2009 POLLUTION PREVENTION INTERN PROGRAM

CASE SUMMARIES

WORKING TOGETHER TO ACHIEVE ECONOMIC AND ENVIRONMENTAL RESULTS

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2009 POLLUTION PREVENTION INTERNS

STUDENTS' PERSPECTIVES

"This internship is something I will certainly carry with me into my post-collegiate career. It was a great way to get into a plant, learn the process and find some opportunities for change. I really feel like I made an impact on how the company operates and will be taking this experience with me wherever I end up."

PAUL PERKINS-McINTOSH,
AMERICAN PACKAGING CORPORATION

"The success of the project was my responsibility and I was able to take it in any direction that was necessary. Most importantly the internship confirmed that I want to work in the environmental engineering field after graduation. I had a great opportunity to learn hands-on and to apply what I have learned in my coursework. Whenever I had a problem I had a chance to troubleshoot it myself."

HEATHER COPELAND,
TYSON FOODS, INC.

"The pollution prevention internship is personally satisfying because allows us to make an environmental and social impact at an early stage in our career. On a professional level, this internship has given me invaluable experience in the working world that I would never receive at college, and has allowed me to make a real economic contribution to the company I work for."

DAVID JONES,
NEBRASKA MEDICAL CENTER

"The amount of information I learned in 12 weeks is about the same as an entire year of school. The pollution prevention internship was one of my most eye-opening experiences in engineering. The textbook only tells half of the story; the rest is out on the floor."

ANDREW PATZ,
CITY OF PELLA

DIRECTOR'S NOTE

Iowa businesses continue to face tough challenges as the impacts of the global recession reach our state. Sharp drops in global trade and reduced consumer spending brought on by record unemployment are shrinking profits and forcing layoffs and closures. This all comes at a time when Iowa businesses and consumers are beginning to embrace "green" concepts and recognize the economic benefits of being good environmental stewards.

As profits fall, business interest in making capital improvements – particularly those that address environmental concerns and resource management issues – fall with them. Too often, businesses look at resource conservation projects, such as energy efficiency improvements, as expenses rather than investments with long-term economic benefits.

Environmental and economic sustainability, however, are compatible concepts that support like goals. It is more important than ever for businesses to recognize that the implementation of sustainable resource management processes can serve as a hedge against the impacts of our current economic downturn while benefiting our environment and protecting our natural resources.

Now, more than ever, programs like the Iowa Department of Natural Resources' (DNR) Pollution Prevention Intern Program serve as valuable tools for developing and promoting the shared benefits of environmental and economic sustainability. Developed and implemented in 2001, the program has functioned as a collaborative effort between government, business, and academia to develop cost-effective options for preventing or minimizing pollution from industrial processes. The program has been an extraordinary success for Iowa businesses and college students alike.

Pollution Prevention Interns are matched with companies based on their expertise, academic experience, and personal interest. For eleven weeks, they apply their skills through hands-on interaction with real projects. Throughout that eleven-week experience, students are conditioned to consider the life cycle environmental impacts of their decisions, encouraged to persuade businesses to investigate fully both the economic and environmental consequences of the business decisions they make, and challenged to go into their careers asking the tough questions that effect change.

Since 2001, the implementation of Pollution Prevention Intern recommendations has saved Iowa companies more than $58.6 million. You, too, can partner with the Iowa DNR by applying for our summer of 2010 Pollution Prevention Intern Program. I encourage you to read the case studies and student testimonials that follow.

RICHARD A. LEOPOLD

TOTAL IMPLEMENTED ACTUAL SAVINGS 2001 - 2009

CATEGORY	REDUCTION	COST SAVINGS
WATER CONSERVATION	1,002,018,412 GALLONS	$4,839,932
SPECIAL WASTE	83,646 TONS	$1,037,912
SOLID WASTE	117,475 TONS	$12,144,142
HAZARDOUS WASTE	1,179,655 GALLONS 118 TONS	$9,269,403 $217,177
MERCURY ABATED	42,812 GRAMS	-
ENERGY	258,669,658 KWH 16,576,117 THERMS	$14,380,578 $4,756,889
OTHER	-	$11,980,728
BOD	104	$26,640
		TOTAL $58,653,401

2009 EXECUTIVE SUMMARY

Twenty-four upper level engineering students from Iowa colleges and universities served as interns in the 2009 Iowa Pollution Prevention Intern Program.

The intern program is an extension of Pollution Prevention Services, a non-regulatory program of the Iowa DNR that offers confidential technical assistance to Iowa businesses and industries. Interns are placed at host facilities to analyze the company's waste streams and research and recommend process improvements that will lower operating costs while reducing their impact on the environment.

For 2009, the program offered two circuit rider projects: thermal imaging in industrial facilities and source reduction in hospitals. These projects offer the opportunity to assess targeted waste streams that are common to specific processes and industries.

With funding assistance from a U.S. Environmental Protection Agency (EPA) grant, the program purchased an infrared camera to identify sources of radiant energy loss and make recommendations for modifications that will improve efficiency. The project intern visited numerous facilities, identifying these sources and recommending corrective actions. Additionally, the intern demonstrated methods for using thermal imaging in predictive and preventative maintenance procedures. This pilot project will help in establishing parameters for integrating thermal imaging into the technical assistance offered by Pollution Prevention Services.

Continuing a three-year partnership with the EPA, the intern program helped hospitals identify remaining sources of mercury and improve energy efficiency within their facilities. The intern assigned to this project visited seven hospitals in Iowa and two in Nebraska. Through those visits more than 24 pounds of mercury was identified throughout the nine facilities and recommendations were made for abatement. Opportunities to reduce energy consumption were also identified at each facility.

Also highlighted in this edition of case summaries are two 24-week projects, completed in November 2008. Twenty-four week projects allow an intern to collect data over time, and evaluate a system through varying conditions. These extended internships allow more opportunity for the intern to begin implementation of the projects they have recommended. The host company benefits by having continuous oversight of initial stages of the implementation, while the intern gains additional hands-on experience and is able to see the project through to fruition.

Overall, companies served by the Iowa Pollution Prevention Intern Program will realize more than $1.2 million in annual savings through the implementation of environmental improvements initiated by interns this past year. In addition to projects implemented, $4.4 million in savings opportunities were identified and recommended by interns for implementation in the future. In a year of tough economic challenges, companies served by the 2009 Iowa Pollution Prevention Intern Program have demonstrated that process improvements that protect our environment make economic sense as well.

2009 IMPLEMENTED SAVINGS

CATEGORY	REDUCTION	COST SAVINGS
WATER CONSERVATION	6,930,000 GALLONS	$36,711
SOLID WASTE	867 TONS	$30,466
HAZARDOUS WASTE	106,945 GALLONS 57 TONS	$79,205 $25,177
ENERGY	11,134,925 KWH 12,210,685 THERMS	$612,473 $421,674
OTHER	-	$73,936
		TOTAL $1,279,642

AIR POLLUTANTS DIVERTED IN TONS

	Total for all sectors
SO2	103
CO	282.27
NOx	206.98
VOC	15.51
PM	78.04

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

	Total for all sectors
CO2	23,766.40
CH4	9,061.94
N2O	3,987.19
CFC	344.33

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

3M Knoxville

COMPANY BACKGROUND

3M employs more than 79,000 people at plants in over 60 countries. The company produces many familiar brands including Post-it™, Thinsulate™, Nexcare™, and Scotch™, which generate annual sales exceeding $25 billion. The 3M plant in Knoxville, Iowa employs more than 500 people and produces a variety of tapes and fastening systems including very high bond tapes, transfer tapes, acrylic foam tapes, laminating adhesives, tinted window films for commercial and automotive uses, blackout films, diaper-fastening systems and many more.

These products are manufactured using advanced coating and extrusion processes and are used at consumer, commercial and industrial levels.

JASON DE ZWARTE
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

3M has achieved remarkable success in reducing energy usage and utility costs. 3M has realized financial savings while reducing the company's environmental footprint. This year's Pollution Prevention intern at 3M Knoxville focused on opportunities to improve the efficiency of the compressed air system.

INCENTIVES TO CHANGE

Energy costs have been rising as the competition for resources increases. Reducing energy consumption in a cost-effective way is essential in order to reduce production costs and stay competitive. Energy conservation and efficiency are also consistent with 3M Knoxville's sustainability goals to conserve resources and reduce environmental impact. One goal set by 3M in 2005 was to improve energy efficiency by 20 percent by 2010.

RESULTS

Compressed Air Leaks: Compressed air is widely used at 3M in processes, controls, and equipment. Given the cost of compressed air, it is important to ensure that it is not wasted. An air leak survey revealed that more than 25 percent of the compressed air was escaping. An ongoing leak detection program is recommended.

Compressor Cooling: The majority of the air compressors at the plant are cooled by the chilled water system, due to past water quality issues affecting compressor performance. Since the compressors were put on the chilled water system most water quality issues have been resolved. It is therefore recommended to find another source of cooling water, since the energy required to provide chilled water to the air compressors significantly increases the cost of compressed air in the plant. A process requiring makeup water that would not be adversely affected by the warmer water was identified, allowing the compressors to use fresh, clean, city water for cooling.

Compressed Air Dryers: To increase the effectiveness of the air dryers it is recommended that the discharge air from dryers not be used as intake air for other units. Auto drains would reduce the need for the current receiver drain method.

Duct Outside Air to Compressor Five: Currently all air compressors except number five receive the intake air from outside. The outside temperature is generally cooler than the temperature in the boiler room, which allows for a greater mass flow rate through the air compressors and better utilizes the existing equipment. It is recommended that outside air be ducted to compressor number five.

Improve Compressor Controls: The compressors are controlled by a PLC that targets a set pressure. The PLC would frequently bring additional compressors online when the system pressure was increasing so that it would arrive at the target pressure more quickly. Since the pressure level was still being maintained at an acceptable level, this was unnecessary.

Steam Traps: Approximately one-third of the steam traps in the plant were checked using an ultrasonic gun. About one-half of the traps surveyed were out of service because they served heating applications. Of the traps that were in service, 20 percent were found to have failed in some way and 15 percent had failed while open. The cost savings shown in the summary table were extrapolated to include all steam traps in the plant.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	18.0
CO	1.84
NOx	8.6
VOC	0.30
PM	0.45

GREEN HOUSE GASES DIVERTED IN TONS

(CO2 Equivalent)

Total for all sectors	
CO2	3330
CH4	125.2
N2O	1.67
CFC	41.0

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPAIR COMPRESSED AIR LEAKS	$32,750	505,000 KWH	IN PROGRESS
COMPRESSOR COOLING	$24,750	615,000 KWH	RECOMMENDED
IMPLEMENT AN ONGOING AIR LEAK DETECTION PROGRAM	$21,000	525,000 KWH	RECOMMENDED
DUCT OUTSIDE AIR TO COMPRESSOR 5	$2,400	60,000 KWH	RECOMMENDED
IMPROVE COMPRESSOR CONTROLS	$875	21,900 KWH	IMPLEMENTED
DRYER AUTO DRAINS	$775	19,400 KWH	RECOMMENDED
RECEIVER AUTO DRAIN	$120	3,000 KWH	RECOMMEND METHOD CHANGE
DRYER CONDENSER COOLING AIR	$315	7,900 KWH	RECOMMENDED
REPAIR LEAKING STEAM TRAPS	$200,000	200,000E THERMS	RECOMMENDED
IMPLEMENT A STEAM TRAP MAINTENANCE PROGRAM	$50,000	50,000E THERMS	IN PROGRESS

Acument Global Technologies

COMPANY BACKGROUND

Acument Global Technologies manufactures fasteners for the commercial, industrial, electronics, distribution, construction and automotive industries. The Decorah plant is a global enterprise, serving hundreds of companies in more than 30 countries. Acument Global Technologies produces a wide range of fasteners, including standard catalog, special custom and miniature. Manufacturing processes include cold forging, standard upsetting, deep part extrusion, reverse extrusion, thread rolling, CNC & form tool shaving, tapping, crimping, heat treating, painting, stripping, passivating, and class 100 cleanroom cleaning and packaging. In 2008 Acument saw $81.9 million in sales.

BEN PETERSON
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

2009 is the sixth year Acument has participated in the Pollution Prevention Intern Program. Nearly a decade ago, Acument's insurance provider encouraged infrared (IR) inspections of the plant for fire prevention measures. Since then, Acument has seen an opportunity to use IR technology in-house for predictive maintenance (PdM). This summer, the intern focused on the feasibility of an IR PdM program, locating problematic areas and wasted energy.

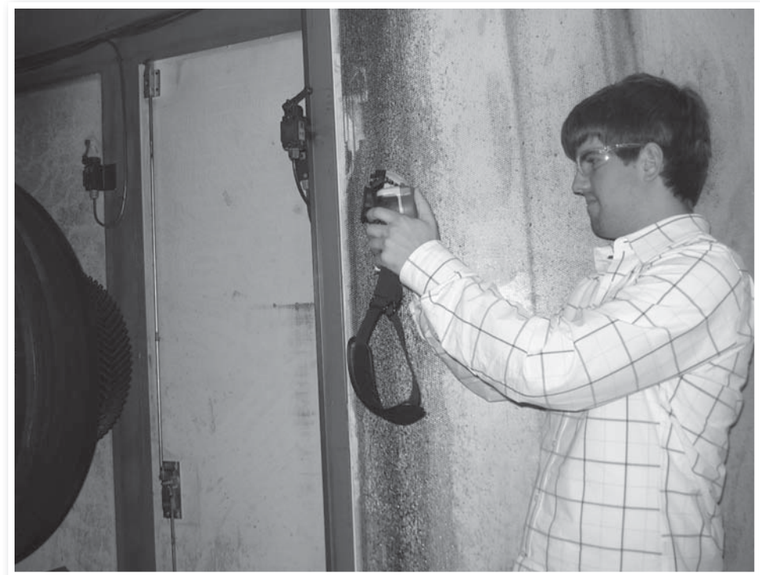
INCENTIVES TO CHANGE

Acument Global Technologies operates on preventative and reactive maintenance strategies. However, unexpected downtime is still an issue that affects the productivity of the plant. Acument continues to be ISO 14001 certified because of the company's commitment to continual improvement of their environmental management system and prevention of pollution. Due to the rising cost of utilities it is important that manufacturing processes run as efficiently and reliably as possible in order to reduce cost, maintain customer loyalty and increase the bottom line.

RESULTS

Motor Management and Upgrades: Motor management is important for reducing energy usage and downtime. Acument has no inventory of motors in operation or on hand for backup. A free software package from the U.S. Department of Energy, MotorMaster, serves as a database for motor nameplate information. MotorMaster also stores field data and makes calculations that are significant to motor efficiency and reliability, such as voltage imbalance and load factor. MotorMaster will ensure backup motors are available and properly sized and the database will serve as a vital part of the PdM program. Nearly all motors at Acument are rated below National Electrical Manufacturers Association (NEMA) premium efficiency. When replacing motors, NEMA premium efficient motors should be considered by assessing life-cycle cost.

IR Predictive Maintenance: Critical equipment should be inspected for thermal anomalies regularly. Electrical, mechanical and electro-mechanical systems can be inspected using an IR imager.



Electric components such as transformers, breakers and busses should be inspected regularly for loose connections, phase imbalance and overheating indicated by temperature differentials. As mechanical equipment degrades, friction increases and the IR imager will detect an increase in heat. Almost all rotating equipment, such as bearings, is eligible to be inspected with an IR imager. When a thermal anomaly is identified, maintenance can be scheduled during planned downtime, fixing the problem before it causes any unplanned downtime. Over the summer several hundred IR images were captured and analyzed for maintenance risks. Because of advances in IR technology, the cost of the technology is relatively inexpensive. Acument would see payback periods of only a few months.

Motor Preventative Maintenance: Motors are often overlooked, unless they have failed and need replacement. Factors such as voltage imbalance, inadequate ventilation, dirty surfaces and improper lubrication can quickly degrade motor efficiency, usable life expectancy and rated capacity. Using the IR imager and a scale to estimate motor inefficiencies, a figure for wasted radiant energy was calculated. To keep motors from degrading, simple actions such as cleaning, properly lubricating and correcting voltage imbalances should be taken.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	1.61
CO	0.165
NOx	0.764
VOC	0.026
PM	0.040

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	298
CH4	11.2
N2O	0.149
CFC	3.66

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
MOTOR MANAGEMENT AND NEMA PREMIUM MOTOR UPGRADES	$14,200	225,000 KWH	IMPLEMENTING
INFRARED PREDICTIVE MAINTENANCE	$200,000	30,750 KWH	RECOMMENDED
MOTOR PREVENTATIVE MAINTENANCE	$10,800	170,000 KWH	RECOMMENDED

Allen Memorial Hospital

COMPANY BACKGROUND

Allen Memorial Hospital, a member of Iowa Health Systems, was established in 1925. Allen has grown to its current size of approximately 750,000 square feet with the addition of the 70,000 square foot Pauline Barrett Pavilion that opened in March 2009. Allen Hospital is one of the largest hospitals serving the Cedar Valley area, caring for more than 50,000 patients a year in its many service programs. The mission of Allen Memorial Hospital is to improve the health of the people and communities they serve through healing, caring and teaching.

MEREDITH BRETON
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

Allen Memorial Hospital produces a large amount of solid waste every day, and has consistently searched for ways to reduce its waste generation through source reduction and recycling. The hospital turned to the Pollution Prevention Intern Program for additional assistance. The main goals of the intern were to reduce biohazard waste, and to conduct a waste assessment to find other potential areas for savings.

INCENTIVES TO CHANGE

Allen Memorial Hospital established a "Green Team" about two years ago. This team, along with representatives of Iowa Health Systems, encourages the entire facility to decrease its environmental impact. Allen has recognized increases in its regulated medical waste output and associated disposal cost. Allen's goals were to reduce this waste stream and investigate other ways the institution could reduce its environmental impact.

RESULTS

Biohazard Waste Reduction: The reduction of regulated medical waste, also called biohazard waste, was the intern's main objective while on site. By conducting a waste assessment, it was shown that 13 percent of the hospital's overall waste was composed of regulated medical waste. The Center for Disease Control estimates that a hospital's regulated medical waste should be approximately 3 percent to 5 percent of its total waste output. After observing the collection procedures, monitoring the volumes produced, and assessing the articles placed in biohazard containers, it was determined that through clinical staff education, container relocation, and posting signs, biohazard waste output could be reduced by 38 percent. By implementing these changes, Allen hospital will save $25,177 annually.

Occupancy Sensor Installation: Using blueprints, 487 locations including public bathrooms, patient bathrooms, offices, meeting rooms and storage closets were identified as potential areas for occupancy sensor installation. This would reduce Allen's electrical usage by 450,745kWh per year.

Lighting Upgrades: The intern uncovered several other opportunities for electrical savings. These include the mass replacement of incandescent bulbs with compact fluorescent bulbs throughout the facility, the substitution of incandescent exit signs with LED exit signs, and the de-lamping of vending machines utilized by visitors and staff. These changes would save Allen $3,314 per year.

Sterilizer Water Reduction: One of Allen Memorial Hospital's four sterilizers is not capable of recycling its discharged steam. Because of this, a continuous flow of cold water is used to cool the steam for discharge into the sewer. Through the installation of a water tempering device, the temperature of the steam would be monitored and cold water would be added only when necessary, which would significantly reduce the amount of water used per hour.

Solvent Recycling: The on-site laboratory serving Allen Memorial Hospital and its affiliates uses xylene for the preparation of slides. The solvent is used once and disposed of as hazardous waste. By introducing a solvent recycling system that utilizes fractional distillation, the lab could reduce its xylene purchasing and disposal cost by 95 percent.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	3.254
CO	0.333
NOx	1.544
VOC	0.054
PM	0.081

GREEN HOUSE GASES DIVERTED IN TONS

(CO2 Equivalent)

Total for all sectors	
CO2	601.135
CH4	22.612
N2O	0.301
CFC	7.39

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
BIOHAZARD WASTE REDUCTION	$25,177	56.6 TONS	IMPLEMENTING
OCCUPANCY SENSOR INSTALLATION	$17,599	450,746 KWH	RECOMMENDED
LIGHTING UPGRADES	$3,296	121,657 KWH	RECOMMENDED
STERILIZER WATER REDUCTION	$3,314	328,500 GALLONS	RECOMMENDED
SOLVENT RECYCLING	$2,984	247 GALLONS	RECOMMENDED

American Packaging Corporation

COMPANY BACKGROUND

American Packaging Corporation is an integrated flexible packaging converter that services the food, beverage, medical, personal care, lawn and garden, household, agricultural chemical and pet food markets. With three divisions and more than 550 employees nationwide, American Packaging Corporation is one of the largest privately-owned packaging companies in the world. The Story City facility specializes in flexographic printing with in-line adhesive laminations using a variety of substrates. It operates the latest slitting and rewinding equipment and produces a wide assortment of pouches and bags.

PAUL PERKINS-McINTOSH
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

American Packaging Corporation is committed to preserving natural resources and minimizing waste. Last year's Pollution Prevention intern proposed projects with substantial cost savings and environmental benefits and helped the company to become more sustainable. This year's intern focused on reducing adhesive and organic solvent waste, limiting solid waste and decreasing natural gas consumption at the Story City plant.

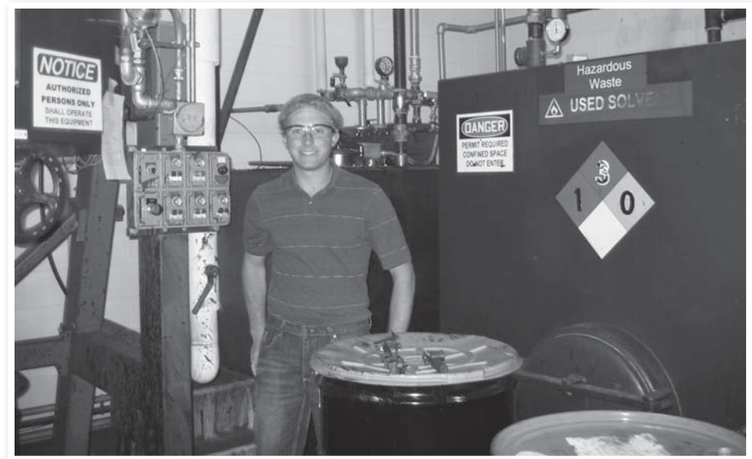
INCENTIVES TO CHANGE

For American Packaging Corporation to maintain its competitive edge, environmental stewardship is not a choice; it is a necessity. As energy prices continue to rise and customers demand environmentally conscious suppliers, American Packaging will continue to innovate and reduce its environmental impact. Each of American Packaging's three facilities has developed a 'Green Team' consisting of members from various areas in the plants. The teams have been charged with identifying and implementing pollution prevention opportunities.

RESULTS

Solvent/Hazardous Waste: The intern reviewed and provided updates to the company's hazardous waste profile. During the review, an accounting error was realized. American Packaging Corporation received credit for the mistake and the treatment, storage and disposal (TSD) vendor's bid was corrected. It was also found that the TSD's use and price for hazardous waste removal is dependent on the accumulation of a solid layer at the bottom of each drum; a more solid drum is more difficult to dispose of and is less useful. Eliminating the practice of mixing ink and adhesive waste will increase the number of liquid drums produced and decrease the cost of removal. American Packaging Corporation currently uses a still to recover solvents from ink waste. Adding a holding tank for the ink waste will promote liquid separation from solid ink waste and better standardize the still's output. Introducing a recycle stream into the still would increase the solvent recovered and decrease the amount of hazardous waste exported.

Vapor Waste: American Packaging Corporation uses two Regenerative Thermal Oxidizers (RTO) to convert solvent vapors to CO_2 and H_2O. They operate at approximately 1550°F and require natural gas supplements to maintain the high temperature. A vendor was contacted



and it was determined that through installation of insulation, an upgrade in ceramic media, practice changes and installation of heat recovery equipment, significant natural gas savings could be realized.

Plastic Recycling: Approximately 20.8 tons per month of plastic trim is currently generated in the slitting process. The waste is currently compacted and incinerated for energy recovery. The purchase and installation of a baler will allow American Packaging Corporation's recycling vendor to take the scrap, making better use of 250 tons of scrap per year.

Adhesive: American Packaging Corporation currently uses ethyl acetate as a solvent when cleaning adhesives from machinery. Although some adhesives are not hazardous, when mixed with ethyl acetate, the waste must be handled as hazardous. Employing a non-hazardous solvent would reduce the amount of hazardous waste generated and create a safer waste stream. A potential candidate has been identified and trials are currently underway.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	1.27
CO	2.33
NOx	1.36
VOC	2.87
PM	0.13

GREEN HOUSE GASES DIVERTED IN TONS
(CO_2 Equivalent)

Total for all sectors	
CO2	1737
CH4	744
N2O	1.90
CFC	5.67

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
HAZARDOUS WASTE PRICING ERROR	$55,100 (ONE TIME)	N/A	CREDIT ISSUED
STILL TEAR STREAM	$2,575	2,361 GALLONS	RECOMMENDED
STILL TUNDISH	$5,150	4,722 GALLONS	RECOMMENDED
RTO HEAT RECOVERY	$254,000	252,000 THERMS	RECOMMENDED
RTO CERAMIC MEDIA UPGRADE	$175,000	159,090 THERMS	RECOMMENDED
RTO INSULATION	$55,000	50,400 THERMS	RECOMMENDED
EXHAUST AIR USE ON GEOENERGY RTO	$6,225	5,660 THERMS	RECOMMENDED
TRIM RECYCLING	$27,075	245.8 TONS	RECOMMENDED
NON-HAZARDOUS SOLVENT	TBD	TBD	TRIALS IN PROGRESS

City of Pella

COMPANY BACKGROUND

The City of Pella Municipal Power Plant has been owned and operated by the City of Pella since 1911. The power plant has grown to a generating capacity of 38 MW on site and an additional 28 MW at a nearby diesel plant for peak electricity. While the power plant still utilizes coal as its main fuel, it is moving to other energy sources such as co-firing with a coal/ biomass blend.

ANDREW PATZ
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

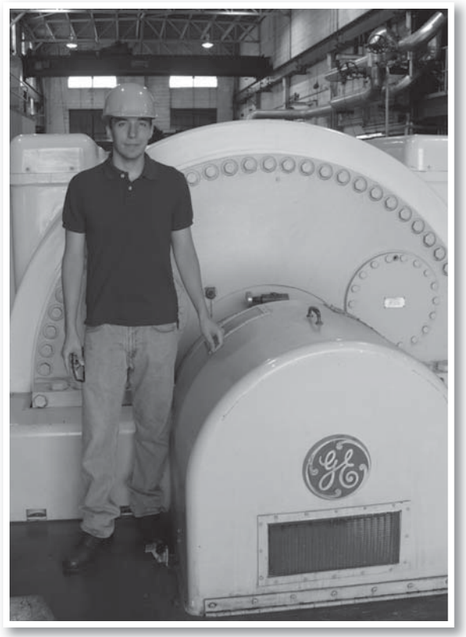
Several areas were examined to improve overall plant performance. The first area of focus was chemical and water conservation in both the cooling tower and the boiler water loop. In addition to conservation, it was necessary to ensure that outfall permit standards were met or surpassed. The second area of focus was on the energy efficiency of the many pumps and fans in the facility.

INCENTIVES TO CHANGE

It has become increasingly apparent over the past few years that the City of Pella needs to find ways to reduce water usage. With about 20 percent of the city's treated water going to the power plant, it was clear that the power plant was one of the first places to investigate. Unprecedented coal prices have made plant efficiency not only a priority, but also a necessity.

RESULTS

Boiler Upgrades: Several options are available to improve the efficiency and reduce the emissions of the coal boilers. These upgrades include new boiler seals for less air infiltration, oxygen controls for minimum excess air and flue gas recirculation to reduce NOx production.



Blowdown and Wastewater Recovery: Approximately 17 percent of the water going to the cooling tower is sent down the drain because of the high concentration of solids. A new chemical treatment system would eliminate about 95 percent of this blowdown as well as allow other sources of wastewater to be used in the cooling tower. These sources would come from the power plant and possibly other area facilities.

Variable Frequency Drives (VFD) for Pumps and Fans: Several large pumps and fans operate on highly variable loads while only slightly changing energy consumption. A VFD will allow a pump or fan to vary its speed to match the load while saving significant amounts of electricity.

Cogeneration: Due to the close proximity of manufacturing plants and other facilities, the power plant has the opportunity to supply steam and chilled water to them. The power plant can utilize heat resources such as extraction steam from the turbines, backpressure steam from a boiler feed pump and excess heat from flue gas to supply the steam. Chilled water can also be supplied by using the produced steam in an absorption chiller. The chilled water system can be optimized by using an ice storage system and an air-side economizer, to help the supplied facilities handle peaking in the summer and low loads in the fall and spring.

Lighting upgrades: Based on recommendations, the facility plans to replace older 400W metal halides with T5 or T8 fluorescent fixtures, depending on location. The 70W – 300W incandescent bulbs will be replaced by heavy-duty compact fluorescent lamps, and eventually by LED lamps.

Central air for plant use: Several areas of the power plant are air conditioned by separate residential-type units that can be replaced by a centralized unit.

Cooling tower operations: While the power plant generally operates with the water running on all cells before a fan starts, standardizing this procedure will ensure water and electricity conservation in the spring and autumn.

Insulation program: An insulation program is recommended, which would include removable mechanical insulation, building envelope insulation and seals for the building envelope and boilers.

Baghouse ejector recovery: The baghouse utilizes a steam jet ejector to create a vacuum for ash handling. Hot water is created from this process, which can be recovered for plant heating, makeup water heating and cooling tower water.

Vent condenser on deaerator: The deaerators operate at a high pressure and release a considerable amount of steam to get rid of air in the feedwater. Vent condensers can condense the steam for reuse while ejecting the entrapped gases.

Evaporator replacement: An evaporator currently supplies the boilers with distilled feedwater. The best replacement would be a reverse osmosis system in series with a deionizer for a supply of high-quality water without heating losses or the need for a rental system during plant shutdown.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	28.1
CO	256.8
NOx	160.6
VOC	2.17
PM	0.79

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	5251
CH4	1481
N2O	54.0
CFC	157

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
BOILER UPGRADES	$581,400	980,000 THERMS 127 TONS OF NOx	RECOMMENDED
BLOWDOWN AND WASTEWATER RECOVERY	$81,200	25 MILLION GALLONS	RECOMMENDED
VFD FOR PUMPS AND FANS	$43,200	405,000 KWH	RECOMMENDED
COGENERATION	$829,400	1,100,000 THERMS 1,675,000 KWH	RECOMMENDED
LIGHTING UPGRADES	$15,800	310,000 KWH	IN PROGRESS
CENTRAL AIR FOR PLANT USE	$6,600	120,000 KWH	RECOMMENDED
COOLING TOWER OPERATIONS	$4,000	50,000 KWH 250,000 GALLONS	IMPLEMENTED
INSULATION PROGRAM	$20,000	73,500 THERMS	RECOMMENDED
BAGHOUSE EJECTOR RECOVERY	$14,500	29,400 THERMS 1,300,000 GALLONS	RECOMMENDED
VENT CONDENSER ON DEAERATOR	$12,200	41,650 THERMS 250,000 GALLONS	RECOMMENDED
EVAPORATOR REPLACEMENT	$31,400	53,900 THERMS 2,250,000 GALLONS	RECOMMENDED

CNH America LLC

COMPANY BACKGROUND

Case New Holland (CNH) was formed in 1999 when New Holland NV and Case Corporation merged, and is now part of the Fiat Group. Rising to be a leader in 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, which makes the tractor loader backhoe, utility tractor and rough terrain forklift, is one of 11 CNH manufacturing plants in the United States and employs approximately 265 people.

SAMANTHA LEE
INDUSTRIAL ENGINEERING, ST. AMBROSE UNIVERSITY

PROJECT BACKGROUND

This was CNH-Burlington's second year hosting an intern with the Pollution Prevention Intern Program. The intern focused on implementing a comprehensive recycling program throughout the plant and establishing utility sub-metering and heat recovery systems.

INCENTIVES TO CHANGE

CNH is dedicated to pursuing greener manufacturing methods and is continually improving its environmental management system. Because CNH is aware of the environmental and financial impacts of better waste management, the company has set out to be a 'no-landfill plant'. Beginning a comprehensive recycling program was the first step in achieving this goal. Energy conservation through utility metering and heat recovery is another step for CNH to become a greener plant.

RESULTS

Recycling Program: In order to assess CNH's current waste situation, a waste audit was performed. Each waste container throughout the plant was cataloged and the amount of specific materials was estimated and recorded. After examining all containers, the intern discovered that 70 percent of CNH's waste was made up of recyclable materials, mostly coming from packaging waste. If CNH recovered three-fourths of the recyclable material, the company could divert more than 50 percent of its waste stream from the landfill.

CNH was able to financially justify setting up a plant-wide recycling program by diverting waste from the landfill, cutting the number of trips taken to the landfill in half and reducing the number of waste containers rented. There is potential for CNH to produce an income by selling the recyclable goods.

CNH set up the recycling program to be easy and sustainable for operators. Operators are able to throw any type of recyclable material in the same bin, which they then dump in nearby recycling area collection points. An outside company picks up the containers at the collection points and sorts, bales and loads the recyclable material.

After only two weeks of operation, the program has recycled four tons of cardboard, one ton of plastic, one ton of paper and 250 pounds of Styrofoam. The program has run smoothly and is on track to meet all of its recycling goals.

Utility Sub-Metering: CNH has hundreds of motors throughout the Burlington plant, which were in need of cataloging and managing for utility usage. CNH is working on cataloging the motors and purchasing utility sub-metering to monitor the motor's electricity usage. The data collected will then be used to reduce the electricity usage.

Heat Recovery System: CNH has a large E-Coat paint system that must maintain a temperature of 350° F in its large ovens. Utilizing a heat exchanger to capture heat from the oven exhaust and reroute it to heat a portion of the assembly area would generate significant savings. This practice has successfully been used in other areas of the plant.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	2.22
CO	0.47
NOx	1.09
VOC	0.34
PM	0.06

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	2191.1
CH4	96.5
N2O	0.40
CFC	5.32

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RECYCLING PROGRAM	$21,100	222 TONS 74,815 THERMS	IMPLEMENTED
UTILITY SUB-METERING	$35,000	1,225 KWH	IN PROGRESS
HEAT RECOVERY	$31,000	30,940 THERMS	IN PROGRESS

Diamond Vogel Paint

COMPANY BACKGROUND

Diamond Vogel Paint is a family owned, Midwest-based coatings manufacturer and retailer headquartered in Orange City, Iowa. Since 1926, Diamond Vogel Paint has produced industrial and architectural coating solutions. Today, the company has a diversified market, manufacturing paints, wood stains, powder coatings and traffic paint. Diamond Vogel Paint also distributes and retails its products, with more than 80 retail stores in 14 states. The company has a workforce of 800 employees. Annual sales in 2008 topped $150 million.

MATTHEW VANDER WERFF
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

After a site visit from Pollution Prevention Services' engineers, Diamond Vogel Paint recognized the potential to improve its compressed air system and the benefits of a solid waste audit. The Pollution Prevention intern used a systematic approach to evaluate the effectiveness of the system and to recommend possible improvements. A secondary project assessed efficiency of the hot water bath stage in the production process.

INCENTIVES TO CHANGE

Diamond Vogel Paint is partnering with the Pollution Prevention Intern Program in its pursuit of ISO 14000 certification. The company objectives in obtaining certification are to:

- Identify and control the environmental impacts of its products;
- Continually improve its environmental performance; and
- Implement a systematic approach to setting environmental goals with measurable results, achieving these results, and verifying the impacts.

RESULTS

Repair Compressed Air Leaks and Leak Detection Program: The intern conducted a compressed air leak audit and found 33 leaks. These leaks comprised 23 percent of the compressed air system's capacity. By repairing the leaks identified and implementing an aggressive leak detection program, Diamond Vogel Paint can reduce its system capacity lost to leaks to less than 10 percent.

Lower Compressed Air System Pressure: By documenting the pressure requirements of compressed air end uses, it was discovered that the system pressure in the liquid production facility was higher than necessary. If the system pressure were lowered, the electricity consumed by the compressor could be reduced by 15 percent.

Heat Recovery: During the colder months of the year, it is possible for Diamond Vogel Paint to use the hot exhaust air from three of its air-cooled compressors for space heating. These compressors are located very close to production areas that are currently heated by a boiler system. If the hot exhaust air were recovered for 24 weeks each year, these three compressors would provide almost 540 million BTUs of heat to offset the use of the boiler system.

Modify Compressors Air Intake Location: The largest compressor, which is 75 horse power (HP), currently draws outside air for its air intake. Two smaller compressors, 40 HP and 20 HP, have air intake directly attached to each compressor. The air surrounding the compressors is in excess of 100° F. By piping each air intake vertically 6 feet through the roof, the air intake temperature would be greatly reduced. Cooler air requires less energy to compress, and the electrical consumption of the 40 HP and 20 HP compressors would be lowered by 11.5 percent.

Install Electric Control on Water Pump: As part of the aerosol production line, spray paint cans must be tested for defects before they are packaged and distributed. Once the cans are filled with paint and charged with natural gas, they are immersed in a hot water bath at 130° F. Aerosol production runs 12-hour shifts four days per week. When production is not operating, the hot water bath is not needed. The intern recommended a seven-day electric timer as a viable option to reduce the natural gas consumed by turning the system off during non-production hours.

Modify Tank Volume: When the aerosol hot water bath was initially chosen, it was purchased with the capacity for a second process line in case of production expansion. A second process line is not planned, and the current tank is 67 percent larger than necessary. By reducing the volume of the tank to the minimum required, the total system volume would be reduced by 164 gallons. This change would reduce the time required to warm up the hot water bath each morning as well as the amount of heat lost during production.

Insulate Piping and Tank: In the aerosol production line, 71 feet of steel piping and 110 square feet of the hot water bath are not insulated. By insulating these areas, the heat lost to the surroundings would be reduced, and the working conditions for employees would be improved. This reduction in heat loss would allow the thermostat for the water heater to be set to a lower temperature.

Increase Solid Waste Recycling: In the liquid and aerosol production facilities, some cardboard recycling occurs. By expanding the recycling program to include more cardboard materials and plastics, 167 tons of waste can be diverted from the landfill. To do this, Diamond Vogel Paint would need to educate employees on the types of materials recycled and where to deposit the materials.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	1.05
CO	0.20
NOx	0.53
VOC	0.13
PM	0.03

GREEN HOUSE GASES DIVERTED IN TONS

(CO2 Equivalent)

Total for all sectors	
CO2	203.50
CH4	36.96
N2O	0.17
CFC	2.50

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPAIR COMPRESSED AIR LEAKS	$9,540	127,000 KWH	IMPLEMENTED
LEAK DETECTION PROGRAM	$4,580	61,000 KWH	RECOMMENDED
LOWER COMPRESSED AIR SYSTEM PRESSURE	$1,230	16,290 KWH	RECOMMENDED
HEAT RECOVERY	$5,340	5,390 THERMS	RECOMMENDED
MODIFY COMPRESSOR AIR INTAKE LOCATION	$1,440	19,170 KWH	RECOMMENDED
INSTALL ELECTRIC CONTROL ON WATER PUMP [NATURAL GAS]	$12,400	12,510 THERMS	RECOMMENDED
MODIFY TANK VOLUME	$1,575	1,590 THERMS	RECOMMENDED
INSULATE PIPING AND TANK	$470	474 THERMS	RECOMMENDED
INCREASE SOLID WASTE RECYCLING	$14,810	167 TONS	RECOMMENDED

Drake University

COMPANY BACKGROUND

Drake University and Sodexo Education Services have been in partnership for more than ten years. Sodexo is committed to enhancing the learning environment on the Drake Campus through managing both food services and the facilities and maintenance activities. With the start of a sustainability program at Drake, efforts have been made to improve energy and plant operations, as well as grounds and custodial services. Drake and Sodexo strive together to improve in areas of sustainability, diversity and wellness.

SARA SCHMIEG
ENVIRONMENTAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

The 'Blue is Green' sustainability motto at Drake University has encouraged both staff and students to consider green practices on campus. Through the Pollution Prevention Intern Program, Drake has taken further steps by working on such projects as the HVAC system, food service equipment and a campus-wide recycling program. These projects, and others, have given Drake the opportunity to be a model of sustainability, both on campus and in the community of Des Moines.

INCENTIVES TO CHANGE

With the signing of the American Colleges/Universities Presidents Climate Commitment, Drake University has shown its dedication to the practices and actions that are needed for carbon neutrality and overall sustainability. This began what is now the Blue is Green program. With the help of the sustainability committee, Drake is now an example of how colleges and universities could take action and make positive environmental impacts. Since this commitment, Drake has taken action in food service and facility operations. Student groups have also formed to encourage the campus to become more 'green.'

RESULTS

Solid Waste: Recycling and solid waste programs were an important part in reducing Drake's carbon footprint. Drake has started a campus wide, single-stream recycling program that collects paper, plastics and cans in one receptacle. This will improve the convenience for students and staff, and reduce the cost of receptacles. The program will divert more than 360 tons of solid waste from the landfill each year. In addition, Drake's option to go trayless in dining areas will prevent 105 tons of food scraps from being thrown away during the course of the year and reduce purchasing and disposal costs.

HVAC Optimization: Improvements to Drake's boiler and HVAC systems could save more than 500,000 kWh, 10,000 therms and reduce carbon dioxide emissions by 200 tons per year. Recommendations include installing variable frequency drives on fans, variable air flow systems and dampers with sensors in areas that have zone heating or cooling. These additions will improve air flow throughout buildings and prevent overcooling of classrooms and offices that are unused during summers.

Steam Valve and Line Insulation: Drake could recover waste heat by insulating 303 feet of steam lines. Valves and plating could be insulated with retrofit blankets to save more than 39,000 therms per year. This project will improve boiler efficiency and prevent sulfur dioxide emissions by reducing the amount of natural gas needed for operation.

Food Service Equipment Optimization: Food service equipment can be a large investment for dining halls and concessions. Drake examined space usage and optimization for its equipment to not only decrease energy use, but also improve efficiency. Walk-in coolers and freezers could be improved through updated insulation, variable frequency drives and by replacing door seals. In addition, cutting back 350 kWh from peak demand by shutting off all unused concession equipment and phantom loads from drink dispensers could save Drake $14,000 annually.

Vending Misers: Vending misers are commonly used to shut down vending machines when not in use. They could reduce the machine running time by 40 percent, and on the Drake campus misers have been installed that save more than $3,000 and more than 60,000 kWh annually. This project will be further improved through a program to actively repair and install the tools in other areas to maintain the system at efficiency.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	3.40
CO	0.59
NOx	1.69
VOC	0.37
PM	0.09

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	652.64
CH4	103.90
N2O	0.51
CFC	8.03

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
SINGLE-STREAM RECYCLING PROGRAM	$9,000	360 TONS	IMPLEMENTED
FOOD WASTE REDUCTION: TRAYLESS	$6,000	105 TONS	IN PROGRESS
HVAC DISTRIBUTION: BOILERS	$8,100-$12,200	7,300-11,000 THERMS	IN PROGRESS
HVAC DISTRIBUTION: CHILLERS	$25,300-$33,200	412,200-577,100 KWH	IN PROGRESS
STEAM LINES AND VALVE INSULATION	$43,400	39,477 THERMS	RECOMMENDED
FOOD SERVICE AND HVAC EQUIPMENT OPTIMIZATION	$25,300	253,100 KWH	IN PROGRESS

EMCO Enterprises

COMPANY BACKGROUND

EMCO Enterprises is a fully owned subsidiary of Andersen Windows, which is located in Bayport, Minnesota. The company is North America's leader in storm door manufacturing and employs more than 500 people at two locations in the United States: Des Moines, Iowa and Luray, Virginia. EMCO produces 15 different types of storm doors.

BILL MAURER
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

The intern focused on solid waste recycling and energy reduction projects that included compressed air leak reductions and lighting efficiency.

INCENTIVES TO CHANGE

EMCO is committed to becoming an environmental leader in the manufacturing business. To do this, the company has initiated an ECO 3 program and has set company-wide environmental goals that include a 10 percent increase in recycling and a 6 percent reduction in energy consumption over the next year.

RESULTS

Recycling: A process has been implemented to increase recycling amounts company wide, which will benefit the environment and EMCO's bottom line. EMCO sent more than 470 tons of trash to the landfill last year, but with increased recycling efforts, the company's goal is to cut this number to fewer than 300 tons over the next year. Cardboard accounted for approximately 65 percent of the volume of trash EMCO sent to the landfill last year. Smaller amounts of other materials such as paper, wood and aluminum were also landfilled. EMCO has already increased its recycling of these materials. Packaging material for the aluminum product accounts for the majority of paper used at the plant. The company is testing alternatives to eliminate the paper packaging, thus reducing usage and cost.

Compressed Air Leaks: Compressed air leaks account for approximately 18 percent of EMCO's compressor electrical costs. A total of 148 leaks were identified and tagged throughout the manufacturing floor, accounting for 320 CFM. By repairing these air leaks, EMCO's electricity costs will be reduced significantly. In addition, ongoing audits and maintenance of the compressed air system will decrease the amount of wasted energy. Air leaks are not always predictable, but with increased attention, the leaks can be kept to a minimum, which will benefit EMCO and the environment. Maintenance and upkeep of the compressed air system will have a small upfront cost, but the payback is almost immediate.

Lighting: The lighting used on the plant floor is outdated and inefficient. It is recommended that EMCO update from T12 fluorescent bulbs to T8 fluorescent bulbs. Since all ballasts will need to be changed, the company would incur labor and supply costs, but fewer fixtures would be needed. With fewer fixtures and increased efficiency, EMCO could cut back on energy consumption by a considerable amount.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	1.807
CO	0.1837
NOx	0.992
VOC	0.03
PM	0.043

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	334
CH4	12.558
N2O	0.167
CFC	4.108

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RECYCLING	$15,466	180 TONS	IMPLEMENTED
AIR LEAKS	$18,000	298,400 KWH	IMPLEMENTED
LIGHTING	$15,000	250,000 KWH	RECOMMENDED

Flexsteel Industries Inc.

COMPANY BACKGROUND

Flexsteel Industries Inc. began manufacturing upholstered furniture in 1893. Headquartered in Dubuque, Iowa, Flexsteel employs 1,450 people corporately with operations throughout the United States. As a manufacturer of residential, commercial and vehicle seating, Flexsteel develops furniture products for home, office, motor home, travel trailer, yacht, health care and hotel applications.

ZACK YOUNG
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

This summer, Flexsteel coordinated with the Pollution Prevention Intern Program to identify opportunities for operational improvements at the 100-year old facility in conjunction with their environmental initiative. This project focused on improving the lighting systems within the Dubuque facility to produce better lighting conditions while reducing the amount of energy consumed.

INCENTIVES TO CHANGE

Flexsteel is involved with Enhancing Furniture's Environmental Culture (EFEC), a voluntary environmental management program developed by the American Home Furnishings Alliance (AHFA) to create and maintain a proactive environmental system. The EFEC committee at Flexsteel has been working toward reducing its environmental impact by creating a facility-wide recycling program, educating its employees about the environment, working with its suppliers to induce positive change at their companies and making systems and processes more efficient at Flexsteel Dubuque.

RESULTS

Lighting Upgrades: A lighting audit of the plant was performed, which confirmed that the lighting conditions could be improved. While T8 fluorescent lights offer better light in addition to saving energy, inefficient high-intensity discharge and outdated T12 fluorescent lamps provide much of the plant lighting. The current lighting system, which includes more than 3,200 fixtures, accounts for more than one-half of the electric bill. Employee morale, safety and productivity can all be improved with lighting renovations. Since the lighting layout had not been adjusted for changes in function for different areas, production lighting was left where warehouse sections are now located. This resulted in over-lighting and under-lighting, varying fixture types and sporadic light temperatures leading to headaches and eyestrain.

The current fixtures can all be replaced with new T8 fluorescent fixtures that deliver more light, allow for better visibility and reduce electric bills. This solution will provide a standard replacement light with increased lamp life that will reduce maintenance time and improve lighting quality. Rebates from Flexsteel's utility provider and a tax deduction provision in the Energy Policy Act of 2005 will help the company reduce the cost of lighting upgrades.

Lighting Management: Lights that are continuously lit in unoccupied areas also contribute to excessive electric bills. This problem has been reduced by education through the EFEC committee and written reminders throughout the facility.

Energy Projects: Energy reduction opportunities have been identified at the plant for appliances and electronics including computers, fans, space heaters, refrigerators and microwaves.

Compressed Air Leaks: An estimated 35 percent of the compressed air generated is currently lost to leaks. Repairing these leaks will save roughly $7,000 in energy costs annually, but a leak detection program also needs to be implemented to detect and suppress leaks before they become bigger issues.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	5.16
CO	0.53
NOx	2.45
VOC	0.09
PM	0.12

GREEN HOUSE GASES DIVERTED IN TONS

(CO2 Equivalent)

Total for all sectors	
CO2	954.56
CH4	35.89
N2O	0.48
CFC	11.74

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LIGHTING UPGRADES	$74,500	783,000 KWH	IN PROGRESS
MISCELLANEOUS ENERGY PROJECTS	$14,000	147,000 KWH	RECOMMENDED
FIX COMPRESSED AIR LEAKS	$7,000	74,000 KWH	RECOMMENDED

General Mills Operations, Inc.

COMPANY BACKGROUND

General Mills Incorporated is a worldwide leader in consumer food products, with more than 100 leading U.S. brands. The company had worldwide revenue of nearly $15 billion in 2008. Since 1866, General Mills Inc. has grown to employ almost 30,000 people, with facilities in more than 100 countries.

The Carlisle, Iowa facility produces milled wheat flour and flour-based baking products, supplying both retail and food service industries. The facility has approximately 90 employees, producing more than 430 million pounds of flour products annually.

DAIN SPURGEON
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

General Mills Operations, Inc. has adopted a company wide effort to continually look for ways to conserve resources, reduce energy and water usage, minimize packaging, and reduce waste. The Carlisle facility has recently increased efforts to reduce energy use and lessen its environmental impact. The Pollution Prevention Intern Program is the most recent step in an effort to reduce energy use through changes to the compressed air system, which is a large user of energy within the plant.

INCENTIVES TO CHANGE

At the Carlisle facility, compressed air costs nearly $80,000 annually. The objectives of the intern project will help satisfy the facility's goal to reduce overall energy consumption by 15 percent.

RESULTS

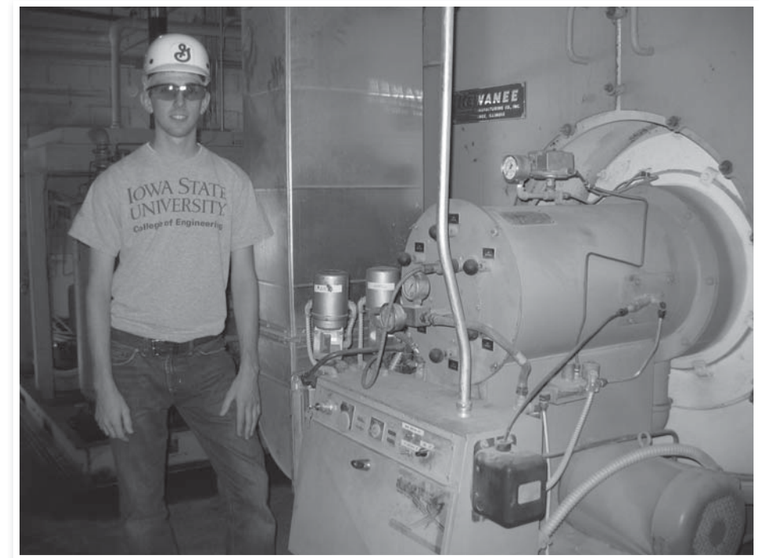
Compressed Air: In evaluating the uses and supply of compressed air in the facility, several recommendations for improvement were identified.

Nozzles: Several product packaging lines use compressed air extensively for machine cleaning and product pouch inflation. Testing of high efficiency nozzles was performed to evaluate their air savings and performance. Results showed an average reduction in air use of 66 percent. With 18 applications recommended for nozzles, up to 205 CFM of continuous air loss could be eliminated.

Leak Detection: Air leaks at the facility were estimated to account for almost 10 percent of the system capacity. Using an ultrasonic leak detector, 98 leaks were located, tagged, and logged to allow for repair. Continual leak detection and repair is an important part of an efficient compressed air system. Therefore, an ongoing leak detection program has been implemented with the help of maintenance staff.

Compressor Inlet Air Location: Temperatures within the plant's two compressor rooms averaged 10-30°F higher than the outdoor air temperature. For every 10°F reduction in inlet air temperature, a 2 percent savings in energy required can be achieved. Simple ducting to provide cooler ambient air will provide a savings of up to 29,500 kWh annually.

Compressor Relocation: Because of the separate locations of the plant's compressor rooms, proper control of the compressors has proven to be very difficult. Fluctuations between both sides of the systems cause artificial demand and wasted energy. It has been proposed to create a new centralized compressor room, which will allow for proper control as well as easier maintenance and operation of the compressor system.



Waste Heat Recovery: Up to 93 percent of the electrical energy used by an air compressor is converted into wasted heat. Up to 90 percent of this heat is easily recoverable, which amounts to more then 2 billion Btu's annually for all three compressors. Recovery of this heat for use in supplemental heating of the facility's warehouse areas would provide substantial savings in natural gas used for space heating.

Boiler Retrofit: The facility's boiler currently operates inefficiently due to an old burner that is difficult to adjust. A new burner will provide annual fuel savings of nearly 5 percent due to improved air-to-fuel ratios during operation.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
COMPRESSED AIR SYSTEM	$25,500	447,827 KWH	IN PROGRESS
WASTE HEAT RECOVERY	$23,065	21,760 THERMS	RECOMMENDED
BOILER	$8,607	6,206 THERMS	RECOMMENDED

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	1.452
CO	0.276
NOx	0.735
VOC	0.191
PM	0.039

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	281.478
CH4	53.295
N2O	0.238
CFC	3.469

Hach Company

COMPANY BACKGROUND

Hach Company is a leader in analytical instruments, test kits and reagents for water testing. The company manufactures a variety of products that can be used in labs, in-line processes or in the field. Its products are designed to be easy to use, high in quality and accessible to customers. Hach Company has two manufacturing facilities in the United States. The Ames facility produces chemical reagents and testing kits and is the worldwide product distribution center. Approximately 300 people work in the Ames facility.

CHRISTINE BAUER
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

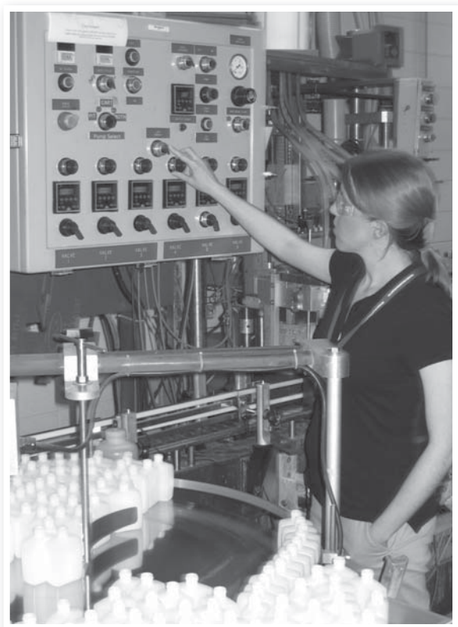
The intern primarily focused on two goals in waste reduction: heavy metal wastewater and aniline wastewater. These pollution prevention projects are viewed to have high economic and environmental impacts. Boiler insulation and compressed air leaks were also investigated.

INCENTIVES TO CHANGE

Hach Company is committed to reducing its environmental impact as well as its costs. Recent increases and changes to production have increased waste disposal costs and driven Hach to explore more advanced pollution prevention strategies. Potential savings were identified through the Pollution Prevention Intern Program. Actions related to boiler heat loss and compressed air leaks should result in significant spending reductions and reduced environmental impacts. These monetary savings will help Hach Company absorb other costs throughout the company.

RESULTS

Heavy Metals Wastewater Reduction: Molybdenum wastewater from cleaning bottling lines is collected after each product run. There is no standard procedure to control how much water should be collected as hazardous waste so collection was excessively cautious. Operators were often unnecessarily including non-hazardous rinses in the collection. Testing showed that minimizing the rinses and waste collection was possible and would not affect switch-over time between product runs. According to the data, this minimization would result in a waste reduction of about 40 percent and offer monetary savings.



Aniline Wastewater Treatment: Wastewater containing the hazardous constituent aniline is produced from a chemical synthesis process at Hach Company. An evaporator may be an option to reduce the volume of aniline waste. A pilot test showed that a 75 percent volume reduction was possible, which is a significant amount of hazardous wastewater. This option could be adapted to other waste streams at Hach Company. The intern also explored the use of an activated carbon system to reduce aniline waste. Test results on the effectiveness of the system are not conclusive at this time. Further research is needed to determine feasibility.

Boiler and Dryer Insulation: Hach Company's boilers and one dryer were appraised for insulation to prevent heat loss. Traditional insulation was impossible to easily remove for maintenance and production. A local appraisal company was contacted to provide a cost analysis for custom insulation.

Compressed Air: Compressed air is used throughout the plant, especially in the production lines and other machinery. A compressed air leak audit was completed and a total of 27 leaks were discovered. A record of each leak's location and description was kept, along with a tagging system using labeled pictures. A compressed air leak maintenance program would be an option to investigate in terms of viability and ease of implementation.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.564
CO	0.219
NOx	0.329
VOC	0.102
PM	0 .026

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	109.2
CH4	18.7
N2O	1.45
CFC	1.84

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
HEAVY METALS WASTEWATER REDUCTION	$3,200	1,100 GALLONS CHEMICAL WASTE	RECOMMENDED
ANILINE WASTEWATER REDUCTION - EVAPORATION	$8,400	6,060 GALLONS HAZARDOUS WASTE	INVESTIGATION IN PROGRESS
BOILER INSULATION	$8,910	12,002 THERMS	RECOMMENDED
REPAIR COMPRESSED AIR LEAKS	$7,700	128,000 KWH	RECOMMENDED

Hydrite Chemical Company

COMPANY BACKGROUND

Established in 1929, Hydrite Chemical Company is a diversified chemical company with national reach. Hydrite Chemical Company currently has ten locations throughout Illinois, Indiana, Iowa, and Wisconsin. Established in 1984 and employing 55 people, Hydrite Chemical Company in Waterloo, Iowa, specializes in cleaning products and manufactured sulfur products. At the Waterloo facility, a majority of chemicals are in liquid solution and require large volumes of water for processing and cleaning. Hydrite claims more than $60 million in annual sales each year.

ADAM SMITH
CHEMICAL ENGINEERING, UNIVERSITY OF IOWA

PROJECT BACKGROUND

Hydrite utilizes a permitted Elementary Neutralization Unit (ENU) to pH-adjust more than 50 million gallons of wastewater each year before it is disposed to the Waterloo publically-owned treatment works (POTW). Hydrite expressed interest in substantially reducing their virgin chemical needs by more than 20 percent. The company also aims to reduce the overall volume of wastewater disposed to the POTW by more than 10 percent.

INCENTIVES TO CHANGE

Described as the "heartbeat" of the plant, the ENU requires more than $200,000 in virgin food-grade chemicals per year to adjust the pH of the wastewater. Due to the nature of pH adjustments and the large volume of chemical wastewater generated at Hydrite, the ENU struggles at times to keep up with neutralizing the incoming wastewater. By reducing the overall volume of generated wastewater and subsequently reducing the virgin chemical needs, Hydrite may reduce the burden on the ENU, reduce its yearly water, chemical, and disposal costs, and become more environmentally friendly.

RESULTS

Advanced Control Programming and Motorized Control Valves: On average, 225 gallons of virgin caustic and 650 gallons of virgin acid are used each day to adjust the pH of chemical wastewater sent to the ENU. The current neutralization system involves an "all-or-nothing" control program to add the chemicals. When the pH of the wastewater goes outside the set boundary points, the caustic or acid valve opens completely, adding chemical to adjust the pH of the wastewater. Unfortunately, nearly 90 percent of the acid used for neutralization is wasted because of inadequate control of the neutralization chemicals. The addition of more complex control programming and motorized control valves will prevent the waste of at least 50 percent of the current neutralization chemical use. Improved control programming and motorized valves will allow for slower addition of chemical and subsequent longer reaction times. The programming will take into account the rate at which the pH is changing and the volume of the wastewater in the tank. This will result in fewer pH spikes and consumption of substantially smaller volumes of neutralization chemical.

Marketable material: Due to the reduction in raw material usage used for internal operations the surplus inventory can now be included with the saleable materials.

Flow Control Valves for Pump Seals: Pump seal flushes utilizing softened water are widely used throughout the Waterloo facility. Twenty pumps run continually throughout the plant, requiring seal flushes to remove build-up of solids. With a varying range of flow rates and water pressures, and an average of more than two gallons per minute throughout the plant, pump seal flushes are the largest wastewater generators, producing 36.7 percent of total wastewater volume, or 57,600 gallons per day. Pump manuals specify that only one-half to two gallons per minute are necessary to provide adequate flushing of solid build-up. Pump seal flow rates can therefore be reduced from 2 GPM to 1 GPM using flow control valves. It is recommended that flow control valves be installed to limit and control the liquid flow rate through pipes. This measure would prevent excessive flow rates and manual valve tampering and would significantly reduce costs by conserving large volumes of water.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.288
CO	0.735
NOx	0.254
VOC	0.383
PM	0.048

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	130.8
CH4	110.2
N2O	72.9
CFC	4.58

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
ENU NEUTRALIZATION CHEMICAL ADDITION ADVANCED CONTROL PROGRAMMING	$79,205	106,945 GALLONS OF ORGANIC CHEMICAL	IMPLEMENTING
ENU NEUTRALIZATION CHEMICAL ADDITION ADVANCED CONTROL PROGRAMMING	$79,810 (ADDITIONAL SALES)	-	RECOMMENDED
INSTALLATION OF FLOW CONTROL VALVES FOR PUMP SEALS	$17,815	10,512,000 GALLONS	RECOMMENDED

John Deere Ottumwa Works

COMPANY BACKGROUND

Deere & Company, founded in 1837 and collectively called John Deere, has grown from a one-man blacksmith shop into a corporation that conducts business around the world and employs approximately 56,000 people. John Deere consists of three major business segments: agriculture and turf, construction and forestry, and credit. The company's three support operations (parts, technology systems, and power systems) help customers be more productive as they improve the quality of life for people worldwide.

NICHOLAS PETRICH
CHEMICAL ENGINEERING, UNIVERSITY OF IOWA

PROJECT BACKGROUND

John Deere is guided by four main core values which are commitment, innovation, integrity, and quality. These values help the company as it conducts its business and protects employees, customers, suppliers, and the environment. The environmental department of John Deere Ottumwa Works (JDOW) strives to meet or surpass environmental expectations on company and governmental levels. The company's 2008 Environmental Goals and Objectives include hazardous and solid waste reduction. JDOW's main goal is to lower its hazardous waste generator status to a small quantity generator, which produces less than 1,000 kg of hazardous waste per calendar month.

INCENTIVES TO CHANGE

JDOW spends an estimated $31,000 per year to purchase solvents to clean the paint gun lines. On-site solvent distillation has been under consideration for many years at JDOW. Solvent distillation would recover the solvent that is used to clean and flush the paint gun system. However, due to the lack of time and initial investment required to purchase, install, and use a distillation unit, the plant had resorted to another method to dispose of its paint and solvent waste. Used paint/solvent waste is currently shipped out as hazardous waste through a certified hauler, costing the company an estimated $15,000 per year. Not only is this an excessive cost for JDOW; the manufacturing of this solvent contributes to releasing greenhouse gases into the atmosphere.

RESULTS

Solvent Substitution: One option for reducing the hazardous waste generated by the facility is to replace the existing hazardous solvent with one that is safe and environmentally friendly. Solvent substitution is an ongoing project at JDOW. The company is currently testing alternate biodegradable solvents as replacements. When this is accomplished, it will help JDOW move a step towards reducing its hazardous waste generator status.

Solvent Distillation: Periodically, waste solvent must be removed from the site to a disposal facility. Currently, about 4,000 gallons of solvent is purchased per year to clean the paint gun lines. By using a distillation unit to recover solvent from the spent material, an estimated 3,500 gallons annually could be reduced. There would also be a reduction of greenhouse gas emissions and conventional air pollutants associated with the manufacturing and transportation of the solvent and hazardous waste.

Waste Monitoring System: Currently, JDOW's solid waste compactor is picked up weekly and taken to the local landfill. However, when this is done, the compactor is only 60 percent full, on average. If a waste monitoring system for JDOW's compactor were installed, the landfill waste would no longer need to be picked up weekly. This would allow the trash compactor to reach full capacity before it is picked up, which would reduce the number of waste hauls by 40 percent. This would save JDOW roughly $3,000 dollars annually in transportation and fuel costs and would reduce conventional air pollutants and greenhouse gas emissions by 40 percent.

Office Paper: JDOW currently recycles office paper throughout the facility. However, starting August 1, 2009, if office paper comprises more than 10 percent of JDOW's waste going to the landfill, the overall price of waste per ton will double. To optimize recycling of office paper, every office employee has a saddle basket connected to his or her trash bin for paper recycling. In addition, 23-gallon recycling bins were placed by every major copier, printer, and fax machine. By recycling as much office paper as possible, JDOW will avoid extra landfill costs.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.073
CO	0.332
NOx	0.066
VOC	0.095
PM0	0.024

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	27.82
CH4	4.00
N2O	2.02
CFC	0.89

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
SOLVENT SUBSTITUTION	N/A	HAZARDOUS WASTE REDUCTION	UNDER EVALUATION
SOLVENT DISTILLATION	$49,000 – $65,000	HAZARDOUS WASTE REDUCTION 24.9-30.8 TONS CO2E	RECOMMENDED
WASTE MONITORING SYSTEM	$3,000	2.39 TONS CO2E	RECOMMENDED
OFFICE PAPER RECYCLING	N/A	SOLID WASTE REDUCTION	IN PROGRESS

Koch Nitrogen Company

COMPANY BACKGROUND

Koch Nitrogen Company is a subsidiary of Koch Industries, Inc., which is one of the largest privately owned companies in America. The Fort Dodge plant has 48 employees. Koch Nitrogen manufactures, markets, and distributes nitrogen fertilizer products. Its Fort Dodge facility produces up to 1,100 tons of ammonia and 1,800 tons of urea ammonium nitrate each day. The company places a high priority on the environment and it is committed to performing better than mandatory environmental regulations.

ALISON DIRKS
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

Due to the low boiling point of ammonia, vaporization occurs easily within the storage tanks. When pressure builds, ammonia must be flared to reduce this pressure. Although the flare is operated within permit limits, Koch Nitrogen Company's goal was to further reduce the amount of ammonia flaring that occurs. An additional goal was to reduce the amount of ammonia lost to fugitive emissions within the process.

INCENTIVES TO CHANGE

Every pound of ammonia burned or lost within the process is a pound of manufactured product that could have been sold. Flaring ammonia also produces NOx emissions. Using one year as an example, $264,019 worth of ammonia was flared in 2007, emitting 80,088 pounds of NOx. With improvements made to the loading and storage system, Koch Nitrogen Company can keep more product available for sale and reduce emissions even further. Fugitive emissions also result in wasted product. Estimated losses for 2008 amount to 98,000 pounds of ammonia. The economic and environmental benefits from reducing lost product are incentives to change.

RESULTS

Compressor Replacement: The refrigeration system includes a set of four back-up compressors that help keep storage tank pressure down. These supplement three primary compressors that are used all of the time. The primary compressors are sufficient under most circumstances. However, under extreme weather conditions, the back-up compressors do not have the capacity to continually handle all of the ammonia vapors from the two 30,000 ton ammonia tanks. Additionally, during plant shutdowns the primary compressors do not run and more ammonia is flared.

Because the primary compressors are able to keep tank pressures down in most circumstances, attention focused on the back-up compressors. The back-ups were installed in 1968. Therefore, efficiency is not as high as possible and parts are becoming obsolete. In order to reduce flaring and electricity costs, these compressors should be improved. Average potential profits would amount to $41,324 each year, reducing NOx emissions by 12,030 pounds.

Railcar Loading Reroute: Railcars are loaded with liquid ammonia. When the railcars are filled, ammonia is left in the line between shut-off valves. Currently, this is routed to the flare. Although there is not a large amount per railcar, the total ammonia flared from railcar loading could produce an annual profit of $824 and emit 288 fewer pounds of NOx. This ammonia could be rerouted from the flare back to a storage tank. However, there are not enough railcars loaded at this time to offset piping installation price quotes.

Leak Detection: In order to locate leaks accounting for the fugitive emission totals, an ultrasonic leak detector was used throughout the plant. The bolts on many valves, flanges, and other connections should be tightened more frequently, reducing the amount of ammonia that escapes. This kind of preventative maintenance would reduce electricity costs and also keep more product available for sale. Leaks found within reachable areas of the plant could prevent 63,700 pounds of ammonia from escaping and save $18,836 annually.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.59
CO	1.29
NOx	1.18
VOC	0.42
PM	0.24

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	392.7
CH4	32.9
N2O	401.5
CFC	1.93

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
SKID BUILDING COMPRESSOR REPLACEMENT	$41,324	12,030 LBS NOx PREVENTED	RECOMMENDED
RAILCAR LOADING LINE REROUTE	$824	288 LBS NOx PREVENTED	RECOMMENDED (UPON INCREASE IN PRODUCTION)
PREVENTATIVE MAINTENANCE – LEAK DETECTION	$18,836	63,700 LBS NH3 PREVENTED	IMPLEMENTING

Nebraska Medical Center

COMPANY BACKGROUND

The Nebraska Medical Center (NMC) is Nebraska's largest hospital and a national leader in the areas of organ transplant, cancer treatment and neurology. Situated in Omaha, Nebraska, NMC's main campus is comprised of 14 buildings that provide more than two million square feet of space, 689 licensed beds and 29 operating rooms. NMC employs more than 1,000 physicians and nearly 5,000 hospital staff.

DAVID JONES
MECHANICAL ENGINEERING, UNIVERSITY OF IOWA

PROJECT BACKGROUND

The NMC Energy Management Team had outlined a number of energy-saving opportunities. The intern focused on the retrofit of lighting fixtures in two of the hospital complex's doctor's office towers. The retrofits will provide energy savings and other less quantifiable benefits as well.

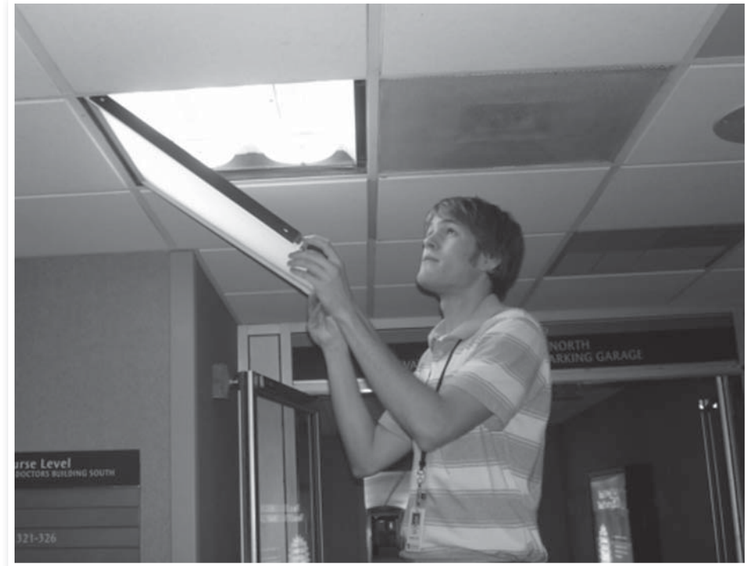
INCENTIVES TO CHANGE

The NMC Facilities Management Team has made a commitment to reduce the hospital's environmental impact. Increasing utility rates and aging light fixtures are further incentives for NMC to cut consumption and increase end-user satisfaction. The energy and dollar savings associated with this project amount to more than just bottom-line reductions; money saved from lighting costs can be put to use in future projects around the NMC campus.

RESULTS

Lighting Retrofit: The goals of this lighting project are: (1) to increase light levels throughout the facilities, (2) to decrease energy consumption and (3) to utilize utility provider incentives and state-of-the art retrofit fixtures. Two out dated lighting technologies are targeted in this project. T12 fluorescent fixtures will be replaced with higher efficiency T8 fixtures, powered by electronic ballasts. Incandescent bulbs, which appear in a variety of wattages throughout the two buildings, will be replaced with compact fluorescent lamps.

Of top priority to the NMC staff is the satisfaction and safety of patients, doctors and other hospital personnel. Light levels throughout the doctor's buildings, including exam rooms, office and reception space, hallways and stairwells were insufficient. Through frequent use, lamp depreciation and the build-up of dirt, old lighting fixtures lose their ability to effectively illuminate space over time. New lighting can significantly increase light levels with fewer lamps, while updating the aesthetic value of these facilities.



In the two buildings targeted by this project, there are more than 400 incandescent down-lighting fixtures and roughly 1,600 T12 light fixtures containing approximately 4,200 40-watt lamps. By replacing these fixtures, the electrical consumption attributed to lighting can be cut nearly in half. Due to annual increases in utility rates, dollar savings will be compounded year after year.

By standardizing the use of T8 and compact fluorescent technologies, demands on maintenance and inventory will also be greatly simplified, which will further reduce costs.

The fixtures chosen as replacements have many desirable qualities. They are retrofit kits, which utilize some of the existing fixtures, helping to reduce waste and disposal costs. They have a modern architectural style, which will breathe new life into dated facilities. These fixtures will also take full advantage of rebates made available through a lighting incentive program administered by the local utility provider.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	2.39
CO	0.24
NOx	1.14
VOC	0.04
PM	0.06

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	440.92
CH4	16.53
N2O	0.22
CFC	5.42

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LIGHTING RETROFIT	$39,400	695,400 KWH	IMPLEMENTING

Quaker Oats

COMPANY BACKGROUND

Quaker Oats Company, a division of PepsiCo, operates the world's largest cereal mill, located in downtown Cedar Rapids. The production facility was built in 1873 and employs more than 1,000 people. There are 1.9 million square feet of building under roof. Quaker Oats produces many well-known brands, including Life cereal, Captain Crunch cereal and Quaker Oatmeal.

DUSTIN TARDIFF
MECHANICAL ENGINEERING, UNIVERSITY OF IOWA

PROJECT BACKGROUND

Quaker Oats Company is continuously improving its environmental awareness and sustainability. Quaker's Cedar Rapids plant has begun to map utility usage throughout its various production lines for use in resource conservation projects. As part of a growing resource conservation initiative, the utility modeling is a long-term project that will identify opportunities to eliminate wasted energy.

INCENTIVES TO CHANGE

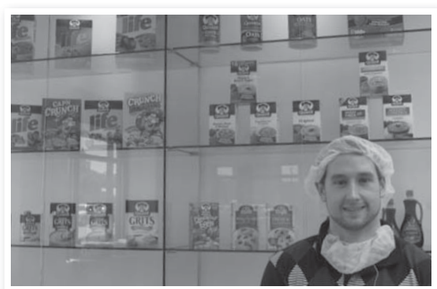
The size and age of the plant, as well as the complexity of numerous lines and operations, create many opportunities to reduce resource consumption and decrease energy costs. Additional demands being placed on current equipment increase the need to fully understand consumption inside the plant. Effects of the 2008 flood have presented additional needs and opportunities for improvement. Major production components use multiple sources of energy, and as prices continue to rise, sustainable practices will become increasingly vital.

RESULTS

Utility Model: Manufacturing departments were analyzed to determine utility usage rates. Natural gas, water, steam, and electricity were estimated at the specific process level such as ovens, mixing, and extruding. Internal energy sources of compressed air and vacuum air were considered as well. Particular attention was given to flow parameters, in order to identify opportunities for pollution prevention strategies and cost savings.

Flash Furnaces: Flash furnaces are used to heat air to approximately 500° F for cereal food processing. Currently, this air is exhausted through the roof. It is recommended that the hot air be routed back to the respective flash furnaces to recover heat energy, which would reduce natural gas use for this system. A fresh-air intake damping system should be included for airflow adjustment as process demands continue to change in the future.

Flash Steam: The main use of steam throughout the plant is in oat milling processes. One building in particular presents an excellent opportunity to implement a condensate flashing vessel in order to regenerate low-pressure steam. This will not only recover heat and provide additional steam, but also provide a control for condensate flow.



Compressed Air: A compressed air audit assessed the plant-wide distribution system and its more than 300 dust collectors. Dust collection is an essential function throughout the plant. Fans and airlocks are used to remove and control unwanted light material from main product feeds. Plant compressed air is used to clean filters within the dust collection units in order to maintain airflow.

Leaks and equipment malfunctions have become an increasing problem in terms of production and energy costs. Repairing current problems would provide quick payback through energy savings in compressed air conservation. Likewise, instituting a rigorous compressed air program to identify and repair leaks and maintain dust collectors would ensure continued savings in the future.

Steam Traps: Steam use accounts for roughly 40 percent of the plant's utility costs. Steam trap audits conducted plant-wide found significant energy and cost savings could be realized by repairing or replacing failing steam traps. Further, steam load shortages have been detrimental to production in certain departments.

Instituting a continual steam trap program to maintain the more than 1,000 steam traps would reduce steam loss and improve the plant's condensate recovery system. An active steam trap database for reporting failures would benefit the company.

Lighting: A proposal for plant-wide lighting upgrades has been formulated to conserve energy and lower maintenance costs. Utility rebates and tax credits would augment electrical and maintenance savings.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	13.22
CO	2.95
NOx	6.63
VOC	3.05
PM	0.40

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	2777.13
CH4	3325.09
N2O	1660.00
CFC	32.92

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
UTILITY MODELING	-	-	IN PROGRESS
FLASH FURNACES: WASTE HEAT RECOVERY	$47,695	95,389 THERMS	RECOMMENDED
FLASH STEAM	$22,025	9,471 THERMS (957,600 POUNDS OF STEAM)	RECOMMENDED
COMPRESSED AIR REPAIRS AND MAINTENANCE	$195,595	3,957,780 KWH	IN PROGRESS
STEAM TRAP REPAIRS AND MAINTENANCE	$529,600	397,200 THERMS (33,100,000 POUNDS OF STEAM)	RECOMMENDED
LIGHTING UPGRADE	$130,145	1,451,236 KWH	RECOMMENDED

Sara Lee Foods

COMPANY BACKGROUND

Sara Lee Foods, Storm Lake Plant division, is a large-scale turkey harvesting facility employing approximately 660 people. The facility was founded by Bert Vilas; then in 1902 the company expanded and changed its name to Bil-Mar Foods. In 1987, Sara Lee Foods purchased the plant from Bil-Mar and the company has been expanding its processes ever since. The plant processes more than 8.1 million birds each year, resulting in 232 million pounds of finished product.

CHELSEA LAMAR
ENVIRONMENTAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

Sara Lee Foods continuously assesses its environmental performance and upholds environmentally friendly practices that respect the earth and its restricted resources. The main projects pursued during the summer focused on monitoring and reducing water and energy usage and examining the use of raw materials.

INCENTIVES TO CHANGE

Sara Lee Foods attempts to meet or surpass pertinent environmental laws and regulations and to continuously improve environmental performance through resource conservation, water and energy efficiency, waste curtailment, and well-organized use of raw resources. Sara Lee promotes the value of the environment around the world through sustainable environmental activities. As new regulations are implemented, the company constantly seeks new ways to conserve water, reduce energy use and decrease costs.

RESULTS

Water Conservation: An initial investigation determined that there were a number of areas in the plant where excess water was used. A water audit was conducted and areas with opportunities for improvement were identified. Recommended changes include: installing aerators on hand wash stations, installing a new valve on the thigh deboner, installing a photo eye on a bird wash and diverting the cavity overflow from one of the meat chillers. Behavioral changes were also made in order to conserve water by staff, including turning off water to all production machines during breaks and lunches. These changes resulted in a savings of $27,310 in water, heating, cooling, and chemical costs.

Chiller water re-use: There are three large meat chillers at Sara Lee that hold a total of 100,000 gallons of water. This project would involve reusing some of the water from the final chiller in a preliminary chiller. This project could save 25,000 gallons of water daily. It would also reduce cooling and chemical costs, with annual savings of approximately $50,580.

Boiler Insulation: Sara Lee Foods uses steam for heating water and for different processes throughout the plant. Adding insulation to the boiler tanks, condensate return lines, hot water lines, and other processes would result in significant energy savings. It was recommended that Sara Lee insulate 900 feet of bare piping and add 60 insulating blankets, resulting in an energy savings of 47,600 therms.

Stack Economizer: Installing a boiler economizer could reduce operating costs by recovering energy from flue gas. This would be a feasible project because there would be little condensate returned in the steam system, resulting in annual savings of $10,990 for the company.

Reverse Osmosis System: Installing a reverse osmosis system to remove particulates from the boiler feedwater is an attractive project. It would reduce blow-down as well as chemical usage, and would save water, sewer, and chemical costs.

Energy Improvements: Adding occupancy sensors to the lighting in the offices, hallways, and storerooms, and installing vending misers in the cafeteria will result in energy and cost savings.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.372
CO	0.522
NOx	0.325
VOC	0.707
PM	0.031

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	134.224
CH4	428.381
N2O	0.469
CFC	1.518

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WATER CONSERVATION	$27,310	3,580,000 GALLONS 6,430 THERMS	IMPLEMENTING
CHILLER WATER RE-USE	$50,580	6,500,000 GALLONS 15,480 THERMS	RECOMMENDED
BOILER INSULATION	$40,280	47,600 THERMS	RECOMMENDED
STACK ECONOMIZER	$10,990	13,100 THERMS	RECOMMENDED
REVERSE OSMOSIS SYSTEM	$7,080	255,000 GALLONS 9,400 THERMS	RECOMMENDED
ENERGY IMPROVEMENTS	$1,430	35,750 KWH	IMPLEMENTING

Snap-on Tools

COMPANY BACKGROUND

Snap-on Tools in Algona, Iowa is a global manufacturer of tools and equipment that are known for their high quality and durability. The Algona plant is approximately 500,000 square feet in area, employs approximately 270 workers, and manufactures large tool storage equipment. Rolls of sheet metal enter the plant and are stamped, formed, welded, painted and assembled to create the final product. The powder-coat paint systems allow for a variety of colors and textures to match the customers' needs.

TYLER GIBNEY
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

Snap-on Tools uses three air-cooled reciprocating chillers to cool several important plant processes. With reliability and efficiency as top priorities for Snap-on, a decision was made to consider upgrades to improve the chiller system and compressed air system.

INCENTIVES TO CHANGE

The 30-year old chillers affect production at Snap-on Tools, which would be temporarily interrupted if the chillers were to quit working. Maintenance costs escalate as aged parts wear out. Audible air leaks are an indication that a compressed air system is not working as it should be, and subsequent costs of these inefficiencies can be unknown. It was determined that an upgrade to the efficiency and reliability of the chiller and compressed air systems would generate significant cost savings and reduce the risk of production delays.

RESULTS

Chiller System: The current chillers, rated at 340 tons, are used for cooling plant air compressors, welders, and air conditioners. Two newer, more efficient, water-cooled chillers, rated at a total of 360 tons, are available at the plant since the removal of an electrocoat painting system in 2008.

Switching the chillers would benefit Snap-on in several ways. The most important reason to switch the cooling load to the water-cooled chillers is to minimize potential production disruptions. Switching to water-cooled chillers would also reduce the amount of electricity required to operate the plant, which will result in cost savings.

Compressed Air System: Compressed air is used in the majority of processes at the plant and is essential for production. For Snap-on, compressed air is one of the most expensive utilities, accounting for 15 percent of the electricity used at the plant. The cost of leaks and of running the compressors overnight and on weekends adds up quickly.

With the assistance of the intern a plan was developed to optimize the compressed air system. Modifications to operating and maintenance procedures were also developed which are expected to produce substantial cost savings for Snap-on Tools with minimal capital cost. The benefits of implementing the comprehensive plan to optimize the compressed air system would include reductions in noise, heat generated, cooling capacity required, and energy used.

Repair Compressed Air Leaks: With leaks accounting for a significant portion of daytime air use, a great deal of electricity and money can be saved by spending a small amount of time repairing them. A tagging system was developed to enhance consistency in maintenance of the compressed air system.

On-going Leak Detection Program: A preventative maintenance program is necessary to ensure leaks are kept to a minimum and the compressed air system continues to operate efficiently. Snap-on Tools owns an Ultraprobe 100 leak detector, which has the ability to locate costly air leaks that are not otherwise audible, and has implemented it into the preventative maintenance program so the entire plant can be checked quarterly with the leak detector to keep the system working efficiently.

Reduce Air Compressor Running Times
Only a small amount of air is needed during the overnight and weekend hours to supply a small area of the plant, yet demand was not dropping proportionately during this time. Snap-on Tools uses valves which are tied to the lighting system and allow for specified sections of the plant to be provided with compressed air while other sections are not operating. Installing an additional valve into a recently installed air line will eliminate leakage into plant areas not currently in production.

A timing device that would allow for automatic settings for one shift, two shift, and manual on/off positions can be added to the compressed air system to further reduce wasted run time. Based on the number of shifts that the plant is currently operating, the timer would be set to automatically shut down and restart the compressors at specified times.

Add Receivers & Increase Main Air Line Size: Additional demand side storage capacity would reduce the pressure settings that are required for the lack of current volume.

Turn 2 Pumps Off Nights & Weekends: An additional compressor can be shut down during the off hours by supplying the required compressed air for the product recovery area through re-plumbing to another operating unit.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	6.46
CO	0.66
NOx	3.07
VOC	0.11
PM	0.16

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	1,193.73
CH4	44.88
N2O	0.61
CFC	14.68

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
CHILLER UPGRADE TO WATER-COOLED UNITS	$35,739	1,089,964 KWH	IN PROGRESS
REPAIR COMPRESSED AIR LEAKS	$25,541	851,367 KWH	IN PROGRESS
ON-GOING LEAK DETECTION PROGRAM	$10,000	333,333 KWH	RECOMMENDED
REDUCE AIR COMPRESSOR RUNNING TIMES	$27,153	905,112 KWH	IN PROGRESS
ADD RECEIVERS & INCREASE MAIN AIR LINE SIZE	$8,000	200,000 KWH	RECOMMENDED
TURN 2 PUMPS OFF NIGHTS & WEEKENDS	$1,861	63,307 KWH	RECOMMENDED

Tyson Foods, Inc.

COMPANY BACKGROUND

Tyson Foods, Inc. is the world's largest processor of chicken, beef, and pork and the second-largest food company in the Fortune 500. Tyson produces a wide variety of food products as well as rendered products and tanned hides to customers throughout the United States and more than 80 countries. The company employs 114,000 people at more than 300 facilities and offices in the United States and around the world, including eight facilities in Iowa.

HEATHER COPELAND
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

The purpose of the intern project was to develop a water use inventory and to create tracking tools that would allow personnel to better understand the water usage at various facilities. It was important that the tracking tools could easily be replicated at any Tyson facility. The tracking tools will allow the impact of future water conservation projects to be monitored.

INCENTIVES TO CHANGE

Food processing is a very water-intensive process. Source reduction is becoming an important focus as utility costs continue to increase and natural resources become more scarce. All utilities are impacted by a decrease in water usage. Energy bills are reduced when less electricity is required to pump the water throughout the facility and treat the water at the wastewater facility. Water utility bills drop due to a reduction in the amount of water required to operate. Wastewater treatment plants operate more efficiently with the decreased load.

RESULTS

Water Audit: An inventory of major water-consuming equipment was completed at two beef and two pork plants. Equipment flow rates and specifications were recorded in the inventory. Flow diagrams were created to illustrate how the equipment and water meters are connected in the water system. Equipment usage and water meter readings were also included. The flow diagrams will help with implementation of future water conservation projects and will allow for comparisons across different facilities.

Meter Installation: Several meters were recommended for installation at each facility visited by the intern. Water meters provide an opportunity to gather detailed water usage and track operating changes. It was recommended that Tyson Foods install meters on several of the large washes on the slaughter floor at all of the facilities that were visited by the intern. Installing several additional meters in areas common to each facility will allow the company to compare water use per head across all of its beef and pork plants.

Leak Detection Maintenance Program: Several water leaks of various sizes were observed in the facilities that the intern visited. It is recommended that a leak detection maintenance program be implemented at all Tyson facilities. The program would assign maintenance personnel to conduct daily walks around the facility to look for any leaks. The assigned personnel would be in charge of logging the location and severity of all leaks and scheduling repair. The main goal of this program would be to decrease water usage caused by unrepaired leaks and to create awareness of the occurrence of new leaks.

Pump Operating Conditions Modifications: Pumps that do not operate at the designed optimum-efficiency point consume excessive energy. Several modifications to pump operating conditions are recommended for each plant that was visited. High-pressure pumps were targeted since they require large horsepower motors to operate. Small inefficiencies can turn into thousands of dollars of unnecessary electricity costs. It was recommended that impellers be replaced on two of the high-pressure pumps at one facility to increase efficiencies.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	5.42
CO	0.71
NOx	2.61
VOC	0.38
PM	0.14

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	1038.86
CH4	400.44
N2O	190.80
CFC	12.64

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
LEAK DETECTION PROGRAM AND METER INSTALLATION	$90,000	452,000 KWH 69,200,000 GALLONS	RECOMMENDED
PUMP OPERATING CONDITIONS MODIFICATIONS	$70,000	1,622,000 KWH	RECOMMENDED

** Calculations represent three of the four Tyson facilities visited (Storm Lake, IA, Perry, IA and Lexington, NE)*

Vermeer Corporation

COMPANY BACKGROUND

Located in Pella, Iowa, Vermeer Corporation has grown from a one-person operation in 1948 to become a leading manufacturer of environmental, construction, agricultural and industrial equipment. The Iowa production facility employs approximately 2,000 people across seven production plants and provides equipment for more than 150 dealerships worldwide.

BRIAN BAEHLER
CHEMICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

As a supplement to its corporate environmental policy, Vermeer utilized the Pollution Prevention Intern Program to decrease its overall environmental impact in all areas of production.

A previous year's intern devised a process by which the sludge produced in the on-site water treatment system could be land-applied. In addition to the cost savings through eliminated labor and disposal fees, the discontinued operation of the sludge filter press produces a cleaner environment for the process water treatment plant employees.

The 2009 intern focused mainly on water reduction projects throughout the production plants.

INCENTIVES TO CHANGE

Environmental efforts have been and continue to be a focus at Vermeer. An extensive recycling program is already in place and annually diverts hundreds of tons from the local landfill. In a time of increasing environmental awareness and water costs, water conservation can provide not only significant cost savings but can help promote environmental stewardship as well.

RESULTS

Distiller Cooling Water Loop: Solvents used in the painting process at Vermeer are recycled in-house using a solvent distiller apparatus. In order to condense the solvent vapors back into a usable liquid form, cooling water is used as a heat exchange medium. It was found that the distiller's condenser operates with a single-pass cooling water system and operates at 6 gallons per minute or 3.1 million gallons per year. The conversion of the single pass system to a recirculation loop will reduce the amount of water consumed by the distiller to almost zero and in the process reduce the total amount of water used at Vermeer by 12 percent.

Rainwater Harvesting: Because Vermeer's buildings are covered by more than one million square feet of steel roofing, rainwater harvesting has the potential to provide a significant portion of the source water needed by the in-house reverse osmosis (RO) systems. Based on the average rainfall rate for central Iowa, each of the seven production plants at Vermeer could collect 2.2 million gallons per year. The rainwater collected would contain fewer contaminants than the water provided by the city and would reduce water purchases. In addition, the membranes used in the RO systems would need to be replaced less often, providing further cost savings.

Reverse Osmosis Membrane Replacement: The reverse osmosis systems that provide water to the automated parts washers operate with a rejection rate of 40 percent. The chlorine and high amounts of total dissolved solids (TDS) make lower rejection rates uneconomical as the cost of replacing the membranes becomes excessive. Replacing the current membranes with cellulose acetate based membranes offers a solution. These types of membranes can withstand higher amounts of chlorine while still operating at rejection rates of between 10 and 15 percent. Replacing the membranes would save 1.4 million gallons of water annually.

Automated Landscape Watering Controls: Often overlooked, the amount of water spent for landscaping purposes can quickly reach substantial volumes especially at large manufacturing facilities. Automated water controls that utilize weather and soil data can provide water savings of 30 percent simply by preventing over-watering.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.04
CO	0.07
NOx	0.03
VOC	0.11
PM	0.01

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	21.74
CH4	143.52
N2O	75.15
CFC	0.21

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
DISTILLER COOLING WATER LOOP	$13,400	3,100,000 GALLONS	IMPLEMENTING
RAINWATER HARVESTING (SINGLE PLANT)	$7,500	2,200,000 GALLONS*	RECOMMENDED
RAINWATER HARVESTING (ALL PLANTS)	$53,040	15,600,000 GALLONS	RECOMMENDED
REVERSE OSMOSIS MEMBRANE REPLACEMENT	$5,160	1,400,000 GALLONS	RECOMMENDED
AUTOMATED LANDSCAPE WATERING CONTROLS	$1,980	450,000 GALLONS	RECOMMENDED

Volume of water is calculated for a single production area. Total volume of water would depend on the amount of production areas converted for rainwater harvesting.

Hospital Circuit Rider

COMPANY BACKGROUND

The hospital circuit rider internship originated from the Hospitals for a Healthy Environment (H2E) initiative, which is now integrated into Practice Greenhealth. Practice Greenhealth is the nation's only membership association devoted to environmentally responsible healthcare. It is a nonprofit organization founded on the principles of positive environmental stewardship and best practices by organizations in the healthcare community. Practice Greenhealth encourages mercury elimination, waste reduction, and environmentally sound operational practices.

LUCINDA SMART
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

The circuit rider internship is in its third year and is funded by a grant from the Environmental Protection Agency (EPA) Region VII. The intern visits hospitals throughout Iowa and Nebraska to identify mercury, strategize new energy efficiency methods, and provide waste reduction and management techniques. A similar project is also carried out through the Kansas State University Pollution Prevention Institute to reach hospitals in Kansas and Missouri.

INCENTIVES TO CHANGE

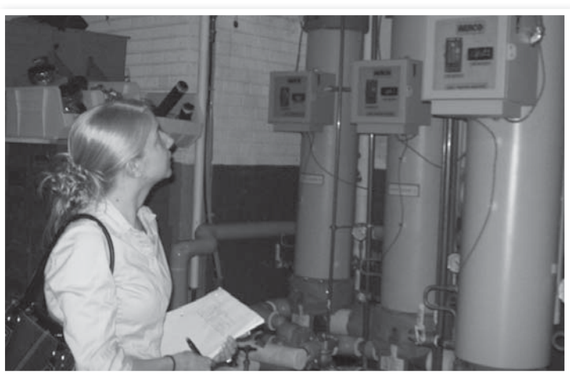
Mercury is listed as one of 12 priority chemicals by the EPA's Persistent, Bioaccumulative, and Toxic (PBT) Program. Mercury neonatal exposure is linked to serious birth defects. All hospitals are encouraged to eliminate mercury from their facilities due to its toxic properties.

Hospitals are among the nation's most energy-intensive sectors, spending more than eight million dollars on energy each year. The EPA reports that each dollar saved by a healthcare facility results in the equivalent of $20 of additional revenue. Greenhouse gas emissions from burning fossil fuels contribute to dangerous environmental and health consequences.

The proper segregation and reduction of regulated medical waste protects against infectious diseases, minimizes disposal costs, and reduces environmental impacts.

RESULTS

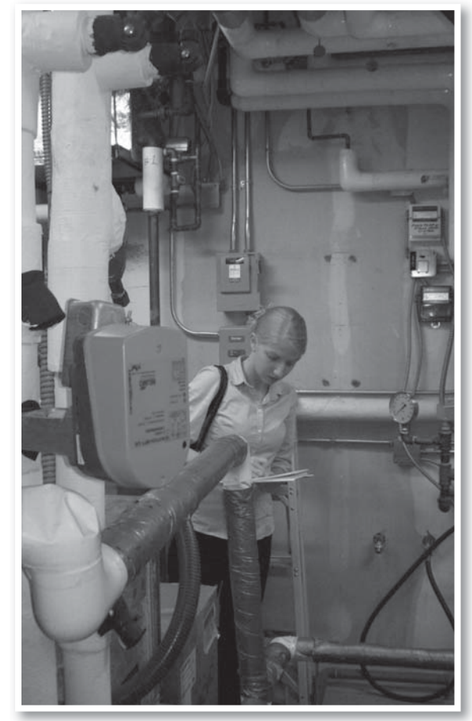
Mercury Reduction: Mercury audits were performed at nine hospitals throughout Iowa and Nebraska. The audits identified a total of 24.63 pounds of mercury. Hospitals were encouraged to remove this mercury, and to create a proper emergency spill procedure for mercury that must remain in the facility, such as within the fluorescent lighting.



Energy Star Applications: Hospitals use many standard appliances, such as refrigerators and televisions, which can be purchased as Energy Star appliances. The Energy Star label indicates an appliance uses 15 percent to 60 percent less energy than its standard counterpart. The Energy Star Portfolio Manager was created for each hospital to manage its energy and water consumption, in an effort to track changes as various projects are implemented.

Lighting Upgrades: Several opportunities for lighting upgrades exist within hospitals. Fluorescent lighting fixtures can be converted from magnetic T12 ballasts to electronic T8 ballasts and 25W T8 bulbs can replace 32W T12 bulbs. Decorative lighting that uses 75W halogen or incandescent bulbs can be switched to 9W compact fluorescent lights (CFL) to reduce energy consumption. Exit signs that are still using two incandescent bulbs at 36W per sign should be replaced with 5W light emitting diode (LED) signs. Occupancy sensors, used to turn off lights when necessary, can be placed in rooms that are frequently unoccupied or contain adequate natural lighting.

Miscellaneous Energy Projects: Other energy-saving options were presented specific to the facility. These included computer energy saving modes, Vending miser technology, rooftop reflection upgrades and window tinting. The computer energy savings modes include sleep and standby modes, saving a great deal of energy for no upfront cost. Vending miser technology uses motion detection to determine if a vending machine can be turned off while not in use. Rooftop reflection upgrades would decrease the solar heating effects during the summer and increase insulation during the winter. Window tinting decreases solar heating, provides additional insulation, and improves creature comfort in the facility.



Waste Reduction: Three hospitals were audited for their waste consumption. Regulated medical waste was inspected for proper segregation, and paper towel consumption was monitored. Infectious waste is labeled as RMW and must be placed in the appropriate bags. This material is generally incinerated to disinfect and therefore costs much more for disposal than non-infectious waste. If waste is not properly segregated, hospitals may be paying too much for waste disposal. Paper towel waste can be reduced by installing electric hand dryers.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	3.86
CO	0.92
NOx	1.85
VOC	0.15
PM	0.17

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	720.05
CH4	63.42
N2O	0.47
CFC	8.84

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
MERCURY REDUCTION	N/A	24.52 POUNDS	RECOMMENDED
ENERGY STAR APPLICATIONS	$7,779	349,467 KWH	RECOMMENDED
LIGHTING UPGRADES	$29,016	448,445 KWH	RECOMMENDED
MISCELLANEOUS ENERGY PROJECTS	$26,346	579,283 KWH	RECOMMENDED
WASTE REDUCTION	$7,079	3.47 TONS	RECOMMENDED

Thermal Imaging Circuit Rider

COMPANY BACKGROUND

The Iowa Department of Natural Resources (DNR) has offered technical assistance to Iowa companies since 2001 through its Pollution Prevention Intern Program. This program places qualified student interns with Iowa companies for 12 weeks to identify, research, and implement changes that result in environmental and financial savings. In addition, the Iowa DNR's Pollution Prevention Services maintains a staff of engineers and environmental specialists who regularly conduct assessments for facilities. The goal is to identify changes improve the company's economic and environmental performance. All of these services are confidential, non-regulatory, and free to Iowa industry.

MATT FISHER
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

The 2009 thermal imaging circuit rider internship was hosted by the Pollution Prevention Intern Program in partnership with a grant from the US Environmental Protection Agency. The grant funding provided cost share for the purchase of an infrared camera to be used to identify radiant energy loss and make recommendations for modifications that will improve efficiency. Traveling and doing thermal imaging and analysis of facilities throughout Iowa and Nebraska, the intern identified a multitude of areas for improvements at the companies visited.

INCENTIVES TO CHANGE

In today's unstable economy many companies are looking at all possible ways to save money. Add to that the possibility of sky-rocketing energy prices and energy-saving projects become all the more important. This pilot project will help establish parameters to integrate thermal imaging into the technical assistance offered by Pollution Prevention Services.

The intern used the infrared camera to identify areas of energy loss. Locating these sources and recommending corrective actions will assist companies in decreasing their equipment downtime and energy costs. In addition to reducing energy consumption companies will improve environmental performance. The intern also demonstrated ways to use thermal imaging in predictive and preventative maintenance procedures.

RESULTS

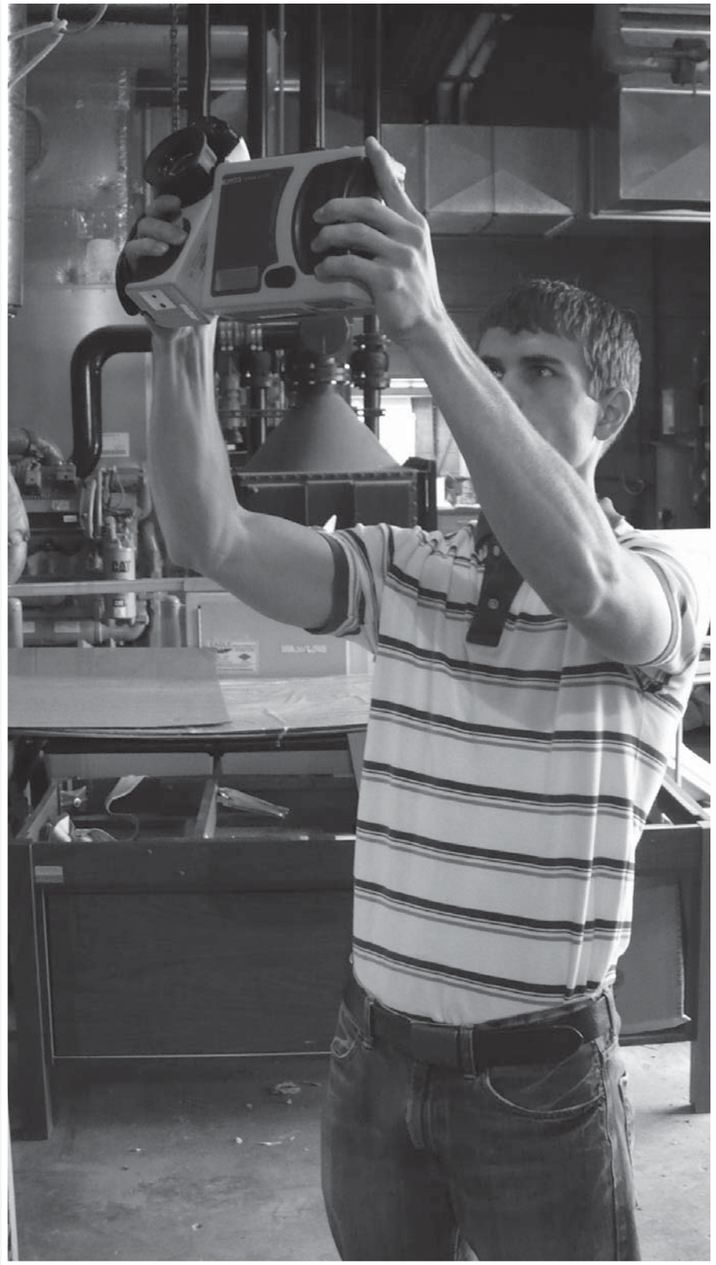
Electrical Panels: Inspecting electrical panels can lead to multiple benefits for a company. The intern identified loose, dirty, and corroded connections. These types of poor connections often have high resistance associated with them leading to the high temperature. Fuses and breakers were also examined because as they begin to fail, their temperature will increase. Another area evaluated was three phase wiring. Unbalanced three phase wiring will lead to higher electrical costs and can also be an early warning of equipment failure elsewhere in the line. A failure in any of these areas can cause a costly shutdown of production until the problem can be fixed.

Building Shells: The intern used thermal imaging to identify areas of poor insulation by looking for any anomalies during a scan of a building shell. Areas of no insulation along with areas of wet insulation can be identified when there is a contrast in the ambient conditions. A high contrast between the inside and outside temperatures makes identification easier. Fixing problems in a building shell can create a more comfortable environment to work in for employees and also reduce the amount of energy used to maintain a certain environment.

Motors and Shafts: Using the infrared camera, the intern identified motors that could be a source of high energy usage. A motor that is not operating at its optimum efficiency uses more electricity and will often produce more heat than one operating efficiently. Every 10°C a motor is running over its specified operating temperature cuts the life expectancy in half. When a company has many motors operating at reduced efficiencies, a large amount of electricity is wasted along with the additional load of having to cool the air beyond what would typically be needed. Worn shaft bearings were also identified as a source of energy waste. Failing bearings produce more heat and require more power to turn the shaft at the same speed. Keeping the motors and shafts working smoothly will save energy and reduce unexpected failure of equipment.

Door Seals: In facilities that have large areas of cold storage or walk-in freezers, poorly performing door seals can often go overlooked. The intern used the infrared camera to identify doors that have leaky seals. The thermal images were a visual representation of the condition of the door seals. The intern made recommendations for replacing old, cracked, or leaky door seals to keep air from leaking around the door and to reduce the amount of energy needed to maintain specified temperatures.

Boilers and Steam Lines: The intern used the camera to identify opportunities to reduce energy loss in boilers, steam lines, and condensate returns lines. Adding or replacing insulation can produce large energy savings. Added insulation will reduce the energy required to heat the fluid to the desired temperature, and will also reduce the energy needed to cool the area where the excess heat escapes. Insulation can typically reduce energy losses so substantially that any surface over 120°F should be insulated. Insulating these hot surfaces also provides employee safety and comfort when working around these surfaces.



Procter and Gamble

COMPANY BACKGROUND

Founded in 1837, Procter and Gamble is now one of the world's largest companies. Procter and Gamble makes many well known household and personal products, and employs over 138,000 people worldwide. The Iowa City site has traditionally been responsible for making shampoos and conditioners, as well as Scope® mouthwash. Shampoo and conditioner brands produced at Iowa City include Head and Shoulders® and Clairol Herbal Essence®. Recently the plant has expanded to include Crest Pro Health® mouthwash as well as Gillette® and Oil of Olay® body washes.

ALEX POSS
CHEMICAL ENGINEERING, UNIVERSITY OF IOWA

PROJECT BACKGROUND

The main goal of the pollution prevention internship was to investigate water reduction and reuse possibilities. Other projects identified included investigating the potential to use renewable energy onsite.

INCENTIVES TO CHANGE

In 2007, Procter and Gamble launched a global initiative to reduce carbon dioxide emissions by 10%. Procter and Gamble also committed to 10% reductions in water, energy, and solid waste. Goals have been set for each Procter and Gamble plant to achieve this reduction by fiscal year 2011-2012. For the Iowa City site, water has been identified as one of the key areas for improvement.

RESULTS

Wastewater Reuse: A recently constructed onsite wastewater treatment plant uses city water at several different places in order to blend with chemicals being added to the system. Rather than use city water, it is possible to reuse water that has already been through the treatment process. Using the effluent from the wastewater plant rather than city water will provide large water savings.

RO Optimization: The three reverse osmosis units used at the plant are currently being increased from 75 percent recovery to 80 percent recovery. A study was undertaken to determine if an 85 percent recovery was possible. Based on Reverse Osmosis System Analysis (ROSA) software results, 85 percent recovery has been shown to be obtainable. This will greatly reduce the amount of water used in the RO systems.

Also noticed in the process of optimizing the RO system is that the current antiscalant provider for the company is using a large amount of chemicals to control scaling. A quote from another antiscalant provider showed the potential to drastically reduce the amount of chemicals necessary to control scaling. A large saving in chemical usage can be seen by switching antiscalant providers.

Another savings potential for the RO system is to use a variable frequency drive on each of the three RO feed pumps. These 75 hp pumps are currently boosting the pressure much higher than necessary. The pressure is then throttled down to achieve the necessary osmotic pressure for separation. Using a variable frequency drive on each pump can reduce the electrical consumption by 50 percent.

Reject RO Reuse: The next step in optimizing the performance of an RO system is to reuse the reject water being produced. The plant factory feed system was identified as the best area for reuse of this water. Before the water can be reused here, it must first be treated to prevent scaling in equipment throughout the plant. Several treatment methods were investigated. Lime softening or a magnetic treatment system would potentially be able to eliminate scaling. More research needs to be done to determine the best possible option.

Tank Farm Washout Reduction: Cleaning occurs on a regular basis throughout the plant's tank farm. Currently, hot reverse osmosis water is used to clean at four different washout stations. Each station has a hose that uses large amounts of water. It was identified that by using nozzles, a 75 percent reduction in water use could be seen.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	1.53
CO	0.90
NOx	0.88
VOC	1.40
PM	0.074

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	451.13
CH4	1705.88
N2O	892.42
CFC	4.88

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
WASTEWATER REUSE	$44,000	4,000,000 GALLONS	IMPLEMENTING
WASTEWATER REUSE	$78,300	7,700,000 GALLONS	IMPLEMENTING
SWITCH ANTISCALANT PROVIDERS	$54,537	4,170 KG OF CHEMICAL	RECOMMENDED
RO PUMP REPLACEMENT	$17,500	350,000 KWH	RECOMMENDED
RO REJECT REUSE	$201,300	18,300,000 GALLONS	RESEARCHING
TANK FARM WASHOUT REDUCTION	$10,125	337,500 GALLONS	IMPLEMENTING

West Liberty Foods, LLC

COMPANY BACKGROUND

West Liberty Foods, LLC is a food manufacturing company based out of West Liberty, IA. They have plants located in Iowa and Utah and employ more than 2,000 people. The plants are located in West Liberty, IA, Mt. Pleasant IA, and Tremonton, UT. Their products include cooked turkey, meatballs, chicken and several other products.

PRANAV CHOPRA
AGRICULTURAL ENGINEERING, IOWA STATE UNIVERSITY

PROJECT BACKGROUND

West Liberty Foods plant located in West Liberty, IA uses a large amount of vegetable oil every year. This oil is mainly used to fry meats. This process generates a large amount of waste oil. This year West Liberty Foods wanted to focus on ways to utilize this waste oil by either producing biodiesel or by simply recycling the oil.

INCENTIVES TO CHANGE

West Liberty Foods has had a strong environmental record in the past and would like to continue this by having a consistent waste disposal method for the waste oil. With the help of this project, West Liberty Foods can use the waste oil to produce biodiesel and use it in their current trucking fleet. Once this plan is implemented in West Liberty, IA, it can be easily implemented in their other plants located in Mt. Pleasant, Iowa and Tremonton, Utah.

RESULTS

Biodiesel Project: Biodiesel can be produced from the waste oil generated at West Liberty Foods. This will require the installation of equipment and a separate facility located on site. The biodiesel produced from the oil can be used in the company's trucking fleet, which will reduce transportation costs considerably. By using biodiesel, West Liberty Foods will not only reduce transportation costs but also reduce emissions such as SOx, PM, HC, CO, SO2 and CO2.

Re-using Oil Project: Re-using the cooking oil was determined to be a cost effective method to reduce waste generation. West Liberty Foods can recycle the waste oil through separation and filtration and reuse it in their production process. The equipment involved can be installed on the current site.

Digester Project: West Liberty Foods generates 4,000 tons of solid waste every month. This waste can be utilized to produce energy by processing it through a digester. Currently this waste is sent off site for disposal.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	0.87
CO	9.00
NOx	2.10
VOC	1.99
PM	0.86

GREEN HOUSE GASES DIVERTED IN TONS
(CO2 Equivalent)

Total for all sectors	
CO2	493.68
CH4	44.89
N2O	629.20
CFC	4.09

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
BIODIESEL	$103,000	300,000 GALLONS OF OIL	OPTIONAL
RE-USING OIL	$170,000	300,000 GALLONS OF OIL	IMPLEMENTING
BOILER CHANGE	$(-50000)	300,000 GALLONS OF OIL	NOT COST EFFECTIVE
DIGESTER PROJECT	$500,000	1,000,000 POUNDS	FURTHER RESEARCH NEEDED

2009 PROJECT INDEX

POLLUTION PREVENTION INTERN PROGRAM

BOILER EFFIECIENCY
- CITY OF PELLA
- DRAKE UNIVERSITY
- GENERAL MILLS OPERATIONS, INC.
- HACH COMPANY
- SARE LEE FOODS

ENERGY SAVINGS
- 3M KNOXVILLE
- ACUMENT GLOBAL TECHNOLOGIES
- ALLEN MEMORIAL HOSPITAL
- CNH AMERICA LLC
- CITY OF PELLA
- DIAMOND VOGEL PAINT
- DRAKE UNIVERSITY
- EMCO ENTERPRISES
- FLEXSTEEL INDUSTRIES, INC.
- GENERAL MILLS OPERATIONS, INC.
- HOSPITAL CIRCUIT RIDER
- NEBRASKA MEDICAL CENTER
- QUAKER OATS
- SARA LEE FOODS
- SNAP-ON TOOLS
- TYSON FOODS, INC.
- THERMAL IMAGING CIRCUIT RIDER
- PROCTER AND GAMBLE

PROCESS IMPROVEMENT
- ACUMENT GLOBAL TECHNOLOGIES
- ALLEN MEMORIAL HOSPITAL
- AMERICAN PACKAGING CORPORATION
- CNH AMERICA LLC
- HYDRITE CHEMICAL COMPANY
- HACH COMPANY
- JOHN DEERE OTTUMWA WORKS
- KOCH NITROGEN COMPANY
- THERMAL IMAGING CIRCUIT RIDER

HEAT RECOVERY
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- CNH AMERICA LLC
- CITY OF PELLA
- DIAMOND VOGEL PAINT
- GENERAL MILLS OPERATIONS, INC.
- QUAKER OATS

WASTE REDUCTION
- ALLEN MEMORIAL HOSPITAL
- ACUMENT GLOBAL TECHNOLOGIES
- CNH AMERICA LLC
- DIAMOND VOGEL PAINT
- DRAKE UNIVERSITY
- EMCO ENTERPRISES
- JOHN DEERE OTTUMWA WORKS

WATER USE REDUCTION
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- CITY OF PELLA
- HYDRITE CHEMICAL COMPANY
- SARA LEE FOODS
- TYSON FOODS, INC.
- VERMEER CORPORATION
- PROCTER AND GAMBLE

WASTE WATER TREATMENT
- HYDRITE CHEMICAL COMPANY
- VERMEER CORPPORATION
- PROCTER AND GAMBLE

HAZARDOUS WASTE REDUCTION
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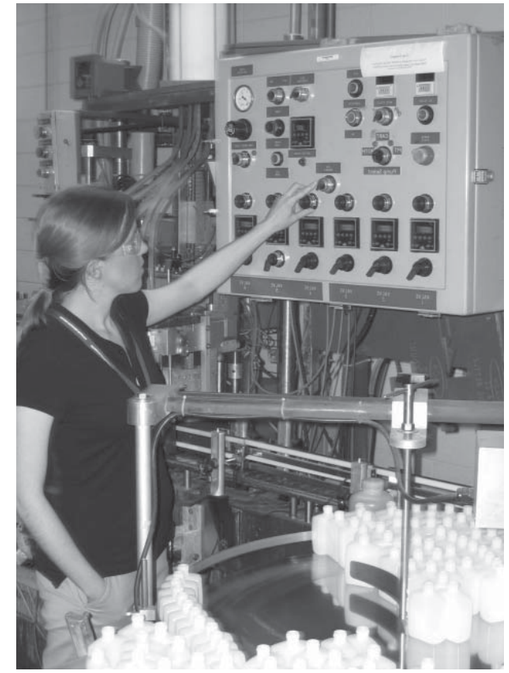
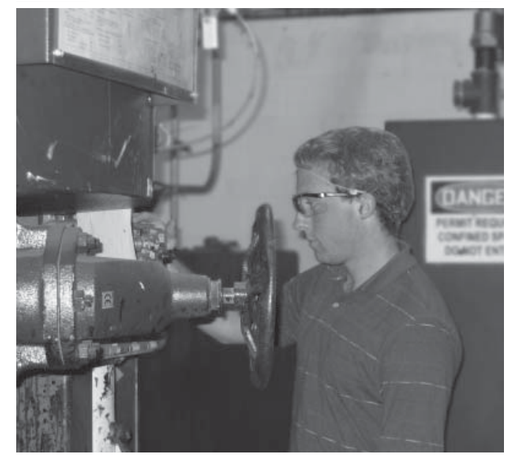
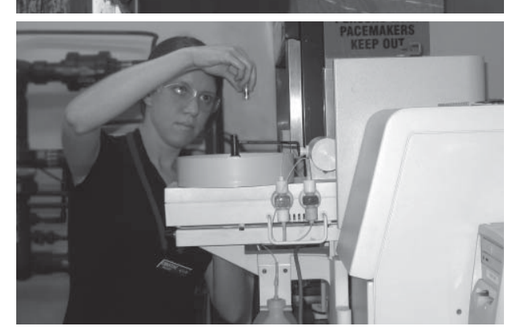
- AMERICAN PACKAGING CORPORATION
- HACH COMPANY
- HOSPITAL CIRCUIT RIDER
- JOHN DEERE OTTUMWA WORKS
- KOCH NITROGEN COMPANY
- PROCTER AND GAMBLE

COMPRESSED AIR SYSTEM EFFIECIENCY
- 3M KNOXVILLE
- DIAMOND VOGEL PAINT
- EMCO ENTERPRISES
- FLEXSTEEL INDUSTRIES, INC.
- GENERAL MILLS OPERATIONS, INC.
- HACH COMPANY
- QUAKER OATS
- SNAP-ON TOOLS

BIO-DIESEL
- WEST LIBERTY FOODS







APPLICATION PROCESS

Application and proposal forms for students and businesses are available online at www.iowap2services.com. Forms may be submitted electronically, faxed or mailed.

FOR COMPANIES

Companies that would like to be considered for participation in the 2010 Pollution Prevention Intern program should submit a project proposal by November 20, 2009.

Companies who are committed to implementing cost effective pollution prevention methodologies and reducing their environmental impact should submit a proposal 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.

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

FOR STUDENTS

Graduate and upper-level undergraduate students who wish to be considered for 2010 internship positions should submit an application, along with a resume, cover letter, an informal copy of transcripts and a list of current coursework by FEBRUARY 8, 2010.

Pollution Prevention Services is offering internships for three months during the summer or for six months in 2010. Applications are requested from students enrolled in environmental science, physical science and all engineering disciplines. Selected applicants will be matched to a project based on coursework performance, experience and technical skills.

SUBMIT PROPOSALS AND APPLICATIONS TO:

Danielle Dilks
Iowa Department of Natural Resources
Pollution Prevention Intern Program Coordinator
502 East Ninth Street
Des Moines, IA 50319-0034

Phone: (515) 281-8063
Fax: (515) 281-8895
Danielle.Dilks@dnr.iowa.gov

GEAR UP & GO GREEN

with the

POLLUTION PREVENTION

INTERN PROGRAM

INTERNSHIPS

MECHANICAL

CHEMICAL

INDUSTRIAL

ENVIRONMENTAL/CIVIL

ENVIRONMENTAL SCIENCES/STUDIES

MANUFACTURING

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