This report is one in a series of volumes published by the U.S. Environmental Protection Agency (EPA) to provide information of general interest regarding environmental issues associated with specific industrial sectors. The documents were developed under contract by Abt Associates (Cambridge, MA), and Booz-Allen & Hamilton, Inc. (McLean, VA). This publication may be **purchased** from the Superintendent of Documents, U.S. Government Printing Office. A listing of available Sector Notebooks and document numbers is included on the following page.

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EPA / 310-R-95-003

EPA Office of Compliance Sector Notebook Project

Profile of the Wood Furniture and Fixtures Industry

September 1995

Office of Compliance
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
401 M St., SW (MC 2221-A)
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EPA/310-R-95-003.	Wood Furniture and Fixtures Industry	Bob Marshall	564-7021
EPA/310-R-95-004.	Inorganic Chemical Industry*	Walter DeRieux	564-7067
EPA/310-R-95-005.	Iron and Steel Industry	Maria Malave	564-7027
EPA/310-R-95-006.	Lumber and Wood Products Industry	Seth Heminway	564-7017
EPA/310-R-95-007.	Fabricated Metal Products Industry*	Scott Throwe	564-7013
EPA/310-R-95-008.	Metal Mining Industry	Jane Engert	564-5021
EPA/310-R-95-009.	Motor Vehicle Assembly Industry	Anthony Raia	564-6045
EPA/310-R-95-010.	Nonferrous Metals Industry	Jane Engert	564-5021
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EPA/310-R-95-018.	Transportation Equipment Cleaning Ind.	Virginia Lathrop	564-7057
EPA/310-R-97-001.	Air Transportation Industry	Virginia Lathrop	564-7057
EPA/310-R-97-002.	Ground Transportation Industry	Virginia Lathrop	564-7057
EPA/310-R-97-003.	Water Transportation Industry	Virginia Lathrop	564-7057
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EPA/310-R-98-008.	Local Government Operations	John Dombrowski	564-7036

*Spanish translations available.

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WOOD FURNITURE AND FIXTURES
(SIC 25)
LIST OF ACRONYMS

AFS - AIRS Facility Subsystem (CAA database)
AIRS - Aerometric Information Retrieval System (CAA database)
BIFs - Boilers and Industrial Furnaces (RCRA)
BOD - Biochemical Oxygen Demand
CAA - Clean Air Act
CAAA - Clean Air Act Amendments of 1990
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS - CERCLA Information System
CFCs - Chlorofluorocarbons
CO - Carbon Monoxide
COD - Chemical Oxygen Demand
CSI - Common Sense Initiative
CWA - Clean Water Act
D&B - Dun and Bradstreet Marketing Index
ELP - Environmental Leadership Program
EPA - United States Environmental Protection Agency
EPCRA - Emergency Planning and Community Right-to-Know Act
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act
FINDS - Facility Indexing System
HAPs - Hazardous Air Pollutants (CAA)
HSDB - Hazardous Substances Data Bank
IDEA - Integrated Data for Enforcement Analysis
LDR - Land Disposal Restrictions (RCRA)
LEPCs - Local Emergency Planning Committees
MACT - Maximum Achievable Control Technology (CAA)
MCLGs - Maximum Contaminant Level Goals
MCLs - Maximum Contaminant Levels
MEK - Methyl Ethyl Ketone
MSDSs - Material Safety Data Sheets
NAAQS - National Ambient Air Quality Standards (CAA)
NAFTA - North American Free Trade Agreement
NCDB - National Compliance Database (for TSCA, FIFRA, EPCRA)
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NEIC - National Enforcement Investigation Center
NESHAP - National Emission Standards for Hazardous Air Pollutants
NO_2 - Nitrogen Dioxide
NOV - Notice of Violation

WOOD FURNITURE AND FIXTURES
(SIC 25)
LIST OF ACRONYMS (CONT'D)

NO_X -	Nitrogen Oxide
NPDES -	National Pollution Discharge Elimination System (CWA)
NPL -	National Priorities List
NRC -	National Response Center
NSPS -	New Source Performance Standards (CAA)
OAR -	Office of Air and Radiation
OECA -	Office of Enforcement and Compliance Assurance
OPA -	Oil Pollution Act
OPPTS -	Office of Prevention, Pesticides, and Toxic Substances
OSHA -	Occupational Safety and Health Administration
OSW -	Office of Solid Waste
OSWER -	Office of Solid Waste and Emergency Response
OW -	Office of Water
P2 -	Pollution Prevention
PCS -	Permit Compliance System (CWA Database)
POTW -	Publicly Owned Treatments Works
RCRA -	Resource Conservation and Recovery Act
RCRIS -	RCRA Information System
SARA -	Superfund Amendments and Reauthorization Act
SDWA -	Safe Drinking Water Act
SEPs -	Supplementary Environmental Projects
SERCs -	State Emergency Response Commissions
SIC -	Standard Industrial Classification
SO_2 -	Sulfur Dioxide
TOC -	Total Organic Carbon
TRI -	Toxic Release Inventory
TRIS -	Toxic Release Inventory System
TCRIS -	Toxic Chemical Release Inventory System
TSCA -	Toxic Substances Control Act
TSS -	Total Suspended Solids
UIC -	Underground Injection Control (SDWA)
UST -	Underground Storage Tanks (RCRA)
VOCs -	Volatile Organic Compounds

WOOD FURNITURE AND FIXTURES (SIC 25)

I. INTRODUCTION TO THE SECTOR NOTEBOOK PROJECT

I.A. Summary of the Sector Notebook Project

Environmental policies based upon comprehensive analysis of air, water, and land pollution are an inevitable and logical supplement to traditional single-media approaches to environmental protection. Environmental regulatory agencies are beginning to embrace comprehensive, multi-statute solutions to facility permitting, enforcement and compliance assurance, education/outreach, research, and regulatory development issues. The central concepts driving the new policy direction are that pollutant releases to each environmental medium (air, water, and land) affect each other, and that environmental strategies must actively identify and address these inter-relationships by designing policies for the "whole" facility. One way to achieve a whole facility focus is to design environmental policies for similar industrial facilities. By doing so, environmental concerns that are common to the manufacturing of similar products can be addressed in a comprehensive manner. Recognition of the need to develop the industrial "sector-based" approach within the EPA Office of Compliance led to the creation of this document.

The Sector Notebook Project was initiated by the Office of Compliance within the Office of Enforcement and Compliance Assurance (OECA) to provide its staff and managers with summary information for eighteen specific industrial sectors. As other EPA offices, States, the regulated community, environmental groups, and the public became interested in this project, the scope of the original project was expanded. The ability to design comprehensive, common sense environmental protection measures for specific industries is dependent on knowledge of several inter-related topics. For the purposes of this project, the key elements chosen for inclusion are: general industry information (economic and geographic); a description of industrial processes; pollution outputs; pollution prevention opportunities; Federal statutory and regulatory framework; compliance history; and a description of partnerships that have been formed between regulatory agencies, the regulated community, and the public.

For any given industry, each topic listed above could alone be the subject of a lengthy volume. However, in order to produce a manageable document, this project focuses on providing summary information for each topic. This format provides the reader with a synopsis of each issue, and references where more in-depth information is available. Text within each profile was researched from a variety of sources, and was usually condensed from more detailed sources pertaining to specific topics. This approach allows for a wide coverage of activities that can be further explored based upon the citations and references listed at the end of this profile. As a check on the information included, each notebook went through an external review process. The Office of Compliance appreciates the efforts of all those that participated in this process and enabled us to develop more complete, accurate, and up-to-date summaries. Many of those who reviewed this notebook are listed as contacts in Section IX and may be sources of additional information. The individuals and groups on this list do not necessarily concur with all statements within this notebook.

I.B. Additional Information

Providing Comments

OECA's Office of Compliance plans to periodically review and update the notebooks and will make these updates available both in hard copy and electronically. If you have any comments on the existing notebook, or if you would like to provide additional information, please send a hard copy and computer disk to the EPA Office of Compliance, Sector Notebook Project, 401 M St., SW (2223-A), Washington, DC 20460. Comments can also be uploaded to the Enviroene Bulletin Board or the Enviroene World Wide Web for general access to all users of the system. Follow instructions in Appendix A for accessing these data systems. Once you have logged in, procedures for uploading text are available from the on-line Enviroene Help System.

Adapting Notebooks to Particular Needs

The scope of the existing notebooks reflect an approximation of the relative national occurrence of facility types that occur within each sector. In many instances, industries within specific geographic regions or States may have unique characteristics that are not fully captured in these profiles. For this reason, the Office of Compliance encourages State and local environmental agencies and other groups to

supplement or re-package the information included in this notebook to include more specific industrial and regulatory information that may be available. Additionally, interested States may want to supplement the "Summary of Applicable Federal Statutes and Regulations" section with State and local requirements. Compliance or technical assistance providers may also want to develop the "Pollution Prevention" section in more detail. Please contact the appropriate specialist listed on the opening page of this notebook if your office is interested in assisting us in the further development of the information or policies addressed within this volume.

If you are interested in assisting in the development of new notebooks for sectors not covered in the original eighteen, please contact the Office of Compliance at 202-564-2395.

II. INTRODUCTION TO THE WOOD FURNITURE AND FIXTURES INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the Wood Furniture and Fixtures industry. The type of facilities described within the document are also described in terms of their Standard Industrial Classification (SIC) codes. Additionally, this section contains a list of the largest companies in terms of sales.

II.A. Introduction, Background, and Scope of the Notebook

The furniture and fixtures industry encompasses companies that manufacture household, office, store, public building, and restaurant furniture and fixtures. These practices correspond to the Standard Industrial Classification (SIC) code 25 created by the Bureau of the Census to track the movement of goods and services within the economy. Although it is difficult to determine the exact number of facilities that fall within SIC code 25, 1987 Census data indicate that there were approximately 11,000 furniture manufacturing facilities in operation (complete 1992 Census data were not available).

SIC 25, Furniture and Fixtures, consists of the following five three-digit industry groups:

- SIC 251 - Household Furniture
- SIC 252 - Office Furniture
- SIC 253 - Public Building and Related Furniture
- SIC 254 - Partitions, Shelving, Lockers, and Office and Store Fixtures
- SIC 259 - Miscellaneous Furniture and Fixtures.

The following discussion focuses on SIC 251 because a majority of the wood furniture manufacturing facilities fall into this SIC code and the facilities in this SIC code tend to be the most heavily regulated. The Bureau of the Census estimates that in 1992, 256,000 people were employed by the household furniture manufacturing sector (SIC 251) of the furniture industry, a decline of approximately 10 percent from 1987. The 1993 value of shipments for these firms exceeded $22 billion, representing an increase of approximately seven percent over the previous year. Sales from the household furniture manufacturing industry were expected to rise by four percent in 1994.

The household furniture manufacturing industry (SIC 251) consists of producers of wood furniture (SIC 2511), accounting for 42 percent of household furniture industry shipments in 1993; upholstered furniture (SIC 2512), accounting for 30 percent of shipments; metal furniture (SIC 2514), accounting for ten percent of shipments; and miscellaneous furniture (SIC 2517 and 2519), accounting for four percent of shipments.

This industry is comprised of the production of many different types of products including wood household furniture, metal household furniture, mattresses, machine cabinets, shelving, and lockers. Because the items produced vary greatly in design depending upon the type of material used, style, price, and final use, the different types of machinery used in the various phases of production can reach into the hundreds or even thousands. This diversity of products provides a challenge for most manufacturers.

Production lines for assembling furniture are costly, and because of this most manufacturers do not supply an exceptionally large range of items. To combat this problem, many firms specialize their production processes, allowing facilities to fill a specific niche in the market while still retaining flexibility in their manufacturing area. Manufacturers may specialize depending on the product manufactured, the product group, or the production process. Specialization has also allowed manufacturers to focus on quality by more carefully monitoring the entire production process, from raw material to finished product.

Because SIC 25 covers such a diverse group of products, much of this profile will concentrate on the wood furniture manufacturing industry as defined by the following SIC codes:

- SIC 2511 - Wood Household Furniture, Except Upholstered
- SIC 2512 - Wood Household Furniture, Upholstered
- SIC 2517 - Wood Television, Radio, Phonograph, and Sewing Machine Cabinets
- SIC 2521 - Wood Office Furniture
- SIC 2531 - Public Building and Related Furniture
- SIC 2541 - Wood Office and Store Fixtures, Partitions, Shelving, and Lockers.

All discussions on production processes and applicable regulations will be limited to activities covered by these four-digit SIC codes.

II.B. Characterization of the Wood Furniture and Fixtures Industry

The discussion of the characterization of the wood furniture and fixtures industry is divided into the following four topics: industry size and geographic distribution, profile of the top ten furniture manufacturers, characterization of products, and economic health and outlook.

II.B.1. Industry Size and Geographic Distribution

Variation in facility counts occur across data sources due to many factors, including reporting and definitional differences. This document does not attempt to reconcile these differences, but rather reports the data as they are maintained by each source.

Size Distribution

According to 1987 Census data, approximately 63 percent of household furniture manufacturing facilities (SIC 251) have fewer than 20 employees. Approximately 53 percent of facilities within this SIC code produce wood household furniture, while approximately 20 percent produce upholstered household furniture. Exhibit 1 provides a distribution by facility size for household furniture manufacturing facilities.

Exhibit 1
Facility Size Distribution of Household Furniture Manufacturers

Type of Furniture Facility	Facilities with 1 to 19 employees	Facilities with 20 to 99 employees	Facilities with 100 or more employees	Total
Wood Household SIC: 2511	2,084	573	291	2,948
Upholstered Household SIC: 2512	574	358	218	1,150
Metal Household SIC: 2514	207	123	88	418
Mattresses and Bedsprings SIC: 2515	504	282	53	839
Wood Television and Radio Cabinets SIC: 2517	44	22	14	80
Household Furniture (misc.) SIC: 2519	126	38	13	177
Total	**3,539**	**1,396**	**677**	**5,612**

Source: 1987 Census of Manufacturers Industry Series.

According to information contained in EPA's October 1991 draft guidelines for the *Control of Volatile Organic Compound Emissions from Wood Furniture Coating Operations*, approximately 86 percent of the wood furniture industry (SIC codes 2434, 2511, 2512, 2517, 2519, 2521, 2531, and 2541) have fewer than 50 employees. Approximately 37 percent of facilities in this listing are wood household furniture manufacturers, while approximately 34 percent are wood kitchen cabinet manufacturers. Exhibit 2 provides a breakdown by facility size for the wood furniture manufacturers.

Exhibit 2
Facility Size Distribution of Wood Furniture Manufacturers

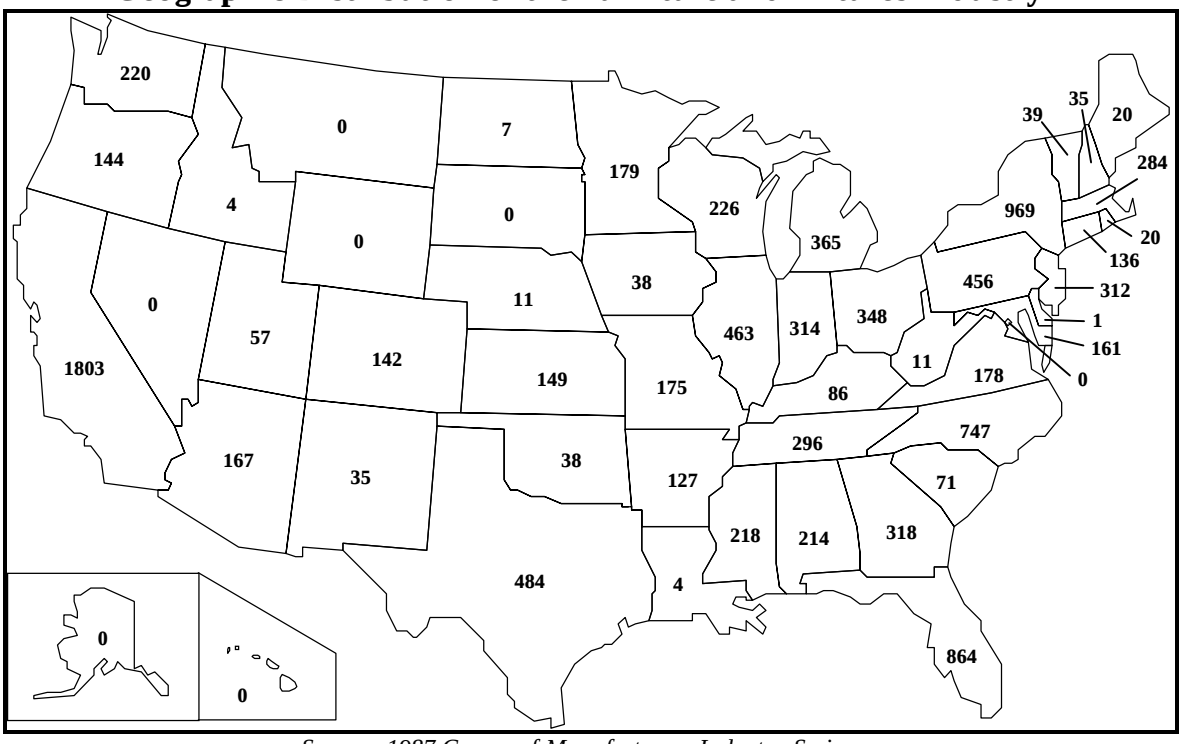
Type of Furniture Facility	Facilities with 1 to 49 employees	Facilities with 50 to 249 employees	Facilities with 250 or more employees	Total
Wood Kitchen Cabinets SIC: 2434	3,460	218	35	3,713
Wood Household Furniture, except upholstered SIC: 2511	2,466	344	138	2,948
Wood Household Furniture, upholstered SIC: 2512	782	292	76	1,150
Wood Television, Radios, Phonograph, and Sewing Machine Cabinets SIC: 2517	61	11	8	80
Household Furniture, not elsewhere classified SIC: 2519	150	22	5	177
Wood Office Furniture SIC: 2521	505	113	31	649
Public Building and Related Furniture SIC: 2531	381	95	15	491
Wood Office and Store Fixtures, Partitions, Shelving, and Lockers SIC: 2541	1,672	184	10	1,866
Total	**9,477**	**1,279**	**318**	**11,074**

Source: EPA Draft Guidelines for the Control of Volatile Organic Compound Emissions from Wood Furniture Coating Operations.

Geographic Distribution

According to 1987 Census data, of the estimated 11,000 furniture manufacturing facilities (SIC 251), approximately 17 percent are located in California. North Carolina is home to approximately seven percent of these facilities, even though four of the top ten facilities are located in this State. Exhibit 3 provides a geographic distribution of the number of furniture and fixtures manufacturers (State totals are based on the number of facilities per State with 150 or more employees in a given industry sector).

Exhibit 3
Geographic Distribution of the Furniture and Fixtures Industry

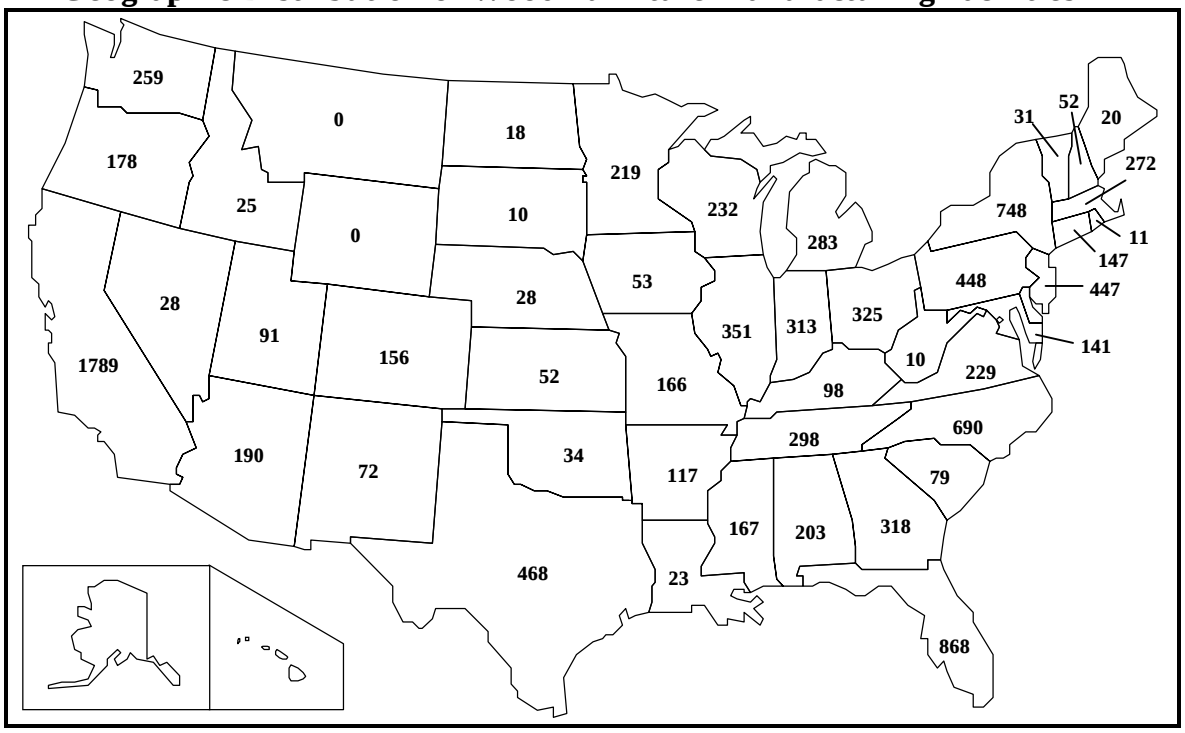


Source: 1987 Census of Manufacturers Industry Series.

Information contained in EPA's draft guidelines for the *Control of Volatile Organic Compound Emissions from Wood Furniture Coating Operations* shows that of the estimated 10,757 wood furniture manufacturing facilities (SIC codes 2434, 2511, 2512, 2517, 2519, 2521, 2531, and 2541) approximately 17 percent are located in California. Although more facilities are located in California, the largest furniture manufacturing facilities and those responsible for producing the highest volume of furniture are located in North Carolina. Exhibit 4 provides a geographic distribution of the wood

furniture manufacturing industry (information is not available for Alaska, Delaware, Hawaii, Montana, Washington D.C., and Wyoming).

Exhibit 4
Geographic Distribution of Wood Furniture Manufacturing Facilities



Source: EPA Draft Guidelines for the Control of Volatile Organic Compound Emissions from Wood Furniture Coating Operations.

According to a 1990 ranking by total annual sales of the top 300 wood furniture manufacturing facilities in Furniture Design and Manufacturing Magazine, Masco Corporation is the largest residential wood furniture manufacturer, with annual sales of $1.2 billion. Steelcase, Inc. is the largest manufacturer of wood office/institutional furniture, with annual sales of $1.8 billion. Exhibit 5 provides a breakdown of the top ten manufacturers of residential wood furniture and wood office/institutional furniture (sales figures are based on 1988 and 1989 data and are estimates in some instances).

Exhibit 5
Top Ten Wood Furniture Manufacturers - 1990

Rank	Name of Manufacturer	Annual Sales, $ million
Residential Furniture		
1	Masco Corporation	1,200
2	Interco	1,100
3	Ohio Mattress Company	700
4	La-Z-Boy Chair Company	553
5	Bassett Furniture Industries, Inc.	466
6	Ladd Furniture	450
7	Simmons USA	425
8	Thomasville Furniture Industries, Inc.	417
9	Mohasco Corporation	400
10	Klaussner Furniture Industries	250
Office/Institutional Furniture		
1	Steelcase, Inc.	1,800
2	Herman Miller, Inc.	793
3	Hanworth, Inc.	>500
4	HON Industries, Inc.	500
5	Kimball International, Inc.	475
6	Knoll International	275
7	Allsteel, Inc.	220
8	Virco Manufacturing Corporation	183
9	Westinghouse Furniture Systems	170
10	Shelby William Industries, Inc.	169

Source: Furniture Design and Manufacturing Magazine.

II.B.2. Product Characterization

The furniture and fixtures industry, as defined by SIC 25, manufactures a wide variety of products, including wood and metal furniture, mattresses, draperies, public seating (i.e. stadium seats and bleachers), lockers, and restaurant furniture. Because this profile focuses on the wood furniture portion of the industry (SIC codes 2511, 2512, 2517, 2521, 2531, and 2541), the product characterization of the profile is limited in scope. Products covered under the relevant four-digit SIC codes include wood household furniture, such as beds, tables, chairs, bookshelves; wood television and radio cabinets; wood office furniture such as cabinets, chairs, and desks; and wood office and store fixtures and partitions, such as bar fixtures, counters, lockers, and shelves.

II.B.3. Economic Trends

According to the American Furniture Manufacturers Association (AFMA), wood furniture comprises approximately 50 percent of all furniture shipments nationally. Following a steady decline beginning in 1989, the furniture industry experienced moderate increases in 1992 and 1993. This is in part attributed to the fact that private housing starts increased for the second consecutive year and the value of new residential construction rose an estimated seven percent. This rise in home sales and residential construction figures translated into a five percent increase in furniture shipments in 1993. Employment in the furniture and fixtures industry increased by two percent in 1993 following a five year decline.

Wood furniture manufacturers' profits did not rise by as much as the increased shipments would suggest. Major increases in lumber prices, over 30 percent for softwood in approximately one year, significantly gouged profits in 1993. A similar rise in hardwood prices occurred in early 1992. Although lumber prices may fluctuate mildly, they are not expected to fall to the reduced levels of 1991 or early 1992.

In 1993, wood furniture accounted for 48 percent of total furniture exports, followed by upholstered furniture (19 percent), metal furniture (10 percent), plastic furniture (four percent), and mattresses and bedsprings (three percent). Although overall U.S. household furniture exports increased five percent to $1.2 billion in 1993, imports rose more than 14 percent in the same time period. The resulting $2.3 billion furniture and fixtures industry trade deficit mimicked that of 1989. However, U.S. exports increased almost 150 percent from 1989 through 1993 while imports increased only 25 percent in the same time period. As foreign markets become increasingly important to U.S. manufacturers of household furniture, attention is being focused on international agreements to ease trade restrictions. For example, many furniture manufacturers favored the North American Free Trade Agreement (NAFTA). Under this agreement, Mexico, a major importer of American home furniture, will immediately eliminate taxes on 21 percent of all imports of U.S. household furniture, with additional reductions to follow.

The real value of U.S. shipments of household furniture is expected to increase by four percent to an estimated $23 billion in 1994 due to improvements in the economy and consumer confidence. Over the next five years, household furniture shipments are expected to increase three to five percent annually. This prediction relies primarily upon increases in product prices rather than overall furniture units produced.

III. INDUSTRIAL PROCESS DESCRIPTION

This section describes the major industrial processes within the Wood Furniture and Fixtures industry, including the materials and equipment used, and the processes employed. The section is designed for those interested in gaining a general understanding of the industry, and for those interested in the inter-relationship between the industrial process and the topics described in subsequent sections of this profile -- pollutant outputs, pollution prevention opportunities, and Federal regulations. This section does not attempt to replicate published engineering information that is available for this industry. Refer to Section IX for a list of reference documents that are available.

This section specifically contains a description of commonly used production processes, associated raw materials, the byproducts produced or released, and the materials either recycled or transferred off-site. This discussion, coupled with schematic drawings of the identified processes, provide a concise description of where wastes may be produced in the process. This section also describes the potential fate (air, water, land) of these waste products.

III.A. Industrial Processes in the Wood Furniture and Fixtures Industry

The following description of production processes focuses on the manufacturing of wood furniture. The primary input for wood furniture manufacturing is raw lumber, and the production processes include steps such as drying, sawing, planing, sanding, gluing, and finishing. Each of these activities is described below.

III.A.1. Drying

Some furniture manufacturing facilities may purchase dried lumber, but others perform drying on-site. Drying of raw lumber is accomplished by using a drying kiln or oven, fired by a boiler. According to EPA document AP-42, furniture manufacturing facilities generally burn wood waste (from later stages of the production process) in boilers to heat the drying kilns and to alleviate possible solid waste disposal problems. The following boiler firing configurations are used for burning wood waste: Dutch oven; fuel cell oven; spreader stoker; suspension-fired; and fluidized bed combustion. The primary outputs of burning wood waste in boilers are point-source emissions to the atmosphere. A more detailed

discussion of all material inputs and pollution outputs will be covered in the following section.

Types of Boilers

One common type of boiler used in smaller operations is the Dutch oven. This unit is widely used because it can burn fuels with very high moisture content. Wood waste is used as fuel and is fed into the oven through an opening in the top of a refractory-lined furnace. The fuel accumulates in a cone-shaped pile on a flat or sloping grate. Combustion is accomplished in two stages: 1) drying and gasification, and 2) combustion of gaseous products. The first stage takes place in the primary furnace, which is separated from the secondary furnace chamber by a bridge wall. Combustion is completed in the secondary chamber before gases enter the boiler section.

In the fuel cell oven, fuel is dropped onto suspended fixed grates and is fired in a pile. Unlike the Dutch oven, the refractory-line fuel cell also uses combustion air preheating and positioning of secondary and tertiary air injection ports to improve boiler efficiency. Because of their overall design and operating similarities, fuel cell and Dutch oven boilers have comparable emission characteristics.

The most common firing method employed for wood-fired boilers larger than 45,000 kg/hr steam generation rate is the spreader stoker. With this boiler, wood enters the furnace through a fuel chute and is spread either pneumatically or mechanically across the furnace, where small pieces of the fuel burn while in suspension. Simultaneously, larger pieces of fuel are spread in a thin, even bed on a stationary or moving grate. The burning is accomplished in three stages in a single chamber: 1) moisture evaporation; 2) distillation and burning of volatile matter; and 3) burning of fixed carbon. This type of operation has a fast response to load changes, has improved combustion control, and can be operated with multiple fuels. Natural gas or oil is often fired in spreader stoker boilers as auxiliary fuel. This is done to maintain constant steam when the wood waste supply fluctuates and to provide more steam than can be generated from the wood waste alone.

The suspension-firing boiler can be used for wood combustion, and differs from a spreader stoker in that small-sized fuel (normally less than 2 mm) is blown into the boiler and combusted by supporting it in air rather than on fixed grates. Rapid changes in combustion rate, and

therefore steam generation rate, are possible because the finely divided fuel particles burn very quickly.

A recent development in wood firing is the fluidized bed combustion boiler. A fluidized bed consists of inert particles through which air is blown so that the bed behaves as a fluid. Wood waste enters in the space above the bed and burns both in suspension and in the bed. Because of the large thermal mass represented by hot inert bed particles, fluidized beds can handle dirty fuels (up to 30 percent inert material). Wood fuel is burned faster in a fluidized bed than on a grate due to its immediate contact with hot bed material. As a result, combustion is rapid and results in nearly complete combustion of the organic matter, minimizing unburned organic compound emissions.

III.A.2. Machining

Once the lumber is dried, it is sawed into a shape of the approximate dimensions of the final furniture part, such as a table leg or a chair rung. Sawing across the grain in called crosscutting, and sawing parallel with the grain is referred to as ripping. Types of power saws used in furniture manufacturing include circular saws, band saws, scroll saws, radial saws, and portable handsaws.

After sawing, the surfaces of the wood which will be flat in the final product are planed. Planing involves shaving one surface of wood by using a wide edged blade or blades called a planer. The type of power planer usually used in this manufacturing process is the jointer or jointer planer, which consists of blades fastened to a rotating cutterhead. The primary outputs from the sawing and planing processes are wood chips.

The design of some furniture pieces requires that certain wooden parts be bent. This production step follows the planing process and usually involves the application of pressure in conjunction with a softening agent and increased atmospheric pressure. While soaking wood in water alone does increase its plasticity, the combination of heat and steam does increase further the plasticity of wood. The actual bending is accomplished by compressing the wood into the desired shape and then drying it to remove excess moisture. Drying after bending is accomplished in much the same way as the drying of raw lumber, in drying kilns using boilers to generate heat.

III.A.3. Assembly

Wood furniture can either be finished (coated) and then assembled, or assembled and then finished. Residential and office/institutional furniture manufactured in the U.S. is generally made up of irregularly shaped, curved components, and for ease of production is assembled and then finished. Cabinets manufactured in the U.S., however, are frequently finished before assembly.

After the wood parts have been planed and, if necessary, bent, they are assembled to form one furniture part, such as a tabletop. The assembly process usually involves the use of adhesives (either synthetic or natural) in conjunction with other joining methods, such as nailing. The wood furniture manufacturing industry uses adhesive formulations containing solvents (typically used for upholstered wood furniture) and hot melts or polyvinyl acetate (typically used for non-upholstered wood furniture). According to a representative of Masco Corporation, the vast majority of adhesives used to assemble non-upholstered wood furniture are hot melts or polyvinyl acetate. The amount of adhesives used depends on the type of product.

The next step in the production process is the application of veneer. Veneer is a thin piece of wood of uniform thickness which is usually rotary-cut from a bolt of wood using a lathe. Not all furniture manufacturing involves the application of veneer. The production of veneer falls under SIC code 24 (lumber and wood products). The veneer is applied to the furniture part using adhesives, some of which require the use of heat and/or pressure. While not a significant source of releases, gluing operations and the use of adhesives for assembly and veneer are a source of atmospheric solvent releases.

After veneer application or furniture assembly, the furniture part is sanded to ensure that its surface is as smooth as possible for the finishing stages of the production process. Sanding is usually accomplished by a disk, belt, or roller sanding machine using either open- or closed-coated sand paper. For open-coated sand paper, approximately 50 to 70 percent of the paper surface is coated with abrasive. For closed-coated sand paper, the paper surface is completely covered with abrasive. Closed-coated sand paper is generally used in operations requiring higher removal rates. The sanding process can also be employed at other stages of the production process, such as prior to the application of veneer or between the application of several coats of varnish during the finishing process. The primary outputs from sanding are wood particulates.

III.A.4. Pre-finishing

After initial sanding, an even smoother surface is attained by spraying, sponging, or dipping the furniture part with water, which causes the fibers of the wood to swell and "raise." After the surface is dried, a solution of glue or resin is applied and allowed to dry, causing the raised fibers to become more brittle. The raised fibers are then sanded down to form a particularly smooth surface. The primary outputs from second sanding are wood and glue or resin particulates.

Because certain types of wood contain rosin (a naturally occurring resin) which can interfere with the effectiveness of certain finishes, a process known as derosination may be employed. Derosination is accomplished by applying a mixture of acetone and ammonia to the surface of the wood. Spent acetone and ammonia are the primary outputs from derosination.

Once the unwanted rosin is removed from the wood, a process known as bleaching is used to lighten the color of the wood when the natural color is darker than that of the stain or finish to be applied. The process entails spraying, sponging, or dipping the wood into a bleaching agent, such as hydrogen peroxide. Spent bleaching agents are the primary outputs of this step of the production process.

III.A.5. Coating Application

There are various coating application techniques used by the wood furniture manufacturing industry for applying finishing coatings. The two principal methods are flatline finishing and spray application. Flatline finishing is used only to coat truly flat furniture parts and cannot be used for curved pieces, preassembled pieces, or pieces with many recesses. Although, spray application is the most commonly-used method to finish these furniture parts, brushing and dipping can also be used.

The two principal ways of performing flatline finishing are roll coating and curtain coating. Roll coating involves the transfer of coating material by a roller or series of rollers, while curtain coating involves passing the furniture part through a cascade, or curtain, of coating material.

The methods used to spray apply coatings include air, airless, air-assisted airless, high-volume low-pressure (HVLP), electrostatic, and the UNICARB® spray system. The conventional air spray technique uses compressed air to atomize the coating materials as they are being sprayed, by forcing them through a small opening at high pressure. The liquid coating is not mixed with air before exiting the nozzle. Air-assisted airless spray uses an airless spray unit with a compressed air jet to finalize the breakup of the coating material.

HVLP spraying involves the use of a high volume of air delivered at low pressure to atomize the coating material into a pattern of low-speed particles. The use of low pressure can result in decreased overspray, which translates into less coating usage and less volatile organic compound (VOC) emissions.

Electrostatic spraying has long been used in the metalworking and automobile industries to coat metal products. In the wood furniture industry, electrostatic spraying has somewhat limited use, mostly by cabinet and chair manufacturers. This finishing process is performed by spraying negatively-charged coating particles onto positively-charged wood products. If the wood piece has a sufficient moisture content, it can be electrostatically sprayed without pretreatment. However, some wood must be pretreated to allow the piece to hold a positive charge. The material used for pretreatment often contains VOCs.

The UNICARB® system is a relatively new system for spray coating developed by Union Carbide. A coating normally contains both coalescing (slow-evaporating) and diluent (fast-evaporating) solvents. The UNICARB® technology replaces the diluent solvents with liquid carbon dioxide. The carbon dioxide/coalescing solvent coating mixture is used to coat the wood with an airless spray gun. When the coating leaves the spray nozzle, the carbon dioxide in the mixture immediately flashes, and the coating material, which still contains coalescing solvents, continues enroute to the piece and cures in the conventional way. As of June 1991, the UNICARB® system was being tested in several coatings applications, but was not yet being used commercially in any production coating operation.

III.A.6. Finishing

The finishing of wood furniture can be subdivided into two different categories, interior finishing (furniture for indoor use) and exterior finishing (furniture for outdoor use), although the actual production processes involved are fairly similar. The main difference between interior and exterior finishing is the type of coating material applied, not the application processes. The following discussion outlines the production processes involved in interior finishing; exterior finishing will be mentioned only when the process differs from that of interior finishing.

Wood finishing processes include coating, drying, and sanding the furniture in a series of steps which are repeated until the desired final appearance is achieved. While in small facilities the assembled furniture is sometimes moved between finishing stations manually, in most facilities the furniture is moved along the finishing line mechanically by tow-lines, overhead chain conveyors, and other conveyors including belt, roller, and slat conveyors. Tow-lines, chains or cables mounted in or on the floor, move a pallet, on which the assembled piece of furniture rides along the finishing line. The pallets can rotate and can be automatically disengaged from and reengaged to the tow-line to allow for pauses, as needed. Some facilities move the furniture on pallets that are hung from overhead chain conveyors. Many facilities use a combination of these methods to transport the furniture along the finishing line.

Many of the finishing application methods use relatively high concentrations of VOCs which volatilize when the coating is applied. For example, solvents are used in the stains, paints, and finishes as well as in the inks used to print simulated wood grain onto plywood and particleboard. In addition, solvents are used in cleanup operations (i.e., to remove overspray from spray booths and to rinse solvent-based finishes from spray lines and equipment between color changes). The primary outputs from the following finishing applications are point-source and fugitive air emissions, as well as wood and coating material particulates.

Staining involves the application of a clear colorant which adds initial color, evens out color, and accents without hiding the natural wood grain. Stains usually consist of transparent or semitransparent color solids (typically less than five percent by volume) suspended in a volatile liquid solution with a certain amount of a nonvolatile binder, which facilitates spreading, penetration, and fixation of color.

Commonly-used stains, all of which are used in conjunction with organic solvents, include: nongrain-raising, dye-type, no-wipe, and toners.

Nongrain raising stains are dye-type stains which are intended to give clarity and depth to the wood finish. Dye-type stains consist of dyes that are completely dissolved in methanol. No-wipe stains are pigmented stains, containing a small amount of oil, pigment, and solvent, that are sprayed on and not wiped off. No-wipe stains are used to accent the wood grain, provide color uniformity and color retention. Toners are stains that contain nitrocellulose or vinyl binders, dissolved in solvent. Toners are not wiped, and are often pigmented.

After staining, a washcoat, consisting of 2 to 13 percent solids by volume, is applied to the furniture piece. Washcoating is used to aid in adhesion, assist in filling or color uniformity, and partially seal the wood from subsequent staining operations. Washcoat also prepares the wood surface for another sanding after stain application. Some facilities buy sealer in bulk, and dilute their sealer to make washcoat. There are three main types of washcoat materials: standard nitrocellulose; vinyl or modified vinyl; and vinyl-modified/"conversion" types. Advantages of nitrocellulose washcoats include quick drying, easy sanding, and clarity. Vinyl and vinyl-modified washcoats consist of nitrocellulose and vinyl and provide better toughness and adhesion than pure nitrocellulose washcoats; however, some clarity is sacrificed. The "conversion" or precatalyzed-type washcoats also provide good adhesion and toughness, and are good for open pore woods. Because they react in place, they are impervious to solvents contained in subsequently applied sealers and topcoats.

Fillers are applied to the wood surface to produce a smooth, uniform surface for later stages in the finishing process. Fillers, which consist of colorless or covering pigments, can be combined with stains or other pigments and are usually dispersed in a vehicle of drying oils, synthetic resins, and thinners based on organic solvents. Fillers are usually supplied as heavily pigmented, high-solids, low-VOC materials, which are reduced on the job. As supplied, solids contents of fillers are in the 75 percent solids by volume range. Once reduced, the solids contents usually range from 10 percent to 45 percent by volume. Fillers are usually spray applied, then wiped into the wood.

Sealing, which is completed after staining and either before or after filling, consists of applying one or many coats of sealer. Sealers are usually a nitrocellulose-based lacquer, although vinyl or vinyl-modified sealers and catalyzed sealers are also available and provide advantages similar to those of the washcoat counterparts. The primary purposes of sealers are to provide adhesion, make sanding more effective, and to seal the wood and establish a foundation for further coating applications. Solids contents of sealers typically range from ten to 30 percent by volume.

For outdoor furniture, instead of, or in addition to, the filling and sealing processes, the wood surface is treated through a process known as priming. Priming treatments commonly used for outdoor wooden furniture include the application of fungicide and water-repellent.

One alternative to staining is painting. The process for applying paints is similar to that of applying stains or other finishes, although the chemical composition of paints differs from the other finishes. Paint is a viscous fluid, usually consisting of a binder or vehicle, a pigment, a solvent or a thinner, and a drier. Pigments are insoluble in the coating material and are deposited onto the wood surface as the vehicle dries. The chemical composition of a pigment varies according to its color as illustrated in Exhibit 6.

Exhibit 6
Chemical Components of Pigments Found in Paint

Pigment Color	Chemical Components
White	Titanium dioxide, white lead, zinc oxide
Red	Iron oxides, calcium sulfate, cadmium selenide
Orange	Lead chromate-molybdate
Brown	Iron oxides
Yellow	Iron oxides, lead chromate, calcium sulfide
Green	Chromium oxide, copper, phosphotungstic acid, phosphomolybdic acid
Blue	Ferric ferrocyanide, copper
Purple	Manganese phosphate
Black	Black iron oxide

Source: McGraw-Hill Encyclopedia of Science and Technology, 1987.

After the furniture part has been stained or painted, a topcoat, such as varnish or shellac, is applied in one of the final stages of the finishing process. Topcoats provide a clear coat whose function is to protect the

color coats, enhance the beauty of the furniture, and provide a durable final finish. Typical solids contents range from 13 to 30 percent solids by volume. There are four categories of topcoats: standard nitrocellulose topcoats; acrylic topcoats; catalyzed topcoats; and conversion varnishes.

Nitrocellulose lacquers provide the best clarity, pick up little dirt, dry quickly, and are easy to wipe off and repair. Acrylic lacquers are used over white or pastel finishes as protection from common household cleaning products. They can also be applied over nitrocellulose topcoats for color retention. The clarity of acrylic lacquers is not as good as the nitrocellulose lacquers. Catalyzed topcoats are available in one- and two-pack form. The one-pack coatings are precatalyzed, and contain nitrocellulose resins and a small amount of urea resin. Because only a small amount of catalyst is added, it can take up to three to four weeks after application until the coating is completely cured, although it dries to the touch much sooner. The shelf life of precatalyzed coatings is more than six months. Conversion varnishes do not dry as quickly as nitrocellulose topcoats, and are difficult to spot repair, with washoff also being difficult or impossible. Conversion varnishes, like two-pack coatings, have a limited pot life.

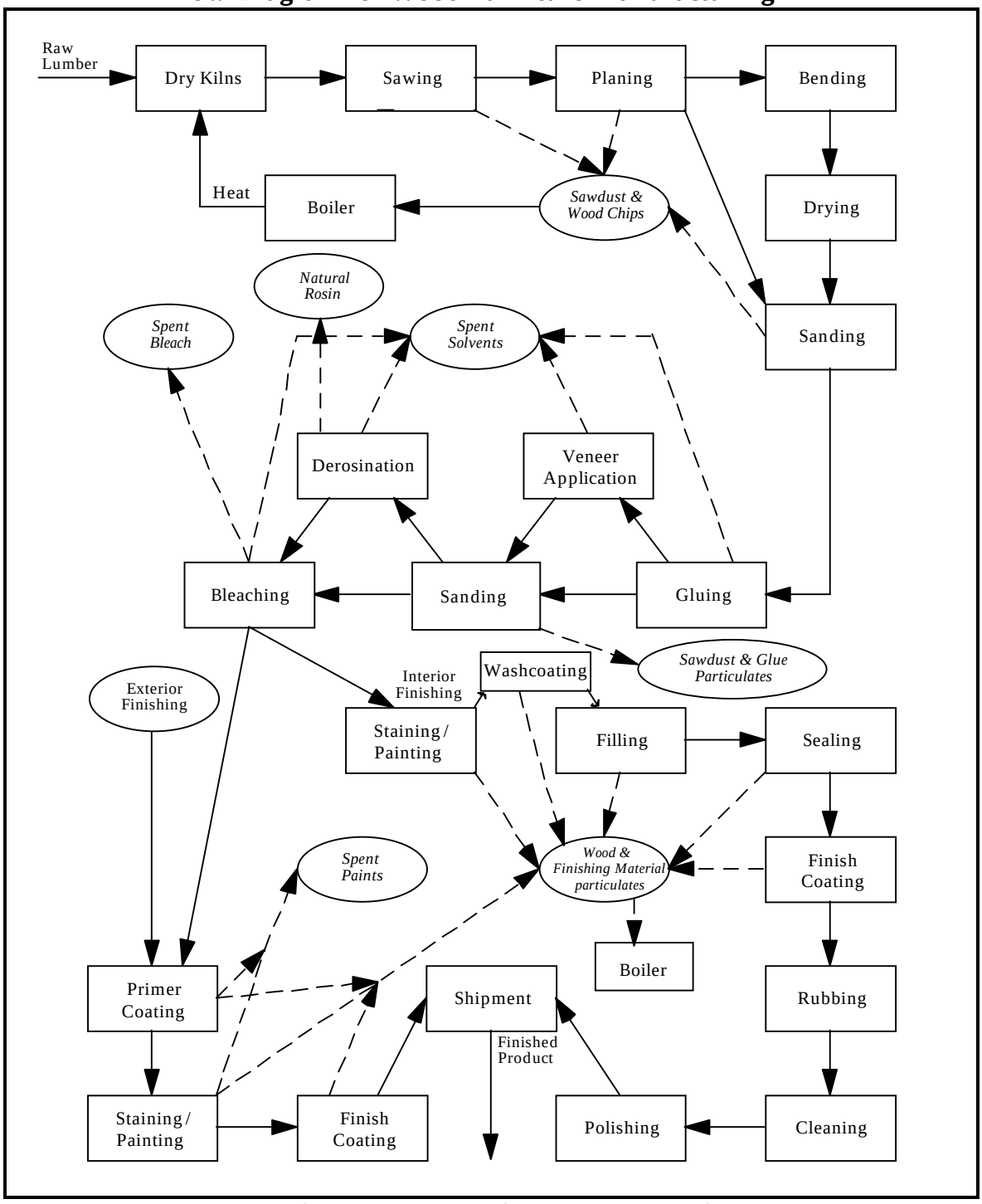
The two-pack coatings consist of two packs, one containing urea or melamine-based resins, and the other containing the catalyst. The two components are mixed before use. More catalyst is added to two-pack catalyzed coatings, so cure time is short (on the order of minutes or hours). Two-pack catalyzed coatings have a limited pot life after mixing (from one day to more than a week).

In the U.S., lacquers (mostly nitrocellulose-based) are used by approximately 75 percent of the wood furniture industry; mostly by residential furniture manufacturers. Nitrocellulose lacquers have been used in the residential wood furniture industry for many years; they are easy to use, quick drying, and easy to repair.

Approximately 15 percent of the wood furniture industry, primarily the cabinet and office/institutional furniture manufacturers, use conversion coatings (mostly acid-catalyzed coatings). Cabinets and office/institutional furniture require the chemical and mechanical resistance offered by catalyzed finishes. As of October 1991, polyurethane and unsaturated polyester and unsaturated polyacrylate coatings have had limited use in the United States.

Rubbing, polishing, and cleaning are the final steps of the production process. Rubbing consists of the application of an abrasive in conjunction with a lubricant to level or dull the luster. Polishing consists of the application of soft abrasives or possibly only waxy ingredients to increase the gloss. The furniture parts are then ready for shipment and sale after a final assembly stage, if appropriate (i.e., attaching table legs to a table top). Exhibit 7 illustrates the steps of the wood furniture manufacturing process.

Exhibit 7
Flow Diagram for Wood Furniture Manufacturing



Source: Process Flow Diagram for Franklin Furniture of Greeneville, Tennessee found in Pollution Prevention Options in Wood Furniture Manufacturing, 1992.

III.B. Raw Material Inputs and Pollution Outputs

The following discussion of raw material inputs and pollution outputs is organized along the same lines as the production process description. While there are solid waste and process wastewater implications for the wood furniture manufacturing industry, the vast majority of outputs from this industry are air emissions resulting from the solvent-intensive finishing operations.

III.B.1. Drying

The major emissions of concern from drying the raw lumber using wood boilers is particulate matter (PM), although other pollutants, particularly carbon monoxide (CO) and organic compounds, may be emitted in significant quantities if the boiler is in poor operating condition. The type and amount of the emissions depend on a number of variables, including the composition of the waste fuel burned, the degree of fly ash reinjection employed, and furnace design and operating condition.

The composition of wood waste depends largely on the industry from which it originates. Furniture manufacturing generates a clean, dry wood waste (e.g., 2 to 20 weight percent moisture) which produces relatively low particulate emission levels when properly burned. However, other operations, such as pulp manufacturing, produce great quantities of bark which may contain a much higher weight percent moisture, possibly causing bark boilers to emit considerable particulate matter to the atmosphere unless they are well controlled.

Furnace design and operating conditions are particularly important when firing wood waste. Because of the high moisture content that may be present in wood waste, a larger than usual area of refractory surface is often necessary to dry the fuel before combustion. In addition, sufficient secondary air must be supplied over the fuel bed to burn the volatiles that account for most of the combustible material in the waste. When proper drying conditions do not exist, or when secondary combustion is incomplete, the combustion temperature is lowered, and increased PM, CO, and organic compound emissions may result. Short-term emissions can fluctuate with significant variations in fuel moisture content.

Fly ash reinjection, which is commonly used with larger boilers to improve fuel efficiency, has a considerable effect on PM emissions.

Because a fraction of the collected fly ash is reinjected into the boiler, the dust loading from the furnace and, consequently, from the collection device increase significantly per unit of wood waste burned. More recent boiler installations typically separate the collected particulate into large and small fractions in sand classifiers. The smaller particles, mostly inorganic ash and sand, are sent to ash disposal.

The four most common control devices used to reduce PM emissions from wood-fired boilers are mechanical collectors, wet scrubbers, electrostatic precipitators (ESPs), and fabric filters.

Fabric filters (i.e., baghouses) and ESPs are employed when collection efficiencies above 95 percent are required. However, fabric filters have had limited applications to wood-fired boilers. The principle drawback to fabric filtration, as perceived by potential users, is a fire danger arising from the collection of combustible carbonaceous fly ash. Steps can be taken to reduce this hazard, including the installation of a mechanical collector upstream of the fabric filter to remove large burning particles of fly ash.

Emissions of nitrogen oxides (NO_X) from wood-fired boilers are lower than those from coal-fired boilers due to the lower nitrogen content of wood and the lower combustion temperatures which characterize wood-fired boilers.

According to the AFMA document *Integrated Waste Management Program Applicable to the On-site Management of Certain Non-hazardous Wood Product Finishing Wastes,* dated May 1993, the operating temperatures of boilers used by this industry are sufficient to adequately combust the chemical constituents of wood product finishing waste (i.e., sawdust mixed with dust from the various coating materials used in furniture finishing operations such as dried lacquer chips). Based on its interpretation of hazardous waste as defined in 40 CFR 261.21(a)(2), the AFMA determined that wood product finishing waste was acceptable for combustion in a boiler. The State of North Carolina Department of Environment, Health, and Natural Resources initially disagreed with this interpretation. However, according to the AFMA, the Director of the Division of Solid Waste Management, in a March 9, 1994 meeting, approved the AFMA's interpretation.

III.B.2. Machining

The primary outputs from the sawing and planing processes are wood chips and sawdust, which are used as fuel in boilers for other furniture production processes. Wood chips may also be sold to manufacturers of other wood-based products, such as pulp and paper mills. Because no coating materials have been applied to the furniture prior to machining, the particles are almost completely composed of wood, unlike outputs from later sandings which contain particles of finishing material as well as wood particles.

III.B.3. Assembly

Adhesives can be either natural or synthetic in origin and typically contain solvents. Commonly used adhesive formulations contain solvents such as methyl isobutyl ketone, methyl ethyl ketone, xylene, toluene, and 1,1,1-trichloroethane. Solvents are also used to clean adhesive application equipment such as spray guns. Adhesives used to apply veneer can differ from adhesives used for assembly and usually include phenolics, ureas, melamines, polyvinyl resin emulsions, hot melts, contacts, and mastics. Application of some of the above-mentioned adhesives requires the use of heat and/or pressure. Solvent release from the use of adhesives during assembly and veneer application (either as a product carrier or cleaning agent) can be significant.

According to a representative of Masco Corporation, the wood furniture industry primarily uses hot melts or polyvinyl acetate which do not contain volatile organic compounds and therefore have little or no emissions implications. Wood chips and sawdust are outputs of the sanding performed after the assembly and application of veneer.

III.B.4. Pre-finishing

Typical outputs of the pre-finishing steps of the manufacturing process are spent solvents from the derosination process and spent bleaching agents from the bleaching process. Derosination entails the application of ammonia and acetone to remove the natural resin in the wood. The outputs from this step are, therefore, spent ammonia and acetone, as well as any of the naturally-occurring resin removed by this process. Bleaching agents typically used by the wood furniture industry include hydrogen peroxide, sodium bisulfite, sodium

hyposulfite, sodium perborate, oxalic acid, potassium permanganate, and sodium or calcium hypochlorite.

III.B.5. Coating Application

In the wood furniture industry, coatings are usually applied in spray booths, using various types of spray application equipment. The booths generally do not have any temperature or humidity control, and are maintained at ambient conditions. Often, both manual and automatic spray booths are equipped with dry filters, typically a paper material, to control particulates. In the past, water curtains had been used to control particulates. However, since the spent water had to be disposed of as a hazardous waste, and as hazardous waste disposal costs increased, the cost effectiveness of water curtain filtration decreased. Therefore, most of the new and modified spray booths in the wood furniture industry that use filters are equipped with dry filters. Some water-wash spray booths are still in use.

Recirculating a portion of the exhaust from the spray booth increases the concentration of VOCs in the exhaust air leaving the spray booth and discharged to an end-of-pipe control system. According to a document entitled *Demonstration of Paint Spray Booth Air Recirculation and Flow Partitioning: Design Validation,* the concept of recirculation was patented by John Deere Corporation in 1979, but a large segment of the coating industry mistakenly believed that this practice was prohibited by OSHA regulations. During approved recirculation practices, equal portions of fresh air and recirculated air are pumped back into the booth. One advantage of using recirculation is the decreased exhaust flow volume emitted to the atmosphere and decreased capitol and operating costs of the VOC control system. A joint EPA and U.S. Air Force research and development program developed these emissions control concepts for hazardous air pollutants (HAPs).

There are two types of add-on control devices, technologies used to capture pollutants from point-source air emissions: combustion control devices and recovery devices. Combustion control devices are used to destroy contaminants, converting them primarily to carbon dioxide and water. Combustion control devices used by the furniture industry include thermal incineration, with recuperative and regenerative heat recovery, and catalytic incineration.

Recovery devices are used to collect VOCs prior to their final disposition. One recovery device is carbon adsorption used in conjunction with regeneration of the carbon bed by steam or hot air. By using either steam or hot air, the VOCs may be recovered or disposed of following regeneration.

Thermal incineration is a process by which waste gas is brought to adequate temperature, and held at that temperature for a sufficient time for the organic compounds in the waste gas to oxidize.

Catalytic incineration is comparable to thermal incineration in that VOCs are heated to a temperature sufficient for oxidation to occur. However, with catalytic incineration, the temperature required for oxidation is considerably lower than that required for thermal incineration because a catalyst is used to promote oxidation of contaminants. Platinum is the most widely used catalyst; palladium is also commonly used. Because the metals used as catalysts are expensive, only a thin film is applied to the supporting substrate. A commonly used substrate is ceramic.

III.B.6. Finishing

The primary outputs of the finishing steps of the manufacturing process include solvent emissions to the atmosphere, as well as spent solvents, and particles of wood and coating materials applied to the furniture. Solvents or thinners typically used in paints include toluene or xylene. Rubbing and polishing, performed after finishing, require the use of materials containing lubricants, such as detergents and petroleum-based thin oils, and abrasives, such as pumice, tripoli, and diatomaceous earth. Because wood furniture finishing is a solvent-intensive process, the primary outputs are spent solvents and solvent emissions.

Flashoff areas are areas that are either between spray booths, or between a spray booth and an oven, in which solvent is allowed to volatilize from the coated piece. While some flashoff areas have forced air circulation and are referred to as forced-flashoff areas, most flashoff areas do not have a separate exhaust. The length of flashoff areas varies significantly by facility, and even within a facility, depending on whether the coating will be cured in an oven. A flashoff area that is not followed by an oven is often longer than one that is located in between a booth and an oven.

Ovens are used between some coating steps to cure the coating prior to the next step in the finishing sequence. Many types of ovens are used in the wood furniture industry. Most are steam-heated using either a wood- or coal-fired boiler; others are gas-fired. Infrared or ultraviolet ovens are also used, but their use in the wood furniture industry is limited at this time. Oven temperatures can range from less than 38 to 121 degrees Celsius depending on the type of coating used, the piece being coated, and the oven residence time. The exhaust rate from ovens also varies, and can range between 21.2 and 425 cubic meters per minute.

Exhibit 8 contains the relative VOC emissions for three different model plants: a residential furniture manufacturing facility using a long finishing sequence (consisting of a total of three or more stain applications; a single application of wash coat, filler, sealer, and highlight; and two or three topcoat applications); a residential furniture manufacturing facility using a short finishing sequence (consisting of two stain applications, one application of washcoat and sealer, and two topcoat applications); and an office/cabinet manufacturing facility using a short finishing sequence (consisting of one application of stain, sealer, and topcoat). The relative VOC emissions are presented as a percent of each coating applied for each model plant.

Exhibit 8
Relative VOC Emissions

Type of plant	Furniture long	Furniture short	Office/cabinet
Stain	26 percent	28 percent	32 percent
Washcoat	4 percent	4 percent	---
Filler	3 percent	---	---
Wiping stain/glaze	8 percent	---	---
Sealer	18 percent	32 percent	32 percent
Highlight	1 percent	---	---
Topcoat	40 percent	36 percent	36 percent
Total	**100 percent**	**100 percent**	**100 percent**

Source: EPA Draft Guidelines for the Control of Volatile Organic Compound Emissions from Wood Furniture Coating Operations.

III.B.7. Cleanup Operations

Solvent-borne nitrocellulose lacquers are the predominant type of coatings used by the wood furniture industry today. The resins in such coatings are relatively "difficult" to dissolve, so a high-solvency-rated solvent must be used in their formulation. Similarly, thinning of these coatings requires the use of the same solvent or one with equivalent solvency. This solvent is generically referred to as "lacquer thinner." The current practice is to use lacquer thinner for both incidental thinning of premixed coatings and for cleanup of the coatings. Advantages of the lacquer thinner include its compatibility with the finishing materials and the ease with which it removes cured nitrocellulose lacquers.

In wood-coating operations, industrial solvents are used predominantly for cleaning application equipment. In addition, cleanup solvent can also be used to clean out piping, clean booths and rails, strip cured coatings from wood parts or machinery, and periodically clean centralized coating storage and distribution (pump room) equipment.

Application equipment must be cleaned every time there is a color change, and usually before the equipment is to be idle for a period of time (e.g., at the end of the day). For spray coating application, equipment cleaned with solvents includes spray guns, feed lines, and coating reservoirs (where applicable). In the case of roll coating operations, the rollers and spray bar nozzles must be cleaned periodically to maintain application quality as well as prior to color changes.

Spray guns have traditionally been cleaned by sending pure solvent from the coating reservoir through the gun, and atomizing the solvent into the booth ventilation system. Recognizing that this results in significant emissions of solvent, some operators cut off the atomizing air to the spray gun and pump the cleanup solvent through the gun into a container. This procedure can work if the gun is the type that does not depend on the flow of the atomizing air to pump the coating (or cleanup solvent) through the mechanism. Alternately, cleanup may involve soaking the entire gun in solvent. This guards against the possibility that small amounts of coating inadvertently missed during the cleaning will cure and clog the small orifices of the gun. Cleanup solvent is often reused within a facility, and eventually recycled in-house or sent out for recycling/disposal. Exhibit 9 provides an

overview of the material inputs and pollution outputs for each step of the wood furniture manufacturing process.

Exhibit 9
Inputs and Outputs of Wood Furniture Manufacturing Facilities

Process	Material Input	Air Emissions	Process Wastes	Other Wastes
Drying				
Ovens / Drying Kilns (boilers covered below)	Raw lumber	Emissions, including water and possible chemicals used in pretreatment of raw lumber		
Machining				
Sawing / Planing / Sanding	Dried lumber	Wood chips, sawdust	Wood chips, sawdust	Wood chips, sawdust
Bending / Drying (boilers covered below)	Lumber	Emissions, including water and possible chemicals used in pretreatment of raw lumber		
Assembly				
Gluing / Veneer Application	Hot melts, polyvinyl acetate, solvent-based adhesives (e.g., methyl isobutyl ketone, methyl ethyl ketone, xylene, toluene, 1,1,1-trichloroethane)	Solvent emissions (e.g., methyl isobutyl ketone, methyl ethyl ketone, xylene, toluene, 1,1,1-trichloroethane)		Spent solvent-based adhesives (e.g., methyl isobutyl ketone, methyl ethyl ketone, xylene, toluene, 1,1,1-trichloroethane)
Sanding	Assembled furniture	Wood chips, sawdust	Wood chips, sawdust	Wood chips, sawdust
Pre-finishing				
Watering / Sanding	Assembled furniture, water, adhesives, resins		Wood chips, sawdust, adhesive, and resin particles	Wood chips, sawdust, adhesive, and resin particles
Derosination	Ammonia, acetone	Solvent emissions (e.g., acetone)	Spent acetone, ammonia, natural resin from wood	Spent acetone, ammonia, natural resin from wood

Exhibit 9 (cont'd)
Inputs and Outputs of Wood Furniture Manufacturing Facilities

Process	Material Input	Air Emissions	Process Wastes	Other Wastes
Pre-finishing (continued)				
Bleaching	Bleaching agents (e.g., hydrogen peroxide, sodium bisulfite, sodium hyposulfite, sodium perborate, oxalic acid, potassium permanganate, sodium or calcium hypochlorite)		Spent bleaching agents (e.g., hydrogen peroxide, sodium bisulfite, sodium hyposulfite, sodium perborate, oxalic acid, potassium permanganate, sodium or calcium hypochlorite)	Spent bleaching agents (e.g., hydrogen peroxide, sodium bisulfite, sodium hyposulfite, sodium perborate, oxalic acid, potassium permanganate, sodium or calcium hypochlorite)
Finishing				
Staining	Mineral spirits, alcohol, solvents, pigments (e.g., iron oxides, lead chromate, calcium sulfate, cadmium selenide)	Solvent emissions		Pigment wastes (e.g., iron oxides, lead chromate, calcium sulfate, cadmium selenide), solvent wastes
Washcoating	Nitrocellulose-based lacquers, acrylic lacquers, varnish, shellac, polyurethane, solvents	Solvent emissions		Spent solvents, nitrocellulose-based lacquers, acrylic lacquers, varnish, polyurethane, and shellac
Filling	Pigments (e.g., iron oxides, lead chromate, calcium sulfate, cadmium selenide), stains, drying oils, synthetic resins, solvent-based thinners	Solvent emissions		Spent solvents, stains, drying oils, synthetic resins, thinners, and pigments (e.g., iron oxides, lead chromate, calcium sulfate, cadmium selenide)

Exhibit 9 (cont'd)
Inputs and Outputs of Wood Furniture Manufacturing Facilities

Process	Material Input	Air Emissions	Process Wastes	Solid Wastes
Finishing (continued)				
Sealing	Nitrocellulose-based lacquers, acrylic lacquers, varnish, shellac, solvents, polyurethane	Solvent emissions		Spent solvents, nitrocellulose-based lacquers, acrylic lacquers, varnish, shellac, polyurethane
Priming	Fungicide, water-repellent			
Painting	Toluene, pigments (e.g., titanium dioxide, iron oxides, lead chromate), epoxy-ester resins, aromatic hydrocarbons, glycol ether, halogenated hydrocarbons, vinyl acetate, acrylic	Solvent emissions (e.g., toluene)		Spent solvents (e.g., toluene), pigments (e.g., titanium dioxide, iron oxides, lead chromate), epoxy-ester resins, aromatic hydrocarbons, glycol ether, halogenated hydrocarbons, vinyl acetate, acrylic
Topcoat Application	Denatured alcohols, resins, shellac, petroleum distillates, toluene, disocyanate	Solvent emissions (e.g., toluene)		Spent denatured alcohols, resins, shellac, petroleum distillates, toluene, disocyanate
Sanding (occurs intermittently between each of the above finishing applications)	Finished piece of furniture	Particles that include wood, adhesive, resin, nitrocellulose lacquer, paint, stain, filler, and sealer	Particles that include wood, adhesive, resin, nitrocellulose lacquer, paint, stain, filler, and sealer	Particles that include wood, adhesive, resin, nitrocellulose lacquer, paint, stain, filler, and sealer
Rubbing / Polishing	Lubricants, detergents, petroleum-based thin oils, pumice, tripoli, diamaceous earth			Spent lubricants, detergents, oils

Exhibit 9 (cont'd)
Inputs and Outputs of Wood Furniture Manufacturing Facilities

Process	Material Input	Air Emissions	Process Wastes	Solid Wastes
Cleanup Operations				
Brush Cleaning / Spray Gun Cleaning	Acetone, toluene, petroleum distillates, methanol, methylene chloride, isopropanol, mineral spirits, alcohols	Solvent emissions (e.g., acetone, toluene, methanol, methylene chloride)	Spent solvents (e.g., acetone, toluene, methanol, methylene chloride), mineral spirits, alcohols, petroleum distillates	Spent solvents (e.g., acetone, toluene, methanol, methylene chloride), mineral spirits, alcohols, petroleum distillates
Boilers				
Boilers	Wood and coating material particulates from the finishing process	Boiler ash particulates		Boiler ash

Source: Pollution Prevention Options in Wood Furniture Manufacturing, 1992.

III.C. Management of Chemicals in Wastestream

The Pollution Prevention Act of 1990 (EPA) requires facilities to report information about the management of TRI chemicals in waste and efforts made to eliminate or reduce those quantities. These data have been collected annually in Section 8 of the TRI reporting Form R beginning with the 1991 reporting year. The data summarized below cover the years 1992-1995 and is meant to provide a basic understanding of the quantities of waste handled by the industry, the methods typically used to manage this waste, and recent trends in these methods. TRI waste management data can be used to assess trends in source reduction within individual industries and facilities, and for specific TRI chemicals. This information could then be used as a tool in identifying opportunities for pollution prevention compliance assistance activities.

While the quantities reported for 1992 and 1993 are estimates of quantities already managed, the quantities reported for 1994 and 1995 are projections only. The EPA requires these projections to encourage facilities to consider future waste generation and source reduction of those quantities as well as movement up the waste management

hierarchy. Future-year estimates are not commitments that facilities reporting under TRI are required to meet.

Exhibit 10 shows that the furniture and fixtures industry managed about 47 million pounds of production-related waste (total quantity of TRI chemicals in the waste from routine production operations) in 1993 (column B). Column C reveals that of this production-related waste, 98 percent was either transferred off-site or released to the environment. Column C is calculated by dividing the total TRI transfers and releases by the total quantity of production-related waste. In other words, about one percent of the industry's TRI wastes were managed on-site through recycling, energy recovery, or treatment as shown in columns D, E and F, respectively. The majority of waste that is released or transferred off-site can be divided into portions that are recycled off-site, recovered for energy off-site, or treated off-site as shown in columns G, H, and I, respectively. The remaining portion of the production-related wastes (90.6 percent), shown in column J, is either released to the environment through direct discharges to air, land, water, and underground injection, or it is disposed off-site.

From the yearly data presented below it is apparent that the portion of TRI wastes reported as recycled on-site has remained steady and the portions treated or managed through energy recovery on-site have decreased slightly between 1992 and 1995 (projected).

Exhibit 10
Source Reduction and Recycling Activity for SIC 25

A	B	C	D	E	F	G	H	I	J
			On-Site			Off-Site			
Year	Production Related Waste Volume (10^6lbs.)	% Reported as Released and Transferred	% Recycled	% Energy Recovery	% Treated	% Recycled	% Energy Recovery	% Treated	Remaining Releases and Disposal
1992	44	100%	0.66%	0.00%	0.57%	2.32%	6.55%	0.90%	89.35%
1993	47	98%	0.70%	0.02%	0.42%	2.38%	5.10%	0.80%	90.58%
1994	44	—	0.76%	0.00%	0.46%	2.47%	4.60%	0.78%	90.93%
1995	44	—	0.73%	0.00%	0.46%	2.60%	5.19%	0.72%	90.31%

IV. CHEMICAL RELEASE AND TRANSFER PROFILE

This section is designed to provide background information on the pollutant releases that are reported by this industry. The best source of comparative pollutant release information is the Toxic Release Inventory System (TRI). Pursuant to the Emergency Planning and Community Right-to-Know Act, TRI includes self-reported facility release and transfer data for over 600 toxic chemicals. Facilities within SIC Codes 20-39 (manufacturing industries) that have more than 10 employees, and that are above weight-based reporting thresholds are required to report TRI on-site releases and off-site transfers. The information presented within the sector notebooks is derived from the most recently available (1993) TRI reporting year (which then included 316 chemicals), and focuses primarily on the on-site releases reported by each sector. Because TRI requires consistent reporting regardless of sector, it is an excellent tool for drawing comparisons across industries.

Although this sector notebook does not present historical information regarding TRI chemical releases over time, please note that in general, toxic chemical releases have been declining. In fact, according to the 1993 Toxic Release Inventory Data Book, reported releases dropped by 42.7% between 1988 and 1993. Although on-site releases have decreased, the total amount of reported toxic waste has not declined because the amount of toxic chemicals transferred off-site has increased. Transfers have increased from 3.7 billion pounds in 1991 to 4.7 billion pounds in 1993. Better management practices have led to increases in off-site transfers of toxic chemicals for recycling. More detailed information can be obtained from EPA's annual Toxics Release Inventory Public Data Release book (which is available through the EPCRA Hotline at 1-800-535-0202), or directly from the Toxic Release Inventory System database (for user support call 202-260-1531).

Wherever possible, the sector notebooks present TRI data as the primary indicator of chemical release within each industrial category. TRI data provide the type, amount, and media receptor of each chemical released or transferred. When other sources of pollutant release data have been obtained, these data have been included to augment the TRI information.

TRI Data Limitations

The reader should keep in mind the following limitations regarding TRI data. Within some sectors, the majority of facilities are not subject to TRI reporting because they are not considered manufacturing industries, or because they are below TRI reporting thresholds. Examples are the mining, dry cleaning, printing, and transportation equipment cleaning sectors. For these sectors, release information from other sources has been included.

The reader should also be aware that TRI "pounds released" data presented within the notebooks is not equivalent to a "risk" ranking for each industry. Weighting each pound of release equally does not factor in the relative toxicity of each chemical that is released. The Agency is in the process of developing an approach to assign toxicological weightings to each chemical released so that one can differentiate between pollutants with significant differences in toxicity. As a preliminary indicator of the environmental impact of the industry's most commonly released chemicals, the notebook briefly summarizes the toxicological properties of the top five chemicals (by weight) reported by each industry.

Definitions Associated With Section IV Data Tables

General Definitions

SIC Code -- the Standard Industrial Classification (SIC) is a statistical classification standard used for all establishment-based Federal economic statistics. The SIC codes facilitate comparisons between facility and industry data.

TRI Facilities -- are manufacturing facilities that have 10 or more full-time employees and are above established chemical throughput thresholds. Manufacturing facilities are defined as facilities in Standard Industrial Classification primary codes 20-39. Facilities must submit estimates for all chemicals that are on the EPA's defined list and are above throughput thresholds.

Data Table Column Heading Definitions

The following definitions are based upon standard definitions developed by EPA’s Toxic Release Inventory Program. The categories below represent the possible pollutant destinations that can be reported.

RELEASES -- are an on-site discharge of a toxic chemical to the environment. This includes emissions to the air, discharges to bodies of water, releases at the facility to land, as well as contained disposal into underground injection wells.

Releases to Air (Point and Fugitive Air Emissions) -- Include all air emissions from industry activity. Point emissions occur through confined air streams as found in stacks, ducts, or pipes. Fugitive emissions include losses from equipment leaks, or evaporative losses from impoundments, spills, or leaks.

Releases to Water (Surface Water Discharges) - encompass any releases going directly to streams, rivers, lakes, oceans, or other bodies of water. Any estimates for stormwater runoff and non-point losses must also be included.

Releases to Land -- includes disposal of waste to on-site landfills, waste that is land treated or incorporated into soil, surface impoundments, spills, leaks, or waste piles. These activities must occur within the facility's boundaries for inclusion in this category.

Underground Injection -- is a contained release of a fluid into a subsurface well for the purpose of waste disposal.

TRANSFERS -- is a transfer of toxic chemicals in wastes to a facility that is geographically or physically separate from the facility reporting under TRI. The quantities reported represent a movement of the chemical away from the reporting facility. Except for off-site transfers for disposal, these quantities do not necessarily represent entry of the chemical into the environment.

Transfers to POTWs -- are wastewaters transferred through pipes or sewers to a publicly owned treatments works (POTW). Treatment and chemical removal depend on the chemical's nature and treatment methods used. Chemicals not treated or destroyed by the POTW are generally released to surface waters or landfilled within the sludge.

Transfers to Recycling -- are sent off-site for the purposes of regenerating or recovering still valuable materials. Once these chemicals have been recycled, they may be returned to the originating facility or sold commercially.

Transfers to Energy Recovery -- are wastes combusted off-site in industrial furnaces for energy recovery. Treatment of a chemical by incineration is not considered to be energy recovery.

Transfers to Treatment -- are wastes moved off-site for either neutralization, incineration, biological destruction, or physical separation. In some cases, the chemicals are not destroyed but prepared for further waste management.

Transfers to Disposal -- are wastes taken to another facility for disposal generally as a release to land or as an injection underground.

IV.A. Toxic Release Inventory for the Wood Furniture and Fixtures Industry

Exhibits 13-15 illustrate the TRI releases and transfers for the entire furniture and fixtures industry (SIC 25). For the industry as a whole, solvents (such as toluene, methanol, xylene, methyl ethyl ketone, and acetone) comprise the largest number of TRI releases. The large number of solvent releases, both fugitive and point source emissions, result from the solvent-intensive finishing processes employed by this industry. In addition to being used as vehicle carriers, solvents are also used to clean the coatings application equipment.

The TRI database contains a detailed compilation of self-reported, facility-specific chemical releases. The top reporting facilities for this sector are listed below. Facilities that have reported only the SIC codes covered under this notebook appear in Exhibit 11. Exhibit 12 contains additional facilities that have reported the SIC code covered within this report, and one or more SIC codes that are not within the scope of this notebook. Therefore, Exhibit 12 includes facilities that conduct multiple operations — some that are under the scope of this notebook, and some that are not. Currently, the facility-level data do not allow pollutant releases to be broken apart by industrial process.

Exhibit 11
Top 10 TRI Releasing Furniture Manufacturing Facilities (SIC 25)

Rank	Total TRI Releases in Pounds	Facility Name	City	State
1	1,277,737	Broyhill Furniture Ind., Inc. Complex	Lenoir	NC
2	831,751	Broyhill Furniture Ind., Inc., Lenoir Furn. & Occas.	Lenoir	NC
3	723,669	Singer Furniture Co.	Lenoir	NC
4	700,675	Korn Ind., Inc.	Sumter	SC
5	688,907	Lane Co., Inc.	Altavista	VA
6	662,695	Okla Homer Smith Furniture Co., Inc.	Fort Smith	AR
7	661,059	Stanley Furniture Co.	Stanleytown	VA
8	642,385	J. D. Bassett Mfg. Co.	Bassett	VA
9	639,345	Peters-Revington Furniture	Delphi	IN
10	502,582	Bassett Superior Lines	Bassett	VA

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

Exhibit 12
Top 10 TRI Releasing Furniture and Fixtures Facilities

SIC Codes	Total TRI Releases in Pounds	Facility Name	City	State
2522, 2542, 2521	1,321,283	Steelcase Inc.	Grand Rapids	MI
2511	1,277,737	Broyhill Furniture Ind. Complex	Lenoir	NC
2542, 2541	939,055	Hadix, Inc.	Goodwater	AL
2511	831,751	Broyhill Furniture Ind., Inc. Lenoir Furn. & Occas.	Lenoir	NC
2522, 2542, 2521	809,096	Steelcase Inc.	Kentwood	NI
2511	723,669	Singer Furniture Co.	Lenoir	NC
2511	700,675	Korn Ind., Inc.	Sumter	SC
2511	688,907	Lane Co., Inc.	Altavista	VA
2511	662,695	Okla Homer Smith Furniture Co., Inc.	Fort Smith	AR
2511	661,059	Stanley Furniture Co.	Stanleytown	VA

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

Note: Being included on this list does not mean that the release is associated with non-compliance with environmental laws.

Exhibit 13
TRI Reporting Furniture Manufacturing Facilities (SIC 25) by State

State	Number of Facilities	State	Number of Facilities
AL	7	MS	3
AR	8	NC	92
AZ	2	NE	2
CA	23	NH	1
CO	2	NY	14
CT	1	OH	4
FL	3	OK	2
GA	5	OR	3
IA	3	PA	9
IL	2	SC	5
IN	27	TN	13
KS	3	UT	2
KY	4	VA	32
MA	6	VT	3
ME	2	WA	3
MI	6	WI	10
MN	5	WV	1
MO	5		

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

Exhibit 14
Releases for Furniture Manufacturing Facilities (SIC 25) in TRI, by Number of Facilities (Releases reported in pounds/year)

Chemical Name	# Facilities Reporting Chemical	Fugitive Air	Point Air	Water Discharges	Under-ground Injection	Land Disposal	Total Releases	Average Releases per Facility
Toluene	247	1456881	10541044	5	0	70819	12068749	48861
Methanol	178	908347	8166501	10	0	7347	9082205	51024
Xylene (Mixed Isomers)	174	742449	5085471	5	0	14064	5841989	33575
Methyl Ethyl Ketone	166	439743	4241878	5	0	21507	4703133	28332
Acetone	115	282555	3157999	5	0	28328	3468887	30164
N-Butyl Alcohol	99	151616	2208962	5	0	13531	2374114	23981
Methyl Isobutyl Ketone	55	206847	1293417	5	0	58491	1558760	28341
Glycol Ethers	26	68627	413901	0	0	0	482528	18559
1,1,1-Trichloroethane	25	262643	1334203	0	0	4900	1601746	64070
Ethylbenzene	21	120246	241345	0	0	0	361591	17219
Isopropyl Alcohol (Manufacturing)	11	9747	278413	0	0	0	288160	26196
Dichloromethane	6	102811	43894	0	0	0	146705	24451
Formaldehyde	6	30226	1086	0	0	0	31312	5219
Styrene	6	2744	42252	0	0	0	44996	7499
Di(2-Ethylhexyl) Phthalate	4	255	12458	0	0	0	12713	3178

Exhibit 14 (cont'd)
Releases for Furniture Manufacturing Facilities (SIC 25) in TRI, by Number of Facilities (Releases reported in pounds/year)

Chemical Name	# Facilities Reporting Chemical	Fugitive Air	Point Air	Water Discharges	Under-ground Injection	Land Disposal	Total Releases	Average Releases per Facility
Ethylene Glycol	4	616	26576	0	0	0	27192	6798
1,2,4-Trimethylbenzene	4	2159	39987	0	0	0	42146	10537
Trichloroethylene	3	1600	41781	0	0	0	43381	14460
Barium Compounds	2	0	0	0	0	518	518	259
Manganese	2	251	3	0	0	0	254	127
Methylenebis (Phenylisocyanate)	2	10	0	0	0	0	10	5
Naphthalene	2	6	113	0	0	0	119	60
Aluminum Oxide (Fibrous Form)	1	11	224	0	0	0	235	235
Ammonia	1	250	17000	0	0	0	17250	17250
Chromium	1	250	0	0	0	0	250	250
Copper	1	250	0	0	0	0	250	250
Cumene	1	6	114	0	0	0	120	120
Dibutyl Phthalate	1	6	110	0	0	0	116	116
Diethyl Sulfate	1	869	16516	0	0	0	17385	17385
Lead	1	250	0	0	0	0	250	250
Maleic Anhydride	1	0	0	0	0	0	0	0
Nickel	1	250	0	0	0	0	250	250
Phenol	1	1	19	0	0	0	20	20
Sulfuric Acid	1	0	0	0	0	0	0	0
Vinyl Acetate	1	1	1163	0	0	0	1164	1164
Totals	**313**	**4,792,523**	**37,206,430**	**40**	**0**	**219,505**	**42,218,498**	**134,883**

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

Exhibit 15
Transfers for Furniture Manufacturing Facilities (SIC 25) in TRI, by Number of Facilities (Transfers reported in pounds/year)

Chemical Name	# Facilities Reporting Chemical	POTW Discharges	Disposal	Recycling	Treatment	Energy Recovery	Total Transfers	Average Transfers per Facility
Toluene	247	3737	48124	400040	117454	746458	1315821	5327
Methanol	178	2114	33630	162308	25295	387147	610494	3430
Xylene (Mixed Isomers)	174	2869	43912	83315	43768	212406	386270	2220
Methyl Ethyl Ketone	166	1540	38830	176031	57181	530621	804953	4849
Acetone	115	1030	.	281800	33469	304307	620606	5397
N-Butyl Alcohol	99	531	250	40077	26163	81491	148762	1503
Methyl Isobutyl Ketone	55	260	1925	7812	67211	63094	140552	2555
Glycol Ethers	26	0	.	7455	1284	43794	52533	2021
1,1,1-Trichloroethane	25	0	5905	.	.	5608	11513	461
Ethylbenzene	21	255	31500	17979	165	10363	60262	2870
Isopropyl Alcohol (Manufacturing)	11	499	.	.	330	28509	29338	2667
Dichloromethane	6	0	.	.	10430	4000	14430	2405
Formaldehyde	6	250	.	.	.	.	250	42
Styrene	6	0	.	8520	.	131	8651	1442
Di(2-Ethylhexyl) Phthalate	4	0	.	.	.	1625	1625	406
Ethylene Glycol	4	0	.	.	.	.	0	0
1,2,4-Trimethylbenzene	4	0	.	.	0	3393	3393	848
Trichloroethylene	3	0	.	1331	.	.	1331	444
Barium Compounds	2	0	750	.	.	.	750	375
Manganese	2	0	.	.	.	.	0	0
Methylenebis (Phenylisocyanate)	2	0	.	.	.	.	0	0
Naphthalene	2	0	.	.	.	.	0	0
Aluminum Oxide (Fibrous Form)	1	0	.	.	.	.	0	0
Ammonia	1	0	.	.	.	.	0	0
Chromium	1	0	.	.	.	.	0	0
Copper	1	0	.	.	.	.	0	0
Cumene	1	0	.	.	.	.	0	0
Dibutyl Phthalate	1	0	.	.	.	.	0	0
Diethyl Sulfate	1	0	.	.	.	.	0	0
Lead	1	0	.	.	.	.	0	0
Maleic Anhydride	1	0	.	.	.	.	0	0
Nickel	1	0	.	.	.	.	0	0
Phenol	1	0	.	.	.	.	0	0
Sulfuric Acid	1	0	.	.	.	.	0	0
Vinyl Acetate	1	0	.	.	.	.	0	0
Totals	**313**	**13,085**	**204,826**	**1,186,668**	**382,750**	**2,422,947**	**4,211,534**	**13,455**

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

IV.B. Summary of the Selected Chemicals Released

The following is a synopsis of current scientific toxicity and fate information for the top chemicals (by weight) that facilities within this sector self-reported as released to the environment based upon 1993 TRI data. Because this section is based upon self-reported release data, it does not attempt to provide information on management practices employed by the sector to reduce the release of these chemicals. Information regarding pollutant release reductions over time may be available from EPA's TRI and 33/50 programs, or directly from the industrial trade associations that are listed in Section IX of this document. Since these descriptions are cursory, please consult the sources referenced below for a more detailed description of both the chemicals described in this section, and the chemicals that appear on the full list of TRI chemicals appearing in Section IV.A.

The brief descriptions provided below were taken from the *1993 Toxics Release Inventory Public Data Release* (U.S. EPA, 1994), the Hazardous Substances Data Bank (HSDB), and the Integrated Risk Information System (IRIS), both accessed via TOXNET[1]. The information contained below is based upon exposure assumptions that have been conducted using standard scientific procedures. The effects listed below must be taken in context of these exposure assumptions that are more fully explained within the full chemical profiles in HSDB.

[1] TOXNET is a computer system run by the National Library of Medicine that includes a number of toxicological databases managed by EPA, National Cancer Institute, and the National Institute for Occupational Safety and Health. For more information on TOXNET, contact the TOXNET help line at 1-800-231-3766. Databases included in TOXNET are: CCRIS (Chemical Carcinogenesis Research Information System), DART (Developmental and Reproductive Toxicity Database), DBIR (Directory of Biotechnology Information Resources), EMICBACK (Environmental Mutagen Information Center Backfile), GENE-TOX (Genetic Toxicology), HSDB (Hazardous Substances Data Bank), IRIS (Integrated Risk Information System), RTECS (Registry of Toxic Effects of Chemical Substances), and TRI (Toxic Chemical Release Inventory). HSDB contains chemical-specific information on manufacturing and use, chemical and physical properties, safety and handling, toxicity and biomedical effects, pharmacology, environmental fate and exposure potential, exposure standards and regulations, monitoring and analysis methods, and additional references.

The top TRI releases for the furniture and fixtures industry (SIC 25) as a whole, include:

Toluene
Methanol
Xylene
Methyl ethyl ketone
Acetone
N-butyl alcohol
1 1,1-trichloroethane
Dichloromethane.

Summaries of some of these chemicals follow.

Toluene

Toxicity. Inhalation or ingestion of toluene can cause headaches, confusion, weakness, and memory loss. Toluene may also affect the way the kidneys and liver function.

Reactions of toluene (see environmental fate) in the atmosphere contribute to the formation of ozone in the lower atmosphere. Ozone can affect the respiratory system, especially in sensitive individuals such as asthma or allergy sufferers.

Some studies have shown that unborn animals were harmed when high levels of toluene were inhaled by their mothers, although the same effects were not seen when the mothers were fed large quantities of toluene. Note that these results may reflect similar difficulties in humans.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. The majority of releases of toluene to land and water will evaporate. Toluene may also be degraded by microorganisms. Once volatized, toluene in the lower atmosphere will react with other atmospheric components contributing to the formation of ground-level ozone and other air pollutants.

Physical Properties. Toluene is a volatile organic chemical.

Methanol

Toxicity. Methanol is readily absorbed from the gastrointestinal tract and the respiratory tract, and is toxic to humans in moderate to high doses. In the body, methanol is converted into formaldehyde and formic acid. Methanol is excreted as formic acid. Observed toxic effects at high dose levels generally include central nervous system damage and blindness. Long-term exposure to high levels of methanol via inhalation cause liver and blood damage in animals.

Ecologically, methanol is expected to have low toxicity to aquatic organisms. Concentrations lethal to half the organisms of a test population are expected to exceed 1 mg methanol per liter water. Methanol is not likely to persist in water or to bioaccumulate in aquatic organisms.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. Liquid methanol is likely to evaporate when left exposed. Methanol reacts in air to produce formaldehyde which contributes to the formation of air pollutants. In the atmosphere it can react with other atmospheric chemicals or be washed out by rain. Methanol is readily degraded by microorganisms in soils and surface waters.

Physical Properties. Methanol is highly flammable.

Xylene (Mixed Isomers)

Toxicity. Xylenes are rapidly absorbed into the body after inhalation, ingestion, or skin contact. Short-term exposure of humans to high levels of xylenes can cause irritation of the skin, eyes, nose, and throat, difficulty in breathing, impaired lung function, impaired memory, and possible changes in the liver and kidneys. Both short- and long-term exposure to high concentrations can cause effects such as headaches, dizziness, confusion, and lack of muscle coordination. Reactions of xylenes (see environmental fate) in the atmosphere contribute to the formation of ozone in the lower atmosphere. Ozone can affect the respiratory system, especially in sensitive individuals such as asthma or allergy sufferers.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. The majority of releases to land and water will quickly evaporate, although some degradation by microorganisms will occur.

Xylenes are moderately mobile in soils and may leach into groundwater, where they may persist for several years.

Xylenes are volatile organic chemicals. As such, xylenes in the lower atmosphere will react with other atmospheric components, contributing to the formation of ground-level ozone and other air pollutants.

Methyl Ethyl Ketone

Toxicity. Breathing moderate amounts of methyl ethyl ketone (MEK) for short periods of time can cause adverse effects on the nervous system ranging from headaches, dizziness, nausea, and numbness in the fingers and toes to unconsciousness. Its vapors are irritating to the skin, eyes, nose, and throat and can damage the eyes. Repeated exposure to moderate to high amounts may cause liver and kidney effects.

Carcinogenicity. No agreement exists over the carcinogenicity of MEK. One source believes MEK is a possible carcinogen in humans based on limited animal evidence. Other sources believe that there is insufficient evidence to make any statements about possible carcinogenicity.

Environmental Fate. Most of the MEK released to the environment will end up in the atmosphere. MEK can contribute to the formation of air pollutants in the lower atmosphere. It can be degraded by microorganisms living in water and soil.

Physical Properties. Methyl ethyl ketone is a flammable liquid.

Acetone

Toxicity. Acetone is irritating to the eyes, nose, and throat. Symptoms of exposure to large quantities of acetone may include headache, unsteadiness, confusion, lassitude, drowsiness, vomiting, and respiratory depression.

Reactions of acetone (see environmental fate) in the lower atmosphere contribute to the formation of ground-level ozone. Ozone (a major component of urban smog) can affect the respiratory system, especially in sensitive individuals such as asthmatics or allergy sufferers.

Carcinogenicity**.** There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate**.** If released into water, acetone will be degraded by microorganisms or will evaporate into the atmosphere. Degradation by microorganisms will be the primary removal mechanism.

Acetone is highly volatile, and once it reaches the troposphere (lower atmosphere), it will react with other gases, contributing to the formation of ground-level ozone and other air pollutants. EPA is reevaluating acetone's reactivity in the lower atmosphere to determine whether this contribution is significant.

Physical Properties. Acetone is a volatile and flammable organic chemical.

Note: Acetone was removed from the list of TRI chemicals on June 16, 1995 (60 FR 31643) and will not be reported for 1994 or subsequent years.

1,1,1-Trichloroethane

Toxicity. Repeated contact of 1,1,1-trichloroethane (TCE) with skin may cause serious skin cracking and infection. Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations.

Exposure to high concentrations of TCE causes reversible mild liver and kidney dysfunction, central nervous system depression, gait disturbances, stupor, coma, respiratory depression, and even death. Exposure to lower concentrations of TCE leads to light-headedness, throat irritation, headache, disequilibrium, impaired coordination, drowsiness, convulsions and mild changes in perception.

Carcinogenicity. There is currently no evidence to suggest that this chemical is carcinogenic.

Environmental Fate. Releases of TCE to surface water or land will almost entirely volatilize. Releases to air may be transported long distances and may partially return to earth in rain. In the lower atmosphere, TCE degrades very slowly by photooxidation and slowly diffuses to the upper atmosphere where photodegradation is rapid.

Any TCE that does not evaporate from soils leaches to groundwater. Degradation in soils and water is slow. TCE does not hydrolyze in water, nor does it significantly bioconcentrate in aquatic organisms.

IV.C. Other Data Sources

The Aerometric Information Retrieval System (AIRS) contains a wide range of information related to stationary sources of air pollution, including the emissions of a number of air pollutants which may be of concern within a particular industry. With the exception of volatile organic compounds (VOCs), there is little overlap with the TRI chemicals reported above. Exhibit 16 summarizes annual releases of carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter of 10 microns or less (PM10), total particulates (PT), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).

Exhibit 16
Pollutant Releases (Short Tons/Year)

Industry	CO	NO_2	PM_{10}	PT	SO_2	VOC
U.S. Total	97,208,000	23,402,000	45,489,000	7,836,000	21,888,000	23,312,000
Metal Mining	5,391	28,583	39,359	140,052	84,222	1,283
Nonmetal Mining	4,525	28,804	59,305	167,948	24,129	1,736
Lumber and Wood Products	123,756	42,658	14,135	63,761	9,149	41,423
Wood Furniture and Fixtures	**2,069**	**2,981**	**2,165**	**3,178**	**1,606**	**59,426**
Pulp and Paper	624,291	394,448	35,579	113,571	341,002	96,875
Printing	8,463	4,915	399	1,031	1,728	101,537
Inorganic Chemicals	166,147	108,575	4,107	39,082	182,189	52,091
Organic Chemicals	146,947	236,826	26,493	44,860	132,459	201,888
Petroleum Refining	419,311	380,641	18,787	36,877	648,153	309,058
Rubber and Misc. Plastic Products	2,090	11,914	2,407	5,355	29,364	140,741
Stone, Clay, Glass, and Concrete	58,043	338,482	74,623	171,853	339,216	30,262
Iron and Steel	1,518,642	138,985	42,368	83,017	238,268	82,292
Nonferrous Metals	448,758	55,658	20,074	22,490	373,007	27,375
Fabricated Metals	3,851	16,424	1,185	3,136	4,019	102,186
Electronics	367	1,129	207	293	453	4,854

Motor Vehicles, Bodies, Parts, and Accessories	35,303	23,725	2,406	12,853	25,462	101,275
Dry Cleaning	101	179	3	28	152	7,310

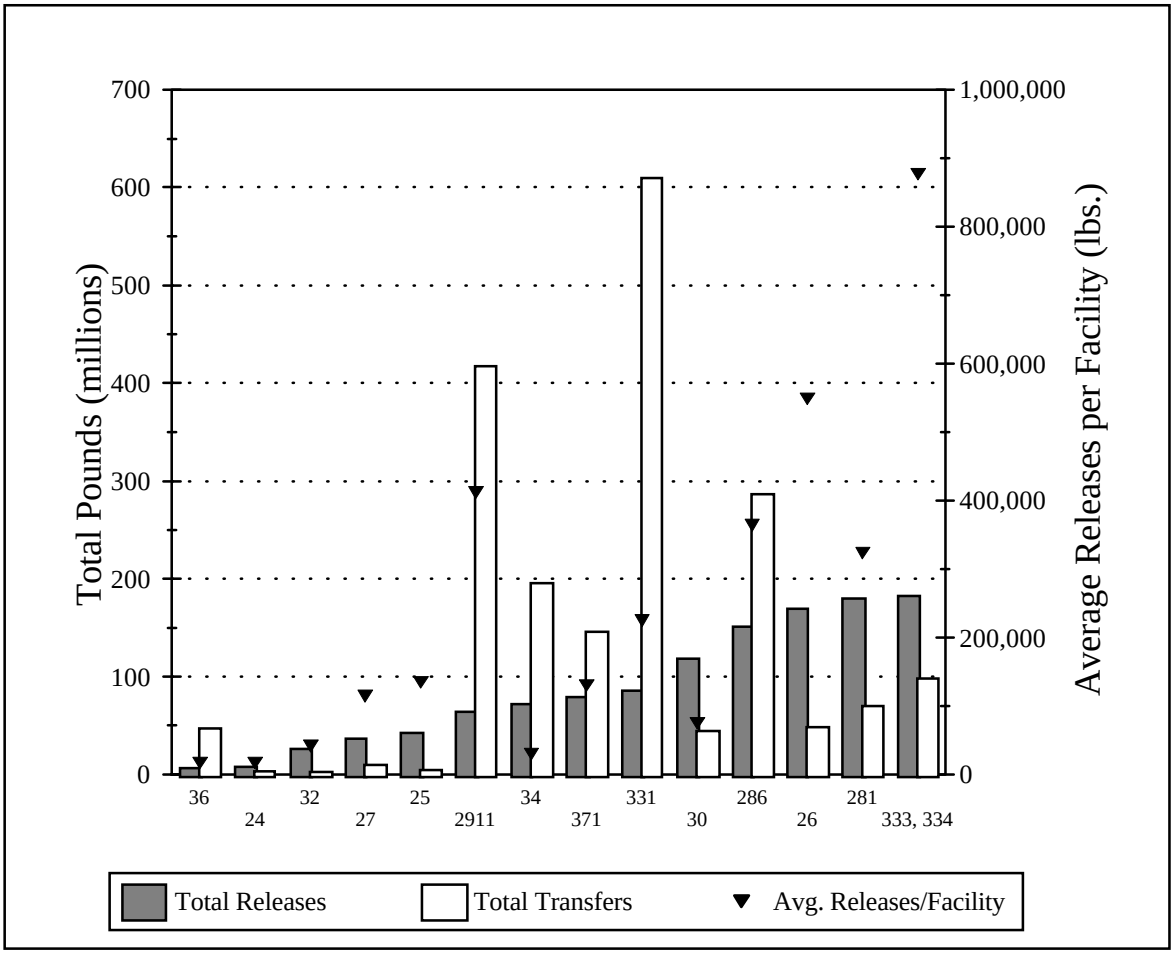
Source U.S. EPA Office of Air and Radiation, AIRS Database, May 1995.

IV.D. Comparison of Toxic Release Inventory Between Selected Industries

The following information is presented as a comparison of pollutant release and transfer data across industrial categories. It is provided to give a general sense as to the relative scale of releases and transfers within each sector profiled under this project. Please note that the following table does not contain releases and transfers for industrial categories that are not included in this project, and thus cannot be used to draw conclusions regarding the total release and transfer amounts that are reported to TRI. Similar information is available within the annual TRI Public Data Release book.

Exhibit 17 is a graphical representation of a summary of the 1993 TRI data for the Wood Furniture and Fixtures Industry and the other sectors profiled in separate notebooks. The bar graph presents the total TRI releases and total transfers on the left axis and the triangle points show the average releases per facility on the right axis. Industry sectors are presented in the order of increasing total TRI releases. The graph is based on the data shown in Exhibit 18 and is meant to facilitate comparisons between the relative amounts of releases, transfers, and releases per facility both within and between these sectors. The reader should note, however, that differences in the proportion of facilities captured by TRI exist between industry sectors. This can be a factor of poor SIC matching and relative differences in the number of facilities reporting to TRI from the various sectors. In the case of the Wood Furniture and Fixtures Industry, the 1993 TRI data presented here covers 313 facilities. These facilities listed SIC 25, Wood as a primary SIC code.

Exhibit 17



SIC Range	Industry Sector	SIC Range	Industry Sector	SIC Range	Industry Sector
36	Electronic Equipment and Components	2911	Petroleum Refining	286	Organic Chemical Mfg.
24	Lumber and Wood Products	34	Fabricated Metals	26	Pulp and Paper
32	Stone, Clay, and Concrete	371	Motor Vehicles, Bodies, Parts, and Accessories	281	Inorganic Chemical Mfg.
27	Printing	331	Iron and Steel	333,334	Nonferrous Metals
25	Wood Furniture and Fixtures	30	Rubber and Misc. Plastics		

Exhibit 18
Toxic Release Inventory Data for Selected Industries

Industry Sector	SIC Range	# TRI Facilities	Releases		Transfers		Total Releases + Transfers (10^6 pounds)	Average Release+ Transfers per Facility (pounds)
			Total Releases (10^6 pounds)	Average Releases per Facility (pounds)	1993 Total (10^6 pounds)	Average Transfers per Facility (pounds)		
Stone, Clay, and Concrete	32	634	26.6	41,895	2.2	3,500	28.2	46,000
Lumber and Wood Products	24	491	8.4	17,036	3.5	7,228	11.9	24,000
Furniture and Fixtures	25	313	42.2	134,883	4.2	13,455	46.4	148,000
Printing	2711-2789	318	36.5	115,000	10.2	732,000	46.7	147,000
Electronics/Computers	36	406	6.7	16,520	47.1	115,917	53.7	133,000
Rubber and Misc. Plastics	30	1,579	118.4	74,986	45.0	28,537	163.4	104,000
Motor Vehicle, Bodies, Parts and Accessories	371	609	79.3	130,158	145.5	238,938	224.8	369,000
Pulp and paper	2611-2631	309	169.7	549,000	48.4	157,080	218.1	706,000
Inorganic Chem. Mfg.	2812-2819	555	179.6	324,000	70.0	126,000	249.7	450,000
Petroleum Refining	2911	156	64.3	412,000	417.5	2,676,000	481.9	3,088,000
Fabricated Metals	34	2,363	72.0	30,476	195.7	82,802	267.7	123,000
Iron and Steel	3312-3313 3321-3325	381	85.8	225,000	609.5	1,600,000	695.3	1,825,000
Nonferrous Metals	**333, 334**	**208**	**182.5**	**877,269**	**98.2**	**472,335**	**280.7**	**1,349,000**
Organic Chemical Mfg.	2861-2869	417	151.6	364,000	286.7	688,000	438.4	1,052,000
Metal Mining	10	Industry sector not subject to TRI reporting						
Nonmetal Mining	14	Industry sector not subject to TRI reporting						
Dry Cleaning	7215, 7216, 7218	Industry sector not subject to TRI reporting						

Source: U.S. EPA, Toxics Release Inventory Database, 1993.

V. POLLUTION PREVENTION OPPORTUNITIES

The best way to reduce pollution is to prevent it in the first place. Some companies have creatively implemented pollution prevention techniques that improve efficiency and increase profits while at the same time minimizing environmental impacts. This can be done in many ways such as reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals. Some smaller facilities are able to actually get below regulatory thresholds just by reducing pollutant releases through aggressive pollution prevention policies.

In order to encourage these approaches, this section provides both general and company-specific descriptions of some pollution prevention advances that have been implemented within the Wood Furniture and Fixtures industry. While the list is not exhaustive, it does provide core information that can be used as the starting point for facilities interested in beginning their own pollution prevention projects. When possible, this section provides information from real activities that can, or are being implemented by this sector -- including a discussion of associated costs, time frames, and expected rates of return. This section also provides the context (in terms of type of industry and/or type of process affected) in which the pollution prevention technique can effectively be used.

The following discussion of pollution prevention initiatives is based mainly on the EPA document *Pollution Prevention Options in Wood Furniture Manufacturing* and identifies those steps in the manufacturing process for which pollution prevention initiatives can and have been implemented. Exhibit 19 provides examples of process modification, material substitution, waste reduction, and recycling options for finishing and gluing operations. The EPA document from which this exhibit was developed does not indicate the methods used to compute cost savings.

V.A. Identification of Pollution Prevention Activities in Use and Environmental and Economic Benefits of Each Pollution Prevention Activity

Pollution prevention techniques and processes currently used by the wood furniture and fixtures industry can be grouped into the following general categories:

- Production planning and sequencing
- Process or equipment modification
- Raw material substitution or elimination
- Loss prevention and housekeeping
- Waste segregation and separation
- Solvent recycling
- Training and supervision.

Each of these categories is discussed below briefly. Refer to Exhibit 19 for specific pollution prevention techniques and associated costs, savings, and other information.

Production planning and sequencing is used to ensure that only necessary operations are performed and that no operation is needlessly "undone" by a following operation. One example is to sort out reject parts prior to painting or finishing. A second example is to reduce the frequency of cleaning equipment by staining or painting all products of the same color at the same time. A third example is to schedule batch processing of lighter shades of paint prior to darker shades of paint so that equipment need not be cleaned between batches.

Process or equipment modification is used to reduce the amount of waste generated. Manufacturers can change to a paint application technique that is more efficient than spray gun systems, such as airless and air-assisted airless systems, electrostatic spray systems, or flat line finishing.

Several technologies currently in the development stage could potentially apply to the wood furniture industry. These technologies are in the areas of spray booth design and curing methods. The spray booth designs discussed in this section include the Classic System Campbell Spray Booth and the Mobile Zone. Both designs seek to reduce the volume of air exhausted.

Classic Systems has developed the Campbell spray booth, which the company indicates can reduce the volume of exhaust air by approximately 80 percent. The basic design of the Campbell spray booth involves the use of air curtains; the worker stands outside of the booth and sprays through the air curtain. The air curtain provides a barrier between the worker and the solvent emissions inside the booth resulting from coating the piece. A pilot system has been built, and a full-scale system has been designed.

Mobile Zones Associates has developed a device which, when installed on a spray booth, enables the worker(s) to spray coatings from a partially enclosed mobile work platform. The worker stands inside a "cab," the movement of which is controlled from inside the cab by the worker. Within the Mobile Zone cab, fresh ventilating air passes across the painter from an open "moving window" at his rear. The remaining section of the mobile work platform is ventilated using recirculated air. The Mobile Zone design contrasts with a conventional spray booth, in which the entire length of the booth is supplied with fresh ventilating air.

Ultraviolet (UV)-curable coatings are frequently used by flatline furniture coating operations. Since the pieces are flat, curing in a conventional UV-cure oven is straightforward. Although UV-curable coatings are also applied to case goods (nonflat pieces), the UV-curing process with such pieces is more difficult. In order for a UV-curable coating to cure, all coating must be exposed to the UV-light. The lamps in the UV-oven must be situated to ensure exposure to all areas of the case goods, including recessed areas, carvings, etc. The UV-lamp locations would need to be set for each type of case good depending on its configuration. Because furniture manufacturers typically produce many different types of case goods on a single line at any time, realignment of the UV-lamps for each type of case good is not feasible. However, if a manufacturer produces a single piece continuously for a length of time, the lamps could be arranged for that configuration. Then, after the lamps are adjusted, another type of piece could be produced for a length of time.

Biofiltration is a control technology which sends contaminated exhaust air through a biofilter for contaminant removal. The biofilter consists of organic matter, such as tree bark and compost, the pores of which are filled with water. Biologically active micro-organisms are present, partly free-floating in the water and partly attached to the organic matter.

Raw material substitution or elimination is the replacement of existing raw materials with other materials that produce less waste, or a non-toxic waste. Some examples include substituting water-based finishes for solvent-based finishes or replacing volatile liquid finishes with electrostatically-applied powder finishes.

Volatile organic compound (VOC) emissions from wood furniture finishing operations (primarily the hazardous air described in Section IV.B.) can be reduced by reformulating coating materials so that they contain fewer VOCs. Currently, in wood furniture finishing operations, VOC emissions result from the application and subsequent evaporation of finishing materials. Efforts are being made to reformulate the finishing materials used in the wood furniture industry so that they contain fewer VOCs.

Waterborne finishing materials are currently being used by some furniture manufacturers. The potential exists for waterborne coatings to be used by all segments of the wood finishing industry. However, the waterborne coatings currently available are better suited to certain applications than others. For example:

- Open pore woods are considered easier to finish with waterborne coatings than filled pores
- Darker woods sometimes appear cloudy when finished with waterborne coatings, though the clarity has improved over the last ten years
- Waterborne finishes do not have the rubbability of nitrocellulose lacquers and the finish is therefore not as glossy where a glossy finish is required
- Waterborne coatings may require a modified drying method (increased airflow and temperature).

Ultraviolet (UV)-curable coatings are currently used in various segments of the wood finishing industry. UV-curable coatings can be applied using spray equipment, roll coaters, or curtain coaters. Therefore, the potential exists for UV-curable coatings to be used on case good as well as flat pieces, and progress in this direction has been made. However, as mentioned previously, curing of the three-dimensional pieces remains difficult because all of the coating materials must be exposed to the UV radiation. Problems arise in curing of recessed surfaces that do not get direct exposure to the

radiation. Many studies are being conducted so that UV-curable materials may experience more widespread use in the future.

Polyurethane coatings are used in some segments of the wood finishing industry. Polyurethane materials can be spray applied, or applied by curtain or roll coat, and are cured in the conventional manner. Polyurethane coatings are characterized by a high-gloss look, which may not be desirable to certain segments of the wood furniture industry. Other limitations that prevent its widespread use include the need for a clean room environment, the short pot life (one to six hours), and the difficulty in repairing.

Polyester coatings are similar to polyurethanes in their uses and their limitations. The film properties of the polyester coatings are good; they provide good build and good chemical, mechanical, and heat resistance. However, application requires a clean room environment which can be very expensive and difficult to maintain.

Loss prevention and housekeeping is the performance of preventive maintenance and equipment and materials management so as to minimize opportunities for leaks, spills, evaporative losses, and other releases of potentially toxic chemicals. For example, spray guns can be cleaned by submerging only the front end of the gun in the cleaning solvent; or routine maintenance of spray gun equipment can prevent equipment from breaking down and leaking.

Waste segregation and separation involves avoiding the mixture of different types of wastes and avoiding the mixture of hazardous wastes with non-hazardous wastes. This makes the recovery of hazardous wastes easier by minimizing the number of different hazardous constituents in a given waste stream. Also, it prevents the contamination of non-hazardous wastes. Specific examples include segregating spent solvents by solvent types, and segregating non-hazardous paint solids from hazardous paint solvents and thinners.

Solvent recycling is the use or reuse of a waste as an ingredient or feedstock in the production process on-site. Recycling in which a waste is recovered and reused in the production process on-site as an input is a form of pollution prevention. One example is the use of a small on-site still to recycle xylene or lacquer thinner.

Training and supervision provides employees with the information and the incentive to minimize waste generation in their daily duties. This might include ensuring that employees know and practice proper and

efficient use of tools and supplies, and that they are aware of, understand, and support the company's pollution prevention goals.

Exhibit 19
Pollution Prevention Matrix

Process	Pollution Prevention Process	Economic and Environment Savings and Benefits	Payback Period
Application of finish and pre-finish coatings	<u>Process Modification</u> Implement alternatives to compressed air spray gun systems including: 1. Airless and air assisted airless	• Material consumption reduction: 15% • Annual cost savings: $55,000 • Waste volume from spray booth cleanup reduction: 50%	Payback period: 1 year
	2. Electrostatic spray systems	• Annual cost savings: $150,000 • Waste savings / reduction from wiping stain compared to conventional spray units: 25%	Payback period: 2 years
	3. Flat line finishing	• Annual savings in total coating costs: 20-30% • Waste savings / reduction in VOCs: 25%	Payback period: 2 years
	<u>Material Substitution</u> Substitution of solvent-based inks with water-based inks	• Annual cost savings in raw materials: $75,000 • Annual cost savings in disposal costs: $37,000	Information not available
	<u>Waste Reduction</u> Replace water-based paint booth filters with dry filters. Dry filters will double paint booth life and allow more efficient treatment of wastewater.	• Annual cost savings: $1,500 • Waste savings / reductions: 3,000 gallons / year	Information not available
	<u>Process Modification</u> Train spray gun operators in proper spray techniques to minimize coating waste generation	• Annual cost savings: $50,000 to $70,000 • Finishing material required reduction: 8-10%	Information not available

Exhibit 19 (cont'd)
Pollution Prevention Matrix

Process	Pollution Prevention Process	Economic and Environment Savings and Benefits	Payback Period
Application of finish and pre-finish coatings (continued)	Recycling Recycle spent solvents with recovery units including:		
	1. Small on-site solvent recovery still to recycle spent lacquer thinner	• Annual cost savings: $5,700	Payback period: 1 year
	2. Small in-house still to recycle methylene chloride	• Incentive was to avoid RCRA liability related to disposal	Payback period: 2 years
	3. In-house still to recycle xylene	Information not available	Payback period: 13 months
	4. Batch distillation unit to recover xylene from paint equipment cleaning	• Annual savings: $5,000	Payback period: 13 months
	5. Batch distillation to recover isopropyl acetate generated during equipment cleaning	Information not available	Payback period: 2 years
	6. Recovery system for solvents contained in air emissions	• Annual savings: $1,000	Information not available
	7. Small solvent recovery still to recover spent paint thinner from spray gun cleaning and excess paint batches	• Capital investment for a 15-gallon capacity still: $6,000 • Annual savings in new thinner: $3,600 • Annual disposal savings: $5,400 • Waste savings / reduction: 75% (745 gallons of thinner recovered from 1,003 gallons) • Product / waste throughput information: 1,500 gallons of spent thinner processed per year	Payback period: less than one year

Exhibit 19 (cont'd)
Pollution Prevention Matrix

Process	Pollution Prevention Process	Economic and Environment Savings and Benefits	Payback Period
Application of finish and pre-finish coatings (continued)	8. Solvent recovery system to recover and reuse spent methyl ethyl ketone.	• Annual savings: $43,000 • MEK recovery rate: 20 gallons / day (reflecting a 90% reduction in waste)	Information not available
Equipment cleaning	Process Modification Flush equipment first with dirty solvent before final cleaning with virgin solvent and use cleanup solvents in formulation of subsequent batches of paint	• Waste savings / reduction: 98% • Paint cleanup solvents reduction: from 25,000 to 400 gallons	Information not available

Source: Pollution Prevention Options in Wood Furniture Manufacturing, 1992.

V.B. Pollution Prevention Case Studies

Henredon Furniture Industries, located in California, applies stains and other finishes to chairs, benches, and a variety of other furniture items. Because the conventional spray guns that Henredon had been using were not meeting current regulations for VOC emissions, the company researched the feasibility of high-volume low-pressure (HVLP) spray guns.

Henredon tested guns by a variety of manufacturers to find those that best fit their needs. The HVLP guns ultimately selected operate on air pressures from 7 to 10 psi, which is within the definitions set by California's South Coast Air Quality Management District. The lower pressure results in less overspray and more efficient use of material.

The new HVLPs increased efficiency such that average material usage was reduced by 13 to 15 percent. Employee training on application techniques was also conducted to improve efficiency. The new guns improved product quality without slowing production rates. Henredon is currently using the HVLP guns to apply lacquers, sealers, and stains at three plant locations.

Henredon saves approximately 18,512 gallons of raw material annually by using the more efficient guns. These savings equate to a reduction in VOC emissions of 126,060 pounds per year.

Purchase and installation cost between $350 and $500 per gun. Henredon figures to save approximately $119,673 per year in raw material usage, for an average payback period of 3.5 months.

Thomson Crown Wood Products, Inc., manufactures wood television cabinets. Parts of these cabinets were sprayed with finishing materials by an air-assisted airless spray gun, resulting in the production of VOCs and a large paint waste stream. To ameliorate this problem, Crown Wood proposed to test high-volume low-pressure (HVLP) spray guns and evaluate their success in reducing these waste streams.

Through in-house, on-line production testing, Crown Wood reviewed four different HVLP spray guns using penetrating stain (no-wipe), glaze, sap stain, equalizer, toner, shade, and water-based black paint. An HVLP spray gun manufactured by one company gave excellent performance during the penetrating stain and regular glaze applications. This gun was also highly recommended by the sprayers for its size, weight, triggering, and cleaning ease. However, because the sprayer did not hold a specific spray pattern very well, it could not be used for heavier finishes. Instead, an HVLP spray gun manufactured by another manufacturer, which also received good ratings by the sprayers, gave much more consistent coverage and spray pattern for the water-based black, sap stain, equalizer, shade, and toner finishes.

With the new HVLP spray guns, Crown Wood has experienced material reductions of 65 percent for equalizer, 65 percent for stain, 54 percent for toner, 35 percent for glaze, 35 percent for no-wipe, and 53 percent for water-based black finishes. These reductions total over 13,300 gallons per year, which also results in reductions in VOCs and paint waste.

A total of $137,448 per year is the estimated savings from purchasing the new spray guns. Costs associated with paint waste reduction have not been determined, but a reduction in the amount of clean-up waste was evident. The cost of the project was $21,350.

In July 1992, Crown Wood altered its printing process room to incorporate the lay-down or roll-on finishing top and end panels of the outside cabinet. With this process modification, 60 percent of the spraying operation is now diverted to the printing room. Along with paint waste and VOC discharges, this new application procedure reduced finishing purchases by 50 percent.

Ethan Allen, Inc., manufactures dining and bedroom furniture. Coating procedures in the finishing operations produced approximately 37,000 pounds of hazardous waste annually. To reduce the quantity and disposal cost of this waste, the company made the equipment substitutions and cleanup changes discussed below.

Some of the modifications resulted directly from employee suggestions. The company implemented a cost reduction program to facilitate employee involvement in waste/cost reduction activities. Employees submit waste/cost reduction ideas, which are evaluated by a cost reduction committee, and valid suggestions are assigned for savings calculations.

Three main components of the coating operation generate the hazardous waste: overspraying collection systems, material transport systems, and equipment cleanup procedures.

Overspray Collection Systems

- Metal filters replaced paper/cardboard filters for all the coating operations. The metal filters are cleaned in a tank in which solvent is circulated with a diaphragm pump. The waste solvent/coating mix is distilled, and only the overspray is drummed for disposal. The cleaning solvent is reused. The metal filters used for lacquer and sealer overspray are hand wiped, and the dust is sent-off site for recycling.
- A fabricated, sloped polyethylene-lined trough replaced absorbent wood shavings used to catch overspray. In the wiping stain booths, the trough is squeezed into a pan, and only the liquid overspray is drummed for disposal.
- High-volume, low-pressure (HVLP) spray guns replaced conventional air-assisted spray gun equipment. As a result, the quantity of overspray to be filtered is reduced, and spraying efficiency is increased. Also, each operator is required to attend an annual technical training session. Training is provided by a representative of the spray gun manufacturer.

Material Transport Systems

- Polyethylene covers replaced cardboard covers for pallets used to transport products through coating operations. The overspray is peeled off the polyethylene cover and drummed for disposal.

- The racks used to transport material on the conveyor system are cleaned periodically during the boiler watchman's free time. Thus, the employee's time is utilized, and the racks can be reused. This procedure lengthens the life of the racks, which must be cleaned or disposed of as a solid hazardous waste.

Cleanup Operations

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

These equipment substitutions and changes in cleanup procedures resulted in the elimination of 25,900 pounds of hazardous waste annually, for an estimated cost savings of $129,465 per year. The following exhibit lists the process, cost of implementation, quantity of waste reduction, and annual cost savings.

Exhibit 20
Ethan Allen Pollution Prevention Case Study Summary

Process	Capitol Investment, $	Waste Reduction, lbs/year	Savings, $/year
Metal Filters	7,000	10,000	48,125
Lacquer and Sealer Recycle	1,500	2,300	6,150
Polyethylene Trough	400	6,100	38,430
HVLP Spray Guns (12 guns @ $250)	3,000	Material Use Reduction: Sap Stain 27% Sealer 20% Lacquer 11%	Material Use Savings: 15,000 to 20,000
Polyethylene Pallet Covers	2,050	3,700	7,450
Rack Cleaning	200	1,900	8,250
Solvent Distillation	4,500	1,900	3,200
Total	$68,650	25,900	$129,465

Source: North Carolina Department of Environment, Health, and Natural Resources Pollution Prevention Program.

VI. SUMMARY OF FEDERAL STATUTES AND REGULATIONS

This section discusses the Federal statutes and regulations that may apply to this sector. The purpose of this section is to highlight, and briefly describe the applicable Federal requirements, and to provide citations for more detailed information. The three following sections are included.

- Section VI.A contains a general overview of major statutes
- Section VI.B contains a list of regulations specific to this industry
- Section VI.C contains a list of pending and proposed regulations

The descriptions within Section IV are intended solely for general information. Depending upon the nature or scope of the activities at a particular facility, these summaries may or may not necessarily describe all applicable environmental requirements. Moreover, they do not constitute formal interpretations or clarifications of the statutes and regulations. For further information, readers should consult the Code of Federal Regulations and other state or local regulatory agencies. EPA Hotline contacts are also provided for each major statute.

VI.A. General Description of Major Statutes

Resource Conservation And Recovery Act

The Resource Conservation And Recovery Act (RCRA) of 1976 which amended the Solid Waste Disposal Act, addresses solid (Subtitle D) and hazardous (Subtitle C) waste management activities. The Hazardous and Solid Waste Amendments (HSWA) of 1984 strengthened RCRA's waste management provisions and added Subtitle I, which governs underground storage tanks (USTs).

Regulations promulgated pursuant to Subtitle C of RCRA (40 CFR Parts 260-299) establish a "cradle-to-grave" system governing hazardous waste from the point of generation to disposal. RCRA hazardous wastes include the specific materials listed in the regulations (commercial chemical products, designated with the code "P" or "U"; hazardous wastes from specific industries/sources, designated with the code "K"; or hazardous wastes from non-specific sources, designated with the code "F") or materials which exhibit a

hazardous waste characteristic (ignitibility, corrosivity, reactivity, or toxicity and designated with the code "D").

Regulated entities that generate hazardous waste are subject to waste accumulation, manifesting, and recordkeeping standards. Facilities that treat, store, or dispose of hazardous waste must obtain a permit, either from EPA or from a State agency which EPA has authorized to implement the permitting program. Subtitle C permits contain general facility standards such as contingency plans, emergency procedures, recordkeeping and reporting requirements, financial assurance mechanisms, and unit-specific standards. RCRA also contains provisions (40 CFR Part 264 Subpart S and §264.10) for conducting corrective actions which govern the cleanup of releases of hazardous waste or constituents from solid waste management units at RCRA-regulated facilities.

Although RCRA is a Federal statute, many States implement the RCRA program. Currently, EPA has delegated its authority to implement various provisions of RCRA to 46 of the 50 States.

Most RCRA requirements are not industry specific but apply to any company that transports, treats, stores, or disposes of hazardous waste. Here are some important RCRA regulatory requirements:

- **Identification of Solid and Hazardous Wastes** (40 CFR Part 261) lays out the procedure every generator should follow to determine whether the material created is considered a hazardous waste, solid waste, or is exempted from regulation.
- **Standards for Generators of Hazardous Waste** (40 CFR Part 262) establishes the responsibilities of hazardous waste generators including obtaining an ID number, preparing a manifest, ensuring proper packaging and labeling, meeting standards for waste accumulation units, and recordkeeping and reporting requirements. Generators can accumulate hazardous waste for up to 90 days (or 180 days depending on the amount of waste generated) without obtaining a permit.
- **Land Disposal Restrictions** (LDRs) are regulations prohibiting the disposal of hazardous waste on land without prior treatment. Under the LDRs (40 CFR 268), materials must meet land disposal restriction (LDR) treatment standards prior to placement in a RCRA land disposal unit (landfill, land treatment unit, waste pile, or surface impoundment). Wastes subject to the LDRs include solvents, electroplating wastes,

heavy metals, and acids. Generators of waste subject to the LDRs must provide notification of such to the designated TSD facility to ensure proper treatment prior to disposal.

- **Used Oil Management Standards** (40 CFR Part 279) impose management requirements affecting the storage, transportation, burning, processing, and re-refining of the used oil. For parties that merely generate used oil, regulations establish storage standards. For a party considered a used oil marketer (one who generates and sells off-specification used oil directly to a used oil burner), additional tracking and paperwork requirements must be satisfied.

- **Tanks and Containers** used to store hazardous waste with a high volatile organic concentration must meet emission standards under RCRA. Regulations (40 CFR Part 264-265, Subpart CC) require generators to test the waste to determine the concentration of the waste, to satisfy tank and container emissions standards, and to inspect and monitor regulated units. These regulations apply to all facilities who store such waste, including generators operating under the 90-day accumulation rule.

- **Underground Storage Tanks** (USTs) containing petroleum and hazardous substance are regulated under Subtitle I of RCRA. Subtitle I regulations (40 CFR Part 280) contain tank design and release detection requirements, as well as financial responsibility and corrective action standards for USTs. The UST program also establishes increasingly stringent standards, including upgrade requirements for existing tanks, that must be met by 1998.

- **Boilers and Industrial Furnaces** (BIFs) that use or burn fuel containing hazardous waste must comply with strict design and operating standards. BIF regulations (40 CFR Part 266, Subpart H) address unit design, provide performance standards, require emissions monitoring, and restrict the type of waste that may be burned.

EPA's RCRA/Superfund/UST Hotline, at (800) 424-9346, responds to questions and distributes guidance regarding all RCRA regulations. The RCRA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., EST, excluding Federal holidays.

Comprehensive Environmental Response, Compensation, And Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a 1980 law commonly known as Superfund, authorizes EPA to respond to releases, or threatened releases, of hazardous substances that may endanger public health, welfare, or the environment. CERCLA also enables EPA to force parties responsible for environmental contamination to clean it up or to reimburse the Superfund for response costs incurred by EPA. The Superfund Amendments and Reauthorization Act (SARA) of 1986 revised various sections of CERCLA, extended the taxing authority for the Superfund, and created a free-standing law, SARA Title III, also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).

The CERCLA **hazardous substance release reporting regulations** (40 CFR Part 302) direct the person in charge of a facility to report to the National Response Center (NRC) any environmental release of a hazardous substance which exceeds a reportable quantity. Reportable quantities are defined and listed in 40 CFR § 302.4. A release report may trigger a response by EPA, or by one or more Federal or State emergency response authorities.

EPA implements **hazardous substance responses** according to procedures outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). The NCP includes provisions for permanent cleanups, known as remedial actions, and other cleanups referred to as "removals." EPA generally takes remedial actions only at sites on the National Priorities List (NPL), which currently includes approximately 1300 sites. Both EPA and states can act at other sites; however, EPA provides responsible parties the opportunity to conduct removal and remedial actions and encourages community involvement throughout the Superfund response process.

EPA's RCRA/Superfund/UST Hotline, at (800) 424-9346, answers questions and references guidance pertaining to the Superfund program. The CERCLA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., EST, excluding Federal holidays.

Emergency Planning And Community Right-To-Know Act

The Superfund Amendments and Reauthorization Act (SARA) of 1986 created the Emergency Planning and Community Right-to-Know Act (EPCRA, also known as SARA Title III), a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by

State and local governments. EPCRA required the establishment of State emergency response commissions (SERCs), responsible for coordinating certain emergency response activities and for appointing local emergency planning committees (LEPCs).

EPCRA and the EPCRA regulations (40 CFR Parts 350-372) establish four types of reporting obligations for facilities which store or manage specified chemicals:

- **EPCRA §302** requires facilities to notify the SERC and LEPC of the presence of any "extremely hazardous substance" (the list of such substances is in 40 CFR Part 355, Appendices A and B) if it has such substance in excess of the substance's threshold planning quantity, and directs the facility to appoint an emergency response coordinator.
- **EPCRA §304** requires the facility to notify the SERC and the LEPC in the event of a release exceeding the reportable quantity of a CERCLA hazardous substance or an EPCRA extremely hazardous substance.
- **EPCRA §§311 and 312** require a facility at which a hazardous chemical, as defined by the Occupational Safety and Health Act, is present in an amount exceeding a specified threshold to submit to the SERC, LEPC, and local fire department material safety data sheets (MSDSs) or lists of MSDSs and hazardous chemical inventory forms (also known as Tier I and II forms). This information helps the local government respond in the event of a spill or release of the chemical.
- **EPCRA §313** requires manufacturing facilities included in SIC codes 20 through 39, which have ten or more employees, and which manufacture, process, or use specified chemicals in amounts greater than threshold quantities, to submit an annual toxic chemical release report. This report, commonly known as the Form R, covers releases and transfers of toxic chemicals to various facilities and environmental media, and allows EPA to compile the national Toxic Release Inventory (TRI) database.

All information submitted pursuant to EPCRA regulations is publicly accessible, unless protected by a trade secret claim.

EPA's EPCRA Hotline, at (800) 535-0202, answers questions and distributes guidance regarding the emergency planning and community right-to-know

regulations. The EPCRA Hotline operates weekdays from 8:30 a.m. to 7:30 p.m., EST, excluding Federal holidays.

Clean Water Act

The primary objective of the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), is to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters. Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants; "conventional" pollutants, such as biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform, oil and grease, and pH; and "non-conventional" pollutants, including any pollutant not identified as either conventional or priority.

The CWA regulates both direct and indirect discharges. The **National Pollutant Discharge Elimination System (NPDES)** program (CWA §402) controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either EPA or an authorized State (EPA has presently authorized forty States to administer the NPDES program), contain industry-specific, technology-based and/or water quality-based limits, and establish pollutant monitoring and reporting requirements. A facility that intends to discharge into the nation's waters must obtain a permit prior to initiating its discharge. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The permit will then set forth the conditions and effluent limitations under which a facility may make a discharge.

A NPDES permit may also include discharge limits based on Federal or State water quality criteria or standards, that were designed to protect designated uses of surface waters, such as supporting aquatic life or recreation. These standards, unlike the technological standards, generally do not take into account technological feasibility or costs. Water quality criteria and standards vary from State to State, and site to site, depending on the use classification of the receiving body of water. Most States follow EPA guidelines which propose aquatic life and human health criteria for many of the 126 priority pollutants.

Storm Water Discharges

In 1987 the CWA was amended to require EPA to establish a program to address **storm water discharges**. In response, EPA promulgated the

NPDES storm water permit application regulations. Storm water discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing or raw materials storage areas at an industrial plant (40 CFR 122.26(b)(14)). These regulations require that facilities with the following storm water discharges apply for a NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which EPA or the State determines to contribute to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.

The term "storm water discharge associated with industrial activity" means a storm water discharge from one of 11 categories of industrial activity defined at 40 CFR 122.26. Six of the categories are defined by SIC codes while the other five are identified through narrative descriptions of the regulated industrial activity. If the primary SIC code of the facility is one of those identified in the regulations, the facility is subject to the storm water permit application requirements. If any activity at a facility is covered by one of the five narrative categories, storm water discharges from those areas where the activities occur are subject to storm water discharge permit application requirements.

Those facilities/activities that are subject to storm water discharge permit application requirements are identified below. To determine whether a particular facility falls within one of these categories, the regulation should be consulted.

Category i: Facilities subject to storm water effluent guidelines, new source performance standards, or toxic pollutant effluent standards.

Category ii: Facilities classified as SIC 24-lumber and wood products (except wood kitchen cabinets); SIC 26-paper and allied products (except paperboard containers and products); SIC 28-chemicals and allied products (except drugs and paints); SIC 29-petroleum refining; and SIC 311-leather tanning and finishing.

Category iii: Facilities classified as SIC 10-metal mining; SIC 12-coal mining; SIC 13-oil and gas extraction; and SIC 14-nonmetallic mineral mining.

Category iv: Hazardous waste treatment, storage, or disposal facilities.

Category v: Landfills, land application sites, and open dumps that receive or have received industrial wastes.

Category vi: Facilities classified as SIC 5015-used motor vehicle parts; and SIC 5093-automotive scrap and waste material recycling facilities.

Category vii: Steam electric power generating facilities.

Category viii: Facilities classified as SIC 40-railroad transportation; SIC 41-local passenger transportation; SIC 42-trucking and warehousing (except public warehousing and storage); SIC 43-U.S. Postal Service; SIC 44-water transportation; SIC 45-transportation by air; and SIC 5171-petroleum bulk storage stations and terminals.

Category ix: Sewage treatment works.

Category x: Construction activities except operations that result in the disturbance of less than five acres of total land area.

Category xi: Facilities classified as SIC 20-food and kindred products; SIC 21-tobacco products; SIC 22-textile mill products; SIC 23-apparel related products; SIC 2434-wood kitchen cabinets manufacturing; SIC 25-furniture and fixtures; SIC 265-paperboard containers and boxes; SIC 267-converted paper and paperboard products; SIC 27-printing, publishing, and allied industries; SIC 283-drugs; SIC 285-paints, varnishes, lacquer, enamels, and allied products; SIC 30-rubber and plastics; SIC 31-leather and leather products (except leather and tanning and finishing); SIC 323-glass products; SIC 34-fabricated metal products (except fabricated structural metal); SIC 35-industrial and commercial machinery and computer equipment; SIC 36-electronic and other electrical equipment and components; SIC 37-transportation equipment (except ship and boat building and repairing); SIC 38-measuring, analyzing, and controlling instruments; SIC 39-miscellaneous manufacturing industries; and SIC 4221-4225-public warehousing and storage.

Pretreatment Program

Another type of discharge that is regulated by the CWA is one that goes to a publicly-owned treatment works (POTWs). The national **pretreatment program** (CWA §307(b)) controls the indirect discharge

of pollutants to POTWs by "industrial users." Facilities regulated under §307(b) must meet certain pretreatment standards. The goal of the pretreatment program is to protect municipal wastewater treatment plants from damage that may occur when hazardous, toxic, or other wastes are discharged into a sewer system and to protect the quality of sludge generated by these plants. Discharges to a POTW are regulated primarily by the POTW itself, rather than the State or EPA.

EPA has developed technology-based standards for industrial users of POTWs. Different standards apply to existing and new sources within each category. "Categorical" pretreatment standards applicable to an industry on a nationwide basis are developed by EPA. In addition, another kind of pretreatment standard, "local limits," are developed by the POTW in order to assist the POTW in achieving the effluent limitations in its NPDES permit.

Regardless of whether a State is authorized to implement either the NPDES or the pretreatment program, if it develops its own program, it may enforce requirements more stringent than Federal standards.

EPA's Office of Water, at (202) 260-5700, will direct callers with questions about the CWA to the appropriate EPA office. EPA also maintains a bibliographic database of Office of Water publications which can be accessed through the Ground Water and Drinking Water resource center, at (202) 260-7786.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) mandates that EPA establish regulations to protect human health from contaminants in drinking water. The law authorizes EPA to develop national drinking water standards and to create a joint Federal-State system to ensure compliance with these standards. The SDWA also directs EPA to protect underground sources of drinking water through the control of underground injection of liquid wastes.

EPA has developed primary and secondary drinking water standards under its SDWA authority. EPA and authorized States enforce the primary drinking water standards, which are, contaminant-specific concentration limits that apply to certain public drinking water supplies. Primary drinking water standards consist of maximum contaminant level goals (MCLGs), which are non-enforceable health-based goals, and maximum contaminant levels (MCLs), which are

enforceable limits set as close to MCLGs as possible, considering cost and feasibility of attainment.

The SDWA **Underground Injection Control (UIC)** program (40 CFR Parts 144-148) is a permit program which protects underground sources of drinking water by regulating five classes of injection wells. UIC permits include design, operating, inspection, and monitoring requirements. Wells used to inject hazardous wastes must also comply with RCRA corrective action standards in order to be granted a RCRA permit, and must meet applicable RCRA land disposal restrictions standards. The UIC permit program is primarily State-enforced, since EPA has authorized all but a few States to administer the program.

The SDWA also provides for a Federally-implemented Sole Source Aquifer program, which prohibits Federal funds from being expended on projects that may contaminate the sole or principal source of drinking water for a given area, and for a State-implemented Wellhead Protection program, designed to protect drinking water wells and drinking water recharge areas.

EPA's Safe Drinking Water Hotline, at (800) 426-4791, answers questions and distributes guidance pertaining to SDWA standards. The Hotline operates from 9:00 a.m. through 5:30 p.m., EST, excluding Federal holidays.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) granted EPA authority to create a regulatory framework to collect data on chemicals in order to evaluate, assess, mitigate, and control risks which may be posed by their manufacture, processing, and use. TSCA provides a variety of control methods to prevent chemicals from posing unreasonable risk.

TSCA standards may apply at any point during a chemical's life cycle. Under TSCA §5, EPA has established an inventory of chemical substances. If a chemical is not already on the inventory, and has not been excluded by TSCA, a premanufacture notice (PMN) must be submitted to EPA prior to manufacture or import. The PMN must identify the chemical and provide available information on health and environmental effects. If available data are not sufficient to evaluate the chemical's effects, EPA can impose restrictions pending the development of information on its health and environmental effects. EPA can also restrict significant new uses of chemicals based upon factors such as the projected volume and use of the chemical.

Under TSCA §6, EPA can ban the manufacture or distribution in commerce, limit the use, require labeling, or place other restrictions on chemicals that pose unreasonable risks. Among the chemicals EPA regulates under §6 authority are asbestos, chlorofluorocarbons (CFCs), and polychlorinated biphenyls (PCBs).

EPA's TSCA Assistance Information Service, at (202) 554-1404, answers questions and distributes guidance pertaining to Toxic Substances Control Act standards. The Service operates from 8:30 a.m. through 4:30 p.m., EST, excluding Federal holidays.

Clean Air Act

The Clean Air Act (CAA) and its amendments, including the Clean Air Act Amendments (CAAA) of 1990, are designed to "protect and enhance the nation's air resources so as to promote the public health and welfare and the productive capacity of the population." The CAA consists of six sections, known as Titles, which direct EPA to establish national standards for ambient air quality and for EPA and the States to implement, maintain, and enforce these standards through a variety of mechanisms. Under the CAAA, many facilities will be required to obtain permits for the first time. State and local governments oversee, manage, and enforce many of the requirements of the CAAA. CAA regulations appear at 40 CFR Parts 50-99.

Pursuant to Title I of the CAA, EPA has established national ambient air quality standards (NAAQSs) to limit levels of "criteria pollutants," including carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide. Geographic areas that meet NAAQSs for a given pollutant are classified as attainment areas; those that do not meet NAAQSs are classified as non-attainment areas. Under §110 of the CAA, each State must develop a State Implementation Plan (SIP) to identify sources of air pollution and to determine what reductions are required to meet Federal air quality standards.

Title I also authorizes EPA to establish New Source Performance Standards (NSPSs), which are nationally uniform emission standards for new stationary sources falling within particular industrial categories. NSPSs are based on the pollution control technology available to that category of industrial source but allow the affected industries the flexibility to devise a cost-effective means of reducing emissions.

Under Title I, EPA establishes and enforces National Emission Standards for Hazardous Air Pollutants (NESHAPs), nationally uniform standards oriented towards controlling particular hazardous air pollutants (HAPs). Title III of the CAAA further directed EPA to develop a list of sources that emit any of 189 HAPs, and to develop regulations for these categories of sources. To date EPA has listed 174 categories and developed a schedule for the establishment of emission standards. The emission standards will be developed for both new and existing sources based on "maximum achievable control technology" (MACT). The MACT is defined as the control technology achieving the maximum degree of reduction in the emission of the HAPs, taking into account cost and other factors.

Title II of the CAA pertains to mobile sources, such as cars, trucks, buses, and planes. Reformulated gasoline, automobile pollution control devices, and vapor recovery nozzles on gas pumps are a few of the mechanisms EPA uses to regulate mobile air emission sources.

Title IV establishes a sulfur dioxide emissions program designed to reduce the formation of acid rain. Reduction of sulfur dioxide releases will be obtained by granting to certain sources limited emissions allowances, which, beginning in 1995, will be set below previous levels of sulfur dioxide releases.

Title V of the CAAA of 1990 created a permit program for all "major sources" (and certain other sources) regulated under the CAA. One purpose of the operating permit is to include in a single document all air emissions requirements that apply to a given facility. States are developing the permit programs in accordance with guidance and regulations from EPA. Once a State program is approved by EPA, permits will be issued and monitored by that State.

Title VI is intended to protect stratospheric ozone by phasing out the manufacture of ozone-depleting chemicals and restrict their use and distribution. Production of Class I substances, including 15 kinds of chlorofluorocarbons (CFCs), will be phased out entirely by the year 2000, while certain hydrochlorofluorocarbons (HCFCs) will be phased out by 2030.

EPA's Control Technology Center, at (919) 541-0800, provides general assistance and information on CAA standards. The Stratospheric Ozone Information Hotline, at (800) 296-1996, provides general information about regulations promulgated under Title VI of the CAA, and EPA's EPCRA Hotline, at (800) 535-0202, answers questions about accidental release

prevention under CAA §112(r). In addition, the Technology Transfer Network Bulletin Board System (modem access (919) 541-5742)) includes recent CAA rules, EPA guidance documents, and updates of EPA activities.

Exhibit 21 provides an overview of the statues and certain regulations applicable to the wood furniture manufacturing industry. The information contained in this matrix is based on data from the American Furniture Manufacturers Association document, *Environmental Guide for the Furniture Industry.*

Exhibit 21
Impacts of Environmental Statutes on the Wood Furniture Manufacturing Industry

Statute & Section	Drying (ovens, boilers)	Machining (sawing, planing, sanding)	Assembly (gluing, veneer application)	Pre-finishing/ Finishing (all coating applications)	Cleanup/ Shipping (cleanup, equipment maintenance, warehousing)
Resource Conservation and Recovery Act					
Section 6921 (3)(A) (Hazardous Waste)	Boiler water treatment chemicals may be regulated	N/A	Unused commercial chemical products may be regulated	Unused commercial chemical products and potentially ignitable non-liquid wastes are likely to be regulated	Solvent cleanup solutions, burning of potentially ignitable wastes, and chemical storage and spills may be regulated
Section 6941 (Solid Waste) State/Local Regulations	Non-hazardous boiler ash may be regulated	Wood waste may be regulated	Wood and adhesive waste may be regulated	N/A	Equipment maintenance materials may be regulated
Section 6991 (USTs)	Underground fuel tanks may be regulated	N/A	Adhesive and solvent under-ground storage tanks may be regulated	Solvent under-ground storage tanks are likely to be regulated	N/A
Comprehensive Environmental Response, Compensation, and Liability Act					
CERCLA	N/A	N/A	N/A	Potential spill and disposal problems are likely to occur	Potential spill and disposal problems may occur

Source: AFMA Environmental Guide for the Furniture Industry.

Exhibit 21 (cont'd)
Impacts of Environmental Statutes on the Wood Furniture Manufacturing Industry

Statute & Section	Drying (ovens, boilers)	Machining (sawing, planing, sanding)	Assembly (gluing, veneer application)	Pre-finishing/ Finishing (all coating applications)	Cleanup/ Shipping (cleanup, equipment maintenance, warehousing)
Emergency Planning and Community Right-to-Know Act, SARA Title III					
Sections 301-303	N/A	N/A	Adhesives may be regulated	Finishing materials are likely to be regulated	Finishing and maintenance materials are likely to be regulated
Section 304	N/A	N/A	Adhesives spills may be regulated	Finishing materials spills are likely to be regulated	Maintenance materials spills may be regulated
Sections 311-312	N/A	N/A	Adhesives may be regulated	Finishing materials are likely to be regulated	Finishing and maintenance materials are likely to be regulated
Section 313	N/A	N/A	Emissions from solvent-based adhesives may be regulated	Hazardous finishing materials are likely to be regulated	Hazardous chemical emissions disposal may be regulated
Clean Water Act					
Wastewater Discharge Permitting Program	Wastewater discharge from boilers, compressors, cooling water, and drying kiln condensate may be regulated	N/A	Adhesive wash and water discharge may be regulated	Wastewater discharge from water-wash spray booths and rag laundering are likely to be regulated	N/A
SPCC Planning	N/A	N/A	Adhesive management may be regulated	Finishing oil management is likely to be regulated	Storage and use of fuels and lube oils may be regulated

Source: AFMA Environmental Guide for the Furniture Industry.

Exhibit 21 (cont'd)
Impacts of Environmental Statutes on the Wood Furniture Manufacturing Industry

Statute & Section	Drying (ovens, boilers)	Machining (sawing, planing, sanding)	Assembly (gluing, veneer application)	Pre-finishing/ Finishing (all coating applications)	Cleanup/ Shipping (cleanup, equipment maintenance, warehousing)
Clean Water Act (continued)					
Storm Water Discharge Permitting Program	Wood storage may be regulated	Wood particulates in runoff are likely to be regulated	Adhesive storage may be regulated	Finishing materials management is likely to be regulated	Fuel and maintenance chemical management and material storage may be regulated
Clean Air Act					
Section 7411 (NSPS)	May apply to certain boilers	N / A	N / A	N / A	N / A
Section 7411 (New Source Review)	Permit required before construction of new source	Permit required before construction of new source	Permit required before construction of new source	Permit required before construction of new source	Permit required before construction of new source
Section 7411 (Control Techniques Guidelines)	N / A	N / A	N / A	Draft form scheduled for release in August, 1995	N / A
Section 7501 (Nonattain-ment Areas)	Sources in CO, SO_2, NO_X, O_3 (VOC), PM_{10}, or Pb nonattain-ment areas may be subject to additional requirements	Sources in PM_{10} nonattainment areas may be subject to additional requirements	N / A	Sources in O_3 (VOC) and PM_{10} nonattainment areas may be subject to additional requirements	N / A
Section 7412 (Hazardous Air Pollutants)	N / A	N / A	Currently being finalized; scheduled for release in November, 1995	Currently being finalized; scheduled for release in November, 1995	N / A
Section 7410 (a)(2) (Operating Permits Program)	Permit required for all major and certain non-major sources	Permit required for all major and certain non-major sources	Permit required for all major and certain non-major sources	Permit required for all major and certain non-major sources	Permit required for all major and certain non-major sources

Exhibit 21 (cont'd)
Impacts of Environmental Statutes on the Wood Furniture Manufacturing Industry

Statute & Section	Drying (ovens, boilers)	Machining (sawing, planing, sanding)	Assembly (gluing, veneer application)	Pre-finishing/ Finishing (all coating applications)	Cleanup/ Shipping (cleanup, equipment maintenance, warehousing)
Clean Air Act (continued)					
Section 7411 (Enhanced Monitoring)	Certain boilers may be subject to enhanced monitoring requirements depending on the magnitude of emissions	Large operations may be subject to enhanced monitoring requirements	Sources may be subject to enhanced monitoring requirements depending on the magnitude of emissions	Sources may be subject to enhanced monitoring requirements depending on the magnitude of emissions	N / A
Spill Reporting					
Spill Reporting	Boiler fuels may be regulated	N / A	Adhesives and solvents may be regulated	Toxic finishing materials are likely to be regulated	Maintenance chemicals and oils may be regulated

Source: AFMA Environmental Guide for the Furniture Industry.

VI.B. Industry-specific Regulatory Requirements

Clean Air Act (CAA)

The Clean Air Act as amended in 1990 established the basis for the EPA to set new requirements for hazardous air pollutants (HAPs) that apply to emissions of 189 toxic chemicals listed in the Clean Air Act. EPA recently proposed Maximum Available Control Technology (MACT) standards for the wood furniture manufacturing industry.

In addition, the Agency is developing a control techniques guideline (CTG) for the industry to reduce the emissions of VOCs. While a CTG is not a rule, States generally follow the CTG guidance in developing rules for facilities located in ozone non-attainment areas and the ozone transport region. A preliminary draft model rule containing a preview of the reasonably available control technologies (RACT) that will be recommended in the draft CTG has been made publicly available for the wood furniture industry. A more detailed discussion of both the

draft CTG and the MACT standards can be found in the following section pertaining to pending regulatory requirements.

The Economic Incentive Program (EIP) rules, promulgated on April 7, 1994 (59 FR 16690), provide general information on using innovative strategies to meet the Clean Air Act requirements, including RACT. (The RACT applicability threshold for this model rule is 10 tons for a wood furniture facility located in an extreme ozone nonattainment area and 25 tons per year for a wood furniture facility located in a marginal, moderate, serious, or severe ozone nonattainment area or in the ozone transport region; EPA Method 24 is used as the basis for evaluating VOC data on coatings). The EIP rule contains a range of options for States to use in incorporating economic incentives and/or innovative strategies into their State Implementation Plans (SIPs).

Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Act (RCRA) regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. Although the furniture industry does not tend to generate listed hazardous wastes, it may produce characteristic hazardous wastes. The wood furniture manufacturing industry uses many solvents. Spent solvents and solvent still bottoms are often characterized as hazardous wastes. In addition, furniture manufacturing facilities may generate ignitable or toxic wastes. Many wastes generated from the use of paints, wood treatments, stains, varnishes, and adhesives may be ignitable or might fail the Toxicity Characteristic Leaching Procedure (TCLP) test.

If a facility generates 100 kilograms or more of hazardous waste (or one kilogram of acutely hazardous waste) per month, it may be subject to accumulation time limits, storage restrictions, personnel training requirements, manifesting, and land disposal restrictions for these wastes.

Emergency Planning and Community Right-to-Know Act (EPCRA)

Furniture manufacturers may store extremely hazardous substances (EHS) and hazardous chemicals. If so, facilities would be subject to the emergency planning and hazardous chemical inventory provisions of EPCRA. If they release an EHS or a CERCLA hazardous substance such as toluene or acetone, they may need to report it under the emergency release reporting requirements of SARA Title III. The Toxic Chemical Release Inventory affects only relatively large

furniture companies that use toxic chemicals, such as toluene disocyanate or methylene chloride, above 10,000 pounds annually.

Clean Water Act (CWA)

The Clean Water Act (CWA) regulates discharges of various pollutants into the surface waters of the U.S. or to publicly owned treatment works (POTWs). The effluent provisions of 40 CFR Part 429, Subpart L, regulate facilities which conduct wood finishing activities such as staining and dipping, and require that sources not discharge untreated process wastewater into navigable waters.

CWA regulations also regulate wood furniture manufacturers both with water wash spray booths (40 CFR Part 429, Subpart P) and without wash spray booths (40 CFR 429 Subpart O). Both Subparts require that sources not discharge process wastewater pollutants directly into navigable waters. Both effluent limitations greatly restrict the amount of effluent from process wastewaters which may be released into POTWs and require monitoring and recordkeeping activities. For sources discharging to POTWs, Subpart P requirements are similar to those in Subpart O with the exception that pH levels and levels of solids that settle are regulated for the best practicable technology requirements.

VI.C. Pending and Proposed Regulatory Requirements

Information contained in this section was obtained from the *Fact Sheet on the Proposed MACT and CTG for the Wood Furniture Finishing Industry* developed and distributed by the Small Business Ombudsman of North Carolina. The Clean Air Act as amended in 1990 established the basis for the EPA to set new requirements for HAPs and to develop control techniques guidance (CTG) to reduce VOC emissions. The EPA recently proposed a MACT standard for the wood furniture manufacturing industry, which applies to 189 toxic chemicals listed in the Clean Air Act as HAPs. To help States meet the ambient air quality standard for ozone, the Agency is also developing a CTG for the industry to reduce emissions of VOCs.

The MACT and CTG are concerned with two different types of emissions. The MACT will regulate emissions of HAPs from all wood furniture surface coating operations nationwide. The CTG will address emissions of VOCs from wood furniture finishing, cleaning,

and washoff operations at facilities located in ozone non-attainment areas or in the ozone transport region.

The MACT standard will apply to "major sources" in the wood furniture manufacturing industry. A major source is one that emits or has the potential to emit 10 tons per year (tpy) of an individual HAP or 25 tpy of a combination of HAPs per year. The recommended application of the CTG is for sources that emit or have the potential to emit 10 tpy of VOCs in an extreme non-attainment area and 25 tpy per year of VOCs in any other ozone non-attainment area and in the ozone transport region.

Sources using or agreeing to use no more that 250 total gallons per month, or 3,000 gallons per rolling 12-month period, of finishing, contact adhesives, and cleaning materials are not major sources and are exempted from the MACT standard.

The MACT standard proposes numerical emission limits for surface coating operations including finishing, gluing, and peelable spray booth coating. Finishes include stains, washcoats, basecoats, fillers, sealers, glazes, highlighters, enamels, and topcoats. The CTG preliminary draft proposes numeric emissions limits for finishing and cleaning operations and for strippable booth coatings.

In addition to numeric emissions limits, the MACT standard and CTG propose work practice standards that include inspection and maintenance of equipment, good housekeeping practices such as closed tops on solvent and mixing containers, procedures to account for solvent use, and some limitations on the use of conventional air spray guns, promoting the use of more efficient spray guns.

A source may be affected by both the MACT and CTG. For example, if a wood furniture manufacturer is located in an ozone non-attainment area, uses VOCs and potentially emits greater than 25 tons per year of total VOC emissions, and is a major source for HAPs, the facility would be subject to both requirements.

The following implementation/compliance schedule is proposed with respect to the MACT and CTG:

> A preliminary draft model rule to reduce VOCs was distributed to State and local air agencies in June 1994. This preliminary rule contains emission limits based on RACT for reducing VOCs. RACT requirements may vary among states and local

governments as some will set more stringent requirements to accommodate their specific air quality problems.

Under a court-ordered deadline, the MACT standard was proposed November 21, 1994. November 1995 is the scheduled date for final adoption.

Sources emitting more than 50 tpy of HAPs will have until November 21, 1997 to comply with the final rule.

Sources emitting less than 50 tpy of HAPs will have approximately three years to comply with the final rule. This date will probably be November 1998.

Compliance with the MACT standard can be achieved with compliant coatings; that is, either non-HAP coatings or those meeting the limits, such as 1.0 lb of HAP per pound of solid. High-solids coatings and water-based coatings have fewer VOCs and HAPs, and are becoming more readily available. Although add-on control may also be used to meet the standards, the use of less solvent and fewer toxics in coatings and finishes is likely to be the route most manufacturers take towards compliance (and may be more economical).

The basis for the recommended standards for finishing operations is the use of low-HAP materials or control devices such as incinerators. For cleaning operations, the standards are based on use of low-VOC strippable coatings for spray booths.

In addition to numeric standards, the proposed rules minimize evaporative emissions through work practices covering storage, transfer, and applications in finishing, contact adhesive, cleaning, and washoff operations. These practices include employee training, inspection and maintenance, and housekeeping measures (such as "containers should be closed when not in use").

Exhibits 22 and 23 provide an overview of the proposed MACT emissions limits and work practice standards for the MACT and CTG. This information was obtained from the *Fact Sheet on the Proposed MACT and CTG for the Wood Furniture Finishing Industry*.

Exhibit 22 Summary of Proposed MACT Emission Limit

Emission Point	Existing Source	New Source
Finishing Operations		
(1) Achieve a weighted average HAP content across all coatings (maximum lb VHAP/lb solids)	1.0[a]	0.8[a]
(2) Use compliant finishing materials (maximum lb VHAP/lb solids)		
- stains	1.0[a]	1.0[a]
- washcoats	1.0[a,b]	0.8[a,b]
- sealers	1.0[a]	0.8[a]
- topcoats	1.0[a]	0.8[a]
- basecoats	1.0[a,b]	0.8[a,b]
- enamels	1.0[a,b]	0.8[a,b]
- thinners (maximum percent HAP allowable)	10.0	10.0
(3) As an alternative, use add-on control device	1.0[c]	0.8[c]
(4) Use a combination of (2) and (3)	1.0	0.8
Cleaning Operations		
Strippable spray booth material (max VHAP content = lb VOC/lb solids)	0.8	0.8
Contact Adhesive Operations		
(1) Use compliant contact adhesives (max VHAP content, as applied (lb VHAP/lb solids)		
(i) For foam adhesives used in products that meet flammability requirements	1.8	0.2
(ii) For all other adhesives (including foam adhesives used in products not meeting flammability requirements); or	1.0	0.2
(2) Use a control device	1.0[d]	0.2[d]

Source: Fact Sheet on the Proposed MACT and CTG for the Wood Furniture Finishing Industry.

[a] The limits refer to the HAP content of the coating as applied.

[b] Compliant washcoats, basecoats, and enamels must be used if they are purchased premade; that is, they are not formulated on-site by thinning other finishing materials. If they are formulated on-site, they must be formulated with compliant finishing materials and thinners containing no more than three percent HAP by weight.

[c] The control device must operate at an efficiency equivalent to no greater than 1.0 lbs. (or 0.8 lbs.) of HAP being emitted from the affected emission <N> source per pound of solids used.

[d] The control device must operate at an efficiency that is equivalent to no more than 1.0 lbs. Volatile HAP (VHAP) emitted from the affected emission point per pound of solids used.

Exhibit 23
Summary of Work Practice Standards for the Proposed MACT and CTG

Emission Source	Work Practice
Finishing Operations	
Transfer Equipment Leaks	Develop written inspection and maintenance plan to address and repair leaks. The plan must identify a minimum inspection frequency of one per month and procedures for addressing malfunctions.
Storage containers including mixing equipment	When such containers are used for VOC- or HAP-containing materials, keep covered when not in use.
Application equipment	Limit use of conventional air spray guns and encourage use of more efficient technology.
Finishing materials	Demonstrate usage of HAPs of potential concern have not increased except as allowed by the standards; document in the formulation assessment (MACT only).
Cleaning Operations	
Gun/line cleaning	Collect cleaning solvent into a closed container. Cover all containers associated with cleaning when not in use.
Spray booth cleaning	Do not use solvents unless cleaning conveyors or metal filters.
Wash-off tanks/general cleaning	Do not use chemicals that are known, probable, or possible carcinogens, as identified in section 112(g), in concentrations subject to MSDS reporting, as required by OSHA (MACT only). Keep wash tank covered when not in use. Minimize dragout by tilting and/or rotating part to drain as much solvent as possible and allowing sufficient time to dry. Maintain log of the quantity and type of solvent used for washoff cleaning as well as the quantity of waste shipped off site and the fate of this waste (recycling or disposal). Maintain a log of the number of pieces washed off and the reason for washoff.
Miscellaneous	
Operator training	All operators shall be trained on proper application, cleanup, and equipment use. The training program shall be written and retained on site.
Implementation plan	Develop a plan to implement work practice standards. Maintain plan on site.

Source: Fact Sheet on the Proposed MACT and CTG for the Wood Furniture Finishing Industry.

The work practice standards apply to both existing and new major sources. Air guns will be allowed only in the following instances:

- when used in conjunction with coatings less than 1.0 lb. VOC/lb. of solids
- for touch up and repair under limited conditions
- when spray is automated
- when add-on controls are used

- if the cumulative application is less than 5 percent of total gallons of coating applied
- if the permitting agency determines other application technology is economically or technically infeasible.

VII. COMPLIANCE AND ENFORCEMENT HISTORY

Background

To date, EPA has focused much of its attention on measuring compliance with specific environmental statutes. This approach allows the Agency to track compliance with the Clean Air Act, the Resource Conservation and Recovery Act, the Clean Water Act, and other environmental statutes. Within the last several years, the Agency has begun to supplement single-media compliance indicators with facility-specific, multimedia indicators of compliance. In doing so, EPA is in a better position to track compliance with all statutes at the facility level, and within specific industrial sectors.

A major step in building the capacity to compile multimedia data for industrial sectors was the creation of EPA's Integrated Data for Enforcement Analysis (IDEA) system. IDEA has the capacity to "read into" the Agency's single-media databases, extract compliance records, and match the records to individual facilities. The IDEA system can match Air, Water, Waste, Toxics/Pesticides/EPCRA, TRI, and Enforcement Docket records for a given facility, and generate a list of historical permit, inspection, and enforcement activity. IDEA also has the capability to analyze data by geographic area and corporate holder. As the capacity to generate multimedia compliance data improves, EPA will make available more in-depth compliance and enforcement information. Additionally, sector-specific measures of success for compliance assistance efforts are under development.

Compliance and Enforcement Profile Description

Using inspection, violation, and enforcement data from the IDEA system, this section provides information regarding the historical compliance and enforcement activity of this sector. In order to mirror the facility universe reported in the Toxic Chemical Profile, the data reported within this section consists of records only from the TRI reporting universe. With this decision, the selection criteria are consistent across sectors with certain exceptions. For the sectors that do not normally report to the TRI program, data have been provided from EPA's Facility Indexing System (FINDS) which tracks facilities in all media databases. Please note, in this section, EPA does not attempt to define the actual number of facilities that fall within each sector. Instead, the section portrays the records of a subset of facilities within the sector that are well defined within EPA databases.

As a check on the relative size of the full sector universe, most notebooks contain an estimated number of facilities within the sector according to the Bureau of Census (See Section II). With sectors dominated by small businesses, such as metal finishers and printers, the reporting universe within the EPA databases may be small in comparison to Census data. However, the group selected for inclusion in this data analysis section should be consistent with this sector's general make-up.

Following this introduction is a list defining each data column presented within this section. These values represent a retrospective summary of inspections and enforcement actions, and solely reflect EPA, State, and local compliance assurance activities that have been entered into EPA databases. To identify any changes in trends, the EPA ran two data queries, one for the past five calendar years (August 10, 1990 to August 9, 1995) and the other for the most recent twelve-month period (August 10, 1994 to August 9, 1995). The five-year analysis gives an average level of activity for that period for comparison to the more recent activity.

Because most inspections focus on single-media requirements, the data queries presented in this section are taken from single media databases. These databases do not provide data on whether inspections are State/local or EPA-led. However, the table breaking down the universe of violations does give the reader a crude measurement of the EPA's and States' efforts within each media program. The presented data illustrate the variations across regions for certain sectors.[2] This variation may be attributable to State/local data entry variations, specific geographic concentrations, proximity to population centers, sensitive ecosystems, highly toxic chemicals used in production, or historical noncompliance. Hence, the exhibited data do not rank regional performance or necessarily reflect which regions may have the most compliance problems.

[2] EPA Regions include the following States: 1 (CT, MA, ME, RI, NH, VT); 2 (NJ, NY, PR, VI); 3 (DC, DE, MD, PA, VA, WV); 4 (AL, FL, GA, KY, MS, NC, SC, TN); 5 (IL, IN, MI, MN, OH, WI); 6 (AR, LA, NM, OK, TX); 7 (IA, KS, MO, NE); 8 (CO, MT, ND, SD, UT, WY); 9 (AZ, CA, HI, NV, Pacific Trust Territories); 10 (AK, ID, OR, WA).

Compliance and Enforcement Data Definitions

General Definitions

Facility Indexing System (FINDS) -- this system assigns a common facility number to EPA single-media permit records. The FINDS identification number allows EPA to compile and review all permit, compliance, enforcement, and pollutant release data for any given regulated facility.

Integrated Data for Enforcement Analysis (IDEA) -- is a data integration system that can retrieve information from the major EPA program office databases. IDEA uses the FINDS identification number to "glue together" separate data records from EPA's databases. This is done to create a "master list" of data records for any given facility. Some of the data systems accessible through IDEA are: AIRS (Air Facility Indexing and Retrieval System, Office of Air and Radiation), PCS (Permit Compliance System, Office of Water), RCRIS (Resource Conservation and Recovery Information System, Office of Solid Waste), NCDB (National Compliance Data Base, Office of Prevention, Pesticides, and Toxic Substances), CERCLIS (Comprehensive Environmental and Liability Information System, Superfund), and TRIS (Toxic Release Inventory System). IDEA also contains information from outside sources such as Dun and Bradstreet and the Occupational Safety and Health Administration (OSHA). Most data queries displayed in notebook Sections IV and VII were conducted using IDEA.

Data Table Column Heading Definitions

Facilities in Search -- are based on the universe of TRI reporters within the listed SIC code range. For industries not covered under TRI reporting requirements, the notebook uses the FINDS universe for executing data queries. The SIC code range selected for each search is defined by each notebook's selected SIC code coverage described in Section II.

Facilities Inspected --- indicates the level of EPA and State agency facility inspections for the facilities in this data search. These values show what percentage of the facility universe is inspected in a 12 or 60 month period. This column does not count non-inspectional compliance activities such as the review of facility-reported discharge reports.

Number of Inspections -- measures the total number of inspections conducted in this sector. An inspection event is counted each time it is entered into a single media database.

Average Time Between Inspections -- provides an average length of time, expressed in months, that a compliance inspection occurs at a facility within the defined universe.

Facilities with One or More Enforcement Actions -- expresses the number of facilities that were party to at least one enforcement action within the defined time period. This category is broken down further into Federal and State actions. Data are obtained for administrative, civil/judicial, and criminal enforcement actions. Administrative actions include Notices of Violation (NOVs). A facility with multiple enforcement actions is only counted once in this column (facility with 3 enforcement actions counts as 1). All percentages that appear are referenced to the number of facilities inspected.

Total Enforcement Actions -- describes the total number of enforcement actions identified for an industrial sector across all environmental statutes. A facility with multiple enforcement actions is counted multiple times (a facility with 3 enforcement actions counts as 3).

State Lead Actions -- shows what percentage of the total enforcement actions are taken by State and local environmental agencies. Varying levels of use by States of EPA data systems may limit the volume of actions accorded State enforcement activity. Some States extensively report enforcement activities into EPA data systems, while other States may use their own data systems.

Federal Lead Actions -- shows what percentage of the total enforcement actions are taken by the U.S. EPA. This value includes referrals from State agencies. Many of these actions result from coordinated or joint State/Federal efforts.

Enforcement to Inspection Rate -- expresses how often enforcement actions result from inspections. This value is a ratio of enforcement actions to inspections, and is presented for comparative purposes only. This measure is a rough indicator of the relationship between inspections and enforcement. This measure simply indicates historically how many enforcement actions can be attributed to inspection activity. Related inspections and enforcement actions under the Clean Water Act (PCS), the Clean Air Act (AFS) and the Resource

Conservation and Recovery Act (RCRA) are included in this ratio. Inspections and actions from the TSCA/FIFRA/EPCRA database are not factored into this ratio because most of the actions taken under these programs are not the result of facility inspections. This ratio does not account for enforcement actions arising from non-inspection compliance monitoring activities (e.g., self-reported water discharges) that can result in enforcement action within the CAA, CWA and RCRA.

Facilities with One or More Violations Identified -- indicates the number and percentage of inspected facilities having a violation identified in one of the following data categories: In Violation or Significant Violation Status (CAA); Reportable Noncompliance, Current Year Noncompliance, Significant Noncompliance (CWA); Noncompliance and Significant Noncompliance (FIFRA, TSCA, and EPCRA); Unresolved Violation and Unresolved High Priority Violation (RCRA). The values presented for this column reflect the extent of noncompliance within the measured time frame, but do not distinguish between the severity of the noncompliance. Percentages within this column can exceed 100 percent because facilities can be in violation status without being inspected. Violation status may be a precursor to an enforcement action, but does not necessarily indicate that an enforcement action will occur.

Media Breakdown of Enforcement Actions and Inspections -- four columns identify the proportion of total inspections and enforcement actions within EPA Air, Water, Waste, and TSCA/FIFRA/EPCRA databases. Each column is a percentage of either the "Total Inspections," or the "Total Actions" column.

VII.A. Furniture and Fixtures Industry Compliance History

Exhibit 24 provides a Regional breakdown of the five year enforcement and compliance activities for the furniture and fixtures industry. Region IV conducted approximately 68 percent of the inspections of furniture manufacturing facilities performed in the United States. This large percentage is due to the concentration of furniture manufacturers in the Southeastern U.S., specifically in North Carolina.

Exhibit 24
Five Year Enforcement and Compliance Summary for the Wood Furniture and Fixtures Industry

A	B	C	D	E	F	G	H	I	J
Furniture and Fixtures SIC 25	Facilities in Search	Facilities Inspected	Number of Inspections	Average Number of Months Between Inspections	Facilities w/one or more Enforcement Actions	Total Enforcement Actions	State Lead Actions	Federal Lead Actions	Enforcement to Inspection Rate
Region I	13	10	52	15	0	0	0%	0%	—
Region II	14	10	33	25	3	3	0%	100%	0.09
Region III	39	33	211	11	7	15	100%	0%	0.07
Region IV	121	103	1,045	7	10	40	94%	6%	0.04
Region V	50	36	144	21	10	25	96%	4%	0.17
Region VI	10	8	20	30	1	1	0%	100%	0.05
Region VII	13	4	12	65	1	1	100%	0%	0.08
Region VIII	3	3	6	30	1	5	100%	0%	0.83
Region IX	24	3	7	206	1	1	0%	100%	0.14
Region X	6	3	4	90	0	0	0%	0%	—
Total/Average	293	213	1,534	11	34	91	91%	9%	0.06

VII.B. Comparison of Enforcement Activity Between Selected Industries

Exhibits 25-28 contain summaries of the one and five year enforcement and compliance activities for the furniture and fixtures industry, as well as for other selected industries. As indicated in Exhibits 25 and 26, the furniture and fixtures industry has a low enforcement to inspection rate compared to other industries. Exhibits 27 and 28 provide a breakdown of inspection and enforcement activities by statute. Of all the furniture and fixtures industry inspections, approximately 52 percent were performed under the Clean Air Act, while approximately 45 percent were conduced under RCRA. The large percentages of CAA and RCRA inspections for this industry are due to the VOC emissions and spent finishing materials resulting from the solvent intensive processes used by this industry.

Exhibit 25
Five Year Enforcement and Compliance Summary for Selected Industries

A	B	C	D	E	F	G	H	I	J
Industry Sector	Facilities in Search	Facilities Inspected	Number of Inspections	Average Number of Months Between Inspections	Facilities w/One or More Enforcement Actions	Total Enforcement Actions	State Lead Actions	Federal Lead Actions	Enforcement to Inspection Rate
Metal Mining	873	339	1,519	34	67	155	47%	53%	0.10
Non-metallic Mineral Mining	1,143	631	3,422	20	84	192	76%	24%	0.06
Lumber and Wood	464	301	1,891	15	78	232	79%	21%	0.12
Furniture	293	213	1,534	11	34	91	91%	9%	0.06
Rubber and Plastic	1,665	739	3,386	30	146	391	78%	22%	0.12
Stone, Clay, and Glass	468	268	2,475	11	73	301	70%	30%	0.12
Nonferrous Metals	844	474	3,097	16	145	470	76%	24%	0.15
Fabricated Metal	2,346	1,340	5,509	26	280	840	80%	20%	0.15
Electronics/Computers	405	222	777	31	68	212	79%	21%	0.27
Motor Vehicle Assembly	598	390	2,216	16	81	240	80%	20%	0.11
Pulp and Paper	306	265	3,766	5	115	502	78%	22%	0.13
Printing	4,106	1,035	4,723	52	176	514	85%	15%	0.11
Inorganic Chemicals	548	298	3,034	11	99	402	76%	24%	0.13
Organic Chemicals	412	316	3,864	6	152	726	66%	34%	0.19
Petroleum Refining	156	145	3,257	3	110	797	66%	34%	0.25
Iron and Steel	374	275	3,555	6	115	499	72%	28%	0.14
Dry Cleaning	933	245	633	88	29	103	99%	1%	0.16

Exhibit 26
One Year Enforcement and Compliance Summary for Selected Industries

A	B	C	D	E		F		G	H
Industry Sector	Facilities in Search	Facilities Inspected	Number of Inspections	Facilities w/One or More Violations		Facilities w/One or More Enforcement Actions		Total Enforcement Actions	Enforcement to Inspection Rate
				Number	Percent*	Number	Percent*		
Metal Mining	873	114	194	82	72%	16	14%	24	0.13
Non-metallic Mineral Mining	1,143	253	425	75	30%	28	11%	54	0.13
Lumber and Wood	464	142	268	109	77%	18	13%	42	0.15
Furniture	293	160	113	66	41%	3	2%	5	0.04
Rubber and Plastic	1,665	271	435	289	107%	19	7%	59	0.14
Stone, Clay, and Glass	468	146	330	116	79%	20	14%	66	0.20
Nonferrous Metals	844	202	402	282	140%	22	11%	72	0.18
Fabricated Metal	2,346	477	746	525	110%	46	10%	114	0.15
Electronics/Computers	405	60	87	80	133%	8	13%	21	0.24
Motor Vehicle Assembly	598	169	284	162	96%	14	8%	28	0.10
Pulp and Paper	306	189	576	162	86%	28	15%	88	0.15
Printing	4,106	397	676	251	63%	25	6%	72	0.11
Inorganic Chemicals	548	158	427	167	106%	19	12%	49	0.12
Organic Chemicals	412	195	545	197	101%	39	20%	118	0.22
Petroleum Refining	156	109	437	109	100%	39	36%	114	0.26
Iron and Steel	374	167	488	165	99%	20	12%	46	0.09
Dry Cleaning	933	80	111	21	26%	5	6%	11	0.10

*Percentages in Columns E and F are based on the number of facilities inspected (Column C). Percentages can exceed 100% because violations and actions can occur without a facility inspection.

Exhibit 27
Five Year Inspection and Enforcement Summary by Statute for Selected Industries

Industry Sector	Number of Facilities Inspected	Total Inspections	Enforcement Actions	Clean Air Act		Clean Water Act		Resource Conservation and Recovery Act		FIFRA/TSCA/ EPCRA/Other*	
				% of Total Inspections	% of Total Actions	% of Total Inspections	% of Total Actions	% of Total Inspections	% of Total Actions	% of Total Inspections	% of Total Actions
Metal Mining	339	1,519	155	35%	17%	57%	60%	6%	14%	1%	9%
Non-metallic Mineral Mining	631	3,422	192	65%	46%	31%	24%	3%	27%	<1%	4%
Lumber and Wood	301	1,891	232	31%	21%	8%	7%	59%	67%	2%	5%
Furniture	293	1,534	91	52%	27%	1%	1%	45%	64%	1%	8%
Rubber and Plastic	739	3,386	391	39%	15%	13%	7%	44%	68%	3%	10%
Stone, Clay and Glass	268	2,475	301	45%	39%	15%	5%	39%	51%	2%	5%
Nonferrous Metals	474	3,097	470	36%	22%	22%	13%	38%	54%	4%	10%
Fabricated Metal	1,340	5,509	840	25%	11%	15%	6%	56%	76%	4%	7%
Electronics/ Computers	222	777	212	16%	2%	14%	3%	66%	90%	3%	5%
Motor Vehicle Assembly	390	2,216	240	35%	15%	9%	4%	54%	75%	2%	6%
Pulp and Paper	265	3,766	502	51%	48%	38%	30%	9%	18%	2%	3%
Printing	1,035	4,723	514	49%	31%	6%	3%	43%	62%	2%	4%
Inorganic Chemicals	302	3,034	402	29%	26%	29%	17%	39%	53%	3%	4%
Organic Chemicals	316	3,864	726	33%	30%	16%	21%	46%	44%	5%	5%
Petroleum Refining	145	3,237	797	44%	32%	19%	12%	35%	52%	2%	5%
Iron and Steel	275	3,555	499	32%	20%	30%	18%	37%	58%	2%	5%
Dry Cleaning	245	633	103	15%	1%	3%	4%	83%	93%	<1%	1%

* Actions taken to enforce the Federal Insecticide, Fungicide, and Rodenticide Act; the Toxic Substances and Control Act, and the Emergency Planning and Community Right-to-Know Act as well as other Federal environmental laws.

Exhibit 28
One Year Inspection and Enforcement Summary by Statute for Selected Industries

Industry Sector	Number of Facilities Inspected	Total Inspections	Enforcement Actions	Clean Air Act		Clean Water Act		Resource Conservation and Recovery Act		FIFRA/TSCA/ EPCRA/Other	
				% of Total Inspections	% of Total Actions	% of Total Inspections	% of Total Actions	% of Total Inspections	% of Total Actions	% of Total Inspections	% of Total Actions
Metal Mining	114	194	24	47%	42%	43%	34%	10%	6%	<1%	19%
Non-metallic Mineral Mining	253	425	54	69%	58%	26%	16%	5%	16%	<1%	11%
Lumber and Wood	142	268	42	29%	20%	8%	13%	63%	61%	<1%	6%
Furniture	293	160	5	58%	67%	1%	10%	41%	10%	<1%	13%
Rubber and Plastic	271	435	59	39%	14%	14%	4%	46%	71%	1%	11%
Stone, Clay, and Glass	146	330	66	45%	52%	18%	8%	38%	37%	<1%	3%
Nonferrous Metals	202	402	72	33%	24%	21%	3%	44%	69%	1%	4%
Fabricated Metal	477	746	114	25%	14%	14%	8%	61%	77%	<1%	2%
Electronics/ Computers	60	87	21	17%	2%	14%	7%	69%	87%	<1%	4%
Motor Vehicle Assembly	169	284	28	34%	16%	10%	9%	56%	69%	1%	6%
Pulp and Paper	189	576	88	56%	69%	35%	21%	10%	7%	<1%	3%
Printing	397	676	72	50%	27%	5%	3%	44%	66%	<1%	4%
Inorganic Chemicals	158	427	49	26%	38%	29%	21%	45%	36%	<1%	6%
Organic Chemicals	195	545	118	36%	34%	13%	16%	50%	49%	1%	1%
Petroleum Refining	109	439	114	50%	31%	19%	16%	30%	47%	1%	6%
Iron and Steel	167	488	46	29%	18%	35%	26%	36%	50%	<1%	6%
Dry Cleaning	80	111	11	21%	4%	1%	22%	78%	67%	<1%	7%

* Actions taken to enforce the Federal Insecticide, Fungicide, and Rodenticide Act; the Toxic Substances and Control Act, and the Emergency Planning and Community Right-to-Know Act as well as other Federal environmental laws.

VII.C. Review of Major Legal Actions

This section provides summary information about major cases and supplemental enforcement projects that pertain to the Wood Furniture and Fixtures Industry. Information in this section is provided by the Office of Enforcement and Compliance Assurance and EPA's *Enforcement Accomplishments Report*.

VII.C.1. Review of Major Cases

As indicated in EPA's *Enforcement Accomplishments Report, FY1991, FY1992, FY1993* publications, two significant enforcement actions were resolved between 1991 and 1993 for the furniture and fixtures industry, involving RCRA violations. One of the RCRA enforcement cases also included CWA violations. The companies against which the cases were brought include a school furniture manufacturer and a furniture refinisher.

Of the two actions involving RCRA violations, one was a civil action for penalties and injunctive relief against the school furniture manufacturer. The action was based on 29 RCRA and significant CWA violations discovered by EPA inspectors. The violations resulted primarily from the use of two unlined surface impoundments as part of a waste water treatment facility. The second case involving RCRA violations was against a furniture refinisher and resulted in a conviction on four counts of illegal disposal of hazardous waste and imposition of a jail sentence. The hazardous waste consisted primarily of furniture stripping solvents.

VII.C.2. Supplemental Environmental Projects

SEPs are compliance agreements that reduce a facility's stipulated penalty in return for an environmental project that exceeds the value of the reduction. Often, these projects fund pollution prevention activities that can significantly reduce the future pollutant loadings of a facility. The yearly Regional updates and the *Enforcement Accomplishments Reports, FY1991, FY1992,* and *FY1993* did not provide information on any SEPs entered into by furniture or fixture manufacturing facilities.

VIII. COMPLIANCE ACTIVITIES AND INITIATIVES

This section highlights the activities undertaken by this industry sector and public agencies to voluntarily improve the sector's environmental performance. These activities include those independently initiated by industrial trade associations. In this section, the notebook also contains a listing and description of national and regional trade associations.

VIII.A. Sector-related Environmental Programs and Activities

One major sector-related environmental research project has been undertaken at the Furniture and Manufacturing and Management (FMM) Center at North Carolina State University (NCSU), organized in 1991 as an outgrowth the Furniture Manufacturing and Management curriculum, which began in 1948. The mission of the FMM Center is three-fold:

- To conduct applied research on manufacturing and engineering issues for the benefit of the furniture industry;
- To carry out an extension program providing ongoing technical assistance and technology transfer in support of the furniture industry. Extension services focus on the areas of upholstery furniture manufacturing, case goods manufacturing, and environmental management;
- To educate engineers with specific knowledge of furniture manufacturing.

The Environmental Program of the FMM Center is divided into applied research activities and extension services. Research activities are related to the industry in general rather than a particular company. Currently, the FMM Center has two ongoing research projects related to environmental issues:

- Development of environmental recordkeeping software and a computerized tracking system for chemical usage and emission reporting;
- Exploration of a biofiltration project, a method for destruction of VOC and HAP emissions from finishing operations.

The following project, requested by the U.S. EPA, may be undertaken in the near future:

- Use of very low VOC/HAP coatings for wood finishing processes as a pollution prevention option for complying with the MACT and CTG.

The purpose of the environmental extension program is to promote cooperation between the furniture industry and the FMM Center. Activities include providing technical assistance and advisory guidance, conducting literature searches, acting as liaison, and providing training, and other requested services, including:

- Quarterly environmental forum for environmental managers and engineers in the furniture industry
- Information dissemination, including free computerized literature searches
- Technical assistance on an individual company basis, including short-term consultations
- Workshops and training.

In addition to the FMM initiatives, the North Carolina Small Business Ombudsman has been active in increasing awareness about the proposed MACT and CTG for the wood furniture finishing industry by issuing a fact sheet. The Small Business Ombudsman and some of the larger trade associations have also been involved in other compliance-related initiatives (see Section VIII.C.1.).

VIII.B. EPA Voluntary Programs

33/50 Program

The "33/50 Program" is EPA's voluntary program to reduce toxic chemical releases and transfers of 17 chemicals from manufacturing facilities. Participating companies pledge to reduce their toxic chemical releases and transfers by 33 percent as of 1992 and by 50 percent as of 1995 from the 1988 baseline year. Certificates of Appreciation have been given to participants who met their 1992 goals. The list of chemicals includes 17 high-use chemicals reported in the Toxics Release Inventory.

Of the 17 chemicals covered by the 33/50 Program, 11 are used by and are outputs of the wood furniture manufacutring industry. All but three of these eleven chemicals are solvents which are sued throughout furniture production, particularly in the finishing stages of the process.

Exhibit 28 lists those companies participating in the 33/50 program that reported under SIC code 25 to TRI. Many of the participating companies listed multiple SIC codes (in no particular order), and are therefore likely to conduct operations in addition to Wood Furniture and Fixtures Industry. The table shows the number of facilities within each company that are participating in the 33/50 program; each company's total 1993 releases and transfers of 33/50 chemicals; and the percent reduction in these chemicals since 1988.

According to EPA, 359 furniture manufacturing companies comprise the potential 33/50 universe. Of those companies, 31 or 8.64 percent are participating in the program, which is less than the average for all industries of 14 percent participation.

Exhibit 28
Wood Furniture and Fixtures Facilities Participating in the 33/50 Program

Parent Facility name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
Armstrong World Industries	Lancaster	PA	2511	11	1,109,350	*
Bassett Superior Lines	Bassett	VA	2511	12	2,063,109	50
Best Chairs Inc.	Ferdinand	IN	2511	1	51,700	***
Geiger Group Inc	Atlanta	GA	2521	1	45,078	81
Hamilton Industries Inc	Two Rivers	WI	2521	1	31,875	7
Haworth Inc	Holland	MI	2522, 2521	2	194,050	50
Heidelberg Cement Inc	Allentown	PA	2511	1	119,957	*
Itr Industries Inc	Deer Park	NY	2511	1	34,882	*
Joyce International Inc (De)	New York	NY	2541	2	118,847	25
Klipsch & Associates Inc	Indianapolis	IN	2517, 2519, 3651	1	11,521	*
La-Z-Boy Chair Company	Monroe	MI	2511	7	572,153	**
Lozier Corporation	Omaha	NE	2542, 2541	2	186,715	85
Madix Inc	Terrell	TX	2542, 2541	1	623,805	55
Marmon Group, Inc	Chicago	IL	2541	1	1,092,218	1
Mascotech	Taylor	MI	2511	17	3,163,830	35
North American Philips Corp	New York	NY	2517	1	1,281,928	50
Oklahoma Fixture Co.	Tulsa	OK	2541	2	236,975	***
Seely Pine Furniture Inc.	Berkeley Springs	WV	2511	1	22,996	***
Shuford Industries Inc	Hickory	NC	2511	3	1,613,303	58
Silver Furniture Co Inc	Knoxville	TN	2511	1	73,705	45

Exhibit 28
Wood Furniture and Fixtures Facilities Participating in the 33/50 Program (cont'd)

Parent Facility name	Parent City	ST	SIC Codes	# of Participating Facilities	1993 Releases and Transfers (lbs.)	% Reduction 1988 to 1993
Steelcase Inc	Grand Rapids	MI	2522, 2542, 2521	5	2,042,735	20
Suba Mfg. Inc	Benicia	CA	2541	1	5,949	25
Thomson Consumer Electronics	Indianapolis	IN	2517	1	2,110,314	43
W. J. Roscoe Co.	Akron	OH	2851, 2891, 2517	1	40,051	50
White Consolidated Industries	Cleveland	OH	3585, 2542, 2541	1	808,298	81

*** = not quantifiable against 1988 data.**
**** = use reduction goal only.**
***** = no numerical goal.**

Environmental Leadership Program

The Environmental Leadership Program (ELP) is a national initiative piloted by EPA and State agencies in which facilities have volunteered to demonstrate innovative approaches to environmental management and compliance. EPA has selected 12 pilot projects at industrial facilities and Federal installations which will demonstrate the principles of the ELP program. These principles include: environmental management systems, multimedia compliance assurance, third-party verification of compliance, public measures of accountability, community involvement, and mentoring programs. In return for participating, pilot participants receive public recognition and are given a period of time to correct any violations discovered during these experimental projects. (Contact: Tai-ming Chang, ELP Director, 202-564-5081 or Robert Fentress, 202-564-7023)

Project XL

Project XL was initiated in March 1995 as a part of President Clinton's *Reinventing Environmental Regulation* initiative. The projects seek to achieve cost effective environmental benefits by allowing participants to replace or modify existing regulatory requirements on the condition that they produce greater environmental benefits. EPA and program participants will negotiate and sign a Final Project Agreement, detailing specific objectives that the regulated entity shall satisfy. In exchange, EPA will allow the participant a certain degree of regulatory flexibility and may seek changes in underlying regulations or statutes. Participants are encouraged to seek stakeholder support from local

governments, businesses, and environmental groups. EPA hopes to implement fifty pilot projects in four categories including facilities, sectors, communities, and government agencies regulated by EPA. Applications will be accepted on a rolling basis and projects will move to implementation within six months of their selection. For additional information regarding XL Projects, including application procedures and criteria, see the May 23, 1995 Federal Register Notice, or contact Jon Kessler at EPA's Office of Policy Analysis (202) 260-4034.

Green Lights Program

EPA's Green Lights program was initiated in 1991 and has the goal of preventing pollution by encouraging U.S. institutions to use energy-efficient lighting technologies. The program has over 1,500 participants which include major corporations; small and medium sized businesses; Federal, State and local governments; non-profit groups; schools; universities; and health care facilities. Each participant is required to survey their facilities and upgrade lighting wherever it is profitable. EPA provides technical assistance to the participants through a decision support software package, workshops and manuals, and a financing registry. EPA's Office of Air and Radiation is responsible for operating the Green Lights Program. (Contact: Susan Bullard at 202-233-9065 or the Green Light/Energy Star Hotline at 202-775-6650)

WasteWi$e Program

The WasteWi$e Program was started in 1994 by EPA's Office of Solid Waste and Emergency Response. The program is aimed at reducing municipal solid wastes by promoting waste minimization, recycling collection, and the manufacturing and purchase of recycled products. As of 1994, the program had about 300 companies as members, including a number of major corporations. Members agree to identify and implement actions to reduce their solid wastes and must provide EPA with their waste reduction goals along with yearly progress reports. EPA in turn provides technical assistance to member companies and allows the use of the WasteWi$e logo for promotional purposes. (Contact: Lynda Wynn, 202-260-0700 or the WasteWi$e Hotline at 1-800-372-9473).

According to a representative from the Business and Institutional Furniture Manufacturers Association (BIFMA), BIFMA has recently joined the EPA's Waste Wi$e Program.

Climate Wise Recognition Program

The Climate Change Action Plan was initiated in response to the U.S. commitment to reduce greenhouse gas emissions in accordance with the Climate Change Convention of the 1990 Earth Summit. As part of the Climate Change Action Plan, the Climate Wise Recognition Program is a partnership initiative run jointly by EPA and the Department of Energy. The program is designed to reduce greenhouse gas emissions by encouraging reductions across all sectors of the economy, encouraging participation in the full range of Climate Change Action Plan initiatives, and fostering innovation. Participants in the program are required to identify and commit to actions that reduce greenhouse gas emissions. The program, in turn, gives organizations early recognition for their reduction commitments; provides technical assistance through consulting services, workshops, and guides; and provides access to the program's centralized information system. At EPA, the program is operated by the Air and Energy Policy Division within the Office of Policy Planning and Evaluation. (Contact: Pamela Herman, 202-260-4407)

NICE^3

The U.S. Department of Energy and EPA's Office of Pollution Prevention are jointly administering a grant program called The National Industrial Competitiveness through Energy, Environment, and Economics (NICE^3). By providing grants of up to 50 percent of the total project cost, the program encourages industry to reduce industrial waste at its source and become more energy-efficient and cost-competitive through waste minimization efforts. Grants are used by industry to design, test, demonstrate, and assess the feasibility of new processes and/or equipment with the potential to reduce pollution and increase energy efficiency. The program is open to all industries; however, priority is given to proposals from participants in the pulp and paper, chemicals, primary metals, and petroleum and coal products sectors. (Contact: DOE's Golden Field Office, 303-275-4729)

VIII.C. Trade Association/Industry Sponsored Activity

The following discussion will provide an overview of the larger trade associations representing the wood furniture manufacturing industry, with contact names, addresses, and summaries of activities undertaken by the associations to heighten their member companies' awareness of environmental regulations and compliance issues.

VIII.C.1. Environmental Programs

The larger trade associations with member companies from the wood furniture manufacturing industry have undertaken campaigns to educate further their membership on environmental regulations and compliance issues. The American Furniture Manufacturers Association (AFMA), in conjunction with 3M Environmental Engineering, Akzo Nobel, and Radian Corporation, has developed an industry compliance notebook and training course to inform facility managers of environmental regulations which could apply to their manufacturing operations. Similarly, Business and Institutional Furniture Manufacturers Association (BIFMA), AFMA, and the Kitchen Cabinet Manufacturers Association (KCMA) have already conducted four training seminars on the draft CTG and MACT standards for the wood furniture industry and how to comply with the new requirements. In addition, AFMA, BIFMA, KCMA, and the National Paint and Coatings Association were the primary industry trade association representatives in the lengthy regulatory negotiation process with EPA and other interested parties on the CTG and MACT standards.

VIII.C.2. Summary of Trade Associations

American Furniture Manufacturers Association (AFMA) P.O. Box HP-7 High Point, NC 27261 Phone: (910) 884-5000 Fax: (910) 884-5303	Members: 336 Staff: 14

Founded in 1984, this trade association includes manufacturers seeking to provide a unified voice for the furniture industry and to aid in the development of personnel. The group provides market research

data, industrial relations services, costs and operating statistics, and general management and information services. The AFMA has annual meetings and publishes a membership directory once a year.

Business and Institutional Furniture Manufacturers Association (BIFMA) 2680 Horizon Drive S.E., Suite A-1 Grand Rapids, MI 49546 Fax: (616) 285-3765	Members: 221 Staff: 6 Budget: $700,000 Contact: Russell Coyner, Exec. Dir. Phone: (616) 285-3963

This trade association consists of firms that manufacture furniture intended for use in offices, public spaces, and non-live-in institutions (including seating and space divider manufacturers). BIFMA is involved in industry relations, government relations, and maintains and provides industry information and statistics. The group conducts annual management conferences and publishes an annual membership directory, a bimonthly newsletter, and various statistical reports for its membership.

Futon Association International (FAI) P.O. Box 6548 Chico, CA 95927-6548 Phone: (916) 534-7833 Toll free: (800) 327-3262 Fax: (916) 534-7875	Members: 450 Staff: 2 Contact: Timothy Jacobs, Executive Director

The FAI includes manufacturers, suppliers, wholesalers, and retailers of futons. This trade association facilitates contact and communication within the futon industry and keeps members informed of changes in the bedding industries codes, laws, and regulations. The FAI annually hosts a Futon EXPO and publishes periodic bulletins, membership directories, and a quarterly document entitled *Updates.*

Grand Rapids Area Furniture Manufacturers Association (GRAFMA) 4362 Cascade Road, S.E., Suite 113 Grand Rapids, MI 49506 Phone: (616) 942-6225 Fax: (616) 942-1730	Members: 56 Staff: 2 Budget: $97,000 Contact: Carol Kooistra, Executive Director

This association consists of furniture manufacturers located in western Michigan. The organization conducts wage surveys, compiles statistics, sponsors periodic seminars on furniture technology, and publishes brochures, newsletters, and the document entitled *Roster*.

International Home Furnishings Marketing Association (IHFMA) P.O. Box 5687 High Point, NC 27262 Phone: (910) 889-0203 Fax: (910) 889-7460	Members: 55 Staff: 2 Contact: Richard Barentine, Executive Director

Founded in 1955, this furniture manufacturers' group works to create a cooperative business environment. The IHFMA holds semiannual meetings in North Carolina and publishes various brochures and pamphlets.

International Wholesale Furniture Association (IWFA) P.O. Box 2482 164 S. Main Street, Suite 404 High Point, NC 27261 Phone: (910) 884-1566	Members: 127 Staff: 2 Contact: Sonny Berry, Executive Director

The IWFA consists mainly of wholesalers of home furniture but also includes some supplier firms that manufacture products offered for sale by wholesale-distributor members. This trade association hosts semiannual banquets and publishes a monthly newsletter entitled *National Wholesale Furniture Association* and an annual publication *Who's Who in Furniture Distribution*.

IX. CONTACTS/ACKNOWLEDGMENTS/RESOURCE MATERIALS/BIBLIOGRAPHY

For further information on selected topics within the furniture and fixtures industry, a list of publications is provided below:

General Profile

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Enforcement Accomplishments Report, FY 1992, U.S. EPA, Office of Enforcement (EPA/230-R93-001), April 1993.

Enforcement Accomplishments Report, FY 1993, U.S. EPA, Office of Enforcement (EPA/300-R94-003), April 1994.

Standard Industrial Classification Manual, Office of Management and Budget, 1987.

1992 Toxic Release Inventory (TRI) Public Data Release, U.S. EPA, Office of Pollution Prevention and Toxics, April 1994. (EPA/745-R94-001)

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1987 Census of Manufacturers, Industry Series: Household Furniture, Bureau of the Census. (MC87-I-25A)

1992 Census of Manufacturers, Preliminary Report Industry Series: Household Furniture, Bureau of the Census, May 1994. (MC92-I-25A(P))

Process Descriptions

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EPA Document AP-42 - Compilation of Air Pollutant Emission Factors

McGraw-Hill Encyclopedia of Science & Technology, 6th ed., vols. 5, 6, 11, 13, 14, 16, 18, 19, McGraw-Hill Book Company, New York, New York, 1987.

Regulatory Profiles

*Draft Control Techniques Guidelines (CTGs) - Appendix B: Preliminary Draft Model Rule for Wood Furniture Finishing and Cleaning Operation*s, U.S. EPA.

Environmental Guide for the Furniture Industry, AFMA, 3M Environmental Engineering, Akzo Nobel, Radian Corporation, Research Triangle Park, North Carolina, 1994.

Furniture/Wood Manufacturing and Refinishing, U.S. EPA, RCRA Fact Sheet. (EPA/530-SW-90-027c)

Pollution Prevention

Pollution Prevention Options in Wood Furniture Manufacturing, A Bibliographic Report, U.S. EPA, Office of Pollution Prevention and Toxics, February 1992. (EPA/560/8-92/001C)

Contacts*

Name	Organization	Telephone
Rosalyn Hughes	U.S. EPA, Region IV (inspector)	404-347-2904
David Stout	Broyhill Corporation	704-758-3111
Gary Bell	La-Z-Boy Chair Company	313-242-1444
Stan Payne	Bassett Furniture	703-629-6000
Ronald Pridgeon	NC Department of Environment, Health, and Natural Resources	919-571-4000
John Cullen	Masco Corporation	313-274-7400
Larry Runyan	American Furniture Manufacturers Association	910-884-5000
Bob Naboicheck	Futon Association International	203-549-2000
Sholeh Azar	NC State University	919-515-6400
Bob McCrillis	U.S. EPA, Office of Research and Development	919-541-2733

* Many of the contacts listed above have provided valuable background information and comments during the development of this document. EPA appreciates this support and acknowledges that the individuals listed do not necessarily endorse all statements made within this notebook.

Bob Marshall	U.S. EPA, OECA	202-564-7021
Madeliene Strum	U.S. EPA, RTP	919-541-2383
Paul Eisele	Masco Corporation	313-274-7400

Name Organization	Telephone	
Edyth McKinney	Small Business Ombudsman, North Carolina	800-829-4841
John Lank	U.S. EPA, Region IV (inspector)	404-347-7603