Pollution Prevention Institute

SPIRIT AEROSYSTEMS

Intern: Kayden Karlin
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Company background

Spirit AeroSystems, Inc., is an aerostructures manufacturer headquartered in Wichita, Kansas. It is one of the world's largest first-tier aerostructures manufacturers responsible for supplying commercial airplanes, business/regional jets and defense platforms. Spirit manufactures several structural components for airlines, including fuselages, integrated wings/wing components, pylons and nacelles. With 16,100 total employees worldwide in 2021, this company has several facilities within the U.S as well as in the United Kingdom, Scotland, Northern Ireland, France, Malaysia and Morocco. The Wichita location is 12.8 million sq. ft., which represents over 75% of the total square footage across all of Spirit's manufacturing sites. It is currently a primary supplier for Boeing aircrafts. Additional customers include Airbus, Rolls-Royce, Mitsubishi Aircraft Corporation, Bombardier, Lockheed Martin and Northrop Grumman.

Project background

Spirit partnered with the K-State Pollution Prevention Institute to host a source- reduction assistance, or SRA, intern to investigate opportunities that could reduce solvent use, resulting in raw material savings and reduced waste, emissions and costs. This was the second year of a two-year project funded by the EPA that continues the source reduction efforts. In addition to reducing its environmental impact and costs, these actions will also increase efficiency, improve health and safety conditions for employees and improve the environment as well as the public health of the surrounding environmental justice community. The intern investigated three projects with the potential for solvent reduction.

Incentives to change

Spirit has demonstrated a strong commitment to protecting human health and the environment. According to its published social responsibility statement, it is its policy to conduct and manage business in a manner that protects the environment and promotes the health, safety and well-being of its employees, customers and surrounding community. In addition, Spirit has published greenhouse gas reduction, or GHG, goals, targeting a 30% absolute reduction in Scope 1 and 2 emissions from 2019–2030. This solvent reduction project, recently added to their ISO 14001 plan, will help Spirit reduce hazardous materials, hazardous waste, costs, air emissions including GHGs, and minimize associated health risks to employees and the community. The overall two-year project goal is to reduce toxic solvents, hazardous waste and emissions by 10% per airplane built, using 2019 as the baseline for solvent reduction.

PROJECTS REVIEWED FOR P2 POTENTIAL

Overflow solvent reduction

Spirit decants solvent from 55-gallon drums into hand-held bottles for employees via an electronic liquid filling machine. The machine-filling process often overflows the solvent, resulting in loss of raw materials that has to be disposed of as hazardous waste. Using a 55-gal drum gauge, the 2021 intern was able to calculate overflow quantities to determine annual costs. The 2021 intern researched alternative options and recommended purchasing a new solvent-filling machine. This machine is currently in the capital approval process, but a large quantity of overflow solvent is still being produced. The 2022 intern identified that the use of solvent bottles with larger openings may be another option for reducing solvent overflow, but sample bottles were delayed due to supply chain issues. Reducing the solvent overflow also reduces labor costs because employees currently spend 1-2 hours daily dumping out bottles with leftover solvent. It would also improve the overall health and safety of the workplace.

Returned solvent waste reduction

Hand-held solvent bottles are reused throughout Spirit's facility to avoid unnecessary waste. These bottles are refilled when empty and redistributed. The 2021 intern found that, due to various circumstances, the bottles were not always returned empty. This returned solvent waste is disposed of as hazardous waste and is a loss of raw material. The 2021 intern was able to use a 55-gallon drum gauge to quantify this waste and the intern estimated annual costs. The 2022 intern researched and has begun implementing various employee outreach initiatives that will increase employee attentiveness to the proper disposal of solvent and ensure

that full and partially full bottles get reused. These initiatives include: improving solvent storage signs, changing chemical color labels to distinguish chemicals easier, improving solvent storage organization by putting shelves in flammable cabinets and removing totes from the flammable cabinets. These initiatives will all be clearly illustrated in training videos that will be made available to both Spirit and the public. During typical production rates, these changes are estimated to reduce VOCs and HAPs emissions by 3.48 tons/yr, 0.76 tons/yr, respectively, reduce hazardous waste generation by 1,008.3 gallons, and save about $14,946.

General solvent reduction - fuselage integration

Fuselage integration is the highest solvent user in the hand-cleaning process at Spirit. The solvent gets used to clean contamination for touchup processes, sealant application, riveting, as well as paint/primer application. Fuselage integration alone used an estimated 19,998.1 gallons of solvent in 2019. Employees also soak ear buds in a 50:50 mix of isopropyl alcohol and water that they use to remove excess sealant from the fuselage; this is an issue because the containers are left uncovered, allowing a volatile IPA to evaporate into the air, posing a fire safety risk, and the amount of solvent that the ear buds are soaking in is a lot more than necessary. The solvent used to soak the ear buds wastes an estimated 850.6 gallons per year in fuselage integration. It is resulting in an estimated $49,395 in raw material costs and bulk hazardous waste disposal costs. It is very important to note that the proposed solutions for fuselage integration solvent reduction as well as the employee outreach initiatives can be applied campus wide. Solutions to reducing solvent usage include providing employees with a solvent guide, as well as getting standardized containers for ear bud processes. The standardized container has three different aspects to it; it would be a smaller container than the one that is currently being used, it would have a lid to prevent IPA evaporation into the air, and it would also contain a swab that would replace the ear buds as a solvent applicator. It would be available to be distributed to employees through the tool crib. The solvent guide is a document that would be available at each employee's work station that details what kind of solvent employees should use depending on the material they are cleaning, as well as reiterating techniques employees should pay attention to when cleaning. Essentially, it is simply providing reminders from training available at their work station for how to clean a material. In fuselage integration, this is estimated to reduce VOCs and HAPs emissions by 12.50 tons/yr, 3.30 tons/yr, reduce solvent usage by 3,622.2 gallons, and save about $38,332 in raw material savings and hazardous waste reduction during a normal production year. Using a standardized container to replace the ear bud process is estimated to save 2.84 tons of VOCs, 732.4 gallons of hazardous waste, and $4,252 in raw material and hazardous waste generation on an annual basis.

SUMMARY OF 2022 P2 INTERN RECOMMENDATIONS

Project	Annual estimated environmental impact	Estimated cost savings ($/year)	Status
[1]Overflow solvent reduction	More research required	More research required	In progress
Returned solvent waste reduction	3.48 tons of VOCs 0.76 tons of HAPs 1008.3 gallons of hazardous waste	$14,946	In progress
Fuselage integration solvent reduction	12.5 tons of VOCs 3.3 tons of HAPs 3622.2 gallons of hazardous waste	$42,584	In progress
Total[1,2]	15.98 tons of VOCs 4.06 tons of HAPs 4630.5 gallons of hazardous waste	$57,529	In progress

[1]Does not include projects "not recommended" or where "more research needed."
[2]VOCs and HAPs emissions calculated using relative densities and chemical's weight % reported on SDS

There were no greenhouse gas emission metrics associated with this project.