Pollution Prevention For Wood Finishing and Manufacturing

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University of Wisconsin - Extension Solid and Hazardous Waste Education Center



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December 1994



Forward

The Solid and Hazardous Waste Education Center (SHWEC) is pleased that you have obtained the guide to waste reduction in your industry. We believe that the evidence supporting pollution prevention is overwhelming. Companies that practice pollution prevention have seen substantial savings in operating costs, improved product quality, reduced risk to worker health and safety, and enhanced standing in their communities. We hope that you will take the time to carefully review the waste reduction opportunities outlined in this guide and apply them as appropriate to your operations.

The development of this manual is the result of a cooperative effort by those listed below. Substantial modifications have been made to the manual to better serve Wisconsin manufacturers.

Produced by

US Environmental Protection Agency Center for Environmental Research Information Cincinnati, Ohio

Tennessee Valley Authority Waste Management Knoxville, Tennessee

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Preventive Environmental Management Raleigh, North Carolina

Radian Corporation Research Triangle Park, NC

Other sponsors:

Waste Reduction Resource Center Raleigh, North Carolina

State of North Carolina - Office of Waste Reduction Raleigh, North Carolina

American Furniture Manufacturers Association High Point, North Carolina

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Wood Furniture Industry Waste Reduction Opportunities · · .

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Pollution Prevention For Wood Finishing and Manufacturing

Introduction

This workbook is provided to you as a tool to help keep your company COMPETITIVE !!!

Purpose

The purpose of this manual is to provide a simple, easy to use reference of waste reduction opportunities for the wood finishers and manufacturers. This manual provides a compilation of waste reduction ideas that can reduce operating costs, improve product quality, reduce risk to worker health and safety, limit waste related liability, and improve company image by:

- improved manufacturing efficiency
- conserving raw materials
- minimizing waste volume, toxicity and disposal costs
- eliminating or minimizing the number of regulatory requirements that apply to your operations and the risk of associated penalties
- meeting the customer's growing desire for environmentallyresponsible products made by environmentally-responsible processes
- being recognized as a good corporate neighbor who protects the environment
- providing workers a safer work place with less hazardous materials and processes

Use this manual to identify waste reduction opportunities that you can use at your facility.

Design of the Workbook

For companies just starting a waste reduction program, a brief overview of the basic steps for developing an EPA recommended program is provided.

Waste reduction opportunities and practices are given in a summary format for each of the respective major manufacturing processes. For each process, there is a brief process description and a list of the waste reduction opportunities for that process.

The information provided about the waste reduction opportunities includes:

- a description of the opportunity and its benefits
- any cautions regarding implementation
- brief case studies of the successful application of the opportunity

The degree of benefit that results from implementing any of the waste reduction opportunities will depend on the operations at your facility. For example, large manufacturers with large lumber inventories and kiln drying facilities may realize a significant benefit from implementing the opportunities summarized in Section 2 - Lumber Receiving, Drying and Storage. However, smaller manufacturers may find their largest benefits in Section 1 - Wood Finishing, as finishing operations may generate the majority of wastes in a smaller manufacturing facility.

Companion documents that can be used with this manual include:

• The American Furniture Manufacturers Association (AFMA) Environmental Guide for the Furniture Industry which provides information for regulatory compliance and environmental management.

• SHWEC Pollution Prevention: A Guide to Program Implementation which provides information for establishing and implementing a pollution prevention/waste reduction program at your facility.

Steps for Developing A Waste Reduction Program

The following are the steps recommended by EPA.



Some key factors for success include visible commitment from facility leadership, program ownership and support by all employees, multi-functional participation, establishment of waste reduction goals, management systems for tracking the types and amounts of materials, wastes and associated costs, and the measurement and celebration of progress.

Additional information on developing a program can be found in the

• EPA Facility Pollution Prevention Guide (EPA/600/R92/088, May 1992) which provides information for establishing and implementing a pollution prevention/waste reduction program at your facility.

1 Wood Finishing

Process Description

The purpose of the finishing operations is to provide the furniture with a pleasing appearance, a feeling of smoothness, and protection of the wood. The basic operations of the typical finishing process include:

- glue sizing or bleaching
- cleaning / stripping
- coating
- drying
- sanding
- rubbing / buffing
- equipment cleaning
- repair / touch-up

Finishing Wastes

- volatile organic compound (VOC) emissions and hazardous air pollutants (HAP) emissions
- liquid wastes including spent stains, wash coats, fillers, sealers, glazes, topcoats, solvents, and spray booth wastewater
- solid wastes including spray booth filters, overspray masking, paint solids, rags, and solvent still bottoms
- energy

Waste Reduction Opportunities

Coating Formulations:

- 1.1) Use of Waterborne Coatings
- 1.2) Use of High Solids Solvent Based Coatings
- 1.3) Use of Polyester / Polyurethane Based Coatings
- 1.4) Use of CO_2 System Coatings
- 1.5) Use of Radiant Cured Coatings

Coating Application Technology:

1.6) Use of High Pressure Low Volume (HVLP) Spray

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1.7) Use of Airless Spray

1.8) Use of Air-Assisted Airless Spray

1.9) Use of Electrostatic Technology

1.10) Use of Vacuum Coating

1.11) Use of Dip Coating

1.12) Use of Flow Coating

1.13) Use of Roll Coating

1.14) Use of Curtain Coating

Cleaning/Stripping:

1.15) Alternatives to Methylene Chloride

Operation and Maintenance:

1.16) Train Equipment Operators

1.17) Prepare Coatings Properly

1.18) Direct Delivery of Coating to Spray Gun

1.19) Use Heat to Obtain Desired Coating Viscosity

1.20) Spray Equipment Maintenance

1.21) Equipment Cleaning and Line Flushing

1.22) Inventory Management

1.23) Recycling of Finishing Materials

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Waste Reduction Opportunities

1.1) Use of Waterborne Coatings

Water, instead of conventional solvents is the major carrying medium for the coating solids in waterborne coatings. Therefore using waterborne coatings, or "hybrid" coatings with a combination of water and conventional solvents, can significantly reduce VOC air emissions and reduce other associated liquid and solid wastes.

Benefits

- reduced air emissions and hazardous liquid and solid wastes
- finish resists moisture, chemicals, impact and abrasion well
- adaptable to a wide range of conventional application methods
- in some cases equipment can be cleaned with soap and water
- potential reduction in fire insurance when converting from solvent coatings to waterborne
- in some cases reduced toxicity and odor

Cautions

- increased drying times, larger drying air requirements or higher oven temperatures as water takes more time than VOCs to evaporate, especially in high humidity
- for proper solubility and freeze protection must be stored at room temperature
- equipment may need to be cleaned immediately after use
- equipment must be corrosion resistant, and costs of conversion can be significant
- moisture content of substrate and finish room humidity must be controlled
- raising of wood grain possible
- wood surface must be free of oils and dust for good adherence properties
- high gloss finish sometimes difficult to obtain; increased rubbing effort needed
- some atomization difficulties, increased runs and sags, tendency to foam
- refinishing is sometimes difficult

CASE STUDY - NEW ENGLAND WOODCRAFT, FOREST DALE, VT

In 1987, New England Woodcraft, a manufacturer of bedroom and lounge furniture, installed a continuous finishing line that can apply clear water-based sealers and topcoats to their flat furniture pieces. Sealing steps include spraying, flash-off, infrared heating, followed by hand sanding. Pieces then make their way to the top coat spray booth, another set of flash-of and infrared ovens. After three years of testing waterbased emulsion finishes with C. E. Bradley Laboratories of Brattleboro, VT, the company completely converted its finishing line to water based acrylic clear sealers and topcoats. Results not only included a pleasing, high quality finish with excellent performance, but also the reduction of VOC emission rates by 80% and reduced costs by 25%. Even though the water-based formulations cost more than nitrocellulose, a Woodcraft representative states that they get "more mileage" from the water-based formulations because of the higher solids content.

1.2) Use of High Solids Solvent Based Coatings

These coatings are solvent-based, however they have a high solids concentration in the range of 35% - 40% solids which results in an increased application of coating with less VOC emissions and solvent waste. There are three basic types of high solids coatings - two component ambient temperature cured, one component heat converted, and high solids thermoplastic solvent borne coatings.

Benefits

- reduced air emissions and less liquid and solid wastes
- less compliance and disposal costs
- less material required to coat, reduced solvent usage and costs
- reduced number of spray applications to achieve the same coating thickness
- high transfer efficiency
- reduced inventory, less handling and shipping costs, additional available floor space
- in some cases less fire risk, potential reduction in fire

Cautions

- cannot be used effectively in dip or flow coating applications
- wood surface must be clean
- may require high temperature curing with narrow "time/temperature/cure window"
- difficulty in controlling film thickness and sagging; may require heater
- sensitive to ambient temperature and humidity
- finished piece difficult to repair
- overspray is tacky and difficult to clean
- reduced shelf life, short pot life for two component coating
- odor and slow flash off require use of vented flash off zones

1.3) Use of Polyester / Polyurethane Based Coatings

Polyester-based and polyurethane-based coatings are used significantly outside the U.S. Use of these coatings can result in a reduction of VOC air emissions over nitrocellulose solvent-based coatings. Polyester-based coatings include styrene derived polyester of 100% solids

which is cured by ultraviolet (UV) radiation, and acrylic polyesters (30 to 50% solids) which are cured by catalytic reaction or UV radiation. These coatings are typically applied by conventional spray guns or flat line applicators. Curing may require an initiator such as organic peroxide or UV radiation.

Benefits

- reduction in solvent usage and associated costs
- reduction in VOC air emissions, solvent wastes and associated compliance and disposal costs
- fast drying, less floor space needed
- durable finish
- resistant to heat, chemicals, impact
- high gloss with polyurethane
- multiple application methods

Cautions

- may require a clean room
- piece coated is difficult to repair
- polyester is chemically incompatible with nitrocellulose materials, can not be used in the same system or on the same piece potentially explosive
- pot life is short (1 to 6 hours)
- respiratory protection may be required (potential exposure to isocyanates)
- UV radiation curing may be difficult for non-flat surfaces since energy transfer is along "line of sight"
- some users report "plastic" looking finish

1.4) Use of CO₂ Coatings

In this system, super critical carbon dioxide is used to decrease viscosity and enhance atomization and replaces all or a substantial amount of the solvents used in the conventional spray application of coatings. The system's specially designed spray guns and nozzles enables the resin concentrate to be mixed with the carbon dioxide. The coating cures by air or baking. The use of CO_2 based coatings can reduce VOC emissions by 50% over nitrocellulose solvent-based coatings.

Benefits

- reduction in solvent usage and associated costs
- reduction in VOC air emissions, solvent wastes and associated compliance and disposal costs
- reduced worker exposure
- high quality finish
- high solids content
- nitrocellulose resins can be used and do not need reformulation
- fewer coating applications needed
- high transfer efficiency
- sometimes reduces sanding requirements
- easy to repair

Cautions

- limited suppliers of system equipment
- technology still in the developmental stage with limited experience
- lower fluid delivery rates than air spray guns
- gun and tubing is bulky
- royalty costs
- use of equipment requires training

CASE STUDY - PENNSYLVANIA HOUSE, WHITE DEER, PA

The Pennsylvania House manufacturing facility in White Deer, PA is applying the UNICARB[™] spray finishing system full time for lacquer topcoats on chairs. Starting in the Spring of 1990, Pennsylvania House worked with Union Carbide (licenser of the UNICARB [™] system), Nordson (developer of the spray equipment) and Guardsman Product Inc. (formulator of the top coat lacquer) in the development of the system which was installed on the chair finishing line in July of 1991.

Results include a topcoat finish of equivalent quality and integrity to the finish previously provided by the air assisted airless spray guns, however with only about half as many gallons of finish used. VOC emissions have been reduced by approximately 70%.

1.5) Use of Radiant Cure Coatings

The physical and chemical properties of a coating are altered by ultraviolet (UV), electron beam (EB), or infrared (IR) radiation so that a rapid polymerization takes place. In general, radiation cured coatings require less energy, less time to cure, and contain less VOCs than conventional coatings. Common radiation cured coatings include acrylate based materials and epoxies.

Benefits

- very high solids content
- reduction in solvent usage and associated costs
- reduction in air emissions, solvent wastes and associated disposal costs
- reduced energy costs
- high film thickness, fewer coats needed
- durable and glossy finish
- increased production rates, short curing times
- small ovens
- UV systems are easily installed / retrofitted
- low air movement reduces dust contamination

Cautions

- necessity of automation
- design changes usually require significant modification
- finished pieces difficult to repair
- not applicable to coatings which contain pigments (e.g., stain)
- higher capital investment than conventional ovens
- higher cost for UV and EB coatings
- potential toxicity of coating constituents, dermatitis
- shrinkage / adhesion problems with acrylate
- curing three dimensional pieces is difficult
- may require a clean room
- some "plastic" looking finishes reported by users

CASE STUDY - LOEWENSTEIN, POMPANO BEACH, FL

Loewenstein is a seating manufacturer that finishes over 250 varieties of chairs. Late in 1987, it was ordered to reduce its annual VOC emissions (290,000 lbs.) by 31% with a deadline of February 1, 1989. By April of 1989 Loewenstein had reduced its annual emissions to 165,000 lbs, and as of March 1993, they were down to 75,000 lbs. per year.

This reduction is a result of changing from their previous sealer and with 16% solids to a epoxy acrylate UV sealer and 68% solids.

They have also switched to non-electrostatic guns for stain touch up and guns for sealer and topcoat applications.

Other benefits included improved film properties and appearance, less coatings to achieve the desired film thickness, early sealer film hardness that permits extensive without wearing through the coating.

Spray Application Method	Comparable Transfer Efficiency	Atomization Quality	Categories of Coating Applied
Conventional Air	low	very fine	solvent borne waterborne
High Volume, Low Pressure	medium to high	fine	UV-curable solvent borne waterborne high solids
Airless	low	coarse	solvent borne waterborne
Air Assisted Airless	low to medium	fine	solvent borne waterborne high solids
Electrostatic	high	fine	solvent borne high solids powder coat waterborne UV curable

Table 1-1 Summary of Spray Application Methods

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1.6) Use of High Volume, Low Pressure (HVLP) Spray

HVLP spray guns atomize materials with warm, dry air between 0.1 and 10 psi, while conventional spray guns usually atomize materials at 60 to 100 psi. The low pressure air of HVLP systems transfers the coating to the substrate with low velocity and prevents the rapid expansion of spray caused by higher pressure guns, resulting in less overspray, less bounce back, and better transfer efficiency (40 -70%).

<u>Benefits</u>

- increased transfer efficiency, reduced overspray
- reduced worker exposure from bounce back
- reduced VOC air emissions
- lower booth clean-up costs
- reduced filter replacement costs
- · decreased booth wastewater treatment costs
- sprays well into cavities and recesses
- can be used for a variety of coatings (e.g., waterborne, high solids)
- finish as good as conventional spray guns with low to medium viscosity coatings

Cautions

- less complete atomization, atomization may not be sufficient for fine finishes
- slower application rate, high production rates may be affected
- worker training is a must for success

CASE STUDY - TIZ'S DOOR SALES (TDS), EVERETT, WA

TDS manufactures wood products including interior and exterior doors and frames, window and base moldings, and stained railings. HVLP spray guns were purchased to replace conventional spray guns on manual spray lines which were about 20% efficient. Along with the conversion to HVLP, TDS also installed automated flat line spray equipment which increased application efficiency and recycled overspray, switched from toluene-based coatings to less hazardous coatings, uses heat instead of solvents to thin coatings, uses dedicated pumps and lines for each type of coating, blocks gun nozzles and blows air back through the guns and delivery systems to reduce waste during cleaning.

TDS has reduced coating use by one-half (1991 - 18,000 gallons saved ~ \$180,000) and experienced significant savings in labor and waste disposal costs.

CASE STUDY - HENREDON FURNITURE, MORGANTOWN, NC

Henredon Furniture converted from conventional spray guns to HVLP equipment (7 to 10 psi) for applying lacquers, sealers, and stains to chairs and benches. Spray operators received on operation of the new equipment.

The company realized a savings of \$120,000 per year from a 15% reduction in coating usage. Product quality improved without impact to line speed and VOC emissions were reduced by over 126,000 lbs. Purchase and installation of the spray guns ranged from \$350 to \$500 per gun. Payback period was 3.5 months.

CASE STUDY - THOMSON CROWN WOOD PRODUCTS, MOCKSVILLE, NC

Wood and wood finished television cabinets are manufactured by Thomson Crown. Parts of these cabinets were coated with air-assisted airless spray guns (high air pressure up to 55 psi) with a poor transfer efficiency and a high generation rate of VOC emissions and coating waste. HVLP spray guns were purchased to replace the existing guns.

Material reductions of 65% for equalizer, 65% for toner, 35% for glaze, 35% for no-wipe, and 53% for water-based black finishes that total 13,300 gallons per year have been realized with an estimated savings of \$137,448. The cost of the project was \$21,350.

CASE STUDY - ETHAN ALLEN INC., OLD FORT, NC

Ethan Allen, who manufactures dining and bedroom furniture, replaced air assisted spray guns with HVLP equipment. Each operator is required to attend annual technical training provided by the spray gun manufacturer.

Spraying efficiency has increased and the quantity of to be filtered has been reduced. The investment was \$3000 (12 guns @ \$250). Raw materials were reduced by \$15,000 to \$20,000 per year, and costs associated with waste management and disposal were reduced.

1.7) Use Of Airless Spray

Airless spray systems atomize the coating by increasing the coating's fluid pressure (ranges from 500 to 6500 psi) without introducing a pressurized air flow.

Benefits

- high transfer efficiency (35 65%)
- reduced coating usage
- reduced air emissions and wastes
- high rates of paint flow, can move gun faster
- greater productivity, less operator fatigue
- ability to apply highly viscous fluids
- no air hose providing increased gun handling versatility

Cautions

- reduced spray pattern
- relatively poor atomization
- expensive nozzles
- coatings limitation
- tip plugging
- danger of skin injection
- increased training and maintenance

1.8) Use of Air-Assisted Airless Spray

Air-assisted airless spraying combines compressed air atomization with airless atomization. About 85% of the atomization of the coating is provided by fluid pressure (150 - 800 psi) as in airless, and the remaining 15% is provided by air pressure (5 - 30 psi) supplied at the nozzle.

Benefits

- high transfer efficiency relative to conventional (40 70%)
- finish comparable to conventional spray
- reduced material usage
- less overspray and bounce back

Cautions

- not compatible with some coatings
- risk of skin injection
- increased maintenance
- increased operator training
- capital cost

1.9) Use of Electrostatic Technology

During electrostatic coating, coating particles are given a negative electric charge and the piece to be finished is either grounded or is given a positive charge. This electrostatic action causes the coating particle to be drawn to the piece creating a high transfer efficiency of 35 - 70% for spray guns, and 60 - 90% for rotary disk (centrifugal force) applicators. This allows each piece to be coated with fewer passes and less coating material and associated waste. The particle velocity and electrostatic charge must be balanced to achieve optimum coating.

Benefits

- high transfer efficiency
- reduced material usage and associated VOC emissions and waste
- uniform film thickness
- good wrap around coating and edge cover
- can apply a variety of coatings (e.g., solvent-based, high solids, water-based, radiation curable)

Cautions

- pieces sometimes need to be coated by humidity sensitizing agent as pieces must be conductive
- safety/fire risk
- extra cleanliness essential
- coating accumulation at high points and "skips" (uncoated areas) in corners caused by Faraday effect may require touch-up
- bulky and delicate spray guns
- relatively high cost
- wrap-around may over-coat rear edges

CASE STUDY - BROYHILL FURNITURE INDUSTRIES, CONOVER PLANT

In December 1983, Broyhill installed an electrostatic system in their Conover chair plant in order to obtain a better quality finish and reduce material and labor costs. The new system, which uses five electrostatic high speed reciprocating turbo-disks, replaced a conventional spray system. The system also includes a flow coater that applies a sensitizer to make the surface of the chairs stain-conductive, and two non-grain raising stain spray booths.

After the system had been operating for two years, it was determined that material costs were reduced by 25% and the new system eliminated the need for six employees, who were relocated into different jobs at the plant. Associated wastes were also reduced and the payback period for the system was less than two years.

CASE STUDY - SUNTUI, ST. PAUL, MN

In 1992, Sun Tui, which manufactures futon frames, installed an automated electrostatic spray line that applies waterborne coatings to futon frames. The system replaced conventional air spray that applied water based coatings. The system includes a conveyor line, a photosensitive light curtain that communicates piece size information to the spray guns, water spray guns to add humidity to the piece for better conductivity, electrostatic bells which apply the coating, and an infrared oven.

Results have included increasing transfer efficiency 30 - 35% over the conventional system, less overspray and wasted material, and less VOC emissions.

CASE STUDY - THOMASVILLE FURNITURE, THOMASVILLE, NC

Thomasville Furniture was realizing a 80% loss of finishing materials (20% transfer efficiency) from their conventional air spray guns on their chair finishing line. In 1979, the company installed five hand-held airless, electrostatic sprayers in an effort to reduce the amount of coating material wasted.

Clean up of the spray booth is now conducted once a week instead of once per day. Material waste was reduced by 30% - 40% and associated wastes and VOC emissions were reduced. The walls of the spray booth are grounded so that overspray is attracted to the walls keeping the remainder of the area clean. The greatest savings occurred in the lines wiping stain where stain usage was reduced from 12 ounces per chair (dipping process) to 3 ounces per chair. In spite of some difficulties with humidity problems and higher coating prices, a payback period of one year was realized.

1.10) Use of Vacuum Coating

In vacuum coating, pieces are passed through a coating chamber under a vacuum. Coating material fills the chamber and the piece is coated as it proceeds through the chamber. As the piece leaves the chamber, an air jet removes excess finish. The film thickness is controlled by varying the coating viscosity, the magnitude of the vacuum and the velocity of the air jet. The technology has been limited to pieces possessing the same silhouette along the entire length of the piece. In theory, there is no wasted material as excess material is recycled within the chamber. For water based coatings however there can be some build up of solid coating on reservoir walls and other parts that requires cleaning.

Benefits

- excellent transfer efficiency (~ 100%)
- waste coating and VOC emissions essentially eliminated
- high production rates
- low labor costs

Cautions

- pièce must have uniform silhouette
- primary use for waterborne coatings
- thinners and water can be removed from the coating by the vacuum causing viscosity adjustments
- some tendency to foam

1.11) Use of Dip Coating

Parts are coated by dipping them into a tank of coating material. This provides better coverage and causes less waste than conventional air spray systems. Dipping can be manual or pieces can be loaded onto a conveyor that dips the piece into the tank. Excess coating drips off the piece and drains back into the tank. Viscosity must be optimized for desired coating thickness. If solvent-based coatings are being applied, the system should be enclosed to prevent VOC emissions from escaping the tank.

Benefits

- excellent transfer efficiency
- reduced wastes
- low labor requirements
- high production rates

<u>Cautions</u>

- finish is viscosity sensitive
- not suitable for pieces with hollows or cavities
- color change is difficult and slow
- appearance is poor to fair compared to spray finishes

1.12) Use of Flow Coating

In flow coating, many individual streams (10 - 80) of coating are directed at the surfaces of the piece as it passes through the flow coating chamber.

Benefits

- high transfer efficiency
- reduced wastes
- high production rates
- low labor requirements
- low installation costs

Cautions

- poor to fair finish appearance
- coating controls film thickness

1.13) Use of Curtain Coating

Curtain coating coats flat pieces by moving the pieces through a continuous flowing "waterfall" of coating material. The coating material flows at a controlled rate from a reservoir onto the pieces which are conveyed through the stream at high rates of speed. The excess coating material is trapped in a reservoir and recirculated with minimal waste.

Benefits

- excellent transfer efficiency
- reduced wastes
- very high production rates
- uniform coating thickness
- lends itself to UV / EB curing

Cautions

- suitable for flat work only
- may require clean room
- · foaming and curtain breaks are sometimes associated with waterborne coatings

1.14) Use of Roll Coating

In roll coating, coatings are applied by rollers to a flat surface of the piece. The roll coaters that apply the coating are often times engraved so as to produce a wood grain effect onto the piece if fiberboard or plywood.

Benefits

- high transfer efficiency
- reduced material waste
- high production rates
- allows the use of high solids coatings
- lends itself to UV / EB curing

<u>Cautions</u>

- limited to flat work
- for solvent-based coatings, potentially large amounts of VOC emissions as the rollers have to stay wet
- will not coat cavities or hard to reach areas
- "ribs" resulting from poor flow of the coating are sometimes created on the substrate

CASE STUDY - STEELCASE INC., FLETCHER, NC

Steelcase installed a flatline roller coating system in 1985 in order to increase productivity, maintain consistent high quality, and reduce VOC emissions.

Paint was saved through an increased transfer efficiency and by converting to a high solids paint. A 30% - 50% decrease in rejects and associated touch-up work was achieved, and overall VOC emissions were reduced by 25%.

1.15) Alternatives to Methylene Chloride

Methylene chloride, the active ingredient in many coating strippers, has come under increasing scrutiny for its potential damage to health and the environment. Alternative stripping materials have been developed that have less potential for damage. These materials utilize the active ingredients:

- N methyl pyrrolidone (NMP), a water soluble, biodegradable solvent that has relatively low toxicity, is nonflammable and noncarcinogenic
- Gamma Butyrolactone, a water soluble, biodegradable solvent that is FDA approved and has tested noncarcinogenic in rats and mice

Benefits

- biodegradable
- nonflammable
- no offensive vapors
- soap and water cleanup
- less VOC emissions

Cautions

• hazardous waste may still be generated when using non-hazardous strippers because of the characteristics of the materials being stripped

1.16) Training of Operators

Formal operator training is essential to successful waste reduction and should include:

- communication of safety and health, quality, productivity, waste reduction and energy conservation goals and expectations, and how this will help the company and the operators
- use of equipment in accordance with the manufacturer's specifications such as utilizing proper spray gun air or fluid pressures, coating concentrations and flow rates, care and maintenance
- proper spray technique fundamentals such as -
 - 50% overlap of the spray pattern
 - spray gun held 6 8 inches away from the workpiece
 - holding the spray gun perpendicular to the workpiece surface
 - triggering the gun at the beginning and ending of each pass
 - maintaining a consistent gun speed (general rule approximately 250 fpm)
- safety and health hazards associated with the equipment and materials and how to protect themselves, prevent accidents and environmental incidents

Some companies periodically videotape their operators so that the operators can critique themselves and point out where improvements are necessary (see the Case Study below).

Benefits

When finishing operators are properly trained, they can:

- reduce material costs
- achieve a higher quality finish
- reduce wastes and VOC emissions
- improve productivity
- improve work place safety
- reduce incidence of injury (e.g., carpal tunnel syndrome) through ergonomic improvements

<u>Cautions</u>

- informal training by other operators can continue bad habits
- infrequent or inappropriate training for the equipment or the coating type will not help

CASE STUDY - ETHAN ALLEN FURNITURE, OLD FORT, NC

Ethan Allen has a training program for spray operators that utilizes video taping as a operator training tool. The training consists of three stages:

1 - Operators are video taped while performing their job (it is important to communicate the purpose of the taping to the operators before video taping starts so that there are no misunderstandings).

2 - The operators in groups of three along with their supervisors and technical personnel, review the tapes in one hour sessions in order to identify ways to improve. Instruction on spray techniques is provided during the session and follow-up is provided during production on the manufacturing floor.

3 - The operators are taped again and given a chance to compare the tapes and observe the improvements.

The training is conducted twice a year and equipment and coating suppliers provide technical assistance. The company projects saving \$50,000 to \$70,000 annually as a result of 8 - 10% savings in material usage. Wastes and VOC emissions are also reduced.

1.17) Prepare Coatings Properly

Proper coating material preparation can impact the amounts of material used and wasted. For example, too much thinning or reduction can cause running and sagging, while too little reduction can cause defects such as orange peeling. These defects can result in rejects and waste. Proper coatings preparation includes:

- always adding reducer to the material versus material to the reducer
- add reducer to the material slowly and test often to determine when you have reached the desired mixture
- test for complete mixing by sampling the top and the bottom layers of the mixture and placing each on separate pieces of glass to observe and compare color and rate of flow
- mix materials thoroughly before use and during use to maintain the desired uniformity
- keep tanks covered to prevent evaporative losses and contamination of the contents
- for continuous coating systems, monitor the viscosity of the coating in the reservoir so that the amount of solvent added is not excessive

1.18) Direct Delivery of Coating to Spray Gun

Direct delivery of the coating material to the spray gun or application device instead of indirect transfer (e.g., filling an interim container from a drum or tank, transporting the container to the work area, transferring the coating material from the interim container to the spray gun or application device reservoir) can provide benefits and savings.

There are three types of direct transfer systems:

- 1. Dead-end delivery supplies materials that do not have settling problems to the application, without a return line.
- 2. Simple-flow delivery provides continuous circulation back to the storage tank through a return line which prevents settling in the storage tank.
- 3. Recirculating delivery circulates the material throughout the system, including in the hose of the spray gun, to prevent settling of materials with high settling rate. This is especially useful when using preheaters with high solid coatings in order to maintain viscosity level.

Benefits

- volume cost discounts for bulk coating purchases
- · less waste from: spills during transfer, container residues, and evaporative losses
- less employee exposure to hazardous chemicals
- better finish quality through uniform material consistency
- increased productivity and lower labor costs because of reduced transfer tasks
- lower solvent cost and reduced solvent wastes because interim containers do not need to be cleaned

1.19) Use Heat to Obtain Desired Coating Viscosity

Traditionally, viscosity adjustments to coatings have been made by adding organic solvents as a reducer to the coating material. Also, as the ambient temperature of the work place changes, the viscosity of the coating being applied changes, which causes operator problems and gun adjustments. Heat, instead of solvent, can be used in some cases to adjust and maintain the incoming coating to the desired viscosity.

Benefits

- less solvent usage
- less waste solvent and VOC emissions
- more consistent viscosities
- faster curing
- allows the use of higher solids coatings
- improves coating flow and finish appearance

1.12) Spray Equipment Maintenance

Regular care and maintenance must be performed on all equipment, especially spray equipment, to keep it in optimum working condition, prevent breakdowns or malfunctions, and waste. Some fundamental measures include:

- keep feed tanks clean of contamination such as dirt, dried coating particles, and dust, by keeping them covered whenever possible
- keep tanks agitated to prevent skim from forming and solids from settling
- locate the compressor where it can intake clean air and maintain it properly by checking filters and draining condensate
- select the appropriate spray gun attachments needle, nozzle, air cap for each coating utilized
- maintain proper fluid and air pressures
- correlate air pressure at the spray gun with the air pressure of the coating tank to maintain proper air pressure
- perform solvent pump maintenance to prevent leakage
- prevent spray gun leakage by placing only the front end of the gun in solvent when cleaning, lubricate bearings and packings of the spray gun daily
- do not spray and varnish in the same booth as it may cause spontaneous combustion
- whenever possible, do not spray different types of coatings in the same booth as it may make the resulting wastes mixed and more difficult and costly to dispose of or recycle
- use closed paint gun cleaning units to control VOC emissions and exposure
- equipment should be cleaned as soon as possible after use before coating cures and is more difficult to remove

1.21) Equipment Cleaning and Line Flushing

Finishing equipment cleaning is usually needed when a process is completed, for changes in coating materials or colors, and when maintenance is required. The more cleaning that takes place, the more waste that is usually generated. Also, solvents are often used to clean equipment and lines, generating waste solvents and VOC emissions.

Here are some ideas that can help you reduce waste from equipment cleaning:

- clean only as necessary rather than by schedule only
- minimize the number of cleanings of the equipment by finishing with a light coating first, then progressively use darker coatings whenever possible
- flush equipment first with dirty solvent, then with clean solvent
- reuse cleaning solvent until solvency is lost
- use clean solvent as final equipment cleaning, then use as coating reducer
- use air to blow lines free of coating back to pots
- use bubble injection and pigs to aid line flushing
- centralize solvent cleaning operations to reduce losses and standardize cleaning methods and type of solvent used
- use mechanical cleaning such as scraping and wiping before solvent cleaning
- utilize teflon lined tanks to improve drainage and minimize waste coating build-up on tank walls
- use rubber wipers to remove coatings off tank walls instead of rags

CASE STUDY - ETHAN ALLEN FURNITURE, OLD FORT, NC

1. Cardboard filters that were used for all coating operations were replaced with metal filters. The cardboard filters were disposed of as waste, while the metal filters are cleaned in a solvent tank. The waste solvent / coating mix is distilled and the overspray is drummed for disposal, while the solvent is reused. The metal filters used for capturing lacquer and sealer overspray are wiped by hand and the dust is sent offsite for recycling.

Cost: \$57,000, Waste Reduction: 10,000 lbs. per year, Savings: \$48,125.

2. A fabricated, sloped polyethylene trough replaced absorbent and wood shavings to catch coating . The overspray is squeegeed from the trough into a pan for disposal eliminating the absorbent as a waste material.

Cost: \$400, Waste Reduction: 6100 lbs. per year, Savings: \$38,430.

3. Polyethylene covers replaced cardboard covers for the pallets that transferred products through coating operations. The overspray is peeled off the pallet cover and drummed for disposal and the covers reused.

Cost: \$2050, Waste Reduction: 3700 lbs. per year, Savings: \$7450

4. Racks used to transport product are now cleaned of overspray periodically by the watchman during his free time. The racks can be reused instead of disposed of as hazardous waste.

Cost: \$200, Waste Reduction: 1900 lbs. per year, Savings: \$8250.

1.22) Inventory and Scheduling Management

Too much inventory or lack of inventory control for materials can result in waste in the form of material never used (inventoried more than needed) or material that deteriorates before use (exceedance of shelf life). Work with material suppliers closely to provide just-in-time (JIT) material delivery and order accurate amounts needed for the job.

Managing production schedules to reduce color changes by grouping parts requiring the same finish can eliminate substantial amounts of waste from gun cleaning and line flushing. Efficient production scheduling can maximize the usage of coatings with short pot life.

Benefits

- prevents costs for unneeded materials
- prevents waste disposal costs
- increased floor space
- less hazardous material stored
- reduce waste from color changes

If you end up with an excess of coating material:

- return unused materials to the vendor (make arrangements with the vendor up-front before purchase)
- trade or give to other finishers to use
- contact a waste exchange to see if someone might be able to use the material

1.23) Reuse and Recycling of Finishing Materials

There are many opportunities for the recycling of finishing materials. Recycling reduces the amount of waste to be treated and disposed of, and the associated disposal and compliance costs. It also reduces the amount of new materials needed.

Some ideas for recycling include:

- distillation of solvents, either on-site or off-site
- extending solvent life by settling, filtration of solids, and using for jobs not requiring virgin solvent (e.g., rough cleaning)
- collect and reuse overspray from staining operations
- capturing overspray in the spray booth wash water and returning both the coating material and the wash water back to the process (coating material that is immiscible in water can be separated from the booth water wall by settling and ultrafiltration)
- reusing clean-up solvents or solvent sludge for coating secondary surfaces, where appearance is not a factor
- exchanging wastes with other companies or organizations

CASE STUDY - BOLING COMPANY, MT. OLIVE, NC

Until January 1993, Boling was burning spent solvents from the finishing process for fuel. Boling installed a "Little Still" to recycle spent thinners from the plant's wash off operations. Even though the quality of the solvent product from the distillation process was not the quality necessary for reuse as wash off, by mixing one part acetone with three parts reclaimed solvent, the mixture could be used as a thinner in the spray coat operation. The stills operated four times a week and generates 40 - 60 gallons per week.

The cost of the still was \$4825, and operating costs are about \$0.12 per gallon of solvent reclaimed. The net savings is about \$ 100 per week, not including reduced waste disposal costs. The still paid for itself in one year.
CASE STUDY - MEDALLION KITCHENS, WACONIA, MN

Medallion Kitchens manufactures kitchen cabinets and bathroom vanities. The company's desire was to reduce raw material costs, reduce VOC emissions, minimize hazardous waste disposal costs and associated liabilities, and decrease labor costs. Overspray from sealer and topcoat applications was a problem. About 75 gallons of sealer was used per day and 50 gallons of hazardous waste sludge was generated per day.

The company invested in a reclamation system for sealer. The system consists of two holding reservoirs and some minor plumbing. The system is designed to catch most of the overspray before it falls into the wash water tank. A cooling water system is applied to the collection trays to minimize solvent evaporation, collected material is agitated to prevent "skinning", the reclamation trays are removed and replaced easily, and a non-stick coating is applied to the collection trays. After about 5 gallons of overspray is collected, the overspray is removed and solvent and catalyst is added to the material to obtain the desired coating properties. It is then added back to the spray system to be reused.

The system cost about \$2500 per installed booth. Savings include \$23,000 annually from reduced material usage. Waste sludge has been reduced from 50 to 25 gallons per day, saving the company \$30,000.

CASE STUDY - ETHAN ALLEN FURNITURE, OLD FORT, NC

A solvent unit was installed to recover solvents and reduce hazardous waste generation. A seven gallon batch still, which is run twice daily, recovers 5 gallons of reusable solvent for every 7 gallons of cleanup waste.

Cost: \$4500, Waste Reduction: 1900 lbs. per year, Savings: \$3200 per year

CASE STUDY - THOMSON CROWN WOOD PRODUCTS, MOCKSVILLE, NC

Thomson Crown previously disposed of its wet spray booth wastewater as hazardous waste. The company started a system to separate paint solid from the wash water and recycle the water back to the spray booth. The change reduced hazardous waste disposal costs by \$92,500.

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Lumber Receiving, Drying and Storage

Process Description

The purpose of this process is to receive, prepare and maintain an adequate inventory of appropriate quality lumber for the subsequent manufacturing processes. The typical functions of lumber receiving, drying and storage include:

- unloading
- grading
- stacking
- air drying
- kiln drying
- dry shed storage
- maintaining inventory records

Lumber Receiving, Drying and Storing Wastes

- wood
- energy
- air emissions from boilers
- · condensate from dehumidification

Waste Reduction Opportunities

- 2.1) Arrange Lumber Delivery to Minimize Inventory and Storage Time
- 2.1) Inspect and Sort Lumber
- 2.3) Separate Lumber by Kiln Sticks When Stacking
- 2.4) Use Stick Guides for Proper Alignment of Kiln Sticks
- 2.5) Improve Boiler Efficiency
- 2.6) Improve Drying Kiln Efficiency
- 2.7) Improve Kiln Drying by Using High Speed or Variable Speed Fans
- 2.8) Dehumidification Drying

2.9) Air Vacuum Drying

2.10) Vacuum Resistance Drying

2.11) Vacuum Press Drying

2.12) Radio Frequency (RF) Redrying of Veneer

2.13) Provide Adequate Dry Shed Capacity and Environment

Waste Reduction Opportunities

2.1) Arrange Lumber Delivery to Minimize Inventory and Storage Time.

The longer that delivered lumber stays in the lumber yard, the more chance of degradation resulting from exposure to the environment or damage (breaking, cracking, etc.) from inadvertent contact with equipment or other lumber. Sometimes, excessive quantities of lumber are purchased because of lower prices, however the money saved up front can be lost through damaged lumber that is eventually wasted. Plan carefully so that lumber in your yard maintains the desired quality and is utilized efficiently.

Benefits

• conservation of raw materials, less lumber waste

2.2) Inspect and Sort Lumber.

Many times, lumber is shipped in packages with a random mixture of lengths - 6, 8, 10, 12, 14 and 16 feet. It is recommended that the incoming lumber be inspected and sorted by length, thickness, and quality to reduce wood waste.

Lumber that is received below the quality grade requested, or is poor quality, can be identified promptly and returned to the supplier or used appropriately. Also, yard space and drying space can be utilized more efficiently by the elimination of large voids in the packages resulting from mixed board lengths. Mixed lengths will also cause improperly supported stacks and associated defects, and potentially damaged lumber caused by the movement of lumber packages with protruding boards.

Sorting can be done by hand or by mechanical sorters. The investment in mechanical sorters can be significant. Hand sorting is less capital intensive. Sorting will result in energy savings by increasing space utilization, improving the quality of lumber and generating less waste which will more than offset the cost of sorting.

Modern manufacturing concepts recommend a close partnership with suppliers which encourages more shared responsibility and trust. This partnership can eliminate costly, nonvalue-added steps such as inspection and reshuffling materials. Quality programs which document out-of-spec materials will give both the supplier and the customer the facts to measure and improve performance. Train suppliers as you would your own inspectors so that they know and meet your needs. Consider pre-shipment inspections and "custom" shipments that are one length, one grade, etc. so that costly additional steps after are avoided.

- conservation of raw material
- less lumber damage and waste
- lumber that meets quality expectations
- efficient space utilization
- improved productivity

2.3) Separate Lumber by Kiln Sticks When Stacking.

Most lumber is received in stacked "packages" that are "dead hacked", or stacked board-toboard with no air space between boards. If the lumber remains this way, no drying will take place. This will result in lumber that is not dry enough for use, and stains and rot will occur, resulting in wasted lumber. As the lumber is inspected and sorted, restacking must occur. It is recommended that "kiln sticks", or relatively small stick separators (e.g., 8' long x 1-1/2" wide x 1" thick) be used to place the lumber in layers. This practice separates the boards in a package of uniform size that corresponds to the size of the dry kilns and lumber lifts to be used later. Air movement around the lumber allows it to dry and prevents staining and rotting that results in wasted wood.

Benefits

- conservation of raw materials
- less lumber damage and waste
- improved drying

2.4) Use Stick Guides for the Proper Alignment of Kiln Sticks

One of the most important factors in the stacking of lumber is to get perfect alignment of the kiln sticks. As packages of stacked lumber are placed on top of each other, considerable weight is put on the bottom lumber. If the kiln sticks are not perfectly aligned, deformation of the wood can occur, making it unsuitable for quality furniture and creating waste.

Stick guides can be used to align the sticks to the recommended spacing as listed below:

Thickness of Lumber	Spacing of Kiln Sticks
5/8	12" - 18"
4/4	18" - 24"
5/4	24"
6/4	24"
8/4	24"

Benefits

- conservation of raw materials
- · less lumber damage and waste
- improved drying

2.5) Improve Boiler Efficiency.

Heat that is generated by the boiler can be lost through many avenues such as:

- pipes, valve and trap leaks,
- inadequate insulation on boiler and pipe surfaces,
- inefficient fuel burning,
- dirty heat transfer surfaces,
- inadequate condensate return to boiler,
- poor boiler water treatment,
- poor steam pressure,
- pressure reduction valves,
- high moisture content in the wood waste fuel,
- poor fire and combustion air, and
- inadequate maintenance.

Loss of heat not only results in a higher cost of fuel or electricity for the operation, but also provides additional pollution in the form of air emissions to the environment.

Many states and local power companies offer programs to help conserve energy through energy efficiency programs. Energy conservation experts will visit your site and look for opportunities to conserve energy. Most of these programs are provided at no cost and can improve the energy efficiency of your operations resulting in considerable cost savings and pollution prevention. In Wisconsin energy audits are usually provided by electric and gas utilities, or by the Energy Analysis & Diagnostic Center at UW-Milwaukee.

Benefits

- energy conservation
- reduced energy costs
- reduced air emissions

2.6) Improve Drying Kiln Efficiency

Operate drying kilns at capacities that result in the best efficiency. Filling a kiln too full of lumber may prevent adequate air movement and cause inadequate or increased drying times. This results in wasted energy, increased air emissions and higher costs. Utilizing the kiln at low capacities (e.g., 10 - 50%) may provide for adequate air movement and fast drying times, however it will also result in wasted energy and higher costs, as the kiln operation may not be optimal. Keeping records on kiln process control will provide information that contributes to continuous improvement and quality.

Benefits

- energy conservation
- reduced air emissions
- reduced costs
- improved yield

2.7) Improve Kiln Drying by Using High Speed or Variable Speed

Increasing air velocities typically at 350 feet per minute, to 800 to 1200 feet per minute will result in drying times that are two to three times faster when used in steam kilns. Higher quality lumber is produced and the steam energy savings can offset the increased power costs. Another technique that maximizes energy efficiency is enabling the fan speed to be adjusted for the need. During the initial phase of drying when moisture is readily available, the fans are run at high speeds. Later, when water diffuses from the wood more slowly, the fan speed is reduced without reducing the drying rate. Computerized controls can be applied to the variable speed fans to optimize air flow as conditions change.

- improved lumber quality and less waste
- energy savings
- reduction of boiler air emissions

Cautions

• condenser corrosion from acidic condensate

2.8) Dehumidification Drying

Where steam capacity is unavailable, or where new boiler emissions are prohibited because of air pollution regulations, dehumidification can be economical. Electric heat pumps can be used to dry the lumber with less cracking or warpage than conventional drying methods.

Lumber to be dried is placed in a drying building or kiln where heated air takes the moisture out of the wood. The moisture saturated air is then circulated via ducts to heat pumps that condense the moisture and remove it from the air. The air is then re-heated and passed back over the lumber. Reusing the air provides precise control of temperature and humidity and prevents drastic temperature fluctuations.

Benefits

- improved lumber quality and less waste
- potential energy savings
- elimination of boiler emissions

Cautions

• condenser corrosion from acidic condensate

2.9) Air Vacuum Drying

Alternating steam derived hot air with a vacuum is possible for commercial lumber applications ranging from 2,000 to 14,000 board-feet capacities. Drying times are about onetenth of steam kilns. Vacuum dryers are most economical for wood fabricators using high value hardwoods.

• potential energy savings

2.10) Vacuum Resistance Drying

This technology uses electrical resistance blankets to provide heat between the layers of wood in the kiln. Capacity is approximately 2,000 board-feet with drying times significantly reduced over conventional steam kilns.

Benefits

• potential energy savings

2.11) Vacuum Press Drying

This technology is applicable to straight lumber which is free of side bend, cup or twist in batches less than 1,000 board-feet. Lumber is dried under 1,800 pounds per square foot of mechanical pressure in a vacuum chamber. Heat is provided by a self-contained hot water unit. After drying, pressure is maintained during cooling, resulting in flat, stress-free lumber.

Benefits

- improved lumber quality and less waste
- potential energy savings

2.12) Radio Frequency (RF) Redrying of Veneer

Conventional redrying of plywood veneer typically results in 15% to 20% breakage rate and over-drying. RF redrying provides moisture redistribution from wet spots to over dried areas, thus controlling moisture profile and minimizing breakage. A two year payback is estimated for a \$1 million dollar investment for operations with high redry losses as well as plants with limited capacity.

- improved veneer quality, less breakage and waste
- potential energy savings

2.13) Provide Adequate Dry Shed Capacity and Environment.

Significant cost and effort have gone into adequately drying the lumber produced by the drying kiln, therefore it is important to protect it. Dried lumber that is exposed to the weather and potentially damaging yard activities can become waste wood.

If not immediately used, kiln dried lumber needs to be stored in an enclosed dry shed where it is protected from the weather. Also, if the lumber is stored long term (several months), a controlled environment is recommended to prevent deterioration.

3 Rough End and Gluing

Process Description

The purpose of the rough end and gluing is to remove defects and convert the dried rough lumber into rectangular shapes or "blanks" of lumber or veneer that will be used to make the furniture components. The typical functions of rough end and gluing include:

- cutting
- sawing

• gluing and joining

Rough End and Gluing Wastes

• wood

- sawdust
- glue
- volatile air emissions

Waste Reduction Opportunities

3.1) Remove Defects from Rough Lumber Efficiently

- 3.2) Finger Jointing
- 3.3) Recycle Wood Waste and Sawdust
- 3.4) Use the Proper Glue
- 3.5) Use Proper Gluing Techniques

Waste Reduction Opportunities

3.1) Remove Defects from Rough Lumber Efficiently.

Significant wood can be saved if care is taken when removing defects as the rough lumber is cut. Combining the cutting of multiple long and short lengths on the same rough lumber board will improve yield and reduce wood waste. New equipment and technology such as "rip first" methodology, automatic board advancing, and computerized vision scanning to identify defects and cutting patterns are being developed and applied.

Benefits

• improved yield

· less wood waste

3.2) Finger Jointing

Finger jointing is the joining of two short sticks or boards end-to-end to form a longer one resulting in less waste and better material utilization. The pieces are joined and glued end-to-end by a finger joint. Any piece five inches or longer can be used. Equipment is available that can machine the joints, apply the glue and press the pieces together. For circumstances where areas are not exposed in the final product, the finger jointing process can provide significant increases in material utilization reducing wood waste.

Equipment is available to quickly cure glued joints using penetration heating devices such as radio frequency fields which can speed the curing and improve the quality of the joint.

Benefits

- improved yield
- less wood waste

3.4) Recycle Wood Waste and Sawdust

For many years wood waste was open burned or disposed of in landfills. As the cost of both wood and disposal continue to rise, and open burning is no longer an option, it makes sense to find ways to recycle wood waste. Recycling options include:

- use in particle board, chipcore, laminates
- absorptive materials
- shredding or grinding for use as animal bedding, sludge stabilizer, mulch or decorative landscaping material (this also reduces storage volume)
- use in pulp and paper manufacturing (usually softwood only)
- using as fuel for energy and heat recovery either for on-site or off-site energy recovery facilities where other sources of waste wood can be combined

Benefits

- efficient use of raw materials
- reduction of wood wastes

Cautions

- some wood wastes need to be dried or pelletized before being used as fuel which adds equipment and expense
- burning treated or coated wood can release regulated hazardous air pollutants
- be familiar with applicable regulations before installing and operating a wood boiler
- waste streams should not be combined (ie., mixing, wood chips, end pieces, etc.) as it may inhibit secondary use

3.4) Use the Proper Glue

Using the wrong glue can result in wasted material and time. Some glues are non-reversible, once they are cured, they cannot be liquified again. If the desired quality of the bond is not achieved, the material may end up in the scrap pile.

Glues come in basic categories:

- natural glues (animal, starch, casein)
- synthetic resins including thermoplastic, polyvinylacetate (PVA) used in assembly and edge gluing, and urea formaldehyde used for plywood and edge gluing
- Specialty adhesives such as epoxies and cyanoacrylate

- reduced wood and glue wastes
- improved yield

Cautions

- The shelf life and pot life of glues vary. Be sure to know the shelf life before purchasing or catalyzing large quantities as they could end up as waste.
- PVA is more expensive than urea, however it is better suited for certain applications
- Urea formaldehyde resins are sources of formaldehyde emissions; discuss with suppliers to obtain the lowest emitting resin that can do the job

3.5) Utilize Proper Gluing Techniques.

Improper gluing techniques can lead to inefficient material use and waste. When gluing two pieces of wood together, four steps are necessary - application, transfer, wetting, and cure. After applying the glue to one piece, transfer of the glue to the other piece must take place while the glue is still able to flow and thoroughly wet the surface of the other piece. Using glue spreaders provides a consistent layer thickness. Some wood species resist wetting more than others, so the speed of the gluing process must be controlled.

Curing is the solidification of the glue and must start after wetting and be complete before the assembly is removed from the press and the joint is subjected to stress. Selecting the proper curing technique (e.g., air dry, reactive, heating, resistant heating, etc.) is also important.

Keep glue containers covered whenever possible to prevent chemical vapors from escaping, and keep out moisture and oxygen, prolonging shelf life.

Periodic maintenance and calibration (where possible) of glue applicators provides proper transfer and prevents waste.

Benefits

- reduced wood and glue wastes
- improved yield

4 Machining and Sanding, Assembly

Process Description

Machining, or sometimes called the finishing machine room, shapes the rectangular strips produced by the rough end and the plywood produced by veneering and laminating into the finished dimensions specified for the furniture part. Sanding rubs the wood with an abrasive to smooth or prepare the surface for subsequent finishing or coating steps. Sanding can be done by hand or with sanding machinery. Sanding can take place on parts before furniture assembly, or take place during finishing in between coating steps. The typical operations of machining and sanding include:

- planing
- moulding
- shaping
- cutting
- tenoning

Machining and Sanding Wastes

- wood, sawdust
- sanding belts
- machine tools

Assembly, or sometimes known as the cabinet room, takes the parts produced by previous operations and assembles them to make furniture. Component parts are glued, screwed, stapled, and nailed together to make the furniture. The typical operations found in assembly are:

- assembly putting parts together to make the final piece of furniture
- fitting making components of the furniture piece fit (ie., drawers or doors) by adjusting the dimensions, stops, or hinges by machining or sanding
- repairing all exposed surfaces are repaired of rough spots and defects that affect the finish such as glue spots, raised grain, dents, cross sand scratches
- inspection a check to see if the furniture piece is ready for finishing

Assembly Wastes

- wood waste
- spent glue
- volatile air emissions from the glue
- bolts, nails, staples

Waste Reduction Opportunities

- 4.1) Use Segmented Polishing Platens
- 4.2) Cleaning Sanding Belts and Machine Tools
- 4.3) Dust Collection
- 4.4) Recycling Wood Waste and Sawdust (see Section 3.3)
- 4.5) Use the Proper Glue (see Section 3.4)
- 4.6) Use Proper Gluing Techniques (see Section 3.5)

Waste Reduction Opportunities

4.1) Use Segmented Polishing Platens

Sanding with minimal stock removal is important as the cost of lumber, veneers, and waste management and disposal continue to grow. Using segmented platens provides an opportunity to leave more wood on the piece being sanded. Using segmented platens on sanding equipment, controlled electronically or pneumatically, will provide more sensitivity and efficiency. For example, sanding with air pressure helps dissipate heat, allowing a more uniform finish at a higher grit without varnishing. The electronic platen is more sensitive, but the pneumatic sanding platen is less expensive.

Benefits

reduced wood waste

• improved efficiency

4.2) Cleaning Sanding Belts and Machine Tools

Cleaning sanding belts by either commercial belt cleaner or steam will extend the life of the belt. Also cleaning saws and other tools of resin build-up preserves tool life.

Benefits

• longer tool and belt life

• reduced waste

4.3) Dust Collection

As wood parts are machined and sanded, a substantial amount of sawdust is generated. Dust collection systems can provide safety and waste reduction benefits, but must be properly designed to be effective, safe and efficient. Adequate face and collection velocities are necessary for collection orifices, and appropriate velocities in the ventilation ducts must be provided to prevent particulate settling. Energy efficient systems have dampers to cut off branches that are not needed. Filters, bag houses, and cyclones are examples of mechanisms to separate the dust from the exhausted air.

- improves worker health and safety by keeping the dust out of the breathing air and off the floor
- improves sanding efficiency by preventing dust from becoming embedded in the sanding belt
- extends equipment life and decreases maintenance by keeping dust away from machinery
- collects and keeps the from becoming contaminated with dirt and other contaminants so that it can be recycled

Cautions

• consult an industrial ventilation design manual or obtain assistance from a qualified engineer to assure that the system is safe, effective and energy efficient

5

Packing, Shipping and Warehouse

Process Description

Shipping and warehouse activities include finished product inventory control and material handling operations. Material handling equipment such as forklifts, overhead conveyors, and in-floor chain conveyors are commonly used. Packing operations typically includes the following:

- attaching hardware or inserting for customer attaching
- · securing drawers for shipment to prevent damage
- general clean-up
- final inspection
- touch-up, if needed
- packing and labeling to provide the necessary protection to prevent damage during shipping

Packing, Shipping, and Warehouse Wastes

- paper
- wood waste (pallets, packaging)
- packing materials
- broken mirrors, glass
- damaged hardware

Waste Reduction Opportunities

- 5.1) Enhance Packaging Performance by Evaluating Damage History
- 5.2) Enhance Packaging Performance by Evaluating Packaging Water Resistance
- 5.3) Redesign Packaging to Minimize Volume and Weight by Evaluating Packaging Materials and Closure Methods
- 5.4) Develop Reusable Packaging
- 5.5) Improve Compatibility of Packaging Materials for Recycle
- 5.6) Recycle Other Wastes Produced in the Packaging, Shipping and Warehouse

Waste Reduction Opportunities

5.1) Enhance Packaging Performance by Evaluating Damage History

Management of packaging material for furniture products can be a source of environmental concern due to the large volume of material used for protection of the furniture. However, inadequate packaging can result in furniture being damaged in transit and subsequently disposed in some cases, thereby creating a larger environmental problem than the packaging.

The focus here is to minimize the damaged furniture waste by improving packaging. Records should be collected of what goods are damaged. Evaluate these records periodically to determine sources of packaging problems. What caused the piece of furniture to be damaged? Would additional labeling aid in the situation? Would a different packaging approach provide protection from such incidents? Develop methods of improving packaging to eliminate or minimize these problems.

As an example, staples which have not been completely removed from a box before the furniture is removed, have been known to produce significant scratches on a new product (and in some case, on the customer, resulting in lawsuits). Changing to tape, banding or adhesives for box closure eliminates this source of damage.

Evaluate current and proposed packaging practices according to standard methods for packaging assessment. ASTM D4169-93 Standard Practice for Performance Testing of Containers and Systems provides testing procedures for evaluating the ability of packaging to adequately protect the contents during distribution. By using test methods to evaluate the packaging, it will be possible to improve packaging efficiency without having to incur actual product damage.

Packaging systems can be improved by evaluating the sources of past furniture damage, and conducting performance tests on current and proposed packaging. Damage to a large piece of furniture has an environmental price as well as a financial price related to the wasted production of the piece and the ultimate disposal of the piece.

5.2) Enhance Packaging Performance by Evaluating Water Resistance

Furniture pieces are typically sensitive to water damage, therefore, most packages must be carefully protected from exposure to water. Unfortunately, there are many cases where boxes are exposed to blowing rain or snow at loading docks, leaks in trailers and extremely high humidity. In these cases, it is important that the basic packaging materials be water resistant.

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Various test methods exist for evaluating the water resistance of packaging materials. The Technical Association of Pulp and Paper Industries (TAPPI) developed test methods including the "Cobb Test" for evaluating water adsorptiveness of sized paper and Paperboard (TAPPI Test Method T 441 om-84, 1984). The ASTM Committee D-10 on packaging has developed standards for water resistance for box closure adhesives and tapes. In a recent study (Sheehan), the ASTM water resistance tests were used in conjunction with the ASTM package performance tests (referenced in Opportunity 1; ASTM D 4169-93; Standard Practices for Performance Testing of Shipping Containers and Systems) to test different types of closures. Water resistant film tape maintained package integrity while the paper reinforced tape without water resistant adhesive failed in the ASTM performance drop test.

When selecting packaging materials, ask suppliers how the materials ranked in standardized water resistance tests and choose materials which have sufficient water resistance and strength to properly protect the furniture being shipped.

5.3) Minimize Volume and Weight of Packaging Materials

Although it is ultimately important to protect the product, it is also desirable to minimize the packaging required to the extent possible. Although "no packaging" is the ideal alternative, minimizing packaging is the second best alternative. By decreasing the packaging required, the manufacturer is saving in five ways:

•Less raw materials are required to produce the packaging

•Less labor may be required to package the material (in many cases)

•Less energy is needed to transport the package

•More efficient package size is achieved (decreasing cost of transport)

•Less waste handling at the shipping destination

Selection of packaging materials should include evaluation of the total energy and other environmental resources used to create the packaging, as well as the energy required to ship the package. Various materials are being developed for packaging which are lighter weight yet equally strong.

Some special self sticking stretchable film tapes are being used in the place of considerable quantities of shrink wrap for specific applications. These tapes are reducing the volume and weight of packaging materials used and are recyclable.

Wood is also often used in packaging. As an example, wooden skids are often used under a piece of furniture to transport the piece around the manufacturing facility, and later to support that piece in the container. Heavy duty cardboard skids have been developed that sufficiently carry the furniture load, protect the furniture in transit and can be recycled. Wooden skids are more expensive to purchase and are much heavier than cardboard, adding to the fuel charge for shipping. In one case study, a facility was able to significantly decrease

materials and shipping costs by simply changing to the cardboard skids from the wooden skids. Wooden skids are also more difficult for the customer to recycle than cardboard.

An alternative to conventional plastic, paper and wood is the development of bioplastics; plastics created from fermentation of glucose by natural bacteria. The bioplastics can be processed and used in the same manner as other plastics. One advantage of bioplastics is that they can be produced from a renewable resource (typically corn) and are biodegradable when exposed to aerobic conditions and microbial activity (for example in a composting system). However, the cost of producing bioplastics is about 10 times the cost of producing conventional plastics.

The decision on whether to use paper, plastics or bioplastics is complex and confusing and must be addressed on a case by case basis. The best advice is to use as little of whatever type of packaging is chosen and reuse or recycle as much as possible. Minimizing the overall weight of the package (as well as the volume) will also result in savings on energy resources needed to transport the package.

CASE STUDY - REPLACE WOODEN SKIDS WITH CORRUGATED SKIDS

A wooden skid is often used under a piece of furniture to transport the piece around the manufacturing facility, and later to support that piece in the shipping container. Switching from wooden skids to heavy duty cardboard skids created significant savings in materials and shipping for the facility in this case study. Table 5-1 below provides a summary of the cost savings realized by the facility.

Table 5-1.

Cost Savings For Using Corrugated Skids Instead of Wood Skids

1.	How Many Cases Per Day	500
2.	Days Worked Per Year	250
3.	Total Cases Per Year (Item 1 x Item 2)	125,000
4.	Weight of Wood Skid (lbs)	11
5.	Weight of Cardboard Skid (lbs)	2
6.	Difference in Weight (lbs); (Item 4 - Item 5)	9
7.	Lbs. Saved Per Year; (Item 6 x Item 3)	1,125,000
8.	Cost to Ship Per Lb.	\$.08
9.	Freight Savings \$'s Per Year (Item 7 x Item 8)	\$90,000
10.	Material Cost of Wood Skid	\$ 1.00
11.	Material Cost of Cardboard Skid	\$.56
12.	Cost Difference (Item 10 - Item 11)	\$.44
13.	Savings Per Year (Item 3 x Item 12)	\$55,000
14.	Total Savings Per Year (Item 9 + Item 13)	\$145,000

5.4) Develop Reusable Containers

Environmental concerns about packaging have resulted in the development of reusable containers. Packaging ordinance have been passed in other countries which obligate manufacturers and suppliers to reclaim used containers and to either reuse them or to transmit them for recycling rather than sending them to conventional disposal facilities. Similar standards have been developed more recently in areas of in the United States.

When selecting packaging for furniture delivery, reuse and recycling goals established by state legislation should be considered. It is best if manufacturers develop containers which can be returned to the manufacturing facility to be reused. Cardboard boxes, if taped not stapled or glued, can be effectively slit, collapsed and returned in quantity to the manufacturer from a retailer. Bins can be used for reusable corner protection blocks and other support items. These bins can be filled at the retailer's facility then returned to the manufacturing plant when full. A credit or some other incentive can be associated with return of packaging materials to the manufacturer. In many cases, reusable protective blankets are used to protect furniture in transit to the retailer or customer.

Some furniture companies are developing packaging bags which can be collapsed and mailed back to the manufacturer. In these cases, the customer may be provided with a large sturdy envelope or small box in which to put all the packaging material. The envelope or box could be pre-addressed to the manufacturer and have a return postage paid guarantee to encourage customers to use the system. The practicality of this approach must be determined on a case by case basis, but should be considered in packaging selection.

5.5) Improve Compatibility of Packaging Materials for Recycling

In many cases a reuse system may not be able to be established. Even where such a system is in place, the recyclability of packaging materials which are either damaged beyond continued use or escape the reuse circle should be considered. The two major types of recyclable packaging materials currently used in furniture packaging are plastic (polyethylene or other plastic) wrapping film and corrugated cardboard. Additionally, wood, metal and some foam products are used in the packaging process.

The recyclability of the packaging material should be considered on the basis of technical opportunities and practical options. It may be technically possible to recycle the material, but it is also necessary to have the collection systems in place for the retailer and the customer to use to get the materials to the right recycling facility. For some plastics, collection systems are not available in some towns, leaving plastics out of the recycling loop. In most areas, cardboard, glass, aluminum and steel recycling collection systems are available.

Following the choice of the primary packaging material, it is necessary to evaluate the method of closure. It is important that the materials used to tape or seal the package do not interfere with the recycling of the major packaging material in question.

Laminated and coated papers are not as amenable to recycling because it is difficult to get the materials into solution and the laminates and wax-coats contribute to the problems with "stickies" (globules of tacky material which may result in sticking of paper and possible flaws in the final paper). Some types of labels and closure materials are not amenable to recycling. Any tape adhesives and hot melt adhesives which pass through the cleaning process and stay in the slurry will turn into "stickies". The presence of stickies is a significant concern in quality control for recycling of paper.

According to a information from the US Forestry Service (Klungness), the three major sources of problems with "stickies" in the OCC recycling process are wax-coated corrugated cardboard, hot-melt adhesives and pressure sensitive labels where the adhesive is not designed to stay with the backing during the recycle process.

Tapes and labels which are designed to meet two specific criteria are preferable for use on packaging materials to be recycled. These criteria are:

a) the adhesive must stay with the backing when placed in a water slurry, and

b) the backing must remain intact during the recycling process so it can be easily removed with devices normally employed in the process.

In a study conducted by the Forest Service, pressure sensitive plastic tape designed to meet these requirements was found to not interfere with recycling and to not impact the quality of the paper product.

Staples are not considered a technical problem for the recycling process. However, in some areas of the country, staples have been a problem for recycling collection operations. Some recycling collection operations will not handle the stapled boxes. The justification given is that workers have a high rate of injury (cuts and scratches) from handling the stapled boxes. The health and safety aspects are a problem to the recycling companies so they often establish policies stating that they simply will not handle stapled boxes. Table 5-2 provides a comparison of different types of closure methods with an indication of the impact on recyclability.

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Table 5-2 Comparison of Closure Method Impact on Recycling Operations

Closure Material	Recyclable	Removable in Recycle Process	Possible Paper Contaminant	Possible Water Contaminant
Staples		1		
Plastic Pressure Sensitive Tape and Labels				
Components: Plastic		4		
Adhesive		√ (stays on plastic)		
Paper Pressure Sensitive Tape and Labels				
Components: Paper	۲.			
Adhesive			√ (dissolves off paper)	
Reinforced Gummed Tape - Paper - Components: Paper	V			
Fiberglass Laminating		V	1	
Adhesive Gummed				J
Adhesive				
Strapping		√		
Hot Melt Adhesive			√	
Water Borne Adhesive				\checkmark

5.6) Recycle Other Wastes Produced in Packaging, Shipping and Warehouse

Recyclers are available for paper (paper, cardboard), wood (pallets, frames, skids), metals (hardware, fasteners), and glass. If the materials cannot be reused within the facility, check to see if it can be reused or recycled externally. Keep dedicated containers in work areas as receptacles for each type of material.

CASE STUDY - SHELBY WILLIAMS INDUSTRIES INC.

Corrugated cardboard from cartons received with raw materials in addition to the dunnage wrapped around pallets of product cartons created large amounts of scrap for Shelby Williams Industries. Historically, the scrap was picked up by recycler. However, it was suggested that this material was appropriate for use as carton inserts and furniture edge protectors, which Shelby Williams was purchasing by the thousands each week.

In 1992, a small, in house department was established to re-cut the scrap cardboard into inserts. Machines were designed and developed by Shelby Williams employees to die cut and crease edge protectors and other inserts. Even though the project was successful, the remaining odd shaped scrap that remained after cutting was not acceptable by recyclers, and many smaller boxes did not convert to the insert sizes required. Shelby Williams had no boiler where scrap might be used as fuel.

To resolve this problem, Shelby Williams made arrangements with a local recycler to take <u>all</u> their scrap cardboard for no cost. The recycler then uses Shelby Williams "homemade" cutting and creasing machines to make all the inserts that Shelby Williams needs at no charge, or for only a few cents each to cover labor costs.

The net result is a reduction of the cost of inserts from an average of 22 cents each to about 3 cents each. Applied over 3000 to 5000 inserts per week, significant savings were realized. Also, most of the cardboard is re-used rather than recycled which prevents additional energy usage associated with recycling.

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Building and Equipment Maintenance

Process Description

Building and equipment maintenance is necessary to keep the facility and equipment operating. This means a variety of tasks and the generation of a variety of wastes. Typical tasks include:

- repairing and maintaining equipment installing new parts, changing lubricating, cleaning equipment
- installing new equipment and removal of old equipment
- kiln and boiler operation and maintenance
- repairing and maintaining the facility and grounds plumbing, electrical, carpentry, and landscaping tasks
- plus many other activities

Building and Equipment Maintenance Wastes

- lubricating oils
- scrap metal
- spent cleaning chemicals
- spills and spent absorbent materials
- boiler treatment chemicals
- boiler air emissions
- boiler ash
- cooling tower blow down
- compressor condensate
- general trash

Waste Reduction Opportunities

- 6.1) Use Synthetic Lubricating Oils with Longer Life
- 6.2) Recycle Oils
- 6.3) Maintain Kiln and Controls
- 6.4) Oil Clean Up with Recyclable Absorbents
- 6.5) Keep Chemical Wastes Segregated
- 6.6) Segregate and Recycle Paper, Wood, Metals and Glass

Waste Reduction Opportunities

6.1) Use Synthetic Lubricating Oils with Longer Life

Synthetic oils are available that can replace conventional oils and will lubricate better and last longer. Replace old oils with synthetic oils whenever possible. Be sure to check with the equipment manufacturer before making the change.

6.2) Recycle Oils

Oil purifiers that can recycle machine lubricating and hydraulic oils are available. Many of these are portable so that they can be rolled right to the machine that needs to be serviced. Also, oils can be taken to off-site recycling facilities.

6.3) Maintain Kiln and Controls

Heat and other energy that is used by the kiln can be lost if maintenance is not performed. The following areas need regular attention in a kiln preventive maintenance program:

- kiln door seals
- baffles
- door seals
- kiln coating
- fan bearings
- line shaft stands
- fin pipe protection
- control calibration
- wet bulb socks
- V- belts and sheaves on fan drives

6.4) Oil Spill Clean Up with Recyclable Absorbents

Reusable absorbents can pick up most of the liquid and may allow oil reuse if not contaminated.

6.5) Keep Chemical Wastes Segregated

Many times chemical wastes are mixed because users believe they have no further use. Some spent chemicals can be recycled. Even if recycling is not an option, chemical mixing of a non-hazardous waste with a hazardous waste makes a greater volume of hazardous waste. The mixture must be managed as a hazardous waste and the disposal or treatment costs will be much higher.

Keep chemical wastes segregated and investigate recycling as an option. Do not mix chlorinated or unknown chemical wastes as the mixture may be reactive and cause a fire, explosion or spill. It is also less expensive to dispose of two containers of segregated waste than one container of mixed wastes.

6.6) Segregate and Recycle Paper, Wood, Metals and Glass

Recyclers are available for paper (paper, cardboard, material), wood (pallets, frames, skids), metals (hardware, fasteners), and glass. If it can't be recycled within your facility, check to see if it can be recycled externally. Keep marked, dedicated containers in work areas as a receptacle for each type of material.

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APPENDIX A - REGULATIONS

NESHAP FOR WOOD FURNITURE MANUFACTURING OPERATIONS BACKGROUND

- On July 16, 1992 (57 FR 31576), pursuant to Section 112(c) of the Clean Air Act, "Wood Furniture (Surface Coating)" was listed as a source category to be regulated under Section 112.
- The proposed rule would apply to facilities engaged in the manufacture of wood furniture that are major sources. The affected emission points are defined in Table 1.

Affected Sources	Emission Points	Applicable Sections of Subpart JJ
The proposed rule would apply to facilities engaged in the manufacture of wood furniture that are major sources as defined in 40 CFR part 63. Applicable SIC codes include 2434, 2511, 2512, 2517, 2519, 2521, 2531, 2541 and 2599.	Finishing, gluing, cleaning, and washoff operations.	63.800
Sources that commit to using no more than 250 gallons per month, or 3,000 gallons per rolling 12 month period, of coating, gluing, cleaning, and washoff materials, including materials used for source categories other than wood furniture, are area sources and are not subject to any other provisions of this rule.	All emission points at the source.	63.800(b)

TABLE 1. APPLICABILITY OF THE PROPOSED RULE

- The proposed rule would establish emission limits for finishing materials, adhesives, and strippable spray booth coatings. It also specifies work practices that minimize evaporative emissions from the storage, transfer, and application of coatings and solvents.
- The proposed rule was developed largely through a regulatory negotiation with representatives from the furniture manufacturing industry (including small business), the coatings industry, environmental groups and State agencies. The emission limitations for adhesives were developed by EPA, with input from both wood furniture manufacturers and adhesive manufacturers, outside of the regulatory negotiation.

RECOMMENDED STANDARDS

- Basis: For finishing operations at new and existing affected sources, the proposed emission limit is based on the use of finishing materials with low volatile HAP (VHAP) levels or the use of control devices. For gluing operations, it is based on the use of adhesives with low VHAP level or the use of control devices. For cleaning operations, it is based on the use of low-VOC strippable coatings for spray booths that minimize emissions during cleaning. For storage, transfer, and application of coatings and solvents, the standard would require work practice measures to minimize evaporative emissions.
- All new and existing major source wood furniture plants would be required to meet the emission limits in Table 2 and the work practice measures in Table 3.

COMPLIANCE DATES

- Existing affected sources that emit less than 50 tons per year of HAP would need to comply no later than 3 years after the effective date of the standard. Existing affected sources that emit 50 tons per year or more would need to comply by November 21, 1997. Existing area sources that become major sources would need to comply within 1 year after becoming a major source.
- New affected sources would need to comply upon promulgation of the standard or upon startup, whichever is later. New area sources that become major sources would need to comply upon becoming a major source.
| Emission point | Existing
source | New
source |
|--|---|--|
| Einishing Opportions | | |
| Finisming Operations | | |
| (a) Achieve a weighted average HAP content across all coatings (maximum kg VHAP/kg solids [lb VHAP/lb solids], as applied); | 1.0ª | 0.8ª |
| (b) Use compliant finishing materials (maximum kg VHAP/kg solids [lb VHAP/lb solids], as applied); | | |
| stains washcoats sealers topcoats basecoats enamels thinners (maximum % HAP allowable); or | $ \begin{array}{c} 1.0^{a} \\ 10.0 \end{array} $ | 1.0°
0.8° b
0.8°
0.8°
0.8° b
0.8° b
10.0 |
| (c) As an alternative, use control device; or | 1.0° | 0.8° |
| (d) Use a combination of (b) and (c) | 1.0 | 0.8 |
| Cleaning Operations | | |
| Strippable spray booth material (maximum VOC content, kg VOC/kg solids [lb VOC/lb solids], as applied) | 0.8 | 0.8 |
| Gluing Operations | | |
| Contact adhesives | | |
| (a) Use compliant contact adhesives (maximum kg VHAP/kg solids [lb VHAP/lb solids], as applied) based on following criteria | | |
| i. For foam adhesives used in products that meet flammability requirements | 1.8 | 0.2 |
| ii. For all other contact adhesives (including foam adhesives used in products not meeting flammability requirements); or | 1.0 | 0.2 |
| (b) Use a control device | 1.0 ^d | 0.2 ^d |

TABLE 2. SUMMARY OF PROPOSED EMISSION LIMITS (see 63.802)

^aThe limits refer to the HAP content of the coating as applied.

^bCompliant washcoats, basecoats, and enamels must be used if they are purchased premade, that is, if they are not formulated onsite by thinning other finishing materials. If they are formulated onsite, they must be formulated using compliant finishing materials and thinners containing no more than 3.0 percent HAP by weight.

"The control device must operate at an efficiency that is equivalent to no greater than 1.0 kilogram (or 0.8 kilogram) of HAP being emitted from the affected emission source per kilogram of solids used.

^dThe control device must operate at an efficiency that is equivalent to no greater than 1.0 kilogram (or 0.2 kilogram) of HAP being emitted from the affected emission source per kilogram of solids used.

EMISSION POINT	WORK PRACTICE
	Finishing Operations
Transfer equipment leaks - 63.803(c)	Develop written inspection and maintenance plan to address and prevent leaks. The plan must identify a minimum inspection frequency of 1/month.
Storage containers, including mixing equipment - 63.803(g)	When such containers are used for HAP or HAP-containing materials, keep covered when not in use.
Application equipment - 63.803(h)	Discontinue use of air spray guns. ^b
Finishing materials - 63.803(1)	Demonstrate that usage of HAP of potential concern have not increased except as allowed by proposed standards; document in the formulation assessment plan.
	Cleaning Operations
Gun/line cleaning - 63.803(i) and (j)	 Collect cleaning solvent into a closed container. Cover all containers associated with cleaning when not in use.
Spray booth cleaning - 63.803(f)	Do not use solvents unless cleaning conveyors, metal filters, or continuous coaters, or the spray booth is being refurbished.
Washoff/general cleaning - 63.803(e) - 63.803(k) - 63.803(k) - 63.803(d)	 Do not use chemicals that are known or probable human carcinogens in cleaning solvents in concentrations subject to MSDS reporting, as required by OSHA. Keep washoff tank covered when not in use. Minimize dripping by tilting and/or rotating part to drain as much solvent as possible and allowing sufficient dry time. Maintain a log of the quantity and type of solvent used for washoff
- 63.803(d)	and cleaning, as well as the quantity of waste solvent shipped offsite, and the fate of this waste (recycling or disposal).Maintain a log of the number of pieces washed off, and the reason for the washoff.
Miscellaneous	
Operator training - 63.803(b)	All operators shall be trained on proper application, cleanup, and equipment use. The training program shall be written and retained onsite.
Implementation plan - 63.803(a)	Develop a plan to implement these work practice standards and maintain onsite.

TABLE 3. SUMMARY OF PROPOSED WORK PRACTICE STANDARDS^a

^a The proposed work practice standards apply to both existing and new major sources.

^b Air guns will be allowed only in the following instances:

- when they are used in conjunction with coatings that emit less than 1.0 kg VOC per kg of solids used;

- touchup and repair under limited conditions;

- when spray is automated;

- when add-on controls are employed;

- if the cumulative application is less than 5 percent of the total gallons of coating applied; or

- if the permitting agency determines that it is economically or technically infeasible to use other application

technologies.

RECOMMENDED COMPLIANCE PROCEDURES

- Affected sources would choose from the following methods to demonstrate compliance with the standard:
 - Emission limit for finishing operations:

1) achieve a maximum allowable weighted average VHAP content across all coatings, 2) use compliant materials, 3) use a control device, or 4) use a combination of compliant materials and control devices.

A source that chooses the weighted average approach would show initial and ongoing compliance by calculating the average mass of VHAP emitted per mass of solids for all finishing materials each month, including any thinner added at the plant, and verifying that it does not exceed the emission limitation.

A source that uses compliant finishing materials can demonstrate initial and ongoing compliance by measuring the mass of VHAP emitted per mass of solids for each material, as applied (or use data based on those measurements).

A source that uses a control device would demonstrate initial compliance by conducting performance testing; ongoing compliance would be demonstrated by continuously measuring and recording site-specific operating parameters, the values of which are established during the initial compliance test.

Emission limits for gluing operations:

Use compliant adhesives or use a control device. Initial and ongoing compliance can be demonstrated by measuring the mass of VHAP emitted per mass of solids for each contact adhesive, as applied. For control devices, initial and continuous compliance are demonstrated as described above.

- Emission limits for cleaning operations: Use compliant strippable spray booth materials.
 - Work practice standards:

Develop and implement a Work Practice Implementation Plan.

REPORTING AND RECORDKEEPING

- The recordkeeping requirements associated with the proposed rule are summarized in Table 4. All affected sources would be required to maintain for 5 years all records necessary to demonstrate compliance with the standards.
- Initial notification and a compliance status report are required by the General Provisions (Subpart A to Part 63, in particular, see 63.9). The compliance status report should include calculations (for the weighted average approach) or performance test results (for control devices) demonstrating initial compliance with the emission limits.
- Semiannual reporting is required. A source using compliant finishing materials, thinners, adhesives, or strippable spray booth coatings must certify that compliant materials are being used. A source using a weighted average approach must provide copies of emission calculations for the previous 6 month period. Each source also must certify compliance with the Work Practice Implementation Plan.
- All of the reporting and recordkeeping requirements of the General Provisions (Subpart A to part 63) apply for sources using control devices. Sources using control devices that experience excess emissions must follow a quarterly reporting format for at least one year after the excess emissions occur and until a request to reduce reporting frequency is approved.

Records Required	Applicability	Applicable Sections of Subpart JJ
Certified product data sheets for each regulated finishing material, booth coating, thinner, and adhesive.	All affected sources.	63.806(b)
The VHAP content, in kg VHAP/kg solids (lb VHAP/lb solids), as applied of each finishing material and adhesive subject to the emission limits in 63.802.	All affected sources.	63.806(b)
Quantity of finishing materials and thinners to support calculations for Equation 1 and copies of the averaging calculation.	Sources using an averaging approach to comply with emission limitations for finishing.	63.806(c)
Solvent and coating additions, viscosity measurements, and data demonstrating relationship between viscosity and VHAP content.	Sources using a compliant coatings approach and applying coatings with a continuous coater.	63.806(d)
Copy of the work practice implementation plan and records associated with fulfilling the requirements of the plan.	All affected sources.	63.806(e)
Calculations demonstrating that the overall control efficiency of the control system is sufficient to reduce emissions from finishing or gluing operations to the required level.	Affected sources using a control system to comply with the emission limitations for finishing or gluing.	63.806(f) & 63.806(g)
Copy of the compliance certifications and any information submitted with the compliance status reports.	All affected sources.	63.806(h) & 63.806(i)

TABLE 4. RECORDKEEPING REQUIREMENTS

IMPACTS (Nationwide impacts)

- Volatile HAP emissions: reduction of at least 59 percent from 50,600 Mg/yr (55,800 tons/yr) to 20,800 Mg/yr (23,000 tons/yr). The actual reduction will be higher because the impact of many work practice standards could not be quantified.
- Energy and Secondary air pollution: None. The use of control devices would increase these impacts, but it is anticipated that most sources will meet the limits through the use of finishing materials that comply with the rule.
- Water/Solid waste/Noise: No negative impact expected.
- Costs: The total industry-wide capital investment is estimated to be \$7.0 million. The total nationwide annual cost is estimated to increase by \$15.3 million.
- Economic: Implementation of the proposed NESHAP is expected to result in market price increases of 0.07 percent or less. Total employment losses were estimated at 0.22 percent of total industry employment. Reductions in market output were estimated to be betweem 0.03 and 0.2 percent, depending on the type of furniture produced. Three out of the 750 plants were predicted to close. The proposed NESHAP would not have a significant economic impact on small business entities.

CONTROL TECHNIQUES GUIDELINES (CTG)

- Section 183(a) of the Clean Air Act requires that EPA issue CTG's for 11 categories of stationary sources of volatile organic compound (VOC) emissions. The EPA is developing a CTG for the wood furniture manufacturing industry as part of this requirement.
- The status of the CTG and the basis for selecting the regulatory alternatives were presented to the National Air Pollution Control Techniques Advisory Committee (NAPCTAC) in November 1991. In June of 1993, the Federal Advisory Committee was chartered to develop the CTG, concurrently with the NESHAP, through a regulatory negotiation. Due to the court ordered deadline for the NESHAP, work on the CTG lags somewhat behind the NESHAP.
- A draft of the model rule for wood furniture finishing and cleaning operations was distributed to EPA's Regional Offices, State and local Agencies, and the the public through OAQPS's Technology Transfer Network and the EPA's Control Technology Center) in June 1994. This document, when final, will be an appendix to the CTG.

Wisconsin's Environmental Regulations

AIR MANGEMENT

The federal Clean Air Act requires the states develop a state implementation plan that assures attaining and maintaining the nation's air quality standards. A preconstruction review program for new and modified air pollution sources is a required element of this plan. Wisconsin meets this requirement through it construction permit program.

An air permit is required for the construction or modification of an air contaminant source and for the operation of an existing source unless the source is exempt by statute or administrative rule. Under both state and federal regulation, it is unlawful to commence construction without an air permit unless the facility is exempted. Exemption determinations are made on a case by case basis.

If you can answer "yes" to any of the following questions it is likely that your facility will need an air permit from the DNR Air Management program.

- 1. Will the facility have equipment to burn fuels at rates greater than:
 - Gaseous Fuels--30 million BTU/hour
 - Distillate Oil--10 million BTU/hour
 - Residual Oils or wood alone--5 million BTU/hour
 - Coal or other solid fuels--1 million BTU/hour
- 2. Will the facility have processes vented to the air which together have the capacity to emit, assuming that pollution control equipment is not operating, at rates greater than:
 - 4.3 pounds/hour or particulates
 - 5.7 pounds/hour of organic compounds, solvents or nitrogen oxides
 - 9.0 pounds/hour or sulfur oxides or carbon monoxide
- 3. Will there be equipment for incineration of nonhazardous waste with a total capacity of more than 500 pounds/hour?
- 4. Will there be storage tanks of organic compounds with a total capacity of more than 10,000 gallons?

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- 5. Will the facility have the potential to use more than 250 gallons per month of inks, paints, coatings or organic solvents?
- 6. Will the facility handle sand, grain or other materials that release dust into the air in amounts greater than 5.7 pounds/hour?
- 7. Will the facility include a parking lot with a capacity for 1,000 cars, or add more than 500 cars capacity to an existing lot?
- 8. Does the project involve construction or modification of either an airport or a highway project?
- 9. It is also important for businesses to know that Washington county, Ozaukee county, Waukesha county, Milwaukee county, Racine county and Kenosha county have been classified by EPA as a "severe" ozone non-attainment area. Because of this classification, there are additional air regulations which affect businesses in these counties.

The following forms and fees are required under the Air Management program:

- 1. Permit application forms.
- 2. An application fee is assessed for permits for new or modified sources. The amount of the fee depends upon the work required to process the permit application.
- 3. The minimum fee, if a permit is required, is \$900. The fee is charged after the review of the permit application is completed and a determination is made that a permit is required.

The form used to calculate the application fee is available from the Air Management program.

The permit process time frames for the Air Management program are (assuming that a public hearing is not required): 120 days for new or modified minor sources. 210 days for new or modified major sources.

The people to contact in the Central Madison Office about the Air program are:

Donald Theiler, Director, Bureau of Air Management: (608) 266-0603.

Dale Ziege, Chief, Permit Section: (608) 266-0113

Dan Johnston, Supervisor, New Source Review Unit: (608) 267-9500

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HAZARDOUS WASTE MANAGEMENT

Any business which transports, stores, treats, or disposes of hazardous waste must notify the Department and the Federal Environmental Protection Agency of that activity. Any business that generates between 100 and 1000 kilograms of waste per month is considered to be a small quantity generator and must notify the Department and the federal EPA of their activity. Any business that generates over 1000 kilograms of waste per month is considered a Large Quantity Generator and must notify the Wisconsin DNR or the federal EPA. If a very small generator (less than 100Kg/month) submits a tracking form called a manifest to the Department, then the generator must notify DNR and federal EPA of their activity.

The following is what you should keep in mind when deciding if your facility will need a manifest form from the Hazardous Waste program.

- 1. Does the business generate more than 100 kilograms per month of hazardous wastes or more than one kilogram of acutely hazardous waste?
- 2. Does the business store, treat or dispose of hazardous wastes? *If you can answer "yes" to these questions, then your facility will need to use the Wisconsin Manifest system. A manifest is a form used to identify the quantity, composition, origin, routing and destination of any hazardous waste during transportation. *Wastes that are *legally* stored, treated or disposed of *at the generation site* are exempt from these manifest requirements.

You are encouraged to contact the District Solid and Hazardous Waste Program Supervisor located in all six DNR District Offices if you have a question about this program:

Doug Rossberg DNR Lake Michigan District:	(414) 492-5863
Gary Kulibert DNR North Central District:	(715) 369-8960
Gary LeRoy DNR Northwest District:	(715) 635-4059
Dave Lundberg DNR Western District:	(715) 839-3708
Frank Schultz DNR Southeast District:	(414) 961-2703
Joe Brusca DNR Southern District:	(608) 275-3296

For additional information on the Hazardous Waste Minimization program, contact Lynn Persson, (608) 267-3763. To obtain copy of the DNR publication: "Managing Your Hazardous Wastes: A Guide For Wisconsin Small Quantity Generators", call Lauranne Bailey (608) 264-8852.

For Hazardous Substance Spills, call your district hazardous waste specialist (listed below), and the Wisconsin Division of Emergency government at 800/943-0003.

WASTE OIL RECYCLING

Waste oil is any oil refined from crude oil or synthetic oil that becomes contaminated during use. It includes engine oil, gear oil, grease, lubricating oil, cutting oil, transformer fluids and tempering or quenching oils. Waste oil is generated from home and commercial use. Almost any business or public agency that maintains heavy equipment and machinery, or a fleet of vehicles, produces waste oil. Wisconsin statutes prohibit disposal of all waste oil in landfills. In Wisconsin, waste oil is regulated as a non-hazardous solid waste unless it displays a hazardous characteristic or mixed with a listed hazardous waste.

The people to contact in the DNR Madison Office about the Waste Oil Recycling program are:

 Kate Cooper, Solid Waste Recycling:
 (608) 267-3133

 Andy Swartz,
 (608) 267-9388

 Ed Lynch,
 (608) 266-3084

MUNICIPAL WASTE WATER

The municipal waste water program is responsible for dealing with any publicly or privately owned waste water treatment.

The following is what you should keep in mind when deciding if your facility will need a municipal waste water permit:

1. Does the project include facilities, other than a septic system for the treatment and disposal of domestic waste waters? If the answer to this question is "yes", then:

You must apply for a Wisconsin Pollutant Discharge Elimination System permit (WPDES).

You must file plans and specifications for the treatment facilities.

A certified operator must be employed to run the facility. The owner does not need this certification, but the plant operator does.

2. A facility with a hold tank larger than 3000 gallons per day needs to get an approval from the Department of Industry Labor and Human Relations. DILHR will then contact the Department of Natural Resources about the necessary disposal plan.

The person to contact in the DNR Madison Office about the Municipal Waste Water program is: John Melby, Acting Chief, Municipal Waste Water Section: (608) 266-2304.

WASTE WATER PRETREATMENT

Waste Water Pretreatment Requirements apply to facilities which dispose of non-domestic waste water to a Publicly Owned Treatment Works (POTW). The intent of the program is to prevent or minimize the discharge of materials which interfere with the operation of the POTW, pass through the POTW without sufficient treatment, or impair the use or disposal of the POTW sludge. This program requires that you look at the section of the code that explains the types of pollution that may not go to a POTW and the types of industrial categories that have regulated process wastewater.

Generally, if the project involves new or increased discharge of industrial process wastewater to publicly owned treatment works the following may apply:

- 1. The discharge may not exceed the general prohibitions established in Natural Resources Code 211.10 for industrial users.
- 2. Certain types of industrial process waste waters are regulated by federal categorical standards. These industry types are found in Natural Resources Code 202-297. The discharge must conform to these standards.
- 3. All discharges on non-domestic wastewater must conform to any local limits or other requirements administrated by the local sewage authority.
- 4. Discharge of any material that is considered to be an acute hazardous waste or more than 15 kilograms per month of any other hazardous waste must be reported to the POTW, the Environmental Protection Agency's Region V office and the DNR Bureau of Solid Waste Management at least 180 days before commencement of discharge.
- 5. If the project involves the construction of a wastewater treatment system, the DNR is required to review and approve the plans and specifications for the treatment system before construction begins.

The people to contact in the DNR Madison Office about the Waste Water Pretreatment program are:

Stanton Kleinert, Chief, Pretreatment and Permits Section:	(608) 266-7721
Bill Bauman, for information on plans and specifications:	(608) 267-7666

STORM WATER PROGRAM

The Wisconsin storm water discharge control program has been implemented in accordance with recent federal regulations. The purpose of this program is to control and reduce pollutants in storm water runoff which are carried to our lakes, streams, and groundwater. These permits will typically require management practices which minimize contact of storm water with potential pollutant sources.

The people to contact in the DNR Madison Office about the storm water program are:

Jack Saltes	(608) 261-6406
Gary Bartz	(608) 267-7634
Dan Houston	(608)267-7621

WISCONSIN RECYCLING PROGRAM

Wisconsin's 1989 ACT 335 is designed to change the state's throw-away habits. Every home, apartment building, hospital, school, office, industry, and governing unit in Wisconsin is getting involved in recycling. Although much of the recycling law addresses how individuals and institutions handle their recyclables, the law also contains specific requirements for business property owners.

The following points describe the recycling mandates required of building and property owners of Wisconsin businesses.

1. Commercial, retail and industrial property owners must separate post consumer items that have been banned from landfills and incinerators from their solid waste. After January 1, 1991, lead acid batteries, major appliances and waste oil are banned from landfills. After January 1, 1995, aluminum containers, corrugated paper, foam polystyrene, glass containers, magazines, newspapers, office paper, plastic containers, steel containers, waste tires, and steel/aluminum containers for soda and malt beverages will be banned from landfills.

The people to contact in the Department of Natural Resources about the Recycling program are the district recycling specialists located in all six DNR districts.

Len Polczinski Lake Michigan DNR District:	(414) 492-5870
Paul Wiegner Western DNR District:	(715) 839-5171
Rick Weigle Southern DNR District:	(608) 275-3207
Vacant North Central DNR District:	(715) 359-4522
John Spangberg Northwest DNR District:	(715) 635-4060
Melinda Carpenter Southeast DNR District:	(414) 961-2711
Scott Lee Southeast DNR District:	(414) 961-2712

UNDERGROUND STORAGE TANKS

Underground storage tanks containing fuels and other hazardous substances are regulated by the Department of Industry Labor and Human Relations (DILHR). Regulations require the removal of leaking tanks and remediation of contaminated soil be carried out by licensed contractors. Replacing existing underground storage tanks with above ground tanks is a prudent approach to managing potential legal liability caused by leaking underground tanks. For more information on underground tank regulations contact the Bureau of Petroleum Inspection at 608/267-1384.

OSHA

The Occupational Safety and Health Administration regulates work place safety standards including employee hazardous materials education and right to-know requirements. A complete file of Material Safety Data Sheets (MSDS) for all chemicals used in the work place must be kept up-to-date in a readily accessible location for employee use. All employees must also be trained in safe handling procedures for hazardous materials. The Wisconsin Department of Industry Labor and Human Relations-OSHA On-Site Safety Consultation program provides a non-regulatory review of OSHA regulations for businesses, including on-site assistance. For more information call 414/521-5063.

Wisconsin's Pollution Prevention Resources

Solid and Hazardous Waste Education Center (SHWEC)

SHWEC was established at the UW-Extension to fulfill the educational and technical assistance responsibilities assigned to UW-Extension in the areas of pollution prevention under Wisconsin Act 325. Pollution prevention specialists at the Center provide technical assistance to industry and local government to reduce the amounts of hazardous waste and toxic emissions sent to disposal facilities or released to the air, land or water. In accordance with Act 325, the Center's pollution prevention activities focus on education and technical assistance to business, industry and local government. SHWEC specialists work closely with the county-based faculty of the Cooperative Extension to conduct programming at the local level. SHWEC pollution prevention specialist work closely with UW-Extension Community Natural Resource and Economic Development Agents and can be reached by calling 608/262-0385.

SHWEC is committed to providing the most effective service possible to Wisconsin industry and local government. To accomplish this, SHWEC specialists target pollution prevention opportunities within the state to allow them to focus their expertise to best advantage. Using existing hazardous waste databases, and taking into account such factors as: waste volume, need for reduction, motivation of industry and ability to provide pollution prevention options, the staff focus on processes and industries that can be effectively reached with education and technical assistance.

The objectives of SHWEC educational programming are to communicate the need for pollution prevention, its costs and benefits, available options and technologies. Audiences include business managers, industrial facility managers, UW-Extension agents, local government officials and engineering consultants. SHWEC workshops and courses are designed for specific industries or processes (e.g., solvent-based parts cleaning or metal plating). Trade and industry organizations are involved in sponsoring workshops whenever possible. Education efforts draw in experts from industries, trade organizations, equipment suppliers, and related State and Federal programs. Through UW-Madison Department of Engineering Professional Development, SHWEC specialists also develop and conduct pollution prevention courses geared for industrial engineers, environmental engineers, facility managers and local government personnel.

The objectives of SHWEC technical assistance activities are to develop and disseminate information about pollution prevention concepts, technology and implementation, and provide on-site pollution prevention assessments to Wisconsin industry and local governments to actively promote the implementation of pollution prevention statewide. SHWEC pollution prevention assessments provide on-site technical expertise to Wisconsin industry, businesses and local governments to identify opportunities for pollution prevention. SHWEC assessments are non-regulatory and free of charge. Solid and Hazardous Waste Education Center 528 Lowell Hall 610 Langdon Street Madison WI 53703 608/262-0385

Jack Annis, Pollution Prevention Specialist - West Allis, (414) 475-2845 David S. Liebl, Pollution Prevention Specialist, (608) 265-2360 Philip R. O'Leary, Co-Director, (608) 262-0493 Wayne P. Pferdehirt, Pollution Prevention Specialist, (608) 265-2361

Wisconsin Department of Natural Resources

WI-DNR incorporates pollution prevention into regulatory and enforcement programs and maintains a technical publication clearinghouse.

Tom Eggert, Acting Director, Pollution Prevention Program, (608) 267-9700

Lynn Persson, Coordinator, Hazardous Waste Minimization Program (608) 267-3763

U.S. Environmental Protection Agency

Hotline for Solid & Hazardous Waste (RCRA) & Superfund (800) 424-9346 or (703) 920-9810

Hotline for Chemical Emergency Preparedness Program, including Community Right to Know Provisions (800) 535-0202 or (703) 920-9877

National Pesticide Telecommunications Network (provides information about pesticides, including spill handling, disposal cleanup, and health effects) (800) 858-7378

APPENDIX B - EQUIPMENT VENDORS

COATING APPLICATOR - ELECTROSTATIC

BINKS MANUFACTURING COMPANY 9201 WEST BELMONT AVENUE FRANKLIN PARK IL 60131 PHONE: 708-671-3000

GRACO INC. P.O. BOX 1441 MINNEAPOLIS MN 55440-1441 PHONE: 612-623-6000

COATING APPLICATOR - LOW PRESSURE

ACCUSPRAY P.O. BOX 391525 CLEVELAND OH 44146 PHONE: 216-439-1200 Description: HIGH VOLUME LOW PRESSURE SPRAY GUN

BINKS MANUFACTURING COMPANY 9201 WEST BELMONT AVENUE FRANKLIN PARK IL 60131 PHONE: 708-671-3000 Description: HIGH VOLUME LOW PRESSURE SPRAY GUN

BOSCO MFG. INC. 105 WEST MAIN STREET FORESTVILLE WI 54213 PHONE: 414-856-6256 Description: HIGH VOLUME LOW PRESSURE SPRAY GUN

CAN-AM ENGINEERED PRODUCTS INC. 30850 INDUSTRIAL ROAD LIVONIA MI 48150 PHONE: 313-427-2020 Description: HIGH VOLUME LOW PRESSURE SPRAY GUN

CROIX AIR PRODUCTS, INC. 520 AIRPORT ROAD SO. ST. PAUL MN 55075 PHONE: 612-455-1213 Description: TURBINE SPRAY GUN DEVILBISS RANSBURG 1724 INDIAN WOOD CIRCLE, SUITE F MAUMEE OH 43537 PHONE: 419-891-8200 Description: HIGH VOLUME LOW PRESSURE SPRAY GUN

GRACO INC. P.O. BOX 1441 MINNEAPOLIS MN 55440-1441 PHONE: 612-623-6000 Description: HIGH EFFICIENCY LOW PRESSURE SPRAY GUN

IWATA AIR COMPRESSOR MFG. CO., LTD. FITZ & FITZ (U.S. DISTRIBUTOR) 2416 "E" STREET NE AUBURN WA 98002 PHONE: 206-927-9352 Description: LOW VOLUME LOW PRESSURE SPRAY GUN

LEX-AIRE PRODUCTS, INC. 34-2 SULLIVAN ROAD BILLERICA MA 01862 PHONE: 508-663-7202 Description: PORTABLE SELF-CONTAINED HVLP SPRAY SYSTEMS

MATTSON SPRAY EQUIPMENT, INC. P.O. BOX 132 RICE LAKE WI 54868-0132 PHONE: 715-234-1617 Description: HIGH VOLUME LOW PRESSURE SPRAY GUN

SMITH EASTERN CORP. 5020 SUNNYSIDE AVENUE, #207 BELTSVILLE MD 20705 PHONE: 301-937-4548

COATING APPLICATOR - SYSTEMS

JBI INCORPORATED 1717 OMAHA P.O. BOX 38 OSSEO WI 54758 PHONE: 715-597-3168 Description: OVERSPRAY RECLAIM SYSTEMS

PAINT O MATIC P.O. BOX 1426 WILLITS CA 95409 PHONE: 707-459-9411 Description: VACUUM APPLICATION SYSTEM

PROTECTAIRE SYSTEMS CO. 8N450-A TAMELING CT. BARTLETT IL 60103 PHONE: 708-697-3400 Description: PAINT BOOTH BAFFLES

THOMAS INDUSTRIES INC. 1419 ILLINOIS AVENUE SHEBOYGAN WI 53082-0029 PHONE: 414-457-4891 Description: AIR-LESS PAINT SPRAYING SYSTEM

COATING APPLICATOR - THERMAL

BINKS MANUFACTURING COMPANY 9201 WEST BELMONT AVENUE FRANKLIN PARK IL 60131 PHONE: 708-671-3000

COATING CURE OVEN - THERMAL

BBC INDUSTRIES, INC. 1526 FENPARK DRIVE FENTON MO 63026 PHONE: 314-343-5600 Description: INFRARED OVENS

BGK FINISHING SYSTEMS, INC. 4131 PHEASANT RIDGE DRIVE N MINNEAPOLIS MN 55449-7102 PHONE: 612-784-0466

BLASDEL ENTERPRISES, INC. PO BOX 260 GREENSBURG IN 47240 PHONE: 812-663-3213 Description: INFRARED OVENS CASSO-SOLAR CORP. P.O. BOX 163, ROUTE 202 POMONA NY 10970 PHONE: 914-354-2500 Description: BATCH AND CONTINUOUS OVENS

COMENCO 2550 GOLDENRIDGE RD., UNIT 64 MISSISSAUGA ON L4X 2S3 PHONE: 416-615-9150 Description: BATCH AND CONVEYORIZED OVENS

EPCON INDUSTRIAL SYSTEMS, INC. P.O. BOX 7060 THE WOODLANDS TX 77387 PHONE: 409-273-1774 Description: BATCH AND CONTINUOUS OVENS

F SYSTEMS, INC. 400 INDUSTRIAL DRIVE LYNN IN 47355-0387 PHONE: 317-874-2531 Description: CONVEYORIZED OVENS

GLA FINISHING SYSTEMS 38830 TAYLOR PARKWAY NORTH OH 44039 PHONE: 216-327-3323 Description: CONVEYORIZED OVENS

THE GRIEVE CORPORATION 500 HART ROAD ROUND LAKE IL 60073-9989 PHONE: 708-546-8225 Description: BATCH AND CONVEYORIZED OVENS

INFRATECH CORP 1770 WORKMAN STREET LOS ANGELES CA 90031 PHONE: 213-223-1041 800-421-9455 Description: INFRARED OVENS

MILBANK SYSTEMS INC. P.O. BOX 419097 KANSAS CITY MO 64141-0097 PHONE: 816-241-9450 Description: CONVEYORIZED OVENS

RANSOHOFF N. 5TH ST. AT FORD BLVD. HAMILTON OH 45011 PHONE: 513-863-5813 Description: BATCH AND CONTINUOUS RAPID ENGINEERING, INC. 1100 SEVEN MILE ROAD NW COMSTOCK PARK MI 49321 PHONE: 616-784-0500

RESEARCH INC. BOX 24064 MINNEAPOLIS MN 55424 PHONE: 612-941-3300 Description: INFRARED OVENS

SPRAY BOOTH SYSTEMS, INC. PO BOX 15070 FORT WORTH TX 76119 PHONE: 817-572-4029 Description: CONVEYORIZED OVENS

STEELMAN INDUSTRIES, INC. P.O. BOX 1461 KILGORE TX 75663 PHONE: 903-984-3061 Description: BATCH OVENS

TECH SYSTEMS, INC. P.O. BOX 485 GREENSBURG IN 47240 PHONE: 812-663-4720 Description: BATCH AND CONVEYORIZED OVENS

WISCONSIN OVEN CORPORATION PO BOX 873 EAST TROY WI 53120 PHONE: 414-642-3938 Description: BATCH OVENS

COATING CURE OVEN - UV

AETEK INTERNATIONAL, INC. 1750 N. VAN DYKE RD. PLAINFIELD IL 60544 PHONE: 815-436-2304 Description: UV CURING SYSTEMS

BINKS MANUFACTURING COMPANY 9201 BELMONT AVENUE FRANKLIN PARK IL 60131-2887 PHONE: 708-671-3000 Description: PORTABLE UNIT

RADTECH INTERNATIONAL 60 REVERE DRIVE, SUITE 500 NORTHBROOK IL 60062 PHONE: 708-480-9576 Description: UV/EB CURING SYSTEMS

COATING - LOW VOC

AMITY P.O. BOX 36 WATERLOO WI 53594 PHONE: 414-478-9633 Description: WATERBORNE FINISHES

CARDINAL INDUSTRIAL FINISHES 1329 POTRERO AVENUE SOUTH EL MONTE CA 91733-3088 PHONE: 213-283-9335 Description: POWDER, ENAMEL, EPOXY, ACRYLIC

GUARDSMAN PRODUCTS, INC. 1350 STEELE AVENUE SW GRAND RAPIDS MI 49507-1599 PHONE: 616-452-5181 Description: WATERBORNE FINISHES

JOHN C. DOLPH COMPANY PO BOX 267 MONMOUTH NJ 08852 PHONE: 908-329-2333 Description: INSULATING VARNISH AND RESIN SOLUTIONS

MCCLOSKEY 7600 STATE ROAD PHILADELPHIA PA 19136 PHONE: 800-345-4530 Description: WATERBORNE FINISHES

PIERCE & STEVENS CANADA, INC. 224 CATHERINE STREET FORT ERIE ON L2A 5M9 PHONE: 416-871-2724 Description: LOW-VOC AND WATERBORNE WOOD FINISHES

RADTECH INTERNATIONAL 60 REVERE DRIVE, SUITE 500 NORTHBROOK IL 60062 PHONE: 708-480-9576 Description: UV/EB CURE

RUST-OLEUM CORPORATION 11 HAWTHORN PARKWAY VERNON HILLS IL 60061 PHONE: 708-367-7700 Description: WATER-BASED ACRYLIC AND EXPOXY SYSTEMS LOW-VOC INDUSTRIAL ENAMEL

COATING RECOVERY

HI STRAND P.O. BOX 368 LENOIR NC 28645 PHONE: 704-754-4992 Description: LAQUER DUST RECYCLING

COATING THICKNESS GAUGE

DEFELSKO CORPORATION 802 PROCTOR AVENUE OGDENSBURG NY 13669 PHONE: 613-925-5987

ELEKTRO-PHYSIK 778 W ALGONQUIN RD ARLINGTON IL 60005 PHONE: 708-737-6616

FISCHER TECHNOLOGY, INC. 750 MARSHALL PHELPS ROAD WINDSOR ·CT 06095 PHONE: 203-683-0781

KTA TATOR, INC 115 TECHNOLOGY DRIVE PITTSBURGH PA 15275 PHONE: 412-788-1300

DUST COLLECTION

ENVIRONMENTAL DYNAMICS CORP. 256 TERRACE BLVD VOORHEES NJ 08043 PHONE: 609-768-1100 Description: CYCLONIC SYSTEMS

EUROVAC 37 KLONDIKE DRIVE WESTON ON M9L 1S1 PHONE: 416-748-8396 Description: TABLE AND HOSE COLLECTION SYSTEMS

FISHER-KLOSTERMAN, INC. PO BOX 11190 LOUISVILLE KY 40211 PHONE: 502-776-1505 Description: CYCLONIC SYSTEMS

FIVE SEASONS COMFORT LIMITED 351 NORTH RIVERMEDE ROAD CONCORD ON L4K 3N2 PHONE: 416-669-5620 Description: MOBILE ELECTROSTATIC AIR CLEANER KRAEMER TOOL & MFG. COMPANY LTD. 75 DEVON ROAD BRAMPTON ON L6T 5A4 PHONE: 416-458-0400 Description: TABLE AND CYCLONIC SYSTEMS

MAC ENVIRONMENTAL BOX 205, HWY 75 S. SABETHA KS 66543 PHONE: 913-284-2191 Description: CYCLONIC SYSTEMS

MPF ENGINEERED FILTER PRODUCTS 845 MAIN STREET EAST, UNIT 5 MILTON ON L9T 3Z3 PHONE: 416-876-1113 Description: FILTER MEDIA

N.R. MURPHY LTD. 430 FRANKLIN BOULEVARD CAMBRIDGE ON N1R 8G6 PHONE: 519-621-6210 Description: CYCLONIC SYSTEMS

PBR INDUSTRIES 400 FARMINGDALE ROAD WEST NY 11704 PHONE: 516-422-0057 Description: VACUUM CLEANER

PENTEK INC. 1206 FOURTH AVENUE CORAOPOLIS PA 15108 PHONE: 412-262-0725 Description: MEDIA BLASTING DUST COLLECTION

SONIC AIR SYSTEMS 13610 IMPERIAL HWY. SANTA FE CA 90670 PHONE: 310-414-1973 Description: CYCLONIC SYSTEMS

UNITED AIR SPECIALISTS, INC. 4440 CREEK ROAD CINCINNATI OH 45242 PHONE: 513-891-0400 Description: CARTRIDGE FILTER AND PORTABLE SYSTEMS

FILTER MEDIA - AIR

COMPLETE FILTRATION 1776D WEST CLARKSTON ROAD LAKE ORION MI 48362 PHONE: 313-693-0500 Description: DUST AND POWDER COLLECTION CARTRIDGES

MEDIA BLASTING

ALPHEUS CLEANING TECHNOLOGIES, CORP. 9105 MILLIKEN AVENUE RANCHO CA 91730 PHONE: 714-944-0055 Description: CO2 BLASTING

CDS GROUP 469 NORTH HARRISON STREET PRINCETON NJ 08543-5297 PHONE: 609-683-5900 Description: SODIUM BICARBONATE BLASTING

COLD JET INC. 455 WARDS CORNER ROAD SUITE 100 LOVELAND OH 45140 PHONE: 513-831-3211 Description: CO2 BLASTING

COMPOSITION MATERIALS CO., INC. 1375 KINGS HIGHWAY EAST FAIRFIELD CT 06430 PHONE: 203-384-6111 Description: PLASTIC BEAD, GLASS BEAD, STEEL SHOT

EMPIRE ABRASIVE EQUIPMENT CORP 2101 W. CABOT BLVD LANGHORNE PA 19047-1893 PHONE: 215-752-8800 Description: MEDIA RECOVERY SYSTEM

FRIESS EQUIPMENT, INC. 2222 AKRON-PENINSULA ROAD AKRON OH 44313 PHONE: 216-945-9440 Description: SODIUM BICARBONATE BLASTING

ICE BLAST INTERNATIONAL CORP. 627 JOHN ST. VICTORIA BC V8T 1T8 PHONE: 604-383-2155 Description: ICE BLASTING JET EDGE 825 RHODE ISLAND AVENUE SOUTH MINNEAPOLIS MN 55426 PHONE: 612-545-1477 Description: WATERJET BLASTING

KLEER-FLO 15151 TECHNOLOGY DRIVE EDEN PRAIRIE MN 55344 PHONE: 612-934-2555 Description: VACUUM BLASTING RECOVERY SYSTEM

LS INDUSTRIES PO BOX 1442 WICHITA KS 67201 PHONE: 316-265-7997 Description: TUMBLE BLASTER

LTC AMERICAS 22446 DAVIS DRIVE, SUITE 142 STERLING VA 20164 PHONE: 800-822-2332 Description: VACUUM BLASTING SYSTEM

MAXI BLAST INC. 630 EAST BRONSON STREET SOUTH BEND IN 46601 PHONE: 219-233-1161 Description: PLASTIC BEAD

THE TDJ GROUP, INC. 760-K INDUSTRIAL DRIVE CARY IL 60013 PHONE: 708-639-1113 Description: TOXICITY REDUCING BLASTING ADDITIVE

PAINT CAN LINER

MATTSON SPRAY EQUIPMENT, INC. P.O. BOX 132 RICE LAKE WI 54868-0132 PHONE: 715-234-1617

PAINT FILTER

ANDREAE FILTERS, INC. 3550 CYPERT WAY ARDMORE OK 73401 PHONE: 800-334-7943 Description: PRE-BAFFLE SYSTEM

BAY STATE ENTERPRISES, INC. 64 WINTHROP STREET, P.O. BOX 4956 SPRINGFIELD MA 01101-3070 PHONE: 413-781-2128 Description: SOLVENT SOLUBLE FILTER

JBI INCORPORATED 1717 OMAHA P.O. BOX 38 OSSEO WI 54758 PHONE: 715-597-3168 Description: REUSABLE - THERMALLY CLEANED FILTER

PROTECTAIRE SYSTEMS CO. 8N450-A TAMELING CT. BARTLETT IL 60103 PHONE: 708-697-3400 Description: PRE-BAFFLE SYSTEM

SOLVENT DEGREASER

BIOCHEM SYSTEMS, INCORPORATED 14452 WEST 44TH AVENUE GOLDEN CO 80403 PHONE: 303-277-9700 Description: TERPENE DEGREASER

BIOSOLUTIONS, INC. 1216 N. LASALLE, 2ND FLOOR CHICAGO IL 60610 PHONE: 312-654-2500 Description: MICROBIAL SOLVENT SOLUTION

BUCKEYE INTERNATIONAL, INC. 2700 WAGNER PLACE MARYLAND MO 63043 PHONE: 314-291-1900 Description: BIODEGRADABLE SOLVENT SOLUTION

CHEMICAL SOLVENTS INCORPORATED 3751 JENNINGS RD. CLEVELAND OH 44109 PHONE: 216-741-9310 Description: RECYCLABLE SOLVENT SOLUTION CHEMTECH INTERNATIONAL, INC. 1800 DIAGONAL ROAD, SUITE 600 ALEXANDRIA VA 22314 PHONE: 703-360-8004 Description: BIODEGRADABLE SOLVENT SOLUTION

GLADE CHEMICALS 7302 EAST HELM DR. #1002 SCOTTSDALE AZ 85260 PHONE: 602-991-2725 Description: BIODEGRADABLE SOLVENT SOLUTION

INLAND TECHNOLOGY INC. 2612 PACIFIC HIGHWAY EAST TACOMA WA 98424 PHONE: 206-922-8932 Description: TERPENE DEGREASER

INTERNATIONAL ENZYMES MARKETING CORPORATION 19779 EDSHIRE GROSSE POINT MI 48236 PHONE: 313-882-7214 Description: NON-TOXIC

MODERN CHEMICAL, INC. P.O. BOX 368 JACKSONVILLE AR 72076 PHONE: 501-988-1311 Description: BIODEGRADABLE SOLVENT SOLUTION

ORANGE-SOL INDUSTRIAL PRODUCTS, INC. 955 N. FIESTA BLVD. GILBERT AZ 85233 PHONE: 800-279-8822 Description: CITRENE BASED CLEANERS

PURAC AMERICA, INC. 111 BARCLAY BOULEVARD LINCOLNSHIRE IL 60069 PHONE: 708-634-6330 Description: BIODEGRADABLE SOLVENT SOLUTION

SENTRY CHEMICAL COMPANY 1481 ROCK MOUNTAIN BLVD. STONE MOUNTAIN GA 30086 PHONE: 404-621-8240 Description: DIELECTRIC SOLVENT SOLVENT KLEENE INC. 131 1/2 LYNNFIELD STREET PEABODY MA 01960 PHONE: 508-531-2279 Description: RECYCLABLE SOLVENT SOLUTION

TEXO CORPORATION 2801 HIGHLAND AVE. CINCINNATI OH 45212 PHONE: 513-731-3400 Description: ALKALINE SOLVENT SOLUTION

SOLVENT DISTILLATION

BINKS MANUFACTURING COMPANY 9201 WEST BELMONT AVENUE FRANKLIN PARK IL 60131-2887 PHONE: 708-671-3000 Description: BATCH UNIT

BRIGHTON CUSTOM FABRICATING DIVISION TRINITY INDUSTRIES, INC. 11861 MOSTELLER RD. CINCINNATI OH 45241 PHONE: 513-771-2400 Description: FLOW THROUGH SYSTEM

CHINOOK RINGS P.O. BOX 338 BEAVERTON OR 97075 PHONE: 503-641-2411 Description: BATCH UNIT

DISTIL KLEEN 22 HUDSON PLACE HOBOKEN NJ 07030-5512 PHONE: 201-217-0505 Description: BATCH UNIT

ECOLOGY EQUIPMENT, INC 4162 LIBRARY ROAD PITTSBURGH PA 15234 PHONE: 412-341-7190 Description: BATCH UNIT

ENDERS PROCESS EQUIPMENT CORP. P.O. BOX 308 GLEN ELLYN IL 60137 PHONE: 708-469-3796 Description: FLOW THROUGH SYSTEM FINISH THOMPSON INC. 921 GREENGARDEN ROAD ERIE PA 16501-1591 PHONE: 814-455-4478 Description: BATCH UNIT, FLOW THROUGH SYSTEM

GARDNER MACHINERY CORPORATION P.O. BOX 33818, 700 N. SUMMIT AVENUE CHARLOTTE NC 28233 PHONE: 704-372-3890 Description: FLOW THROUGH SYSTEM

GIANT INDUSTRIES INC. 900 NORTH WESTWOOD AVENUE TOLEDO OH 43607 PHONE: 419-531-4600 Description: BATCH UNIT

HYDRO-TEK 8501 WEST 191ST ST. MOKENA IL 60448 PHONE: 815-469-3585 Description: FLOW THROUGH SYSTEM

PBR INDUSTRIES 400 FARMINGDALE ROAD WEST BABYLON NY 11704 PHONE: 516-422-0057 Description: BATCH UNIT

PROGRESSIVE RECOVERY INC. PRI P.O. BOX 126 DUPO IL 62239 PHONE: 618-281-7196 Description: FLOW THROUGH SYSTEM

PURE-FLO INTERNATIONAL 9617 WALLISVILLE ROAD HOUSTON TX 77013 PHONE: 713-675-3801 Description: BATCH UNIT

RECYCLING SYSTEMS OF AMERICA, INC. P.O. BOX 358 GREENLAND NH 03840 PHONE: 603-430-9343 Description: BATCH UNIT

SIVA 4647 S.W. 40TH AVENUE OCALA FL 34474-5799 PHONE: 904-237-1220 Description: BATCH UNIT SOLVENT KLEENE INC. 131 1/2 LYNNFIELD STREET PEABODY MA 01960 PHONE: 508-531-2279 Description: FLOW THROUGH SYSTEM

SOLVENT RECOVERY SYSTEMS INC. 14335 WEST INTERDRIVE, BLDG. A HOUSTON TX 77032 PHONE: 713-449-8871 Description: BATCH UNIT

VACO-SALV CHICAGO, INC. P.O. BOX 1544 BARRINGTON IL 60011 PHONE: 708-381-4079 Description: VACUUM STILLS

WESTPORT ENVIRONMENTAL SYSTEMS FORGE ROAD WESTPORT MA 02790-0217 PHONE: 508-636-8811 Description: BATCH UNIT

SOLVENT - LOW VOC

BIX MANUFACTURING COMPANY, INC. PO BOX 69 ASHLAND CITY TN 37015-0069 PHONE: 615-792-3260

SOLVENT RECOVERY

AGA GAS P.O. BOX 94737 CLEVELAND OH 44101-4737 PHONE: 216-642-6600 Description: CRYOGENIC CONDENSATION

APV.CREPACO INC. 395 FILLMORE AVENUE TONAWANDA NY 14150-0366 PHONE: 716-692-3000 Description: STEAM STRIPPING

BARNETT-HORMBERG INC. 1709 EAST BOULEVARD CHARLOTTE NC 28203 PHONE: 704-332-1597 Description: CARBON ABSORPTION

EDWARDS ENGINEERING CORP 101 ALEXANDER AVENUE POMPTON PLAINS NJ 07444 PHONE: 201-835-2800 Description: CRYOGENIC CONDENSATION ENVIRO-PROCESS SYSTEMS P.O. BOX 731 BRONXVILLE NY 10708 PHONE: 914-965-0599 Description: MEMBRANE SEPARATION

ENVIRONOMICS, INC. 955 INDUSTRIAL ROAD SAN CARLOS CA 94070 PHONE: 415-592-2552 Description: BATCH PROCESS FOR TOWELS, RAGS, ETC.

FLUID TRANSFER SYSTEMS, INC. 22545 HESLIP DRIVE NOVI MI 48375-4140 PHONE: 810-348-6700 Description: WASTE SOLVENT CONTAINERS

GLENRO INC. 39 MCBRIDE AVENUE PATERSON NJ 07501-1715 PHONE: 201-279-5900 Description: CRYOGENIC CONDENSATION

MAX DAETWYLER CORPORATION 13420 REESE BLVD. WEST HUNTERSVILLE NC 28078 PHONE: 704-875-1200 Description: VACUUM DISTILLATION BATCH UNITS

MOREHOUSE COWLES, INC. 1600 W. COMMONWEALTH AVE FULLERTON CA 92633 PHONE: 714-738-5000 Description: CRYOGENIC CONDENSATION

NUCON INTERNATIONAL INC. P.O. BOX 29151 7000 HUNTLEY RD. COLUMBUS OH 43229 PHONE: 614-846-5710 Description: CARBON ABSORPTION

PRINTERS' SERVICE (PRISCO) 26 BLANCHARD STREET NEWARK NJ 07105 PHONE: 212-962-6565 Description: CENTRIFUGE BATCH PROCESS FOR TOWELS, RAGS, ETC.

SMISETH P.O. BOX 1424 MURFREESBORO TN 37133 PHONE: 615-890-1018 VARA INTERNATIONAL 1201 19TH PLACE VERO BEACH FL 32960 PHONE: 407-567-1320 Description: CARBON ABSORPTION

VIC MANUFACTURING 1620 CENTRAL AVENUE NE MINNEAPOLIS MN 55413 PHONE: 612-781-6601 Description: CARBON ABSORPTION

WESTPORT ENVIRONMENTAL SYSTEMS FORGE ROAD WESTPORT MA 02790-0217 PHONE: 508-636-8811 Description: CARBON ABSORPTION INERT GAS CONDENSATION

APPENDIX C

Additional Information

o Solid and Hazardous Waste Education Center

Waste Education Series



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Cooperative Extension • University of Wisconsin-Extension

POLLUTION PREVENTION RESOURCES IN WISCONSIN

SOLID AND HAZARDOUS WASTE EDUCATION CENTER

528 Lowell Hall, 610 Langdon Street, Madison, WI 53703 (608)262-0385 Jack Annis, Pollution Prevention Specialist - West Allis, (414) 475-2845 David S. Liebl, Pollution Prevention Specialist, (608) 265-2360 Philip R. O'Leary, Co-Director, (608) 262-0493 Wayne P. Pferdehirt, Pollution Prevention Specialist, (608) 265-2361 Pat Walsh, Co-Director & Solid Waste Specialist, (608) 262-8179

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Incorporates pollution prevention into regulatory and enforcement program. Maintains technical clearinghouse. Box 7921, Madison, WI 53707

Ken Wiesner, Coordinator, Pollution Prevention Program, (608) 267-9700

Lynn Persson, Coordinator, Hazardous Waste Minimization Technical Assistance Program, (608) 267-3763

Bob Baggot, Coordinator, CAA Small Business Assistance Program (608) 267-3136

WISCONSIN DEPARTMENT OF DEVELOPMENT

Administers pollution prevention audit grant program. 123 W Washington Ave., Madison, WI 53707 (608) 267-7099

U.S. ENVIRONMENTAL PROTECTION AGENCY

Hotline for Solid & Hazardous Waste (RCRA) & Superfund . (800) 424-9346 or (703) 920-9810

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Hotline for Chemical Emergency Preparedness Program, including Community Right to Know Provisions (800) 535-0202 or (703) 920-9877

National Pesticide Telecommunications Network (provides information about pesticides, including spill handling, disposal cleanup, and health effects) (800) 858-7378

INDUSTRIAL MATERIAL EXCHANGE SERVICE

Publishes bi-monthly bulletin that provides opportunity to businesses to trade, sell, or give away materials they consider a waste but which another firm can productively use. Listings are published free and mailed to over 10.000 subscribers nationwide.

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For subscriptions, contact Lynn Persson at Wisconsin DNR. To list a material, contact P.O. Box 19276, Springfield, IL 62794-9276; (217) 782-0450

For More Information, Contact Your County Extension Agent or SHWEC *

County Extension Information

SHWEC Offices

<u>UW-Green Bay</u>

University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

UW-Madison

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

<u>UW—Stevens Point</u>

College of Natural Resources University of Wisconsin Stevens Point, WI 54481 715/346-2793 FAX 715/346-3624



Solid & Hazardous Waste Education Center

610 Langdon Street, Rm. 529 Madison, WI 53703 Phone: 608/262-0385 Fax: 608/262-6250 **Fact Sheet** University of Wisconsin–Extension

4/15/93

UNDERSTANDING POLLUTION PREVENTION ASSESSMENTS

David S. Liebl Pollution Prevention Specialist

The goal of a pollution prevention assessment by specialists from the Solid and Hazardous Waste Education Center (SHWEC) is to identify opportunities for reducing or eliminating hazardous waste and emissions from manufacturing processes, and provide information about waste reduction technologies that will allow generators to actually reduce waste.

SHWEC specialists perform an assessment in response to requests from companies as this usually indicates that a company recognizes that it is generating hazardous waste and has some motivation for accomplishing reductions. The initial telephone contact by the company is an important opportunity for getting information about waste generation throughout the facility. Most generators will call with a question about a specific waste generating process, and some effort may be required to get them to describe what other types of activities occur in their facility. Once a complete picture of the facility has been obtained from the caller, and a time arranged for the assessment, background information on the company and its manufacturing processes are compiled. Regulatory databases are searched to obtain current discharge and disposal data and companies may be asked to provide past years waste data, and descriptions of their manufacturing processes.

This information is used to develop a profile of waste generating processes. Using this profile, background research on waste reduction technologies is conducted and a preliminary packet of waste reduction information is compiled. If a company demonstrates an existing commitment to change, SHWEC specialists do not normally pursue a detailed justification for waste reduction options based on cost savings or manufacturing efficiencies. Although these topics are routinely addressed during the assessment, and the specialist may give direction to a company that wishes to develop such a justification, the time required for such a detailed assessment is typically beyond the scope of SHWEC services.



The on-site pollution prevention assessment normally begins with a short meeting to discuss what services SHWEC can provide, review the needs of the company and describe the prepared information packet. The specialist then joins with a company representative for a walk-through tour of the plant. The walk-through usually follows a logical flow through the plant, either following the production process from raw material to finished product, or following the waste from source to discharge. During the walk-through other relevant aspects of the facility are examined to identify any regulatory compliance problems or other waste reduction opportunities.

Questions relating to the processes are posed to company representatives and line workers with the goal of stimulating thinking about waste reduction in addition to clarifying points about waste generation. The ongoing dialogue between the specialist and company representatives is the essential educational opportunity during the assessment. It is usually the best time to reach the individuals responsible for implementing waste reduction and provide them with motivation, information and resources to accomplish the implementation. During the assessment, SHWEC staff make note of additional information the company may need and of other waste reduction opportunities that have been identified. A brief exit interview is conducted with company personnel to discuss the observations made during the assessment and clarify any questions. A typical assessment will take 2-4 hours depending on company size and the complexity of the manufacturing process.

Following the assessment SHWEC staff research additional waste reduction opportunities for the company and write a report describing in detail the findings of the assessment and the opportunities for implementing waste reduction. The assessment report includes a description of each waste and the process that generates it; opportunities for reducing the waste; sources of additional information, technology and services to support waste reduction; and a discussion of regulatory, worker health and safety issues related to the use of a new material or process. Copies of the report are then submitted to the company and kept on file at SHWEC offices.

SHWEC specialists continue to be available to the company following the completion of the assessment report to answer any additional questions that arise during the implementation of a waste reduction option. Specialists can also provide long term support to companies that must deal with complex issues, or that wish to develop inhouse waste reduction programs. SHWEC pollution prevention assessments are nonregulatory and free of charge. Companies that are interested in an assessment can contact their county UW-Extension CNRED Agent, or contact SHWEC directly at 608/262-0385 or 414/475-2845

Solid and Hazardous Waste Education Center Waste Education Series



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Pollution Prevention Case Study	Gerry wood Products Company Suring, WI
	Alternative coating to reduce volatile organic compound (VOC) emissions from lacquer coating operations
Industry; SIC Code	Manufacturer of wooden juvenile furniture and expansion gates; SIC 2511.
Process	Finish coating for wood furniture.
Type of Waste	Solid Wastes Scrap wood and office wastes. Waste coatings which test as non-hazardous sent for fuel-blending.
	Hazardous Wastes Spent solvents.
	<i>Air Emissions</i> Volatile organic compounds (VOCs) from coating operations and associated cleanup.
Strategies	<i>Material Substitution</i> Dry application of a formulated wax coating for selected parts in lieu of a lacquer coating.
Background	Gerry Wood Products presently employs approximately 300 people and pro over 1.8 million units per year.
	Many of Gerry's product components, such as wooden slots and rods, are finished by means of a tumbling process. Previously, the finishing process

environment.

Motivation



furniture. astes. Waste coatings which test as non-hazardous are nds (VOCs) from coating operations and associated nulated wax coating for selected parts in lieu of a resently employs approximately 300 people and produces r year. t components, such as wooden slots and rods, are umbling process. Previously, the finishing process consisted of loading component parts into a barrel, pouring lacquer-type finishing material in the barrel and rotating it until coverage of the components was smooth and uniform. This process had been cost-effective and efficient. However, the lacquer-type finish that had been used in the tumbler was a significant source of VOC emissions in the facility. To reduce VOC emissions while improving the air quality of the work

Changes Implemented

In 1992, Gerry completed a transition to a new material that allows the facility to produce over 80% of the total tumbled production without VOC emissions. The replacement material is a formulated granular wax material that is tumbled with the parts using the original equipment. There are no known hazards associated with this material.

Problems Encountered

None.

Material/Energy Balance

Original Approach

Feedstock Liquid lacquer.

Waste

VOC emissions from the curing of tumbled lacquer coated products and other hazardous wastes from daily cleanup.

Disposal Air emissions.

Pollution Prevention Approach

Feedstock Dry formulated wax.

Dry formulated wax.

Waste VOC emissions have been reduced by 44,800 pounds per year. Also, hazardous wastes from daily cleanup have been reduced by 5,000 pounds per year.

Disposal Air emissions. The working environment no longer requires a special air supply or exhaust to remove the VOCs.

Capital Costs No new capital costs.

Operating/Maintenance Costs Daily cleanup, labor and waste costs have all been reduced.

Payback Period Immediate. Annual savings of over \$200,000 have been realized.

Gerry already uses ultraviolet (UV) coatings, and both electrostatic and airassisted airless spray equipment, to reduce VOC emissions and to increase transfer efficiency.

Realizing the cost savings and environmental benefits of eliminating waste, Gerry is vigorously pursuing reuse of the collected overspray from its spray coating operations. Testing is underway to facilitate possible reformulation of collected dry overspray powder into a reusable coating material.

Economics

Other Waste Reduction Projects

Planned Future Waste Reduction Projects **Company Address**

Contact Person

Gerry Wood Products Company 214 Nu-Line Street Suring, WI 54174

Mr. Ward Longtine Environmental Finishing Technician Phone: 414/842-2141

For More Information, Contact Your County Extension Agent or SHWEC

County Extension Information

Call the UW-Extension office in your county, and ask for the Community Natural Resource and Economic Development (CNRED) Agent.

SHWEC Offices

UW-Green Bay

University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

<u>UW-Madison</u>

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

<u>UW-Stevens Point</u>

College of Natural Resources University of Wisconsin Stevens Point, WI 54481 715/346-2793 FAX 715/346-3624

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Solid and Hazardous Waste Education Center Waste Education Series



Cooperative Extension • University of Wisconsin-Extension **Industrial Recycling**

This is a partial listing of firms that provide industrial recycling services. Companies that require specific industrial recycling needs should contact several of the listed firms to obtain descriptions of their services and competitive pricing.

ABC Services, Inc.

•Empty barrels and drums •Fuel oil Industrial lubricants Solvents 5910 49th Street Kenosha, WI 53142 Phone: 414/552-9090

AIS: Automotive and Industrial Services

•Oils and waxes •Organic chemicals Solvents 5200 State Road 93 Eau Claire, WI 54701 Phone: 715/834-9624

Black Gold Environmental Corp.

•Inorganic chemicals •Oils and waxes •Solvents 101 Spring Street Ogdensburg, WI 54962 Phone: 414/244-7488

Chemical Analytics, Inc.

•Acids •Alkalis Inorganic chemicals •Metals/metal sludges •Oils and waxes •Organic chemicals Solvents Menomonee Falls, WI 53051 Phone: 414/781-8804

CleanSoils Inc.

•Solid wastes/soil 311 N. Main Street Jefferson, WI 53549 Phone: 414/674-6210

EOG Environmental, Inc.

•Empty barrels and drums •Fuel oil Industrial lubricants Solvents 5611 W. Hemlock Street Milwaukee, WI 53223 Phone: 414/353-1156

France Sales and Service

•Refrigerants 1151 Foundry Street Schofield, WI 54476 Phone: 715/359-0091

Graphic House

•Fluorescent lamps 9204 Packer Drive Wausau, WI 54401 Phone: 715/842-0402

Hydrite Chemical Company

•Oils and waxes •Organic chemicals •Solvents 7400 Highland Drive Wausau, WI 54401 Phone: 715/848-1890

JB Industrial Sales

•Empty barrels and drums •Fuel oil •Heavy metal sludge •Industrial lubricants •Solvents 568 WI8246 Martin Drive Muskego, WI 53150 Phone: 414/679-4325

Laidlaw Environmental Services •Organic chemicals

•Solvents 6125 North Pecatonica Road Pecatonica, IL 61063 Phone: 414/422-1802

Liesch Environmental Services •Acids •Alkalis •Inorganic chemicals •Metals/metal sludges Solvents 4781 Haves Road Madison, WI 53704 Phone: 608/241-3555

Lochrie & Associates, Inc.

•Empty barrels and drums •Fuel oil Industrial lubricants •Pallets Solvents 7746 Menomonee River Parkwav Milwaukee, WI 53213 Phone: 414/258-6613

Marathon Oil Company

•Oils and waxes 116 Main Street P.O. Box 455 Marathon, WI 54448 Phone: 715/443-2400

Milsolve Environmental Services

•Oils and waxes •Solvents P.O. Box 444 Butler, WI 53007 Phone: 414/252-3550 800/558-8501

Recyclers Transport

 Dunnage •Empty barrels and drums 610 Knoll Ter. Road Waterford, WI 53185 Phone: 414/535-4176

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Collaborating UW Institutions: UW-Green Bay, UW-Madison, UW-Stevens Point

SHWEC Education Series

Recyclights

•Fluorescent lamps 2010 East Hennepin Avenue Minneapolis, MN 54401 Phone: 800/831-2852

Rock Oil Refining

•Oil filters •Oils C4522 Hwy. 97 Stratford, WI 54484 Phone: 715/687-4198

Safety-Kleen Envirosystems

Oil filters
Oils and waxes
Organic chemicals
Solvents
P.O. Box 1419
Elgin, IL 60121
Phone: 800/669-5750

Saint Marie Recycling

•Empty barrels and drums •Fuel oil •Pallets RR1, Box 580 Green Lake, WI Phone: 414/294-9915

Superior Environmental Services

Metals/metal sludges Plastics and rubber Solvents P.O. Box 500 Port Washington, WI 53704 Phone: 414/284-9101 800/932-6216

WRR: Waste Research and Reclamation Company •Fuel oil

•Industrial lubricants •Solvents 5200 State Road 93 Eau Claire, WI 54701 Phone: 715/834-9624

Wausau Chemical Corporation

Acids
Alkalis
Inorganic chemicals
Organic chemicals
Solvents
2001 N. River Drive
P.O. Box 953
Wausau, WI 54403
Phone: 715/842-2285

Wausau Steel Corporation

Metals/metal sludges 2900 West Sherman Street P.O. Box 329 Wausau, WI 54402 Phone: 715/845-4286 ex. 234

For More Information, Contact Your County Extension Agent or SHWEC

County Extension Information

SHWEC Offices

<u>UW-Green Bay</u>

University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

UW-Madison

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

<u>UW-Stevens Point</u>

Solid and Hazardous Waste Education Center

Waste Education Series



Cooperative Extension • University of Wisconsin—Extension

Environmental Analytical Labs

This is a partial listing of firms that provide environmental analytical services. Companies that require specific environmental analysis to meet regulations are advised to contact several of the listed firms to obtain descriptions of their services and competitive pricing.

AIS: Automotive and Industrial Services

Contact: Wes Vlcek 5200 State Road 93 Eau Claire, WI 54701 Phone: 715/834-9624

Becher-Hoppe Associates

Contact: Terry Kittson 330 Fourth Street P.O. Box 8000 Wausau, WI 54401 Phone: 715/845-8000

CWE (Central Wisconsin Engineers)

Contact: George Peterson 903 Grand Avenue Rothschild, WI 54474 Phone: 715/359-9400

Employee Health Assurance Group

Contact: Raymond J. Matejczyk 405 Alderson Street Schofield, WI 54476 Phone: 715/359-8200 800/627-8200

Ensco: Environmental Systems Company Contact: Mike Kini Phone: 414/291-0519

Enviroscan Corporation

303 West Military Road Rothschild, WI 54474 Phone: 715/355-3221 Foth and Van Dyke Contact: Gary Sikich 2737 S. Ridge Road P.O. Box 19012 Green Bay, WI 54307 Phone: 414/497-8516

Huntingdon

Contact: Greg Aldrian Tom Normington 555 South 72nd Avenue P.O. Box 1817 Wausau, WI 54402 Phone: 715/845-4100

Hydrite Chemical Company

Contact: Brian Parks 7400 Highland Drive Wausau, WI 54401 Phone: 715/848-1890

Laidlaw Environmental Services

Contact: Tim Bast 6125 North Pecatonica Road Pecatonica, IL 61063 Phone: 414/422-1802

NET (National Environmental Testing)

Contact: Mike Dew 602 Commerce Drive P.O. Box 288 Watertown, WI 53094 Phone: 414/261-1660

Northern Lake Service

Contact: Mal Gross 400 North Lake Avenue Crandon, WI 54520 Phone: 715/478-2777

Precision Analytical Laboratory

Contact: Glen Moses 205 West Galena Milwaukee, WI 53212 Phone: 414/272-6949 800/438-9186

Ramaker and Associates

Contact: Terry Ramaker Sandy Ramaker 806 Water Street Sauk City, WI 53583 Phone: 608/643-4100

Safety-Kleen Envirosystems

Contact: Ian H. Wood P.O. Box 1419 Elgin, IL 60121 Phone: 800/669-5750

Serco Laboratories

Contact: David Allen 1931 West County Road C2 St. Paul, MN 55113 Phone: 612/636-7178

Strand Associates

Contact: Steve Karklins 910 West Wingra Drive Madison, WI 53715 Phone: 608/251-4843

Wausau Insurance Companies -Environmental Health Laboratory P.O. Box 8017 Wausau, WI 54402 Phone: 715/842-6810

WRR: Waste Research and Reclamation Company Contact: Jim Wickie 5200 State Road 93 Eau Claire, WI 54701 Phone: 715/834-9624

10/93



Collaborating UW Institutions: UW-Green Bay, UW-Madison, UW-Stevens Point

✤ For More Information, Contact Your County Extension Agent or SHWEC ◆

County Extension Information

SHWEC Offices

<u>UW-Green Bay</u>

University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

UW-Madison

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

UW-Stevens Point

Solid and Hazardous Waste Education Center



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Hazardous Waste Transporters

This is a partial listing of firms that provide hazardous waste transportation services. Companies that require specific waste transportation needs should contact several of the listed firms to obtain descriptions of their services and competitive pricing.

Alliance Transportation

Services P.O. Box 1182 Milwaukee, WI 53201 Phone: 414/344-6400

Aptus Incorporated

21750 Cedar Avenue Lakeville, MN 55044 Phone: 316/251-6380

Ashland Chemical Company 1033 North Hawley Road Milwaukee, WI 53208 Phone: 414/258-4282

Cermatics Incorporated

10014N124W Wasaukee Mequon, WI 53092 Phone: 414/242-1037

Deluxe Disposal Service P.O. Box 67 Mosinee, WI 54455 Phone: 715/693-3714

E & K Hazardous Waste

Service P.O. Box 1249 Sheboygan, WI 53082 Phone: 414/458-6030

Envirite Corporation

16435 South Center Avenue Harvey, IL 60426 Phone: 708/596-7040

Hy-Ho Silver

6411 Windor Prairie DeForest, WI 53532 Phone: 608/221-1375

Hydrite Chemical Company 114 North Main Street

Cottage Grove, WI 53527 Phone: 608/257-1414

Laidlaw Environmental Services

RR 1 Telfer Side Road Corunna, Ontario Phone: 519/864-1021

Milwaukee Solvents &

Chemical N59 W14765 Bobolink Menomenee Falls, WI 53051 Phone: 414/252-3550

N & M Transfer Company 630 Muttart Road Neenah, WI 54956 Phone: 414/722-7760

National Tank Service 1813 South 73rd Street West Allis, WI 53214 Phone: 414/257-0030

Northwest Petroleum Route 1 Box 84 Brule, WI 54820 Phone: 715/372-5000

Rainbow Freight Systems 10941 West Layton Avenue

Milwaukee, WI 53228 Phone: 414/529-8200

Rock Oil Refining

Incorporated C4522 Highway 97 Stratford, WI 54484 Phone: 715/687-4198

Safety-Kleen Corporation

777 Big Timber Road Elgin, IL 60123 Phone: 708/697-8460

Schwerman Trucking

P.O. Box 1601 Milwaukee, WI 53201 Phone: 414/671-1600

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Tank Transport

Incorporated 9202 North 107th Street Milwaukee, WI 53224 Phone: 414/357-8380

The Metal Men

Incorporated S76 W14755 Velva Drive Muskego, WI 53150 Phone: 414/422-9311 Waste Research & Reclamation Route 7 Eau Claire, WI 54701 Phone: 715/834-9624

Wausau Chemical Company 2001 North River Drive Wausau, WI 54401 Phone: 715/842-2285

For More Information, Contact Your County Extension Agent or SHWEC

County Extension Information

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SHWEC Offices

<u>UW-Green Bay</u> University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

UW-Madison

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

UW-Stevens Point

Solid and Hazardous Waste Education Center Waste Education Series



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Industrial and Environmental Consultants

This is a partial listing of firms that provide industrial and environmental consulting services. SHWEC recommends that companies contact multiple firms to obtain descriptions of services and competitive pricing.

Advent Environmental Services

6100 W. Executive Dr., Suite E Mequon, WI 53902 Phone: Mequon - 414/238-1998 Eau Claire - 715/831-1530

Ayres Associates

P.O. Box 1590 Eau Claire, WI 54702 Phone: 715/834-3161

Badger Labs & Engineering

Contact: Joe Kramer 1110 S. Oneida St. Appleton, WI 54915 Phone: 800/776-7196

Becher-Hoppe Associates

Contact: Terry Kittson 330 Fourth Street P.O. Box 8000 Wausau, WI 54401 Phone: 715/845-8000

Braun Intertec

Contact: William Fink 16855 W. Cleveland Ave. New Berlin, WI 53151 Phone: 414/796-8231

Camp Dresser & McKee, Inc.

5215 N. Ironwood Road #250 Milwaukee, WI 53217 Phone: 414/964-6166

Capsule Engineering

Contact: Dan Reinke 1970 Oakcrest Ave., Suite 215 St. Paul, MN 55113 Phone: 800/328-8246 612/636-2644

CH2M Hill

310 Wisconsin Avenue P.O. Box 2090 Milwaukee, WI 53201 Phone: 414/272-2426

CWE (Central Wisconsin Engineers) Contact: George Peterson 903 Grand Avenue Rothschild, WI 54474 Phone: 715/359-9400

Delta Environmental Consultants

2775 S. Moorland Road #300 New Berlin, WI 53151 Phone: 414/789-0254

Drake Environmental

Contact: James J. Meer P.O. Box 610 Minocqua, WI 54548 Phone: 715/358-7612

Earth Technology Corporation

12129 West Feerick Street Wauwatosa, WI 53222 Phone: 414/466-9266

Eder Associates

8025 Excelsior Drive Madison, WI 53717 Phone: 608/836-1500

Flark Associates

Contact: Sharon Schwab 8221 100th Street South Wisconsin Rapids, WI 54494 Phone: 715/325-3827

Foth and Van Dyke

Contact: Gary Sikich 2737 S. Ridge Road P.O. Box 19012 Green Bay, WI 54307 Phone: 414/497-8516

Geraghty & Miller Inc. Contact: Eric Carman 126 N. Jefferson #400 Milwaukee, WI 53202 Phone: 414/276-7742

Graef, Anhalt, Schloemer and Associates 345 N. 95th Street Milwaukee, WI 53226 Phone: 414/259-1500

HNTB Corporation

Contact: Jeff Mazanec One Park Plaza, Suite 500 11270 West Park Place Milwaukee, WI 53224 Phone: 414/359-2300

Huntingdon

Contact: Greg Aldrian Tom Normington 555 South 72nd Avenue Wausau, WI 54402 Phone: 715/845-4100

John Robinson and Associates

101 Grand Avenue P.O. Box 31 Wausau, Wi 54402 Phone: 715/842-4655

Key Environmental Services

Contact: Ken Wein W62 N244 Washington Avenue Phone: 414/375-4750 715/542-3502

Liesch Environmental Services Contact: David Macdonald 4781 Hayes Road Madison, WI 53704 Phone: 608/241-3010 Fax: 608/241-3555



Collaborating UW Institutions: UW-Green Bay, UW-Madison, UW-Stevens Point

Michaels Engineering Inc. 900 Moniter LaCrosse, WI 54602-2377 Phone: 608/785-1900

Mid-State Associates

1230 South Boulevard Baraboo, WI 53913 Phone: 608/356-8344

Northwest Petroleum Services

4080 North 20th Avenue Wausau, WI 54401 Phone: 715/675-2084

Omnni Associates Inc.

Contact: Brian Wayner 303 S. Bluemound Dr. Appleton, WI 54914 Phone: 414/739-7814

Radian Corporation

5103 W. Beloit Road Milwaukee, WI 53214 Phone: 414/643-2668

Ramaker and Associates

Contact: Terry Ramaker Sandy Ramaker 806 Water Street Sauk City, WI 53583 Phone: 608/643-4100

Remedial Engineering

901 N. Cherry Street Wausau, WI 54401 Phone: 715/675-9784 **RMT Inc.** 744 Heartland Trail Madison, WI 53717 Phone: 608/831-4444

Contact: David Seitz 2727 N. Grandview #103 Waukesha, WI 53188 Phone: 414/521-1100

RUST Environment and Infrastructure

Contact: Tom Degen 3051 Wilson Avenue Plover, WI 54467 Phone: 715/341-8110 4738 N. 40th St. Sheboygan, WI 53083 Phone: 414/458-8711

Sigma Environmental Services

Contact: Ken Kaszubowski 9555 South Howell Avenue Oak Creek, WI 53154 Phone: 414/768-7144

Simon Hydro-Search

175 N. Corporate Dr. #100 Brookfield, WI 53045 Phone: 414/792-1282

Strand Associates

Contact: Steve Karklins 910 West Wingra Drive Madison, WI 53715 Phone: 608/251-4843

Triad Engineering

Contact: Rick Fulk 325 E. Chicago Street Milwaukee, WI 53202 Phone: 414/291-8840

Twin Cities Testing Corporation

P.O. Box 1817 Wausau, WI 54402 Phone: 715/845-4100

Warzyn

One Science Court P.O. Box 5385 Madison, WI 53705 Phone: 608/231-4747

Roy F. Weston

3 Hawthorn Parkway Vernon Hills, IL 60061 Phone: 708/918-4000

WW Engineering & Science 5417 N. 118th Ct. Milwaukee, WI 53225 Phone: 414/466-5554

Woodward-Clyde Consulting 8383 Greenway Blvd. Middleton, WI 53562 Phone: 608/836-5040

Yanko Environmental Services 3303 Paine Ave. Sheboygan, WI 53081 Phone: 414/459-2500

✤ For More Information, Contact Your County Extension Agent or SHWEC

County Extension Information

SHWEC Offices

UW-Green Bay

University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

UW-Madison

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

<u>UW-Stevens Point</u>



Solid and Hazardous Waste Education Center Waste Education Series



Cooperative Extension • University of Wisconsin—Extension

Industrial Environmental Training Programs Offered by Wisconsin Technical Colleges

Blackhawk Technical College
Fox Valley Technical College
Lakeshore Technical College
Mid-State Technical College
Milwaukee Area Technical College
Moraine Park Technical College

- Water/Wastewater (Continuing Education)
- Natural Resources Technician (2 year associate degree program)
- Hazardous Material Technician (2 year associate degree program)
 - Handling Hazardous Materials (Continuing Education)
 - Environmental and Pollution Control Technician (2 year A.A.S. Degree)
 - Water and Wastewater Treatment Technician (2 year associate degree)

The need for an educated work force is an essential ingredient in maintaining your companies' competitive advantage in today's world. With technology changing so rapidly, successful companies need to continuously provide their employees with the skills they need to perform their jobs.

In Wisconsin, resources are available to any individual or company, to obtain this necessary education and training. These resources are Wisconsin's two-year technical colleges located throughout the state. These technical colleges offer education and training in one of three ways:

- 1. Non-credit, continuing education courses
- 2. Two-year associate degree programs
- 3. The option of setting up a program, tailor made to meet your specific needs or goals

This fact sheet highlights technical colleges with industrial environmental programs and provides a brief description of the classes that are offered. If the technical college closest to you is not listed as having a program, call them and discuss the possibility of creating a seminar or workshop in the area of interest to you. A list of Wisconsin technical colleges is provided.

Course Descriptions

Blackhawk Technical College

Water/Wastewater

Groundwater and Distribution (506-411)

Designed for entry-level operators providing basic skills and knowledge required for day-to-day operation of a public water supply groundwater and distribution facility. Certified operators desiring a better understanding of groundwater treatments and available options as they may apply to their own facilities will also benefit from this program.

Advanced Activated Sludge (506-431)

Fine tuning of an activated sludge process can effect savings of thousands of dollars (depending on plant size) and can greatly improve consistency of effluent quality. This course specializes in troubleshooting, fine tuning, and necessary math calculations for the activated sludge process. Also includes hands-on microscopic examination of activated sludge, as well as determination of oxygen uptake rates using samples of activated sludge.

Phosphorous Removal (506-460)

When waste food energy (BOD) removal is not enough to protect surface water quality, phosphorous removal is sometimes required. We explain equipment, chemicals used, points of application, laboratory controls, and calculations necessary to prevent excessive growth of algae and rooted vegetation.

Land Application of Sludge (506-465)

We will explain DNR regulations controlling the land application of sludge. Students will explore characteristics of soil including soil properties, soil pH and application exchange capacity. Calculation of sludge application rates and annual volume generation rates will also be discussed.

Fox Valley Technical College

Certification courses that are offered are: Wastewater

#101 Introduction to Wastewater (45525)
#111 Lab Analysis 1 (44648)
#113 Lab Quality Assurance 1 (44657)
#116 Advanced Activated Sludge (44659)
#130 Advance Phosphorous (48281)

Groundwater

#202 Internal Corrosion Control (48283) #206 Well In and Out (44656) #213 Zeolite (44646)

Water/Groundwater Management #302 Level One Management (44658)

Credit courses offered are:

Introduction to Natural Resources (057-103)

This course provides a basic study of natural resources-their abundance, importance and need for conservation. The physical and biological variables of the natural environment are studied as they relate to natural resources management by the human resource.

Soil and Water Conservation 1 (057-134)

This course will acquaint students with the physical, chemical and biological properties of soil in relation to water and wind erosion. The identification, planning and use of soil and water conservation practices are examined. Students will learn about fertility and its relationship to soil conservation and management.

Soil and Water Conservation 2 (057-135)

Soil and water conservation practices are explored in greater detail including planning, design and layout. Field locations will help familiarize students with the standards and specifications used in the design of structural and vegetable erosion control practices. Proper construction and maintenance of these practices is stressed.

Water Quality and Wastewater Management 1 (057-136) This course examines the physical, chemical and biological characteristics of surface and groundwater and its pollution. Water quality standards and regulations are discussed. Surveys of the various forms and sources of water pollutants are conducted, and water quality assessments using biological indicators and chemical tests are covered. There will be a brief overview of the treatment process from influent to final effluent.

Wastewater 1 (057-136A)

Wastewater 1 examines the chemical, physical and biological characteristics of water pollution. The course covers water quality regulations and requirements. Techniques for sampling both surface waters and process effluents are discussed. The equipment involved in the collection and pretreatment of wastewaters is examined. An overview of primary, secondary and tertiary treatment methods is also provided. Lab sessions and field trips provide "hands-on" experience relating to the course work.

Water Quality and Wastewater Management 2 (057-137) Waste treatment systems are studied in detail, including the collection, handling and disposal of wastewaters and sludges Laboratory work emphasizes the tests and methods used to evaluate the performance of treatment units.

Lakeshore Technical College

Hazardous Material Technician

Hazardous Materials Waste Site Worker (503-150) This course is designed to meet the 40-hour training requirement of 29 CFR 1910.120 for the Hazardous Waste Site Worker. Included are site safety plans, health plan, health and safety hazards, personal protective clothing and equipment, safe work practices, medical surveillance, monitoring techniques, drum and container handling, emergency response and hazard recognition.

Chemistry of Hazardous Materials (503-151)

Reviews the principles of chemical reactions. It covers the chemistry of oxygen, hydrogen halides, carbon, and phosphorous and sulfur. The chemistry of corrosive materials, water reactive materials, and toxic materials are included. The course also includes oxidation-reductions, organic compounds, plastics, resins, fibers, and chemical explosives. In addition, a laboratory section is included to help the student gain knowledge in the chemistry of hazardous materials.

Hazardous Material Regulations (503-152)

Provides an overview of local, state, and federal regulations governing hazardous materials and waste. Also included is the legislative process by which regulations are promulgated and how the governing agencies operate.

Hazardous Materials Health and Safety (503-153)

Is an introduction to the fundamentals of occupational and environmental health and safety. Topics include regulations, standards, and roles of employees and employers, techniques for recognition, evaluation, and control of health and safety hazards, as well as specific health and safety programs.

Hazardous Material Toxic Effects (503-154)

This class discusses the consequences of hazardous materials which have the potential to endanger the environment, food, and human health. Included are toxicological effects of hazardous materials on humans, animals, plant life, water, etc., and the importance of neutralizing or containing hazardous material contamination.

Computer Applications in Hazardous Materials (503-155) This is an introduction to the various forms of data management utilizing personal computers. Topics covered include computerized inventory control, material and record tracking, modeling, databases, on-line systems, electronic bulletin boards, and the basic operation of IBM computers.

Personal Protective Equipment and Clothing (503-156)

This course is designed to provide the knowledge and skills necessary for selection and use of personal protective clothing and equipment. The different levels of protective clothing and equipment are included. Simulated work environments are used for demonstration and practice of planned entry, remedial actions, acute exposure, and safety.

Environmental Sampling (503-158)

Presents methods, requirements, and criteria related to sampling. Topics covered include sampling plans, techniques for groundwater, soils, and container sampling, as well as air monitoring instruments. The course will address the specific sampling requirements for underground storage tanks, lead, asbestos, and PCBs.

Hazardous Material Transportation (503-160)

Gives hazardous material handling procedures for safety and compliance with state and federal transportation regulations and guidelines. Included are procedures and regulations regarding containers/vessels, driver/operator certification, material identification, labeling/placarding, bills of lading, vehicle inspection and safety.

Emergency Incident Response (503-170)

Provides an awareness of hazardous material including radioactive incident responses. Emphasis is placed on the role of the different response groups, such as public sector, industrial, strike teams, and commercial teams. Also included are responses to specific types of incidents such as explosives, gases, flammable liquids, oxidizers, poisons, and corrosives.

Hazardous Material Collection Storage Disposal Waste (503-172)

Provides waste generator requirements for proper management of hazardous wastes. Included are federal, state, and local regulation compliance, waste collection segregation, characterization, storage, containers, identification protection, safety, handling, disposal methods, transportation, documentation, and reporting.

In House Management of Hazardous Materials (503-174) Involves facility management requirements for hazardous materials for safe operations and compliance with government regulations. Included are methods for gathering and furnishing chemical information, approved handling and storage practices, site inspection and control, risk assessment and emergency planning, permits and documentation, and personnel training, protection, and reporting.

Hazardous Material/Waste Management (503-175) Addresses federal and state laws and regulations of hazardous materials and hazardous waste. Included are writing contingency plans on management and storage of hazardous materials/waste; training responsibilities; principles of waste minimization, recycling, and pollution prevention; managing special hazardous materials such as asbestos, PCBs, and pesticides; and spill and accident investigation.

Milwaukee Area Technical College

Environmental and Pollution Control Technician Introduction to Environmental Health (506-101) This course includes a study of the history, development, and philosophy of environmental health, including basic environmental health literature, vocational opportunities, the role of the technician, communicable diseases, and vital statistics.

Environmental Biology (506-102)

The classification, nature, and behavior of biological organisms are basic to the operation of water and wastewater treatment plants, stream sanitation, and environmental disease prevention and control. The subject matter includes the sanitary significance of each group of organisms.

Toxic and Hazardous Substances (506-103)

The environmental health problems of the community are studied. Included is a study of private water supplies and wastewater disposal methods. A study is also made of solid waste disposal, soil classification and analysis, and beach sanitation. Fundamentals of Hazardous Materials Control (506-105) The properties of materials commonly used in the workplace which are potentially hazardous to workers and the techniques of detection of those materials, along with proper methods of transporting and handling those materials in the workplace, are studied.

Applied Instrumental Calibrations (506-110)

Computation and interpretation of related data to environmental instrumentation are studied. Equations and formulas are used to solve problems in pollution control and environmental assessment and monitoring situations.

Water and Wastewater Analysis (506-111) No description given.

Air Pollution Technology (506-115)

This study of the effects of air pollution includes the types of air pollution, their sources, and their prevention and control. The various air pollution sampling techniques and air analysis methods are performed by the student.

Pollution Control Process Management (506-143)

Instruction is provided in fundamentals of managing a water or wastewater treatment facility. Instruction covers the relationships among different processes and equipment, record-keeping, and cost estimating, as well as occupational safety and health hazards.

Water/Wastewater Operations - Municipal (506-145) Operational procedures and facilities used in public water supply treatment and wastewater treatment are studied. Included are methods of establishing and maintaining hydraulic flow, techniques for chemical treatment, and emphasis on application to remove phosphorous.

Water/Wastewater Operations - Industrial (506-146)

The operational procedures for handling sludge in wastewater treatment plants are studied. This includes common operational problems encountered in the operation of digesters, sludge thickeners, sludge pumps, and filtration systems. Major emphasis is placed on proper maintenance, remedial measures, and process problems.

Environmental Bacteriology (506-173)

Emphasis is placed on laboratory techniques, quality control procedures, and the significance of environmental parameters. Interpretation of results is then correlated with applicable standards.

Moraine Park Technical College

Water and Wastewater Treatment Technician

Introduction to Treatment Processes (527-100) The student is introduced to the subject of water purification technology by learning to relate nature's self-purification system to artificial treatment process units, and the procedures and parameters involved in their operation.

Treatment Processes 1 (527-103)

Covers the design and parameters of operation of wastewatertreatment plant process units. Students learn to perform safe, proper laboratory analysis according to accepted procedures and to relate these results to operational problems in the control of plant process units. Format includes lecture, lab, films, field trips, and out-of-class assignments.

Treatment Processes 2 (527-105)

Covers advanced laboratory instrumentation techniques, modifications of conventional treatment processes, and advanced treatment methods used in water and wastewater technology. Field trips and guest speakers are scheduled to supplement laboratory progress in proper sequence.

Treatment Plant Instrumentation and Electricity (527-108)

The student will learn the purpose, theory, and operation of mechanical, hydraulic, and electronic treatment plant information systems. The course provides a laboratory in which the student will learn to monitor, interpret, and record instrument readings in the language of the industry, and to take appropriate actions to control the operation of the treatment plant.

Hydraulics of Water/Wastewater (527-120)

Designed to train the student in the basic principles of hydraulics as applied to the transmission, collection, and treatment of water and wastewater. Laboratory assignments and exercises on a hydraulic trainer are performed parallel to the lectures to demonstrate predicted flows and performance.

Qualitative and Quantitative Analysis (527-122)

Provides classroom and laboratory instruction in the theory, instrumentation, and the practical procedures used in the industrial and/or municipal water and wastewater laboratory. Students will learn to perform safe proper analysis in the laboratory and to relate test results to the operational procedures used to control the water and wastewater treatment plant.

Industrial Wastes (527-125)

Provides advanced laboratory instrumentation techniques to detect, monitor, and control industrial pollutants. Includes modifications of conventional processes and advanced methods used to treat, recover, recycle, and ultimately dispose of industrial pollutants. Field trips and guest speakers are scheduled to supplement the laboratory.

Water Supply (527-130)

This course covers groundwater supply, water distribution systems, and surface water treatment for potable water treatment. Format includes lecture, films, field trips, and out-of-class assignments.

Process Equipment Maintenance (527-135)

The student will learn to recognize mechanical malfunctions which necessitate immediate operational adjustments or repairs of treatment plant equipment. The student will learn to perform basic maintenance procedures safely and properly and to design and implement a preventative maintenance program. Emphasis is placed on job skills in heavy equipment used in water supply and wastewater industries.

Environmental Topics (527-140)

Provides detailed information on the causes and effects of environmental degradation and establishes strategies to minimize problem areas. Topics addressed include air pollution and global warming, forest lands and biodiversity, marine and freshwater pollution, population growth, poverty and land degradation, and environmental economic policies.

Water and Wastewater Technician - Field Experience (527-171)

Involves laboratory experience including on-the-job training supervised by the Moraine Park Technical College staff in cooperation with industry.

Wisconsin Technical Colleges

Blackhawk Technical Box 5009 Janesville, WI 53547 Phone: 608/756-4121

Chippewa Valley Technical College 620 West Clairemont Avenue Eau Claire, WI 54701 Phone: 715/833-6200

Fox Valley Technical College 1825 N. Bluemound Drive Appleton, WI Phone: 414/735-5600

Gateway Technical College 3520 30th Avenue Kenosha, WI 53141 Phone: 414/656-6900

Lakeshore Technical College 1290 North Avenue Cleveland, WI 53015 Phone: 414/458-4183

Madison Area Technical College 211 N. Carroll Street Madison, WI 53703 Phone: 608/246-6100

Mid-State Technical College 500 32nd Street North Wisconsin Rapids, WI 54494 Phone: 715/423-5650 Milwaukee Area Technical College 1015 North Sixth Street Milwaukee, WI 53203 Phone: 414/278-6600

Moraine Park Technical College 235 North National Avenue Fond du Lac, WI 54935 Phone: 414/922-8611

Nicolet Technical College Box 518 Rhinelander, WI 54501 Phone: 715/369-4451

Northcentral Technical College 1000 Campus Drive Wausau, WI 54401 Phone: 715/675-3331

Northeast Wisconsin Technical College 2740 West Mason Street Green Bay, WI 54307 Phone: 414/498-5400

Southwest Wisconsin Technical College Bronson Boulevard Fennimore, WI 53809 Phone: 608/822-3262

Waukesha County Technical Collége 800 Main Street Pewaukee, WI 53702 Phone: 414/691-5200 Western Wisconsin Technical College 304 North Sixth Street LaCrosse, WI 54602 Phone: 608/785-9144

Wisconsin Indianhead Technical College Box 452 Shell Lake, WI 54871 Phone: 715/468-2815

✤ For More Information, Contact Your County Extension Agent or SHWEC

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SHWEC Offices

<u>UW-Green Bay</u>

University of Wisconsin Environmental Science 317 2420 Nicolet Drive Green Bay, WI 54311 414/465-2707 FAX 414/465-2143

UW---Madison

610 Langdon Street, Rm. 529 Madison, WI 53703 608/262-0385 FAX 608/262-6250

<u>UW-Stevens Point</u>

Solid and Hazardous Waste Education Center

Waste Education Series



Cooperative Extension • University of Wisconsin-Extension

May 12, 1993

SHWEC FACT SHEET

SOLID AND HAZARDOUS WASTE ACRONYMS

compiled by Wayne P. Pferdehirt, P.E., AICP **Pollution Prevention Specialist**

E	ARCHITECT/ENGINEER		INFORMATION
ESF	AMERICAN ELECTROPLATERS AND SURFACE	CESOG	CONDITIONALLY EXEMPT SMALL QUANTITY
	FINISHERS SOCIETY		GENERATORS
ChE	AMERICAN INSTITUTE OF CHEMICAL ENGINEERS	CFC	CHLOROFLUOROCARBON
PP	AMERICAN INSTITUTE FOR POLLUTION PREVENTION	CFR	CODE OF FEDERAL REGULATIONS
ISI	AMERICAN NATIONAL STANDARDS INSTITUTE	CGLG	COUNCIL OF GREAT LAKES GOVERNORS
DC	AREAS OF CONCERN	CHMM	CERTIFIED HAZARDOUS MATERIALS MANAGER
°C	AMERICAN PLASTICS COUNCIL	CHMR	CENTER FOR HAZARDOUS MATERIALS RESEARCH
PC .	AIR POLLUTION CONTROL	CIS	CHEMICAL INFORMATION SYSTEM
И	AMERICAN PAPER INSTITUTE	CMA	CHEMICAL MANUFACTURERS ASSOCIATION
PWA	AMERICAN PUBLIC WORKS ASSOCIATION	CNT	CENTER FOR NEIGHBORHOOD TECHNOLOGY
2	AIR OUALITY	CO	CARBON MONOXIDE
low	ASSOCIATED RECYCLERS OF WISCONSIN	COD	CHEMICAL OXYGEN DEMAND
BO	ASBESTOS AND SMALL BUSINESS OMBUDSMAN	COPE	COUNCIL ON PACKAGING AND THE ENVIRONMENT
ME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	CORRE	COALITION ON RESOURCE RECOVERY AND THE
STM	AMERICAN SOCIETY FOR TESTING AND MATERIALS		ENVIRONMENT
STSWMO	ASSOCIATION OF STATE AND TERRITORIAL SOLID	CPSA	CONSUMER PRODUCT SAFETY ACT
	WASTE MANAGEMENT OFFICIALS	CPSC	CONSUMER PRODUCT SAFETY COMMISSION
WWA	AMERICAN WATERWORKS ASSOCIATION	CRS	CENTRAL RECOVERY SYSTEM
ACT	BEST AVAILABLE CONTROL TECHNOLOGY	CWA	CLEAN WATER ACT
NANA	BUILD ABSOLUTELY NOTHING ANYWHERE NEAR	CWRT	CENTER FOR WASTE REDUCTION TECHNOLOGIES
	ANYBODY	CY	CUBIC YARD
ART	BEST AVAILABLE RETROFIT TECHNOLOGY	DATCP	DEPARTMENT OF AGRICULTURE TRADE AND
ARTER	BUSINESSES ALLIED TO RECYCLE THROUGH		CONSUMER PROTECTION (WD)
	EXCHANGE AND REUSE	DILHR	DEPARTMENT OF INDUSTRIAL LABOR AND HUMAN
CSD	BUSINESS COUNCIL FOR SUSTAINABLE		RELATIONS (WI)
	DEVELOPMENT	DNR	DEPARTMENT OF NATURAL RESOURCES (WD)
DAT	BEST DEMONSTRATED AVAILABLE TECHNOLOGY	DO	DISSOLVED OXYGEN
DC	BUSINESS DEVELOPMENT CORPORATION	DOA	DEPARTMENT OF ADMINISTRATION (WI)
DD	BIOLOGICAL OXYGEN DEMAND	DOC	DEPARTMENT OF COMMERCE
ับ	BRITISH THERMAL UNIT	DOD	DEPARTMENT OF DEFENSE
& D	CONSTRUCTION AND DEMOLITION	DOE	DEPARTMENT OF ENERGY
AA	CLEAN AIR ACT	DOI	DEPARTMENT OF IUSTICE
444	CLEAN AIR ACT AMENDMENTS	DOT	DEPARTMENT OF TRANSPORTATION
AC	CITIZEN ACTION COMMITTEE	EAF	ENVIRONMENT ACTION FOUNDATION
AP	CAPACITY ASSURANCE PLAN	EDA	ECONOMIC DEVELOPMENT ADMINISTRATION
- A.S	CHEMICAL ABSTRACT SERVICE	EDB	ETHYLENE DIBROMIDE
BE	CITIZENS FOR A BETTER ENVIRONMENT	EDE	ENVIRONMENTAL DEFENSE FUND
CA	CHEMICAL COATERS ASSOCIATION	EIS	ENVIRONMENTAL IMPACT STUDY
CP	COMMERCIAL CHEMICAL PRODUCTS	ENR	DEPARTMENT OF ENERGY AND NATURAL
 C	CENTERS FOR DISEASE CONTROL (HHS)		RESOURCES (IL)
EM	CONTINUOUS EMISSIONS MONITOR	EP	EXTRACTION PROCEDURE
30	COUNCIL ON ENVIRONMENTAL QUALITY	EPA	ENVIRONMENTAL PROTECTION AGENCY
ERCLA	COMPREHENSIVE ENVIRONMENTAL RESPONSE	EPCRA	EMERGENCY PLANNING AND COMMINITY
	COMPENSATION, AND LIABILITY ACT OF 1980	Diolai	RIGHT-TO-KNOW ACT (PART OF SARA)
	(SUPERFUND)	EPTOX	EXTRACTION PROCEDURE TOXICITY
ERI	CENTER FOR ENVIRONMENTAL RESEARCH	~	

SHWEC FACT SHEET: Solid & Hazardous Waste Acronyms

Feb		T MOS	I ARE MICHICAN OZONE STUDY
ESP ED		LMUS	
FD	FORCED DRAFT	LQG	LARGE QUANTITI GENERATOR
FDA	FOOD AND DRUG ADMINISTRATION	LULU	LOCALLY UNDESIRABLE LAND USE
FERC	FEDERAL ENERGY REGULATORY COMMISSION	LUSI	LEAKING UNDERGROUND STORAGE TANK
FET	FEDERATION OF ENVIRONMENTAL	LWV	LEAGUE OF WOMEN VOTERS
	TECHNOLOGISTS	MACT	MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY
FFA	FLAMMABLE FABRICS ACT	MAP	MANAGEMENT ASSISTANCE PROJECT
FFDCA	FEDERAL FOOD, DRUG AND COSMETIC ACT	MAPI	MANUFACTURERS ALLIANCE FOR PRODUCTIVITY
FHA	FARMER'S HOME ADMINISTRATION		AND INNOVATION, INC.
FHSA	FEDERAL HAZARDOUS SUBSTANCES ACT	MCI	MANUFACTURING CHEMICAL INTERMEDIATES
FIFRA	FEDERAL INSECTICIDE, FUNGICIDE, AND	MCL	MAXIMUM CONTAMINANT LEVEL
	RODENTICIDE ACT	MCLG	MAXIMUM CONTAMINANT LEVEL GOAL
FOIA	FREEDOM OF INFORMATION ACT	MCU	MODULAR COMBUSTION UNIT
FPL	FOREST PRODUCTS LABORATORY	MEB	MANAGEMENT INSTITUTE FOR ENVIRONMENT AND
FR	FEDERAL REGISTER	· · · · · · · · · · · · · · · · · · ·	BUSINESS
FWPCA	FEDERAL WATER POLLUTION CONTROL ACT	MFSA	METAL FINISHING SUPPLIERS ASSOCIATION
FY	FISCAL YEAR	MMT	MILLION METRIC TONS
GACT	GENERALLY AVAILABLE CONTROL TECHNOLOGY	MNTAP	MINNESOTA TECHNICAL ASSISTANCE PROGRAM
GAO ⁷	GENERAL ACCOUNTING OFFICE	MPCA	MINNESOTA POLLUTION CONTROL AGENCY
GEP	GOOD ENGINEERING PRACTICE	MRF	MATERIAL RECOVERY FACILITY
GI	GOVERNMENT INSTITUTES	MSDS	MATERIAL SAFETY DATA SHEET
GIS	GEOGRAPHIC INFORMATION SYSTEM	MSW	MUNICIPAL SOLID WASTE
GLI	GREAT LAKES INITIATION	NAAQS	NATIONAL AMBIENT AIR QUALITY STANDARDS
GLNPO	GREAT LAKES NATIONAL PROGRAM OFFICE (EPA)	NACEPT	NATIONAL ADVISORY COUNCIL OF
GLPF	GREAT LAKES PROTECTION FUND		ENVIRONMENTAL POLICY AND TECHNOLOGY
GLWQA	U.SCANADA GREAT LAKES WATER QUALITY	NAMF	NATIONAL ASSOCIATION OF METAL FINISHERS
	AGREEMENT	NBS	NATIONAL BUREAU OF STANDARDS
GO	GENERAL OBLIGATION	NCASI	NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR
GPI	GLASS PACKAGING INSTITUTE		AIR AND STREAM IMPROVEMENT
GW	GROUNDWATER	NCP	NATIONAL CONTINGENCY PLAN
HAP	HAZARDOUS AIR POLLUTANT	NE-MW	NORTHEAST-MIDWEST INSTITUTE
HCL	HYDROCHLORIC ACID	NEHA	NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION
HDPE	HIGH DENSITY POLYETHYLENE	NESHAP	NATIONAL EMISSIONS STANDARDS FOR
HHW	HOUSEHOLD HAZARDOUS WASTE		HAZARDOUS AIR POLLUTANTS
HMTA	HAZARDOUS MATERIALS TRANSPORTATION ACT	NETA	NATIONAL ENVIRONMENTAL TRAINING
HOC	HALOGENATED ORGANIC COMPOUNDS		ASSOCIATION
HVLP	HIGH-VOLUME LOW-PRESSURE	NEWMOA	NORTHEAST WASTE MANAGEMENT OFFICIALS
HW	HAZARDOUS WASTE		ASSOCIATION
HWRIC	HAZARDOUS WASTE RESEARCH AND INFORMATION	NHTSA	NATIONAL HIGHWAY TRAFFIC SAFETY
	CENTER		ADMINISTRATION (DOT)
ICC	INTERSTATE COMMERCE COMMISSION	NIDI	NICKEL DEVELOPMENT INSTITUTE
D	INDUCED DRAFT	NIH	NATIONAL INSTITUTE OF HEALTH
IESC	INTERNATIONAL ENVIRONMENTAL SERVICE	NIMBY	NOT IN MY BACK YARD
	CENTRE	NIMEY	NOT IN MY ELECTION YEAR
ILSR	INSTITUTE FOR LOCAL SELF RELIANCE	NIMTOO	NOT IN MY TERM OF OFFICE
IMES	INDUSTRIAL MATERIAL EXCHANGE SERVICE	NIOSH	NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY
IMF	INSTITUTE OF METAL FINISHING		AND HEALTH
IPF	INTERMEDIATE PROCESSING FACILITY	NOPE	NOT ON PLANET EARTH
IPM	INTEGRATED PEST MANAGEMENT	NOV	NOTICE OF VIOLATION
IRA	ILLINOIS RECYCLING ASSOCIATION	NOX	NITROGEN OXIDE
IRIS	INTEGRATED RISK INFORMATION SYSTEM	NPDES	NATIONAL POLLUTANT DISCHARGE ELIMINATION
ISO	INTERNATIONAL ORGANIZATION FOR		SYSTEM
	STANDARDIZATION	NPL	NATIONAL PRIORITIES LIST
ISRI	INSTITUTE OF SCRAP RECYCLING INDUSTRIES	NPV	NET PRESENT VALUE
JAPCA	JOURNAL OF THE AIR POLLUTION CONTROL	NRC	NATIONAL RECYCLING COALITION
	ASSOCIATION	NRC	NUCLEAR REGULATORY COMMISSION
LAER	LOWEST ACHIEVABLE EMISSIONS RATE	NRRA	NATIONAL RESOURCE RECOVERY ASSOCIATION
LAMP	LAKEWIDE MANAGEMENT PLAN	NSWMA	NATIONAL SOLID WASTE MANAGEMENT
LDPE	LOW DENSITY POLYETHYLENE		ASSOCIATION
LDR	LAND DISPOSAL RESTRICTION	NTIS	NATIONAL TECHNICAL INFORMATION SERVICE
LEL	LOWER EXPLOSIVE LIMIT	NOX	NITROGEN OXIDES
LERC	LOCAL EMERGENCY RESPONSE COMMISSION	OBW	OVERSIZE & BULKY WASTES
LMF	LAKE MICHIGAN FEDERATION	OCC	OLD CORRUGATED CONTAINERS

1

SHWEC FACT SHEET: Solid & Hazardous Waste Acronyms

C	OZONE-DEPLETING COMPOUND	SBIC	SMALL BUSINESS INVESTMENT COMPANY
∕BB	OFFICE OF MANAGEMENT AND BUDGET	SBIR	SMALL BUSINESS INNOVATION RESEARCH
VP	OLD NEWSPAPERS	SCRI	STEEL CAN RECYCLING INSTITUTE
)p	OFFICE OF POLUTION PREVENTION	SDWA	SAFE DRINKING WATER ACT
PE	OFFICE OF POLICY, PLANNING AND EVALUATION	SERC	STATE EMERGENCY RESPONSE COMMISSION
	(USEPA)	SHWEC	SOLID AND HAZARDOLIS WASTE EDUCATION
DN	OUT DOI LITTON DEFVENTION NETWORK	SHWLC	CENTER
20	OFFICE OF DESEABOR AND DEVELOPMENT	SIC	STANDADD DIDISTRIAL CLASSIE(CATION
	OTHER RECHARCH AND DEVELOPMENT	SIC	STANDARD INDUSTRIAL CLASSIFICATION
	OTHER REGULATED MATERIAL	SPLL	SPILL PREVENTION, CONTROL, AND
HA	OCCUPATIONAL SAFELY AND HEALTH		
	ADMINISTRATION	SPI	SOCIETY OF THE PLASTICS INDUSTRIES
A	OFFICE OF TECHNOLOGY ASSESSMENT	SQG	SMALL QUANITTY GENERATOR (RCRA)
D	OLD TELEPHONE DIRECTORY	STEL	SHORT-TERM EXPOSURE LIMIT
S	OFFICE OF TOXIC SUBSTANCES	SWANA	SOLID WASTE ASSOCIATION OF NORTH AMERICA
VM	OFFICE OF WASTE MANAGEMENT	SWICH	SOLID WASTE INFORMATION CLEARINGHOUSE AND
	POLLUTION PREVENTION		HOTLINE (SWANA)
Р	PAYBACK PERIOD	TANSTAFL	THERE AIN'T NO SUCH THING AS A FREE LUNCH
В	POLYCHLORINATED BIPHENYL	TAP	TECHNICAL ASSISTANCE PROGRAM
DD	POLYCHLORINATED DIBENZO-P-DIOXINS	TAPPI	TECHNICAL ASSOCIATION OF THE PULP AND PAPER
DF	POLYCHLORINATED DIBENZOFURANS		INDUSTRY
F	PROJECT ENVIRONMENT FOUNDATION	TCA	TRICHLOROETHANE
L	PERMISSIBLE EXPLOSIVE LIMIT	TCE	TRICHLOROETHYLENE
NTAP	PENNSYLVANIA TECHNICAL ASSISTANCE PROGRAM	TCLP	TOXICITY CHARACTERISTIC LEACHING PROCEDURE
RC	PERCHLOROETHYLENE	TLV	THRESHOLD LIMIT VALUE
۱G	PUBLIC INTEREST RESEARCH GROUP	TOC	TOTAL ORGANIC CARBON
[-10	PARTICULATE MATTER LESS THAN 10 MICRONS IN	TPD	TONS PER DAY
	SIZE	TPO	THRESHOLD PLANNING OUANTITY
TR.	PLASTIC MEDIA BLASTING	TPY	TONS PER YEAR
ne	PRECIOUS METAL PLATERS	TOM	TOTAL OUALITY MANAGEMENT
101	DIELICI V OWNED TREATMENT WORKS	TON	TOTAL QUALITI MANAOLIMIANI TOYIC DELEASE INVENTORY
1 **	POBLICE FOWRED TREATMENT WORKS	TSCA	TOXIC RELEASE INVENTOR I
	POLLOTION FREVENTION	TSDE	TDEATMENT STODAGE AND DISDOSAL EACH ITY
0	POLIPROPILENE	TSDF	TREATMENT STORAGE AND DISPOSAL FACILITY
р С	PARIS PER BILLION	ISP	TOTAL SUSPENDED PARTICULATES
-	POUNDS PER CAPITA	155	TOTAL SUSPENDED SOLLDS
IC .	POLLUTION PREVENTION INFORMATION	110	TOTAL TOXIC ORGANICS
	CLEAKINGHOUSE	IWA	TIME WEIGHTED AVERAGE
M	PARIS PER MILLION	UBC	USED BEVERAGE CONTAINER
PA	POISON PREVENTION PACKAGING ACT	UN	UNITED NATIONS
L	PRACTICAL QUANTIFICATION LIMIT	USDA	UNITED STATES DEPARTMENT OF AGRICULTURE
P	POTENTIALLY RESPONSIBLE PARTY	UST	UNDERGROUND STORAGE TANK
	POLYSTYRENE	USEPA	UNITED STATES ENVIRONMENTAL PROTECTION
D	PREVENTION OF SIGNIFICANT DETERIORATION		AGENCY
[POUNDS PER SQUARE INCH	UWEX	UNIVERSITY OF WISCONSIN-EXTENSION
RPA	PUBLIC UTILITY REGULATORY POLICIES ACT OF	VOC	VOLATILE ORGANIC COMPOUND
	1978	VSQG	VERY SMALL QUANTITY GENERATOR
С	POLYVINYLCHLORIDE	VTAE	VOCATIONAL, TECHNICAL AND ADULT EDUCATION
/QC	QUALITY ASSURANCE/QUALITY CONTROL	WISE	WISCONSIN INDUSTRY SAVING OUR ENVIRONMENT
& D	RESEARCH AND DEVELOPMENT	WMC	WISCONSIN MANUFACTURERS AND COMMERCE
Р	REMEDIAL ACTION PLAN	WPC	WISCONSIN PAPER COUNCIL
RA	RESOURCE CONSERVATION AND RECOVERY ACT	WRAP	WASTE REDUCTION ASSISTANCE PROGRAM
/RA	REMEDIAL DESIGN/REMEDIAL ACTION	WRITAR	WASTE REDUCTION INSTITUTE FOR TRAINING AND
F	REFUSE-DERIVED FUEL		APPLICATIONS RESEARCH
AP	RESOURCE ENHANCEMENT AND PROTECTION	WTE	WASTE TO ENERGY
T	RECOMMENDED EXPOSURE LIMIT	WWTP	WASTEWATER TREATMENT DI ANT
P	REOLIEST FOR PROPOSALS	** ** # E	······································
	DECLIEST FOR OUAL IEICATIONS		
Y E		Diana and me	actions to be added to future undeted listing to Warm Dendot to
r3 D	REMEDIAL INVESTIGATION/FEASIBILITT STUDT	cinumo	to be aqued to runne updated listings to wayne rierdehirt at
U 2	RECORD OF DECISION	SHWEC.	
L L			e e e e e e e e e e e e e e e e e e e
KA	SUPERFUND AMENDMENTS AND		
	KEAUTHOKIZATION ACT		
A	SMALL BUSINESS ADMINISTRATION		
DC	SMALL BUSINESS DEVELOPMENT CENTER		

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✤ For More Information, Contact Your County Extension Agent or SHWEC ◆

County Extension Information

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