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Preliminary Industry Characterization: Wood Building Products Surface Coating

ESD

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Preliminary Industry Characterization: Wood Building Products Surface Coating

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EXECUTIVE SUMMARY

Under Section 112(d) of the Clean Air Act (CAA), the U. S. Environmental Protection Agency (EPA) is developing national emission standards for hazardous air pollutants (NESHAP) for the wood building products surface coating source category. The EPA is required to publish final emission standards for the wood building products surface coating source category by November 15, 2000. For this source category, a national volatile organic compound (VOC) rule or control technique guidelines (CTG) may also be developed under Section 183(e) of the CAA.

There is a possibility that case-by-case maximum achievable control technology (MACT) determinations will be required under Section 112 (g) for newly constructed and/or reconstructed major sources. The information summarized in this document is intended to provide preliminary information that can be used by States that may have to make case-by-case MACT determinations under Sections 112(g) or 112(j) of the CAA.

Section 1 of this document gives an overview of the initial MACT development phase for this source category. Section 2 summarizes the issues raised and information gathering techniques used in this process. A preliminary characterization of the wood building products source category is given in Section 3. Section 3 also focuses on the source category's products, types of coatings used, application methods, emissions, and emission control techniques. Section 4 addresses recommendations for next steps in the MACT development process.

1.0 OVERVIEW OF INITIAL MACT DEVELOPMENT PHASE FOR THE WOOD BUILDING PRODUCTS SURFACE COATING SOURCE CATEGORY

Under Section 112(d) of the Clean Air Act (CAA), the U. S. Environmental Protection Agency (EPA) is developing national emission standards for hazardous air pollutants (NESHAP) for the wood building products surface coating source category. The EPA is required to publish final emission standards for the wood building products surface coating source category by November 15, 2000. For this source category, a national volatile organic compound (VOC) rule or control technique guidelines (CTG) may also be developed under Section 183(e) of the CAA

The CAA requires that the emission standards for new sources be no less stringent than the emission control achieved in practice by the best controlled similar source. For existing sources, the emission control can be less stringent than the emission control for new sources, but it must be no less stringent than the average emission limitation achieved by best performing 12 percent of existing sources (for which the EPA has emissions information). In categories or subcategories with fewer than 30 sources, emission control for existing sources must be no less stringent than the average emission limitation achieved by the best performing 5 sources The NESHAP are commonly known as maximum achievable control technology (MACT) standards

The MACT standards development for the wood building products surface coating industry began with a Coating Regulations Workshop for representatives of EPA and interested stakeholders in April 1997 and continues as a coordinated effort to promote consistency and joint resolution of issues common across nine coating source categories.[1] The first phase was one in

[1] The workshop covered eight categories: fabric printing, coating and dyeing; large appliances; metal can; metal coil; metal furniture; miscellaneous metal parts; plastic parts; and wood building products. The automobile and light duty truck surface coating project was started subsequently.

which EPA gathered readily available information about the industry with the help of representatives from the regulated industry, State and local air pollution agencies, small business assistance providers, and environmental groups. The goals of the first phase were to either fully or partially:

1. Understand the coating processes;
2. Identify typical emission points and the relative emissions from each;
3. Identify the range(s) of emission reduction techniques and their effectiveness;
4. Make an initial determination of the scope of each category;
5. Determine the relationships and overlaps among the source categories;
6. Locate as many facilities as possible, particularly major sources;
7. Identify and involve representatives from each industry segment;
8. Complete informational site visits;
9. Identify issues and data needs and develop a plan for addressing them;
10. Develop questionnaire(s) for additional data gathering; and
11. Document results of the first phase of regulatory development for each source category.

The associations that participated in the stakeholder process were American Plywood Association (APA), Composite Panel Association (CPA), National Wood Window and Door Association (NWWDA), Hardwood Plywood and Veneer Association (HPVA), American Forest and Paper Association (AFPA), National Wood Flooring Association (NWFA), National Oak Flooring Association (NOFA), Architectural Woodworking Institute (AWI), American Hardboard Association (AHA), Manufactured Housing Institute (MHI), Wood Moulding and Millwork Producers Association (WMMPA), Laminating Materials Association (LMA), Adhesives and Sealants Council, National Paint and Coatings Association (NPCA), and the Chemical Manufacturers Association (CMA) Solvents Council. The States that participated in the process were Florida, Oklahoma, Oregon, and Washington. Appendix A contains a complete list of participants.

The information summarized in this document is intended to provide preliminary information that can be used by States that may have to make case-by-case MACT determinations under Sections 112(g) or 112(j) of the CAA. The initial phase of the regulatory development focused primarily on the characterization of the wood building products industry's coating application methods, types, and emissions. This document summarizes that phase of rule development.

This document includes a description of the emission control technologies EPA identified that are currently used in practice by the industry and that could serve as the basis of MACT. Within the short time-frame allotted for this initial phase, however, only limited data were collected. The information summarized in this document was collected prior to July 15, 1998. Additional information will be collected and considered before the wood building products standards are promulgated.

During the next phase, EPA will continue to build on the knowledge gained to date and proceed with more focused investigation and data analyses. We will also continue our efforts to coordinate cross-cutting issues. We will continue to identify technical and policy issues that need to be addressed in the rule making and enlist the help of the stakeholders in resolving those issues.

2.0 SUMMARY OF INITIAL MACT DEVELOPMENT PROCESS

2.1 ROUNDTABLE MEETINGS

The first phase of development of the NESHAP for Wood Building Products Surface Coating began on April 8 and 9, 1997 with a workshop held by the Coatings and Consumer Products Group (CCPG) of the Emission Standards Division (ESD) in Research Triangle Park, North Carolina. The workshop presented information on the standards development process. As part of the workshop, EPA held breakout sessions with representatives of each of the eight source categories that the CCPG plans to regulate, including one for the wood building products source category.

At this workshop and subsequent roundtable meeting a number of industry stakeholders were identified. Appendix A contains a list of industry stakeholder or regulatory groups that have attended roundtable meetings.

During the April 8 and 9, 1997 meeting EPA and stakeholders identified and discussed four major issues:

1. Potential for overlap with the wood furniture, paper and other web coating, printing and publishing, and particleboard/plywood manufacturing NESHAP.

2. Overlap with other non-EPA standards/requirements (OSHA requirements and wood product certification requirements). The OSHA issue is based on industry concerns that as capture efficiency requirements are tightened, worker exposure issues under OSHA may come into play. Less air flow means that workers may be exposed to higher concentrations of chemicals. Many of the products manufactured by the industry are subject to requirements related to fire and weather resistance. Changing the coatings these facilities use can have an impact on their wood product certification requirements for resistance to fire and weather.

3. The group developed a preliminary list of trade associations that should be involved in the standards development process. Included on this list are the following associations:

American Plywood Association (APA), National Particleboard Association (NPA), American Forest and Paper Association (AFPA), National Paint and Coatings Association (NPCA). Hardwood Plywood and Veneer Association (HPVA).

4. The group also raised three issues directly related to rule development. These included economic impact (for example, the combined impact on one facility of multiple standards), flexibility, and recordkeeping.

At the June 5, 1997, roundtable, the EPA gave a presentation on the MACT partnership approach, potential definitions for wood building products surface coating MACT, information collected to date on the wood building products industry, additional data needed by the EPA to develop PMACT and MACT, and potential mechanisms for collecting the data. Major issues raised at the June 5 meeting were: the applicability of the wood building products surface coating MACT standard and the identification of other potential stakeholders.

A regulatory subgroup meeting was held on June 10, 1997. The discussion focused on the role of the regulatory subgroup, issues raised in stakeholder meetings, and how the regulatory subgroup could assist in data gathering activities. At this meeting, several States offered to help set up site visits and gather permit information.

A second industry roundtable meeting was held on August 12, 1997. The primary purpose of the meeting was to present draft definitions to the stakeholders for comment. Other discussion items included future data collection activities, such as site visits and an information collection request (ICR) for the industry that will be used to establish the MACT floor

The next meeting was held on May 20, 1998 to discuss stakeholders comments on the draft wood building products ICR and list of recipients. A major issue raised at this stakeholder meeting was the addition of a group of small businesses questionnaire recipients.

2.2 SITE VISITS

The EPA representatives participated in multiple site visits to wood building products surface coating facilities to collect information on the industry. These visits focused on collecting general facility information and information on the finishing processes, emission sources, and the types of coatings used. As of June 1998, visits have been made to 11 facilities The principal products and type of coating applicator or operation of each facility visited are given in Table 2-1.

TABLE 2-1. SITE VISITS TO WOOD BUILDING PRODUCTS SURFACE COATING FACILITIES

Product	Coating methods
Coating supplier	N/A
Hardboard siding	DRC, RRC, curtain coater
Laminate flooring	DRC (adhesive)
Miscellaneous wood products	DRC, HVLP, airless spray guns
Prefinished doors, millwork, and mouldings	AAA, airless spray guns, spraybooths
Prefinished doors and mouldings	HVLP, airless spray guns, dip tank, spraybooths
Prefinished door and window trim	Flow coaters, rotogravure cylinder
Prefinished doors, windows, and miscellaneous wood products	HVLP, spraybooths
Prefinished interior wall paneling	AAA, DRC, airless spray guns, rotogravure cylinder
Prefinished medium density fiberboard mouldings	Flow coaters
Primed cementitious and cedar siding	Flood coater

DRC = Direct roll coater
RRC = Reverse roll coater
HVLP = High volume low pressure spray gun
AAA = Air assisted airless spray gun

Future site visits will be made to a manufactured home production (manufacturing) facility that performs on-site surface coating of wood building products and to facilities using ultra-violet (UV) and electron beam (EB) coating/curing technologies for coating wood building products.

2.3 INFORMATION COLLECTION REQUEST

On May 20, 1998, a roundtable meeting was held among interested parties to obtain feedback on a recent CCPG decision to look at alternative ways to collect the information needed for regulatory development. The census approach would involve more than 1,500 ICR mail-outs and responses with all the associated effort and logistical problems involving confidential business information (CBI) and incomplete responses. For information-gathering purposes, the CCPG elected to divide the wood building products industry into five industry segments based on primary products (manufactured home; millwork, panel and reconstituted wood products; windows and doors; architectural/specialty millwork and miscellaneous; and small businesses)

The fifth segment designated as "small business" facilities was added in an attempt to receive additional/representative input from small businesses across the industry. Additional steps may be taken to analyze this regulation's effect on small businesses. A draft of the ICR survey and a list of possible industry recipients of each segment was circulated to the stakeholders for comment.

Of the current listing of more than 1,500 companies/facilities that comprise the wood building products industry, nine parent companies in each of the five segments were selected to receive the ICR. Location of the companies, number of employees, reported TRI emissions, and number of facilities were considered in obtaining a representative cross-section of each of the segments. Approximately 300 facilities will be surveyed from only 45 ICR mailings (each parent company is to send the ICR to each of its facilities that performs wood building products coating operations).

On June 12, 1998, the Agency distributed the questionnaires to the five segments of the wood building products industry to gather general facility information, as well as information on the coating operations, coating types, HAP emissions, and emission controls employed. Data obtained in response to these questionnaires will be used in the development of MACT for this source category.

To date, the EPA, with assistance from State regulatory agencies, has collected background information for the wood building products surface coating source category from the Aerometric Information Retrieval System (AIRS), Source Test Information Retrieval System (STIRS), and Toxic Chemical Release Inventory (TRI) data bases; the Census of Manufactures, and State regulations and permit information. The gathered information is summarized in this document and will be used for the development of MACT. Additional information will be collected and considered before emission standards for wood building products surface coating operations are proposed.

3.0 WOOD BUILDING PRODUCTS SURFACE COATING SOURCE CATEGORY

3.1 INDUSTRY PROFILE

The wood building products coating source category includes facilities engaged in the surface coating of flooring, shingles, awnings, doors, mantels, shutters, mouldings hardwood/softwood plywood panels, arches, trusses, manufactured homes, hardboard, particleboard, reconstituted wood panels, wall tile, wallboard, and cementitious board. These facilities apply a protective, decorative, or functional layer (i.e., paints, stains, sealers, topcoats, basecoats, primers, enamels, inks, laminates) to the wooden substrate before final sale to distributors. The original source category designation was "surface coating of flatwood paneling." After meetings with industry stakeholders, the EPA learned that interior paneling products are no longer manufactured in large quantities in the United States and that there are other wood surface coating operations with HAP emissions that are not addressed in current or future regulations. Therefore, the EPA decided to revise the scope to cover the surface coating of wood building products.

Table 3-1 lists the SIC codes that include facilities manufacturing wood building products, the SIC code descriptions, and the total number of facilities included in each SIC code based on the 1992 Census of Manufactures. Each SIC code includes facilities which do not have surface coating operations and only manufacture the substrate (e.g., particleboard or plywood). The census does not distinguish between manufacturers of unfinished and prefinished substrate. The listed SIC codes also include manufacturers of other products that are not considered wood building products. Many facilities in Table 3-1 will not be covered under this standard; however, the SIC codes and census data do serve as starting points for conducting analyses of potentially

TABLE 3-1. SIC CODES REPRESENTING THE WOOD BUILDING PRODUCTS INDUSTRY[a]

SIC Code	Description	Representative products	Total facilities
2426	Hardwood dimension and flooring mills	Hardwood and parquet flooring	831
2429	Special product sawmills, NEC	Wood shingles	192
2431	Millwork	Awnings, doors, garage doors, mantels, shutters, mouldings	3,155
2435	Hardwood veneer and plywood	Hardwood plywood panels, prefinished hardwood plywood	318
2436	Softwood veneer and plywood	Softwood plywood panels	201
2439	Structural wood members, NEC	Arches, trusses	895
2451	Mobile homes	Mobile buildings, classrooms, homes	286
2452	Prefabricated wood buildings and components	Prefabricated floors, panels for prefabricated buildings	655
2493	Reconstituted wood products	Hardboard, particleboard, reconstituted wood panels, wall tile, wallboard	288

[a] Some SIC codes include facilities that do not perform surface coating operations and facilities that do not manufacture wood building products or are not major sources of HAP.

affected sources. In addition, not all of the facilities in these SIC codes are major sources of HAP.

Wood building products manufacturing facilities are located throughout the country. The States with the largest number of facilities are North Carolina, California, Oregon, and Pennsylvania. Table 3-2 lists the number of facilities in each State for the SIC codes of interest. The data presented in the table are based on the 1992 Census of Manufactures. Again, not all of these facilities are major sources of HAP.

3.2 SUMMARY OF EXISTING STATE/FEDERAL REQUIREMENTS

There are currently no Federal regulations that limit either VOC or HAP emissions from the wood building products industry. The EPA did publish a CTG for some segments of the flatwood paneling industry in 1978. Table 3-3 summarizes the emission limits included in the CTG.

TABLE 3-2. WOOD BUILDING PRODUCTS FACILITIES BY STATE[a,b]

Region	State	No. of facilities	Facilities with 20 or more employees
Region I	CT	54	3
	ME	52	23
	MA	80	18
	NH	42	11
	RI	17	1
	VT	38	15
		283	71
Region II	NJ	74	20
	NY	259	68
		333	88
Region III	DE	9	3
	MD	65	29
	PA	318	125
	VA	182	86
	WV	39	23
		613	266
Region IV	AL	157	84
	FL	321	113
	GA	215	86
	KY	90	38
	MS	141	58
	NC	459	215
	SC	84	45
	TN	176	74
		1,643	713
Region V	IL	190	52
	IN	188	132
	MI	214	89
	MN	117	58
	OH	193	80
	WI	215	102
		1,117	513
Region VI	AK	112	47
	LA	51	27
	NM	29	8
	OK	37	9
	TX	273	95
		502	186
Region VII	IA	34	13
	KS	45	16
	MO	135	38
	NE	27	9
		241	76
Region VIII	CO	89	21
	MT	35	13
	ND	8	2
	SD	10	4
	UT	54	11
	WY	4	2
		200	53
Region IX	AZ	119	46
	CA	695	218
	NV	26	11
		840	275
Region X	ID	62	32
	OR	287	170
	WA	315	89
		664	291
Total		6,436	2,532

[a] No data available for States not listed. Includes information for the following SIC codes: 2426, 2429, 2431, 2435, 2436, 2439, 2451, 2452, 2493.

[b] Some SIC codes include facilities that do not perform surface coating operations and facilities that do not manufacture wood building products or are not major sources of HAP.

TABLE 3-3. .RECOMMENDED MACT LIMITS FROM THE CTG FOR THE FACTORY SURFACE COATING OF FLATWOOD PANELING

Product	Emission rate limit, lb VOC/1,000 ft^2	Equivalent coating limit, lb VOC/gal-water
Printed interior panels	6.0	2.5
Natural finish hardwood	12	3.3
Class II hardboard panel	10	2.8

Most States have developed regulations that are based on the 1978 CTG. However, both California's Bay Area Air Quality Management District (BAAQMD) and Wisconsin have expanded their regulations to include products not covered under the CTG. The BAAQMD regulation limits the VOC content of all adhesives and coatings used for flat wood paneling and for all other flat wood stock including door skins, baseboards, and tileboard. Wisconsin limits the VOC content of the coatings used for finishing wood doors and molded wood parts and the VOC content of the adhesives used for these products and the products covered under the original CTG. A summary of existing State regulations that differ from the CTG is provided in Table 3-4.

3.3 APPLICABILITY

Several applicability and overlap issues were identified early in the rule development process. Industry members expressed concern about overlap with the printing and publishing, wood furniture manufacturing (surface coating), and plywood and particleboard NESHAP. At some facilities, numerous products are coated on the same line; panels used as both furniture and building components are often finished on the same line with the same coatings. The EPA intends for this NESHAP to cover surface coating of wood building products, not components that are intended for use in furniture manufacture. Printing (i.e., of a simulated wood grain) on wood building products will also likely be addressed by this NESHAP. The wood building products NESHAP will not cover the manufacturing of the actual wooden substrate (e.g., plywood). The manufacturing of the substrate will likely be addressed under emission standards such as those being developed for plywood and particleboard manufacturing operations

TABLE 3-4. STATE REGULATIONS FOR THE SURFACE COATING OF WOOD BUILDING PRODUCTS[a]

State	California, Bay Area	Delaware	Wisconsin	North Carolina	New York	Washington
Regulation No.	Rule 238	RgAP24\se23(a)	NR 422	R5A\ch2\sh2d\rl.0935	Rti6\ch3\shA\pt228	WAC 173-490-025
Applicability cutoff	Coating use <20 gal/yr	Coating use <15 lb/d	Paneling emissions <100 ton/yr Adhesive emissions <15 lb/month Adhesive use <1 pint/d	None specified	Coating use <55 gal/yr and does not exceed 5% of the facility's total annual potential to emit	Emissions <40 lb/month
VOC content limitations for coatings	Flat wood coatings, adhesives, and inks <2.1 lb/gal	None specified	Adhesives contain 23% solids by weight Adhesive emissions <4.5 lb/gal Wood door coating emissions <5.7 lb/gal Molded wood parts prime coat <2.5 lb/gal top coat <3.5 lb/gal	None specified	Interior panels (hardwood, plywood, thin particleboard) 2.5 lb/gal Natural finish hardwood panels 3.3 lb/gal Hardboard paneling 3.6 lb/gal	None specified
VOC emission limits	None specified	Interior panels (hardwood, plywood, thin particleboard) 6 lb/1,000 ft^2 Natural finish hardwood panels 12 lb/1,000 ft^2 Hardwood panels of Class II finish 10 lb/1,000 ft^2	Interior panels (hardwood, plywood, thin particleboard) 6 lb/1,000 ft^2 Natural finish hardwood panels 12 lb/1,000 ft^2 Hardboard paneling of Class II finish 10 lb/1,000 ft^2	Interior panels (hardwood plywood, thin particleboard) 6 lb/1,000 ft^2 Natural finish hardwood panels 12 lb/1,000 ft^2 Hardboard paneling of Class II finish 10 lb/1,000 ft^2	None specified	Interior Panels (hardwood, plywood, thin particleboard) 6 lb/1,000 ft^2 Natural finish hardwood panels 12 lb/1,000 ft^2 Hardboard paneling of Class II finish 10 lb/1,000 ft^2

TABLE 3-4. (continued)

State	California, Bay Area	Delaware	Wisconsin	North Carolina	New York	Washington
Alternative compliance methods	Emission control system with overall efficiency of 90% by weight	Emission control system with overall efficiency of 95% by weight	Emission control system with overall efficiency of 90% by weight	None specified	Emission control system with overall efficiency of 80% by weight	Emission control system with overall efficiency of 90% by weight
Allowable application equipment	Electrostatic High volume, low pressure (HVLP) spray Hand roller Flow coat Roll coater Dip coater Paint brush Detailing or touch-up operation guns	None specified	None specified	None specified	None specified	None specified
Exemptions	Wood stock intended to be used as furniture or cabinet components	None specified	Exterior siding Tileboard Particleboard used as furniture	None specified	None specified	Exterior siding Tileboard or Particleboard used as furniture components

[a] Other States have regulations similar to the 1978 CTG (Control of Volatile Organic Emissions from Existing Stationary Sources Volume VII: Factory Surface Coating of Flatwood Paneling), reference the 1978 CTG directly in the State regulation, or have a general surface coating regulation not specific to the surface coating of wood building products.

Applicability to laminated products and products not finished on a flat line has also been raised as an issue by stakeholders. Some gluing and laminating operations will likely be covered by this rule. For purposes of this rule, laminated products are considered wood building products to which a protective, decorative, or functional layer has been bonded. Products that are produced by bonding layers to the substrate as part of the substrate manufacturing process (e.g., plywood manufacture) are not considered laminated products for purposes of this rule, and will likely be addressed under the emission standards being developed for particleboard and plywood manufacturing operations.

3.4 WOOD BUILDING PRODUCTS COATING PROCESSES

The finishing processes and types of coatings used in the wood building products industry vary by product type. Some facilities manufacture numerous products, while some manufacture only panels that are then sold to other companies for final processing. The number of coatings a product receives is determined by its end use. Substrates that are finished again after field installation (e.g., wood siding) are typically only primed and sold to distributors after which building contractors or homeowners apply architectural coatings which are formulated for consumer use. High end products (e.g., wall paneling and millwork) receive numerous coatings.

Types of coatings used in the wood building products industry include fillers, sealers, groove coats, primers, stains, basecoats, inks, and topcoats. Fillers are used to fill pores, voids, and cracks in the wood and to provide a smooth surface. Sealers seal off substances in the wood that may affect subsequent finishes and also protect the wood from moisture. Groove coats cover grooves cut into panels and assure the grooves are compatible with the final surface color. Primers are used to protect the wood from moisture and provide a good surface for further coating applications. Stains are non-protective coatings that color the wood surface without obscuring the grain. Basecoats provide color and hide substrate characteristics. Inks are used to print decorative designs on printed panels or produce a simulated wood grain. Pigmented (enamels) and clear topcoats provide protection, durability, and gloss.

Typical coating application methods include spraying, roll coating, rotogravure cylinder, curtain coating, flow coating, pneumatic (air knife) coating, brush coating, vacuum coating, and dip coating. Each of these methods is discussed below.

In spray coating, a handheld or automatic spray gun is used to apply the coating. The guns are typically used in a spray booth. Air is constantly pulled into and vented from the booth to keep levels of volatile compounds low. Spray coating is often used to coat non-flat pieces. Spray technologies used include conventional air, airless, air-assisted airless, electrostatic, and high-volume low-pressure (HVLP). Conventional air spray uses compressed air to atomize the finishing materials. Airless spraying involves atomizing the finish by forcing it through a small opening at high pressure. Air-assisted airless spray uses an airless spray unit with a compressed air jet to finalize breakup and help shape the spray pattern of the finish material. Electrostatic finishing is performed by spraying negatively charged finish particles onto grounded wood products. High-volume low-pressure spraying involves the use of a high volume of air delivered at an effectively low pressure to atomize a finish into a pattern of low-speed particles, which typically results in less overspray.

A curtain coating applicator uses a metered slit (shown in Figure 1) or weir to create a free falling film of coating that the wooden substrate passes through. Coating pump speed, weir or metered slit coating reservoir head, and conveyer belt speed all control the amount of coating applied. Excess coating is collected in a reservoir and returned to the coating head. Curtain coating is typically used when a relatively thick coat is required. The rate of panel movement and the controlled uniform flow of the film of coating determines the coating thickness

Roll coating is a process in which cylindrical rollers apply a limited amount of coating to the wood substrate. There are four types of roll coaters: direct roll (rolls in same direction as product), reverse roll (rolls in opposite direction of product), differential roll (has two cylinders that move at different speeds), and sock (has a fabric sock over the roll to produce a textured finish). In a roll coater, a rubber covered coating roll and a smooth, chrome-plated doctor roll create a reservoir that holds the coating material. The material is held in this reservoir by adjustable end seals at the ends of the rolls. The doctor roll meters the coating material onto the surface of the coating roll. A feed roll or conveyor belt holds the stock in contact with the coating roll and helps drive it through the machine. A simplified schematic of both a direct roll coater and a reverse roll coater is presented in Figure 1. A rotogravure cylinder is similar to the direct roll coater, only the cylinder is etched and coated with ink to apply a pattern such as a simulated wood grain onto the substrate. Roll coating is suitable for the application of coatings when a low-build finish is sufficient.

Flow coaters use nozzles and low pressure to create a wet film of coating that the wood substrate passes through. Excess coating is collected in a reservoir and returned to the nozzle heads. A simplified schematic of a flow coater is presented in Figure 2. Pneumatic (air knife) coaters flood a panel with coating similarly to flow coaters and then remove the excess by exposing the panel to pressurized air. The excess is collected in a reservoir and recycled back to the coater. Brush coaters flood a panel with coating similarly to flow coaters and then use brushes to remove the excess. The excess is collected in a reservoir and recycled back to the coater. A vacuum coater pulls paint up from a reservoir, creating a wall of paint. The wooden substrate passes through paint and receives a coating. Excess paint is vacuumed off the substrate. Paint thickness is controlled by vacuum and the conveyor speed. Vacuum coaters can be used in coating application that require all side of a substrate to be coated at one time. A simplified schematic of a vacuum coater is presented in Figure 2.

Dip coating is a process in which the piece is dipped into a vat of coating, and the excess is allowed to run off. Dip coaters can be used on multi-dimensional pieces and/or non-typical part configurations.

A typical coating line moves between 100 to 400 feet/minute. The industry currently uses primarily waterborne and UV-cured coatings, although some products (i.e., tileboard, fire resistant paneling) still require solventborne coatings to provide good water, weather, and fire resistance. Quick drying time is another reason why manufacturers use solventborne coatings, especially when fast line speeds are used. The product's coating needs to be dry, hard, and cool prior to packaging, otherwise the products have the potential to stick together when stacked, causing defects or reject material. This problem is sometimes referred to as "blocking." Following is a brief description of the primary products manufactured by the industry and the finishing process used for each product.

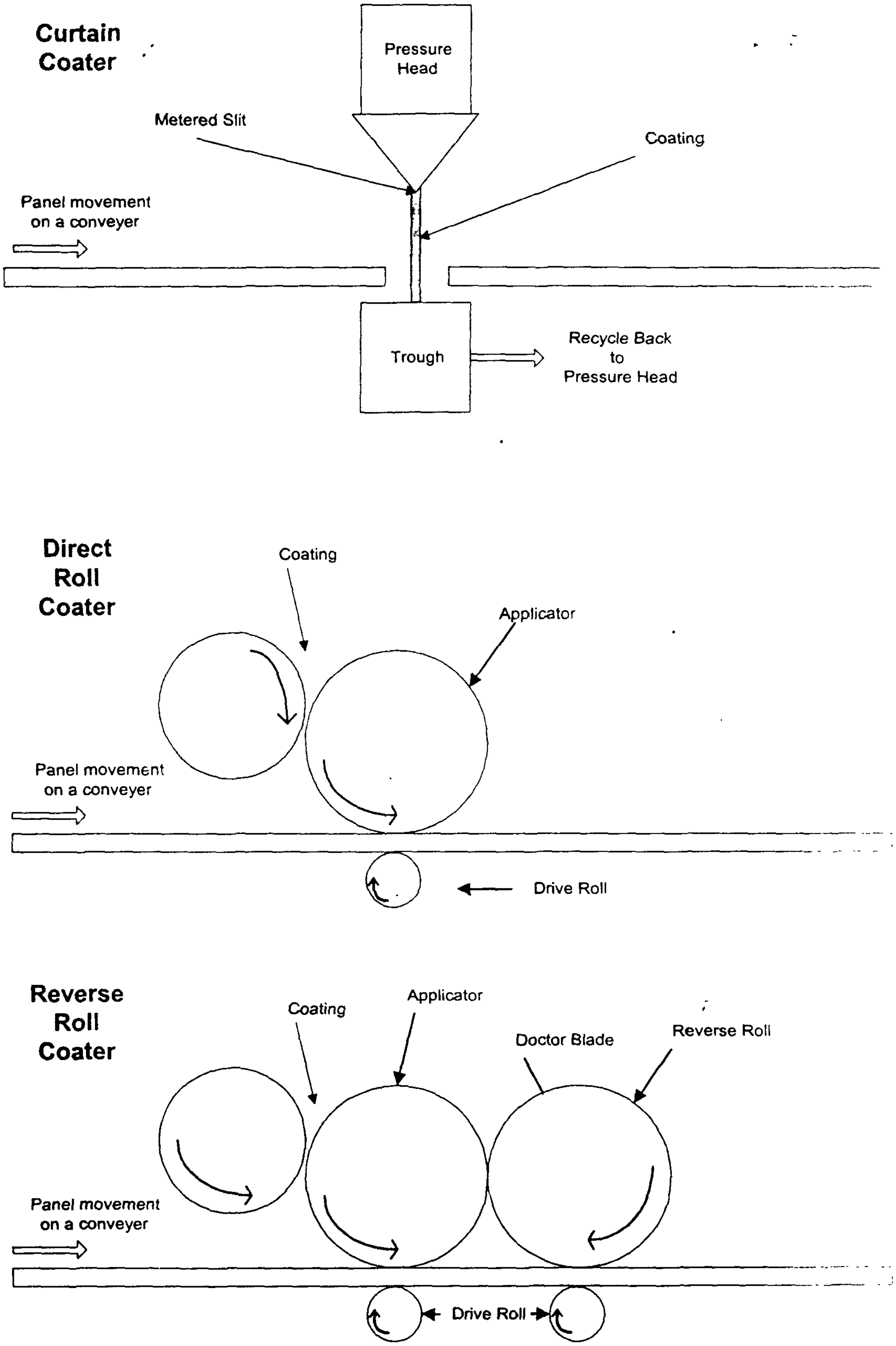


Figure 3-1. Simplified curtain and roll coater diagrams.

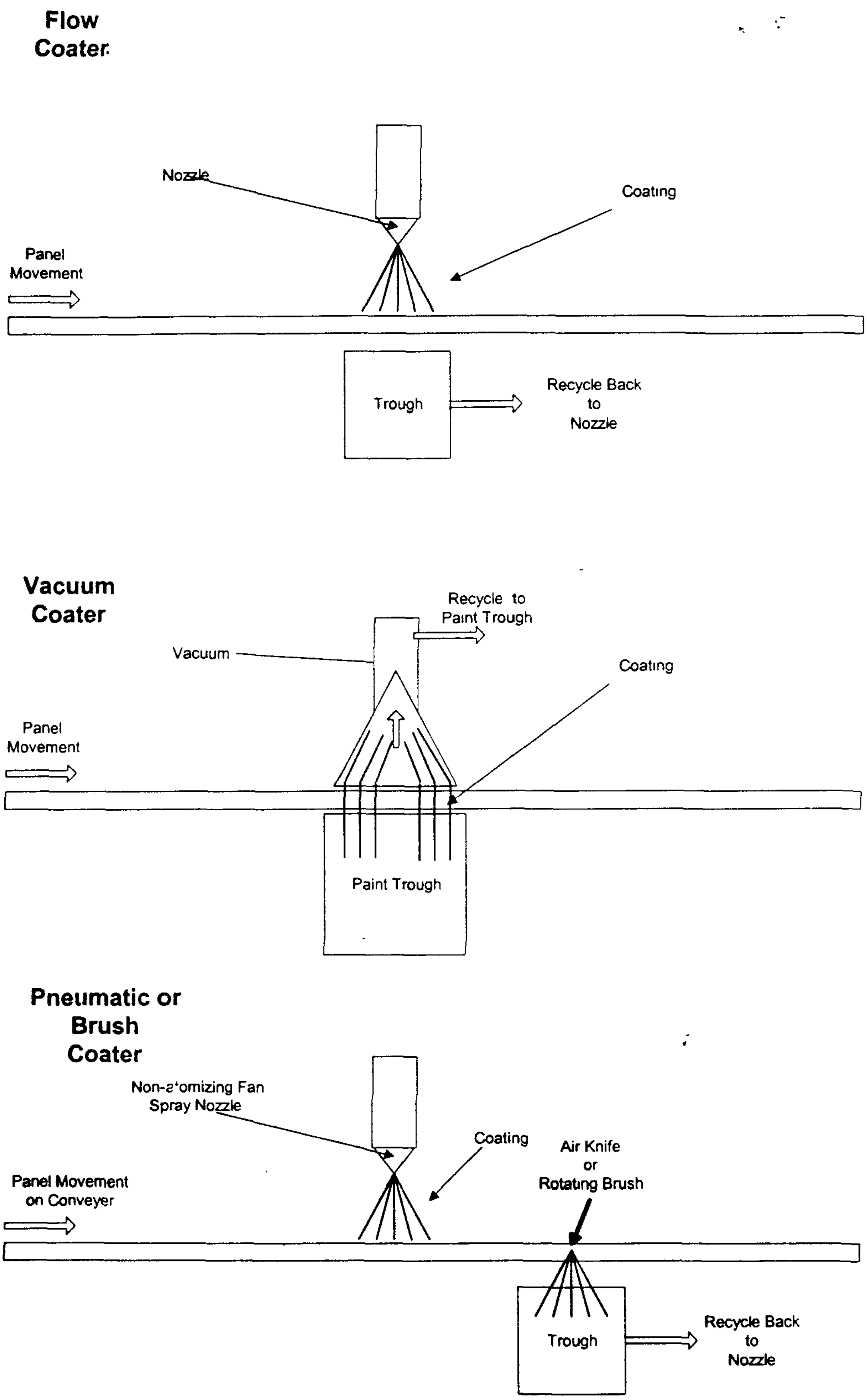


Figure 3-2. Simplified flow, vacuum, and pneumatic coater diagrams.

3.4.1 Interior Paneling

The 1978 CTG developed by the EPA covered surface coating of interior paneling only. Since the CTG was published, the use of interior paneling has decreased dramatically. One coating supplier to the industry estimates that the production of traditional interior paneling has decreased 75 percent over the last two decades due to the increased popularity of wallpaper and use of dry wall. Most interior paneling manufactured today is manufactured outside of the United States. However, there is still limited production in the United States. There are three primary types of interior paneling: paper laminated, printed, and natural finish. The finishing processes for each type are discussed below.

3.4.1.1 Paper Laminated Paneling. These panels are laminated with a decorative paper Polyvinyl acetate (PVA) is the primary adhesive used for laminating, but urea-formaldehyde resins and contact adhesives are also used for limited applications. Grooves are often cut in the panel after lamination and then usually sprayed with waterbased pigmented coating. The overspray is then ordinarily cleaned up with low solids waterbased clear coating which is applied by rollcoaters. A protective waterborne topcoat is typically applied with a roll coater over some paper laminated panels.

3.4.1.2 Printed Interior Paneling. A typical coating process for printed interior panels includes filler, basecoat, ink, and topcoat. Groove coats are also used for finishing the grooves cut in the paneling. The filler is typically a waterborne or UV coating that is applied using reverse roll coating. After the filler is applied, a basecoat is applied, typically with a direct roll coater. The basecoats are also primarily waterborne coatings. The inks are applied with a rubber offset gravure printer. Several ink colors may be applied to reproduce the appearance of wood or other substrates such as marble or textured cloth. One or two coats of a clear protective topcoat are then applied with a direct roll coater. Both waterborne and UV-cured topcoats are used

3.4.1.3 Natural Finish Interior Paneling. Stains, toners, sealers, and topcoats may all be used to produce the final finish. A pigmented groove coat is also applied to the panel grooves. Stains give the wood a uniform color. The stains are applied with a direct roll coater. A toner may then be applied with a direct roll coater to seal the stain. Filler is then applied using a reverse roll coater. The sealer, which is applied after the filler, protects the wood from moisture and provides a smooth base for the topcoat. Finally, one or more topcoats is applied with a direct roll coater or a curtain coater. The topcoat may be waterborne or UV-cured, although the other finishes are typically waterborne.

Figure 3 shows a generic coating process diagram for prefinished interior lauan paneling. A sander smooths and cleans the substrate to ensure a suitable surface for coating adhesion. A reverse roll coater applies filler to the paneling. Grooves are cut into the panels. Spray guns apply a groove coat. The panels are sanded again before a direct roll coater applies a basecoat. If needed, a second basecoat is applied. Ovens then cure the basecoat. An artificial wood grain is printed onto the panel by a rotogravure cylinder. The panels then receive a topcoat from a direct roll coater. Finally, the panels are oven dried, cooled, and packaged for storage and shipment.

3.4.2 Exterior Siding

Exterior siding was not covered under the 1978 CTG. Exterior siding may be made of a solid wood such as cedar, of hardboard or waferboard, or of a relatively new product known as cementitious board. Siding made of solid wood is typically finished in the field, although some finishing is done in the factory on a limited basis. Hardboard siding is typically primed in the factory, usually with waterborne coatings; a final coating is applied in the field using consumer architectural paint. Waferboard siding utilizes a coated paper overlay with a waterborne primer. Cementitious board, which consists of approximately 10 to 30 percent wood fiber and 70 to 90 percent cement, has been used extensively in Europe, and is growing in popularity in the United States. Several companies are in the process of opening, or have recently opened, new facilities to produce cementitious board for use in the United States. Some industry representatives and end users state that cementitious board has several advantages over hardboard in that it is more moisture resistant, termite resistant, and fire resistant than hardboard. As with hardboard siding, cementitious board is typically primed in the factory with the final coating applied in the field. However, some board is sold unfinished or prefinished. Both the primers and topcoats are typically either waterborne or UV cured.

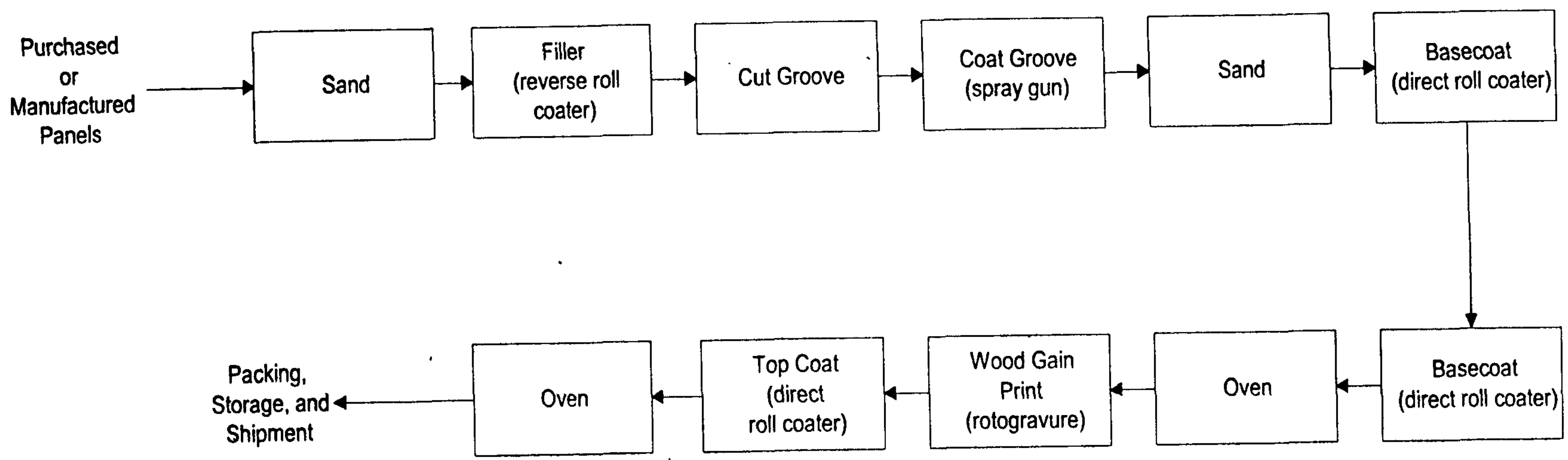


Figure 3-3. Generic coating line schematic for prefinished interior lauan plywood paneling.

3.4.3 Doors and Door Skins

Door and door skin manufacturing are substantially differentiated processes in practice. Doors are made by applying adhesive to a core and frame, and then pressing a doorskin on either side of the core and frame. Such an operation is not usually done at the doorskin manufacturing location. The door factory may do some finishing of doorskins and or doors and frames. These finishes are generally waterbased, but smaller operations may use solvent based finishes.

Door skins are produced on high speed finishing lines using low VOC and HAP coatings. The predominant market for door skins are the door manufacturers themselves, who use them in their own manufacturing processes. The following paragraphs are generic descriptions and typical coating applications for different door products.

3.4.3.1 Solid Wood Doors. Solid wood doors are typically constructed from multi-layers of veneer or flat pieces of wood over a wooden core. These doors are usually finished by a spray application of stain, sealer, and topcoat using solvent, waterborne, or UV coatings.

3.4.3.2 Hollow Core Doors. Hollow core doors are constructed by flat pieces of veneer or plywood built into a hollow wood frame.

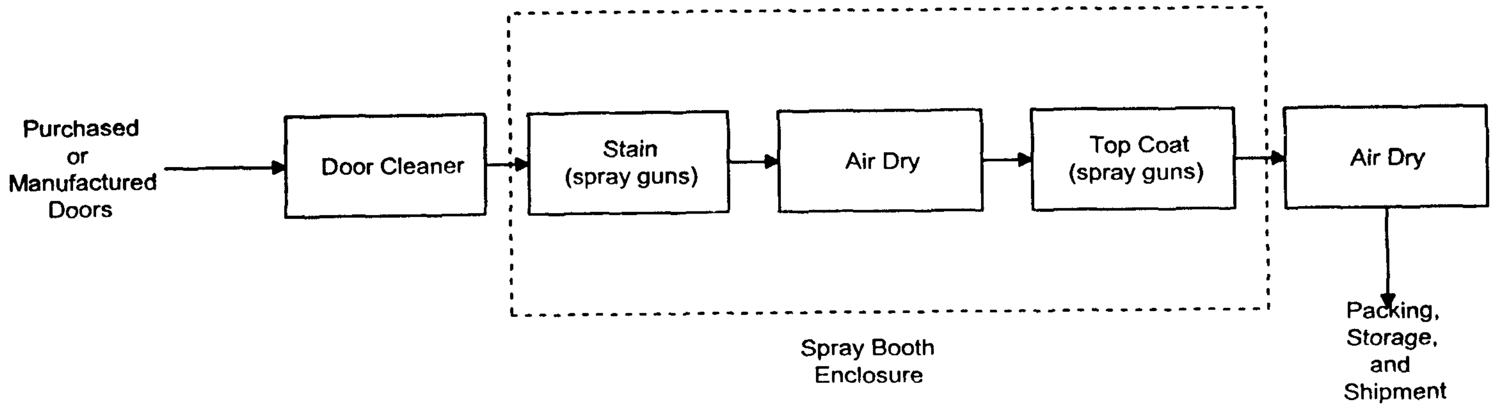
3.4.3.2.1 Plywood Veneer Doors. The typical surface coating processes for plywood veneer doors include spray or direct roll coat of stain, sealer, and topcoat using solvent, waterborne, or UV coatings.

3.4.3.2.2 Flat Composite Doors. Typical coating process steps for flat composite doors are seal, fill, basecoat, ink, topcoat via spray or direct roll coat application. Ink is printed. Coatings may be solventborne or waterborne.

3.4.3.2.3 Molded Doors. Molded doors are usually primed and prefinished using waterborne or UV-curable coatings.

Figure 4 displays generic coating process diagrams for molded and smooth-face doors. A sander smooths and cleans the substrate to ensure a suitable surface for coating adhesion. A reverse roll coater applies filler to the doors. The doors are sanded again before a direct roll coater applies a stain. Ovens dry the stain. Then the doors receive a topcoat from a direct roll coater. Finally, the topcoat is UV cured, cooled, and packaged for storage and shipment.

Molded Door Spraybooth Line



Flat Composite or Plywood Veneer Door Skin Line

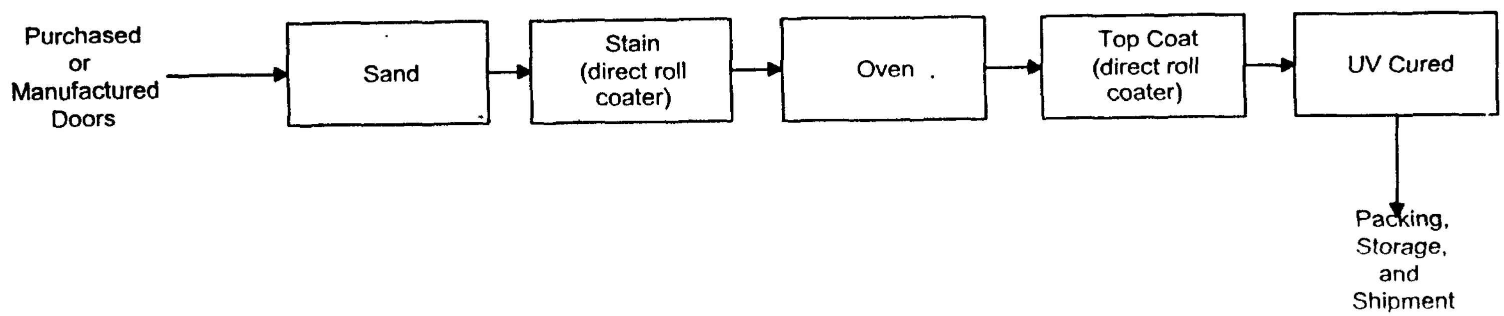


Figure 3-4. Generic coating line schematic for prefinished molded doors and doorskins.

3.4.4 Tileboard

Tileboard is a type of Class I hardboard. Tileboard is a wood product that resembles tile. It is used as a splashboard around sinks and tubs. While most hardboard is finished with waterborne primers and topcoats, tileboard is finished with solventborne coatings because waterborne coatings do not provide the required moisture resistance. Emissions from the solventborne coatings are often controlled with a thermal oxidizer.

3.4.5 Flooring

Hardwood flooring is cut and grooved, and then is typically finished in 8 foot by 12 foot strips. The industry uses both waterborne and solventborne stains and primarily UV-cured topcoats. Coatings are typically applied with a roll coater. Laminate flooring is becoming increasingly popular in the United States. Adhesives (typically urea formaldehyde or melamine formaldehyde) are used to apply a paper backing to one side of a thin piece of particle board and a decorative laminate to the other side. The adhesive is usually applied with a roll coater. Alternatively, the decorative laminate and backing paper may be applied to the particle board using pressure and high temperatures. The flooring usually is then cut to size and given tongue and groove edges.

3.4.6 Window Frames and Joinery

Window frames and joinery are typically finished with either flow coaters or spray guns. Both waterborne and solventborne coatings are used. Solventborne coatings are required for some products, particularly those with a long warranty, because they are more durable and provide better protection than the waterborne coatings. Some products are also dipped in a water repellant/preservative treatment (usually consisting of wax, mineral spirits, etc.) before finishing.

3.4.7 Shutters

Shutters are usually roll, spray, or dip coated with a protective and/or decorative coating. Waterborne coatings are typically used for finishing.

3.4.8 Moulding and Trim

These are decorative or ornamental wood products that are used around doors and windows. Exterior use of these products is growing. The products are typically spray-coated or flow coated with waterborne or solventborne coatings. Additionally, factories which are finishing wood moulding and trim products may also be finishing a considerable amount of plastic mouldings and trim. The surface finishes for plastic usually require a coating which is more technically difficult to use and apply than for coatings used for wood substrates.

Figure 5 represents a generic coating process for high end woodgrain millwork. The substrate is cut to the size and milled to the shape of the final product. A sander smooths and cleans the substrate to ensure a suitable surface for coating adhesion. A flow coater applies a basecoat. Ovens dry the coating. If needed, a second basecoat is applied. A rotogravure cylinder applies a wood grain ink. The millwork receives a topcoat from a curtain coater. Finally, the millwork is oven dried, cooled, and packaged for storage.

Other products and finishing lines can incorporate any number of combinations of coaters, sanders, ovens, etc. The combination typically depends upon uses of the final product.

3.5 EMISSIONS

The primary source of emissions associated with surface coating operations at wood building products manufacturing facilities is the finishing process. The emissions result from the application and subsequent evaporation of the solvents in the finishing materials. Other sources of emissions are:

1. Storage of finishing materials. Emissions can result from the filling and cleaning of storage media. If containers are not kept closed, evaporation of the finishing materials may also occur. Some surface coating applicators that use waterborne coatings must operate with open top paint reservoirs to dissipate the foam created in the coating and recycling process.

2. Gluing operations (e.g., laminating). The adhesives used in gluing operations typically contain formaldehyde and may be a significant source of emissions. Laminating may be considered part of the finishing process for purposes of this rulemaking.

3. Mixing operations. Facilities that thin their coatings or have other mixing operations will have emissions from evaporation of the solvent in the mixing materials.

4. Cleaning operations. Most cleaning operations use water or mechanical devices. However, cleaning solvents that are used to remove coatings from coating applicators and other equipment are a source of emissions.

5. Repair/rework. Most repair and reworking involves the substrate being sent down the regular finishing line to be finished. However, solvent used in repair or rework of pieces with finishing defects is a source of emissions.

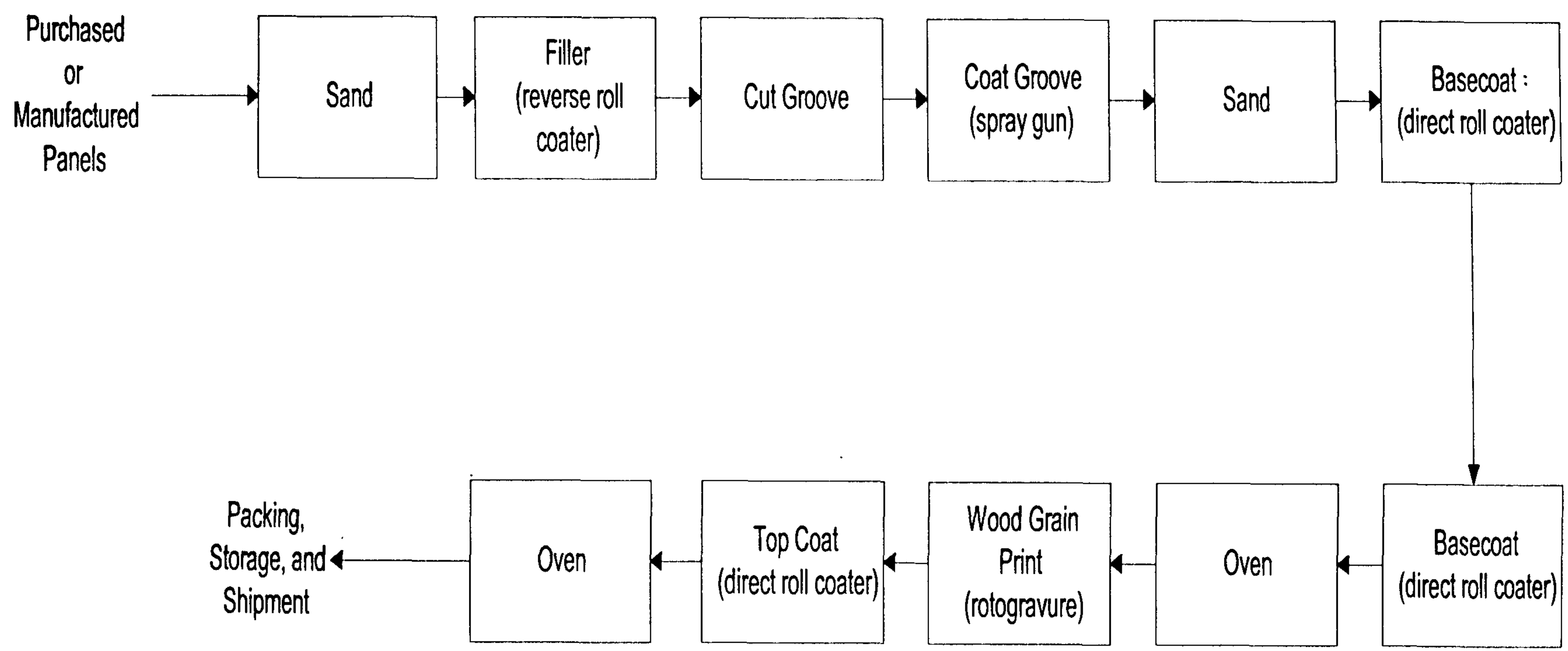


Figure 3-5. Generic coating line schematic for prefinished woodgrain mouldings.

Based on the 1994 and 1995 emissions data from EPA's Toxic Release Inventory (TRI) System data base, methanol, formaldehyde, xylene, toluene, and methyl ethyl ketone (MEK) are the primary HAP emitted by the industry. Tables 3-5 and 3-6 present the primary HAP and VOC, respectively, emitted by facilities included in the SIC codes of interest as reported in the 1994 TRI data base. Table 3-7 lists total HAP/VOC emissions by SIC code.

Several of the HAP listed in Table 3-5 and VOC listed in Table 3-6 are not emitted from the finishing of wood building products or associated emission sources (e.g., cleaning and gluing). Many are likely emitted from the substrate manufacturing process(es) or other processes at the facility; these emissions can include acetaldehyde, hydrochloric acid, and chlorine

In addition, some of the other HAP listed are emitted from both the finishing process and the substrate manufacturing process, so the total emissions reported are likely higher than actual emissions from the finishing process and associated emission sources. These HAP include methanol, formaldehyde, and phenol. Unfortunately, the TRI data base does not provide sufficient information to apportion the emissions to a particular process.

3.6 EMISSION CONTROL TECHNIQUES

The most prevalent form of emission control for the wood building products surface coating source category is the use of low-VOC or low-HAP coatings, such as waterborne or UV-cured coatings. Solventborne coatings are typically only used in applications where water, fire, or weather resistance is an issue. In addition, solventborne coatings typically have quick drying times. This allows facilities to operate coating lines much faster and dedicate less floor space to curing/drying, and prevents incomplete drying of products that could subsequently stick together in shipment. Much effort has been put into developing coating materials for the wood finishing industry that contain fewer HAP and VOC.

TABLE 3-5. PRIMARY HAP EMITTED BY THE WOOD BUILDING PRODUCTS INDUSTRY[a]

Pollutant	Tons emitted
Methanol	7,069
Formaldehyde	1,881
Toluene	1,261
Xylene (Mixed Isomers)	906
Acetaldehyde	853
Methyl Ethyl Ketone	635
Hydrochloric Acid	424
Phenol	301
Chloroform	227
Methyl Isobutyl Ketone	163
Certain Glycol Ethers	122
Dichloromethane	106
Ethylbenzene	98
n-Hexane	56
Styrene	52
Ethylene Glycol	39
Cresol (Mixed Isomers)	38
Chlorine	22
Methyl Methacrylate	13
Chloromethane	13
1,1,1-Trichloroethane	10
Dibutyl Phthalate	9
1,2,4-Trichlorobenzene	8
Diisocyanates	5

[a] Based on 1994 TRI data.

TABLE 3-6. PRIMARY VOC EMITTED BY THE WOOD BUILDING PRODUCTS INDUSTRY[a]

Pollutant	Tons emitted
Methanol	7,069
Formaldehyde	1,881
Toluene	1,261
Xylene (Mixed Isomers)	906
Acetaldehyde	853
Methyl Ethyl Ketone	635
Phenol	301
Chloroform	227
n-Butyl Alcohol	171
Methyl Isobutyl Ketone	163
Certain Glycol Ethers	122
Dichloromethane	106
Ethylbenzene	98
n-Hexane	56
Styrene	52
Ethylene Glycol	39

[a]Based on 1994 TRI data.

TABLE 3-7. HAP EMISSIONS BY SIC CODE

SIC Code and Title	Total Annual HAP Emissions (tons/yr)	
	TRI 1994	TRI 1995
2426- Hardwood Dimension and Flooring Mills	388	225
2429 - Special Product Sawmills, NEC	1,520	3,159
2431 - Millwork	2,267	1,664
2435 - Hardwood Veneer and Plywood	467	955
2436 - Softwood Veneer and Plywood	3,120	3,679
2439 - Structural Wood Members, NEC	170	148
2451 - Mobile Homes	128	130
2452 - Prefabricated Wood Buildings and Components	50	32
2493 - Reconstituted Wood Products	5,905	8,704

Waterborne coatings are coatings in which water is the main solvent or dispersing agent. Each type of waterborne coating exhibits different film properties depending on the type of polymer in the formulation. Waterborne coatings are typically not free of VOC, but their use can reduce VOC emissions by as much as 70 percent. However, disadvantages include grain raising, increased drying time, and low gloss. Use of waterborne coatings also requires the facility to convert to stainless steel lines and equipment. Some facilities may be able to use waterborne coatings for some finishing steps, but not all. Higher solids coatings can also be used to reduce HAP/VOC emissions. Based on equivalent solids applied, the higher solids coating results in lower emissions than a traditional finish.

Radiation curing is a technology that utilizes electromagnetic radiation energy to affect chemical and physical change of organic finish materials by the formation of cross-linked polymer networks. One type of radiation used is UV light. The primary components of UV-cured coatings are multifunctional polymers, monofunctional diluent monomers, and the photoinitiators. A photoinitiator absorbs the UV light and initiates the curing process. The diluent serves as a viscosity modifier for the finish and is similar to a traditional solvent in this regard, but most of the diluent in UV finishes polymerizes and becomes part of the coating film. Only the diluent in the coating that does not reach the piece is emitted. The curing process is very fast (as little as one or two seconds), and provides a final film that is stain-, scratch-, and mar-resistant. The UV-curable finishes are often considered to contain up to 100 percent solids because 100 percent of the components reacts to form the coating. Due to the generally high solids content of these types of coatings, high film thicknesses can be achieved with fewer coats or process steps than with lower solids conventional coatings. Because curing requires "line of sight" radiation, these types of coatings are ideal as flat panel or component part finishes.

Add-on controls, such as incinerators, are not widespread in this industry. Thermal incinerators can be used to control waste streams containing various organic compounds and thus are technically feasible for controlling emissions from wood finishing operations. However, the exhaust stream from most wood finishing operations is characterized as a dilute concentration of VOC/HAP in a high-volume airflow. The costs associated with control of a dilute air stream can be very high due to auxiliary fuel requirements.

Use of pollution prevention techniques is common in the coating industries. They are cost-effective means of reducing emissions from the coating process and also from cleaning operations. Typical pollution prevention techniques/work practices for coating facilities include:

1. Use of low or no HAP/VOC coatings and/or cleanup solvents;
2. Use of more efficient spray equipment;
3. Use of nonspray alternatives;
4. Inventory control and material audits;
5. Process improvements to reduce waste/cross-media impacts;
6. Coating operator training;
7. Keeping storage containers covered or closed;
8. Recycling of cleaning solvent and finishing materials;
9. Proper coating preparation;
10. Direct delivery of coating to spray gun;
11. Use of heat (rather than thinner) to obtain the desired coating viscosity;
12. Proper care and maintenance of spray equipment.
13. Use of high transfer efficiency application and recovery equipment.

4.0 NEXT STEPS IN THE MACT DEVELOPMENT PROCESS

Further information gathering efforts will include: analysis of data collected from the ICR responses (October 1998); additional permit information and data collected from States (fall 1998); analysis of emission inventory data (fall 1998); additional site visits (August 1998); and additional stakeholder meetings. The ICR data will aid in characterizing the types and magnitudes of emission sources and HAP contents of coatings used at particular facilities for specific products. These data will also aid in developing the scope of the regulation. State permit information will provide information on the types of emission limits wood building products coating facilities already have to meet. Data on surface coating emissions by 8-digit Source Classification Code (SCC) will be collected for this source category. The additional site visits will be targeted toward facilities using pollution prevention type measures (e.g., waterborne, UV, or EB coating technologies) and those in segments of the industry not yet visited. The additional information collected will be used to develop the MACT floor and, ultimately, the MACT standard for the surface coating of wood building products.

APPENDIX A

LIST OF STAKEHOLDERS

TABLE A-1. INDUSTRY STAKEHOLDERS

Name	Affiliation	Organization
Jim Berry	Industry	Berry Environmental
Kurt Bigbee	Industry	American Plywood Association
John Bradfield	Industry	Composite Panel Association
Jack Burgess	Industry	Archetectural Woodworking Institute
Erich Burke	Industry	ABTco Inc.
Allen Campbell	Industry	National Wood Window and Door Association
Gary Gramp	Industry	Hardwood Plywood and Veneer Association
Michael Jonas	Industry	Lozier Corporation
Rob Kaufmann	Industry	American Forest and Paper Association
Edward Korczak	Industry	National Wood Flooring Association
Brock Landry	Industry	Venable, et al.
Mike Luffy	Industry	ABTco, Inc.
Barbara Martin	Industry	Building Systems Councils
Brad Miller	Industry	BIFMA International
Mickey Moore	Industry	National Oak Flooring Association
Jim Rabe	Industry	Masonite
David Ritchey	Industry	Architectural Woodworking Institute
Alex Ross	Industry	Radtech
Jeff Twaddle	Industry	Secor International Incorporated
Paul Vasquez	Industry	Georgia Pacific
Louis Wagner	Industry	American Hardboard Association
Dave Walters	Industry	Chesapeake Hardwood Products
Frank Walters	Industry	Manufactured Housing Institute
Robert Weiglein	Industry	Wood Moulding and Millwork Producers Association
Tammy Wyles	Industry	Georgia Pacific
George Carter	Industry supplier	Laminating Materials Association
Mark Collatz	Industry supplier	Adhesives and Sealants Council
Madelyn Harding	Industry supplier	Sherwin-Williams
Allen Irish	Industry supplier	National Paint and Coatings Association
Bob Matejka	Industry supplier	Akzo Nobel Coatings Inc.
David Mazzocco	Industry supplier	PPG
Bob Nelson	Industry supplier	National Paint and Coatings Association
Carol Niemi	Industry supplier	CMA Solvents Council
Sherry Stookey	Industry supplier	Lilly

TABLE A-2. REGULATORY SUBGROUP

Name	Affiliation	Organization	Phone Number and E-mail Address
Maggie Corbin	Local agency	Puget Sound APCA	(904) 488-0114
Jerry Ebersole	State agency	Oregon DEQ	(503) 229-6974 ebersole.jerry@deq.state.or.us
Gregg Lande	State agency	Oregon DEQ	(503) 229-6411 lande.gregg@deq.state.or.us
Venkata Panchakarla	State agency	Florida DEQ	(904) 488-0114
Saba Tahmassebi	State agency	Oklahoma DEQ/AQD	(405) 702-4100

APPENDIX B

LIST OF HAZARDOUS AIR POLLUTANTS

List of Hazardous Air Pollutants

CAS No.	Chemical name
75070	Acetaldehyde
60355	Acetamide
75058	Acetonitrile
98862	Acetophenone
53963	2-Acetylaminofluorine
107028	Acrolein
79061	Acrylamide
79107	Acrylic acid
107131	Acrylonitrile
107051	Allyl chloride
92671	4-Aminobiphenyl
62533	Aniline
90040	o-Anisidine
1332214	Asbestos
71432	Benzene (including benzene from gasoline)
92875	Benzidine
98077	Benzotrichloride
100447	Benzyl chloride
92524	Biphenyl
117817	Bis(2-ethylhexyl)phthalate (DEHP)
542881	Bis(chloromethyl)ether
75252	Bromoform
106990	1,3-Butadiene
156627	Calcium cyanamide
133062	Captan
63252	Carbaryl
75150	Carbon disulfide
56235	Carbon tetrachloride
463581	Carbonyl sulfide
120809	Catechol
133904	Chloramben
57749	Chlordane
7782505	Chlorine
79118	Chloroacetic acid
532274	2-Chloroacetophenone
108907	Chlorobenzene
510156	Chlorobenzilate
67663	Chloroform
107302	Chloromethyl methyl ether
126998	Chloroprene
1319773	Cresols/Cresylic acid (isomers and mixture)
95487	o-Cresol
108394	m-Cresol
106445	p-Cresol
98828	Cumene
94757	2,4-D, salts and esters
3547044	DDE
334883	Diazomethane
132649	Dibenzofurans
96128	1,2-Dibromo-3-chloropropane
84742	Dibutylphthalate
106467	1,4-Dichlorobenzene(p)
91941	3,3-Dichlorobenzidene
111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)
542756	1,3-Dichloropropene
62737	Dichlorvos
111422	Diethanolamine
121697	N,N-Diethyl aniline (N,N-Dimethylaniline)
64675	Diethyl sulfate
119904	3,3-Dimethoxybenzidine
60117	Dimethyl aminoazobenzene
119937	3,3'-Dimethyl benzidine
79447	Dimethyl carbamoyl chloride
57147	1,1-Dimethyl hydrazine
68122	Dimethyl formamide
131113	Dimethyl phthalate
77781	Dimethyl sulfate
534521	4,6-Dinitro-o-cresol, and salts
51285	2,4-Dinitrophenol
121142	2,4-Dinitrotoluene
123911	1,4-Dioxane (1,4-Diethyleneoxide)
122667	1,2-Diphenylhydrazine
106898	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
106887	1,2-Epoxybutane
140885	Ethyl acrylate
100414	Ethyl benzene
51796	Ethyl carbamate (Urethane)
75003	Ethyl chloride (Chloroethane)
106934	Ethylene dibromide (Dibromoethane)
107062	Ethylene dichloride (1,2-Dichloroethane)
107211	Ethylene glycol
151564	Ethylene imine (Aziridine)
75218	Ethylene oxide
96457	Ethylene thiourea
75343	Ethylidene dichloride (1,1-Dichloroethane)
50000	Formaldehyde
76448	Heptachlor
118741	Hexachlorobenzene
87683	Hexachlorobutadiene
77474	Hexachlorocyclopentadiene
67721	Hexachloroethane
822060	Hexamethylene-1,6-diisocyanate
680319	Hexamethylphosphoramide
110543	Hexane
302012	Hydrazine
7647010	Hydrochloric acid
7664393	Hydrogen fluoride (Hydrofluoric acid)
123319	Hydroquinone
78591	Isophorone
58899	Lindane (all isomers)
108316	Maleic anhydride
67561	Methanol
72435	Methoxychlor
74839	Methyl bromide (Bromomethane)
74873	Methyl chloride (Chloromethane)
71556	Methyl chloroform (1,1,1-Trichloroethane)
78933	Methyl ethyl ketone (2-Butanone)

List of Hazardous Air Pollutants (continued)

[illegible]	[illegible]
60344	Methyl hydrazine
74884	Methyl iodide (Iodomethane)
108101	Methyl isobutyl ketone (Hexone)
624839	Methyl isocyanate
80626	Methyl methacrylate
1634044	Methyl tert butyl ether
101144	4,4-Methylene bis(2-chloroaniline)
75092	Methylene chloride (Dichloromethane)
101688	Methylene diphenyl diisocyanate (MDI)
101779	4,4'-Methylenedianiline
91203	Naphthalene
98953	Nitrobenzene
92933	4-Nitrobiphenyl
100027	4-Nitrophenol
79469	2-Nitropropane
684935	N-Nitroso-N-methylurea
62759	N-Nitrosodimethylamine
59892	N-Nitrosomorpholine
56382	Parathion
82688	Pentachloronitrobenzene (Quintobenzene)
87865	Pentachlorophenol
108952	Phenol
106503	p-Phenylenediamine
75445	Phosgene
7803512	Phosphine
7723140	Phosphorus
85449	Phthalic anhydride
1336363	Polychlorinated biphenyls (Aroclors)
1120714	1,3-Propane sultone
57578	beta-Propiolactone
123386	Propionaldehyde
114261	Propoxur (Baygon)
78875	Propylene dichloride (1,2-Dichloropropane)
75569	Propylene oxide
75558	1,2-Propylenimine (2-Methyl aziridine)
91225	Quinoline
106514	Quinone
100425	Styrene
96093	Styrene oxide
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin
79345	1,1,2,2-Tetrachloroethane
127184	Tetrachloroethylene (Perchloroethylene)
7550450	Titanium tetrachloride
108883	Toluene
95807	2,4-Toluene diamine
584849	2,4-Toluene diisocyanate
95534	o-Toluidine
8001352	Toxaphene (chlorinated camphene)
120821	1,2,4-Trichlorobenzene
79005	1,1,2-Trichloroethane
79016	Trichloroethylene
95954	2,4,5-Trichlorophenol
88062	2,4,6-Trichlorophenol
121448	Triethylamine
1582098	Trifluralin
540841	2,2,4-Trimethylpentane
108054	Vinyl acetate
593602	Vinyl bromide
75014	Vinyl chloride
75354	Vinylidene chloride (1,1-Dichloroethylene)
1330207	Xylenes (isomers and mixture)
95476	o-Xylenes
108383	m-Xylenes
106423	p-Xylenes

List of Hazardous Air Pollutants (continued)

CAS No.	Chemical name
0	Antimony Compounds
0	Arsenic Compounds (inorganic including arsine)
0	Beryllium Compounds
0	Cadmium Compounds
0	Chromium Compounds
0	Cobalt Compounds
0	Coke Oven Emissions
0	Cyanide Compounds[1]
0	Glycol ethers[2]
0	Lead Compounds
0	Manganese Compounds
0	Mercury Compounds
0	Fine mineral fibers[3]
0	Nickel Compounds
0	Polycylic Organic Matter[4]
0	Radionuclides (including radon)[5]
0	Selenium Compounds

NOTE: For all listings above which contain the word "compounds" and for glycol ethers, the following applies: Unless otherwise specified, these listings are defined as including any unique chemical substance that contains the named chemical (i.e., antimony, arsenic, etc.) as part of that chemical's infrastructure.

[1] X'CN where X = H' or any other group where a formal dissociation may occur. For example KCN or $Ca(CN)_2$

[2] Includes mono- and di-ethers of ethylene glycol, diethylene glycol, and triethylene glycol $R\text{-}(OCH2CH2)_n\text{-}OR'$ where

n = 1, 2, or 3

R = alkyl or aryl groups

R' = R, H, or groups which, when removed, yield glycol ethers with the structure: $R\text{-}(OCH2CH)_n\text{-}OH$. Polymers are excluded from the glycol category.

[3] Includes mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.

[4] Includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100°C.

[5] A type of atom which spontaneously undergoes radioactive decay.

APPENDIX C

GLOSSARY

Glossary

Adhesive. A substance capable of holding materials together by surface attachment. Various descriptive adjectives are used with the term adhesive to indicate certain characteristics: physical (liquid adhesive, tape adhesive), chemical type (silicate adhesive, resin adhesive), materials bonded (paper adhesive), and conditions of use (hot-set adhesive).

Airless and Air Assisted Airless Spray Guns. Spray gun technologies that are not conventional air spray because the coating is not atomized by mixing it with compressed air.

Class I Hardboard. Hardboard that meets the specifications for Class I given by the standard ANSI/AHA A135.4-1995 as approved by the American National Standards Institute. The standard specifies requirements and test methods for water absorption, thickness swelling, modulus of rupture, tensile strength, surface finish, dimensions, squareness, edge straightness, and moisture content for five classes of hardboard. Class I hardboard is also known as tempered hardboard.

Class II Hardboard. Hardboard that meets the specifications for Class II given by the standard ANSI/AHA A135.4-1995 as approved by the American National Standards Institute. The standard specifies requirements and test methods for water absorption, thickness swelling, modulus of rupture, tensile strength, surface finish, dimensions, squareness, edge straightness, and moisture content for five classes of hardboard. Class II hardboard is also known as standard hardboard.

Coating. A protective, decorative, or functional film applied as a thin layer to a substrate or surface and which cures to form a continuous solid film. This term applies to paints such as lacquers or enamels, but also is used to refer to films applied to paper, plastics, or foil. Inks, adhesives, and caulks are being treated as "coatings" for purposes of this rule development.

Coating Applicator. A unit operation for applying coatings to a wooden substrate (direct roll coater, curtain coater, spray gun, etc.).

Coating Line. A unit operation necessary for producing a finished wood product (coating applicator, sander, oven, etc.).

Coating Operation. Those activities in which a coating is applied to a substrate and is subsequently air dried, cured in an oven, or cured by radiation.

Curtain Coater. A coating applicator that uses a weir or metered slit to create a free falling film of coating that the wood substrate passes through.

Direct roll coater (DRC). A coating applicator that uses cylindrical rollers to apply coatings to the wood substrate. The cylinders on a DRC rotate in the same direction as the wood substrate movement.

Finished (wood) product. Any wood building product to which a protective, decorative, or functional layer has been applied. Materials used include, but are not limited to, paints, stains, sealers, topcoats, basecoats, primers, enamels, inks, adhesives, and temporary protective coatings.

Flow coaters. Coating applicators that uses nozzles and low pressure to create a film of coating in which the wood substrate passes through.

HAP. Hazardous Air Pollutant. Any air pollutant listed in or pursuant to Section 112(b) of the Clean Air Act. The current list of HAP is attached separately (see Appendix B).

High Volume Low Pressure (HVLP) Spray Equipment. Spray equipment that is used to apply coating by means of a spray gun that operates at 10.0 psig of atomizing air pressure or less at the air cap.

Laminated (Wood) Product. Any wood building product which a protective, decorative, or functional layer has been bonded with an adhesive. Products that are produced by bonding layers to the substrate as a part of the substrate manufacturing process are not considered laminated products under this regulation.

Primer. The first layer and any subsequent layers of identically formulated coating applied to the surface to be coated. Primers are typically used for corrosion prevention, protection from the environment, functional fluid resistance, and adhesion of subsequent coatings. Primers that are defined as specialty coatings are not included under this definition.

Process (Process Line). The aggregate of unit operations necessary for producing a product. The emissions from a process include all sources of air emissions (e.g., storage, transfer, handling, painting, and packaging).

Reverse Roll Coater (RRC). A coating applicator that uses cylindrical rollers to apply coatings to the wood substrate. The cylinders on a RRC rotate against the movement of the wood substrate.

Solvent. The liquid or blend of liquids used to dissolve or disperse the film-forming particles in a coating and which evaporate during drying. A true solvent is a single liquid that can dissolve the coating. Solvent is often used to describe turpentines, hydrocarbons, oxygenated compounds, furans, nitroparaffins, and chlorinated solvents.

Solventborne. Coatings in which volatile organic compounds are the major solvent or dispersant.

Spray gun. A device that atomizes a coating or other material and projects the particulates onto a substrate.

Thinning Solvent. Organic solvent used to thin coating material prior to application to the par or product.

Topcoat. A coating that is applied over a primer on a part, product, or component for appearance or protection. Topcoats are typically the last coat applied in a coating system.

Touch-up and Repair Operation. That portion of the coating operation that is the incidental application of coating used to cover minor imperfections in the coating finish or to achieve complete coverage. This definition includes out-of-sequence or out-of-cycle coating.

Unit Operation. An industrial operation, classified or grouped according to its function in an operating environment (e.g., a paint mixing vessel, a spray booth, etc.).

VOC (Volatile Organic Compound). Any compound defined as VOC in 40 CFR 51.100(s). This includes any organic compound other than those determined by the EPA to be an "exempt" compound.

Waterborne coatings. Coatings in which water accounts for more than 5 weight percent of the volatile portion.

Wood Building Product. Any finished or laminated wood product that is used in the construction, either interior or exterior, of a residential, commercial, or institutional building.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

National emission standards to control the emission of hazardous air pollutants (HAP) from the Wood Building Products (Surface Coating) industry are being proposed under Section 112 of the Clean Air Act (CAA). There is a possibility that case-by-case maximum achievable control technology (MACT) determinations will be required under Section 112 (g) for newly constructed and/or reconstructed major sources. The information summarized in this document is intended to provide preliminary information that can be used by States that may have to make case-by-case MACT determinations under Sections 112(g) or 112(j) of the CAA. Section 1 of this document gives an overview of the initial MACT development phase for this source category. Section 2 summarizes the issues raised and information gathering techniques used in this process. A preliminary characterization of the wood building products source category is given in Section 3. Section 3 also focuses on the source category's products, types of coatings used, application methods, emissions, and emission control techniques. Section 4 addresses recommendations for next steps in the MACT development process.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
surface coating, wood building products, air pollution, NESHAP, hazardous air pollutant, HAP, window, door, panel, reconstituted wood, flooring, tileboard, doorskin, Class I hardboard, laminate flooring	air pollution control wood building product manufacturing stationary sources	

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