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TPI COMPOSITES, INC.

COMPANY PROFILE

TPI Composites, Inc. is a multinational corporation founded in 1968 as a composite powerboat body manufacturer. Headquartered in Scottsdale, Arizona, the company refocused to production of wind turbine blades with a mission of becoming the preferred global structural composites supplier in the wind energy and transportation markets. To this end, the company produces composite wind turbine blades and automotive bodies. TPI is committed to accelerating global clean energy growth by manufacturing competitive, innovative composite materials. Among its blade manufacturing facilities is the plant in Newton, Iowa, where TPI is the largest private employer within Jasper County.

PROJECT BACKGROUND

The host company sought the assistance of Pollution Prevention Services to work toward reducing hazardous waste generation, solid waste generation, and volatile organic compound (VOC) emissions, with a goal of reducing each metric by five percent based on the previous year's numbers. Project initiatives included waste stream analysis and standardization of new waste stream creation procedures. The intern's primary focus was on formulating solutions, which furthered TPI's VOC emission and hazardous waste reduction goals. In addition to pre-determined hazardous waste and VOC sources of the focus project, the intern's baseline assessment revealed further opportunities to assist TPI in reaching its environmental goals.

INCENTIVES TO CHANGE

Thorough analysis of solid waste sources and costs can reveal profitable material savings opportunities. Additionally, supply chain disruptions caused by the COVID-19 pandemic presented opportunities to reassess internal processes and the economic impacts of potential waste reduction improvements. Hazardous waste disposal can be highly expensive, and material substitution or recovery maximizes operating margins while minimizing negative environmental impacts. Positioning the Newton facility to meet its waste reduction objectives simultaneously ensures a holistic implementation of TPI's sustainability values on the global level.

RESULTS

Tackifier Pail Recycling: For fiberglass to adhere to a mold, a sticky substance known as tackifier must be applied to the surface. The material is delivered to TPI as a bulk liquid in unlined metal pails. Analysis of the tackifier waste stream revealed that the empty metal pails were being discarded and landfilled. By diverting the tackifier pails to TPI's existing metal drum recycling stream, savings will arise from avoided landfill costs. This waste stream diversion was successfully implemented and semi-regular internal inspections by EHS staff are planned to ensure continuation of the program and adherence to all relevant recycling guidelines.

Root Shavings Recycling: Metal and fiberglass shavings are generated during the milling process that shapes the root of the blade. These shavings were previously difficult to capture and quantify due to the indirect nature of the generation process. Through a process established by the intern, shavings are now immediately collected from the floor following completion of the root sanding process and diverted to a recycling partner. The economic benefit is represented as landfill cost avoidance. After successful implementation, the metal and fiberglass waste is now collected in drums bound for recycling.

Acetone Recovery: Composite manufacturing relies on the precise application of pastes in different areas of the blade. By their nature, these pastes undesirably adhere to the application tools. Tools must therefore be regularly cleaned to ensure proper reusability.

Acetone is a preferred solvent for general industrial cleaning. Accordingly, the largest portion of TPI's current hazardous

waste stream is an acetone slurry containing solid adhesive particles. A distillation solvent recycling system capable of recovering a high proportion of this spent acetone is recommended. Distillation systems evaporate the solvent and recondense it in an area separate from the undesired contaminants, allowing the solvent to be reused instead of having to continually purchase new supply. Indirect costs associated with handling acetone waste and ordering virgin solvent would be greatly reduced. Carried inventory of acetone would also significantly decrease. Labor costs to operate the system are minimal once the engineering department calibrates the optimal evaporation temperature.

The cost savings of implementing this system are generated from decreased acetone purchasing and disposal costs. Additionally, this recommendation dramatically reduces the volume of TPI's hazardous waste streams and introduces indirect environmental impacts of avoided carbon emissions from incinerated wastes. Updated disposal procedures to accommodate separated solid waste must be completed for future implementation to occur.

Mold Release Replacement: Blade skins and components must be released from their molds with minimal friction so that damage to their surface is avoided. To accomplish this, chemical products are applied to the molds to prevent costly repairs. The currently utilized chemicals are highly flammable and the rags used to apply them to the molds are disposed of as hazardous waste.

It is recommended that TPI substitute the current family of mold release agents with set of water-based alternatives. In addition to environmental benefits, the water-based alternatives have been shown to be more effective at achieving high quality demolds. Material consumption also decreases because water evaporates at a slower rate than the currently utilized organic agent. Water-based agents contain negligible VOCs and do not generate hazardous wastes due to their inflammability.

The financial savings of this recommendation stem from reduced chemical consumption due to better material retention on the molds and the ability to avoid applying mold release after every demold. Ongoing analyses to determine material consumption and effectiveness, cycle time impact, and supply chain considerations will be conducted throughout product trialing.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
TACKIFIER PAIL RECYCLING	$307	3.1 tons	IMPLEMENTED
ROOT SHAVINGS RECYCLING	$360	3.6 tons	IMPLEMENTED
ACETONE RECOVERY	$49,287	10.0 metric tons CO_2 14.5 tons hazardous waste	RECOMMENDED
MOLD RELEASE REPLACEMENT	$376,997	21.0 metric tons VOCs 11.5 tons hazardous waste	RECOMMENDED