Wood Finishing: Reducing Waste and Cost Saving Ideas for Wood Finishers

Minnesota Technical Assistance Program ■ FACT SHEET

Emissions and Waste Issues

The wood products industry is important to Minnesota both economically and environmentally. Minnesota has over 1,000 furniture, cabinet and millwork shops. The wood finishing process is a significant source of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). Common HAPs in the industry include: methanol, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, toluene and xylenes. Wood finishing shops should also be concerned about disposal of waste solvents, finishes and rags, which are often considered hazardous waste. The industry receives increased regulatory scrutiny from the Wood Furniture Manufacturing National Emission Standard for Hazardous Air Pollutants (NESHAP).

Through the use of alternative coatings, such as waterborne finishes, and the use of higher transfer efficiency spray equipment, some companies are seeing significant reductions in emissions and savings on disposal and raw material costs.

Benefits of Reducing Waste

Reducing VOCs and HAPs is smart business for wood finishing shops. Benefits include:

- Improved work environment, health and safety for employees
- Reduced regulatory compliance burden
- Savings on materials and disposal costs
  Note: Alternative finishes may cost more on a per gallon basis, but they have a high solids content requiring less to be used to complete the job–saving you money.
- Marketing advantage of being “environmentally friendly"

This fact sheet describes some options available to reduce emissions from wood finishing operations, giving company examples and specific things to consider for a material, equipment or process change.

Current Standard Wood Finishing Process

Many wood finishers use the traditional solvent-borne stains and nitrocellulose lacquers to finish wood products. Solvent-borne coatings provide a durable, high quality finish at a reasonable cost. They are also easy to spray and problems with the finish are easy to fix because a compatible solvent can quickly strip off the finish.

Finishing steps vary between shops because of the type of wood being used, the type of product being manufactured and the desired finish.

VOC and HAP emissions are associated with the spraying and curing processes and hazardous waste may be generated from wiping stains and cleaning equipment.

Alternative Coatings

Low VOC finishes may contain higher solids content, non-VOC solvents or water. Types of low VOC wood finishes include: high solids coatings, laminates, ultraviolet (UV) curable coatings, waterborne finishes and powder coatings.

Waterborne Finishes

Waterborne finishes use water instead of conventional solvents as the major carrying medium for the finishes’ solids. Using a waterborne finish can significantly reduce VOC air emissions. This can result in reduced regulatory compliance burdens.

> With assistance from MnTAP, Pine-Tique, a furniture manufacturer in Minnetonka, successfully piloted a low-VOC waterborne wood finish. Through the trial MnTAP found that Pine-Tique could reduce VOCs by 80 percent and eliminate its HAPs The company reduced its hazardous waste from equipment cleanup.

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Because waterborne finishes release less fumes and pollutants than solvent-based finishes, employee working conditions can improve significantly. Improved indoor air quality may lead to a higher production rate and better employee morale.

> Automated Building Components (ABC), a millwork manufacturer in Chanhassen, says its employees are physically more comfortable since the switch to waterborne wood finish. Employees have fewer headaches and less sick days. Employees at ABC recognize the health and safety benefits of making the switch from a solvent-based finish to a water-based finish.

Although many benefits exist when using waterborne finishes, the process of finding and converting to alternative coatings takes time. The facility must consider many factors and be willing to alter its processes to successfully implement an alternative coating system.

Both Pine-Tique and Viking, a small wood-furniture finishing company in St. Joseph, had unique concerns when searching for suitable waterborne coatings. Below are some of their findings that should be considered by wood finishers when deciding to switch to a waterborne finish.

Wood species. Viking's products are made primarily from pine while Pine-Tique's products were made from six different types of hard and soft woods. Applying waterborne finishes to soft woods, such as pine, often causes problems with grain rise as these woods are more porous. An even, smooth-to-the-touch surface is an industry standard for wood furniture manufacturers.

Tip: If a complete waterborne finishing system is not working for your company, look at options such as using a solvent-borne sealer with waterborne stains and topcoats.

Color matching. Pine-Tique was concerned about matching the appearance of products already in showrooms and customers homes. Pine-Tique had been using nitrocellulose lacquers which have an amber tint. Waterborne finishes are water-clear so matching a nitrocellulose lacquer can be difficult. Also, walnut and cherry wood gain a deep, oiled finish with nitrocellulose lacquer which can also be difficult to match with a waterborne finish.

Pine-Tique's desire was to find one finishing product that is suitable for a large variety of woods because mixing special tints for different woods adds labor costs, equipment costs and/or scheduling difficulties.

Tip: Find vendors that are willing to help with trouble shooting.

Finishing after assembly. A large percentage of Pine-Tique's products were finished after assembly. These three-dimensional pieces need special attention to minimize overspray onto finished areas. Dry waterborne overspray does not blend into a finish as well as lacquer and could cause finishing defects like those caused by dust. The dry time of a topcoat should be slow enough to allow the wet edges to be blended together as the finisher completes the piece.

Tip: Your vendor may be able to supply a coating or additive with a slower dry time.

Dry time. Viking has a short dry time requirement. Because of shipping schedules and customer requirements, an eight-hour dry time is required for some products. This can be an obstacle for waterborne finishes which may not dry as quickly as solvent-borne finishes under certain conditions.

Tip: Allow a longer drying time or invest in equipment that will speed up the drying process. A climate controlled finishing/drying area may help.

Storage and transportation concerns. Storage of raw materials and coatings also becomes important when using waterborne finishes. Coatings should be stored in heated buildings to prevent freezing. Remember that eliminating solvents in coatings and cleaners reduces fire risk and helps meet building codes.

Because Viking has unheated warehouses, it tests for "cold cracking," small finishing flaws shaped like spider webs that appear under cold stress. A finish is tested by placing a finished sample in a cooler with dry ice, then warming it to simulate the dramatic temperature changes the product could experience moving from unheated storage to trucks and then to showrooms or homes. The test is repeated several times.

Tip: Communicate the current method of storing finished products to your vendor and be open to change.

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Sanding. Viking does not sand its product finely. This leaves more surface area open to absorb water which increases grain rising. Sanding at 60 grit is considered "rough" by many wood finishers, but Viking gets a satisfactory finish with this method and was not interested in investigating finer sanding methods. The finer grit paper would clog more often with pine pitch, resulting in increased material and labor costs.

Tip: Rough sanded wood may best be sealed with a high solids material or dried quickly with an oven or lamps to minimize grain raising.

UV Curable Coatings

UV coatings can only be used for interior applications and as a sealer or filler coat for exterior applications. The benefits of UV curable coatings include:

- A fast curing time reduces grain raise and dust
- Lower grain raise sometimes eliminates the need for sanding between the sealer and topcoat, saving time
- A fast curing time saves floor space by allowing the product to be immediately stacked
- UV coatings typically cost less than conventional coatings
- UV coatings can reduce VOC's by 90 to 100 percent

Powder coatings

Powder coatings are making great improvements in their ability to finish wood products. Many of the "fabricated" fiber-board products are able to handle curing temperatures. Shelving, white boards and other similar wood products are now being powder coated. The powder coating industry is working to improve technology and materials to successfully coat other wood products.

Laminates

Although not technically a wood finish, laminates are an alternative to traditional finishes. Laminates offer superior durability and reduced air emissions compared to other wood finishes.

Alternative Spray Equipment—Uses, Benefits and Considerations

Another way for wood finishers to reduce waste and save money is by *increasing transfer efficiency* in their operations. Simply stated, transfer efficiency measures how much finish makes it from the finish can to the surface being finished. Overspray on the floor or booth filters is considered waste.

To achieve the best transfer efficiency study the application equipment available, then evaluate the equipment's performance using the coating material which meets your specifications. Because each application equipment combination has its own characteristics, the advantages and disadvantages must be weighed against the coating specifications for your product. Increase transfer efficiency to match your specified coating film thickness.

Conventional Spray

In use for over 40 years, conventional spray uses air at high pressure (40 to 70 pounds per square inch [psi]) to atomize a liquefied stream of finish. A high-energy air stream very finely atomizes the finish making it easy to apply. This yields very good finishes with high-quality visual characteristics.

Conventional spray guns have a disadvantage because they are susceptible to overspray, resulting in more waste and less transfer efficiency. The solvent in the finish is highly atomized along with the paint solids increasing VOC emissions from the solvent in the finish.

High Transfer Efficiency Technologies

High-volume/low-pressure (HVLP). As the name suggests, a high volume of air at low pressure is used to atomize the finish. The defined air-pressure limit for HVLP is 10 psi at the spray gun. This reduced spray gun energy level reduces overspray and improves transfer efficiency. Generally, fluid-delivery rates up to 10 ounces per minute with low viscosities will work best with the HVLP gun. With higher fluid-delivery rates and heavier materials, HVLP may not atomize well enough to achieve an acceptable finish.

Airless. This is a method of atomizing finish without using compressed air. The paint is pumped at high pressure though a small opening at the spray tip to achieve atomization. Adjustments in airless spraying are done by adjusting the viscosity of the system pressure. Many high-viscosity coatings can be applied without costly solvent thinning. Also, this method allows a heavy finish coat to be applied rapidly—useful for keeping up with fast-moving painting lines.

Air-assisted. This spraying system helps or "assists" airless systems by using supplemental air jets to guide the finish spray and boost the level of atomization. Air-assisted airless technology

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combines the best characteristics of both air and airless spray. Benefits include substantial material savings and reduced overspray when compared to conventional air spray, and improved transfer efficiency and finishing appearance when compared to airless technology. Air-assisted has lower fluid pressure which increases finish quality. Operator technique is also enhanced as the application rate is reduced and the operator can more easily coat the product.

Companies Testing and Using Alternative Spray Equipment

Many companies have begun testing and are switching to higher transfer efficiency spray equipment. This change results in cost savings and reduced emissions.

Viking. Viking switched to an HVLP spray gun for applying sealer coat. The estimated material savings are 1,300 gallons of sealer per year, translating into a savings of $10,530. Approximately four tons of VOC emissions and two tons of HAPS are prevented annually.

Viking also switched to an air-assisted airless spray gun to apply dark stain. Although cost savings and reduced emissions data have not been collected on this process, employees at Viking have noticed reduced overspray. Adjustments in spray techniques or gun spray tip size will need to be made to ensure correct wet film application or more stain will need to be wiped off, increasing rag use.

Foldcraft Company. A MnTAP intern worked with Foldcraft Company in Kenyon, a table and seating manufacturer for restaurants, fast food chains and cafeterias, to test alternative spray equipment. The intern found that by purchasing two air-assisted airless guns and an HVLP gun, transfer efficiency could increase 29 percent. He determined that the new equipment could save the company a total of $9,500 per year and reduce varnish use by 33 percent.

Considerations When Switching to Alternative Spray Equipment

Switching to a higher transfer efficiency spray gun will require employees to learn new techniques. For example, HVLP guns may spray more slowly than conventional guns. Proper training of employees is required to adjust to the new equipment.

Other Waste Reduction Options for Wood Finishers

Laundering Staining Rags

Industrial laundry services and uniform leasing companies also lease towels which can be used for staining operations. During the laundering process solvent washwaters may be generated and are difficult to manage. Laundry services may require rags to be spun in a centrifuge before they accept them. Reputable laundry services have industrial wastewater permits and properly manage their waste streams.

Optimizing Cleaning Solvents

Pine-Tique began reusing the solvent used to clean mixing equipment, disposing of it when the solids content becomes too high. Fresh solvent is used to flush pressure pots, lines and guns because the solids would plug the in-line strainer on the spray gun.

MnTAP tested the ability of a paint strainer to remove solids from old cleaning solvents so the solvent could be used as a first wash. The strained cleaning solvent was pumped though equipment and no solids were detected in the gun screen. This practice could have cut Pine-Tique's solvent waste stream in half with a few modifications to solvent collection and use. In addition, Pine-Tique could have let solids settle periodically to prevent the paint strainer from getting clogged. Reusable strainers can also be fabricated and then back-washed into the solids container.

Operator Training

All finishing companies can improve finishing material transfer efficiencies by focusing on training operators. Many times production-push conflicts with the pace necessary to do the job right. This often results in increased overspray and lower material transfer efficiencies. Training on good spray techniques should be given to veteran and new spray operators periodically. Spray operators should share improvements on techniques or their "tricks" for spraying particular pieces, including sharing between shifts. Videotaping and reviewing the tape with spray operators may also help improve spray techniques.

Good spray techniques include the following:

- Hold the spray gun perpendicular to the surface of the part being sprayed. This reduces the chance of the coating coverage being uneven.

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- Trigger the gun slightly before and after each pass to minimize overspray.
- Overlap each stroke by 50 percent to achieve a uniform coating thickness.
- Maintain a consistent distance between the gun tip and the part. This ensures the best spray pattern. The distance is dependent on the spray equipment, coating and operating pressures.
- Spray with a suitable speed to give a full, wet coat with each stroke, without causing the coating to run.
- Adjust the air and fluid pressures, and select the correct tip size for the coating and gun being used. This minimizes overspray and avoids wasted material.

Uniform coating thickness is stressed because applying too much coating wastes material and may pose quality problems. Too little finish may produce a reject part both wasting time and creating refinishing costs.

One new tool to assist spray painters is a laser pointing attachment for spray guns. This tool assists painters in targeting and aiming the spray gun. It shows the painter that the correct gun-to-part distance is achieved when the two laser beams cross at the part to show one dot. Call MnTAP for more information about this tool.

Additional Resources

Additional information on waste reduction and management can be found on:
- MnTAP's Web site <www.mntap.umn.edu>
- Minnesota Pollution Control Agency's (MPCA) Web site <www.pca.state.mn.us>

For assistance with air quality permits call the MPCA's Small Business Compliance Assistance Program (SBAP) at 800/657-3938 or 651/282-6143.

Below is a sample of additional resources available from MnTAP. Visit the Paining and Wood Finishing page on MnTAP's Web site, or use the search option to search the site for topics of concern to you and your business.
- Spray Painting and Coating; Waste Reduction Alternatives [#85]
- Paint and Related Materials Options [#69]
- Suppliers of Low VOC and Waterborne Wood Finishes [#7]

For More Information

MnTAP has a variety of technical assistance services available to help Minnesota Businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution and reduce costs. Our information resources are available online at <www.mntap.umn.edu>. Or, call MnTAP at 612/624-1300 or 800/624-0015 from greater Minnesota for personal assistance.