to ensure compliance with the new practice.

Solvent Recycling: Various solvents are used throughout the production process to clean parts. The used solvent must be disposed of as hazardous waste. Solvent recovery would allow these solvents to be reused, thus reducing overall hazardous waste generation. Onsite solvent recycling was considered but was not feasible due to the low volume of solvent waste produced at the site and associated costs of implementation. Offsite solvent recycling through a hazardous waste disposal vendor was determined to be a more financially viable option. The solvent waste was tested to determine whether it met recovery specifications and unfortunately, it was determined that the various types of solvent would need to be segregated to meet the specifications. At the end of the internship, Cobham was considering options and barriers to segregating the solvent waste for recovery.

Chemical Substitution: Identifying effective, less toxic substitutions to hazardous chemicals offers environmental, health, and safety benefits that are difficult to quantify but are of critical value to Cobham. The intern researched possible substitutions for a number of hazardous chemicals used onsite and identified one application where a less hazardous solvent was viable. The less hazardous alternative is more expensive to purchase, but offers a measurable decrease in toxicity due to having a slower evaporation rate than the current solvent. This decreased evaporation rate lowers the employees' exposure time to the chemical and is also a less toxic air pollutant, generating environmental, health and safety benefits for employees and the site. In addition, the lower evaporation rate is expected to decrease quantity of use and a 20 percent reduction in overall annual solvent is projected as a result of this change. At the end of the internship, the replacement solvent was approved and on order.

Paper Reduction: Cobham's Davenport facility has placed a high priority on reducing overall paper use. The intern gathered data on paper use for each department across the company and used the data to develop source reduction solutions to lower paper use and decrease waste. Online forms for specific internal repair orders were developed, replacing a paper intensive process. Additionally, dual monitors were installed for specific employees in high paper use areas of the facility. This change resulted in a 50 percent decrease in paper usage for those employees. Other printing reduction initiatives were identified and at the end of the internship, were in progress.

Wood Recycling: Wood waste is produced as a packaging byproduct from incoming parts and raw materials. Cobham's current wood waste vendor was no longer viable and an alternative was needed to ensure wood waste was not sent to the landfill. The intern identified a new, cost effective vendor that could provide a consistent collection schedule. A larger staging space is required for the new vendor as a collection container would need to be stored onsite and would be picked up when full. At the end of the internship, the space was not yet made available for the project to be fully implemented.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
SOLVENT-CONTAMINATED WIPES EXEMPTION	$441	11 tons	IMPLEMENTED
SOLVENT RECYCLING	$1,280	17.5 tons of solvent	RECOMMENDED
CHEMICAL SUBSTITUTION	—	0.5 tons of solvent	IN PROGRESS
PAPER REDUCTION	$121	0.08 tons	IMPLEMENTED
WOOD RECYCLING	$1,368	26 tons	IN PROGRESS

2021 PROJECT INDEX

POLLUTION PREVENTION INTERN PROGRAM

CHEMICAL REDUCTION/REPLACEMENT

- Cobham (2019 24-week)
- JBS Swift Pork
- TPI Composites, Inc.

COMPRESSED AIR

- NSK Corporation
- Tyson Foods Inc. Hillshire Brands

ENERGY REDUCTION

- CNH Industrial America, LLC
- JBS Swift Pork
- JBS USA, LLC
- NSK Corporation
- Tyson Foods Inc. Hillshire Brands
- Woodharbor Custom Cabinetry

HAZARDOUS WASTE

- Cobham (2019 24-week)
- TPI Composites, Inc.

HEAT RECOVERY

- CNH Industrial America, LLC

HVAC

- Woodharbor Custom Cabinetry

PROCESS IMPROVEMENT

- CNH Industrial America, LLC
- JBS Swift Pork
- JBS USA, LLC
- Woodharbor Custom Cabinetry
- TPI Composites, Inc.

SOLID WASTE MANAGEMENT

- Cobham (2019 24-week)
- TPI Composites, Inc.
- Woodharbor Custom Cabinetry

WATER USE REDUCTION

- JBS Swift Pork
- JBS USA, LLC

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