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Pollution Prevention Opportunities for Molded Fiberglass Fabrication

There are many opportunities for fiberglass molders to improve environmental performance and minimize waste. Some of the pollution prevention opportunities are categorized below, in the following areas:

- Alternative Materials and Design
- Mixing
- Spraying
- Additives
- Alternative Processes and Controls
- Energy Efficiency
- Tool and Equipment Clean Up
- Waste Management and Recycling
- General Operations and Housekeeping

NOTICE! *Stay tuned for new updates. The American Composites Manufacturers Association is launching a "Sustainable Manufacturing Initiative" in early 2009 to promote low-emission technologies. This hub will be updated at that time to include these developments.*

Alternative Materials and Design

One general opportunity in facilitating change to more environmentally friendly materials is to improve the customer's knowledge of such products and materials. Some specific alternatives are suggested below.

Resins and Materials

- Improve customer knowledge of alternative products that reduce environmental impacts.
- Use resin with no or low styrene content, as styrene has recently been classified as a reasonably anticipated human carcinogen.
- Convert to UV cure resins to reduce resin waste and cleaning requirements due to hardening of the resin from air exposure.
- Use vapor-suppressed or vinyl toluene resins.
- Use inert fillers to replace some of the resin content.

Design

- Reduce laminate thickness to an engineered minimum.
- Devise reusable packaging or crate systems for product storage and shipment.

Acetone Alternatives

- Citrus-based solvent, aqueous, or higher-boiling solvents (*see page 4 of this resource*).
- Diacetone alcohol
- Dibasic acid ester
- Emulsifiers
- Ethyl ethoxypropionate
- Isopropanol
- Propylene carbonate
- Use uncatalyzed resin to flush lines

Additives

- Use benzoyl peroxide (BPO) in place of methyl ethyl ketone peroxide (MEKP).
- Use higher amounts of cobalt and cimethylacetamide (DMA) in place of MEKP
- Use higher percentage of inert filler
- Explore alternatives to brominated fire retardants

Mixing

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- Mix exact quantities of resin for a job or batch, or that can be used prior to expiration of the mix. (Some formulations can be stored for about 14 days at 45°F without adverse effect on product quality).
- Evaluate the installation of mechanized automatic resin-mixing and metered dispensing units, equipped with air valves to blow out excess materials.
- Capture contaminated exhaust and directed to existing air scrubbers for treatment.

Spraying

Training

- Train operators to optimize transfer efficiency. Some recommended programs that may provide help with this are using laser equipment to maintain the optimal distance from spray tip to the object. Other programs include controlled spray techniques, and STAR program. In addition to the laser, other spraying efficiency techniques include:
  - holding the spray gun perpendicular to the surface;
  - cleaning nozzles on a routine basis;
  - properly setting up and maintaining the equipment and equipment settings to avoid unnecessary atomization;
    - calibrating to reduce tip pressure to the lowest point possible while maintaining an acceptable spray pattern;
  - triggering the gun to start at the beginning and stop at the end of each pass to avoid overspray before making the next pass; and,
  - establishing and following standardized shot times for different product types to ensure operators do not apply more resin than is necessary.

Equipment

- Use nonatomized or non-spray application equipment, such as flow coaters and fluid impingement systems.Use air-assisted airless spray guns in place of air-spray guns.
- Use high volume/low pressure (HVLP) spray guns (preferred for spraying fiberglass resin).
- Use flow meters to regulate outflow from spray guns, which can greatly reduce manual calibration wastes.
- Use lasers to help with proper positioning to optimize transfer efficiency.

Alternative Processes and Controls

One general opportunity in facilitating change in processes and materials is to improve the customer's knowledge of environmentally friendly products and processes.

Several additional suggestions follow. Several are focused on styrene emissions reduction strategies, which requires elmination of styrene when possible, and minimizing resin contact with air.

Opportunities include:

- Convert from open molding to a closed-mold system (infusion, vacuum, or resin transfer molding).
- Maximize transfer of resin into the mold (operator training and improved resin application techniques).
- Install an impregnator system (reduces time and waste by combining fiber and resin application).
- Install gel coat timing equipment (timing is crucial in applying gel coat finishes).
- Install resin rollers.
- Establish and standardized shot times for different products - then use timers to dictate and maintain shot times. This helps to ensure operators do not apply more resin than is necessary.
- Substitute acrylonitrile, butadiene, and styrene-backed acrylic sheets in place of fiber lay-up.
- To extend life of solvents, allow them to become dirtier before disposing or recycling.
- Install additional spray lines if these will help to reduce waste generation and frequency of clean-out.

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Energy Efficiency

- If bulk resin storage requires higher-than-ambient temperatures (78 to 80 dF), only heat the localized zones rather than heating the entire plant. If tank storage is used for the resin, insulate the tank and use heating lines or coils on the exterior of the tank rather than heating the whole area.
- An alternative is to employ in-line heaters next to the spray booth rather than
- Implement a preventive maintenance and leak detection for compressed air system(s).
- Ensure make-up air flow meets standards for removal of styrene and other hazardous air pollutant (HAP) emissions, but is not more than necessary. Moving air requires significant energy.
- For make-up air draw, use high-efficicency fans with variable speed drives.
- If make-up air requires heating, consider using heat recover from a boiler or the air compressor room, to heat the incoming make-up air.

Tool and Equipment Clean-Up

- Do not allow resins or gel coats to cure on application equipment and rollers, thus reducing or avoiding the use of HAP-containing solvents.
- Install disposable liners in buckets to reduce time and wastes for clean-out.
- Install two-bucket wash; one clean and one dirty to extend the bath life.
- Keep lids on soaking buckets to prevent evaporation loss
- Remove as much solid resin by hand prior to solvent wash.

Waste Management and Material Recycling

- Use environmental cost accounting to determine quantities and costs of all waste streams.
- Decant and reuse spent solvent.
- Evaluate the option of using a batch still to recover acetone. Note that a fire permit may be required.
    - If a still is used, grind and reuse still bottoms in "putty".
- Segregate hazardous wastes.
- Keep rags in a covered, approved storage container.
- Recover ground fiberglass for use in another product. For example, a Minnesota manufacture devised a way to use ground fiberglass to reduce filler usage and combine with resin and cast to replace particle board backings.(See http://www.mntap.umn.edu/intern/projects/ast-it12.htm).
- Recover waste fiberglass dust and overspray from floors and vacuum systems before it becomes contaminated, and reuse in finished goods or another products.
- Utilize a Materials Exchange or the Glass Manufacturing Industrial Council to find end uses for fiberglass scrap and dust (Two fiberglass-specific exchanges are IFE Fiberglass Recycling Exchange and Recycler's World).

General Operations and Housekeeping

Housekeeping & Chemical Management

- Keep lids on products and wastes, and store them so they can be easily inspected for leaks.
- Keep labels on products and wastes to quickly identify them and to prevent accidental mixing.
- Use curbs, pans, or buckets to catch any possible leaks or spills.
- Keep work areas and walkways free of tripping hazards and obstructions.
- Stack containers so they do not tip, puncture or break.
- Store empty drums and containers under rain coverrker training/awareness.
- Use 5S to improve accessibility of materials and equipment, improve health and safety, and housekeeping.

Inventory Control

- Improve tracking systems to account for material and chemical use.
- Have Material Safety Data Sheets (MSDS) available and accessible (Where to find

MSDS online).

- Buy and store only the amount of product that is needed, especially for product's with expirable shelf life.
  ◆
- Purchase products in reusable, recyclable containers with a minimal amount of packaging.
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- Ration solvents or other products to minimize use.

◆ Training and Awareness

- Train workers on regulations, emergency procedures, health and safety issues, waste reduction practices, and alternative products.
- Empower employees to suggest and evaluate potential new materials and strategies that may improve efficiency or health and safety.
- Follow routine, standardized procedures for mixing, transferring, and applying gel coats and laminates, and for cleaning tools.
- Have first aid supplies, spill equipment, and emergency phone numbers accessible and all staff trained in their use.
- Have respirators, gloves, and other personal protective gear available to workers. Enforce proper use at all times.
- Improve tracking systems to account for material and chemical use.

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