

Wood Furniture: The Clean Air Act Amendments of 1990 and Pollution Prevention Opportunities

Executive Summary

Introduction

The stains, sealers and topcoats traditionally used by the furniture industry contain solvents that volatilize to the air within the plant and/or are directly vented to the environment, usually without treatment. A typical solvent-based coating contains approximately 6 pounds of volatile organic compounds (VOCs) per gallon; 70 to 90 percent of the liquid applied to a piece of furniture ends up as air emissions, depending on the type of coating. The solvents emitted in the greatest quantities from furniture finishing are toluene, xylenes, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK) and methanol. All of these compounds are flammable liquids, and are classified by the U.S. Environmental Protection Agency (EPA) as volatile hazardous air pollutants (VHAPs) and VOCs. Exposure to these substances can cause adverse health effects and contribute to ambient ozone problems.

This Manual provides valuable information on how manufacturers can significantly reduce air emissions and increase process efficiency, while in many cases improving product quality and saving money. The purpose of this Manual is to promote the maximum emission reductions possible by presenting the many pollution prevention (P2) options available and to illustrate the benefits of P2 to wood furniture manufacturers and those who regulate them.

New Regulations

On December 7, 1995, the EPA promulgated a National Emission Standard for Hazardous Air Pollutants (NESHAP) for the wood furniture manufacturing industry. On May 20, 1996, EPA issued a control technology guideline (CTG) for reducing VOC emissions associated with wood furniture finishing. VOCs are a broader group of chemicals which include most VHAPs. Therefore, many wood furniture manufacturers have to understand and comply with the requirements of two different federal mandates. In addition, many of the Northeast states regulate the wood furniture industry under their state air toxics control programs. The Manual details the new NESHAP and CTG requirements and includes an overview of state-specific air and P2 requirements for each of the eight Northeast states.

The new wood furniture NESHAP and CTG require that manufacturers reduce emissions from their coating operations and implement numerous work practice standards. Both of these federal requirements recognize that add-on pollution control equipment is not technically or economically

feasible for most sources in the wood furniture industry. Rather, they emphasize a P2 approach instead. The goal of P2 is to reduce or eliminate hazardous chemical use and by-products. In addition to improving conditions for employees by improving indoor air quality and reducing environmental impacts, firms that implement P2 techniques often realize a financial benefit. Financial gains can be substantial and are typically realized from reductions in coating use, waste generation, labor requirements, fire insurance premiums, and record keeping and reporting burdens. There are also many qualitative benefits from P2 projects that can become real economic benefits such as reduced long-term liability associated with hazardous material storage, use and disposal, improved public image, and “green” marketing potential. Finally, improved working conditions within the facility can translate into increased employee productivity and company loyalty.

P2 projects strive to improve process efficiency and product quality. The quantity

of waste generated from a manufacturing process is typically related to the efficiency of that process; more waste is generated from a less efficient process. Reducing inefficiencies typically results in long-term cost savings for a company. Therefore, P2 should be integral to all of the continuous improvement strategies that businesses implement to stay competitive. The wood furniture NESHAP work practice standard requirements will help manufacturers reduce air emissions by promoting the replacement of inefficient application equipment and improving housekeeping practices. The emission limits encourage the use of low-VHAP containing coatings. These coatings can increase process efficiency because less coating material is needed to produce the same dried thickness on the furniture item. The NESHAP and CTG requirements center on three areas: coatings, application equipment, and operator training.

Coatings

Solvent-based stains, sealers and topcoats are used widely in the wood furniture industry because they are easy to apply and repair, dry quickly, are familiar to the industry, and provide the final product appearance to which consumers are accustomed. However, there are three main drawbacks to solvent-based coatings: they are highly flammable; the solvents are often toxic and volatile, creating large quantities of potentially harmful emissions; and the dried finish is not

Alternative Coatings Reduce Emissions and Save Money

- New England Woodcraft of Forest Dale, Vermont manufactures oak and maple institutional furniture and switched to aqueous-based sealers and lacquers. VOC emissions were reduced from 96 to 16 tons per year, despite the doubling of production. Hazardous waste generation was cut from 2_ 55-gallon drums per week, to only 3 drums per year. Fire insurance premiums were cut in half.
- Ethan Allen of Beecher Falls, Vermont manufactures high-quality residential furniture and switched to high-solids sealers and topcoats. They eliminated one topcoat application step reducing coating use and associated air emissions, and saving \$175,000 annually on labor.
- Hussey Seating of North Berwick, Maine manufactures bleacher seating and switched to an automated UV-cured coating system. VOC emissions were reduced from 50 tons per year to only 219 pounds per year, despite increasing production from 9,000 to 14,000 units per week. Labor and coating material savings are \$235,000 per year.

highly durable - it is easy to damage, is ruined by water, and turns yellow when exposed to sunlight. The NESHAP and CTG require manufacturers to meet VHAP and VOC content limits, respectively, for the coatings they use.

Fortunately for wood furniture manufacturers, numerous alternative coatings are available that can meet and/or exceed the NESHAP emission standards: higher-solids nitrocellulose, aqueous-based, ultraviolet (UV)-cured, polyester/polyurethane, and/or some traditional coatings in combination with one or more of the alternatives.

The finish appearance of alternative coatings, such as aqueous-based and UV-cured, has improved in recent years. Newer alternative coatings can produce a high quality finish.

However, the style of furniture, the type of wood used and the finish appearance differs among manufacturers so changes that work for one facility might not produce an acceptable finish at another facility. Companies should contact multiple vendors when making changes to ensure that the best system is found in terms of product quality, VHAP and VOC reductions, and capital and operating costs.

Application Equipment

The type of application equipment used affects the amount of coating used, and the quantity of air emissions and solid and/or hazardous waste generated. Nearly 90 percent of the industry uses manual spray guns, many of which are conventional air spray guns. Conventional air spray guns have a low transfer efficiency (TE), only 20 to 40 percent under actual line conditions. Therefore, 60 to 80 percent of the coating material sprayed never contacts the furniture item and becomes a waste. The NESHAP and CTG prohibit the continued use of conventional air spray guns with certain exceptions.

Large quantities of overspray require frequent spray booth filter replacement and the spray booths require frequent cleaning. Frequent cleaning increases labor requirements, solvent use and waste generation; expenses that could be minimized with a higher TE application method.

Therefore, there are strong financial incentives associated with switching from conventional air spray technology, in addition to the environmental benefits of lower VOC and HAP emissions.

High volume low pressure (HVLP) spray guns have a TE of 40 to 60 percent in practice, reducing overspray and HAP and VOC emissions substantially when compared to conventional air spray guns. The lower pressure reduces coating “bounceback,” further reducing operator exposure. HVLP guns can apply a wide range of coatings, and are relatively inexpensive, paying for themselves often in a few weeks or months because of reduced coating use. If HVLP guns

HVLP Guns Reduce Emissions and Coating Costs

- Ethan Allen of Beecher Falls, Vermont spent \$8,125 to replace 25 conventional air spray guns with HVLP guns and realized a 39 percent reduction in coating use, saving more than \$145,000 per year
- Henredon Furniture of Morganton, North Carolina switched to HVLP spray guns for stain, sealer, and lacquer application, and reduced coating material costs by \$120,000 and VOC emissions by 63 tons per year

cannot keep up with the production rate, low air pressure air-assisted airless guns can be an effective alternative. If possible, firms should switch to an automated coating system, many of which have a TE of nearly 100 percent.

Operator Training

The level of training an operator receives regarding proper application technique and equipment settings can have a significant impact on the quantity of material used to coat a given item and the quantity of cleaning solvent used. Recognizing the significance of the operator, the NESHAP and CTG require that facilities develop a formal operator training program. Maintaining the highest possible TE saves money by minimizing coating costs.

A P2 approach can lower VHAP and/or VOC emissions, facilitate compliance with the NESHAP and CTG, and benefit public health and the environment, as well as improve production efficiency and save money. Environmental improvement combined with efficiency improvements and cost savings is an ideal “win - win” situation for a wood furniture manufacturer and this Manual can help both large and small firms make these cost-effective P2 improvements.

Operator Training Reduces Emissions and Coating Costs

At the Ethan Allen facility in Old Fort, North Carolina spray gun operators were trained on-the-job by a co-worker. Old Fort implemented a more formal training program, and the benefits include: reduced overspray, reduced material use, reduced air emissions, and a higher quality finish. Material use was reduced by 8 to 10 percent, for an annual savings of \$50,000 to \$70,000.