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POLLUTION PREVENTION

IN RHODE ISLAND

Case studies of the Rhode Island On-Site Technical Assistance Program

Boat Builder
VOC's

Fiberglass boat builder incorporates infusion molding or the Seeman Composite Infusion Molding Process (SCRIMP) on a 30 foot sailboat hull and cuts laminating resin usage and volatile organic compound (VOC) production.

Industry \ Contact
SIC Code: 3732 Fiberglass Boat Builder, Rhode Island
Contact: RI Port Authority Marine Trade Pollution Prevention Research Project
Client #2

Technology Description
The Company provides fabrication, modification, and repair services for fiberglass reinforced plastic (FRP) boats. The product line consists of dinghies (7-9 ft) and sailboats (30 ft). The Company has been in business for ten years and employs 13 people.

Hand lay-up and spray lay-up procedures are used to manufacture boats and components such as hatches. Transfer efficiency for spray procedures can be as low as 50% and volatile organic compound emissions in the form of styrene average about 5% for each pound of resin used. Cleanup after spray procedures can require up to one gallon of acetone per spray gun. Hand lay-up procedures, although enjoying high transfer efficiencies, produce about 3% VOCs per amount of resin used and are subject to acetone-based cleanup procedures.

The SCRIMP process relies on a vacuum drawn on a plastic sealed mold to transport resin through a repositioned glass fiber matrix. Because the mold is sealed, emissions are drastically reduced and personal protective equipment is unnecessary. The process is also inherently repeatable, meaning the same amount of raw materials can be allocated every time a certain product is made. Infusion molding also "reverses" the glass to resin ratio usually seen in spray lay-up applications. The typical 30%/70% ratio becomes 70%/30% with SCRIMP, resulting in a lighter product with no strength compromises. Emission factors for infusion molding have been measured from 0.2 - 0.6% of the amount of resin used (see **Impact** section for details). Acetone usage for cleanup after infusion molding is minimal.

Feedstock Materials
65 gallons of laminating resin per hull. 3 gallons of acetone for tool cleaning.

Costs
Use of the SCRIMP process requires licensing through Tillotson Pearson Inc. (TPI) at a cost of $25,000 plus 5%-7% royalties on each piece sold using the process. Modification of existing molds to support the process costs about $2,000.

Operation \ Maintenance
Labor required for the two processes are nearly equal. The largest portion of labor in the SCRIMP process is tailoring the bagging material to the mold. A preformed silicon bag is commercially available, but it is expensive, and TPI estimates that 12 units would have to be sold before the cost of a custom bag could be recouped. If the silicon bag is used, labor will drop to 70% of what is required with the disposable bagging.

Savings
65 gallons ($715) structural laminating resin for conventional methods vs. 50 ($550) gallons of resin for the SCRIMP process.

3 gallons ($11.50) of acetone used for cleanup form conventional methods vs. none for the SCRIMP process.

Labor
Standard bagging: 110 hours ($1,210) for conventional methods vs. 90 hours ($990) for the SCRIMP process.

Silicon bagging (theoretical): 110 hours ($1,210) for conventional methods vs. 63 hours ($693) for the SCRIMP process.

Wastes
Major waste costs arise in the SCRIMP process when the standard bags are used and disposed of after one use at a cost of $410. Wasted resin in the conventional processes represents about a $165 loss.

Impact
The major savings in the SCRIMP process (labor and resin) are equivalent to approximately $400. This savings is offset by the $410 cost of discarded bagging and resin delivery materials. Considering the increased tooling costs, it is apparent that the SCRIMP process will not pay for itself on a per unit basis when not using a silicon bag.

VOC reductions from the SCRIMP process are significant. The emissions factor for the process has been measured from 0.2% to 0.6% of the resin used by the safety engineer at TPI with RIDEM Division of Air Resources in attendance. Comparatively this is about 20-55 times less than spray lay-up and about 15-35 times less than hand lay-up. This is equivalent to saying that by converting from hand lay-up to the SCRIMP process, a facility can increase its production rate by 15-35 times without increasing VOC emissions from cement levels.

Infusion molding also "reverses" the glass to resin ratio usually seen in spray lay-up applications. The typical 30%/70% ratio becomes, 70%/30% with SCRIMP, resulting in a lighter but just as strong product.

Another advantage is the reduction of cleaning materials and labor, because of the method of resin transfer. With the exception of gel coat and skinning out applications, no hand lay-up tools or spray-up tools are required. Less solvent usage means less VOCs (especially if acetone is used as a cleaner).