TECHNIQUES FOR POLLUTION PREVENTION IN FURNITURE COATING OPERATIONS

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The 1990 Clean Air Act Amendments (CAA) will require many furniture manufacturers to reduce emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). These new regulatory requirements come at a time when furniture companies are already faced with the need to reduce costs to respond to increasing competition. Pollution prevention offers an opportunity to reduce emissions and save money at the same time helping the company to become more efficient.

Pollution Prevention Techniques

Many furniture companies will find that applying pollution prevention techniques to modify and improve their current processes to be more cost effective than installing emissions control devices to reduce HAP and VOC emissions. Applicable pollution prevention techniques include:

- Improved operation and maintenance,
- Inventory management,
- Water and chemical conservation,
- Production process modification,
- Recovery and recycle/reuse.

One single technique or technology, neither pollution prevention nor pollution control, will not usually be adequate to achieve the level of performance required by the CAA. Rather a combination of approaches will be required to comply.

The following section outlines how some of these pollution prevention techniques can be applied to reduce air emissions, hazardous waste generation, and worker exposure to toxic chemicals. Case studies are presented to demonstrate that these techniques and technologies have been implemented effectively by other companies. It is important to keep in mind that most of the case studies presented preceded the passage of the Clean Air Act Amendments and that the cost savings alone justified the changes that the companies made.

I. OPERATION AND MAINTENANCE

- Plays critical role
- 25 - 50 % waste attributed to poor operation and maintenance

Equipment Setup and Adjustment.

- Coating viscosity -- less viscous coatings are easier to atomize and need lower atomization pressures.
- Air and fluid pressure -- high enough to provide good atomization but minimize overspray, blowback and worker exposure.
- Shape and size of spray pattern -- optimize spray patterns
- Proper positioning of work piece -- overspray from small piece onto another piece

Operator Training.[1].

- Essential for good finish quality and efficient material usage.
- Training on :
  - gun position -- 8-12 inches from workpiece
  - motion -- perpendicular, sweeping arm motion
  - triggering -- triggered with each stroke
  - overlap -- overlap strokes by 50 %
- Periodic training -- reinforce proper technique

CASE STUDY - OPERATOR TRAINING
ETHAN ALLEN FURNITURE - Old Fort, NC

Ethan Allen videotaped each spray gun operator applying coatings to typical workpieces. The operators then met in groups of two or three with the supervisor and finishing experts to review the tapes. The operators identified their own poor techniques by watching themselves work, and they were also given constructive advice and hands-on instruction on ways to improve their technique. The operators were videotaped again and given a chance to compare the before and after tapes. The company projected an 8 to 10 percent reduction in coating material usage through improved spray technique. This translated into an estimated savings of $50,000 to $70,000 annually.[2]

Equipment Maintenance.[1]

- Spray guns -- cleaned and lubricated daily, trigger, control valves and springs lubricated periodically
- Check spray pattern
- Replace worn parts

II. PRODUCTION PROCESS MODIFICATION

A more high-tech pollution prevention technique is production process modification. This includes chemical substitution, equipment substitution or modification, and product redesign or reformulation.

Chemical Substitution/Coating Reformulation.[3]

- Substitute with materials that have reduced quantities of solvents for materials currently being used
- High solids coatings
  - * ADV: Reduced VOC and HAP emissions, reduced solvent usage, reduced fire hazard, reduced number of spray applications, and improved mar and abrasion.
  - * DISADV: High cure temperature may be needed, sensitive to temperature and humidity, tacky overspray difficult to clean .
- Water-borne coatings
  - * ADV: Reduced VOC/HAP emissions, conventional application processes, reduced toxicity/odor, easy clean up, reduced fire hazard, low hazardous waste.
  - * DISADV: Longer drying times or increased oven temperature may be needed, cost, coating line material conversion, reduced transfer efficiencies.

(HANDOUT: THOMSON CROWN WOOD PRODUCTS CASE STUDY)

Equipment Substitution.

- High Volume/Low Pressure (HVLP)
  - * Transfer Efficiency = 40 - 65 %
  - * Reduced raw material use and reduced overspray
  - * Effective for both solvent and water-borne materials
- UNICARB™
  - * High transfer efficiency
  - * Uses supercritical carbon-dioxide in place of organic solvents
  - * Reduced VOCs/HAP

CASE STUDY - HVLP SPRAY
HENREDON FURNITURE - Morganton, NC

Henredon Furniture switched from conventional to HVLP spray equipment operating at 7-10 psi for applying lacquers, sealers, and stains to wood furniture products. Spray operators received training on proper use of the new equipment. The company realized a 13-15% reduction in coating usage and a $120,000 per year savings in raw material usage. The new equipment also improved product quality without slowing line speeds. The payback period for the project was 3.5 months. The change also reduced VOC emissions by 126,000 lbs.[4]

CASE STUDY - HVLP SPRAY
ALEXVALE FURNITURE - Taylorsville, NC

Alexvale Furniture switched from conventional spray equipment to HVLP equipment for applying finishing materials. The excessive overspray of the conventional equipment resulted in large quantities of hazardous waste from booth cleanout and filter replacement. The HVLP equipment uses less coating material and reduced hazardous waste generation by 40 drums per year. Cost savings were estimated to be $50,000 per year. The payback period was less than one week.[5]

CASE STUDY - UNICARB™ COATING APPLICATION

An unnamed wood furniture manufacturer conducted an in-plant trial of UNICARB coating technology for applying sealers and topcoats. The UNICARB sealers and topcoats were formulated to eliminate HAPs. The UNICARB™ system resulted in a 50% reduction in material usage. The company was able to eliminate one coating application due to the thicker coating that can be applied with UNICARB™. Finish quality improved and less reworks were necessary.

This trial was part of an overall coating process modification. The company also switched to using HVLP equipment for applying water borne stains and washcoats. Overall VOC emissions were reduced by 65%. The company estimated an annual savings of $125,000 with a payback for the UNICARB™ equipment of less than a year. The process modifications may allow the company's to change its status under the CAA to a minor HAPs source.[6]

III. RECOVERY AND RECYCLE/REUSE

- Reuse of cleaning solvent
- Wet spray booth washwater recycling
- Solvent distillation

CASE STUDY - SOLVENT SEGREGATION AND REUSE
SHERWIN-WILLIAMS - Greensboro, NC

Sherwin-Williams, formerly Desoto, Inc., manufacturers industrial coating materials. Waste from batch cleanup is separated by color and is then used when the next batch of that color is made. This practice has reduced waste mineral spirits at the company by 98% from 25,000 lbs. per year to 400 lbs. per year. Virgin mineral spirits purchases and paint raw materials purchases have also been reduced.[1]

CASE STUDY - WET SPRAY BOOTH WASHWATER RECYCLING
THOMSON CROWN WOOD PRODUCTS - Mocksville, NC

Thomson Crown Wood products formerly disposed of its contaminated wet spray booth washwater as hazardous waste. The company instituted a system to separate the paint solids from the washwater and then recycle the water back to the spray booth. The idea for this project came from a Quality Leadership Program team of employees. The change reduced hazardous waste disposal costs by $92,500 per year. The company was the 1991 recipient of the Governor's Award for Excellence in Hazardous Waste Management.[5]

SUMMARY

The pollution prevention techniques discussed can offer furniture manufacturers an opportunity to reduce VOC and HAP emissions and save money at the same time. Many companies may be able to come into full compliance with the Clean Air Act Amendments without installing expensive pollution control equipment. Pollution control equipment can only pay for itself through avoided environmental fines and other intangible costs such as improved environmental quality and improved public relations. The case studies presented in this paper show companies who have reduced air emissions and hazardous waste generation with less than one year payback through reduced raw material usage. These companies also realized the intangible savings mentioned above.

Pollution prevention has been proven by countless companies to be the most cost effective approach to environmental protection. The North Carolina Pollution Prevention Program is available to help companies identify opportunities for pollution prevention. Companies interested in receiving free non-regulatory technical assistance should call (919) 571-4100.

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