

Summary Sheet

Comparison of Closed Mold Processing to Open Molding Application



1 – Company Size Characterization

This comparison is constructed around different size manufacturing operations that are easily recognizable as companies found across the composites industry. These general size characterizations include:

- Small Company – 7 production employees - Use 1-drum of resin per day = 125,000 lb resin per year
- Medium Company – 35 production employees - Use 5-drums of resin per day = 625,000 lb resin per year
- Large Company – 105 production employees - Use 1-tanker of resin per week = 1,875,000 lb resin per year
- Very Large Company – 210 production employees - Use 2-tankers of resin per week = 3,750,000 lb resin per year

2 – Emissions Factors

The open molding process uses the *Unified Emissions Factors (UEF)* to determine emissions. This includes laminating resin and gel coat application. These factors cover variations in application methods (e.g. atomized spray and non-atomized spray), and are based on resin or gel coat styrene content. Closed molding emissions are derived from *AP-42 Emissions Factors* for Closed Molding¹.

3 – Open Molding Application verses Closed Molding

The change from traditional open molding, using non-atomized resin spray application and atomized gel coat application, to *Closed Mold Processing* along with *Controlled Spraying* gel coat application, can result in:

- An average reduction in overall plant styrene emissions of 40%
- A heat cost savings of ventilation make-up air (50 ppm) of between 34% - 52%
- A heat cost savings of ventilation make-up air (20 ppm) of between 45% - 61%
- A reduction in resin waste (evaporation and overspray loss) of 12%
- A reduction in gel coat waste (evaporation and overspray loss) of 13%
- An average reduction in clean-up solvent usage of 88%

Summary

Effects of Production Conversion From Open Molding to Closed Molding

(Open molding - Non-atomized resin application + atomized gel coat application vs. Closed Mold Processing + Controlled Spraying of Gel Coat)

Company Size Characterization--->		Small Company	Medium Company	Large Company	Very Large Company
Company Profile	Number of F/G production employees	7	35	105	210
	Resin Usage (lb/yr)	125,000	625,000	1,875,000	3,750,000
	Gelcoat Usage (lb/yr)	14,700	73,500	220,500	441,200
Styrene Emissions	Emissions Factor - Resin 38% Styrene- Non-Atomized Spray	86 lb/ton	86 lb/ton	86 lb/ton	86 lb/ton
	Emissions Factor - Resin 38% Styrene- Closed Molding	8-23 lb.ton ¹	8-23 lb.ton ¹	8-23 lb.ton ¹	8-23 lb.ton ¹
	Emissions Factor - Gelcoat 33% Styrene- Atomized Spray	294 lb/ton	294 lb/ton	294 lb/ton	294 lb/ton
	Emissions Factor - Gelcoat 33% Styrene- Controlled Spray	215 lb/ton	215 lb/ton	215 lb/ton	215 lb/ton
	Emissions Reduction with Closed Molding & Controlled Spray	2.2 tons/yr	11.3 tons/yr	33.9 tons/yr	67.8 tons/yr
	Percent of Emissions Reduction with CM & Cont. Spray	40%	40%	40%	40%
Ventilation & Heat	Ventilation Airflow Reduction with CM & Cont. Spray - 50 ppm	5,046 cfm	21,234 cfm	57,703 cfm	115,406 cfm
	Ventilation Airflow Reduction with CM & Cont. Spray - 20 ppm	9,100 cfm	40,300 cfm	112,600 cfm	226,200 cfm
	Heat Cost Savings with CM & Cont. Spraying - 50 ppm	38% - 52%²	38% - 52%²	38% - 52%²	34% - 50%²
	Heat Cost Savings with CM & Cont. Spraying - 20 ppm	45% - 61%²	45% - 61%²	45% - 61%²	45% - 61%²
Material Usage Reduction	Resin Waste Reduction with Closed Molding	11.8%	11.8%	11.8%	11.8%
	Gelcoat Waste Reduction with Controlled Spray	13.2%	13.2%	13.2%	13.2%
	Clean-Up Solvent Reduction with CM & Cont. Spraying	88.3%	88.3%	88.3%	88.3%

¹ Closed Mold Processing is defined as Vacuum Infusion Processing, Closed Cavity Bag Molding, RTM, RTM Light and other process variants within the scope of AP-42 emissions factors.

² This comparison is part of an independent study conducted by Convergent Composites based on data from the ANSI Unified Emissions Factors (UEF) and EPA AP-42 Emissions Factors. The comparison data is the property of Composites One LLC and Cook Composites & Polymers and can be reprinted only with permission. Study Overview and Comparison data available upon request.