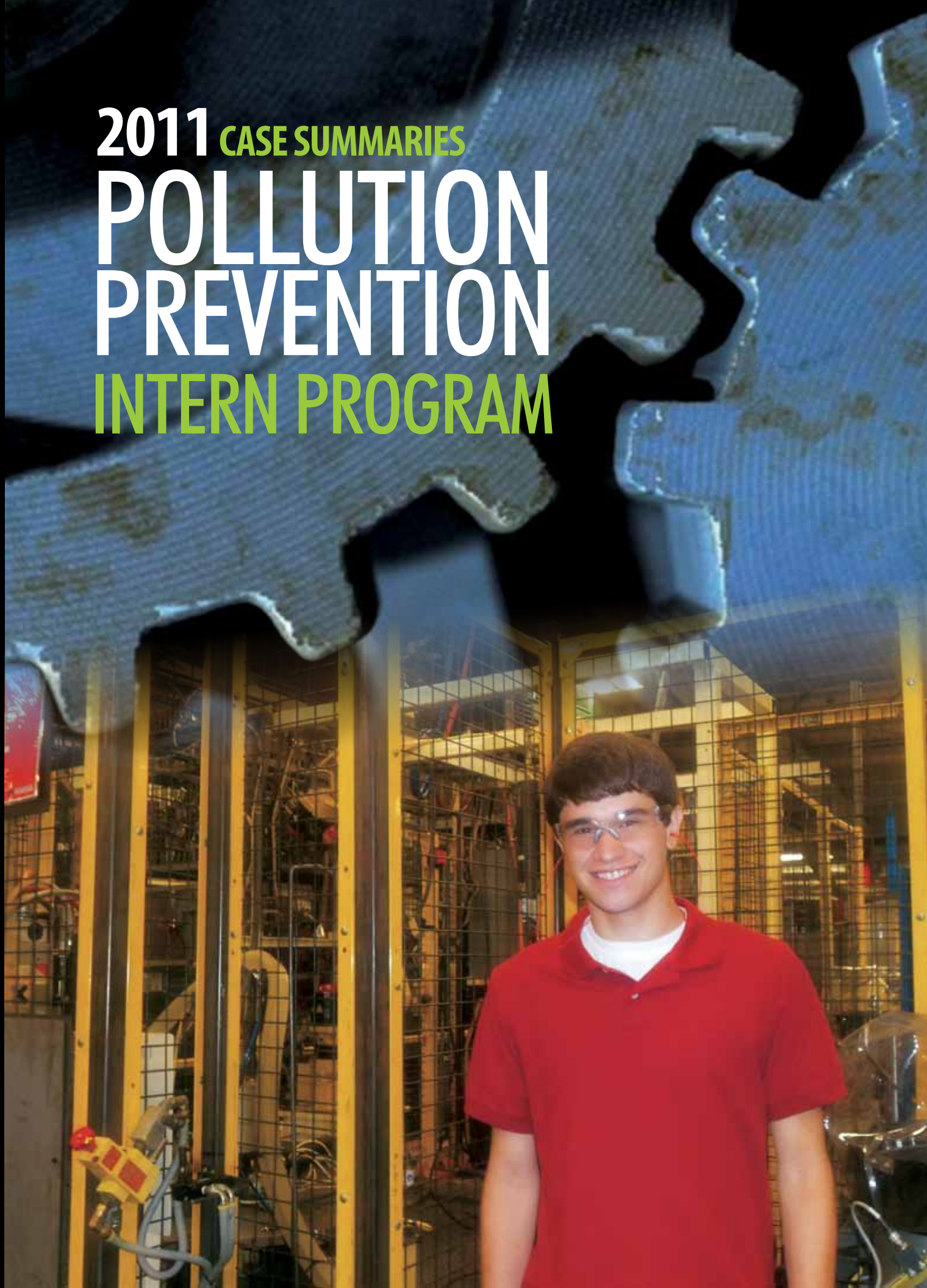
2011 CASE SUMMARIES

POLLUTION PREVENTION INTERN PROGRAM

WORKING TOGETHER TO ACHIEVE ECONOMIC AND ENVIRONMENTAL RESULTS



www.iowap2services.com

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2011 P2 Interns

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CONTENTS

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2011 POLLUTION PREVENTION INTERNS

The Pollution Prevention Intern program is an extension of DNR's Pollution Prevention Services, which offers no-cost, non-regulatory, confidential technical assistance through assessments, internships and other services to Iowa businesses, industries and institutions.

The intern program places upper-level students from Iowa colleges and universities at host companies to analyze the facilities' waste streams and to research and recommend process improvements that will lower operating costs while reducing negative environmental impacts. After a one-week training period, the students serve on-site at the host facilities for 12- or 24-week internships.

STUDENT PERSPECTIVES

"It is a great internship where you can make a real difference for a company and the environment. You work independently with your projects and make them your own."

JAKE SMITH
AMERICAN PACKAGING

"The Pollution Prevention internship was a fantastic opportunity to learn about a specific area in my field and develop professional skills. It is very rewarding personally to find opportunities for the host company to significantly reduce their energy use and help the environment at the same time. "

CHRIS HOLMES
OSCEOLA FOODS

"The Pollution Prevention internship gave me an eye-opening experience in realizing the economic impacts of making small changes to processes or machines. It was rewarding to see changes implemented at the company that will help the bottom line!"

HANNAH WIES
EMCO ENTERPRISES

"It was very rewarding to see my work converted into economic and environmental savings for the company. At the end of the internship I could put a dollar amount on what I accomplished. I also gained a lot of real world experience working with controls and HVAC that I could not have gained in the classroom. "

CODY HUEDEPOHL
3M COMPANY

COMPANY TESTIMONIALS

"The company has benefitted by having an intern on-site to keep up with this project. The intern provided a devoted set of hands to complete testing and look at alternative options."

-JIM BILLINGS, ARMOUR-ECKRICH MEATS LLC

"A benefit of this program is that it provides a dedicated person to focus on the project and really make it happen. To move forward, a project like this really needs the good information and someone who can be focused on completing the testing and compiling the data."

-BRENT ANDERSON, KRAFT FOODS GLOBAL INC.

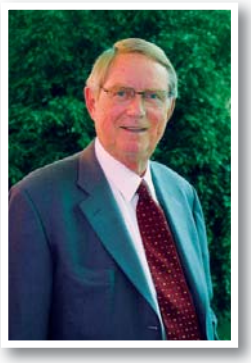
"The P2 program provides a great service to its customers while providing great experience to intern students. I can't say enough good things about the program."

-JIM OBERBROECKLING, 3M COMPANY

"Interns with the Pollution Prevention intern program work well independently and provide the companies with a depth of information not seen in other internship programs."

-TRAVIS PERRY, AMERICAN PACKAGING CORPORATION

DIRECTOR'S NOTE



I am pleased to present the results of the 2011 Pollution Prevention Intern Program and I applaud each of the companies, institutions and interns that have made the program such a remarkable success.

Businesses that partner with this program are as varied as the projects summarized in this booklet, but they all have one thing in common. They realize – and have repeatedly demonstrated – that investing in environmentally sustainable projects provides lasting economic benefits as well.

Since 2001, more than 150 dedicated companies have saved more than $65.7 million by opening their doors to pollution prevention interns, and Iowa's top students have gained irreplaceable experience leading to employment in their chosen fields – often in our own state. The decisions these companies have made to optimize operational efficiencies, conserve resources and reduce waste have led to a cleaner, healthier Iowa.

It is no wonder that this unique partnership between government, businesses and Iowa colleges and universities has earned national awards and recognition and has become a model for other states.

As you read the testimonials and project summaries that follow, I encourage you to consider joining our team of professionals for the summer of 2012 Pollution Prevention Intern Program.

ROGER L. LANDE

CONVENTIONAL AIR POLLUTANTS DIVERTED IN STANDARD TONS

Total for all sectors							
CO_2	SO_2	CH_4	N_20	CFC	NOX	VOC	PM-10
120,840.08	1,851.66	29,083.56	6,377.44	1,294.86	684.98	157.44	486.53

TOTAL IMPLEMENTED ACTUAL SAVINGS 2001-2011

CATEGORY	REDUCTION	COST SAVINGS
WATER CONSERVATION	1,116,892,366 GALLONS	$5,462,459
SPECIAL WASTE	75,146 TONS	$837,912
SOLID WASTE	124,902 TONS	$13,242,898
HAZARDOUS WASTE	1,512,492 GALLONS 560 TONS	$10,145,727 $355,183
MERCURY ABATED	42,817 GRAMS	
ENERGY	310,663,860 KWH 1,747,092 *MMBTU 6,876,065 THERMS	$17,392,073 $6,042,119
OTHER		$12,272,565
BOD	104	$26,640
		TOTAL: $65,777,576

*MMBTUS ARE CALCULATED FROM KWH AND THERMS FOR SPECIAL REPORTING ONLY. ALL DOLLARS AND ACTUAL ENERGY SAVED ARE REPORTED UNDER THERMS AND KWH.

2011 EXECUTIVE SUMMARY

Twenty students served as interns in the 2011 Iowa Pollution Prevention Intern Program.

Fifteen interns completed 12-week internships in August, researching and recommending projects to reduce solid and hazardous waste, water and energy use, air emissions, and greenhouse gases. The interns identified opportunities that could save companies more than $4.3 million annually. Of these, projects estimated to save $863,620 annually were implemented or are in progress.

In 2011, five interns committed to 24-week projects that will continue into November. These projects are outlined in a special section at the back of the booklet. Final results of this year's 24-week projects will be posted to the DNR's website in December and highlighted in the next published booklet. Additional time on site allows interns to conduct more in-depth research, collect data over time and evaluate systems through varying conditions.

Three interns from the 2010 season completed 24-week projects last November. The final results of these projects also are included in the following pages.

Collectively, these case summaries show that outstanding results are possible when companies, students and the DNR work together to achieve common goals.

The following chart shows the implemented results of the summer of 2011 program, including the conventional air pollutants and greenhouse gases diverted.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors							
CO_2	SO_2	CH_4	N_20	CFC	NOX	VOC	PM-10
34,781.87	144.37	4967.59	1713.04	344.86	69.86	8.15	4.18

NOTE: AIR EMISSIONS AND GREENHOUSE GASES SHOWN IN THE FOLLOWING CASE SUMMARIES ARE LIFECYCLE ESTIMATES AND INCLUDE EXTERNAL ACTIVITIES SUCH AS PURCHASING UTILITIES. TOTALS DO NOT SOLELY REPRESENT EMISSIONS GENERATED AT THE PLANT SITES.

2011 IMPLEMENTED SAVINGS

CATEGORY	REDUCTION	COST SAVINGS
WATER CONSERVATION	18,935,412 GALLONS	$24,225
SOLID WASTE	296 TONS	$53,819
HAZARDOUS WASTE	5,833 GALLONS 9 TONS	$32,998 $33,652
ENERGY	9,211,216 KWH 35,376 *MMBTU 108,000 THERMS	$596,204 $70,394
OTHER		$52,329
		TOTAL: $863,621

*MMBTUS ARE CALCULATED FROM KWH AND THERMS FOR SPECIAL REPORTING ONLY. ALL DOLLARS AND ACTUAL ENERGY SAVED ARE REPORTED UNDER THERMS AND KWH.

3M COMPANY

CODY HUEDEPOHL
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

KNOXVILLE

COMPANY BACKGROUND

3M Company is a global technology company delivering innovative solutions to life's everyday needs. 3M Knoxville serves customers through six business segments with operations in more than 65 countries. Production began in 1975 at the Knoxville, Iowa facility, which currently employs approximately 550 people. Various types of tapes and adhesives used in commercial, industrial and consumer applications are manufactured at the 600,000-square-foot facility. Products include acrylic foam tapes, transfer tapes, window films for commercial, home and auto uses, diaper fastening systems and laminating adhesives.

PROJECT BACKGROUND

Air conditioning is vital to product quality assurance. Air handlers are utilized throughout the plant to maintain constant temperature and humidity levels. Most of the 74 air handlers are original to the plant. Currently, no inspection plan is in place to monitor performance or track maintenance. Optimizing the operating efficiency of the air handling units could significantly reduce energy usage and the associated utility costs.

3M is committed to actively contributing to sustainable development through environmental protection, social responsibility and economic progress. High standards in safety, health and the environment are top priorities in this facility. Over the years they have implemented 80 improvement projects that have prevented 30,000 tons of air pollution and 18,000 tons of solid waste.

INCENTIVES TO CHANGE

The air handlers are one of the largest energy consumers in the plant. There have been significant improvements in HVAC controls since the units were installed in 1973. New controls would ensure operational efficiency and could track the performance of each air handler. Increasing the air handlers' efficiency would reduce the demand on the boilers and chillers, extending the lifetime of this equipment.

RESULTS

The intern inspected all of the air handlers and recommended the following four strategies to increase the efficiency of each unit.

Reduce Wasted Heat: Each air handler was inspected during the summer, so they were in cooling mode. It was discovered that preheat coils were still heating the air in some units. This significantly reduces efficiency because it requires energy to heat the air, which must then be cooled back down. Currently, the chillers reach capacity on very hot summer days. Eliminating this additional cooling demand would significantly reduce the load on the chillers. These units also utilize a large amount of reheat to maintain a constant zone temperature and humidity level. Controls could be redesigned to improve the efficiency of this process.

Implement Scheduling: A majority of the plant requires conditioned air 24 hours per day, seven days per week to maintain the product quality. Some areas of the plant and offices are unoccupied during the nights and weekends. Integrating zone schedules into the system controls could considerably reduce equipment run times.

Utilize Free Cooling: Many of the plant's air handlers use both outside air and return air from the zone. An actuator controls a damper on each duct to adjust the amount of

each type of air supplied to the air handler. Few of the air handlers adjust the amount of outside air supplied. An economizer control would measure the enthalpy (energy) of each air stream and determine which one is easiest to cool. As the temperature outside decreases, cooling becomes easier and eventually the outside air cools enough to supply the plant with free cooling. If this control were implemented, the plant could utilize free cooling during most of the spring and fall, which would significantly reduce the load on the chillers.

Install VFDs on Fan Motors: A variable frequency drive (VFD) adjusts the speed of a motor by reducing the power supplied. As the speed of the motor is reduced, the power consumed is reduced to the third power. VFDs installed on most of the air handlers could significantly reduce electrical usage.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
1700.69	8.01	161.65	0.35	18.61	0.19

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REDUCE WASTED HEAT	$130,000	1,600,000 KWH 108,000 THERMS	IN PROGRESS
IMPLEMENT SCHEDULING	$21,000	430,000 KWH 5,700 THERMS	RECOMMENDED
UTILIZE FREE COOLING	$17,700	444,000 KWH	RECOMMENDED
INSTALL VFDS ON FAN MOTORS	$32,750	818,500 KWH	RECOMMENDED

AMERICAN PACKAGING CORPORATION

JAKE SMITH
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

STORY CITY

COMPANY BACKGROUND

American Packaging Corporation in Story City, Iowa is a leader in flexographic printing and lamination, making packages for many well-known consumer products. The company's two other divisions are located in Rochester, New York and Columbus, Wisconsin. The Story City division began operation in 1989. It now employs approximately 150 people at its 230,000-square-foot facility. The company makes packages for a variety of industries including food, household, and personal care. The packages are customized for each product to effectively meet the customers' needs.

PROJECT BACKGROUND

The heating, ventilation and air conditioning (HVAC) system, the compressed air system, and the three regenerative thermal oxidizers (RTOs) each comprise a significant portion of American Packaging's energy bills. Therefore, optimizing these three systems would have a substantial effect on the company's overall energy usage and costs, as well as its environmental footprint.

INCENTIVES TO CHANGE

American Packaging is committed to both high quality production and environmental sustainability. Improving the HVAC, compressed air and RTO systems would help the company meet its goals in both these areas by increasing reliability and productivity and by decreasing the plant's impact on the environment. Furthermore, reducing the energy usage of these systems could considerably reduce American Packaging's energy bills. Realizing that it could positively affect its profits, its production, and the environment, American Packaging had the incentive to invest in pollution prevention efforts.

RESULTS

Destratification Fans: American Packaging has approximately 30-foot high ceilings throughout most of the facility. These high ceilings can cause air to become stratified into layers of different temperatures at different heights, with warmer air concentrated at the ceiling and cooler air concentrated at the floor. This wastes energy and money during winter, when heat that could be used to warm occupied areas is instead left useless at the ceiling. Destratification fans could reduce the wasted energy by pushing warm air from the ceiling down to the floor where it is needed, saving energy and money.

Repair Compressed Air Leaks: Compressed air leaks at American Packaging were accounting for a large portion of the facility's overall compressed air usage. Compressed air is an expensive utility to produce, so repairing the leaks could provide an almost immediate payback for the company.

On-Going Leak Detection Plan: Compressed air leaks form rapidly and the cost of the leaks adds up quickly. Because of this, preventative maintenance on the compressed air system is needed to minimize leaks at all times. A spreadsheet was developed that uses ultrasonic leak detector readings to estimate the amount of air flowing through a given leak. Leaks that are located with the detector can be prioritized for repair.

Compressor Waste Heat Recovery: It generally takes approximately 8 HP of electricity to produce 1 HP of compressed air. The rest of the energy is wasted as excess heat. However, most of this heat is recoverable, so as much as 80 percent of the energy put into an air compressor could become usable heat. The heat can be used for space heat in the winter, reducing the heating load of the facility, and ducted outside in the summer, reducing the cooling load.

Duct Outside Air into Compressor Room: Compressors run more efficiently with cooler intake air. The ambient air inside the compressor room reaches temperatures of up to 90°F. Ducting cooler outside air into the compressor room can save money by making the compressor run more efficiently.

RTO Ceramic Media Upgrade: American Packaging uses three RTOs to prevent solvent vapors from being released into the atmosphere. Solvent-laden air is heated with natural gas to approximately 1500°F to oxidize the solvent vapor into carbon dioxide and water vapor. A ceramic media then recovers much of this heat to preheat the incoming solvent-laden air before the clean airstream is exhausted. Improving the ceramic media would increase the amount of heat that is transferred to the incoming airstream, reducing the need for natural gas heating.

RTO Secondary Heat Recovery: Although most of the heat is recovered by the ceramic media, the air is still exhausted from the RTOs at approximately 200°F. Secondary heat recovery could use heat from the exhaust to preheat air for the plant's press dryers, which would further reduce the demand for natural gas.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
775.83	1.77	341.33	0.85	5.29	0.07

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
DESTRATIFICATION FANS	$22,000	36,750 THERMS	RECOMMENDED
REPAIR COMPRESSED AIR LEAKS	$13,000	160,900 KWH	RECOMMENDED
ON-GOING LEAK DETECTION PLAN	$4,330	53,600 KWH	RECOMMENDED
COMPRESSOR WASTE HEAT RECOVERY	$13,825	21,600 THERMS	MORE RESEARCH NEEDED
DUCT OUTSIDE AIR INTO COMPRESSOR ROOM	$3,165	39,170 KWH	MORE RESEARCH NEEDED
RTO CERAMIC MEDIA UPGRADE	$41,150	68,600 THERMS	MORE RESEARCH NEEDED
RTO SECONDARY HEAT RECOVERY	$142,800	238,000 THERMS	RECOMMENDED

ARMOUR-ECKRICH MEATS LLC

PATRICK CAHALAN
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

MASON CITY

COMPANY BACKGROUND

Armour-Eckrich Meats LLC is a subsidiary of Smithfield Foods, Inc. The Armour-Eckrich plant is located in Mason City and mainly produces lunch meats and hams. The company has been operating at this location since 1978 and currently employs 250 workers. It is a 195,000-square-foot facility that produces about 70 million pounds of product a year.

PROJECT BACKGROUND

Armour-Eckrich uses nearly 300,000 gallons of water daily and has its own pretreatment wastewater facility. Opportunities for reducing water consumption were explored, as well as updating some wastewater processes to more efficient alternatives. General energy efficiency was also considered as timed light switches were installed.

INCENTIVES TO CHANGE

Smithfield Foods mandates that each of its plants operate at 100-percent compliance with all local, state, and federal environmental regulations at all times and has issued a statement that all plants will reduce energy and utility consumption by 10 percent by the end of 2011. Armour-Eckrich strives to make environmentally friendly decisions at all times and knows that economic benefit usually goes hand in hand with green processes.

RESULTS

Sludge Dewatering Press: Armour-Eckrich currently pumps its sludge into biobags to be sent to the landfill. Each biobag weighs approximately 8 tons and the company uses about one per week. More than 90 percent of what is being sent to the landfill is water. Replacing the biobags with a mechanical dewatering system could cut landfilling costs in half, as well as remove the cost of buying biobags.

Automatic pH Regulation: The Mason City wastewater plant requires that all wastewater from Armour-Eckrich be within a pH range of 5.5 to 9.0. Left alone, the pH would fluctuate outside those boundaries with sugars and seasonings being drained during production and soaps being drained during cleaning. A maintenance worker must be on staff at all times to manage the pH by manually adding acid or base and it is possible to use more chemical than is needed to neutralize the stream. An automatic pump has been installed to add base any time the pH dips to a set level and will only add as much base as is necessary to stay within city requirements.

Sausage Casing Soakers: In sausage production there are casings that must be soaked in warm water before use. Instead of running a hot stream of water over the casings, a tank with an electric heater has been installed to reduce the amount of water required to keep the casings warm.

Spray Nozzles: Third shift sanitizes and cleans the production area. This shift uses more water than either of the other shifts even though there is no production taking place. Replacing the spray nozzles with lower volume nozzles with a cone spray option could reduce water usage by up to 25 percent.

Regulated Warehouse Lights: Two warehouses keep lights on nearly constantly, regardless of how much they are used. Replacing the lights with timed light switches where there is bird activity and motion sensors where there is metalworking being done will reduce electric power usage in those warehouses by nearly 95 percent.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
514.96	0.25	190.10	103.88	1.93	0.05

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
SLUDGE DEWATERING PRESS	$38,999	290 TONS	IN PROGRESS
AUTOMATIC PH REGULATION	$27,230	4,862 GALLONS OF 50% SODIUM HYDROXIDE	IMPLEMENTED
SAUSAGE CASING SOAKERS	$2,874	499,200 GALLONS OF WATER	IN PROGRESS
SPRAY NOZZLES	$32,939	6.5 MILLION GALLONS OF WATER	RECOMMENDED
REGULATED WAREHOUSE LIGHTS	$1,964	27,840 KWH	IMPLEMENTED

2010 24-WEEK INTERNSHIP

CNH AMERICA, LLC

LOGAN SMITH
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

BURLINGTON

COMPANY BACKGROUND

CNH America, LLC is a global leader in the manufacturing of construction and agricultural equipment. The company totaled $13.8 billion of revenue in 2009. With approximately 1 million square feet under roof and a workforce of more than 400 employees, the Burlington site manufactures tractor loader/backhoes, rough terrain forklifts and landscaping tractors under the Case Construction name. Through World Class Manufacturing, CNH is set to have its products meet Tier 4 emission standards by 2014.

PROJECT BACKGROUND

This is the third year that CNH has participated in the Pollution Prevention Intern Program. The goal of the 2010 project was to perform an energy audit of the entire facility. During the summer, the intern focused primarily on the compressed air system and the electric motors used at CNH. Fall projects included heat regeneration, cooling systems, and lighting retrofits.

INCENTIVES TO CHANGE

CNH strives to employ development tactics that are environmentally and socially sustainable. The company is not only committed to minimizing the footprint that its products have on the environment; it is also devoted to decreasing the environmental impact of its production processes. An energy audit of the facility will show which systems consume the most energy and identify opportunities to improve efficiencies.

RESULTS

Compressed Air Audit: The intern first conducted a compressed air audit of the facility. Compressed air accounts for more than 10 percent of the electricity used at CNH. Because several processes use compressed air, production is directly affected by its availability. Tests showed that an estimated 29 percent of the system's capacity was lost to leaks. An ultrasonic leak detection survey was performed and approximately 72 percent of the leaks in the system were tagged for repair. Fixing these leaks and implementing an ongoing leak management program would allow CNH to reduce the percentage of system capacity lost to leaks to less than 10 percent.

The intern then examined compressed air applications and determined that modifications to equipment used in the paint system could produce considerable savings. The paint must be continuously agitated or it will coagulate. Compressed air pumps and agitators are much less efficient than their electrical counterparts. If CNH were to switch from pneumatic agitation to electric agitation, the company could save more than 80,000 kWh per year.

The air compressors are operating at a pressure much higher than what is required to run production. If the pressure of the system were lowered to what is necessary, CNH could save 9 percent on the electricity consumption of its compressors.

Closed-Loop Compressor Cooling: Two large operations in the facility require cooling water: the compressors and the experimental test facility. The purchase price of the water typically represents only approximately 25 percent of the price to send the water to the wastewater treatment facility. City water is currently being used as a one-pass coolant to cool both of these systems. If cooling systems were purchased to close the cooling loop on these operations, city water consumption at the plant could be reduced by more than 90 percent.

Supplemental Chiller: A designated cooling tower for the experimental lab is undersized for the operations it currently services. During the summer months the tower overheats and during the winter months the tower's pipes freeze. Adding a supplemental chiller that uses an ethylene-glycol and water mixture would eliminate the weather-related inefficiencies and down-time. The supplemental chiller would also include a computer system that could automate and control both of the systems for additional operational savings.

Electric Motor Survey: CNH utilizes several hundred motors for various processes, so the intern took an inventory of the electric motors and their applications in the facility. Although

there are many direct drive applications, several motors transmit their power through v-belt drive systems. These v-belt drives lose substantial efficiency due to friction and excessive bending in the belts. New technology in synchronous drive systems eliminates many of these losses and allows for an increase in the efficiency of power transmission of between 5 percent and 9 percent. The addition of synchronous drives would save CNH more than 290,000 kWh of electricity annually.

The intern also studied how the electric motors at CNH were used and found that certain motors could be shut off. With a few small modifications to the applications that currently use three 50 hp motors, the motors could be shut off, saving 541,444 kWh annually.

Heat Recovery Ventilator: Because space heating accounts for a large percentage of the natural gas used at CNH, the intern examined the option of regenerating process gas as space heating. The convection ovens currently used to dry painted parts require that the air be continuously exhausted out of the baking area. A large exhaust fan was found, which would be an excellent candidate for an efficient heat recovery unit. The unit could be installed to capture approximately 65 percent of the wasted heat. According to the fan specifications and the temperature of the air being moved, approximately 78,000 therms of heat could be captured each winter.

Lighting Retrofit: Two parts of the facility need lighting retrofits. One of these will be used as a manufacturing area in the future and the other is used as a fabrication area. Both areas require higher quality light than can be acquired through the current method of lighting. Replacing 261 of the existing 400 watt fixtures with LED fixtures would save more than 570,000 kWh annually.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
1,808.89	9.21	948.10	419.36	21.96	0.24

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPAIR COMPRESSED AIR LEAKS	$22,906	309,122 KWH	IN PROGRESS
ONGOING LEAK MAINTENANCE PLAN	$7,635	103,040 KWH	RECOMMENDED
E-FLO ELECTRONIC AGITATION	$5,943	80,202 KWH	RECOMMENDED
LOWER SYSTEM PRESSURE	$7,300	98,515 KWH	IMPLEMENTED
CLOSED-LOOP COMPRESSOR COOLING	$21,343	18,434,293 GALLONS WATER	RECOMMENDED
SUPPLEMENTAL CHILLER	$133,217	30,091,867 GALLONS WATER	RECOMMENDED
SYNCHRONOUS BELT DRIVE RETROFIT	$21,765	293,718 KWH	RECOMMENDED
SHUT OFF E-COAT BLOWERS	$40,121	541,444 KWH	RECOMMENDED
HEAT RECOVERY VENTILATOR	$58,000	78,378 THERMS	RECOMMENDED
LED LIGHTING RETROFIT	$42,941	573,430 KWH	RECOMMENDED

EAGLE WINDOW AND DOOR

RICKY HARDIS
INDUSTRIAL (M.S.) & CHEMICAL ENGINEERING (B.S.), IOWA STATE UNIVERSITY

DUBUQUE

COMPANY BACKGROUND

Eagle Window & Door, an Andersen Corporation company, is a manufacturer of a complete line of high-quality, aluminum-clad windows and doors. Located in Dubuque, Iowa, the company focuses exclusively on high-end residential (new and remodel) and commercial construction. Eagle is housed in a 390,000-square-foot manufacturing facility with a workforce of 531 employees. The company has been handcrafting premium windows and doors for more than 30 years and is a proud member of the WDMA and many other fenestration associations.

PROJECT BACKGROUND

Eagle Window & Door consumes large amounts of solvent in the paint purging and cleaning processes and accordingly generates quantities of hazardous waste. The intern analyzed the processes and investigated opportunities to use solvent more efficiently and to improve the effectiveness of the solvent recycling process in an effort to reduce solvent usage, hazardous waste generation, and associated purchasing and disposal costs.

INCENTIVES TO CHANGE

Eagle Window & Door is committed to ECO 3 environmental policy by continuously striving to minimize waste, recycle materials and improve processes to minimize adverse environmental effects. Reducing solvent usage in paint purging and cleaning processes will decrease air emissions, hazardous waste and costs. The company's ultimate goal is to implement sustainable processes that can be shared with other facilities within the corporation.

RESULTS

New Recycling Unit: The operating time of the plant's recycling unit is inconsistent mainly because it utilizes an air-cooled condenser and a high ambient temperature interferes with the machine operation. Accordingly, only half of the solvent wastes generated in the plant can be recycled every two weeks, which indicates capacity issues. In addition, the current unit generates liquids as still bottoms instead of solids.

A new recycling unit is proposed to meet the current needs of the plant. The proposed unit utilizes a water-cooled condenser and a quick-cool coil for optional rapid cooling of the still for successive runs. A chiller option is recommended so that the water can be used repeatedly. Installing the new unit is expected to reduce solvent purchases by 11,220 gallons and solvent waste by 11,440 gallons, saving $71,446 annually.

Solvent Reduction: Solvent used for cleaning the pumps in the paint booths is highly susceptible to evaporation. Decreasing the volume of solvent in use at one time could reduce the amount of solvent lost to evaporation and still maintain efficiency of the process. Reducing solvent in use by approximately 30 percent is expected to reduce evaporation by 919 gallons, saving $5,332 annually.

Paint Flushing Program: The parameters are pre-set for the amount of solvent needed to clean the lines when a color change takes place in the paint process. To ensure proper cleaning the parameters are set at the maximum needed for a color change. Installing a program with the capability to set the parameters based on paint colors would allow less solvent to be used with some color changes. Installing the new program could decrease the amount of solvent used in the paint purging process by 2,860 gallons per year. The amount of solvent waste would also decrease by 4,290 gallons per year. This program could save the company $22,984 annually.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors						
CO_2	SO_2	CH_4	N_20	CFC	PM-10	VOC
106.79	0.25	13.47	6.80	3.02	0.08	0.32

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
NEW RECYCLING UNIT	$65,076	11,220 GALLONS OF SOLVENT PURCHASED*	RECOMMENDED
	$6,370	11,440 GALLONS OF SOLVENT DISPOSED**	
SOLVENT REDUCTION	$5,332	919 GALLONS OF SOLVENT PURCHASED*	IMPLEMENTED
PAINT FLUSHING PROGRAM	$16,588	2,860 GALLONS OF SOLVENT PURCHASED*	RECOMMENDED
	$6,396	4,290 GALLONS OF SOLVENT DISPOSED**	

*REPRESENTS THE AMOUNT OF PURCHASED SOLVENT THAT COULD BE AVOIDED.
** REPRESENTS AVOIDANCE OF SOLVENT DISPOSAL.

EMCO ENTERPRISES

HANNAH WIES
INDUSTRIAL ENGINEERING, IOWA STATE UNIVERSITY

DES MOINES

COMPANY BACKGROUND

EMCO Enterprises is a fully owned subsidiary of Andersen Corporation. The company manufactures and supports the warranties of a variety of storm doors. With a workforce of approximately 500 employees at locations in Des Moines, Iowa and Luray, Virginia, EMCO produces doors built around energy efficiency, security and durability. The company's storm doors can be purchased at home improvement stores across the United States and Canada.

PROJECT BACKGROUND

This is EMCO's third year hosting interns through the Pollution Prevention Intern Program. The company has made significant reductions in energy use and in the amount of waste sent to the landfill. This year's project was to identify opportunities to reduce process waste.

Non-engineered scrap accounts for a large portion of the waste stream at EMCO. There are several opportunities to investigate the cause of damaged material and make changes to reduce the amount of scrap. The intern focused on studying the processes and material flow and recommended process modifications to reduce recurring sources of kick panel, carton and lineal scrap.

INCENTIVES TO CHANGE

EMCO strives to make a positive impact on the environment by reusing materials, recycling and reducing waste through its ECO 3 environmental initiatives. Reducing the amount of scrap will reduce the amount of energy needed to transport, process and recycle the scrap. Reducing scrap will also lower the associated costs of handling the scrap and purchasing raw material. The economic and environmental impacts of scrap reduction are major incentives to change.

RESULTS

Kick Panel Scrap: While investigating sources of kick panel damage, the intern found that some scrap was caused by material handling at the plant and a majority of the scrap was caused by vendor processes. A storage rack was added and a layout change was made to reduce the potential for material handling damage. Also, a new process was set up to record the reason for damage and place all scrap on a designated cart. This process allows the company to receive credit from the vendor for damaged kick panels received, helps the vendor to identify sources of damage, and saves raw material costs.

Top Carton Scrap: Bundles of corrugated carton used for packaging required excess forklift handling because of the way they were oriented in the delivery trucks. The intern worked with EMCO's carton buyer and vendor to identify an opportunity for the vendor to change its carton handling process, which will reduce forklift damage of cartons at EMCO.

Z-bar Conveyors: Z-bar lineal scratches mainly occur when a portion of the z-bars dive off of conveyors into a holding cart and scratch against each other. On one production line, a roller attachment was developed to connect to the end of the conveyor to eliminate the scratching motion. Implementing roller conveyors on all production lines will reduce the amount of touch-up paint used in the plant and improve product quality, which will lead to significant cost savings.

Handle Hole Machine: Another cause of lineal scratches is when metal shavings occasionally get stuck between clamps and pieces of lineal as they are fed through a machine that cuts handle holes. The intern studied the points of contact in the machine and recommended installing air nozzles to automatically blow metal shavings off the contact surfaces. Eliminating this source of scratches will reduce labor and raw material costs.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
20.02	0.06	1.83	0.14	2.76	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
KICK PANEL SCRAP HANDLING	$10,030	4.45 TONS RECYCLED MATERIAL	IMPLEMENTED
TOP CARTON ORIENTATION	$1,095	0.89 TONS RECYCLED MATERIAL	IMPLEMENTED
Z-BAR SAW OUT FEED ROLLER CONVEYORS	$27,165	N/A	IN PROGRESS
INSTALL HANDLE HOLE MACHINE BLOW OFFS	$3,695	0.78 TONS RECYCLED MATERIAL	IN PROGRESS

GREEN PLAINS SUPERIOR, LLC

WILLIAM EDGMOND
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Green Plains Superior LLC is an ethanol production facility in Superior, Iowa. The plant produces more than 50 million gallons of ethanol annually, while consuming upwards of 18 million bushels of corn. Along with ethanol, the company produces and sells dried distillers grains, wet distillers grains, and syrup, all of which are byproducts of the ethanol production process and are used as livestock rations. The company is a subsidiary of Green Plains Renewable Energy Inc. and currently employs 43 individuals in two daily shifts, who maintain the facility's constant, year-round operation.

PROJECT BACKGROUND

At Green Plains a ring dryer is utilized to dry wet distillers grains into dried distillers grains, a valuable commodity. This dryer consumes up to 30 percent of the plant's natural gas usage. An energy audit on the ring dryer would create a benchmark of natural gas usage and help identify opportunities to optimize efficiency of the drying process through equipment modifications and parameter changes.

INCENTIVES TO CHANGE

Green Plains Superior strives for continuous process improvement in the areas of efficiency, energy consumption and waste management. The company diverts all waste from the landfill, no water is expelled to the sewer, and all byproducts are reused or sold. Presently, continuous improvement and savings efforts focus on process and equipment efficiencies.

RESULTS

Vacuum Leaks: Vacuum leaks in the ring dryer were detected using an ultrasonic leak detector and recorded for maintenance follow up. Most of the detected leaks originated from the access panel seals on the ring dryer. Regular maintenance of the seals, including proper installation and regular replacement, would improve efficiency and reduce natural gas usage by 4,300 therms annually.

Air Preheat: Modification of a cooling water return pipe line through an existing heat exchanger would allow preheating of process air during cold winter months and mild fall or spring weather. This would also divert some of the heat load from the cooling towers. This modification would be effective most of the year, with the exception of warm summer months during which the air is minimally heated.

Air Heater Tuning: The air-heating burner utilized in the ring dryer will be scheduled for a combustion test report and tuning to verify the actual efficiency of the air heater and add accuracy to the energy balance model. Currently, the ambient temperature set-point is entered into the burner management system biannually. An automated temperature sensor for the system would regularly adjust the set-point based on actual ambient temperature, increasing efficiency.

Dryer Enclosure: A large difference in gas consumption of the ring dryer exists between cold winter days and hot summer days with similar production rates. Part of the dryer structure has been enclosed to avoid start up and freezing issues the company was experiencing in the winter. Enclosing the remainder of the dryer structure would further reduce the heat lost to cold winter temperatures and improve safety for maintenance workers during harsh weather conditions.

Moisture Reduction: A decrease in total moisture being dried could produce considerable savings in natural gas consumption. Adjusting the centrifuge set-points and syrup flow rates would yield lower input moisture into the dryer. A 1 ton per hour decrease equates to a 1.5 percent reduction in the moisture content of the mixed product going to the dryer. Diverting 1 ton of water per hour from being evaporated in the dryer could result in significant savings in natural gas costs.

Dryer Optimization: Optimal loading of the dryer means that as the loading of the dryer increases, the gas used per ton produced of dry product and consequently the cost to dry per ton decreases. The study of the dryer system showed a significant increase in gas efficiency as loading increased, with maximum loading being the most efficient and having the lowest MMBTU per ton value. Full loading with no split stream was shown to be the most efficient condition. It is recommended that the plant operate the ring dryer under the most efficient operating conditions to take advantage of the lowest cost per ton to dry the product.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
2538.00	2.59	1570.00	3.93	11.90	0.20

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
VACUUM LEAKS	$7,400	4,300 THERMS	RECOMMENDED
AIR PREHEAT	$10,600	19,900 THERMS	RECOMMENDED
AIR HEATER TUNING	$29,000	54,250 THERMS	IMPLEMENTING
DRYER ENCLOSURE	$220,000	410,000THERMS	RECOMMENDED
MOISTURE REDUCTION	$77,400	144,700 THERMS	RECOMMENDED
DRYER OPTIMIZATION	$659,500	1,300,000 THERMS	RECOMMENDED

INFASTECH™

KELLY BARNETT
CHEMICAL ENGINEERING, THE UNIVERSITY OF IOWA

DECORAH

COMPANY BACKGROUND

Decorah Operations has been manufacturing fasteners since 1969. The company was acquired by Infastech™ in 2010. The current facility produces fasteners of all shapes and sizes used in diverse applications, from cars and construction equipment to cell phones. In 2011, the company added a zinc electroplating process line to the existing cold forming, heading, threading, heat treating, painting, and Class 100 clean room cleaning and packaging processes.

PROJECT BACKGROUND

Water reduction and potential reuse were priorities of Infastech™, with the objective of lowering the strain of increasing water costs. Alternative methods of treating wastewater and the possibility of harvesting rainwater were considered. In addition, soap usage in the plant's parts washing stations was examined, to reduce consumption and develop a standard operating procedure. This is the eighth year that the company has participated in the Pollution Prevention Internship Program.

INCENTIVES TO CHANGE

Decorah Operations is an ISO 14001:2004 certified facility and emphasizes continuous environmental improvement through waste reduction and utility minimization. A new electroplating (EP) line is expected to more than double the current water usage. Since Infastech™ treats its water prior to disposal, this increase in water usage affects the company's water bill, as well as the cost of operating its own wastewater system.

Over-soaping is an issue in the parts washing stations; it places an extra burden on the wastewater pre-treatment (WWPT) system and the company incurs excessive purchasing costs for the soap.

RESULTS

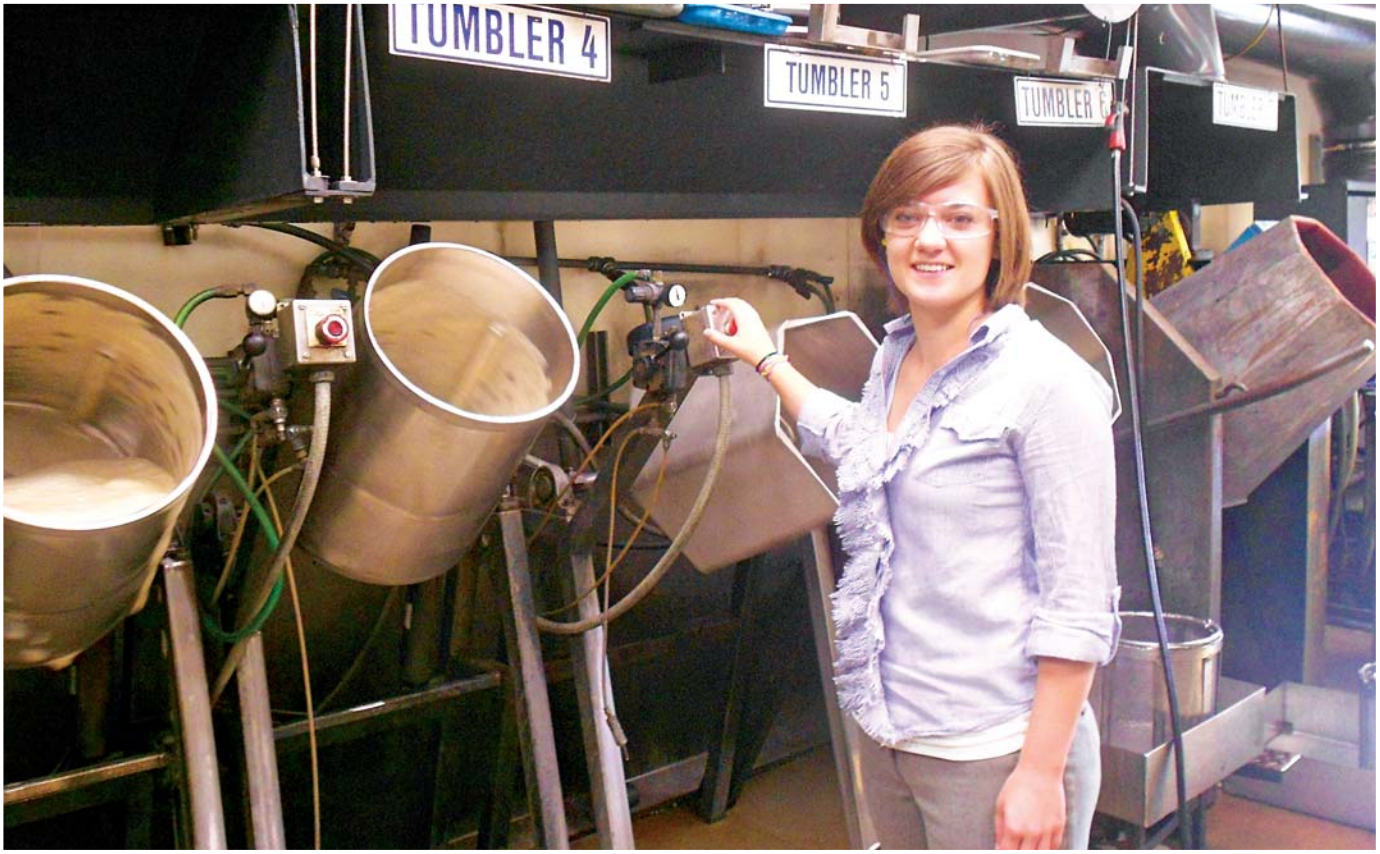
Water Meters: Installing meters on key systems in the plant would provide accurate quantitative data to develop and maintain a baseline for each system. Ongoing monitoring will help identify variances and areas of opportunity to reduce usage.

Soap Reduction: Miniature and specialty parts are washed in the Microtech area in tumbler washers. After forming, parts are washed to remove the oils that would slow down the threading process. Parts were washed in a 60 percent solution of powdered alkaline soap. Testing determined that a 20 percent concentration would still achieve the same level of cleanliness. No capital investment is required to make this process change, which would reduce soap purchases by 32,170 pounds per year.

All other parts are handled by the primary parts washing process. They are cleaned by one of three different types of machines and use a liquid alkaline soap. A piece of proportioning equipment adds a 7 percent concentration to the vibratory wash when only a 5 percent concentration is needed. If this piece of equipment could be adjusted or modified to reduce the soap concentration in this process, $29,835 and 3,900 gallons of soap could be saved annually.

Rainwater Harvesting: Decorah Operations has a roofing surface area of about 185,000 square feet and annual rainfall is 31.5 inches. As a result, 2.6 million gallons of water could be collected each year. For the rainwater to be used, it would need to be filtered and pumped inside. Implementation would require a capital investment of more than $50,000, with an annual cost savings of approximately $2,244. With a 25-year return on investment, rain harvesting is not a cost-effective opportunity at this time.

Wastewater System Reconfiguration: Batch treatment is currently used with pH adjustment and chemical coagulation to remove oil, grease and heavy metals from the wastewater. An ultrafiltration unit was recently purchased to help with the increased demand from the EP line, but is not yet in service. Electrocoagulation is a cost-effective alternative to chemical coagulation because it uses an electrical current to settle out the contaminants in the water. Using electrocoagulation in conjunction with ultrafiltration would enable the wastewater to be reused. Savings would be approximately $247,650 per year from the elimination of coagulation chemicals.



Recycling Wastewater: Since the new wastewater system would enable the effluent water to be reused, it could be recycled to different processes. The parts washing stations and the EP line could use the recycled wastewater, which would save 5.4 million gallons of water per year. Additional savings would be gained from eliminating the need to soften the recycled water. Recycling wastewater could reduce the water costs by approximately 50 percent.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
485.09	1.48	135.35	78.54	2.87	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WATER METERS	TBD	MEASUREMENT ONLY	IMPLEMENTING
SOAP REDUCTION IN MICROTECH PARTS WASH	$52,838	32,170 POUNDS SOAP	RECOMMENDED
SOAP REDUCTION IN PRIMARY PARTS WASH	$29,835	3,900 GALLONS SOAP	RECOMMENDED
RAINWATER HARVESTING	$2,244	2,625,700 GALLONS WATER	NOT RECOMMENDED
WASTEWATER SYSTEM RECONFIGURATION	$247,650+	499,150 POUNDS CHEMICALS	RECOMMENDED
RECYCLING WASTEWATER	$18,680+	5,418,000 GALLONS WATER	RECOMMENDED

IOWA HEALTH - DES MOINES

MATT LITWIN
CIVIL & ENVIRONMENTAL ENGINEERING, THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Iowa Health - Des Moines (IHDM) in Des Moines, Iowa, is the largest affiliate of the Iowa Health System. IHDM has a staff of nearly 7,000 employees, houses 779 beds, and is the parent of four hospitals: Iowa Methodist Medical Center (IMMC), Iowa Lutheran Hospital (ILH), Blank Children's Hospital and Methodist West Hospital (MWH). Some of the many services IHDM provides include cancer, cardiac, diabetes, maternity/OB, and rehabilitation. IHDM is committed to "improving the health of our communities through healing, caring and teaching."

PROJECT BACKGROUND

Water is one of the more expensive utilities for IHDM and future water prices will continue to rise. Water usage at IHDM nearly doubles during the summer months as large amounts of water are used for irrigation and cooling towers. IHDM seeks to use water more efficiently and improve its environmental footprint.

INCENTIVES TO CHANGE

IHDM is constantly searching for ways to create a more eco-friendly environment. The intern focused on water usage and finding opportunities to conserve water and reduce costs. By conducting an overall water balance and analyzing specific areas of use, the intern identified several opportunities to reduce water usage through new technologies, improved efficiencies and reuse.

RESULTS

Deduct Meter Installations (IMMC): More than half of the irrigation usage at IMMC incurs sewer charges. IMMC is paying three times as much as it should be for over half of its irrigation. By installing deduct meters around the campus to remove the sewer charges, IMMC can save $12,717 annually, reducing irrigation costs by 55.6 percent.

Lake Water Use for Irrigation (MWH): A 9 acre lake, owned by IHDM, is adjacent to the MHW facility. Since the facility is in West Des Moines, water charges are more than twice as much as those in Des Moines. If a pumping station were installed in the lake, the water could be used for irrigation, reducing MWH's city water usage by 100 percent and saving $6,450 a year.

Irrigation System Upgrade (IMMC): The irrigation system at IMMC may need replacement in the near future. New technologies in spray bodies and rotors offer greater efficiencies for water savings than systems used in the past. By centralizing the control system, making it weather smart, and upgrading the spray bodies and rotors, a 30-percent reduction in water use would be possible, creating savings in labor as well.

RO Treatment of Boiler Feed Water: Although the boiler system at IMMC is very efficient, savings could still be realized. If the feed water for the boilers at IMMC were pretreated with a reverse osmosis (RO) system, boiler cycles could increase, saving natural gas and chemical costs and approximately $11,010 annually. This would improve condensate corrosion control, lower external costs and reduce the amount of chemicals going down the drain.

On-going Showerhead Retrofit: IMMC is already making progress toward updating its restrooms with the most efficient products. The intern recommended installing more water efficient showerheads in patient rooms. This measure could save $5,783 per year in water and heating costs and it would be an easy replacement.

Reuse of Cooling Tower Blow Down: The operation of IMMC's cooling towers doubles water usage at the facility during the summer, from large makeup water use. By treating the blow down from the cooling tower, an estimated 50 percent of the blow down could be reused as makeup. This would create an annual savings of $8,966 and reduce makeup city water use by 10 percent.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
255.20	0.09	144.26	74.83	0.95	0.04

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
DEDUCT METER INSTALLATIONS (IMMC)	$12,717	-	IN PROGRESS
LAKE WATER USE FOR IRRIGATION (MWH)	$6,450	1,500,000 GALLONS	RECOMMENDED
IRRIGATION SYSTEM UPGRADE (IMMC)	$6,861	1,515,454 GALLONS	RECOMMENDED
RO TREATMENT OF BOILER FEED WATER	$11,010	3532 THERMS 17.3 TONS OF CHEMICALS	RECOMMENDED
ON-GOING SHOWERHEAD RETROFIT	$5,773	2,559 THERMS 638,750 GALLONS	RECOMMENDED
REUSE OF COOLING TOWER BLOW DOWN	$8,966	1,387,864 GALLONS	MORE RESEARCH NEEDED

JBS USA

AMY SROKA
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

MARSHALLTOWN

COMPANY BACKGROUND

JBS is a pork-processing facility located in Marshalltown, Iowa. In 2007, JBS bought Swift & Company and became the largest animal processer in the world. The company is headquartered in San Paulo, Brazil, and has more than 120,000 employees in 140 different facilities. The Marshalltown plant is one of three pork facilities owned by JBS and is the third largest pork processer in the United States. More than 2,400 employees are located at the Marshalltown facility, which produces food-grade meat and other products.

PROJECT BACKGROUND

JBS incorporates continuous improvement strategies into its environmental performance. This is the company's second year of participation in the Pollution Prevention Intern Program. The goal of this year's project was to assess chemical usage at the JBS facility and develop processes to improve the efficiency and effectiveness of chemical usage on site. The intern focused on the development of standard operating procedures for on-site chemical management.

INCENTIVES TO CHANGE

JBS currently spends a considerable amount on chemicals from various suppliers. Adopting standardized procedures will enable JBS to accurately track inventory and product usage and become more efficient in the chemicals they utilize and purchase. Standardizing the storage procedures could help reduce the risk of spills and improve safety. These efforts will assist JBS with becoming more eco-friendly as the company continues to make progress in environmental sustainability.

RESULTS

Implementing Inventory Management Processes: Improved inventory management can save companies significant time, money and materials, as tighter controls reduce the likelihood of unnecessary ordering, overstocked resources and obsolete materials. Updated processes were developed for JBS that could help optimize inventory management. Recommendations included development of standard operating procedures for redeveloped inventory processes and inclusion of "first in, first out" (FIFO) strategies.

Trolley Wash: Trolleys are used to transport animals throughout the production area. After every use, the trolleys are cleaned before returning to the production floor. The current cleaning process uses excessive cleaning chemicals and hot water compared to what the cleaning process actually requires. Development of a standard operating procedure for cleaning trolleys will optimize the use of cleaning materials, saving chemicals, water and energy.

Centralized Storage: Chemicals are stored on site throughout the production area. Some are stored in the same department area where they are used; others are stored where space is available. Without convenient, designated storage locations, there is a higher likelihood of misplaced inventory, resulting in over-ordering and extra costs. By reorganizing, creating a centralized storage location and utilizing back inventory, the company reduced purchases by more than $30,000 this summer and adopted a more efficient ordering process.

Switch to New Polymer: Polymer is one of the chemicals used in the on-site wastewater treatment plant to effectively treat wastewater from production processes before it is discharged to the city. This project identified a polymer that is expected to be more efficient than the current polymer. The new polymer is currently undergoing full-scale testing to confirm the successful sample testing already shown. Switching to the new polymer could allow JBS to utilize approximately 42 tons less polymer per year.

Switch to Bulk Polymer: Polymer is currently purchased in 275-gallon totes and delivered on site approximately every two weeks by semi-trucks that must be unloaded and transported to storage by JBS staff. If the chemical vendor is running low, partial delivery trips occur more frequently, increasing labor requirements. The intern identified that polymer purchased through JBS's chemical vendor can also be purchased in bulk. Buying in bulk would cost less per pound and the polymer could be ordered less frequently. There are two working bulk tanks in wastewater, each capable of holding 2,000 gallons. If these tanks were filled with polymer, reordering would take place less than once per month. This would make ordering easier, less time-consuming and save on labor costs for unloading and transporting to storage, which could save the company several thousand dollars annually.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
302.75	0.69	48.16	64.66	11.55	0.11

PROJECT	ENVIRONMENTAL RESULTS	STATUS
IMPLEMENTING INVENTORY MANAGEMENT PROCESSES	6 TONS CHEMICAL	RECOMMENDED
TROLLEY WASH	1,919 GALLONS WATER 52 GALLONS CHEMICAL 1,325 KWH	IMPLEMENTED
CENTRALIZED STORAGE	8.6 TONS CHEMICAL	IN PROGRESS
SWITCH POLYMERS	42 TONS CHEMICAL	RECOMMENDED
BULK POLYMER	REDUCED	RECOMMENDED

2010 24-WEEK INTERNSHIP

KUM & GO

ZACHARY LAWS
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

WEST DES MOINES

COMPANY BACKGROUND

Founded on exceptional customer service, Kum & Go is a pioneer in the convenience store industry. The family-owned company began in 1959 in Hampton, Iowa, and has grown to more than 430 convenience stores in 11 states (Iowa, Arkansas, Colorado, Minnesota, Missouri, Montana, Nebraska, North Dakota, Oklahoma, South Dakota and Wyoming). Thanks to the efforts of its more than 3,600 associates, Kum & Go convenience stores continue to lead the industry in customer service and convenience.

Kum & Go has maintained 50 years of dedicated community commitment, each year returning at least 10 percent of its profits to the communities it serves. Kum & Go is the third largest private owner-operator of convenience stores in the United States.

PROJECT BACKGROUND

Kum & Go teamed up with Pollution Prevention Services to develop innovative solutions for reducing store energy consumption. The intern conducted energy audits at 11 Kum & Go stores across Iowa. Based on the findings of the energy audits, the intern developed and implemented five energy reduction projects.

INCENTIVES TO CHANGE

With more than 430 convenience stores in 11 states, Kum & Go assets vary in age, size and structure. Providing a large selection of fuel, cold beverages, and warm food around the clock, these stores consume a considerable amount of energy. Kum & Go constructs nearly 25 new stores every year that implement cost-effective, energy-efficient technologies. Retrofitting existing stores with new energy-efficient technology is a company priority.

RESULTS

LED Cooler Door Lighting Retrofit: In most Kum & Go stores, high wattage fluorescent bulbs are used to illuminate the products in the display coolers. These bulbs are inefficient and expensive to maintain. The intern recommended that Kum & Go retrofit existing stores with the efficient LED cooler light fixtures that the company is installing in new store construction. On behalf of the company, the intern applied for and received a U.S. Department of Energy Technology Demonstration Grant

administered through the Iowa Office of Energy Independence to assist in retrofitting 151 Iowa stores with LED cooler lighting. The cooler lighting retrofits are scheduled to begin in the first quarter of 2011.

LED Exterior Lighting Retrofit: Kum & Go stores utilize exterior lighting to illuminate the fuel canopy, parking lot and signage. In most Kum & Go stores, high wattage metal halide bulbs are used to illuminate the exterior of the store. These bulbs are inefficient and expensive to maintain. The intern recommended that Kum & Go retrofit existing stores with the efficient LED exterior light fixtures that are being installed by the company in new store construction. The intern applied for and received a second Technology Demonstration Grant to assist in retrofitting 10 Iowa stores with LED exterior lighting. Along with the LED cooler door retrofit, the exterior lighting retrofit began in the first quarter of 2011.

Monthly Condenser Cleaning: Kum & Go provides customers with a variety of cold beverages, refrigerated foods and frozen-food products. The beverages are generally housed in a walk-in cooler or a stand-alone refrigeration unit. Each stand-alone unit contains an internal compressor and condenser coil. Dust accumulates on these condenser coils, significantly reducing the efficiency of the refrigeration unit. The intern recommended that Kum & Go implement monthly condenser cleanings to ensure that the refrigeration units operate efficiently. The intern assisted with developing training modules to educate store associates on how to properly clean the condensers and the impact this can have on utility bills and extending the life of the unit.

Walk-in Cooler Door Monitor System: In every Kum & Go store, a wide variety of beverages can be found in the walk-in cooler. The intern discovered that product distributors and store associates prop the cooler access door open for extended periods of time throughout the week. Distributors prop the door open to speed up delivery time, while associates prop the door open in an effort to keep warm while stocking products in the cooler. The intern recommended that Kum & Go install walk-in cooler door monitor systems in every store. This door monitor sounds an audible alarm whenever the door is propped open. The monitor also controls the refrigeration system to ensure that the cooler is not running while an associate is stocking product. Kum & Go will be testing these door monitors to determine the savings potential of the project.

Energy Management System (EMS) Installation: In 2009, Kum & Go piloted Energy Management Systems (EMS) in two stores. These units gave the company the ability to monitor energy consumption, control energy usage, and collect usage data directly from the store. As a result, the units provided a reduction of between 13 percent and 18 percent in energy usage in the stores. To continue moving forward with energy management, Kum & Go installed an EMS unit in four more stores in 2010. If significant rebates are available, Kum & Go may consider installing units in a large number of stores.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
3996.08	-	155.1	25.3	25.85	-

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LED COOLER DOOR LIGHTING RETROFIT	$111,200	1,143,700 KWH	IMPLEMENTED
LED EXTERIOR LIGHTING RETROFIT	$39,100	524,000 KWH	IMPLEMENTED
MONTHLY CONDENSER CLEANING	$94,400	1,440,300 KWH	IMPLEMENTED
WALK-IN COOLER DOOR MONITOR SYSTEM	$163,500	2,495,300 KWH	TESTING UNITS
EMS INSTALLATION	$419,000	8,189,500 KWH	RECOMMENDED

LAFARGE NORTH AMERICA

LOGAN SMITH
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Lafarge North America is a French-based company and a global leader in the manufacturing of building materials including cement, aggregates, concrete and gypsum. Lafarge operates at more than 1,963 production sites in 78 countries and is currently ranked as the number one cement manufacturer in the world. Of its €16.2 billion in sales in 2010, 59.7 percent came from cement. The facility located in Buffalo, Iowa is part of the Lafarge cement division and is capable of producing more than 1 million tons of cement annually. The facility operates 24 hours per day, seven days a week, 52 weeks per year.

PROJECT BACKGROUND

The plant's compressed air system was the primary focus of the project. This system was engineered to operate with the capacity of two compressors. However, a backup compressor has since been brought on line to maintain minimum pressure requirements. The goal of the project was to identify inefficiencies in the system and formulate standard operating procedures so that the third compressor may be shut off.

INCENTIVES TO CHANGE

The availability of compressed air directly affects production at Lafarge. Incorrect or inefficient use of compressed air is expensive and is unregulated in most areas. It is important that a company know the amount of compressed air being consumed in an application. Otherwise, the system may be unable to maintain minimum pressure requirements, resulting in equipment damage and costly downtime.

Allowing an excessive number of air leaks to form in a compressor system may also result in bringing extra compressor capacity on line.

Monitoring when and where compressed air is used would enable Lafarge to optimize efficiency of the compressed air system, reduce operating costs and increase reliability. In order to accomplish this, Lafarge hosted a 2011 intern.

RESULTS

Regulate Open Blowing: At a cost of $0.11 per 1,000 cubic feet, compressed air is one of the most expensive utilities at Lafarge and should therefore be used efficiently. Open blowing is commonly used to clean areas or maintain material flow. When open blowing is utilized, more than 7 percent of the system's capacity is dedicated to each application that uses it. If engineered nozzles were used in the same applications, this dedicated capacity could be decreased to less than 2 percent. Open blowing should never be used to clean an area and a log should be kept to track the amount of money spent to maintain material flow.

Implement Electric Blowers: Venturi blowers use high-cost, high-pressure compressed air to move large volumes of air. These blowers are scattered throughout several locations in the facility. Blowers are most commonly used to ventilate an area or to cool equipment and personnel. Because high volumes of air are needed for these tasks, it is essential to choose the most cost-effective system. Installing electric-powered blowers with comparable capacity to venture blowers would be approximately 97 percent more efficient than the present system.

Fix Compressed Air Leaks: As part of the compressed air audit, a leak survey of the plant air system was performed using an ultrasonic leak detector. It was discovered that approximately 7 percent of the system's capacity is lost to air leaks. Allowing air leaks to develop decreases the amount of air available to critical production applications. If these leaks become excessive, extra compressor capacity must be brought on line or purchased. It will be much more cost effective to fix air leaks and to develop a scheduled leak detection plan in order to minimize problems.

Lower Dryer Purge Rate: For pneumatic equipment to function properly, it is vital that the compressed air being used is dry. Exhaust purge dryers use valuable compressed air to regenerate their desiccant beds and maintain necessary dew points. The minimum specified amount of compressed air should be used to accomplish this task efficiently. The dryer's purge rate has been increased from the manufacturer's specifications since it was installed. Lowering the purge rate during the regeneration cycle would save money and increase usable system capacity.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
592.05	3.05	19.27	0.03	6.92	0.07

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REGULATE OPEN BLOWING	$16,400	390,500 KWH	ONGOING
ELECTRIC BLOWERS	$3,560	84,780 KWH	ONGOING
FIX AIR LEAKS	$13,200	314,280 KWH	IN PROGRESS
LEAK MANAGEMENT PLAN	$10,100	240,470 KWH	RECOMMENDED
LOWER DRYER PURGE RATE	$8,000	190,476 KWH	IN PROGRESS

MERCY MEDICAL CENTER

THOMAS FISHER IV
MECHANICAL ENGINEERING, THE UNIVERSITY OF IOWA

DES MOINES

COMPANY BACKGROUND

Mercy Medical Center of Des Moines (MMC-DM) is an 802-bed, acute-care health facility located on three campuses in downtown Des Moines, Iowa. MMC-DM operates as a non-profit, Catholic healthcare facility, along with 72 other hospitals nationwide, as part of the Catholic Health Initiatives organization founded by the Sisters of Mercy. The hospital represents one of the largest employers in Iowa with more than 950 physicians on staff and 6,600 support positions. Mercy's areas of excellence include cancer services, heart and vascular services, diabetes and endocrinology, emergency medicine, medical imaging, birthing services, brain and spine services, orthopedics and rehabilitation, pediatrics, weight loss and nutrition services, and a wide array of specialty and outpatient services. In 2010 the hospital admitted almost 37,000 inpatients and more than 263,000 outpatients.

PROJECT BACKGROUND

The project's objective at Mercy was to determine potential savings from the installation and use of variable frequency drives (VFD) on the heating and chilled water pumps associated with the on-site radiant ceiling panels. The intern also reviewed a recent third-party energy audit and provided additional recommendations for follow-up and energy savings. Other operational projects and maintenance schedules were also identified for future consideration.

INCENTIVES TO CHANGE

Mercy has created a Green Team which investigates ways to reduce the hospital's ecological footprint and annual utilities costs. The central hospital's goals include improving its U.S. Department of Energy's Energy Star Portfolio ranking and increasing its overall energy efficiency. MMC-DM has recently completed a new facility, Mercy-West Lakes, which has been built to LEED specifications and the organization plans to continue implementing LEED design and construction practices in its new buildings and renovations.

RESULTS

Variable Frequency Drives on Radiant Ceiling Panel Pump Motors: The intern investigated the potential economic benefit of installing variable frequency drives (VFDs) on the controls of the motors powering the radiant ceiling panel supply pumps. Using VFDs could reduce the flow rate and pressure on these lines by throttling the power delivered to these motors to maintain a specified temperature drop between the supply line and the return line. The use of VFDs would save money by eliminating any wasted power currently consumed by these motors. VFDs would also prevent condensation and the need for continual repairs.

Install Heat Recovery Chillers: Mercy's HVAC system currently employs simultaneous heating and cooling. Chilled water is produced to first cool the supply air. Then steam heats water that is used to reheat the supply air either in the

hot deck or just prior to room delivery. The HVAC load for the building accounts for a majority of the building's chilled water, steam and electrical requirements. Heat recovery chillers would reclaim the heat dumped into the chilled water lines and use it to reheat the air in the HVAC system. Minimal building chilled water loads ensure year-round potential for the use of these chillers. In the process, these chillers would reduce steam consumption and take over some of the load currently on the main hospital chillers.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
329.18	1.70	10.72	0.02	3.85	0.04

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
INSTALL VFDS ON PUMPS	$28,500	95,500 KWH	RECOMMENDED
DEDICATED HEAT RECOVERY CHILLERS	MORE RESEARCH NEEDED	MORE RESEARCH NEEDED	RECOMMENDED

NEBRASKA MEDICAL CENTER

JASON CHASE
MECHANICAL ENGINEERING, THE UNIVERSITY OF IOWA

OMAHA, NE

COMPANY BACKGROUND

"Serious Medicine. Extraordinary Care." These words embody the scope and purpose of the Nebraska Medical Center. It is one of the region's premier medical providers, a position it has maintained through unceasing dedication to the highest levels of academic and private practice medicine, customer service, clinical care, process improvement and employee satisfaction. The center has received numerous awards, commendations and distinctions for its accomplishments in cancer, cardiology, and neurological illnesses and disorders. The Nebraska Medical Center is comprised of 5,000 staff, and sees more than half a million patients a year.

PROJECT BACKGROUND

The Nebraska Medical Center is successful and growing, despite the challenges of today's economy. Older facilities and equipment contribute significantly to the hospital's energy consumption. The hospital is evaluating several energy improvement opportunities and in its three years of partnering with the Pollution Prevention Intern program has been compiling cost and energy saving data to help prioritize the projects. This year's intern focused primarily on steam traps and a utility metering system, but also provided additional evaluation of efficiencies in the heating, ventilation and air conditioning system.

INCENTIVES TO CHANGE

Optimizing efficiencies of the facility's energy-consuming systems would significantly decrease costs and save resources. Ongoing preventative maintenance, equipment upgrades and continuing implementation of energy-saving projects will move the facility toward optimization of these systems. An effective metering system would provide valuable financial and usage information of individual systems to aid in prioritizing these projects.

RESULTS

Steam Trap Preventative Maintenance: A steam survey conducted in 2010 indicated significant opportunities for savings in the facility's steam utilities. Preventative maintenance of the steam traps on a campus of this size is very time consuming. It is difficult to dedicate staff to the task when needed for more pressing facility needs. Establishing an improved steam maintenance program would significantly reduce the amount of steam lost each year to failed and leaking steam traps, resulting in significant energy and cost savings.

An upgraded maintenance plan would incorporate several features to help make this a more timely process and keep the steam trap systems and associated equipment operating efficiently. The new maintenance plan should include upgraded leak detection equipment for faster and more accurate assessment of the steam traps. A preventative maintenance schedule should also be included in the plan.

Utility Metering System: Meters are currently used to record the utilities serving each of the five campus buildings surveyed. Because of the size of the facilities and the amount of their utility consumption, it is difficult to determine the effectiveness of energy improvement projects. In many cases, the energy reduction from those projects is less than the daily and hourly fluctuations in a building's utility usage. Monitoring utility usage on a more localized level would provide more useful data for evaluating system efficiency and prioritizing projects.

Depending on utility usage, metering could be structured in two different ways. Steam and chilled water are used primarily in HVAC systems such as air handlers and heat recovery chillers. By installing meters on steam and chilled water systems, a baseline can be established for investment return calculations and post-upgrade data can be trended for future maintenance and planning. Electrical usage is divided among HVAC, lighting, medical equipment, and a number of other areas. The most effective way to put an electrical metering system in place would be to install the entire system based on the existing electrical distribution network.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
5210.99	22.13	733.05	226.99	51.21	0.60

The U.S. Department of Energy estimates large savings associated with metering projects as part of a retro-commissioning process. The aid they provide in identifying potential projects creates a consistent and quantifiable value.

Energy Model: The intern developed an energy model to calculate true project savings and return on investment of various improvement and efficiency projects. The model utilizes known energy usage information and operating parameters specific to the equipment on the hospital campus. Moving forward, Nebraska Medical Center will be able to utilize this model to accurately calculate projected savings for a wide spectrum of efficiency improvement projects.

HVAC Projects Return on Investment: Nebraska Medical Center used the developed energy model to accurately project savings on two large HVAC projects previously identified, but the return on investment was unconfirmed. Trend data from the control system was used to estimate the return on investment on upgrade projects but with marginal accuracy, highlighting the benefits of a comprehensive metering program.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
STEAM TRAP PREVENTATIVE MAINTENANCE	$119,544	106,073 THERMS 1,957,600 GALLONS	RECOMMENDED
UTILITY METERING SYSTEM	$345,500	27,600 THERMS 736,900 GALLONS 4,259,000 KWH	RECOMMENDED
ENERGY MODEL	$9,000	MEASUREMENT ONLY	IMPLEMENTED
HVAC PROJECTS RETURN ON INVESTMENT	$256,241	170,500 THERMS 26,225,500 GALLONS 5,406,200 KWH	RECOMMENDED

OSCEOLA FOODS, LLC

CHRIS HOLMES
MECHANICAL ENGINEERING, THE UNIVERSITY OF IOWA

COMPANY BACKGROUND

Osceola Food, LLC, established in 1995, is a wholly owned subsidiary of Hormel Foods. Started in Austin, Minnesota in 1891, Hormel Foods is a multinational manufacturer and marketer of consumer-branded food and meat products, many of which are among the best known and trusted in the food industry. The main purpose of the Osceola Food plant is to make hams and bacon. This state-of-the-art, 330,000-square-foot facility employs about 670 people who work first, second and weekend shifts. Adjacent to the plant, an independently owned distribution center handles not only the products made at Osceola Food, but also the majority of the midwest production for Hormel Foods.

PROJECT BACKGROUND

This is the third internship project in a continued relationship between Osceola Food and the Pollution Prevention Intern Program. While previous interns focused on water usage and wastewater treatment, this year's intern examined the refrigeration system for energy reduction opportunities. The refrigeration system at Osceola Food accounts for approximately 50 percent of the company's annual electrical usage, so even minor system inefficiencies can be costly.

INCENTIVES TO CHANGE

Hormel Foods has a progressive environmental policy statement and sustainability committee that addresses energy use, water use, recycling and environmental concerns. The committee monitors progress on the corporate initiative of reducing energy use at U.S. manufacturing facilities by 10 percent over five years, ending in calendar year 2011. A significant reduction in electrical usage by the refrigeration system will help make this initiative a success for the third consecutive year.

RESULTS

Raise Low Suction: The suction pressure set point determines the lowest saturated ammonia temperature in the refrigeration cycle. The coldest freezers in the plant set the allowable low side suction pressure set point. The initial set point allowed a much larger temperature differential than necessary between the saturated ammonia in the evaporator and the lowest room temperature. The low side suction pressure can therefore be raised 7 psi in the winter and 5 psi the rest of the year while still maintaining efficient heat transfer. This change has been implemented and is currently saving $7,860 annually by reducing compressor usage by 121,486 kWh per year.

Raise High Suction: The majority of the refrigeration system operates on the high side of the multi-stage system. The maximum high side suction pressure is determined by the lowest room temperature set point on this part of the system. The current set point is lower than necessary for efficient heat transfer. The high side suction pressure can be raised 6 psi in the winter when heat loads are low, and 4 psi the rest of the year. This change is currently being tested. If implemented, it would save $56,433 annually by reducing 872,228 kWh in electrical usage per year.

Reconfigure Compressors: The last step in optimizing the suction pressures in this system would be to reconfigure the compressors. This would involve using an intermediate suction pressure in order to increase the suction pressure for the majority of the high side compressors. A single high side compressor would be run to the coolers that have the lowest temperature set point on this part of the system. This change would allow approximately 80 percent of the high side compressors to operate at a much higher suction pressure. The company could save an estimated $76,663 annually by reducing 1,184,896 kWh in high side compressor energy usage.

Compressor VFDs: Refrigeration systems have high load variations due to changes in outdoor conditions and production loads. Though compressor electrical usage isn't currently trended, it appears there are screw compressors modulating to match varying loads for much of the year. Screw compressors operate inefficiently at partial loads, using more energy than necessary. This inefficiency can be reduced by using a variable frequency drive on one compressor on each stage of the system to slow the motor when the compressor unloads. The utility provider offers a rebate for variable frequency drives that would offset some of the upfront cost of implementing this recommendation.

Reduce Hot Gas Times: Evaporators remove heat and condensation from refrigerated areas. Since the coils on the evaporators are the coldest objects in these areas, frozen condensation is formed, which blocks air flow over the evaporator coils, preventing efficient heat removal. The frost must therefore be melted at preset intervals using a hot gas defrost cycle. It was determined that the typical amount of time hot gas flowed through these coils to melt the frost was longer than necessary. These hot gas times were reduced, saving at least $1,800 annually in unnecessary heat removal alone.

Close Cooler Doors: Many cooler doors are currently left open for most of the day. While this is convenient for people and forklifts moving throughout the plant, it also increases demand on the compressors. All cooler doors currently open and close relatively easily, so it is possible to keep these doors closed most of the day. Another option is to install doors that open quickly and automatically close after a short time. It is estimated that open cooler doors are costing at least $13,030 annually considering conduction and infiltration only.

Heat Recovery: The discharge temperature of screw compressors is approximately 180° F and the discharge of reciprocating compressors is approximately 220° F. Some of the sensible and latent heat can be removed from this superheated ammonia vapor and used to heat water for sanitation purposes using a heat exchanger. The heat exchanger would heat incoming city water, offsetting some of the cost of the current water heating system. Recovering this heat all year would offset approximately 58,442 therms of natural gas usage, with an approximate annual savings of $46,754.

Lighting: Several cost-effective lighting upgrades could be made to reduce electrical usage. Many 400-watt metal halide bulbs could be replaced by 315-watt ceramic metal halide bulbs and 250-watt metal halide bulbs could be replaced by 205-watt bulbs. Additionally, there are areas in the plant that would benefit from retrofitting metal halide fixtures with fluorescent fixtures that use about half of the energy. The utility provider offers rebates for the fluorescent retrofit, and these simple lighting upgrades could save $36,820 and 569,088 kWh of electricity usage annually, with an approximate two-year payback.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
2,567.78	12.76	150.84	0.30	29.21	0.30

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RAISE LOW SUCTION	$7,860	121,486 KWH	IMPLEMENTED
RAISE HIGH SUCTION	$56,433	872,228 KWH	IN PROGRESS
RECONFIGURE COMPRESSORS	$76,663	1,184,896 KWH	RECOMMENDED
COMPRESSOR VFDS	$19,783	305,765 KWH	RECOMMENDED
REDUCE HOT GAS TIMES	$1,800	27,821 KWH	IMPLEMENTED
CLOSE COOLER DOORS	$13,030	201,391 KWH	RECOMMENDED
HEAT RECOVERY	$46,754	58,442 THERMS	RECOMMENDED
LIGHTING	$36,820	569,088 KWH	RECOMMENDED

2010 24-WEEK INTERNSHIP

PROCTER AND GAMBLE

BRANDON GOODMAN
MECHANICAL ENGINEERING, THE UNIVERSITY OF IOWA

IOWA CITY

COMPANY BACKGROUND

Since its founding in 1837, Procter & Gamble (P&G) has grown to be the world's top manufacturer of household consumer products. Originally producing soap and candles, P&G has expanded its product base to include home care, beauty care, grooming, health care, snack, and pet care business segments. P&G's Iowa City plant is the second largest production plant in the company, employing approximately 740 people. Iowa City is responsible for shampoos, conditioners, and mouth and body washes that include Clairol®, Head and Shoulders®, Gilette®, and Oil of Olay® product lines.

PROJECT BACKGROUND

In 2007, Procter & Gamble of Iowa City purchased two chillers with the capability to perform free cooling during times of colder ambient air temperatures. In free cooling mode, the machines supply chilled water to the system, but without the use of a compressor. Providing process cooling without running the compressor could supply up to one-half of P&G's chilled water demand at no cost. However, further investigation was required to determine if free cooling could meet the Iowa City facility's chilled water requirements.

INCENTIVES TO CHANGE

Procter & Gamble has long been devoted to providing the best consumer products while fostering responsible environmental practices and policies. A recent unveiling of the company's new vision for sustainability further solidified this commitment.

In line with the company's new global vision, Iowa City P&G actively pursues projects that aim to reduce raw material and water waste. As P&G is the one of the largest water and electrical users in Iowa City, small adjustments in plant processes could produce both environmental and economic benefits.

RESULTS

Chilled Water System Optimization: The catalyst for the project was to determine if the use of free cooling would be feasible at the facility. After a full chilled water loop assessment was performed, it was determined that P&G will be unable to use free cooling in the chilling of process water, due to design limitations and system requirements. In the course of investigating free cooling, alternative optimization strategies were identified. The use of variable frequency drives (VFD) were explored, with the goal of reducing overall electrical usage at the site. It is estimated that chilled water compressors account for one-quarter of P&G's annual energy costs. Small changes in drive efficiency could result in significant energy reduction, given the large number of annual chiller run hours.

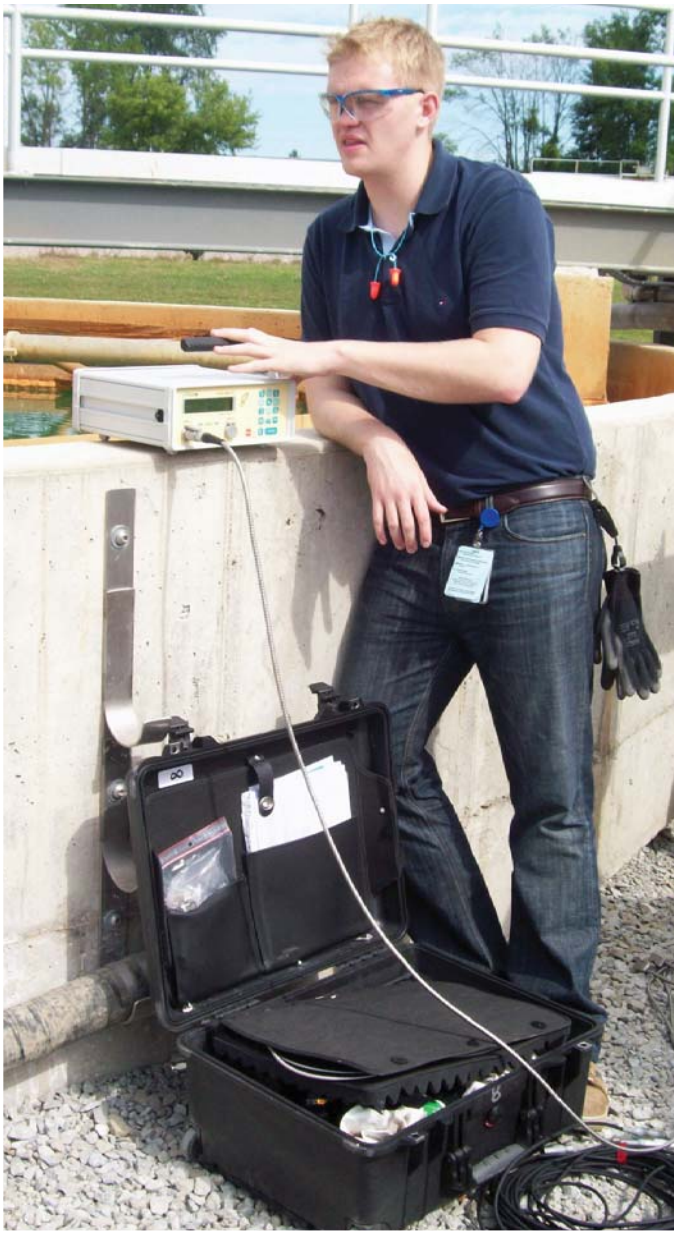
P&G's current chillers use a soft-start mechanism before elevating the compressor drive shaft to a full, fixed speed. Reducing chilled water output capacity is based upon internal chiller valve manipulation. Upgrading the current

compressor drives to variable frequency drives would allow the compressor to control the chilled water output, thus preventing wasted energy at times of reduced chiller demand.

The ability to efficiently manipulate chiller outputs would also provide additional chiller sequencing options. This is particularly important during times when plant demand requires more than one chiller, but less than the full two chillers. Using the VFD drive to trim while running a secondary chiller full-out would increase the efficiency of both machines. If implemented, VFD recommendations could provide solid year-round cost savings.

Water Mapping: As a manufacturer of soaps and body washes, P&G performs chemical processing daily and many of these processes require water. In an effort to locate water losses, a full investigation of site water usage was performed, enabling the intern to identify critical opportunities for water savings.

While several opportunities were considered, the major recommended water savings project involves reject Reverse Osmosis usage. If P&G can locate a suitable buyer for its excess HCl, the company could save more than $300,000 per year in caustic for neutralization alone. A large amount of scrubbing make-up water could also be avoided.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
4417.05	9.88	1597.58	805.29	23.72	0.52

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
FREE COOLING	$100,000	2,000,000 KWH	TEST RECOMMENDATION
CHILLER 4 VFD DRIVE	$45,000	900,000 KWH	RECOMMENDED
VFD + ADAPTIVIEW	$59,000	1,188,000 KWH	RESEARCH FURTHER
HCL REUSE	$300,000	8,000,000 GALLONS WATER	RECOMMENDED

ROCKWELL COLLINS

BRANDON GOODMAN
MECHANICAL ENGINEERING, THE UNIVERSITY OF IOWA

CEDAR RAPIDS

COMPANY BACKGROUND

Rockwell Collins is a pioneer in the development and deployment of innovative communication and aviation electronic solutions for both commercial and government applications. The company has placed its mark on nearly every major aviation success of the last 75 years. The company's expertise in flight deck avionics, cabin electronics, mission communications, information management, simulation and training is delivered by nearly 20,000 employees, and a global service and support network that crosses 27 countries.

PROJECT BACKGROUND

The 2011 intern evaluated Building 105, located at the Rockwell Collins C Avenue Complex in Cedar Rapids, Iowa. The goal of the evaluation was to determine the current condition of the heating, ventilation and air conditioning (HVAC) system in the aging facility. Once comprised entirely of machining space, Building 105 has undergone a number of renovations since its construction in 1958. As a result, the HVAC system no longer matches its service area. Additionally, adjacent office and machining spaces result in temperature/pressure gradients within the building envelope. Establishing a baseline of efficiency for Building 105's air handling system would allow Rockwell Collins to evaluate efficiency overtime and identify potential maintenance issues prior to costly machine failures.

INCENTIVES TO CHANGE

Rockwell Collins has a relentless focus on continuous improvement that has spawned environmental savings projects as the company recognizes and works to reduce its carbon footprint. In recent years, the company has developed its environmental program to include a department devoted solely to environmental awareness. The Global Sustainability team evaluates and helps with projects that support environmental stewardship. The team's goal is to cut CO_2 emissions by 3 percent annually over a five-year period. This is the company's fifth year of participation in the Pollution Prevention Intern Program.

RESULTS

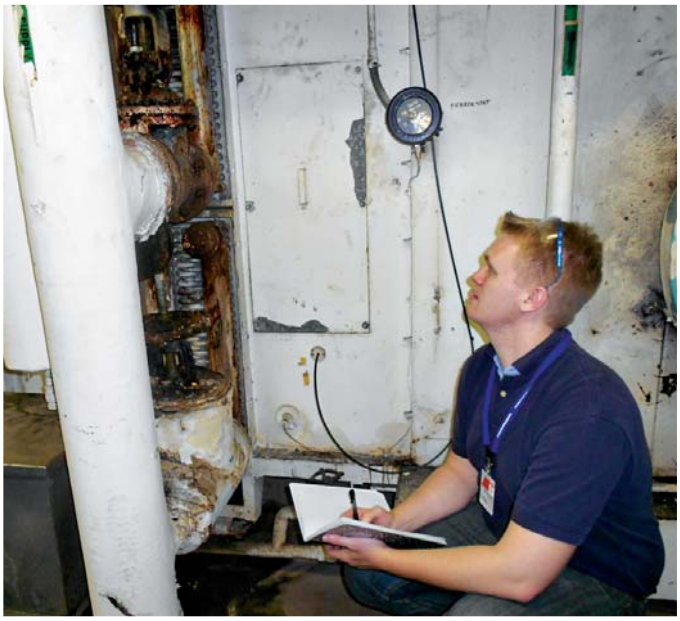
Evaluation of the Building 105 HVAC system resulted in three major cost savings recommendations and one project deemed cost-prohibitive. These projects include variable frequency drive (VFD) installation, air handler replacement, air handler coil replacement, and space destratification.

Variable control drives offer a wide range of operational benefits in addition to paying for themselves in energy rebates. Currently, the Building 105 air handlers use standard motors operating at constant rotational velocity. With VFD, the motor rotation could be modulated, allowing for soft-starts and air handler setbacks during nights and weekends.

At 80 percent load, the recommended drives would provide an approximate 50 percent greater energy savings than the current motor arrangement, with a simple payback of approximately 1.5 years.

Due to equipment age, some units may benefit more from a full replacement of the air handlers. New units could offer many benefits, including decreased maintenance, increased insulation, variable air volume controls, and increased air quality controls. Installing new coils alone would be too costly an investment in the current air handling units and would do very little in the way of increasing the overall building efficiency. Full unit replacement, however, would bring the Building 105 HVAC system up-to-date and provide building operators with a wider range of control options with which to maintain building air conditions.

The fourth project identified during the Building 105 HVAC evaluation involved air destratification. Using temperature probes, the intern evaluated the stratification of the Building 105 machining areas to determine if the air at the ground level was hotter or cooler than the air at the ceiling level. On average, a 5° F temperature difference was observed. At one point, the air at the ceiling level was 10° F above the air at the floor level. During winter months, the heat loss through the building envelope can be significant. Destratification would force the rising warm air back down to user level, reducing the overall strain on the HVAC system and increasing worker comfort. Early research suggests a three- to five-year payback period for a destratification project.



CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
1134.11	5.84	36.92	0.051	13.26	0.13

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
VARIABLE CONTROL DRIVE INSTALLATION	$29,224	449,605 KWH	RECOMMENDED
AIR HANDLER FULL REPLACEMENT	$48,334	743,613 KWH	RECOMMENDED
AIR HANDLER COIL REPLACEMENT	$16,406	252,434 KWH	NOT RECOMMENDED
MACHINING AREA DESTRATIFICATION	$4,227	65,031 KWH	SEASONAL REVIEW RECOMMENDED
IN-HOUSE HVAC TOOL DEVELOPMENT	$3,000	NONE	IMPLEMENTED

ROSENBOOM MACHINE AND TOOL

TIMOTHY JACKELS
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

SPIRIT LAKE

COMPANY BACKGROUND

Rosenboom Machine & Tool, Inc. manufactures custom hydraulic cylinders for a variety of markets. The Sheldon, Iowa plant is home to the corporate headquarters and also includes a 200,000 square foot manufacturing plant. The company has added a 250,000-square-foot plant in Spirit Lake. These two plants operate 22 hours per day, six days per week. Raw material enters the plant and is turned, milled, welded, and assembled into cylinders. The cylinders are then pressure tested and painted per customer requirements.

PROJECT BACKGROUND

The intern conducted an energy audit at the Spirit Lake and Sheldon manufacturing plants. An energy profile of the plants shows the amount of electricity and natural gas consumed per year and identifies areas of energy use. After identifying major energy consumers, the intern focused on identifying opportunities to improve efficiency of individual systems.

INCENTIVES TO CHANGE

Rosenboom Machine & Tool teamed with the Pollution Prevention Intern Program to strengthen its environmental stewardship and to lower operating costs at its Spirit Lake and Sheldon facilities. Reducing energy use at the source is often overlooked, but is the most effective way to minimize waste.

RESULTS

Energy Audit: An energy audit at each of the plants identified major consumers of electricity and natural gas. This information can be used to identify opportunities to increase efficiency and reduce utility bills. Areas of high consumption include plant lighting, compressed air, cooling and ventilation.

Lighting Retrofit: Almost 1,000 metal halide lamps illuminate the Spirit Lake manufacturing facility. These fixtures consume almost half of the total electricity supplied to the plant, at 2.9 million kilowatt-hours. Replacing the metal halide lamps with efficient light-emitting diode (LED) fixtures would significantly reduce electricity consumption and maintenance costs.

Lighting Maintenance: The Sheldon facility is currently lit by T8 fluorescent fixtures. When the facility replaced its high-

intensity discharge lamps with these fixtures, six times the number of lamps was required. An optimized maintenance plan could increase lighting levels by 20 percent while also reducing workload on the maintenance personnel who need to monitor all of the fixtures.

Air leak Detection: Implementing a leak detection plan can keep air leaks under control in the most efficient way possible. An ultrasonic leak detector (ULD) can identify leaks quickly and accurately. A ULD amplifies the noise created by air rushing out of the high pressure air lines and provides a reading that can be used to estimate the size of the leak. Repairing leaks could reduce compressed air use by 44 percent at Spirit Lake and 30 percent at Sheldon. Purchasing a ULD would allow maintenance personnel to carry out an ongoing maintenance plan to keep the system operating efficiently.

Heat Recovery: Any heat that leaves the building envelope must be replaced by the natural gas-fired makeup air units. At the Sheldon facility, heat freely leaves the building through exhaust fans. A heat recovery ventilator (HRV) transfers heat from the exhaust air to the intake air, and therefore reduces the load on the burners. Installing a HRV could reduce natural gas consumption in the Sheldon plant by 40 percent.

Thermal Storage: The chilled water system uses two 500-ton chillers to provide enough cooling capacity to keep the plant at a set temperature of 77°F. Running two chillers creates a large electricity demand, and utility companies charge extra for energy demand during peak daylight hours. Adding thermal energy storage (TES) would allow the chillers to run overnight to create ice, which can be melted during peak hours to reduce or eliminate the need to run the chillers. Installation of a TES could reduce the plant's peak energy demand by 22 percent in the summer months.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_20	CFC	PM-10
2,187.00	11.06	100.68	0.18	25.21	0.25

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LIGHTING RETROFIT	$150,000	1.8 MILLION KWH	RECOMMENDED
LIGHTING MAINTENANCE	$3,000	--	RECOMMENDED
AIR LEAK DETECTION	$40,000	582,000 KWH	RECOMMENDED
HEAT RECOVERY	$20,500	34,000 THERMS	RECOMMENDED
THERMAL STORAGE	$30,000	360 KW PEAK REDUCTION	RECOMMENDED

2011

24-WEEK INTERNSHIP

CASE SUMMARIES

To better assist our clients, Pollution Prevention Services now offers 24-week internships. This additional time allows interns to explore more in-depth opportunities, such as setting up prototypes for testing alternative technologies, evaluating outcomes of trial runs, or even implementing strategies within the timeframe of the internship.

A 24-week internship can provide benefits to both companies and students. Companies have the opportunity to pursue projects that would otherwise be too time consuming. Students get first-hand experience in learning about a complex system, and identifying and overcome challenges they would not encounter in a classroom or less-extensive internship. While a 24-week internship is not feasible for all companies or interns, it has proven to be a viable option for addressing larger projects.

On the following pages you will see case summaries of five 24-week projects currently underway. These projects are slated to end in November 2011. The full case summaries for these projects will be posted on the Pollution Prevention Intern Program website at **www.iowap2services.com** in December and printed in the 2012 Case Summary Booklet.

CNH AMERICA, LLC

MATT BONNEY
MECHANICAL ENGINEERING AND PHYSICS, THE UNIVERSITY OF IOWA

BURLINGTON

COMPANY BACKGROUND:
Case New Holland (CNH) was formed in 1999 when New Holland HV and Case Corporation merged, and is now part of the Fiat Group. Rising to be a leader in the manufacturing of construction and agricultural equipment, CNH is a global company with dealers in 170 locations and manufacturing plants in 16 countries. The Burlington plant is one of 11 CNH manufacturing plants in the United States. Approximately 600 people are employed at the Burlington plant, which makes tractor loader backhoes, utility tractors, rough terrain forklifts and combine headers.

PROJECT BACKGROUND

This is the fourth year of participation in the Pollution Prevention Intern Program for the CNH Burlington plant. The purpose of this year's 24-week project was to create an energy profile of the Burlington plant and identify opportunities for saving energy and reducing costs. Options included reducing demand and power factor costs. Other projects will be prioritized based on a matrix of efficiency and potential cost savings. The major focus was on lighting, ventilation and proper equipment efficiencies.

INCENTIVES TO CHANGE

CNH-Burlington spends more than $100,000 per month for electricity in the production plant. Peak demand charges and power factor charges account for a significant amount of this cost. This profile revealed preliminary information on where and when the energy is being used, in order to guide reduction efforts. An objective of the Fiat Industrial Group is to ensure that each of its plants is a "Green Plant".

RESULTS

Lighting Retrofit: The plant spends approximately $20,000 per month on lighting. This cost could be lowered by reducing excessive lighting, inefficiencies and improving controls. This project focused on improving efficiency in the lighting system. The predominant form of lighting at the plant has been 400 watt metal halide fixtures, although some areas have been upgraded to 320 watt fixtures. Retrofitting the lighting to 200 watt fluorescent fixtures would improve energy efficiency and control capabilities, resulting in reduced costs.

The proposed project is to retrofit two buildings that were determined to have higher lighting power density. In addition to new fixtures, occupancy sensors installed in certain areas could further reduce the energy load. The two buildings are mainly used for storage, light

assembly and welding. The intern is evaluating an upgrade to fluorescent fixtures on several other buildings and installing control systems on all buildings.

Fan Replacement: Throughout the plant, more than 500 fans are used to keep workers comfortable. Most of these fans are old and inefficient wall-mounted units that contribute to the low power factor of the plant. The intern proposed to replace 295 of these fans with new units that have a significantly higher power factor and the ability to either increase or match the performance of the current fans.

On-Going Projects: In the next 12-weeks, the intern will evaluate strategies and prioritize recommendations for reducing energy usage. The intern will focus his evaluation on three main areas of the plant including the heating, ventilation and air conditioning (HVAC) system, ovens used in the paint curing system, and alternative energy generation.

The HVAC system has served the company well for many years. Much of the equipment is now more than 40 years old and some is no longer operational. Many new technologies have been developed since this equipment was originally put into service. The company also experiences an air balance problem during the winter when all the doors are closed.

A large, multi-component oven, used to cure paint on the parts, is housed in a 60-foot-tall building. All parts combined, the oven uses around 1,000 KW and 232 therms per hour when operating. Some of the components run continuously to prevent the paint from solidifying. The intern will evaluate retrofits for the oven to reduce the amount of energy used in the curing process.

The intern will research purchase, installation, and operating costs of alternative technologies for generating electricity. To be cost effective, it is important that a plant become as efficient as possible before investing in alternative energy technologies so that the new system may be sized correctly and operate efficiently once installed. The intern will provide information on initial considerations for using solar technology to run water heating and space heating systems and on hydroelectric generation to provide electricity to the plant.

CONAGRA FOODS

CHELSEA TOMEK
INDUSTRIAL ENGINEERING, IOWA STATE UNIVERSITY

COUNCIL BLUFFS

COMPANY BACKGROUND

ConAgra Foods® is proud to make the food people love, manufacturing and marketing leading branded and specialty food products to retail and foodservice customers in the United States and internationally. The company's consumer foods are found in 97 percent of America's households, and 25 of them are ranked first or second in their category. The Council Bluffs plant manufactures exclusively frozen foods brands, including Marie Callender's®, Banquet®, and Healthy Choice® meals. The plant is built on a 17-acre plot of land and employs more than 850 people.

PROJECT BACKGROUND

ConAgra Foods operates a frozen meal assembly plant located in the business district of Council Bluffs, Iowa. ConAgra Foods maintains a comprehensive safety, health, and environmental management program at the plant. The program includes engineering, education and enforcement provisions for hazard communication; spill preventions and response; hazardous waste; universal waste and oil management; wastewater and storm water management.

INCENTIVES TO CHANGE

In 2009, ConAgra Foods outlined five long-term sustainable development goals to work toward becoming a more environmentally-friendly company. One of these goals is to divert at least 75 percent (or 10 percent above the baseline, if greater) of the company's solid waste from landfills. Achieving these goals will not only benefit the environment, but may also result in significant cost savings to the company as well. The Council Bluffs plant currently diverts 50 percent of its solid waste, including wooden pallets, plastic and metal barrels and corrugated cardboard.

RESULTS

Plant-Wide Recycling Initiative: In order to track the amount of recycling the plant was undertaking, the intern compiled and summarized data to create a baseline of current and historical landfill and solid waste disposal costs. The landfilled and diverted waste tonnages, as well as the associated revenue/costs are recorded monthly in ConAgra Foods' Sustainable Development Reporting Tool (SDRT). This tool is used by all ConAgra Foods plants to measure the extent to which the certain sustainability goals, including solid waste diversion from landfills, are being met. Information is now compiled in one organized location to track all streams.

Organizing and implementing a sustainable, plant-wide recycling program is the intern's main task. The plant has three

main areas of production, and each area has three production lines that are each capable of producing many different types of meals, causing variability in the amount and type of recyclables produced. The intern will develop a plan for collecting recyclables on each production line for every type of meal, and will develop and conduct employee training accordingly.

While the recycling process is being designed, the intern will form and lead a "green team" of employees across the plant interested in driving the sustainability movement. This team will work with the intern to train employees, organize recyclable collection, and maintain the recycling program after the internship is complete.

Wastewater Reduction: The flooding during the summer of 2011 caused a heightened awareness concerning the company's wastewater handling, and provided the opportunity to handle the liquid waste and the solids removed from wastewater in a more economical and ecological manner. Historically, leftover liquid ingredients and wastewater sludge were collected in a pump truck and disposed of at a municipal waste facility in Omaha. The intern researched options and proposed a plan to dry the plant's wastewater sludge and use the cake for land application or composting, reducing trucking costs as well as vehicle emissions. The intern will continue to search for the best outlet for the liquids, and will make recommendations accordingly.

KRAFT FOODS GLOBAL INC.

TYLER PLATT
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

MASON CITY

COMPANY BACKGROUND

Kraft Foods was founded in 1903 and is the largest food and beverage company headquartered in North America and the second largest worldwide. After its acquisition of Cadbury plc, net revenues topped $49 billion in 2010. Kraft Foods produces many leading food brands, including Cadbury®, Philadelphia®, Nabisco®, Trident®, Jell-O®, Oscar Mayer® and many more. The company employs approximately 127,000 people worldwide. Kraft's Mason City, Iowa plant is a producer of Jell-O ready-to-eat dessert cups and employs 274 people.

PROJECT BACKGROUND

Currently, Kraft Foods of Mason City treats wastewater using a dissolved air flotation (DAF) process before it goes into the city sewer system. The plant pays the city wastewater fees to do this, and also pays to have a by-product of the process land applied. These costs and the desire for sustainability improvements are prompting an examination of a micro-filtration system for the facility's wastewater.

INCENTIVES TO CHANGE

As water and wastewater treatment costs continue to rise, curbing these expenses becomes more attractive and can result in measureable sustainability benefits. Kraft plans to continue reducing its water use, and looks for ways to improve its wastewater processing systems, as well.

RESULTS

Microfiltration Wastewater Treatment: If a microfiltration system with alternative treatment chemicals was used instead of the current DAF treatment system, it may be possible to clean water to the point where it can meet direct discharge limits and enable the use of the dry sludge that is produced for animal feed. This would divert some by-product from land application and reduce wastewater costs. Additional opportunities are being evaluated to reuse the cleaned wastewater, which will reduce water use. The intern will assist with additional testing of the microfiltration system, as well as identifying cost reductions and alternate uses for the water and by-product.

Cooling Tower Bleed Controls: Cooling towers use evaporative cooling to exhaust unwanted heat from process equipment in the plant. As water in the cooling towers evaporates, minerals within that water are left behind and can create scaling problems if some water is not removed from the tower and replaced with clean makeup water.

Currently, valves for the facility's cooling towers are manually controlled, resulting in excess water use due to removing too much water. Automatic controls use conductivity to measure mineral content and trigger valves to keep mineral concentrations at acceptable levels. The intern will be evaluating the feasibility and savings potential of installing these automatic controls.

Additional Flow Metering: To identify opportunities to save water, it is important to know how water is being used. The plant currently tracks much of its water use. However, installing several additional meters in the plant would help further pinpoint future opportunities. The intern will identify processes where additional monitoring and use information would most likely provide opportunities for improvement.

Low-Flow Hose Nozzles: Throughout the plant, hoses are used for general cleaning purposes. Current hose nozzles have a flow rate of 7 gallons per minute. Installing lower-flow nozzles would reduce water use and associated costs without compromising cleaning ability.

Boiler Economizers: Plant use of multiple boilers fluctuates at any given time. When the boilers were originally installed, each was equipped with feed water economizers that used waste heat from their exhaust gases to preheat boiler feed water. Today, the economizers are no longer operational. The company could save natural gas use and energy costs by reinstalling economizers on the boilers. The intern is evaluating the feasibility and savings potential of reinstalling economizers.

MONTEZUMA MANUFACTURING

DANIEL NEWKIRK
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

MONTEZUMA

COMPANY BACKGROUND

Montezuma Manufacturing, a division of Cosma International, first opened its doors in 1972. The company specializes in deep draw stamping mild and stainless steels and robotic welding lines featuring metal inert gas (MIG), spot and projection welding. Major customers include General Motors (GM), Ford and Chrysler, to whom the company provides frame rails, heat shields, panel wheelhouses, door reinforcements, inlet pipes, catalytic converter shields and floor pans.

PROJECT BACKGROUND

The focus of the 24-week project was to conduct a facility energy audit to identify opportunities to improve efficiency of the compressed air, heating, ventilation and air conditioning (HVAC), and lighting systems. The focus was on compressors, make-up and infrared heating, traditional air conditioning, ventilation for welding processes, and fluorescent and halide lighting. The intern completed the energy audit in the first 12 weeks and will continue to research options for these systems and provide recommendations to reduce energy consumption during the remaining time on site.

INCENTIVES TO CHANGE

As part of Cosma International, Montezuma Manufacturing is joining its parent company's global initiative to cut costs and reduce energy wherever possible. To achieve these goals, the company needs to conduct a thorough energy audit, develop energy-saving strategies and adopt pollution prevention methodologies. By minimizing waste at the source, the company will reduce emissions, costs and risks and exceed regulatory standards.

RESULTS

Normalize Electrical Demand: Peak demand charges represent over 35 percent of the electrical utility bill at Montezuma Manufacturing. These charges may be reduced by normalizing the plant's half-hourly energy consumption. Methods of achieving these savings include schedule changes and the use of soft starting motors.

Repair Compressed Air Leaks: Almost 40 percent of compressed air output is currently being lost to air leaks. More than one compressor is necessary to supply leaks alone. The intern used an ultrasonic leak detector to find and tag air leaks in the system. Most of the leaks can be repaired with little or no capital cost, which would greatly reduce operating costs.

Convert Compressor Oil to Off-Brand Synthetic Lubricant: The company could reduce costs by switching to an alternate lubricant. Alternate synthetic lubricants can meet or exceed the performance of manufacturer-supplied lubricants at a fraction of the cost. Changing to a synthetic lubricant has proven to increase the operating efficiency of the equipment and provide cost savings to the company.

Intake Outside Air for Compressors: Compressors currently run in a high heat and contaminant environment. Industry's common practice of pulling outside air would provide the cool, dry, clean inlet air the compressors need to run at optimum efficiency. Minimal implementation costs would be incurred to install the necessary piping.

Increase Compressed Air Storage: Proper demand side storage normalizes system pressure, allowing for decreased production pressure, and also decreases loaded cycle time for all compressors. Although initial costs may be high, the indirect savings that would be realized by increasing compressed air storage could make this option feasible.

Increase Compressor Maintenance Check Frequency: Proactive preventative maintenance is essential for keeping compressors running at optimum efficiency. The company could realize considerable cost savings by increasing preventative maintenance of its compressors.

Eliminate Cleaning with Compressed Air: Cleaning with compressed air is a costly, inefficient and often unidentified electrical consumer, so minimizing its use is recommended. Often, cleaning can be accomplished equally well with brushes and brooms. In cases where blowing is required, an electrical blower would use 15 times less energy than compressed air.

VERMEER CORPORATION

JEFFREY GORRIE
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

COMPANY BACKGROUND

Founded in 1948, Vermeer Corporation has grown from a one-man operation into an international leader in the manufacture of agriculture, construction, mining and forage equipment. At the Pella campus, more than 2,000 employees work across seven manufacturing plants and 1.5 million square feet to research, design, assemble and fabricate the full line of Vermeer products.

PROJECT BACKGROUND

As an aid to its Environmental Health and Safety Department, the Pollution Prevention intern will help Vermeer reduce its environmental impact throughout the manufacturing process. After two successful internships with the program, Vermeer is hosting an intern that will complete a campus-wide energy audit and projects to conserve electricity and natural gas.

INCENTIVES FOR CHANGE

Vermeer strives to integrate Lean principles into every aspect of the business — quality, cost, delivery, safety and morale. The company is committed to improved production efficiency and enhanced product quality and reliability, and continually evaluates all processes to identify opportunities to improve efficiency.

Current projects at Vermeer include implementing an extensive recycling program, upgrading lighting and installing a geothermal cooling loop. Recently, Vermeer set a goal to reduce both electrical and natural gas consumption by 10 percent. Reducing waste and using energy more efficiently could significantly lower utility costs and keep the company competitive in foreign markets.

RESULTS

Destratification Fans: Stratification is the phenomenon of warm air rising in an indoor environment. Vermeer has documented a temperature differential of 10 – 20 °F from the floor to the ceiling. During the winter months, providing heat to the buildings accounts for a large portion of Vermeer's energy use. Most of this energy is heating the upper half of the building, when the heat is needed at the work level below. Destratification fans are high-efficiency units that force a column of warm air down to the actual workspace. The redistribution of warm air would provide a more thermally equalized work environment and reduce heating costs.

Lighting Occupancy Sensors: Lighting accounts for 10 to 15 percent of the electrical consumption in each building.

Occupancy sensors turn lights off when the work area is not occupied. Installing occupancy sensors in lower traffic areas of the buildings could produce substantial savings.

Vending Misers: Vending misers operate as occupancy sensors for vending machines; they turn off the lights and reduce the number of refrigeration cycles when not in use. Installing vending misers could reduce the energy use of each vending machine by approximately 46 percent.

Variable Frequency Drive (VFD) Motors on Engine Exhaust Fans: A VFD adjusts the operating frequency of the motor based on demand. Vermeer currently uses a large electric motor and drop-down piping to expel exhaust outside the building when a piece of equipment is in use. One large pipe comes down from the blower, with four to six drop-down pipes coming off of the main pipe. These drop-down pipes connect to the exhaust point of a gas-powered engine. The exhaust runs at full load capacity at all times.

Along with installing VFDs on the motor, dampers should be installed on the drop-down pipes to close a pipe when not in use. A pressure sensor determines the exhaust load from the open pipes and regulates the AC motor current based on the demand. In addition to producing significant electrical savings, this modification would keep more warm air inside the building, reducing the natural gas load on the heaters.

Waste Heat Recovery on Air Compressors: Warm air from the compressors is expelled at approximately 144°F. Rerouting this air into the adjacent work areas could reduce the heating load in three buildings. To avoid excessive heat in the summer, a split in the air exhaust piping would allow the heat to be rerouted into the adjacent work areas in the winter and expelled into the atmosphere in the summer.

VFDs on Multi-stage Washer Motors: Currently, a throttling valve controls the flow characteristic of the multi-stage washer line. Energy can be conserved by replacing the throttling valve with a VFD that would regulate the AC motor current. A VFD could reduce the energy use of these motors up to 50 percent.

Chiller Economizer Package for EcoCenter Distiller: Vermeer is in the process of installing a cold water chilling loop to cool the distillation process in the EcoCenter. An

economizer package added to this system would utilize cold air from the environment when the temperature is below the set point. The economizer could provide free cooling for approximately 27 percent of the year.

Energy Recovery Makeup Air Handling Units (MAUs): The heating, ventilation and air conditioning equipment on one building is not performing satisfactorily and will likely be replaced to ensure the specified five air exchanges per hour. Heat recovery MAUs transfer the heat from hot outgoing air to the cool incoming air. Installing heat recovery MAUs when replacing this equipment could reduce heating costs by up to 61 percent.

Paint Burn Off Oven Waste Heat Recovery: An oven in the EcoCenter burns paint from the hooks used to hang parts on the paint line. This oven expels air at 850–1400°F. The company could harvest this energy to create electricity.

Paper Towel Replacement: Reducing paper towel consumption by 80 percent at Vermeer could save $29,000 dollars annually and divert 7.82 tons of landfill waste. Efficient blow dryers that provide a 12.5-second dry time are an efficient alternative to the costly paper towels.

2011 PROJECT INDEX

POLLUTION PREVENTION INTERN PROGRAM

BOILER EFFICIENCY
- KRAFT FOODS GLOBAL INC. – 2011 24-WEEK PROJECT

COMPRESSED AIR SYSTEM EFFICIENCY
- AMERICAN PACKAGING
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- LAFARGE NORTH AMERICA
- MONTEZUMA MANUFACTURING – 2011 24-WEEK PROJECT
- ROSENBOOM MACHINE AND TOOL

ENERGY SAVINGS
- 3M COMPANY
- AMERICAN PACKAGING
- CNH-AMERICA, LLC – 2011 24-WEEK PROJECT
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- GREEN PLAINS SUPERIOR LLC
- KUM & GO – 2010 24-WEEK PROJECT
- LAFARGE NORTH AMERICA
- MERCY MEDICAL CENTER – DES MOINES
- MONTEZUMA MANUFACTURING – 2011 24-WEEK PROJECT
- NEBRASKA MEDICAL CENTER
- OSCEOLA FOODS, LLC
- PROCTER AND GAMBLE – 2010 24-WEEK PROJECT
- ROCKWELL COLLINS
- ROSENBOOM MACHINE AND TOOL
- VERMEER CORPORATION – 2011 24-WEEK PROJECT

HAZARDOUS WASTE REDUCTION
- EAGLE WINDOW AND DOOR
- INFASTECH™
- IOWA HEALTH SYSTEM
- JBS USA

HEAT RECOVERY
- AMERICAN PACKAGING
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- MERCY MEDICAL CENTER – DES MOINES
- OSCEOLA FOODS, LLC
- ROSENBOOM MACHINE AND TOOL
- VERMEER CORPORATION – 2011 24-WEEK PROJECT

REFRIGERATION SYSTEM EFFICIENCY
- KUM & GO – 2010 24-WEEK PROJECT
- OSCEOLA FOODS, LLC

HVAC EFFICIENCY
- 3M COMPANY
- CNH-AMERICA, LLC – 2011 24-WEEK PROJECT
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- MERCY MEDICAL CENTER – DES MOINES
- ROCKWELL COLLINS
- VERMEER CORPORATION – 2011 24-WEEK PROJECT

LIGHTING
- ARMOUR-ECKRICH MEATS LLC
- CNH-AMERICA, LLC – 2011 24-WEEK PROJECT
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- KUM & GO – 2010 24-WEEK PROJECT
- OSCEOLA FOODS, LLC
- ROSENBOOM MACHINE AND TOOL
- VERMEER CORPORATION – 2011 24-WEEK PROJECT

PROCESS IMPROVEMENT
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- CONAGRA FOODS – 2011 24-WEEK PROJECT
- EAGLE WINDOW AND DOOR
- EMCO ENTERPRISES
- GREEN PLAINS SUPERIOR LLC
- JBS USA
- KUM & GO – 2010 24-WEEK PROJECT

SOLID WASTE REDUCTION
- CONAGRA FOODS – 2011 24-WEEK PROJECT
- EMCO ENTERPRISES
- VERMEER CORPORATION – 2011 24-WEEK PROJECT

WATER USE REDUCTION
- ARMOUR ECKRICH MEATS LLC
- CNH-AMERICA, LLC – 2010 24-WEEK PROJECT
- INFASTECH™
- IOWA HEALTH – DES MOINES
- KRAFT FOODS GLOBAL INC. – 2011 24-WEEK PROJECT
- JBS USA
- PROCTER AND GAMBLE – 2010 24-WEEK PROJECT

WASTE WATER TREATMENT
- ARMOUR-ECKRICH MEATS LLC
- KRAFT FOODS GLOBAL INC. – 2011 24-WEEK PROJECT

Join the P2 INTERN PROGRAM in 2012!

STUDENT APPLICATION & BUSINESS REQUEST FORMS are available online at:
www.iowap2services.com
Forms may be submitted electronically, faxed or mailed.

FOR COMPANIES

Companies who are committed to implementing cost effective pollution prevention methodologies and reducing environmental impacts should submit a request that identifies a focus project and outlines the desired objectives and deliverables. Business selection criteria is based on the project's relationship to the pollution prevention hierarchy - focusing on source reduction first, then reuse and recycling, risk reduction potential and environmental impacts.

Companies that would like to be considered for participation in the 2012 Pollution Prevention Intern Program should submit a project request by DECEMBER 1, 2011.

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

FOR STUDENTS

Graduate and junior or senior-level undergraduate students enrolled in engineering, environmental science or physical science disciplines are encouraged to submit an application, along with a résumé, cover letter, an unofficial copy of transcripts and a list of fall 2011 and spring 2012 classes. The intern selection process will begin mid-November and continue into the Spring until project assignments are finalized.

POLLUTION PREVENTION SERVICES IS OFFERING INTERNSHIPS FOR:
12-weeks (May 21-August 10) or 24-weeks (May 21-November 9) in 2012.

Selected applicants will be matched to a project based on coursework performance, experience and technical skills.

SUBMIT PROJECT REQUESTS & APPLICATIONS TO:

DANIELLE DILKS, P2 Intern Program Coordinator
Iowa Dept. of Natural Resources
502 East Ninth Street
Des Moines, IA 50319-0034

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pollution prevention services

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