

Intern: Seongmin Moon
Major: Chemical Engineering
School: Kansas State University



Company background

RedGuard was founded in 1998 in Wichita, Kansas, as a portable storage unit provider named "ABox4U." The Texas City Refinery explosion in 2005 led RedGuard to become what it is today: a blast-resistant modular building manufacturer. Since its rebranding, RedGuard has opened 23 locations across the U.S., with nine divisions employing more than 420 people. RedGuard supplies blast-resistant buildings to governments and private parties around the globe with a critical emphasis on petroleum refineries.



Project background

RedGuard previously hosted a Pollution Prevention Institute intern in 2019 and 2022. The interns investigated pollution prevention, or P2, and sustainable materials management, or SMM, opportunities to help the company reduce its environmental impacts and operational costs. RedGuard requested another intern for 2023 to follow up on previous studies, address obstacles in prior recommendations and investigate the various projects in multiple RedGuard locations in Wichita.

Incentives to change

RedGuard is actively working toward ISO 14001 certification, which requires consideration of all production-related environmental issues with a strong emphasis on continual improvement. As a result, RedGuard identified several ways to reduce energy usage, solvent purchasing and further investigation of a blast media exchange.

PROJECTS REVIEWED FOR P2 AND SMM POTENTIAL

Wood waste reduction

Due to the variety of custom projects designed by RedGuard, the company generates different sizes and shapes of wood waste that are hard to organize and reuse. The 2022 intern proposed several solutions to manage the wood waste, including reselling and donating it, but these suggestions were ultimately deemed unfeasible. Moving forward, the company has recently redesigned its standard blast resistance building unit, Gen 3. This design does not include wood, which can become an option for a custom design in the future. Future work will estimate potential environmental savings from this new design process.

LED exchange

RedGuard operates several facilities in the Wichita area, two of which have recently transitioned from conventional lighting to LED fixtures. This upgrade has fostered not only substantial electricity savings but also a more secure work environment. To build upon this successful initiative, the intern analyzed the potential

environmental and financial benefits of extending this transition to the remaining two facilities that are contemplating a similar switch to LEDs. For one shift of operation, the company can save 153,550 kWh and \$6,738 annually with a 6.5 years simple payback period by implementing LEDs across all four facilities.

Air leak audit

RedGuard relies heavily on compressed air in numerous operations, a critical element in manufacturing processes that also demands a substantial amount of energy. While a preliminary survey of air leaks was undertaken by the 2019 intern leading to several repairs, the 2023 follow-up audit revealed the presence of an additional 32 leaks, predominantly in hose connections, necessitating a mix of minor and major repairs including part replacements. By fixing all leaks, RedGuard can save 382,200 kWh and \$9,989 yearly.

PROJECTS REVIEWED FOR P2 AND SMM POTENTIAL, CONTINUED

Solvent recovery

Redguard uses methyl ethyl ketone, or MEK, as a primary paint cleaner. MEK is a highly volatile chemical that can quickly evaporate into the atmosphere. The company purchased a solvent recovery unit to minimize MEK purchasing, which was recovering approximately 72% of the solvent being used. The intern investigated optimal settings for the equipment to increase the recovery to 90%, saving an additional 165 gallons of solvent and \$2,270 per year. The intern also recommended utilizing lids to minimize solvent evaporation, which can result in savings of 90 gallons and \$1,513 per year. Lastly, the intern worked on improving the discharge system to minimize leaks and spills to save an additional 3.5 gallons of solvent and \$48 per year.

Blast media exchange and rain cover

Initiated by the 2022 intern and continued by the 2023 intern, this project revolves around the abrasive blasting process RedGuard employs to clean steel structural frames, currently involving the use of coal slag. This slag breaks apart after one blasting cycle and is then discarded. The intern further investigated switching from coal slag to steel grit, which could be reused up to 200 times before recycling. At 50 reuses, RedGuard could save \$40,532 from purchasing costs and reduce 135 tons of waste going to landfill. The intern also investigated installing a rain cover on the coal slag waste bins to avoid collecting and transporting extra moisture to the landfill, resulting in an additional 25.5 tons of weight and \$2,069 in waste bills. A removable cover costs \$4,290 and would result in a payback of about two years.

SUMMARY OF 2023 INTERN RECOMMENDATIONS

Project	Annual estimated environmental impact	Estimated cost savings (\$/year)	Status
LED exchange	153,550 kWh	\$6,738	Recommended
Air leak audit	382,300 kWh	\$9,989	Recommended
Solvent recovery	1,739 lbs. of VOC	\$3,822	Recommended
Blast media exchange and rain cover	135 tons of coal slag 7.5 MTCO ₂ e	\$42,605	Recommended
Total¹	535,851 kWh 1,739 lbs. of VOC 135 tons of coal slag	\$63,154	
GHG reductions^{1,2}	527 metric tons CO₂e		

¹Does not include projects “not recommended” or where “more research needed.”

²EPA P2 GHG Calculator with Cost, 19 November 2022 & EPA WARM Tool- Version 15, September, 2022