



# Fiber Reinforced Plastics Shop Complies With New Air Permit Regulations

Minnesota Technical Assistance Program ■ CASE STUDY

## Air permit requires use of low styrene resins and nonatomized application equipment

<b>Company</b>	Sunrise Fiberglass Company Wyoming, MN
<b>Change</b>	Nonatomized equipment replaced spray equipment in open mold process. Low styrene resin replaced traditional resin.
<b>Cost</b>	\$27,850 for new equipment, including nonatomized equipment and in-line heater.
<b>Benefits</b>	Styrene emissions reduced by 43 percent. Met requirements of new air permit. Cleaner to use. Increased material efficiency.

### Background Information

Sunrise Fiberglass, in Wyoming, Minnesota, produces fiber reinforced plastic (FRP) parts in a 50-person job shop. The parts vary in shape, size and end use.

Sunrise employs an open mold process which uses about one and a half drums per day of resin and gelcoat material. These materials were applied by spraying and resulted in high styrene emissions. In 1999, nearly 36,000 pounds of styrene were emitted.

### Incentives for Change

The U.S. Environmental Protection Agency (EPA) classifies styrene as a hazardous air pollutant. And, the proposed National Emission Standards for Hazardous Air Pollutants (NESHAP) for the reinforced plastics composites industry will limit styrene emissions from FRP shops.

In order to upgrade its process and production capabilities in 2000, Sunrise needed to relocate. Moving to the new facility required a new air permit and compliance with the NESHAP. Although the NESHAP is not yet finalized, the Minnesota Pollution Control Agency (MPCA) looked to the proposed rule when outlining Sunrise's permit limits. The new air permit required the use of low styrene resins and nonatomized application equipment at Sunrise.

### Process Change

#### Using Low Styrene Resin

Styrene is a major component in resin. It lowers viscosity for easier application and reacts with the polymer component to form the rigid end product. In low styrene resins polymer characteristics are changed to allow for a decreased styrene content. The resulting low styrene resin has viscosity properties similar to traditional resin and yields a similar finished part.

Sunrise tested low styrene resins from a variety of suppliers. Experienced operators gave feedback on application characteristics and managers evaluated the quality of finished parts. A general purpose resin capable of yielding appropriate physical properties, at a comparable cost to traditional resin, was selected. This general purpose resin contained 38 percent styrene compared to traditional resin's 43 percent.

#### Choosing Nonatomized Application Equipment

Traditional application equipment requires high fluid pressure and/or air to properly mix the resin with the catalyst to form an appropriate spray pattern as they exit the gun. These finely dispersed spray droplets have a large surface area, allowing styrene to evaporate. Even the smallest droplets become overspray. But, nonatomized application equipment mixes the resin and the catalyst together in an internal chamber. The mixture exits the chamber in a continuous low pressure stream which greatly reduces the surface area for evaporation. And, finely dispersed droplets are negligible, resulting in

decreased emissions. Internal mixing of the catalyst also cuts the amount of "free catalyst" entering the work environment, reducing health and flammability concerns.

Sunrise had the option to upgrade its old application equipment to meet the permit requirements with modifications like different gun heads and metering pumps. But, because of the limited cost difference, the company decided to purchase new, state-of-the-art nonatomized equipment. Sunrise employees tested various equipment on site using low styrene resin. Sunrise chose the Magnum Venus Products fluid impingement technology (FIT) system because it was economical and the most current technology. Magnum FIT has minimal overspray in the form of fog or finely dispersed particles and operators were impressed with its clean application.

## **Implementation Issues**

### **Wet**

With nonatomized application equipment the resin has less opportunity to coat the glass as the mixture is applied to the mold. As the part sits, the resin coats the glass. Because the glass appeared to be under saturated with resin, the operators' initial tendency was to apply more resin. This used excess materials and created "heavy" parts. After operators were educated on the issue, part weights were on target and consistent.

### **Resin Temperature Sensitivity**

Low styrene resin is slightly more viscous—but comparable—to traditional resin. In order to preserve suitable viscosity for any resin, temperatures must be maintained within a narrow range. A resin temperature that is too cool significantly affects its application characteristics, and too high of a resin temperature leads to premature polymerization during storage. Low styrene resin is more sensitive to temperature than traditional resin. For the best working characteristics, traditional resins should be kept between 68 and 80°F, and low styrene resins between 75 and 80°F.

Sunrise worked with its supplier to ensure that resin was delivered within the desired temperature range. Because the company does not have a good means to heat bulk resin in storage, the company specified a delivery temperature closer to 80°F to avoid excessive temperature drops in cooler months.

One of Sunrise's products requires a special low styrene resin that is extremely sensitive to temperature. In order to achieve an acceptable production rate and part quality, Sunrise needed to control the resin temperature for proper dispensing. An electric, in-line heater was added on the resin transfer line ahead of the application equipment. The unit was selected for ease of maintenance.

### **Perceived Hazardous Waste Increase**

Because the FIT's internal mix chambers require frequent flushing with acetone, Sunrise originally anticipated an increase in hazardous waste. But, the mixing chambers have an air purge that blows out the residual catalyzed material, limiting the volume of acetone needed for thorough cleaning. And, FIT produces little overspray so general cleanup using acetone is greatly reduced. This helped keep acetone use from increasing.

### **Cost and Benefits**

- \$26,600 spent for seven nonatomized FIT guns and \$1,250 for one in-line heater. Low styrene resins cost the same as traditional resins.
- Less overspray equals savings in resin and glass, and acetone for cleanup. Less labor is devoted to overspray cleanup.
- Styrene emissions reduced 43 percent. In 1999, total styrene emissions exceeded 36,000 pounds. Using 1999's resin and gelcoat use levels and emissions factors for new equipment and resins, styrene emissions would drop to 20,500 pounds.
- Material savings in excess of \$12,000 per year are anticipated. Based on resin consumption, low styrene emissions can lead to product yield improvements of five to 10 percent. Glass/filler to resin ratios need to be re-calibrated to realize these savings. Payback is about two to three years, or less.
- Met requirements of new air permit without lost production time, excess capital costs or employee issues accepting the new technology.
- Less blow back of material—less material bounces back toward operators after hitting the part during application. This improved working conditions, earning operator acceptance of the new technology. And, less employee protection equipment is needed.

## **Additional Efforts**

Sunrise continues to investigate other possibilities to reduce emissions, including options for styrene reduction in gelcoat application. A large decrease in these emissions could result if nonatomized equipment for gelcoat application is used in conjunction with low styrene gelcoats.

## **For More Information**

Other MnTAP publications for the FRP industry:

- *Controlled Spraying and Laser Touch in the Fiber Reinforced Plastics Industry* [#89]
- *Fiberglass Fabricators Upgrades Open Mold Processing Equipment* [#61]
- *Fiber Reinforced Plastics Shop Implements Light RTM to Produce Parts* [#41]
- *Reducing Volatile Emissions in the Fiber Reinforced Plastics Industry* [#75]

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