Pollution Prevention Institute

DUCOMMUN

Intern: Michael Lincoln
Major: Chemical Engineering
School: Kansas State University

Company background
Ducommun is a large-scale manufacturing company dedicated to the production of engineered products, electronics, and manufacturing and assembly of aerospace structures. Founded in 1849, it has created products for customers such as Boeing, Spirit, Northrop Grumman, Raytheon and General Dynamics and as of May 2022 has a market capitalization of more than $600 million. Ducommun employs up to 2,500 people, and the Parsons site where the internship took place employs roughly 130.

Project background
In 2021, Ducommun contacted the Pollution Prevention Institute, or PPI, regarding waste prevention. Ducommun has a general interest in reducing its environmental impact, and the plant at Parsons and its hazardous waste streams were costing the company large sums of money. The 2021 intern made some suggestions and some were implemented. The 2022 internship focused on refining many of those projects into more manageable forms, exploring opportunities the previous intern didn't have time for, as well as exploring other opportunities. The opportunities presented were in energy usage, mixed acid waste and solid waste generation.

Incentives to change
The two primary motivators to implement were environmental and financial. There were large emissions of VOCs, hazardous waste and solid waste due to the various processes and administrative policies put in place. The plant pumped out an estimated 128,093 pounds of mixed hazardous waste, costing the plant a predicted $80,000 per year in mixed acid disposal fees in 2022. Administrative practices, such as paperwork orders and free plastic water bottles introduce additional costs. These wastes are not recycled due to the lack of recycling plants and regulations stating that any paper needs to be shredded.

PROJECTS REVIEWED FOR P2 POTENTIAL

Lighting changes
The plant currently uses fluorescent lights for most of its lighting. LEDs offer the same amount of lighting for less energy consumption. Furthermore, many of the lights are in areas of low occupancy or are entirely redundant. Utilizing estimations from maintenance and occupancy data from HOBO data loggers, areas that could be "turned off" or have motion sensors applied were identified. Together these changes were estimated to save the plant $18,587 a year, and prevent 217.4 MTCO2e. Replacing the fluorescents could be expensive, resulting in a long return on investment, so this may be more feasible on a smaller scale or staggered over time.

Chemical milling optimization
Mixed acid waste is one of the larger waste streams at the plant. To reduce this, the intern considered creating a closed loop system for the water, adding a backflow on line one, mixed acid reuse, chemical drag out minimization and mixed acid neutralization. Creating a closed loop did not produce water of adequate quality, and all best practices for reducing drag out were already in place. Adding a backflow would save $292 a year, and lower water usage by 37,169 gallons a year. A large mixed acid reuse system was estimated to recycle 80% of the acid, preventing 110,829 pounds of mixed acid waste and saving the company $100,025 a year. Experimentation found that neutralizing the waste would require five times the NaOH as mixed acid. However, it would produce TiO2 and NaF, both products that could be sold if separated. Currently the mixed acid separation and adding a backflow are recommended.

Plastic sleeve minimization
The plant sleeves each piece in a plastic bag for shipping. The average overhang length of these plastic sleeves is around five inches. For curved pieces it can be much higher. Talking to operators it was established this overhang length could be reduced to three inches. The two options considered were creating a shorthand for curved parts, and creating an index that the operators would look through whenever they logged in. Measuring curved pieces found that there was no shorthand that was viable. An index could be made since there are official lengths in the engineering diagram. Instituting such an index would save the plant an estimated $627 a year and prevent 105 pounds of LDPE waste, and is currently recommended.

PROJECTS REVIEWED FOR P2 POTENTIAL, CONTINUED

Going paperless

The site uses high quantities of paper due to its work order system. Each individual order has a set of instructions printed in paper that can be hundreds of pages long. It was found this site spends about $35,000 dollars a year to support its paper system, which produces 238,924 pounds of paper waste a year. Switching to paperless could reduce this up to 90%, and make the plant far more efficient, though this would have to wait until the new management software system gets installed. At a minimum, it is estimated switching to paperless would save $30,968 a year, and prevent 210,575 pounds of solid waste. Such a process is recommended.

Chemical substitutions

The plant uses a variety of chemicals for its processes. Some of these chemicals are, or have the potential to be toxic. Of the chemicals researched it was found most were either inert or could not be swapped out due to customer specifications. One set of chemicals that could have impact is the polyurethane packaging. The packaging is created by mixing two chemicals referred to as 'A' and 'B'. These products are regulated by the EPA for HFCs. Currently only one of the two companies that sell this chemical to Ducommun knows its product does not contain HFCs. It was recommended that Ducommun work with this supplier until the other supplier could confirm its product does not have HFCs.

Preventing plastic water bottle use

Due to the high temperature the plant operates at, the site offers free water bottles to all its employees. Due to the lack of recycling in Parsons, all the water bottles end up in a landfill. The options considered to reduce this were offering filtered thermoses to the office employees, and driving the water bottles to Pittsburg, which does have a recycling center. This can be done either commercially or through volunteerism by employees who live near Pittsburg. Doing so would divert or eliminate 1,680 pounds of PET waste, and if thermoses were used instead of water bottles, the plant would save an estimated $3,216 a year.

Energy projects

A fridge that was no longer in use was identified, cleaned out and turned off, saving the plant an estimated $50 a year, and preventing 0.6 MTCO2e. One of the plant's processes uses argon heated to 1,650°F or more, and the intern investigated whether thermal waste from this process could be reused. However, the processes available to do so would require more energy to operate than they would produce. Solar panels were also suggested, but the intern determined that the ROI would be too long. The intern also investigated the possibility of adding door sweeps to an air conditioned break room to keep cold air from bleeding into the hotter areas of the plant, but this was determined to be impractical due to the ventilation structure.

Other projects

Before the chem mill process, the parts are covered in a maskant, which emits volatile organic compounds (VOC) in the form of toluene. A variety of changes were considered to reduce the waste, but all of these were determined to be unfeasible or already in place.

Abrasive is used in the waterjet cutting process at the plant. Currently the plant sends an estimated 125,320 pounds of garnet a year to landfill. Garnet recycling units were explored, but no viable options were found. Further research is required to identify options for recycling or reuse, such as for growing roses.

The intern also assisted Ducommun in applying for an Environmental Stewardship Award from KDHE for its efforts in reducing its waste by about 69% before 2021 through an administrative change and the resulting projects that came out of that change.

SUMMARY OF 2022 P2 INTERN RECOMMENDATIONS

Project	Annual estimated environmental impact	Estimated cost savings ($/year)	Status
Lighting	206,525 kWh , 217.4 MTCO2e	$18,587	Recommended
Chem mill optimization	37,169 gallons of water, 110,829 lbs of hazardous waste, additional 41.6 $MTCO_2e$ emitted	$100,317	Recommended
Plastic sleeve minimization	105 lbs of LDPE, 0.1 $MTCO_2e$	$627	Recommended
Going paperless	210,575 lbs of landfilled paper, 787.5 $MTCO_2e$	$30,968	Recommended
Water bottle prevention	1,680 lbs of PET, 1.1 $MTCO_2e$	$3,216	Recommended
Turning off the fridge	547.5 kWh, 0.6 $MTCO_2e$	$50	Implemented
Total[1]	**212,360 lbs of solid waste, 110,829 lbs of hazardous waste, 37,169 gallons of water**	**$153,765**	
GHG reductions[1,2]	**965.1 metric tons CO_2e**		

[1]Does not include projects "not recommended" or where "more research needed"

[2]EPA P2 GHG Calculator with Cost, Apr. 7, 2016 & EPA WARM Tool- Version 14, Mar. 13, 2018