United States Environmental Protection Agency | Office Of Air Quality Planning And Standards Research Triangle Park, NC 27711 | November 2002 FINAL REPORT

Air

Regulatory Impact Analysis of the Proposed Plywood and Composite Wood Products NESHAP

Final Report

TABLE OF CONTENTS

List of Exhibits

LIST OF FIGURES

Select List of Acronyms and Abbreviations

BID - Background Information Document
CAA - Clean Air Act
CAPMS - Criteria Air Pollution Modeling System
CO - Carbon Monoxide
COPD - Chronic Obstructive Pulmonary Disease
C/S- Cost to Sales Ratio
EFB - Electrified Filter Beds
EO - Executive Order
EPA - Environmental Protection Agency
EWP - Engineered Wood Products
HAP - Hazardous Air Pollutant
HB - Hardboard
ICR - Information Collection Request
lb - Pound
LDs - Loss Days
LRS - Lower Respiratory Symptoms
LSL - Laminated Strand Lumber
LVL - Laminated Veneer Lumber
MACT - Maximum Achievable Control Technology
MDF - Medium Density Fiber
NAAQS - National Ambient Air Quality Standards
NAICS - North American Industrial Classification System
NESHAP - National Emission Standards for Hazardous Air Pollutants
NOx- Nitrogen Oxides
NPR - Notice of Proposed Rulemaking
NSPS - New Source Performance Standards
NSR - New Source Review
OEM- Original Equipment Manufacturers
OMB - Office of Management and Budget
O&M - Operation and Maintenance
OSB- Oriented Strandboard
ODT - Oven Dry Tons
PB - Particleboard
P/E - Partial Equilibrium
PM - Particulate Matter
PSL - Parallel Strand Lumber
ppbdv - Parts Per Billion, dry volume
ppm - Parts Per Million
PRA - Paperwork Reduction Act of 1995
PTE - Permanent Total Enclosure
RCO- Regenerative Catalytic Oxidizer
RTO - Regenerative Thermal Oxidizer

RIA - Regulatory Impact Analysis
RFA - Regulatory Flexibility Act
R/S - Return to Sales Ratio
SAB - Science Advisory Board
SBA - Small Business Administration
SBREFA - Small Business Regulatory Enforcement Fairness Act of 1996
SIC - Standard Industrial Classification
SOA - Secondary Organic Aerosols
SO_2 - Sulfur Dioxide
SPV - Softwood Plywood Veneer
TAC - Total Annualized Cost
THC - Total Hydrocarbon
tpd - Tons Per Day
tpy - Tons Per Year
UMRA - Unfunded Mandates Reform Act
URS - Upper Respiratory Symptoms
VOS - Value of Shipments
VOCs - Volatile Organic Compounds
WESP - Wet Electrostatic Precipitator
WLDs - Work Loss Days

This page intentionally left blank.

EXECUTIVE SUMMARY

EPA is proposing a rule to reduce hazardous air pollutant (HAPs) emissions from existing and new plywood and composite wood products facilities that are major sources. This rule, scheduled for proposal during 2002, is a National Emission Standards for Hazardous Air Pollutants (NESHAP), and will reduce HAP emissions by requiring affected plywood and composite wood products facilities to meet a level of emissions reductions needed to meet the Maximum Achievable Control Technology (MACT) floor for these sources. This MACT floor level of control is the minimum level these sources must meet to comply with the proposed rule. The major HAPs whose emissions will be reduced are formaldehyde, acetaldehyde, acrolein, methanol, phenol, and propionaldehyde. The proposed rule will also lead to emission reductions of other pollutants such as volatile organic compounds (VOC), particulate matter (PM_{10}), carbon monoxide (CO), and emission increases in nitrogen oxides (NOx) due to the application of incineration-based controls. Increased electricity use due to application of controls will also lead to general increases in the levels of sulfur dioxide (SO_2) and NOx emitted from electric utilities.

This proposed rule allows an affected source to use a production-based compliance option, defined in units of mass of pollutant per unit of production, or any of six control system compliance options if an affected source is equipped with an add-on control system. As explained in the Federal Register proposal notice, the options entail HAP reductions of 90 percent or limiting the concentration of HAPs in the exhaust from the control system. In addition, an affected source may choose to comply with an emissions averaging option that allows the sources to not control or under-control some process units while controlling other affected process units.

The proposed rule is expected to reduce HAP emissions by 11,000 tons per year in the third year after its issuance. The rule is also expected to reduce VOC emissions, measured as total hydrocarbon, by 27,000 tons per year, PM_{10} emissions by 13,000 tons per year, and CO emissions by 11,000 tons per year in the third year. The rule is expected to increase NOx emissions at affected sources by 2,000 tons per year in the third year. The increased electricity required to operate the control systems is also expected to increase NOx and SO_2 emissions at electricity generating utilities by 2,000 and 4,000 tons, respectively. The compliance costs, which include the costs of control and monitoring, recordkeeping and reporting requirements, are estimated at $142 million (1999 dollars). The total social costs, which account for the behavioral response of consumers and producers to higher pollution control costs, are estimated at $134.2 million (1999 dollars). Economic impacts associated with these costs include price increases nationally of 0.9 to 2.5 percent for products affected by this rule, and a reduction in output of only 0.1 to 0.7 percent nationally for the affected industries. An analysis of small business impacts shows that there are 17 small firms affected, with 10 of them having annual compliance costs of 1 percent or greater than their sales, and 3 of these having annual compliance costs of 3 percent or greater than their sales. The Agency has certified that there is no significant impact on a substantial number of small entities (SISNOSE) associated with this proposed rule. Also, an analysis of the energy impacts associated with this proposed rule indicates that there is no significant adverse effect on supply, distribution, or use of energy from implementation of the proposal.

The Agency is unable to monetize the benefits from the HAP, VOC, and CO emissions reductions due to lack of credible data for assigning a benefits value to these reductions. While the Agency has done so in past RIAs and may do so in the future, for this rule, the Agency has not monetized the benefits and disbenefits associated with the criteria pollutant (PM, NOx, SO_2) emission decreases and increases, respectively. This lack of inclusion of a monetized benefits estimate for criteria pollutant emission changes is not meant to imply that the Agency will choose not to provide such monetized benefit estimates for other NESHAPs and other standards.

1 INTRODUCTION

Under the authority of Section 112(d) of the Clean Air Act as amended in 1990, the U.S. Environmental Protection Agency (EPA or the Agency) is proposing a regulation requiring facilities that manufacture plywood and composite wood products to reduce their emissions of hazardous air pollutants (HAPs). This regulation, a National Emission Standard for Hazardous Air Pollutants (NESHAP), will apply to major sources of HAPs in this industry. This economic impact analysis (EIA) presents the supporting documentation and analyses developed by the Agency that describe and quantify the expected impacts of the proposed Plywood and Composite Wood Products NESHAP.

1.1 Scope and Purpose of the Report

The proposed NESHAP will require the manufacturers of plywood and composite wood products to install additional pollution controls to reduce their emissions of HAPs to the air. The purpose of this EIA is to present the results of the Agency's evaluation of the cost, economic impacts, and benefits from compliance with the requirements of the proposed NESHAP.

The proposed NESHAP will apply to all new and existing major sources of HAPs that manufacture plywood and composite wood products. These sources emit HAPs associated with heating of wood and related to their use of resins, adhesives, and additives in the pressing and drying stages of the production process. The EPA estimates that there are 447 facilities that produce plywood and composite wood products. Of these, the EPA determined that 223 facilities are major sources of HAPs.

1.2 Need for Regulatory Action

The purpose of this NESHAP is to protect public health by reducing emissions of HAP from plywood and composite wood products facilities. The authority for doing this lies in Section 112 of the Clean Air Act (CAA), which requires EPA to list categories and subcategories of major and area sources of HAP and to establish NESHAP for the listed source categories and subcategories. The plywood and composite wood products source category was originally listed as the plywood and particleboard source category on July 16, 1992 (57 FR 31576). The name of the source category was changed to plywood and composite wood products on November 18, 1999 (64 FR 63025) to more accurately reflect the types of manufacturing facilities covered by the source category. A major source of HAP is defined as any stationary source source or group of stationary sources within a continuous area and under common control that emits or has the potential to emit, considering controls, in the aggregate, 9.1 Megagrams (Mg)/year (10 tons/yr) or more of any single HAP or 22.7 Mg/year or more (25 tons/yr) of multiple HAP.

Section 112 of the CAA requires EPA to establish NESHAP for the control of HAP from both existing and new sources. The CAA requires the NESHAP to reflect the maximum degree of reduction in emissions of HAP that is achievable. This level of control is commonly referred to as the maximum achievable control technology (MACT).

The MACT floor is the minimum level of control allowed for NESHAP and is defined under section 112 (d) (3) of the CAA. In essence, the MACT floor ensures that the standard is set at a level that assures all major sources achieve the control level that is at least as stringent as that already achieved by the better-controlled and lower-emitting sources in each source category or subcategory. For new sources, the MACT floor cannot be less stringent than the emission control that is achieved in practice by the best-controlled similar source. The MACT standards for existing sources can be less stringent than standards for new sources, but they cannot be less stringent than the average emission limitation achieved by the best-performing 12 percent of existing sources in the category or subcategory (or, the best-performing 5 sources for categories or subcategories with fewer than 30 sources.)

In the course of rule development, we may also consider control options that are more stringent than the floor. EPA may establish standards more stringent than the floor based on the consideration of cost of achieving the emissions reductions, any non-air quality health and environmental impacts, and energy requirements.

1.3 Requirements for this Economic Impact Analysis

This section describes various legislative and executive requirements that govern the analytical requirements for Federal rulemakings, and describes how each analytical requirement is addressed in this RIA.

1.3.1 Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993) as amended by Executive Order 13258 (67 FR 9385, February 28, 2002), the EPA must determine whether the regulatory action is "significant" and therefore subject to review by the Office of Management and Budget (OMB) and the requirements of the Executive Order. The Executive Order defines "significant regulatory action" as one that is likely to result in a rule that may:

1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;

2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligation of recipients thereof;

4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866 as amended by Executive Order 13258, it has been determined that this rule is a "significant regulatory action" because the annual costs of complying with the rule are expected to exceed $100 million. Consequently, this action was submitted to OMB for review under Executive Order 12866 as amended by Executive Order 13258.

1.3.2 Regulatory Flexibility Act and Small Business Regulatory Enforcement Fairness Act of 1996

The Regulatory Flexibility Act (RFA) of 1980 (PL 96-354) generally requires that agencies conduct a screening analysis to determine whether a regulation adopted through notice-and-comment rulemaking will have a significant impact on a substantial number of small entities (SISNOSE), including small businesses, governments, and organizations. If a regulation will have such an impact, agencies must prepare an Initial Regulatory Flexibility Analysis, and comply with a number of procedural requirements to solicit and consider flexible regulatory options that minimize adverse economic impacts on small entities. Agencies must then prepare a Final Regulatory Flexibility Analysis that provides an analysis of the effect on small entities from consideration of flexible regulatory options. The RFA's analytical and procedural requirements were strengthened by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 to include the formation of a panel if a proposed rule was determined to have a SISNOSE. This panel would be made up of representatives of the EPA, the Small Business Administration (SBA), and OMB.

For reasons explained more fully in Chapter 5 of this economic impact analysis for the proposed rule, EPA has determined that there is no SISNOSE for this rule. While there are some impacts to some small firms, these impacts are not sufficient for a SISNOSE. Therefore, the EPA has not prepared an Initial Regulatory Flexibility Analysis for this proposed rule.

The RFA and SBREFA require the use of definitions of "small entities," including small businesses, governments, and organizations such as non-profits, published by the SBA.[1] Screening analyses of economic impacts presented in Chapter 5 of this report examine potential impacts on small entities.

1.3.3 Unfunded Mandates Reform Act of 1995

The Unfunded Mandates Reform Act (UMRA) of 1995 (PL-4) was enacted to focus attention on federal mandates that require other governments and private parties to expend resources without federal funding, to ensure that Congress considers those costs before imposing mandates, and to encourage federal financial assistance for intergovernmental mandates. The Act establishes a number of procedural requirements. The Congressional Budget Office is required to inform Congressional committees about the presence of federal mandates in legislation, and must estimate the total direct costs of mandates in a bill in any of the first five years of a mandate, if the total exceeds $50 million for intergovernmental mandates and $100 million for private-sector mandates.

Section 202 of UMRA directs agencies to provide a qualitative and quantitative assessment (or a "written statement") of the anticipated costs and benefits of a Federal mandate that results in annual expenditures of $100 million or more. The assessment should include costs and benefits to State, local, and tribal governments and the private sector, and identify any disproportionate budgetary impacts. Section 205 of the Act requires agencies to identify and consider alternatives, including the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule.

---

[1] Where appropriate, agencies can propose and justify alternative definitions of "small entity." This RIA and the screening analysis for small entities rely on the SBA definitions.

Since this proposed rule may cause a mandate to the private sector of more than $100 million, EPA did provide an analysis of the impacts of this rule on State and local governments to support compliance with Section 202 of UMRA. A summary of this analysis is in Chapter 4 of this EIA. In short, no government entity is affected by this proposed rule - only businesses.

1.3.4 Paperwork Reduction Act of 1995

The Paperwork Reduction Act of 1995 (PRA) requires Federal agencies to be responsible and publicly accountable for reducing the burden of Federal paperwork on the public. EPA has submitted an OMB-83I form, along with a supporting statement, to the OMB in compliance with the PRA. The OMB-83I and the supporting statement explains the need for additional information collection requirements and provides respondent burden estimates for additional paperwork requirements to State and local governments associated with this proposed rule.

1.3.5 Executive Order 12898

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires Federal agencies to consider the impact of programs, policies, and activities on minority populations and low-income populations. Disproportionate adverse impacts on these populations should be avoided to the extent possible. According to EPA guidance, agencies are to assess whether minority or low-income populations face risk or exposure to hazards that is significant (as defined by the National Environmental Policy Act) and that "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group." (EPA, 1996). This guidance outlines EPA's Environmental Justice Strategy and discusses environmental justice issues, concerns, and goals identified by EPA and environmental justice advocates in relation to regulatory actions. The proposed plywood and composite wood products rule is expected to provide health and welfare benefits to populations around the United States, regardless of race or income.

1.3.6 Executive Order 13045

Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," directs Federal agencies developing health and safety standards to include an evaluation of the health and safety effects of the regulations on children. Regulatory actions covered under the Executive Order include rulemakings that are economically significant under Executive Order 12866 as amended by Executive Order 13258, and that concern an environmental health risk or safety risk that the agency has reason to believe may disproportionately affect children. EPA has developed internal guidelines for implementing E.O. 13045 (EPA, 1998).

The proposed plywood and composite wood products rule is a "significant economic action," because the annual costs are expected to exceed $100 million. Exposure to the HAPs whose emissions will be reduced by this rule are known to affect the health of children and other sensitive populations. However, this proposed rule is not expected to have a disproportionate impact on children.

1.3.7 Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," was published in the Federal Register on May 22, 2001 (66 FR 28355). This executive order requires Federal Agencies to weigh and consider the effect of regulations on supply, distribution, and use of energy. To comply with this executive order, Federal Agencies are to prepare and submit a "Statement of Energy Effects" for "significant energy actions." The executive order defines "significant energy action" as the following:

1) an action that is a significant regulatory action under Executive Order 12866 or any successor order, and

2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or

3) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action.

An analysis of the effects of this proposed rule on supply, distribution, and use of energy is summarized in Chapter 4.

1.4 Other Federal Programs

The only other federal program that may have an effect on these sources is the wood building products surface coating NESHAP, a rulemaking scheduled to be proposed later in 2002. However, the overlap of coverage of these rules is expected to be minimal. The wood furniture manufacturing operations NESHAP, a rule signed in December 1995, may apply to some facilities that will be affected by the proposed plywood and composite wood products rule, but there are no overlapping requirements for individual process units.

1.5 Organization of the Economic Impact Analysis

This report includes eight chapters that present a description of the industry, the costs associated with the regulatory control options associated with the proposed NESHAP, results of the economic impact analysis, a summary of impacts on small businesses, a listing of the qualitative benefits associated with both the HAP and non-HAP emission reductions, and results of the monetized benefits analysis.

- Chapter 2 profiles the plywood and composite wood products industries.
- Chapter 3 summarizes the approach to estimating the costs of the proposed NESHAP, presents the results of the cost analysis, and provide the emissions reductions for the proposed alternative.
- Chapter 4 summarizes the approach to performing the economic impact analysis of the proposed NESHAP and presents the results of the analysis. An analysis of impacts on energy distribution, supply, or use is also in this chapter.

- Chapter 5 includes the results of the analyses of the proposed NESHAP's impact on small businesses.

Throughout this report, a distinction is made between "affected" and "unaffected" facilities and firms. Affected facilities are those that will incur compliance costs (control and monitoring, recordkeeping, and reporting) to comply with the proposed rule. In general, unaffected facilities and firms have no compliance costs. However, of the group of unaffected facilities, 51 of these will incur costs associated with monitoring, reporting, and record keeping (MRR). MRR costs are estimated to be $25,194 per year. The distinction between affected and unaffected facilities and firms will be noted throughout the document.

1.6 References

Federal Register, 1993. Executive Order 12866, *Regulatory Planning and Review.* Vol. 58, October 4, 1993, pg. 51735.

U.S. Environmental Protection Agency, 1996. *Guidance for Providing Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (Review Draft). Office of Federal Activities, Washington, D.C., July 12, 1996.

U.S. Environmental Protection Agency, 1996. Memorandum from Trovato and Kelly to Assistant Administrators. Subject: "Implementation of Executive Order 13045, Protection of Children from Environmental Health and Safety Risks." April 21, 1998.

Federal Register, 2001. Executive Order 13211, *Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use.* Vol. 66, May 22, 2001, pg. 28355.

Federal Register, 2002. Executive Order 13258, *Amending Executive Order 12866 - Regulatory Planning and Review.* Vol.67 , February 28, 2002, pg. 9385.

2 PROFILE OF THE PLYWOOD AND COMPOSITE WOOD PRODUCTS INDUSTRIES

2.1 Introduction

Through a 1998 information collection request (ICR), the EPA identified plants potentially impacted by the proposed NESHAP. This profile presents information on several industries that comprise the plywood and composite wood source category because they will be impacted by the regulation in some way. These industries fall into three categories based on their Standard Industrial Classification (SIC) or North American Industry Classification System (NAICS) classifications.

- Softwood plywood and veneer
- Reconstituted wood products
- Structural wood members

The industries are represented by the three SIC codes and four NAICS codes presented in Exhibit 2-1. The NAICS codes replaced SIC codes in federal statistical data beginning in 1997. The SIC code for Structural Wood Members, Not Elsewhere Classified (n.e.c.) was divided into two NAICS codes for Engineered Wood Members and Truss Manufacturing. The ICR surveyed 416 potentially impacted facilities (EPA, 1998) , and an additional 15 facilities were identified that either did not respond to the survey or have commenced operation since the date of the survey. The Agency determined that of these 431 facilities, 223 were impacted facilities, owned by 52 firms.

EPA expects this rule to primarily impact certain facilities engaged in the manufacturing of softwood plywood, reconstituted wood products, and structural wood members. Exhibit 2-1 shows, for each of the three industry categories, the number of facilities EPA expects will experience compliance costs as a result of this MACT standard and the total number of facilities. The total estimated capital costs associated with the new MACT standard are $479 million. The annualized costs for affected facilities are $138 million on an annual basis, including monitoring, reporting, and record keeping costs (in 1999 dollars). Some unaffected facilities will also have monitoring, reporting, and record keeping costs of approximately $4 million per year. Therefore, the total annualized compliance costs are $142 million (1999 dollars).

Including costs associated with monitoring, reporting, and record keeping requirements, EPA expects 88 softwood plywood and veneer facilities to experience approximately 22 percent of the costs, 38 oriented strandboard facilities to experience approximately 18 percent of the costs, 82 other wood composite (including medium density fiber (MDF), particle board (PB), and hardboard (HB)) to experience approximately 58 percent of costs, and engineered wood product facilities to bear the remaining 2 percent. Most of the discussions contained in this profile will emphasize the softwood plywood and reconstituted wood products industries because facilities in these industries will experience the greatest impacts associated with the new MACT standard. A discussion of the affected EWP facilities is presented in Section 4.4 of this chapter.

Exhibit 2-1: SIC & NAICS Codes for the Plywood and Composite Wood Industries					
SIC Code	**SIC Description**	**NAICS Code**	**NAICS Description**	**Impacted Facilities***	**Total Facilities in Category**
2436	Softwood Veneer and Plywood	321212	Softwood Veneer and Plywood	66	155
2493	Reconstituted Wood Products	321219	Reconstituted Wood Products	Total: 97	317
				OSB: 23	
				PB/MDF: 56	
				HB: 18	
2439	Structural Wood Members, Not Elsewhere Classified	321213	Engineered Wood Members (Except Truss)	3	53
		321214	Truss Manufacturing	0	992
* Does not include number of facilities with MRR costs only. Sources: MRI (1999), U.S. Environmental Protection Agency (1998), Dun & Bradstreet (1999a), U.S. Department of Commerce (1999a).					

Producers of plywood and composite wood products also engage in additional manufacturing activities including furniture and wholesale timber production. In some cases, their primary SIC code[1] may be one other than those listed in Exhibit 2-1. The facilities with a primary SIC codes other than for plywood and wood composite manufacturers are shown in Exhibit 2-2. The operations related to these other SIC codes are unlikely to be affected by the MACT standard. In addition, the number of facilities identified as potentially affected by this rule relative to the total number of establishments in all categories is extremely small (under one percent for all categories). Therefore, this profile focuses on the SIC and NAICS listed in Exhibit 2-1. In particular, the profile will focus on the softwood plywood and veneer and reconstituted wood products industries. All facilities that are impacted by the MACT standard are included in these analyses, regardless of their primary SIC or NAICS code.

[1]See section 2.4.3.1 for a description of how primary SIC codes were assigned to the surveyed facilities.

Exhibit 2-2: Other Primary SIC and NAICS Codes for the Plywood and Wood Composite Industries						
SIC	**Description**	**NAICS**	**NAICS Title**	**Facilities in ICR**	**Impacted Facilities**	**Total Facilities in Category**
2421	Sawmills and Planning Mills, General	321113 321912 321918 321999	Sawmills Cut Stock, Resawing Lumber, & Planning Other Millwork (including Flooring) All Other Miscellaneous Wood Product Manufacturing	32	13	5,815
2426	Hardwood Dimension and Flooring Mills	321113 321912 321918 387215	Sawmills Cut Stock, Resawing Lumber, & Planning Other Millwork (including Flooring) Showcase, Partition, Shelving, and Locker Manufacturing	5	0	833
2448	Wood Pallets and Skids	321920	Wood Container and Pallet Manufacturing	1	0	1,929
2499	Wood Products, Not Elsewhere Classified	321920 333414 339999 321999	Wood Container and Pallet Manufacturing Heating Equipment Manufacturing All Other Miscellaneous Manufacturing All Other Miscellaneous Wood Product Manufacturing	4	0	2,760
2511	Wood Household Furniture, Except Upholstered	337122 337215	Non-upholstered Wood Household Furniture Manufacturing Showcase, Partition, Shelving, and Locker Manufacturing	13	0	2,785
Sources: MRI (1999), U.S. Environmental Protection Agency (1998), Dun & Bradstreet (1999a), U.S. Department of Commerce (1999a).						

Section 2.2 of this chapter describes the supply side of the affected industries and characterizes the production process, the products concerned, and the costs of production. Section 2.3 examines the demand side of the affected industries, product uses, and consumers. Section 2.4 characterizes the facilities and firms that comprise the industry, their organization, and their financial conditions. Finally, Section 2.5 describes the markets and discusses domestic production and consumption, international trade, and prices.

2.2 The Supply Side

The following section contains information concerning the supply of plywood and composite wood products. This section describes the production processes of each of the aforementioned industries. It then presents the products, by-products, and co-products of each industry. Lastly, the costs of production for each of the three industries are presented. Factors, such as industry shipments, costs of materials, fuels and electricity, payroll, capital expenditures, and materials consumed are all examined.

2.2.1 Production Process

This section discusses three categories of plywood and wood composites production: plywood and veneer; particleboard, strand and fiber composites; and structural wood members. The construction of plywood, consists basically of combining an odd number of layers of veneer, with each layer having one or more plies. Hardwood plywood is generally made by applying a hardwood veneer to the face and back of a softwood plywood, MDF, or particleboard panel. The differences between the hardwood and softwood processes occur because of different inputs and markets. Particleboard, oriented strandboard, fiberboard, and hardboard are all processed similarly. These three types of reconstituted wood products are manufactured by combining fragmented pieces of wood and wood fiber into a cohesive mat of wood particles, fibers, and strands. Structural wood members are the products of multiple manufacturing techniques. This section describes the production of glue-laminated timber and the three types of structural composite lumber: laminated veneer lumber, parallel strand lumber, and laminated strand lumber.

2.2.1.1 General Considerations for Plywood and Wood Composites Manufacturing

Release of hazardous air pollutants (HAPs) is primarily associated with drying and pressing processes in the manufacturing of plywood and wood composites. Coating processes are intrinsically related to the manufacturing process and result in further emissions through drying and pressing. Conventional wood composites are generally made with a thermosetting or heat-curing resin or adhesive that holds wood fiber together. Commonly used resin-binder systems include phenol-formaldehyde, urea-formaldehyde, melamine-formaldehyde, and propionaldehyde. A number of additives are used in the manufacturing of wood composites as well. Most notably, wax is used to provide finished products with resistance to water penetration. Other additives include preservatives, fire retardants, and impregnating resins.

While there is a broad range of plywood and wood composites and many applications for such products, this section of the profile groups the production processes of these products into three general categories: plywood and veneer; particle board, strand and fiber composites; and structural wood members. Further descriptions of the production processes for each of these categories are provided in this section.

2.2.1.2 Plywood and Veneer[2]

Construction of plywood relies on combining an odd number of layers of veneer. Layers consist of one or more than one ply with the wood grain running in the same direction. Outside plies are called faces or face and back plies, while the inner plies are called cores or centers. Layers may vary in number, thickness, species, and grade of wood. To distinguish the number of plies (individual sheets of veneer in a panel) from the number of layers (number of times the grain orientation changes), panels are sometimes described as three-ply, three-layer, or four-ply, three-layer.

As described above, veneer is one of the main components of plywood. Most softwood plants produce plywood veneer for their own use. Of facilities reporting drying of veneer, 86 percent of the veneer produced was used for in-facility plywood production. Only approximately 7 percent of the

---

[2]The descriptions contained in this section rely primarily on U.S. EPA's Lumber and Wood Products Sector Notebook (1995).

facilities in the ICR survey produced veneer solely for outside sales and non-internal plywood use (EPA, 1998).

The general processes for making softwood includes: log debarking, log steaming and/or soaking, veneer cutting, veneer drying, veneer preparation, glue application, pressing, panel trimming, and panel sanding. Softwood plywood is generally made with relatively thick faces (1/10 inch and thicker) and with exterior or intermediate glue. This glue provides protection in construction and industrial uses where moderate delays in providing weather protection might be expected or conditions of high humidity and water leakage may exist. Figure 2-1 below presents a diagram of the plywood production process.

Logs delivered to a plant are sorted, then debarked and cut into peeler blocks. Almost all hardwood and many softwood blocks are heated prior to peeling the veneer to soften the wood. The peeler blocks are heated by steaming, soaking in hot water, spraying with hot water, or combinations of these methods. Heated blocks are then conveyed to a veneer lathe. The block, gripped at either end and rotated at high speed, is fed against a stationary knife parallel to its length. Veneer is peeled from the block in continuous, uniform sheets. Depending on its intended use, veneer may range in thickness from 1/16 to 3/16 (1.6mm to 4.8mm) for softwood and much thinner for hardwood and decorative plywood uses (Youngquist, 1999). Slicing methods are also used to produce hardwood decorative veneers generally in thicknesses of 1/24 inch and thinner.

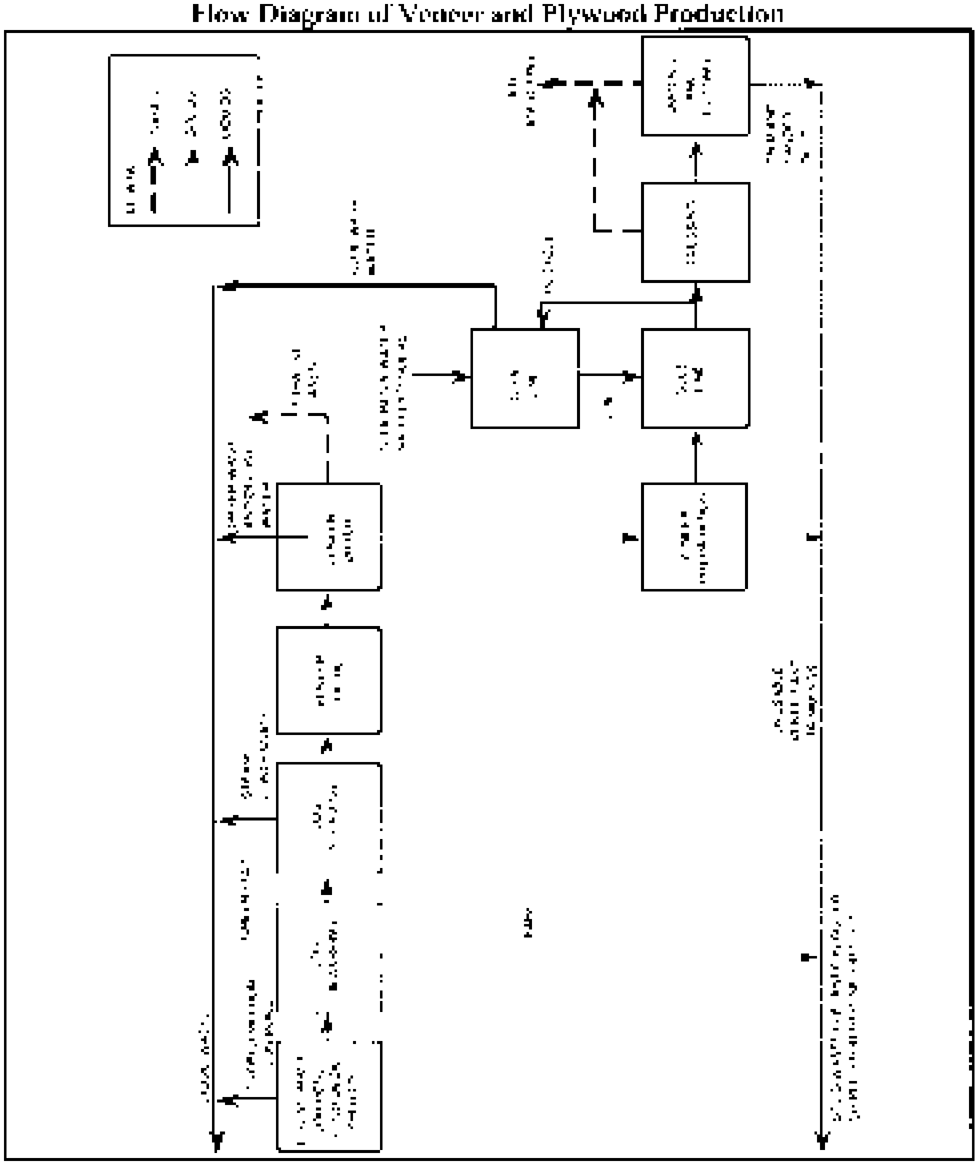
After peeling, the continuous sheets of veneer are transported by conveyor to a clipping station where it is clipped. In softwood mills and some hardwood mills, high-speed clippers automatically chop the veneer ribbons to usable widths and defects are removed. In many hardwood mills, clipping may be done manually to obtain the maximum amount of clear material. Wet clipped veneer is then dried. Proper drying is necessary to ensure moisture content is low enough for adhesives to be effective.

Dryers

Two types of dryers are used in softwood veneer mills: roller resistant dryers, heated by forced air; and "platen" dryers, heated by steam. In older roller dryers, also still widely used for hardwood veneer, air is circulated through a zone parallel to the veneer. Most plants built in recent years use jet dryers (also called impingement dryers) that direct a current of air, at a velocity of 2,000 to 4,000 feet per minute, through small tubes on the surface of the veneer. Veneer dryers may be heated indirectly with steam, generated by a separate boiler, which is circulated through internal coils in contact with dryer air. Dryers may also be heated directly by the combustion gases of a gas- or wood-fired burner. The gas-fired burner is located inside the dryer, whereas combustion gases from a wood-fired burner are mixed with recirculating dryer air in a blend box outside the dryer and then transported into the dryer. Veneer dryers tend to release organic aerosols, gaseous organic compounds, and small amounts of wood fiber into the atmosphere. Once dried, veneer is sorted and graded for particular uses.

Figure 2-1:

Flow Diagram of Veneer and Plywood Production



Source: U.S. EPA (1995).

Adhesives

Plywood manufacturing begins with the veneer sent to a lay-up area for adhesive application. Various adhesive application systems are used including hard rolls, sponge rolls, curtain coaters, sprayers, and foam extruders. The most common application for softwood plywood is an air or airless spray system, which generally uses a fixed-head applicator capable of a 10-foot wide spray at a nozzle pressure of 300 pounds per square inch (psi). The phenol-formaldehyde (PF) adhesives typical in softwood plywood manufacturing is made from resins synthesized in regional plants and shipped to individual plywood mills. At the mills, the resins are combined with extenders, fillers, catalysts, and caustic to modify the viscosity of the adhesive. This glue mixing has several additional effects: allowing the adhesive to be compatible with the glue application method (curtain, roll, spray, foam); allowing for better adhesive distribution; increasing the cure rate; and lowering cost.

Presses

Following the application of glue, the panels must be pressed. The purpose of the press is to bring the veneers into close contact so that the glue layer is very thin. At this point, resin is heated to the temperature required for the glue to bond. Most plywood plants first use a cold press at lower pressure prior to final pressing in the hot press. This allows the wet adhesive to "tack" the veneers together, permits easier loading of the hot-press, and prevents shifting of the veneers during loading. Pressing is usually performed in multi-opening presses, which can produce 20 to 40 4x8-foot panels in each two- to seven-minute pressing cycle.

Finishing

After pressing, stationary circular saws trim up to one inch from each side of the pressed plywood to produce square-edged sheets. Approximately 20 percent of annual softwood plywood production is then sanded. As sheets move through enclosed automatic sanders, pneumatic collectors above and below the plywood continuously remove the sander dust. Sawdust in trimming operations is also removed by pneumatic collectors. The plywood trim and sawdust are burned as fuel or sold to reconstituted panel plants.

2.2.1.3 Particle, Strand, and Fiber Composites[3]

This group of products falls into the SIC or NAICS code category of reconstituted wood products. The impacted facilities in this category manufacture the following products (MRI, 1999).

- Medium density fiberboard
- Oriented stand board
- Particleboard
- Hardboard

[3]The descriptions in this section rely primarily on Chapter 10 of the USDA's Forest Products Laboratory *Wood Handbook* (Youngquist, 1999).

All particle, strand and fiber composites are processed in similar ways. Raw material for particleboard, oriented strandboard (OSB), fiberboard, and hardboard is obtained by flaking or chipping wood. The general process then includes wood drying, adhesive application, and forming a mat of wood particles, fibers, or strands. The mat is then pressed in a platen-type press under heat and pressure until the adhesive is cured. The bonded panel is finally cooled and further processed into specified width, length, and surface qualities. Specific details regarding the production processes for different products are provided below.

Particleboard

Generally, particleboard is produced by mechanically reducing wood materials into small particles, applying adhesive to the particles, and consolidating a loose mat with heat and pressure into a panel product. Particleboard is typically made in three layers with the faces consisting of finer material and the core using coarser material. Particleboard can also be made from a variety of agricultural residues, including kenaf core, jute stick, cereal straw, and rice husks depending on the region. EPA does not expect facilities that produce particleboard made from agricultural residues, also called agriboard, to experience compliance cost impacts associated with the new MACT standard. EPA expects only one facility that produces molded particleboard to experience compliance cost impacts (MRI, 1999).

The raw materials, or "furnish," that are used to manufacture reconstituted wood products can be either green or dry wood residues. Green residues include planer shavings from green lumber and green sawdust. Dry process residues include shavings from planing kiln-dried lumber, sawdust, sander dust, and plywood trim. The wood residues are ground into particles of varying sizes using flakers, mechanical refiners, and hammermills, and are then classified according to their physical properties.

After classification, the furnish is dried to a low moisture content (two to seven percent) to allow for moisture that will be gained by the adding of resins and other additives during blending. Most dryers currently in operation in particle and fiber composite manufacturing plants use large volumes of air to convey material of varied size through one or more passes within the dryer. Rotating drum dryers requiring one to three passes of the furnish are most common. The use of triple-pass dryers predominates in the United States. Dryer temperatures may be as high as 1,100 - 1,200° F with a wet furnish. However, dry planer shavings require that dryer temperatures be no higher than 500° F because the ignition point of dry wood is 446° F. Many dryers are directly heated by dry fuel suspension burners. Others are heated by burning oil or natural gas. Direct-fired rotary drum dryers release emissions such as wood dust, combustion products, fly ash, and organic compounds evaporated from the extractable portion of the wood. Steam-heated and natural gas-fired dryers will have no fly ash.

The furnish is then blended with synthetic adhesives, wax, and other additives distributed via spray nozzles, simple tubes, or atomizers. Resin may be added as received (usually as an aqueous solution), or mixed with water, wax emulsion, catalyst, or other additives. Waxes are added to impart water repellency and dimensional stability to the boards upon wetting. Particles for particleboard are mixed with the additive in short retention time blenders, through which the furnish passes in seconds. The furnish and resin mixture is then formed into mats using a dry process. This procedure uses air or a mechanical system to distribute the furnish onto a moving caul (tray), belt, or screen. Particleboard mats are often formed of layers of different sized particles, with the larger particles in the core, and the finer particles on the outside of the board. The mats are hot pressed to increase their density and to cure the resin. Most plants use multi-opening platen presses. Though more popular in Europe, the continuous press is currently being used in particleboard plants in the United States.

Primary finishing steps for all reconstituted wood panels include cooling or hot stacking, grading, trimming/cutting, and sanding. Cooling is important for UF-resin-cured boards since the resin degrades at high temperatures after curing. Boards bonded using PF resins may be hot-stacked to provide additional curing time. Secondary finishing steps include filling, painting, laminating, and edge finishing. The vast majority of manufacturers do not apply secondary finishes to their panels; panels are finished primarily by end-users such as cabinet and furniture manufacturers. Panels are also finished by laminators who then sell the finished panels to furniture and cabinet manufacturers.

Oriented Strandboard (OSB)

OSB is an engineered structural-use panel manufactured from thin wood strands bonded together with waterproof resin under heat and pressure. OSB manufacturing begins with debarked logs usually heated in soaking ponds sliced into wood strands typically measuring 4.5 to 6 inches long (114 to 152mm). Green strands are stored in wet bins and then dried in a traditional triple-pass dryer, a single-pass dryer, a combination triple–pass/single-pass dryer, or a three-section dryer. A recent advance in drying technology is a continuous chain dryer, in which strands are laid between two chain mats so the strands are held in place as they move through the dryer.

After drying, blending and mat formation take place, blending of strands with adhesive and wax takes place in separate rotating blenders for face and core strands. Different resin formulations are typically used for face and core layers. Face resins may be liquid or powdered phenolics, while core resins may be phenolics or isocyantes. Mat formers take on a number of configurations to align strands along the length and width of the panel. Oriented layers of strands are dropped sequentially (face, core, face, for example), each by a different forming head. The mat is then transported by conveyer belt to the press. Hot pressing involves the compression of the loose layered mat of oriented strands under heat and pressure to cure the resin. Most plants utilize multi-opening presses that can form as many as sixteen 12- by 24-ft (3.7- by 7.3m) panels simultaneously. Recent development of a continuous press for OSB can consolidate the oriented and layer mat in 3 to 5 minutes.

Fiber Composites

Fiber composites include hardboard, medium-density fiberboard (MDF), fiberboard, and insulation board. In order to make fibers for these composites, bonds between the wood fibers must be broken. This is generally done through refining of the material, which involves grinding or shearing of the material into wood fibers as it is forced between rotating disks. Refining can be augmented by water soaking, steam cooking (digesting), or chemical treatments as well.

Fiber composites are classified by density and can involve either a wet process or a dry process. High and medium density boards, such as hardboard and MDF, apply a dry process. Wet processes can be used for high-density hardboard and low-density insulation board (fiberboard). Dry process involves adhesive-coated fibers that are dried in a tube dryer and air-laid into a mat for pressing.

Wet processes differ from the dry processes. This process involves the utilization of water as a distributing medium for fibers in a mat. Further differences lie in the lack of additional binding agents in some wet processes. The technology is very much like paper manufacturing in this pulp-based aspect. Natural bonding in the wood fibers occurs in this process. Refining in this process relies on developing material that can achieve this binding with a degree of "freeness" for removal from mats. The wet process involves a continuously moving mesh screen, onto which pulp flows. Water is drawn off through the screen and through a series of press rolls. The wet fiber mats are dried in a conveyor-type dryer as they move to the press. Wet process hardboard is then pressed in multi-open presses heated by steam. Fiberboard is not pressed.

Manufacturers use several treatments alone or together to increase dimensional stability and mechanical performance of both wet and dry process hardboards. Heat treatment exposes pressed fiberboard to dry heat, reducing water absorption and improving fiber bonding. Tempering is the heat treatment of pressed boards preceded by the addition of oil. Humidification is the addition of water to bring board moisture content into equilibrium with the air.

2.2.1.4 Structural Wood Members[4]

Structural wood members, such as glue-laminated timbers and structural composite timber, are manufactured using a number of methods. Glue-laminated timber, or glulam, is an engineered product formed with two or more layers of lumber glued together in which the grain of all layers, called laminations, is oriented parallel to the length of the lumber. Glulam products also include lumber glued to panel products, such I-joists and box beams. Structural composite lumber consists of small pieces of wood glued together into sizes common for solid-sawn lumber.

Glue-Laminated Timber (Glulam)

Glulam is a material that is made from suitably selected and prepared pieces of wood, either straight or curved, with the grain of all pieces essentially parallel to the longitudinal axis of the member. The manufacturing process for glulam involves four major steps: (1) drying and grading, (2) end jointing, (3) face bonding, and (4) finishing and fabricating.

Structural Composite Lumber

The are three major types of structural composite lumber: laminated veneer lumber, parallel strand lumber, and laminated strand lumber. Each is described in more detail below, however, the general manufacturing process for these composites is similar.

Laminated veneer lumber (LVL) is manufactured by laminating veneer with all plies parallel to the length. This process utilizes veneer 1/8 to 1/10 inches. (3.2 to 2.5 mm) thick, which are hot pressed with phenol-formaldehyde adhesive to form lumber of 8 to 60 feet (2.4 to 18.3 m) in length. The veneer used for LVL must be carefully selected to achieve the proper design characteristics. Ultrasonic testing is often used to sort veneer required for LVL. Once the veneer has been selected, end jointing occurs followed by adhesive application and continuous pressing.

---

[4]The descriptions in this section rely primarily on Chapter 11 of the USDA's Forest Products Laboratory *Wood Handbook* (Moody and Liu, 1999).

Parallel strand lumber (PSL) is a composite of wood strand elements with wood fibers primarily oriented along the length of the member. PSL is manufactured using veneer about 1/8 inch (3 mm) thick, which is then clipped into 3/4 inch (19 mm) wide strands. The process can utilize waste material from a plywood or LVL operation. Strands are coated with a waterproof structural adhesive, and oriented using special equipment to ensure proper placement and distribution. The pressing operation results in densification of the material. Adhesives are cured using microwave technology. As with LVL, the continuous pressing method is used.

Laminated strand lumber (LSL) is produced using an extension of the technology used to produce oriented strandboard structural panels. LSL uses longer strands than those commonly used in OSB manufacturing. LSL is pressed into a billet several inches thick in a steam-injection press, as opposed to an OSB panel pressed in a multi-opening platen press. The product also requires a greater degree of alignment of the strands at higher pressures, which result in increased densification.

2.2.2 Products, By-Products, and Co-Products

Exhibit 2-3 presents products, corresponding SIC and NAICS codes, and product examples of the plywood and composite wood products industry.

The plywood and composite wood products industries have unique manufacturing processes in their use of waste wood products as an input for additional products. Planer shavings, sawdust, edgings, and other wood by-products are inputs to many wood composites. Structural wood members were developed in response to the increasing demand for high quality lumber when it became difficult to obtain this type of lumber from forest resources. Therefore, many of the by- and co-products from one process may be used in another.

Exhibit 2-3: SIC and NAICS Codes and Products

Product Description	SIC	NAICS	Example Products
Softwood Veneer and Plywood	2436	321212	Panels, softwood plywood Plywood, softwood Softwood plywood composites Softwood veneer or plywood Veneer mills, softwood
Reconstituted Wood Products	2493	321219	Board, bagasse Flakeboard Hardboard Insulating siding, broad-mitse Insulation board, cellular fiber or hard pressed Lath, fiber Medium density fiberboard (MDF) Particleboard Reconstituted wood panels Strandboard, oriented Wafer-board Wall tile, fiberboard Wallboard, wood fiber
Structural Wood Members, Not Elsewhere Classified	2439	321213	Arches, glue-laminated or pre-engineered wood Fabricated structural wood members Finger joint lumber manufacturing I-joists, wood Laminated structural wood members Laminated veneer lumber Parallel strand lumber Structural wood members (except trusses)
		321214	Floor trusses, wood, glue-laminated or pre-engineered Roof trusses, wood, glue-laminated or pre-engineered

Source: U.S. Department of Labor, OSHA (no date).

Exhibit 2-4 provides ratios of specialization and coverage (product mix) calculated by the U.S. Census Bureau for the last three Censuses of Manufacturers. The Census assigns a "primary" SIC code to each establishment which corresponds to the SIC code for the largest (by value) single type of product shipped by the establishment. The products shipped from that establishment that are classified in the same industry as the establishment are considered "primary," and all other products shipped by the establishment are considered "secondary." The Census then calculates various measures to illustrate the product mix between primary and secondary products in each industry. The specialization ratio represents the ratio of total primary product shipments to total product shipments for all establishments classified in the industry. The coverage ratio represents the ratio of primary products shipped by the establishments classified in the industry to the total shipments of these products shipped by all establishments classified in all industries.

As Exhibit 2-4 illustrates, all three industries have specialization ratios well above 80 percent and coverage ratios above 90 percent. This implies that most establishments with these SIC codes are highly specialized, and that most product shipments of each type originate in establishments with these SIC codes. Therefore, the Census data on these SIC and NAICS industries provide information on the primary production of facilities engaged in plywood and wood composite manufacturing. These ratios have been stable over time.

Exhibit 2-4: Specialization and Coverage Ratios, 1982 - 1997

SIC	NAICS	Description	1982	1987	1992	1997
2436	321212	*Softwood Veneer and Plywood*				
		Primary products specialization ratio	87	87	84	88
		Coverage ratio	96	95	94	95
2493	321219	*Reconstituted Wood Products*				
		Primary products specialization ratio	96	97	96	97
		Coverage ratio	97	95	95	97
2439	321213	*Structural Wood Members, N.E.C./Engineered Wood Members*				
		Primary products specialization ratio	96	97	96	95
		Coverage ratio	95	97	97	96
2439	321214	*Structural Wood Members, N.E.C./Truss Manufacturing*				
		Primary products specialization ratio	96	97	96	96
		Coverage ratio	95	97	97	94

Source: U.S. Department of Commerce (1999a and 1995b).

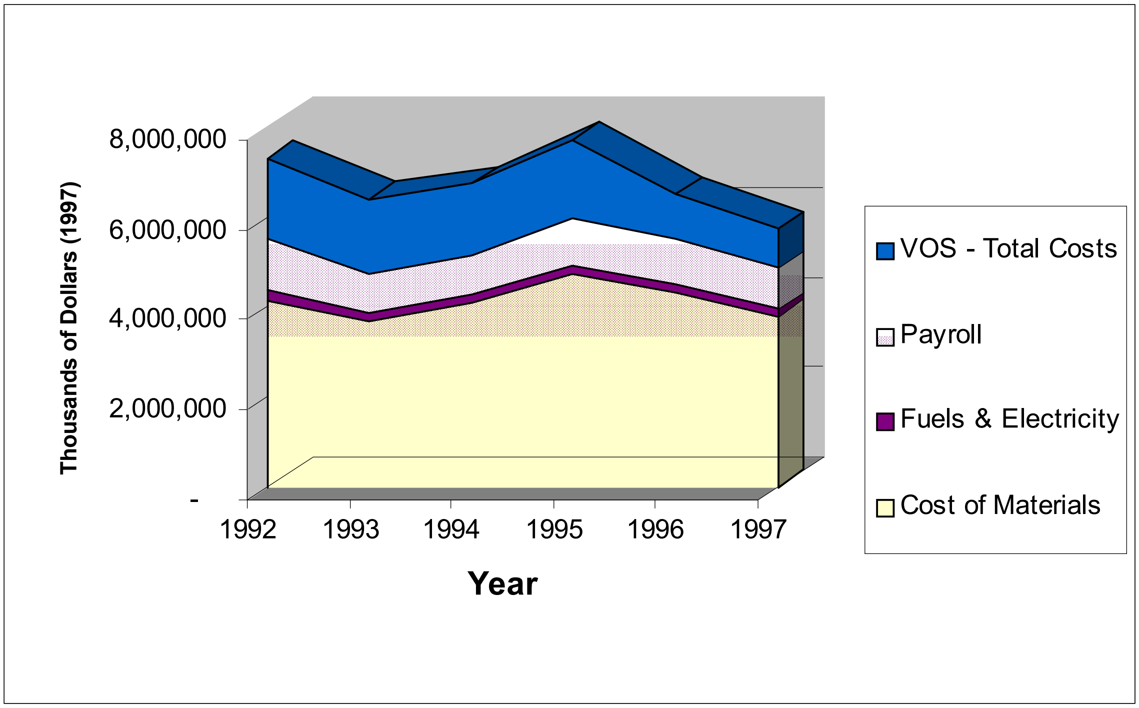
2.2.3 Costs of Production

Exhibit 2-5 provides information on the overall value of shipments (VOS) and production costs (a component of operating expenses) by SIC code as reported by the Bureau of the Census. Typical of many intermediate goods, the cost of materials is the largest portion of production costs, with payroll constituting 15-20 percent of VOS. In particular, timber supply plays a large role in industry costs. In this decade, reductions in public timber supply, especially reductions in National Forest timber harvests, combined with the economy's continued demands for wood has led to substantial increases in the cost of timber (Spelter, 1997).

Exhibit 2-5: Summary of Annual Costs and Shipments, 1992 -1997 (Thousands of 1997 Dollars)							
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**% Change**
Softwood Veneer and Plywood (SIC 2436, NAICS 321212)							
Industry Shipments	7,321,641	6,400,683	6,755,571	7,725,037	6,525,702	5,748,047	-21.5%
Cost of Materials	4,169,048	3,671,638	4,097,921	4,736,984	4,330,167	3,795,985	-8.9%
Fuels & Electricity	220,039	178,592	178,601	183,507	176,759	161,239	-26.7%
Payroll	1,112,158	897,839	883,819	1,047,092	1,006,792	912,613	-17.9%
Ratio of Costs to Shipments	75%	74%	76%	77%	84%	85%	
Reconstituted Wood Products (SIC 2493, NAICS 321219)							
Industry Shipments	5,350,565	4,951,902	5,517,234	5,827,821	5,561,099	5,278,809	-1.3%
Cost of Materials	2,400,670	2,144,060	2,342,362	2,582,565	2,697,471	2,633,139	9.7%
Fuels & Electricity	327,706	250,814	268,934	316,876	321,390	350,950	7.1%
Payroll	825,718	699,627	707,179	810,753	855,237	798,767	-3.3%
Ratio of Costs to Shipments	66%	62%	60%	64%	70%	72%	
Structural wood members (SIC 2439, NAICS 321213 and 321214)							
Industry Shipments	3,367,525	3,281,578	4,295,002	4,739,339	5,096,809	5,112,873	51.8%
Cost of Materials	1,958,576	1,966,635	2,584,765	2,863,098	3,154,297	3,007,103	53.5%
Fuels & Electricity	35,486	33,406	34,585	39,595	42,621	42,090	18.6%
Payroll	692,377	604,180	740,318	867,510	947,403	954,694	37.9%
Ratio of Costs to Shipments	80%	79%	78%	80%	81%	78%	
All dollars adjusted to 1997 using Producer Price Index for Lumber and Wood Products (SIC 24). Source: U.S. Department of Census (1999a).							

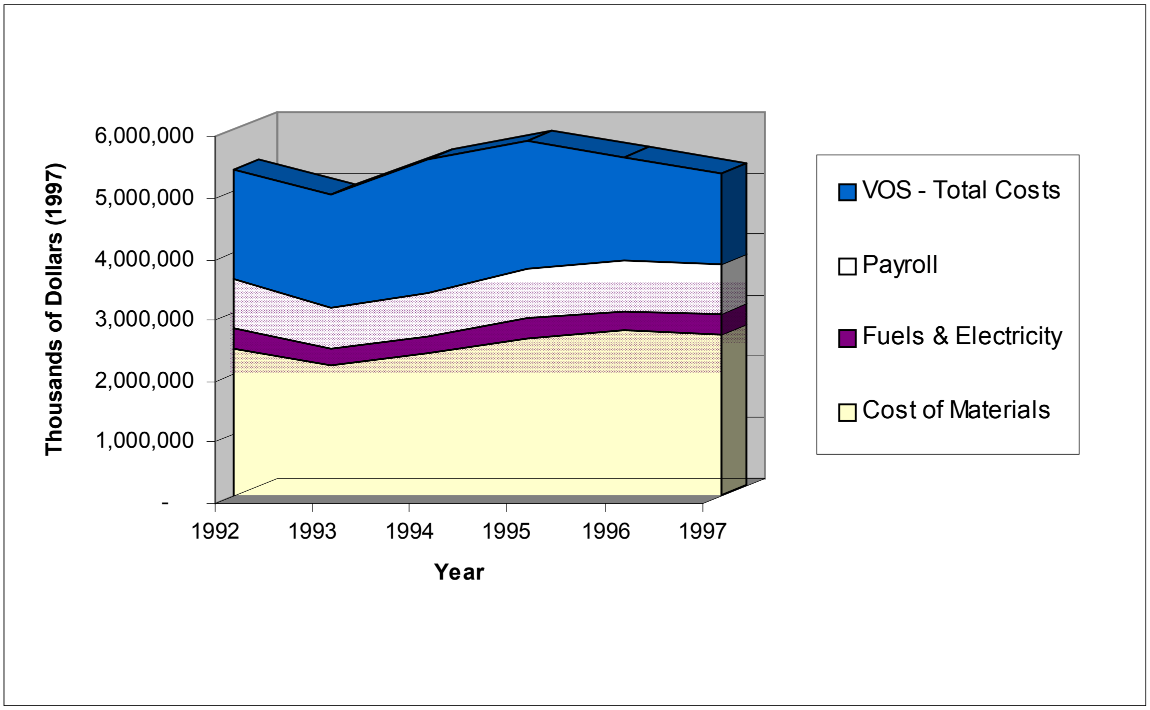
From these data, one can estimate the sector-wide ratio of production costs to VOS. The ratio of costs (materials, fuels and electricity, and payroll) to the VOS has been increasing over the 1992 to 1997 period for softwood plywood and veneer and reconstituted wood products. The data in Exhibit 2-5 show that 1997 cost to shipment ratios range between 72 percent (reconstituted wood products) and 85 percent (softwood veneer and plywood). This measure indicates the proportion of the revenues received for the goods produced that are associated with production expenses (materials, fuel and electricity, and payroll). Figures 2-2 and 2-3 present cost and VOS data for the softwood plywood and reconstituted wood products industries, respectively.

Figure 2-2: Softwood Plywood and Veneer Value of Shipments and Production Costs, 1992 - 1997



Source: U.S. Department of Commerce (1999a).
Note: Total costs in this figure is the sum of payroll, fuels & electricity, and materials costs.

Figure 2-3: Reconstituted Wood Products Value of Shipments and Production Costs, 1992 - 1997



Source: U.S. Department of Commerce (1999a).
Note: Total costs in this figure is the sum of payroll, fuels & electricity, and materials costs.

The cost to shipment ratio does not reflect other operating expenses such as non-payroll employment expenses, taxes, interest, or depreciation. Nor does it indicate whether the expenses are of a variable or fixed nature. However, it does provide an approximate measure of how much cash, at a gross level, the industries are generating to cover all operating expenses, use for capital investment, and provide a return to owners. While this measure is somewhat crude, it indicates that the impacts of the rule may potentially be more significant for the softwood plywood and veneer industry than for reconstituted wood products.

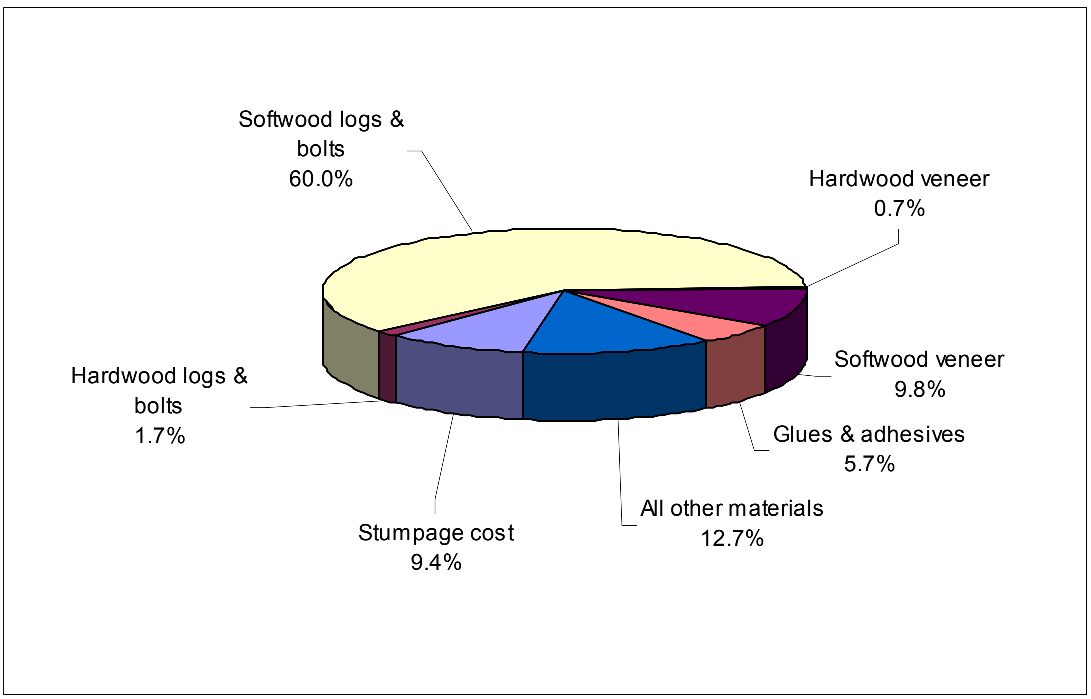
Exhibit 2-6 and Exhibit 2-7 provide information on materials consumed by kind in 1997 for the three sectors. In softwood plywood and veneer manufacturing, 81.6 percent of material costs result from timber and veneer purchasing. Glues and adhesives represent 5.7 percent of the material costs in the softwood plywood and veneer industry.

Exhibit 2-6: Materials Consumed By Kind for Softwood Plywood and Veneer, 1997		
Materials Consumed	**Delivered Cost ($1,000)***	**% of Total Materials**
Stumpage cost (cost of timber, excluding land, cut and consumed at same establishment)	346,854	9.4%
Hardwood logs and bolts	64,617	1.7%
Softwood logs and bolts	2,218,800	60.0%
Hardwood veneer	27,355	0.7%
Softwood veneer	363,583	9.8%
Glues and adhesives	210,105	5.7%
All other materials	471,717	12.7%
TOTAL	3,703,031	100%

* Excludes costs of resales and contract work.
Source: U.S. Department of Commerce (1999a).

Figure 2-4 shows the percentage materials consumed by kind by the softwood plywood and veneer industry in 1997.

Figure 2-4: Materials Consumed by Softwood Plywood and Veneer Products, 1997

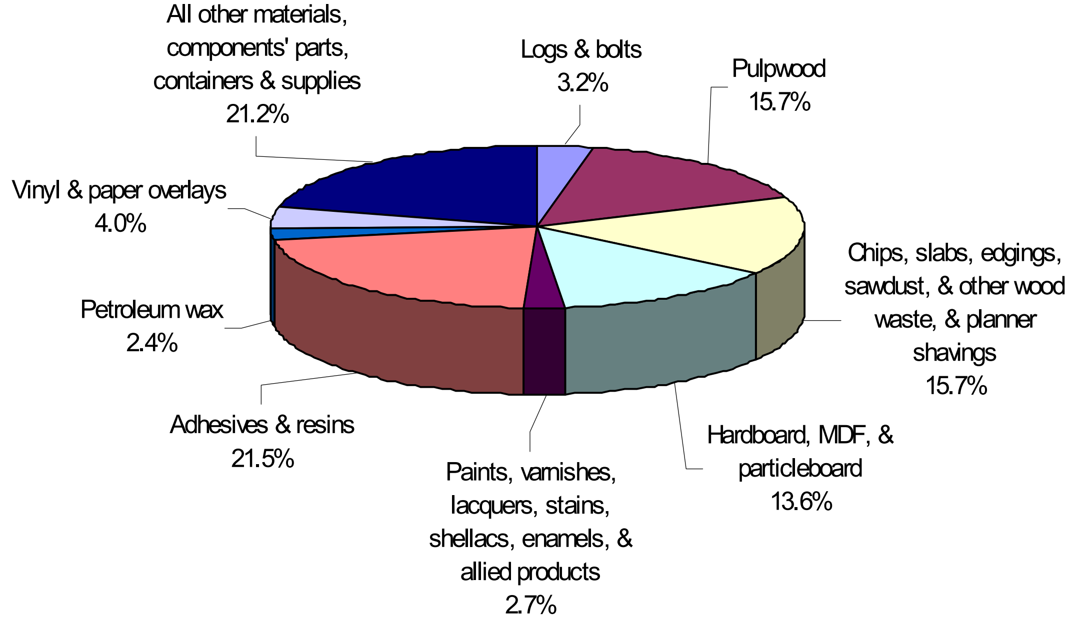


Source: U.S. Department of Commerce (1999a).

Exhibit 2-7: Materials Consumed by Kind for Reconstituted Wood Products, 1997		
Material Consumed	**Delivered Cost ($1,000)***	**% of Total Materials**
Logs and bolts	80,891	3.2%
Pulpwood	400,579	15.7%
Chips, slabs, edgings, sawdust, and other wood waste, and planer shavings	399,446	15.7%
Hardboard, MDF, and particleboard	346,052	13.6%
Paints, varnishes, lacquers, stains, shellacs, enamels, and allied products	69,488	2.7%
Adhesives and resins	548,553	21.5%
Petroleum wax	61,173	2.4%
Vinyl and paper overlays	101,405	4.0%
All other materials, components parts, containers and supplies	538,183	21.2%
TOTAL	2,545,770	100%
* Excludes costs of resales and contract work. Source: U.S. Department of Commerce (1999a).		

As with the plywood industry, timber products are the largest portion of costs for the reconstituted wood product industry. Logs, pulpwood, wood materials, and other wood products account for a combined 48.2 percent of material costs. Unlike plywood and veneer manufacturing, reconstituted wood products have higher material costs for adhesives and resins, compromising 21.5 percent of costs. Figure 2-5 shows the percentage of materials consumed by kind by the reconstituted wood products industry for 1997.

Figure 2-5: Materials Consumed by Reconstituted Wood Product Producers, 1997



Source: U.S. Department of Commerce (1999a).

Wood costs for plywood and wood composite manufacturing vary according to plant location, wood species, and facility efficiency. While there may be considerable variability in wood prices across regions, the last decade has seen substantial increase in wood prices across all regions. Wood use efficiency depends on wood species used, log temperature, speed of cutting, board compaction, and other process variables. Next to wood, adhesives and wax play an important role in industry costs, especially for the production of reconstituted wood products such as OSB, particleboard, and MDF (Spelter et al, 1997).

In 1995, sixteen percent of the output from the adhesive and sealant industry, SIC 2891, went to the wood products market. As such, a MACT standard that greatly reduces the demand for adhesives and sealants (or coatings) could potentially have a significant impact in the adhesive and sealant industry (Abt Associates Inc., 1997). The response on the part of the softwood plywood and veneer and reconstituted wood products industries will depend on the final requirements of the MACT standard and the attractiveness of comparable resin, adhesive and sealant products that do not contribute to HAP emissions. There will be many constraints on the ability of the impacted industries to switch away from current adhesives, as their products generally must meet certain requirements related to building codes. These properties are discussed in the next section.

2.3 The Demand Side

The following section contains information concerning the demand for plywood and veneer, reconstituted wood products, and structural wood members. The characteristics of plywood and wood composites are examined first, highlighting the numerous uses of these types of wood products. The consumers and users of plywood and wood composites are then examined, specifically analyzing the distribution of consumption. Substitution possibilities are addressed, looking at both wood and non-wood options. Lastly, the elasticities of demand of the plywood and composite wood products industries are discussed.

2.3.1 Product Characteristics

Plywood and composite wood products provide a more stable product over solid wood by reducing the variations between wood species, among trees of the same species, and even between wood from the same tree. Unlike solid wood which is evaluated at a cellular level, composite wood is evaluated at fiber, particle, flake, or veneer level. Properties of products can be changed by combining, reorganizing, or stratifying these different elements. Control of the size of particles used in producing composite wood products provides the chief means by which materials can be produced with predetermined properties (Youngquist, 1999).

Strength is a crucial factor in determining the applicability of plywood and wood composites to structural and other manufacturing uses. Stiffness and strength properties of a wood product depend primarily on the constituents from which these products are made. The basic wood elements can be made in a great variety of sizes and shapes, and may utilize any number of wood species. Plywood can be manufactured from over 70 species of wood. The choices available for wood composites is almost unlimited. Types of adhesives and bonding-agents also play an important role in the strength of a composite wood product.

Durability will also determine the market for wood composites. Panels used for exterior applications will have a fully waterproof bond and are designed for permanent exposure to weather and moisture. Interior panels may lack the waterproof bond and be manufactured with glue products designed for interior use.

Depending on the wood composite, a range of sizes and thicknesses are available. The range of structural applications for which these products are used requires production of several standardized sizes as well as custom-made pieces. Sizes and thicknesses will depend on the type of wood composite product and the market for which it is primarily produced.

Wood panels and other composite wood structures are subject to performance-type standards as outlined by various industry organizations. A number of organizations including American Plywood Association - The Engineered Wood Association, Composite Panel Association (CPA), American Hardboard Association, and others monitor products produced by their member firms to assure high-quality production and industry conformity with testing and performance standards.

2.3.2 Consumers and Uses

Exhibit 2-8 shows industry output by SIC code. Output of plywood and veneer goes mainly to the construction sector, primarily to the residential housing and repair industries. Almost one third of plywood goes to the manufacturing sector, part of which is used as an input for other plywood production, and part of which goes for furniture and other durable goods manufacturing. The “Other” category is made up of foreign trade, inventory change, and wholesale trade. The outputs for reconstituted wood products, including particleboard, are more evenly split between construction and manufacturing, The “Other” category for reconstituted wood products is made up of sales to state and local government, foreign trade, and services (Gale Business Resources, 1999).

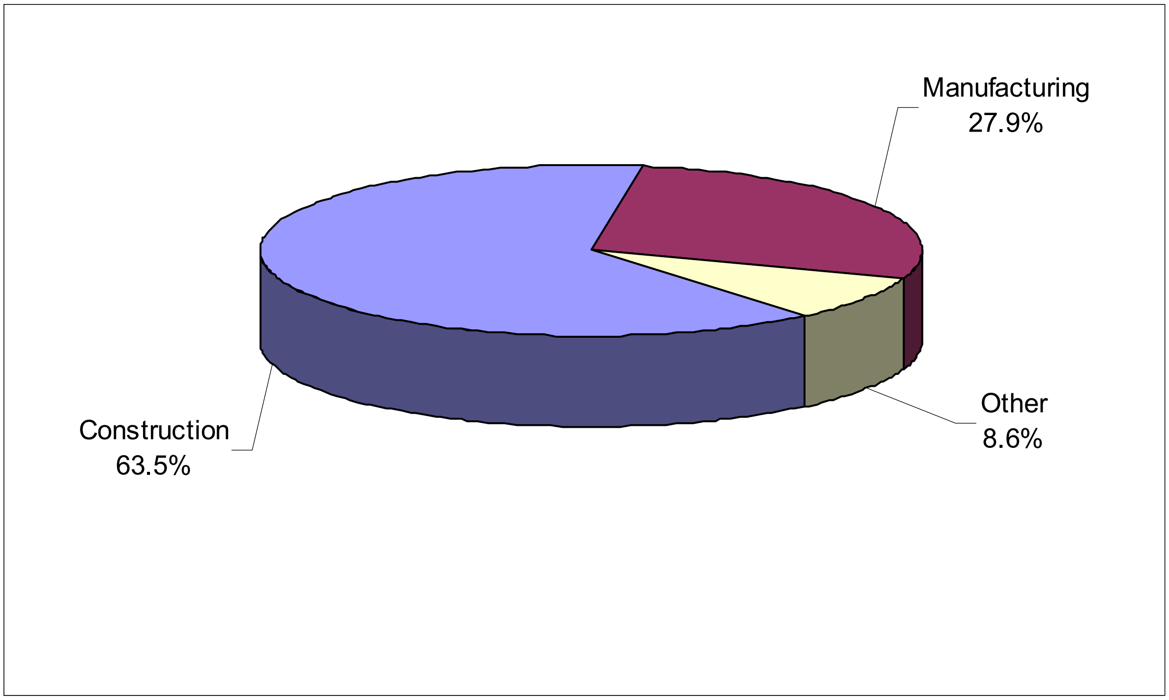
Exhibit 2-8: Consumption of Industry Outputs, by SIC Code

SIC	SIC Description	Construction	Manufacturing	Other
2436	Softwood veneer and plywood	63.5%	27.9%	8.6%
2493	Reconstituted wood products	45.7%	47.6%	6.7%
2439	Structural wood members	94.8%	0.6%	4.6%

Source: Gale Business Resources (1999).

The major use of structural panel products is for construction activities. Panel products include those products such as plywood, OSB, particleboard, and others formed as a panel. These products may be used for floor systems, exterior walls, roofing, and exterior siding. Figure 2-6 shows the industry outputs by percentage for the softwood plywood and veneer industry.

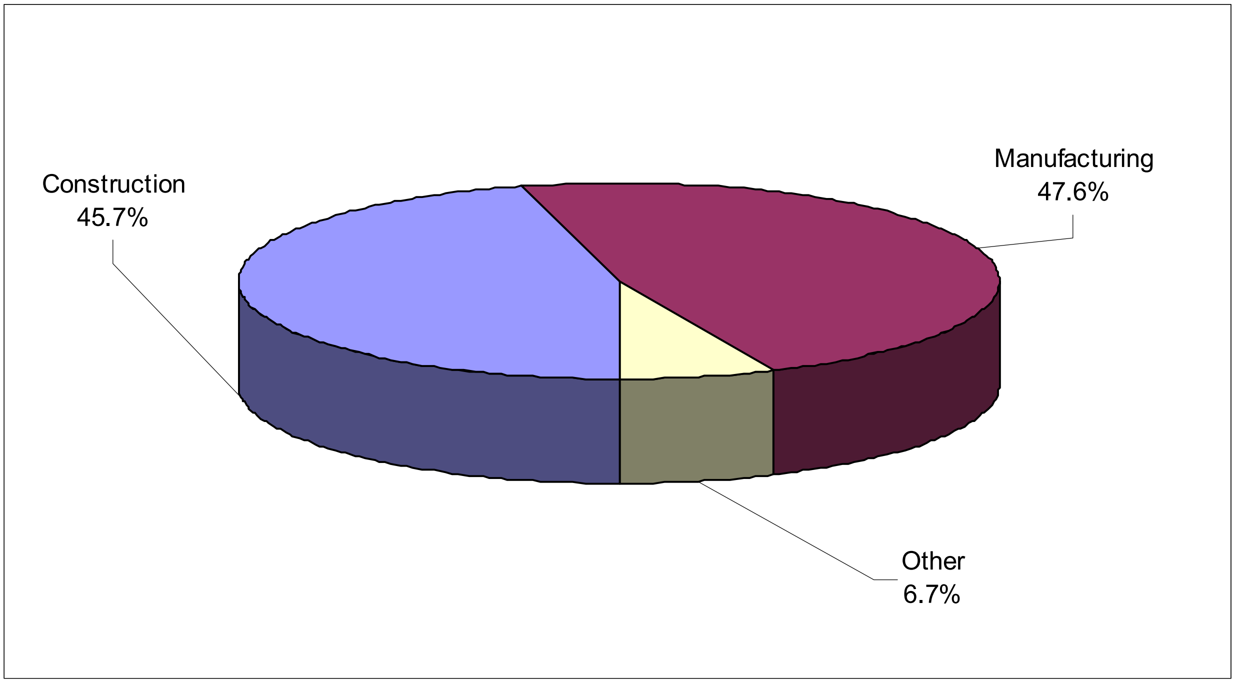
Figure 2-6 Industry Outputs of Softwood Plywood and Veneer Industry



Source: Gale Business Resources (1999).

Figure 2-7 shows the industry outputs by percentage for the reconstituted wood products industry.

Figure 2-7: Industry Outputs of Reconstituted Wood Products Industry



Source: Gale Business Resources (1999).

MDF and particleboard are two products of the reconstituted wood products industry. Exhibits 2-9 and 2-10 below show the downstream uses of MDF and particleboard in 1997. For each of the products, about 20 percent of the output is used for household furniture, and the remainder is used for construction, shelving, cabinetry and other customized applications.

Exhibit 2-9: MDF Shipments by Downstream Market, 1997

Downstream Use	Million ft^2	Percent
Household Furniture	247.8	19%
Custom Laminators	208.6	16%
Stocking Distributors	286.9	22%
Kitchen and Bath	65.2	5%
Molding	130.4	10%
Millwork	65.2	5%
Partitions and fixtures	65.2	5%
All Other	182.6	14%
Other (n.e.c.)	52.2	4%
Total	1,304.0	100%

Source: Composite Panel Association (1998).

Exhibit 2-10: Particleboard Shipments by Downstream Market, 1997		
Downstream Use	**Million ft^2**	**Percent**
Household Furniture	889.0	20%
Custom Laminators	711.2	16%
Stocking Distributors	755.7	17%
Kitchen and Bath	711.2	16%
Flooring Products	400.1	9%
Office Furniture	266.7	6%
Door Core	177.8	4%
All Other	400.1	9%
Other (n.e.c.)	133.4	3%
Total	4,445.2	100%
Source: Composite Panel Association (1998).		

Construction Activities

Over sixty percent of the softwood plywood and veneer industry output and approximately 50 percent of the reconstituted wood products industry output goes to the construction sector, primarily to the construction, remodeling and repair of single and multiple family dwellings. The majority of the work performed by the construction sector is associated with single family dwellings, and the largest share of their costs is associated with materials such as wood-based materials. As Exhibit 2-11 shows, housing starts have been quite strong since 1996 and are expected to continue through at least this year. Housing start activity is closely linked to general economic conditions, employment, income, and interest rates. Renovation and remodeling expenditures have declined in real terms, as would be expected. Generally, more renovation and remodeling takes place during periods when fewer new houses are being constructed (U.S. Department of Commerce, 1995a).

Exhibit 2-11: Housing Market Indicators, 1988 - 1997			
Year	**New Housing Units (thousand)**	**Renovation and Remodeling Expenditures (million current $)**	**Renovation and Remodeling Expenditures (million 1992 $)**
1988	1,706	101,117	110,874
1989	1,574	100,891	106,425
1990	1,381	106,773	109,175
1991	1,185	97,528	98,813
1992	1,411	103,734	103,734
1993	1,542	108,304	104,339
1994	1,761	115,030	106,411
1995	1,694	111,683	99,362
1996	1,838	114,919	99,756
1997	1,828	118,423	99,431
Source: Howard (1999).			

Because economic conditions can vary between regions in the U.S., the impact of housing starts on demand for wood-based construction materials can vary. This regional variation is further amplified by differing local preferences, housing codes, and availability of specific wood-based products.

Wood Furniture Industry

The wood furniture industry produces output for a high value added market. Exhibit 2-12 below shows the value of shipments from the household furniture sector. Wood household furniture is a portion of this sector. Domestic shipments and apparent consumption of household wood furniture have experienced modest growth since 1989, indicating that the shipments from the softwood plywood and veneer and reconstituted wood products industries to the furniture sector has had limited experience for growth.

Exhibit 2-12: Trade for Household Furniture (SIC 251), 1989 -1996 (Millions of 1997 Dollars)*

	1989	1990	1991	1992	1993	1994	1995	1996	% Change
Value of product shipments	23,056	22,477	21,521	21,949	22,823	24,038	24,355	na	6
Value of imports	3,301	3,200	3,117	3,368	3,723	4,201	4,586	5,047	53
Value of exports	565	884	1,091	1,252	1,298	1,385	1,361	1,342	237
Apparent Consumption	25,792	24,793	23,547	24,065	25,248	26,854	27,580	na	7

*Values adjusted to 1997 dollars using PPI for Furniture and Household Durables
Source: U.S. Department of Commerce (1999a).

Wood furniture manufacturers constitute a large portion of the demand, 20 to 30 percent, of the wood-based products other than structural panels and structural members. Much of the growth in retail demand is being met by imports. This translates into a large lost opportunity for domestic furniture manufacturers, as well as for their suppliers, including the industries that are the subject of this profile. The potential causes for this increase in imports are lower material and labor costs in exporting countries, and declining availability of timber products to domestic producers (CINTRAFOR, 1999 and Dirks, 1991).

The 1992 Census of Manufacturers showed that 21 percent of the delivered cost of materials in the manufacture of wood household furniture is associated with plywood and composite wood products. As a result, significant price changes in the cost of plywood and composite wood products have the potential to affect production costs of wood household furniture. As the demand for wood household furniture is highly elastic with respect to price (see discussion in section 2.3.4), increased input costs could affect both the demand for wood household furniture and for plywood and wood composites supplied to furniture manufacturers.

2.3.3 Substitution Possibilities

The basic substitution in these industries is between different wood products, although non-wood substitutes exist as well for some applications. Composite wood products were originally manufactured in response to the growing demand for wood products as the availability of larger sized timber declined. As new wood composites products were developed, they further replaced sawn lumber and other types of wood products. Plywood and veneer production lost market share during the late 1980s and early 1990s to new products that are categorized as reconstituted wood products, largely as a result of several challenges: legislation protecting federal timber lands; recession in the early 1990s; price increases and instability; and supply shortages. To provide an indication of the structural uses of wood panel products and substitutes, Exhibit 2-13 outlines the use of various products in new single-family and multi-family residential construction in the United States.

Exhibit 2-13: Use of Wood and Non-wood Products in Residential Construction 1976 - 1995						
	Incidence of Use (%)					
	Single-family houses			Multi-family houses		
Application	1976	1988	1995	1976	1988	1995
Floor Sheathing						
Lumber	1	5	-	2	6	-
Structural Panels	51	56	55	51	52	54
Softwood Plywood	51	48	31	51	46	24
OSB	0	9	24	0	7	30
Nonstructural Panels	12	9	9	10	9	7
Lightweight Concrete	0	0	0	5	7	3
Concrete Slab	30	30	35	32	26	36
Exterior Wall Sheathing						
Lumber	-	2	-	-	-	-
Structural Panels	16	33	52	17	40	43
Softwood Plywood	16	26	19	17	28	10
OSB	0	7	33	0	12	33
Fiberboard	34	13	6	32	11	5
Foamed Plastic	7	22	29	2	18	34
Foil-faced kraft	-	17	3	0	13	1
Gypsum, other	18	8	2	18	15	8
None	25	5	8	31	5	9
Roof Sheathing						
Lumber	14	6	1	11	2	1
Structural Panels	85	91	98	87	94	94
Softwood Plywood	84	70	37	87	78	19
OSB	1	21	61	1	16	75
Other	1	3	0	2	4	5
Exterior Siding						
Lumber	10	12	7	9	16	2
Structural Panels	22	23	9	32	15	4
Softwood Plywood	22	23	4	32	15	2
OSB	-	-	5	0	-	2
Hardboard	16	16	6	7	11	5
Non-wood	52	49	77	49	58	89
Vinyl	14	15	29	12	14	41
Masonry, stucco	38	34	48	37	44	48
Other	0	0	1	3	-	-
Source: Spelter et al. (1997).						

Structural wood panels hold the majority of the market share for floor, exterior wall, and roof sheathing in single and multi-family housing construction. The major substitution effect in this market has occurred between OSB and softwood plywood, with OSB capturing much of the market from softwood plywood by

1995. Much of the trade-off between softwood plywood and OSB is due to lower cost for OSB. However, questions of exterior durability with OSB have led many builders to continue plywood use despite higher initial costs.

Fiberboard has also seen reduction in market share for exterior wall systems due to increases in OSB use. Non-wood products, mainly masonry, have captured 77 percent of the market for exterior siding, greatly reducing the market share of structural panels in this market. Other major substitutes include concrete slab for floor sheathing and foamed plastic, which gained major shares of the exterior wall sheathing market from wood-based structural panels.

2.3.4 Demand Elasticities

The price elasticity of demand is the percentage change in the quantity of product demanded by consumers divided by the percentage change in price. Demand curves slope downward, signifying a negative response (less demand) to an increase in price. If demand is elastic (an absolute value of greater than one) a small price increase will lead to a relatively large decrease in demand. Conversely, if demand is inelastic with respect to price, or an absolute value less than one, the quantity demanded will change very little relative to a change in price.

For the purposes of performing an economic analysis, short-term price elasticities are relevant as impacts of the regulation fall directly on the entities owning facilities faced with compliance responsibilities. In appropriating compliance costs to facilities impacted by this rule, the economic analysis assumes that these facilities have a fixed capital stock in the short term. This method allows an evaluation of the severity of impacts using static measures of profit and loss. This “non-behavioral” approach differs from other behavioral approaches that take into account adjustments made by producers, such as changing input mixes, that can generally affect the market environment in which they operate over the longer term.

In the case of plywood and reconstituted wood production that is going to the construction industry, the overall price elasticity of demand for these products is relatively inelastic. This is because the wood product component of construction is fixed once the decision to construct has been made. The other factors that contribute to the inelastic nature of demand for structural wood panels include local building codes, home buyer and home owner preferences, and building industry investment in the training and infrastructure required to construct with wood panels as opposed to a substitute.

The demand for each individual type of product may differ, depending on several factors, including the product’s own-price elasticity, the availability and price of other wood based and non-wood products with comparable characteristics, and the availability and price of imported products. Cross price elasticities are often difficult to identify or estimate. However, if available, cross price elasticities of substitutes and imports might be considered when developing an approach to the economic analysis. For example, analysis of the softwood plywood market may incorporate the cross-price elasticity of OSB, a major substitute for plywood. When analyzing the OSB market, the converse would also be true. Even if such cross price elasticities were available, other considerations would also determine whether the economic analysis incorporates the market substitution dynamic.

We examined several recent and historical studies of price elasticities of demand. Most of these studies were concerned with the softwood lumber sector, most likely due to the limited availability of relevant price and consumption information at a disaggregated product level. Our review focused on the

1996 study by Joseph Buongiorno, a forestry economist, who noted that previous econometric studies of the wood products sector have produced estimates of demand elasticities for softwood lumber, a product with similar demand drivers, inputs, input costs, and uses, between zero and -0.9[5]. Buongiorno also reported that other studies have estimated the cross elasticity of lumber with respect to the price of plywood to be between 0.5 and zero. Buongiorno developed a model using a price-endogenous linear programming system (PELPS) that endeavored to address the entire wood products market using a system dynamics approach. The results of this model included short-term price elasticities of demand for wood-based products, as shown in Exhibit 2-14.

Exhibit 2-14: Demand Elasticities

Product	Price Elasticity of Demand
Plywood	-0.16
Fiberboard	-0.10
Particleboard	-0.27

Source: Buongiorno (1996).

Buongiorno's results provide the basis for imputing price elasticities for the other products that are the subject of this MACT standard. In addition, further review of identified studies may produce information useful in the final determination of appropriate elasticities for use in the economic analysis of the impacts of a MACT standard on the softwood plywood and reconstituted wood products industries.

In the case of softwood plywood and reconstituted wood production going to the furniture industry, the price elasticity of demand is highly elastic. This is because the price elasticity of demand for wood furniture is highly elastic itself and the softwood plywood and reconstituted wood component of production costs for wood furniture is also quite high, over twenty percent. The EPA's study of the economic impacts of alternative NESHAPS on the wood furniture industry estimated the price elasticity of demand for wood furniture as -3.477 (U.S. EPA, 1992). This result forms the basis for a derived price elasticity of demand for use in the economic analysis of the impacts of the MACT standard.

2.4 Industry Organization

The following section contains information pertaining to the organization of the plywood and veneer, composite wood , and structural wood members industries. This section will provide the basis for understanding the following.

- The industry structure
- The characteristics of the manufacturing facilities
- The characteristics of the firms that own the manufacturing facilities

[5]The majority of studies reviewed estimated price elasticity of demand as being between -0.15 and -0.4.

A detailed examination of these three topics is essential, as it provides the basis for much of the approach to estimating economic impacts of the MACT standard. In addition, this section also provides detailed information about facilities and firms that are important inputs to the analysis itself as well as to analysis of how the MACT standard might affect firms of different sizes.

2.4.1 Industry Structure

Exhibit 2-15 shows concentration ratios by SIC code for the three census years, 1982, 1987, and 1992. The m-firm concentration ratios are equal to the sum of the market shares for the largest m number of firms in the industry. A market is generally considered highly concentrated if the 4-firm concentration ratio is greater than 50 percent. Exhibit 2-15 also shows the Herfindahl-Hirschman (HH) index, which is an alternative measure of concentration equal to the sum of the squares of the market shares for the 50 largest firms in the industry. The higher the index, the more concentrated the industry is at the top. The U.S. Justice Department uses 1,000 as a benchmark for the presence of market concentration, where any industry with a Herfindahl-Hirschman index less than 1,000 is considered to be unconcentrated (Arnold, 1989).

Exhibit 2-15: Concentration Ratios by SIC Code, 1982-1992*

Year	Number of Companies in Industry	*Percent of value of industry shipments shipped by the largest (in terms of shipment value)*				Herfindahl-Hirschman Index**
		4 Companies	8 Companies	20 Companies	50 Companies	
Softwood Veneer and Plywood (SIC 2436)						
1982	135	41	56	74	92	619
1987	131	38	56	74	93	571
1992	123	47	66	82	96	797
Reconstituted Wood Products (SIC 2493)						
1982	N/A					
1987	158	48	65	82	95	743
1992	193	50	66	81	94	765
Structural wood members (SIC 2439)						
1982	649	15	22	35	50	104
1987	831	13	18	30	44	92
1992	830	19	25	34	46	166

*The latest year for which data is currently available.
**The index is based on the 50 largest companies in each SIC code.
Source: U.S. Department of Commerce (1992).

The concentration ratios presented in Exhibit 2-15 show very little evidence of market concentration in the plywood and composite wood products industries. Four-firm concentration ratios for the three sectors are below 50 with the exception of reconstituted wood products (classified as “General” in the ICR survey) which is 50. The HH indices for all SIC codes are well below the benchmark of 1000. While concentration appears to have increased in general between 1982 and 1992, there is no clear trend as all appear to have been less concentrated in 1987.

2.4.2 Manufacturing Plants

Through an ICR, the U.S. Environmental Protection Agency identified plants potentially affected by this rule. EPA categorized the surveyed facilities according to their production processes and developed estimates of compliance costs for each facility. Exhibit 2-16 below presents information on the number of potentially impacted facilities, and their corresponding primary SIC code. The exhibit also shows the percent of potentially impacted facilities as a percent of total facilities for each SIC.

Exhibit 2-16: Facilities with Compliance Cost Impacts

		Facilities			
SIC Code	**Description**	**Impacted***		**Total in SIC**	**% of Total**
2436	Softwood Veneer and Plywood	66		155	42.6%
2493	Reconstituted Wood Products	Total	97	317	30.6%
		OSB	23		
		PB/MDF	56		
		HB	18		
2439	Structural Wood Members	3		53	5.7%

* Does not include number of facilities with MRR costs only.
Note: Percentages represent survey facilities' share of total facilities in the category.
Sources: U.S. Environmental Protection Agency (1998), U.S. Department of Commerce (1999a), MRI (1999).

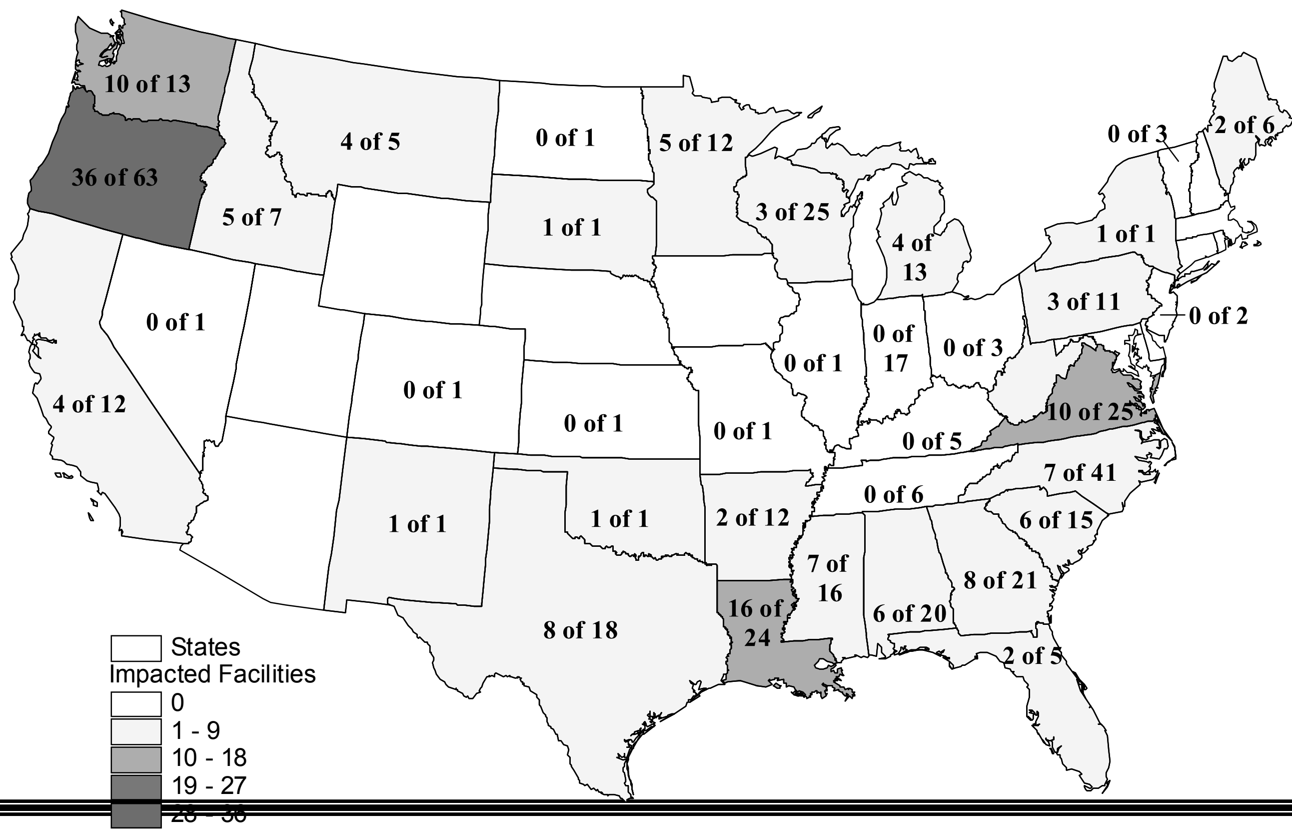
2.4.2.1 Location

Nationally, facilities that produce softwood plywood and reconstituted wood products are clustered in distinct geographic regions of the South, Pacific Northwest, and the upper Mid-West of the U.S. Based on the 1997 Census of Manufacturers, the softwood plywood and veneer facilities have the highest employment in Oregon, Washington and Louisiana. The Census showed that reconstituted wood product facilities had the highest employment in Oregon, California, North Carolina, Texas, and Michigan (source: U.S. Department of Commerce, 1999a).

Figure 2-8[6] is a map of locations of impacted and total ICR facilities as identified by EPA (MRI, 1999, EPA, 1998). For this figure, all types of facilities are combined. The map shows the state-by-state distribution of the potentially impacted facilities relative to the total ICR facilities in the state. The states with the greatest number of potentially impacted facilities are Oregon (36), Louisiana (16), Georgia (8), Mississippi (7), Virginia (10), Texas (8), and North Carolina (7). Major producing states where impacted facilities constitute a significant portion of all facilities in the state include Louisiana (66 percent), Oregon (57 percent), Washington (77 percent), Georgia (38 percent) and Texas (44 percent).

[6] Map developed based on original survey database dated July 23, 1999.

Figure 2-8: Plywood and Wood Composite Facility Locations
(Potentially Impacted Facilities and Total ICR Facilities by State)
Sources: U.S. Environmental Protection Agency (1998), MRI (1999)



2.4.2.2 Production Capacity and Utilization

Exhibit 2-17 shows the capacity utilization rates by SIC code and for all manufacturing industries for 1992 through 1997. The rates for softwood plywood and veneer, and reconstituted wood products are significantly higher than the average for all lumber and wood products and for all industries. Capacity utilization for structural wood members is below industry averages but has increased over the 1992 - 1997 period.

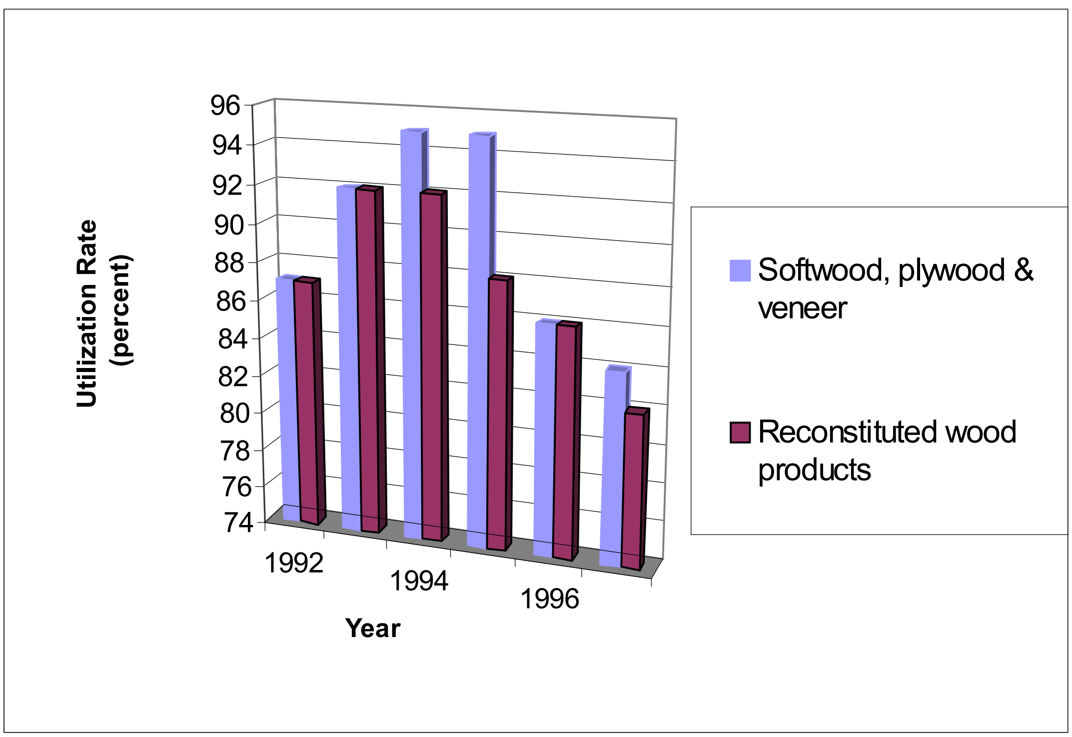
Exhibit 2-17: Full Production Capacity Utilization Rates, Fourth Quarters, 1992 - 1997

SIC	SIC Description	1992	1993	1994	1995	1996	1997	Change
2436	Softwood Veneer and Plywood	87	92	95	95	86	84	-3.4%
2493	Reconstituted Wood Products	87	92	92	88	86	82	-5.7%
2439	Structural Wood Members	65	66	66	74	77	72	10.8%
24	*All Lumber and Wood Products*	*80*	*81*	*80*	*77*	*78*	*75*	*-6.3%*
2000-3999	*All Manufacturing Industries*	*77*	*78*	*80*	*76*	*76*	*75*	*-2.3%*

Source: U.S. Department of Commerce (1997).

Figure 2-9 presents the capacity utilization rates of softwood plywood and veneer and reconstituted wood products from 1992-1997.

Figure 2-9: Full Production Capacity Utilization, Fourth Quarters, 1992-1997



Source: U.S. Department of Commerce (1997).

The capacity utilization for softwood plywood and veneer, and reconstituted wood peaked in 1994, consistent with utilization peaks for all manufacturing industries. Interestingly, utilization rates for reconstituted wood product facilities declined, while softwood plywood and veneer was unchanged in 1995, the year that shows the highest value of shipments for all (see Exhibit 2-17). This may be explained, in part, by capacity expansions driven by the increased capital expenditures by softwood plywood and veneer producers in 1994 and subsequent years.

The ICR provided further information on capacity utilization. A sample of general facilities responding to questions regarding their production processes reported production and capacity. From this data, capacity utilization for general facilities was 78 percent, slightly below the figures in Exhibit 2-17

2.4.2.3 Employment

Exhibit 2-18 provides information on employment at the softwood plywood veneer and reconstituted wood products facilities responding to the ICR in 1998.

Exhibit 2-18a: 1998 Employment at Facilities with Expected Compliance Cost Impacts

	Softwood Plywood and Veneer		Oriented Strandboard		Medium Density Fiberboard/ Particleboard	
Number of Employees	Facilities in Size Category	% of All Impacted Facilities	Facilities in Size Category	% of All Impacted Facilities	Facilities in Size Category	% of All Impacted Facilities
Not reporting	2	3.0%	0	0.0%	0	0.0%
<50	0	0.0%	0	0.0%	1	1.8%
50 to 99	0	0.0%	0	0.0%	12	21.4%
100 to 249	18	27.3%	21	91.3%	30	53.6%
250 to 499	34	51.5%	1	4.3%	2	3.6%
500 to 999	11	16.7%	1	4.3%	8	14.3%
1,000 to 1,499	1	1.5%	0	0.0%	2	3.6%
>1,500	0	0.0%	0	0.0%	1	1.8%
TOTAL	66	100%	23	100%	56	100%

Sources: U.S. Environmental Protection Agency (1998), MRI (1999).

Exhibit 2-18b: 1998 Employment at Facilities with Expected Compliance Cost Impacts

	Hardboard		Engineered Wood Products		Total Facilities	
Number of Employees	Facilities in Size Category	% of All Impacted Facilities	Facilities in Size Category	% of All Impacted Facilities	Facilities in Size Category	% of All Impacted Facilities
Not reporting	0	0.0%	0	0.0%	2	1.2%
<50	0	0.0%	0	0.0%	1	0.6%
50 to 99	1	5.6%	0	0.0%	13	8.0%
100 to 249	8	44.4%	1	33.3%	77	47.2%
250 to 499	4	22.2%	2	66.7%	41	25.1%
500 to 999	5	27.8%	0	0.0%	25	15.3%
1,000 to 1,499	0	0.0%	0	0.0%	3	1.8%
>1,500	0	0.0%	0	0.0%	1	0.6%
TOTAL	18	100%	3	100%	166	100%

Exhibit 2-18b: 1998 Employment at Facilities with Expected Compliance Cost Impacts						
	Hardboard		Engineered Wood Products		Total Facilities	
Number of Employees	Facilities in Size Category	% of All Impacted Facilities	Facilities in Size Category	% of All Impacted Facilities	Facilities in Size Category	% of All Impacted Facilities
Sources: U.S. Environmental Protection Agency (1998), MRI (1999).						

Potentially impacted facilities engaged in the production of plywood and composite wood products tend to be small- to medium-sized. Just over half of the facilities reported having less than 250 employees. Softwood plywood producers tend to have larger facilities, while facilities producing reconstituted wood products tend to be smaller.

2.4.2.4 Facility Population Trends

Plant age may be of particular significance to potential regulatory impacts. Older plants may be less efficient as compared with newer plants utilizing technological improvements in production efficiency. One example mentioned earlier is the development of the continuous press, enabling recently constructed plants to produce more panel products in less time than older manufacturers. Newer plants may utilize better volatile organic compound emission control technologies and have adapted their processes to meet indoor air quality requirements.

While specific age information for all facilities is not available, an analysis performed by Spelter et al. (Spelter, 1997) provides insights into the changing nature of plywood and composite wood facilities over time. In their analysis, they traced the number of mills, average mill capacity, and capacity utilization over the course of 20 or more years. The analysis does not present information on specific plant closures and openings over time, but presents the total number of operating mills, which reflects the net change resulting from both closures and openings. Exhibit 2-19 provides information on the results of the analysis for selected years from 1977 to 1997, using census years to provide some comparison to overall industry figures presented elsewhere in this chapter.

Exhibit 2-19: Number of Mills, Average Capacity and Utilization, 1977 - 1997						
	1977	**1982**	**1987**	**1992**	**1997**	**% Change**
Softwood Plywood						
Number of Mills	62	69	58	56	57	-8%
Average Mill Capacity (1000 m^3)	110	138	180	201	215	95%
Capacity Utilization	97	79	99	95	97	0%
Oriented Strandboard						
Number of Mills	8	21	39	44	66	725%
Average Mill Capacity (1000 m^3)	88	115	148	187	259	194%
Capacity Utilization		44	90	99	84	91%
Particleboard						
Number of Mills	54	43	44	45	45	-17%
Average Mill Capacity (1000 m^3)	137	151	168	181	196	43%
Capacity Utilization	86	87	89	89	97	13%
Medium-density Fiberboard						
Number of Mills	12	13	17	17	26	117%
Average Mill Capacity (1000 m^3)	95	105	122	141	151	59%
Capacity Utilization	69	66	87	91	86	25%
Laminated Veneer Lumber						
Number of Mills		2	6	12	17	750%
Average Mill Capacity (million m^3)		0.078	0.075	0.063	0.085	9%
Capacity Utilization		73	60	75	93	27%
Engineered Joists						
Number of Mills		12	12	18	35	192%
Average Mill Capacity (million meters)		3	4	5	9	200%
Capacity Utilization		69	73	90	58	-16%

*Information not available for some years. For softwood plywood, particleboard, and MDF, 1997 figures are from 1996. For particleboard, 1984 figures are used for 1982.
Source: Spelter et al. (1997).

Average facility capacity has shown substantial increases over the last twenty years for all product groups. While the number of softwood plywood facilities declined by 8 percent between 1977 and 1997, the average mill capacity increased substantially, nearly 100 percent. Particleboard has experienced some capacity growth while the number of plants has declined.

The OSB industry has shown the largest increase in per facility capacity, 194 percent, along with large net additions of facilities. Most notably, there were nine more OSB plants than softwood plywood plants in 1997, whereas in 1977 plywood plants outnumbered OSB plants nearly 8 to one. Recent facility additions for OSB and MDF show these sectors have newer facilities, while the softwood plywood and particleboard industries are generally composed of older facilities.

A review of recent capital investment trends provides some insights into the facility population trends of the softwood plywood and reconstituted wood products industries. Exhibit 2-20 shows capital expenditures by industry sector. Capital expenditures have seen substantial overall increases in the last five years for all three sectors, indicating increasing investment, particularly in the reconstituted wood product and structural wood members sectors. However, investment by the softwood plywood and veneer and reconstituted wood products sectors declined sharply from 1996 to 1997. This trend indicates the connection between declining capital expenditures and the sharp increase in products costs' share of the value of shipments (as shown in Exhibit 2-5) that began after 1995. If such conditions in the baseline continue into the future, it is possible that certain firms may experience difficulty accessing capital to cover these costs in addition to compliance costs associated with the MACT standard.

Exhibit 2-20: Summary of Capital Expenditures, 1992 - 1997
(Thousands of 1997 Dollars)

	1992	1993	1994	1995	1996	1997	% Change
Softwood Plywood & Veneer	110,125	128,490	159,685	192,090	212,277	168,142	52.7%
Reconstituted Wood Products	159,330	185,452	353,665	367,057	583,659	329,744	107.0%
Structural Wood Members*	47,420	70,659	220,523	143,523	108,889	138,880	192.9%

All dollars adjusted to 1997 using GDP Deflator.
* 1997 figure is sum of capital expenditures for NAICS 321213 and 321214.
Source: U.S. Department of Commerce (1999a).

For softwood plywood, the level of capital investment constitutes only 3 percent of the industry's total value of shipments. With the number of mills in decline and average mill capacity growing, it appears that the majority of capital expenditures made by the softwood plywood industry occur at existing plants. This conclusion is supported by *U.S. Industry & Trade Outlook '99*, which reported that only one new softwood plywood facility has opened in the last 10 years (U.S. Department of Commerce, International Trade Administration, 1999).

Conversely, results of the growing capital investments made by the reconstituted wood products industry can be observed in the large increases in the number of OSB and MDF plants, and the rising average plant capacities of reconstituted wood products producers. As a group, these producers invested 6 percent of the value of shipments in 1997, twice the investment rate of the softwood plywood producers. For example, in September of 1999, Willamette Industries announced that it will build an $85 million particleboard plant in South Carolina. The plant will have a capacity of 210 million square feet per year and will be in operation in late 2001.

2.4.3 Firm Characteristics

Several factors will likely be of importance in determining the distribution of impacts generated by the proposed MACT standard on companies. Size may play a role in a company's ability to absorb an increase in compliance costs. Ownership is a second factor that may play a role. Because firms have different legal and financial guidelines based on ownership, their approaches to complying with the MACT standard may vary. Vertical and horizontal integration, or lack there of, in plywood and composite wood product firms may affect the manner in which they absorb the potential costs of the MACT standard. Lastly, the overall financial condition of the plywood and composite wood industries is assessed, attempting to determine the industry's ability to withstand adverse conditions.

2.4.3.1 Size Distribution

Firm size is likely to be a factor in the distribution of the impacts of the proposed MACT on companies. Under the Regulatory Flexibility Act (RFA) and its 1996 amendment, SBREFA, SBA definitions are used to designate which businesses are considered to be small. The SBA has set size standards under the NAICS system, using various thresholds for the number of employees or revenues. In determining the size of a company, the SBA treats a facility that has a substantial portion of its assets and/or liabilities shared with a parent company as part of that company. In this analysis, the company's primary NAICS code is used to determine the appropriate SBA threshold.

Exhibit 2-21 provides information on firm size for plywood and wood composite firms owning facilities with expected compliance cost impacts. In the ICR, facilities were asked to provide information on employment size for domestic parent firms. Many facilities did not report information on the *ultimate domestic parent*. For this reason, information on ultimate domestic parent primary SIC and NAICS code and employment size were obtained from Dun and Bradstreet's DUNS Database. Exhibit 2-21 shows the number of firms and the facilities owned by the firms in the first two data columns. In the absence of Dun & Bradstreet information on the owner, the facility's primary SIC and NAICS code from Dun & Bradstreet was used to determine the appropriate SBA threshold. Based on this SIC code, facility employment information from the ICR was used to make a size determination. Exhibit 2-21 shows the number of firms and the facilities owned by the firms in the third and fourth data columns. In the absence of facility primary SIC code from DUNS, the standard for lumber and wood products (all SIC 24 codes) of 500 employees was used as the threshold. A full list of the facilities and their size determination is provided in the economic impact analysis for this proposed rule.

Exhibit 2-21: Size Distribution of Firms Owning Facilities with Expected Compliance Cost Impacts

Size	SIC Based on DUNS		SIC Based on ICR		Other Sources		Total			
	Firms	Facilities Owned by Firms*	Firms	Facilities Owned by Firms*	Firms	Facilities Owned by Firms*	Firms	%	Facilities Owned by Firms*	%
Small	8	10	5	5	6	7	19	35.2%	22	8.4%
Large	29	231	4	8	2	2	35	64.8%	241	91.6%
Total	37	241	9	13	8	9	54	100%	263	100%

* Includes all facilities reported, impacted and non-impacted.
Sources: U.S. Environmental Protection Agency (1998), MRI (1999). SBA Size Standards from SBA website: http://www.sba.gov/regulations/siccodes/.

While over 35 percent of firms in the industry are considered small, 91 percent of facilities are owned by large firms. Given the concentration ratios presented in Exhibit 2-15, there does not appear to be any significant market power to these larger firms. However, the ability of larger firms to deal with compliance costs, as compared to smaller firms, may have impacts on the industry organization.

The larger parent firms have both impacted and non-impacted facilities. Firms such as Georgia-Pacific (43 ICR facilities), Louisiana-Pacific (32 ICR facilities), Willamette Industries (23 ICR facilities), Columbia Forest Products (13 ICR facilities), Weyerhaeuser (19 ICR facilities), and Boise-Cascade (12 ICR facilities) may be able to make trade-offs between facilities and shift production to more efficient facilities in response to compliance costs associated with the MACT standard.

2.4.3.2 Ownership

The form of firm ownership has a set of legal and financial characteristics that may influence a firm's regulatory compliance alternatives. The legal form of ownership impacts the cost of capital, availability of capital, and effective tax rate faced by the firm. Debt-equity issues for these firm types will play a role in financing capital-intensive controls. Firm ownership may generally be one of three types.

- Sole proprietorships (companies with a private single-owner)
- Partnerships (non-corporate firms with more than one owner)
- Corporations (publically or privately owned companies formed through incorporation)

Exhibit 2-22 provides information on ownership type for the lumber and wood products industry. While specific information by 4-digit SIC or 5-digit NAICS is not available, the table provides a general sense of ownership types in the industry, assuming that ownership structure for the three industries profiled is similar to that of the overall lumber and wood products industry.

Exhibit 2-22: Types of Firm Ownership for Lumber and Wood Products (SIC 24/NAICS 321), 1992

	Corporation	Sole Proprietorship	Partnerships	Other/ Unknown
Single-Facility Firms	1,291	14,909		
Multi-Facility Firms	17,617	61		
All Firms	18,908	10,447	2,336	2,187

Source: U.S. Dept. of Commerce (1992).

Over ninety percent of single facility wood and lumber products firms are owned by sole proprietorships, partnerships, or some other/unknown entity. Nearly all multi-facility firms are owned by corporations. Just over half of all lumber and wood products firms are a corporation, while the remainder are sole proprietorships (30 percent), partnerships (7 percent), or other (6 percent). These data support the conclusion that single-facility firms owned by sole proprietors are more likely to be classified as small businesses, while multi-facility firms owned by corporations are more likely to be classified as large businesses.

2.4.3.3 Vertical and Horizontal Integration

The data presented in Section 2.2 on concentration and specialization ratios for the plywood and composite wood industries, combined with the information on establishment size and ownership type demonstrate that the majority of firms in the three industries examined in this profile are predominantly not, or minimally, vertically or horizontally integrated. However, there are several exceptions to this conclusion. The six largest firms that own multiple facilities are for the most part both vertically and horizontally integrated. These firms, described in more detail below, are large multi-billion dollar concerns that are vertically integrated through their ownership of timberland, their production facilities, and their involvement in product distribution. Their horizontal integration is attributed to their other product lines, generally pulp and paper.

Georgia-Pacific, a large, horizontally and vertically integrated firm, manufactures and distributes building products, pulp and paper, and resins. The company's wood product line includes wood panels, plywood, and hardboard. It also produces lumber, gypsum products, chemicals, and packaging. Georgia-Pacific grows and sells timber, and participates in several other activities related to forestry management.

Its 1998 net sales revenues exceeded $13 billion, and it has 45,000 employees at 400 locations. Its building products division reported record profits during the second quarter of 1999. It currently has plans to build an OSB plant in Arkansas and recently merged with Unisource, a major distributor of imaging paper and supply systems (Financial Times, 1999b; PR NewsWire, 1999b).

Louisiana-Pacific is principally a manufacturer of building products, but also produces pulp and building insulation, and owns almost one million acres of timberland. Its sales of structural lumber, industrial panels, and exterior building products made up nearly 75 percent of the company's revenues, which reached $2.3 billion in 1998. The company manufactures OSB, I-joists, LVL, MDF, fiberboard, particleboard, hardboard, softwood plywood and hardwood veneer. Louisiana-Pacific has been involved in a series of mergers and acquisitions that include Le Goupe Forex of Canada, Evans Forest Products, and ABT Building Products (Louisiana-Pacific, 1999; Financial Times, 1999c).

Willamette Industries, a forest products manufacturing company, has three main lines of business: brown paper, white paper, and building products. The building products division manufactures plywood, lumber, particleboard, MDF, OSB, LVL and I-joists, among others. Approximately one third of the company's $3.7 billion in total revenue is from its building materials segment. Most of Willamette's recent merger and acquisition activity has been with firms in France and Mexico. It also owns plants in Ireland and 1.8 million acres of timberland in the U.S. (Financial Times, 1999d; PR NewsWire, 1999c, 1998, 1997).

Columbia Forest Products describes itself as North America's largest manufacturer of hardwood veneer, and laminated products. They sell their products through a network of wholesale distributors, mass merchandisers and major original equipment manufacturers (OEMs). Their products include decorative, interior veneers and panels used in high-end cabinetry, fine furniture, architectural millwork and commercial fixtures. Columbia Forest Products is an employee-owned company with 13 plants in the U.S. and four in Canada (Columbia Forest Products, 1999).

Weyerhaeuser is an integrated international forest products company. It is involved in growing and harvesting timber, and the manufacturing and distributing of several categories of forest products. Among its wood products are plywood, OSB, and wood composites. The company bills itself as the world's largest private owner of saleable softwood timber and the country's largest producer of softwood lumber and pulp. In addition, it is the top U.S. exporter of forest products. The company has approximately 36,000 U.S. and Canadian employees and sales of $11 billion, ten percent of which comes from exports (Weyerhaeuser, 1999).

Boise Cascade, an integrated international paper and forest products company, manufactures and distributes paper and wood products, distributes office products and building materials, and owns and manages over 2 million acres of timberland. Its building products include lumber, plywood, particleboard, veneer, and engineered wood products. Sales of these products constitute 27 percent of the company's $6.2 billion annual revenue (Financial Times, 1999a; PR NewsWire, 1999a).

2.4.3.4 Financial Condition

The financial condition of an industry's firms will affect the incidence of impacts of the costs associated with complying with a new MACT standard. While information necessary to determine which specific firms might experience adverse impacts is not available, one can examine industry-wide indicators of financial condition. Each year, Dun & Bradstreet (D&B) publishes *Industry Norms & Key Business Ratios*, which reports certain financial ratios for a sample of firms in the industry. This section focuses on measures of profitability and solvency.

Profitability Ratios

The return on sales ratio, also known as the net profit margin, is an indicator of a firm's ability to withstand adverse conditions such as falling prices, rising costs, and declining sales, and is calculated by dividing net profit after taxes by annual net sales.

Return on assets is calculated by dividing a firm's net profit after taxes by its total assets. This ratio is a key indicator of both profitability and operating efficiency by comparing operating profits to the assets available to earn a return. According to Dun & Bradstreet, companies that use their assets efficiently will have a relatively higher return on assets than those firms that do not use their assets efficiently.

The return on equity shows the profitability of the company's operations to owners, after income taxes, and is calculated by dividing net profit after taxes by net worth. According to Dun & Bradstreet, this ratio is looked to as a 'final criterion' of profitability, and a ratio of at least 10 is regarded as desirable for providing dividends plus funds for future growth.

Solvency Ratios

The current ratio is calculated by dividing a firm's current assets by its current liabilities. This is a measure of liquidity that gauges the ability of a company to cover its short-term liabilities. The standard guideline for financial health is 2. The quick ratio is slightly different than the current ratio, because it does not include inventories, advances on inventories, marketable securities, or notes receivables. The quick ratio measures the protection afforded creditors in cash or near-cash assets. Any time this ratio is 1 or greater, the firm is said to be in a liquid condition.

Exhibit 2-23 shows various measures of the financial condition of the plywood and composite wood industry over the period 1995 to 1997. The trends shown in Exhibit 2-23 confirm that the softwood plywood and reconstituted wood products industries have experienced a profit squeeze due to increasing costs and falling prices in recent years.

Exhibit 2-23: Indicators of Financial Condition, 1995-1997*

Indicator	Softwood Plywood and Veneer			Reconstituted Wood Products			Structural Wood Members
	1995	1996	1997	1995	1996	1997	1998
Return on Sales	5.8	3.6	1.7	3.8	3.1	3.5	5.0
Return on Assets	15.7	13.5	6.0	7.8	5.9	3.5	13.0
Return on Equity	28.7	22.9	8.7	15.2	10.0	5.7	NA
Current Ratio	3.2	2.6	2.7	2.8	2.7	1.7	2.3
Quick Ratio	1.1	1.3	1.2	1.8	1.2	1.1	1.3

*Includes 1998 data for Structural Wood Members, the only data reported for this sector.
Source: Dun & Bradstreet (1999). Indicator values are based on median values of the industrial sample.
For SIC 2436, there were 14 establishments in the sample in 1995, 15 in 1996, and 11 in 1997. For SIC 2493, there were 28 establishments in the sample in 1995, 30 in 1996, and 31 in 1997. For SIC 2439, there were 135 establishments in 1998.

The softwood plywood and veneer industry has not maintained its relatively strong degree of financial health, with many of its profitability indicators significantly lower in 1997 than in 1995. In particular, the softwood plywood and veneer industry experienced 60 to 70 percent declines in all three profitability ratios. The falling profitability of this industry is now at a level that indicates the presence of firms that are not using their assets efficiently, are not providing the cash needed for future growth, and may more acutely experience adverse conditions associated with MACT standard compliance costs. The currently low net profit margin is indicative of an industry that is experiencing increasing production costs as a percentage of its value of shipments and falling capacity utilization (Exhibits 2-5 and 2-18).

The reconstituted wood products industry also saw fairly dramatic decreases in its financial indicators over the time period shown, resulting in a relatively low return on assets and return on equity, as well as a current ratio lower than generally considered healthy. These indicators are consistent with recent trends in the industry associated with increases in production costs relative to the value of shipments (Exhibit 2-5), rapid expansion of production capacity (Exhibit 2-20) and competitive pressures on prices from overseas producers. This industry also includes firms that are not using their assets efficiently or providing the cash needed for future growth. The reconstituted wood products industry's profit margin is also somewhat low, but typical of all firms in the lumber and wood products sector (Dun and Bradstreet, 1999b).

In the fall 1999 issue of Engineered Wood Products Journal, industry analyst Evadna Lynn discussed investor response to the industry's current financial performance (APA, 1999c). Lynn attributes several recent trends to stockholder pressure for improved financial performance.

- Separating timber assets
- Corporate restructuring
- Cost control through consolidation

These trends have contributed to a dynamic market structure in recent years. By selling or otherwise spinning off timber assets, forest products companies are converting them to cash and improving financial performance. Restructuring activities have focused on gaining higher returns from core business activities through the closure or divestiture of less profitable facilities or products. Some of the divested facilities, particularly plywood mills, have been reopened by new owners as sawmills. The industry has seen several major corporate mergers and acquisitions in the late 1990s, including: Weyerhaeuser and MacMillan Bloedel, International Paper and Union Camp, and Louisiana Pacific and Le Groupe Forex (of Canada). Most post-merger cost reductions are gained from streamlining operations, including closure of production facilities (APA, 1999c; International Paper, 1998).

2.5 Markets

This chapter discusses general market conditions for the plywood and composite wood products industries. In particular, this chapter discusses market structure, provide background on current market volumes, prices, and international trade. It also presents information on future market volumes, prices and international trade. The purpose of this chapter is to describe the current status of the industry and to support the development and implementation of the economic impact analysis that is summarized in this RIA.

2.5.1 Market Structure

Based on the data, background and analyses reviewed while preparing this industry profile, it is reasonable to conclude that these industries exhibit clear signs of a competitive market for the products that are the subject of this MACT standard. There are several reasons for this conclusion. First, as discussed in section 2.4.2, the plywood and composite wood products industries are unconcentrated. There is little concentration of market power evidenced by each separate industrial category having a 4-firm concentration ratio of 50 or below (often well below) and HH indices below the 1000 benchmark. Next, the output of several of the production sectors are substitutes for each other, putting competitive pressures on suppliers. There are also competitive pressures from alternative products, either traditional sawn lumber or non-wood materials. This chapter will focus on other factors of the competitive nature of these industries. For the most part, the markets for these goods also experience competitive pressures by the presence of imported products. Finally, several industry experts have observed trends where prices of the products respond negatively to the presence of excess capacity. The remainder of this chapter will provide additional details related to these observations on industry competitiveness.

2.5.2 Market Volumes

This section will present a discussion of market consumption and production volumes for the three industrial sectors examined in this study. For the most part, this discussion will rely on the data contained in Exhibit 2-24 and Exhibit 2-25. Exhibit 2-24 shows the value of product shipments by product class for the period 1989 to 1995[7] as reported by the International Trade Administration of the U.S. Department of Commerce. Note that value of shipments data for Structural Wood Members is not available for inclusion in this table. Exhibit 2-25 shows the physical volume of output produced, traded and consumed between 1988 and 1997 for selected products as reported by Spelter et al. in their 1997 statistical report. International trade is discussed later in the section.

[7] 1995 is the latest year for which data is available.

Exhibit 2-24: Trade Balance and Selected Statistics, Thousands of 1997 Dollars								
	1989	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**% Change**
Softwood Veneer and Plywood (SIC 2436, NAICS 321212)								
Value of product shipments	7,125	6,887	6,185	6,422	5,643	5,885	6,671	-6%
Value of imports	81	69	55	79	82	100	111	37%
Value of exports	452	509	428	452	391	333	375	-17%
Trade Surplus (Deficit)	371	440	373	372	310	234	263	-29%
Apparent Consumption	6,755	6,447	5,812	6,050	5,333	5,651	6,407	-5%
Ratio of Imports to Consumption	0.01	0.01	0.01	0.01	0.02	0.02	0.02	45%
Ratio of Export to Product Shipments	0.06	0.07	0.07	0.07	0.07	0.06	0.06	-11%
Ratio of Imports to Exports	0.18	0.14	0.13	0.18	0.21	0.30	0.30	65%
Reconstituted Wood Products (SIC 2493, NAICS 321219)								
Value of product shipments	5,013	4,761	4,743	5,359	4,940	5,511	5,772	15%
Value of imports	461	409	364	540	616	861	1,080	134%
Value of exports	261	334	350	328	271	301	345	32%
Trade Surplus (Deficit)	(200)	(75)	(14)	(212)	(345)	(560)	(735)	268%
Apparent Consumption	5,213	4,836	4,757	5,572	5,285	6,070	6,507	25%
Ratio of Imports to Consumption	0.09	0.08	0.08	0.10	0.12	0.14	0.17	88%
Ratio of Export to Product Shipments	0.05	0.07	0.07	0.06	0.05	0.05	0.06	15%
Ratio of Imports to Exports	1.76	1.22	1.04	1.65	2.27	2.86	3.13	77%
Source: U.S. Department of Commerce, International Trade Administration (1998).								

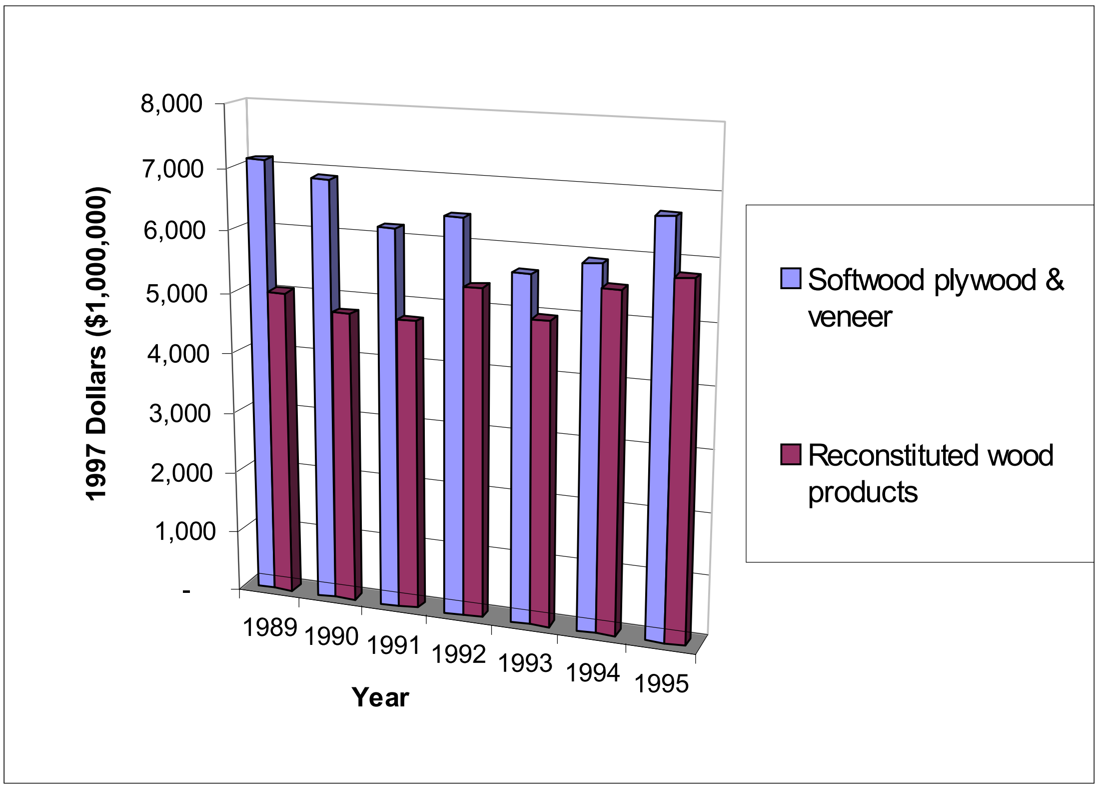
Exhibit 2-25: Production, Trade and Consumption Volumes for Selected Products (1988-1997)											
	1988	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**% Change**
Softwood Plywood (M ft^3, 3/8 in basis)											
Product shipments	22,089	21,385	20,919	18,652	19,332	19,315	19,368	19,367	19,181	17,963	-19%
Imports	96	49	38	28	47	41	47	60	85	104	8%
Exports	1,004	1,442	1,613	1,322	1,442	1,409	1,211	1,267	1,248	1,548	54%
Apparent Consumption	21,181	19,991	19,344	17,358	17,937	17,946	18,474	18,160	18,018	16,519	-22%
Other Structural Panels (M ft^3, 3/8 in basis)											
Product shipments	4,604	5,105	5,418	5,613	6,653	7,002	7,486	7,903	9,314	10,534	129%
Imports	815	1,111	1,313	988	1,572	2,163	2,588	3,214	4,414	5,272	547%
Exports				57	49	60	78	82	157	167	193%*
Apparent Consumption	5,416	6,213	6,728	6,544	8,176	9,105	9,995	11,036	13,572	15,639	189%
Particleboard/Medium Density Fiberboard (M ft^3, 3/4 in basis)											
Product shipments	4,768	4,828	4,856	4,730	5,046	5,402	5,793	5,307	5,705	5,916	24%
Imports	1,634	425	363	293	405	572	775	840	814	963	-41%
Exports	163	333	373	369	394	318	297	319	154	188	15%
Apparent Consumption	6,239	4,920	4,746	4,654	5,057	5,656	6,271	5,828	6,365	6,691	7%
Hardboard (M ft^3, 1/8 in basis)											
Product shipments	5,118	5,196	5,025	4,895	5,273	5,248	5,206	4,930	5,280	4,501	-12%
Imports	633	718	689	571	571	639	1,119	1,152	1,183	1,306	106%
Exports	322	427	552	606	836	917	1,190	1,377	1,426	1,259	291%
Apparent Consumption	5,429	5,487	5,162	4,860	5,008	4,970	5,135	4,705	5,037	4,548	-16%
Source: Spelter et al. (1997). * since 1991											

2.5.2.1 Domestic Production

As Exhibit 2-24 shows, the value of shipments (representing production) of softwood plywood and veneer was slightly lower in 1995 than it was in 1989. During the period, production reached its lowest level in 1993 and then began to climb, in response to meeting demand from rising expenditures for renovation and remodeling and new housing starts. The value of shipments of reconstituted wood products rose 15 percent between 1989 and 1995, linked to the underlying growth in the construction sector and the growth in market share of structural panel products over softwood plywood.

Figure 2-10 compares the value of product shipments of softwood plywood and veneer to reconstituted wood products from 1989-1995.

Figure 2-10: Value of Product Shipments, 1989-1995



Source: U.S. Department of Commerce, International Trade Administration (1998).

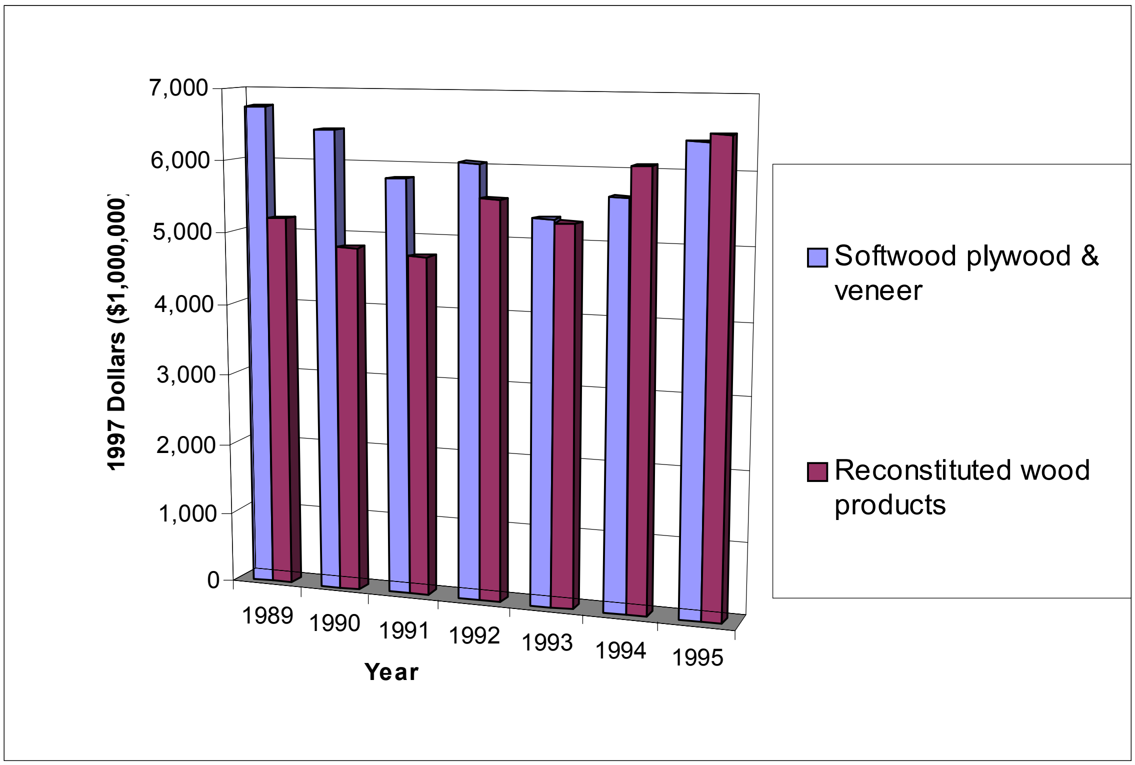
Trends in product shipments by volume (Exhibit 2-25) have been mixed for this group of industries. A statistical report produced by the U.S. Forest Service's Forest Products Laboratory (Spelter et al., 1997) focused on production of softwood plywood, Other Structural Panels (OSB and waferboard), particleboard and MDF as a group, and hardboard. Production by the Other Structural Panels category experienced high growth during the period, with 1997 production almost 130 percent greater than it was in 1988. Most of this increase can be attributed to the rapid increase in OSB's share of the structural panel market in recent years. Particleboard and MDF production grew a moderate 24 percent, while production of softwood plywood and hardboard declined by 19 percent and 12 percent respectively. Historically, softwood plywood production made a continuous steady climb through the late 1980's. At that point, the product began losing market share to OSB and production leveled off. This trend was accompanied by a certain amount of mill attrition (Spelter et al., 1997).

2.5.2.2 Domestic Consumption

Domestic, or apparent, consumption is the sum of domestic production and imports, less exports. The dollar value of apparent consumption (Exhibit 2-25) for softwood plywood and veneer was slightly lower in 1995 than it was in 1989. During the period, demand for softwood plywood and veneer dropped slightly in the early 1990s and reached its lowest level in 1993 and then began to climb. The value of domestic consumption of reconstituted wood products followed a similar pattern, increasing by 25 percent overall between 1989 and 1995. Drivers of consumption trends described here are the same as those presented in the previous section on production (increased demand for renovation, remodeling and new housing starts).

Figure 2-11 compares the apparent consumption of softwood plywood and veneer to reconstituted wood products from 1989-1995.

Figure 2-11: Apparent Consumption, 1989-1995



Source: U.S. Department of Commerce, International Trade Administration (1998)

Further examination of consumption volumes (Exhibit 2-25) shows the following trends for softwood plywood, other structural panels, particleboard and MDF as a group, and hardboard.

- By volume, apparent consumption of softwood plywood fell by over 20 percent in the last 10 years.
- At the same time, consumption of other structural panels increased by almost 200 percent.
- Particleboard and MDF were consumed at a slightly higher level in 1997 than they were in 1988, following a decline that ended in 1992.
- Hardboard consumption has fluctuated during the same 10 years, with a 16 percent decline from 1988.

Demand for softwood plywood and OSB combined experienced an annual average growth rate of 2-3 percent from 1970 to 1996 (Spelter et al., 1997). Most of this demand was met by increased production of OSB by both domestic and imported producers.

2.5.2.3 International Trade

Imports

Import value trends during the 1989-1995 period (Exhibit 2-24) show the constant dollar value of softwood plywood and veneer imports grew by 37 percent, particularly during the later years when the price for the commodity was rising rapidly and supplies of timber were declining. The ratio of imports to consumption of softwood plywood and veneer, while only 0.02, grew by 45 percent. The trade surplus for softwood plywood and veneer fell by 37 percent. Imports of reconstituted wood products more than doubled from 1989 to 1995 and the value of imports' share of consumption grew by almost 90 percent and the trade deficit nearly quadrupled.

Looking at import volumes (Exhibit 2-25) for softwood plywood, other structural panels, particleboard and MDF as a group, and hardboard, imports have made the biggest gains in the other structural panel category, taking advantage of the overall growth in demand for those products. Imports now supply over a third of the other structural panel market. Imports of hardboard have also grown, more than doubling in volume since 1988. There was a slight increase in imports of softwood plywood over the 10 years, and a decline of 40 percent in imports of particleboard and MDF. Exhibit 2-26 shows U.S. imports of by major region and trading partner.

Exhibit 2-26: 1997 U.S. Wood Products Imports by Region and Major Trading Partner

Trade Areas	Value* ($millions)	Share
NAFTA	8,128	85.1
Latin America	541	5.7
Western Europe	234	2.5
Japan/Chinese Economic Areas	35	0.4
Other Asia	458	4.8
Rest of World	150	1.6
World Total	9,554	100.0
Top 5 Countries		
Canada	7,991	83.6
Indonesia	340	3.6
Brazil	303	3.2
Mexico	137	1.4
Chile	108	1.1

*Includes Sawmills (SIC 2421), Softwood Plywood and Veneer (SIC 2436), Reconstituted Wood Products (2435), and Hardwood Plywood and Veneer (SIC 2435).
Source: U.S. Department of Commerce, International Trade Administration (1999).

Exhibit 2-26 shows that a vast majority, 85.1 percent, of U.S. imported wood products originated in the North American Free Trade Agreement (NAFTA) trade zone, of which only 1.5 percent originates in Mexico. The U.S. is also importing a significantly greater value of wood products than it is exporting. In 1997 the U.S. exported about $3,683 million of wood products while it imported $9,554 million.

Imports of softwood plywood and veneer grew by 24 percent from 1996 to 1997. Seventy-seven percent of U.S. softwood plywood and veneer imports are from Canada. This growth is consistent with the strong demand for softwood plywood and veneer during this period. The overall penetration of imports into the U.S. market is quite small (2 percent), which is attributed to the efficiency and low costs of U.S. softwood plywood and veneer producers (U.S. Department of Commerce, International Trade Administration, 1999).

Imports of reconstituted wood products grew by seven percent from 1996 to 1997. Seventy-eight percent of U.S. reconstituted wood products imports are from Canada. The overall penetration of imports into the U.S. market is significant (18 percent), which is attributed to recent capacity additions by Canadian reconstituted wood products producers (U.S. Department of Commerce, International Trade Administration, 1999).

Exports

Export trends during the 1989-1995 period (Exhibit 2-24) show the value of softwood plywood and veneer exports fell by 17 percent, particularly during the later years when the price for the commodity was rising rapidly and supplies of timber were declining. Economic crises in several Asian economies and the falling value of the Canadian dollar relative to the U.S. dollar played a role in this trend. The ratio of exports to value of shipments of softwood plywood and veneer fell by 11 percent. Exports of reconstituted wood products grew by 32 percent from 1989 to 1995 and the proportion of exports to shipments grew by almost 15 percent.

Export volumes (Exhibit 2-25) of hardboard quadrupled between 1988 to 1997, and constitute a significant portion of the total shipments from this industry. Exports of softwood plywood grew by 50 percent, and have become an increasingly important part of the sector's overall production. While total exports of other structural panels grew significantly, this market still remains a small portion of production. Exports of particleboard and MDF grew significantly through 1992 but have dropped steadily in recent years and are now just 15 percent higher than they were seven years ago. Exhibit 2-27 shows U.S. exports by major region and trading partner.

Exhibit 2-27: 1997 U.S. Wood Product Exports by Region and Major Trading Partner		
Trade Areas	**Value* ($millions)**	**Share**
NAFTA	1,001	27.5
Latin America	203	5.6
Western Europe	1,230	33.8
Japan/Chinese Economic Areas	837	23.0
Other Asia	205	5.6
Rest of World	161	4.4
World Total	3,638	100.0
Top 5 Countries		
Canada	800	22.0
Japan	636	17.5
Germany	292	8.0
United Kingdom	244	6.7
Mexico	202	5.5

*Includes Sawmills (SIC 2421), Softwood Plywood and Veneer (SIC 2436), Reconstituted Wood Products (SIC 2493), and Hardwood Plywood and Veneer (SIC 2435).
Source: U.S. Department of Commerce, International Trade Administration (1999).

By region, the U.S. exports its largest share (33.8 percent) of wood products to Western Europe. However, no single country in Europe imports the most significant share of U.S. wood products. Canada imports the largest share, 22 percent, due to two reasons. First, Canada's economy has strengthened. Second, on January 1, 1998 Canada completed its final stage of tariff removal as directed under the U.S.-Canada Free Trade Agreement. For the two aforementioned reasons, U.S. wood product exports to Canada increased 21 percent to $800 million in 1997 (U.S. Department of Commerce, International Trade Administration, 1999).

Continued growth in U.S. exports of wood products is dependent on an Asian economic revival, particularly in Japan's economy. In 1996, prior to the economic crisis, Japan was the largest importer of U.S. wood products. By 1997, Japan's share of U.S. wood product exports fell to 17 percent, a 24 percent decrease from the previous year. To further exacerbate the problem, U.S. exports to Japan are expected to decline an additional 30 percent in 1998 and 1999. Japan has undertaken several steps to revitalize its economy, such as the implementation of the Enhanced Initiative on Deregulation and Competition Policy. However, an increase in the Japanese consumption tax from 3 percent to 5 percent in 1996 is believed to have canceled out the potential gains of the Policy, resulting in the expected continuing decline in Japanese demand for U.S. plywood and wood products (U.S. Department of Commerce, International Trade Administration, 1999).

In 1997, exports of softwood plywood and veneer accounted for about 10.6 percent of wood product exports from the U.S. This was a 24 percent increase from the previous year, raising the total value of softwood plywood and veneer exports to $392 million, the highest level in eight years. Exports to the United Kingdom, Canada, and Germany, the top three importers of U.S. softwood plywood and veneer, experienced strong gains in 1997. A healthy European market has increased the demand for softwood plywood and veneer. In particular, the construction sector throughout Europe has seen an increase in activity. However, the recent strong performance of softwood plywood and veneer is not expected to continue due to an increasing international acceptance of OSB, and increasing competition from Canada, Brazil, and Indonesia (U.S. Department of Commerce, International Trade Administration, 1999).

Reconstituted wood products accounted for about 9.75 percent of U.S. wood product exports in 1997. Both the value and volume of reconstituted wood product exports increased by 15 percent from the previous year. Canada, the United Kingdom, Mexico, and Japan are the largest export markets for U.S. reconstituted wood. The continuing increase in exports is mainly attributable to a growing international acceptance of OSB. Exports are expected to continue to grow in the upcoming years, but at a slower rate than they did in 1997 (U.S. Department of Commerce, International Trade Administration, 1999).

2.5.3 Prices

An index of the change in producer prices for lumber and wood products is shown below in Exhibit 2-28 This index was compiled by the Bureau of Labor Statistics.

Exhibit 2-28: Lumber and Wood Products Producer Price Index, 1988-1997 (1982 = 100)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	88-97
Lumber and wood products (SIC 24)	122.1	125.7	124.6	124.9	144.7	183.4	188.4	173.4	179.8	194.5	
Change from Previous year		2.9%	-0.9%	0.2%	15.9%	26.7%	2.7%	-8.0%	3.7%	8.2%	59.3%

Source: U.S. Bureau of Labor Statistics (1999).

The biggest annual price increases for lumber and wood products occurred in 1992 and 1993 and the overall price increase between 1988 and 1997 was nearly 60 percent. Another source, the Forest Products Laboratory (FPL), that is part of the U.S. Department of Agriculture, provides a statistical report with disaggregated price indices presented in Exhibit 2-29. Note that the base year of the BLS index is 1982 while the base year for the FPL data is 1992.

Exhibit 2-29: Producer Price Indices of Plywood and Wood Composite Products (1992 =100)										
Year	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**88-97**
Softwood Plywood	74.2	84.5	81.4	82.2	100.0	115.4	120.3	128.0	118.3	119.3	
Change from Previous year		0	0	0	0	0	0	0	0	0	1
Particleboard	103.4	106.0	96.7	96.5	100.0	114.8	128.5	128.4	123.3	117.6	
Change from Previous year		0	0	0	0	0	0	0	0	0	0
Hardboard	100.8	100.9	98.6	96.7	100.0	106.5	109.1	113.2	115.8	119.0	
Change from Previous year		0	0	0	0	0	0	0	0	0	0
Source: Howard (1999).											

Softwood plywood experienced the biggest price increase, 61 percent over the 1988 to 1997 period, with volatile price changes within the period with the biggest annual increases came in 1992 and 1993. Overall prices for particleboard rose 14 percent, but the large price increases in 1993 and 1994 have been offset by price declines in the last three years presented. Hardboard prices grew by 18 percent, with mostly steady annual price increases from 1994 on.

The market conditions and the factors that affect softwood plywood prices, supply and demand are somewhat analogous to those that affect prices for softwood lumber. For example, the cost of timber and transportation, foreign supply and demand, inventory levels as well as construction-driven demand are factors that affect market prices for softwood lumber, as well as softwood plywood and other structural panels.

A recent study produced by WEFA (Wharton Economic Forecast Associates) on trends in the softwood lumber market provides some clues about the future of the three industries examined here. Softwood lumber prices have climbed steadily since November of 1998. This climb included some higher than expected price increases in the early summer of this year. The WEFA report cites strong domestic demand related to housing construction as one underlying cause of the price increases in softwood lumber. Current price conditions are partially explained by the expectation that housing demand has peaked while remaining strong, exports to Asia will increase as those economies recover, and imports from Canada will decrease.

For the most part, the WEFA report indicates that the construction industry has responded to climbing prices by switching to "just-in-time" buying of products. Buyers are hoping that prices will begin falling and are postponing inventory build-up during this period of climbing prices. Another short-run factor affecting prices during the second quarter of this year was a constraint on truck and rail transportation availability. WEFA concludes that the market has reached equilibrium for the moment, although this could change if inventories increase at the same time that construction-driven demand levels off or falls (WEFA, 1999).

Exhibit 2-30 presents the industry-reported free on board (f.o.b.) prices of southern plywood, OSB and particleboard from 1989 to 1996. These are the product prices prior to shipping costs and distributor mark-ups. On an adjusted basis, these prices reflect the trends demonstrated in the previous exhibit, with large price increases during early 1992, falling back to or below 1989 levels by 1996.

Exhibit 2-30:
F.O.B. Prices of Southern plywood, OSB, and Particleboard
($ per cubic meter)

Year	Southern plywood		OSB		Particleboard	
	As Reported	Adjusted $1997	As Reported	Adjusted $1997	As Reported	Adjusted $1997
1989	184	229	166	206	129	160
1990	168	200	124	148	122	145
1991	175	201	144	165	120	138
1992	226	252	208	232	129	144
1993	257	279	227	247	152	165
1994	274	291	252	268	171	182
1995	267	277	242	251	173	180
1996	231	235	184	187	165	168
89-96		2.8%		-10.1%		4.5%

Prices adjusted by the GDP deflator.
Source: Spelter, et al. (1997).

Softwood Plywood

Long-term price trend data presented in the report “Review of the Wood Panel Sector in the U.S.” showed a fairly stable price pattern for softwood plywood between 1977 and 1991. At that point, prices increased steadily from 1992 to their peak in 1994. Prices declined over 15 percent from 1994 to 1996. The report authors observe that with softwood plywood prices at their current high levels, producers will have a difficult time competing against the newer, more cost effective OSB producers. However, the authors note that softwood plywood producers may be able to hang on to market share and justify the higher prices by differentiating their product as a premium construction material (Spelter et al., 1997).

Oriented Strand Board

The “Review of the Wood Panel Sector in the U.S.” report presents OSB price data over time that shows a 27 percent decline in price during 1995 and 1996, after a continuous trend of price increases since 1977. The report’s authors attribute this weakening to a rapid increase in capacity that contributed to an increase in production, putting downward pressure on prices. Due to the ability of users to substitute plywood for OSB, these low OSB prices have only added to the growing market share enjoyed by OSB. Falling prices have cut into the net revenues of OSB producers, after a period from 1992 to 1995 where the industry enjoyed excellent cost/price margins, drawing more investment to OSB production capacity (Spelter et al., 1997).

Particleboard

Particleboard price data from 1984 to 1992 presented in the report, “Review of the Wood Panel Sector in the U.S.” show some variation within a relatively small range, with a substantial price increase in the years 1993 to 1995, declining slightly in 1996. The price trend for particleboard from 1977 to 1996 is very similar to that of plywood. One reason for this similarity is the close relationship of particleboard input costs to the plywood manufacturing industry. About 25 percent of industry production cost is for wood inputs, which are primarily made up of wastes from lumber and plywood production (Spelter et al., 1997).

Medium Density Fiberboard (MDF)

Producer-reported MDF prices were \$235 per ton in September of 1996 and declined by 15 percent to \$205 per ton as of April, 1997. Despite this drop, there continues to be a price gap between MDF and less costly particleboard, although increasingly narrow. The price drop was attributed to MDF production capacity expansions that resulted in an increase in supply, putting pressure on the profits of MDF producers (Spelter et al., 1997).

Structural Wood Members

Producer-reported prices for I-joists reach a high in 1994 and have been declining since that time. Recent price conditions have made I-joists more competitive with traditional 2" by 10" lumber on an installed cost basis, typically for floor framing applications. In particular, I-joists are price competitive with lumber when lumber prices are high. However, precise estimates of market prices are difficult to obtain. The authors found that prices varied depending on whether the product was being sold under a brand name, on sale, or under a volume discount. Laminated veneer lumber, presented in the Review at \$550/m^3 f.o.b., is generally more expensive than 2" by 10" lumber, and is used mostly for structural applications or as an input to I-joists (Spelter et al., 1997).

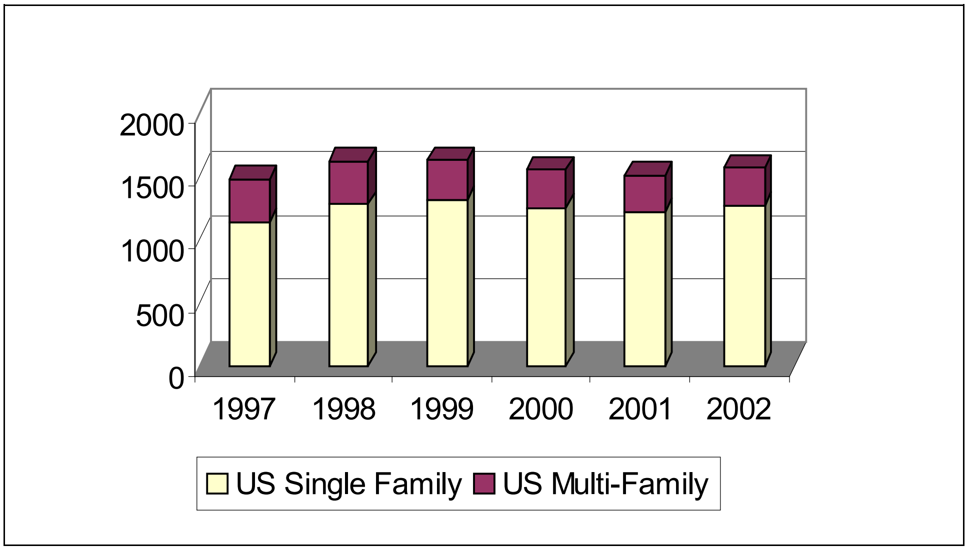
2.5.4 Market Forecasts

Production and Consumption

A study published by WEFA in the summer of 1999 examined housing starts and concluded that housing starts will decline throughout 1999, resulting in a decline in lumber demand (WEFA, 1999). However, housing starts continue to remain strong well into 1999, keeping demand for lumber and other wood products for construction strong as well. The WEFA study also noted that another factor affecting demand for softwood lumber is interest rates and concluded that rising interest rates could have a dampening effect on demand. Higher interest rates will not only affect the affordability of new homes, but also will curtail purchases of existing homes and mortgage refinancing activity, both major sources of demand for materials used in home remodeling. Based on the relationship between housing starts, purchases of existing homes, and remodeling and renovation (the construction-based demand for plywood and other products examined in this profile), this decline in demand can be expected to affect the plywood and wood composite industries, as 60 to 70 percent of their output goes to the construction sector. WEFA expects the industry to experience most of this decline in 2000 (WEFA, 1999).

The most recent wood products market outlook published by APA - The Engineered Wood Association (APA) shows U.S. housing starts exceeding expectations in 1999 (APA, 1999d). Similar to the WEFA study, the forecast expects higher interest rates in the future to play a role in reducing future housing demand in the period from 2000 to 2002. The report also forecasts the same trends for residential improvements and repairs, but notes the long-term outlook for remodeling to be good as home ownership increases. Figure 2-12 below provides information from the APA on U.S. housing starts. The APA forecast also reports the industrial outlook is good for other wood-consuming sectors. The APA expects demand for furniture and fixtures to remain healthy, but not at peak levels as existing home sales will be declining from the current peak rates. Nonresidential construction is forecasted to peak in 1999 and 2000 with declines in 2001 and 2002. Increased school construction will be a driving factor in the upward trend for nonresidential construction (APA, 1999d).

Figure 2-12: APA Projected Housing Starts (000s)



Source: APA (1999d).

In addition to providing overall forecasts for the market demand, the APA outlook includes detailed forecasts of the demand for and production of structural panels, specifically softwood plywood and OSB.[8] These forecasts, summarized in Exhibit 2-31, show the demand from each of the major markets for structural panels, in order of their share of market demand: new residential construction, remodeling, industrial uses including furniture and materials, nonresidential construction, and foreign demand. The industrial use category will have the largest domestic demand increase over the forecast period, 8 percent. Foreign demand shows significant increase of 78 percent. However, reductions in U.S. production as imports gain a large market share point to increased pressure from imports.

[8]While the report does not specify whether the forecast is exclusively for softwood plywood or includes hardwood plywood, it is assumed to cover softwood plywood only, as hardwood plywood is typically not used for structural panels.

Exhibit 2-31: APA Forecasted Structural Panel Production and Demand (million sq. ft. 3/8" basis)					
	1999	2000	2001	2002	% Change
New Residential	18,415	17,715	17,585	18,435	0.00
Remodeling	7,440	7,440	7,475	7,550	1%
Industrial/Other	6,575	6,720	6,875	7,085	8%
Nonresidential	3,800	3,800	3,735	3,670	-3%
Domestic Demand	**36,230**	**35,675**	**35,670**	**36,740**	1%
Foreign Demand	990	1,275	1,705	1,760	78%
Total Demand	**37,220.00**	**36,950.00**	**37,375.00**	**38,500.00**	3%
Imports (Canada only)	(7,345)	(7,400)	(8,300)	(9,330)	27%
Total Domestic Production	**29,875.00**	**29,550.00**	**29,075.00**	**29,170.00**	-2%
Plywood	18,135	17,450	16,575	16,295	-10%
OSB	11,740	12,100	12,500	12,875	10%
Source: APA (1999d).					

The APA forecasts for panel capacity and production provide additional insight into substitution between softwood plywood and OSB. Exhibit 2-32 below shows these projected trends. Softwood plywood shows significant decreases in capacity (down 24 percent) and production (down 16 percent) from 1992 to 2002. Meanwhile, OSB has shown significant increases in capacity and production and is projected to continue to capture the market for structural panels. The relatively constant capacity utilization in the plywood sector with significant decreases in production supports the forecast of expected plant closures in the future, while the opposite is true for OSB with expected increases in the number of facilities.

Exhibit 2-32: APA Actual and Forecasted Structural Panel Capacity and Production (million Sq Ft, 3/8" Basis)						
	Plywood			OSB		
	Capacity	Production	Utilization	Capacity	Production	Utilization
1992	23,700	19,332	82%	7,040	6,653	95%
1993	23,300	19,315	83%	7,560	7,002	93%
1994	21,875	19,638	90%	7,920	7,486	95%
1995	22,070	19,367	88%	8,830	7,903	90%
1996	21,150	19,181	91%	11,285	9,314	83%
1997	19,275	17,965	93%	11,575	10,534	91%
1998	19,075	17,776	93%	12,050	11,227	93%
1999	19,275	18,135	94%	12,250	11,740	96%
2000	18,835	17,450	93%	13,120	12,100	92%
2001	18,260	16,575	91%	13,725	12,500	91%
2002	18,010	16,295	90%	14,380	12,875	90%
% Change	-0.24	-0.16		1.04	0.94	

Shaded areas represent estimated values.
Source: APA (1999d).

The spring edition of the APA's on-line Engineered Wood Journal reports that the expectation of overall production of structural panels in 1999 would be roughly the same as it was in 1998 (APA, 1999b). However, the long term prospects for the softwood plywood and veneer sector indicates that the industry is in for a difficult time. APA members are bracing for a battle to preserve market share, a particularly challenging goal in the face of expected declines in housing starts. Further, the APA's spring journal focuses on the multiple pressures on its market share. A primary source of pressure is from the expanding sentiment that wood products are not environmentally sensitive. They are concerned that environmental advocacy groups are becoming increasingly successful at convincing major corporations that the use of wood products should be curtailed in order to preserve trees and forested land (APA, 1999b).

Shipments of reconstituted wood products are expected to increase 4 percent in 1998 and 1999 according to the U.S. Industry and Trade Outlook 1999. Strong demand in the furniture market has proved beneficial to particleboard, MDF, and hardboard producers. For reconstituted wood products, the forecast predicts an increase in growth of 3.3 percent per year from 1998 to 2003 as furniture markets and residential construction remain healthy (U.S. Department of Commerce, International Trade Administration, 1999).

In their article, "A Look at the Road Ahead for Structural Panels, " authors Spelter and McKeever compare the situation of the OSB industry in 1996 to that of the MDF industry in the 1970's. The MDF industry experienced a major upheaval in the 1970's when an economic slump hit the U.S. right when the industry had added a significant amount of capacity. In this article, Spelter looks at whether the OSB industry is in danger of experiencing the same process. While the OSB industry's capacity additions reflect those of the MDF industry, the economic conditions in the late 1990's lead the author to conclude that the OSB industry conditions probably will not lead to closures like those experienced by the MDF sector in the seventies. However, Spelter does not expect that the OSB producers will continue to enjoy the gains in market share they have experienced over the last 10 to 15 years. He cites the near 100 percent market share held by OSB in the northeast and the Midwest as the peak of growth opportunity in those markets. Further, the market share split in the south and west may have stabilized due to the entrenchment of softwood plywood in those areas (Spelter and McKeever, 1996).

At the same time, manufacturers of substitutes for wood-based construction such as steel, cement and plastic, are aggressively pushing their products hard on the construction industry using the argument that their products are environmentally friendly, and have advantages in the areas of price stability, quality, and performance. In-roads by these competing non-wood substitutes are expected to continue as overall costs for wood-based products continue to climb and the underlying price advantage that wood-products have traditionally held is undermined. Other concerns expressed the Engineered Wood Journal include having adequate supply of timber in the long run to meet producers' needs (APA, 1999b).

International Trade

The hope for the plywood and composite wood products export markets is that declining domestic prices and economic recovery, particularly of the Asian economies, will boost the demand for U.S. produced wood-based products. This is of particular importance to the softwood plywood industry, as they are currently exporting approximately 10 percent of their production. Another international driver of demand for domestically produced wood-based building products is the effect of regulatory changes in countries such as Japan and Korea to promote wood-based housing construction. WEFA attributes most of the increases in exports from North America during 1999 to the U.S. rather than Canada. Continued growth in this market is limited by expected falling housing starts in Japan (WEFA, 1999). Any future changes in the U.S.-Canadian exchange rate will likely have a positive effect on exports in the short-term (in the next 2-3 years), as will any modifications to tariff structures in place for U.S. exports.

The APA outlook includes an international forecast that projects a positive outlook for wood product exports from 2000 to 2002. This projection is based on expectation that the markets in Europe, Mexico, South America, and Japan will pick up in 2000, causing a weaker dollar and better overall climate for exports as (APA, 1999d). The strength of the dollar in 1999 placed U.S. wood products at a disadvantage in world markets, but APA projects significant increases in exports from 2000 to 2002 (see Exhibit 2-31 for structural panel export forecast). The 1999 fall edition of the APA's Engineered Wood Journal pointed to continuing pressures on U.S. exports coming from recent increases in European production capacity as posing a sizeable challenge to structural wood panel products in the U.S. (APA, 1999c).

The *U.S. Industry & Trade Outlook* notes growth in European markets and removal of tariff barriers throughout the world as contributing to modest growth in the wood products industry. At the same time, the report cautions that economic conditions in Asia, especially Japan, may be of some concern. While OSB is making significant strides in residential construction in Japan and elsewhere, an Asian recession could threaten this progress. Softwood plywood is still considered the material of choice in many markets unfamiliar with OSB. Nontraditional markets such as South America, eastern Europe, and China could provide significant opportunity for growth in the wood products industry, especially softwood plywood (U.S. Department of Commerce, International Trade Administration, 1999).

Prices

The recently published WEFA report on softwood lumber forecasts a 5 percent increase in the price index for those products during the third quarter of 1999 from the previous quarter. Because of the expected leveling off or decline in construction, prices are expected to decline during the year's fourth quarter. Based on WEFA's forecast, overall annual prices in 1999 are expected to be about 8 percent higher than they were in 1998. Year 2000 prices are forecast to rise only marginally over 1999.

The "Review of the Wood Panel Sector in the U.S. and Canada" presents a forecast for structural wood panels (softwood plywood and OSB combined). In the 1997 report, Spelter and his co-authors assume that the long run average annual growth in demand for softwood plywood and OSB combined will continue at the historical 3 percent rate. Using that assumption, these industries will have excess capacity until 2001, when capacity utilization reaches 95 percent (Spelter et al., 1997).

This forecast concluded that current and planned production capacity will exceed demand until 2001. This excess capacity will continue to put downward pressure on prices, a trend that began in 1996. The report authors expect that this price pressure will result in a market correction, requiring both the plywood and the OSB sectors to adjust capacity through the closure of some high cost, low productivity plants.

2.6 References

Abt Associates Inc. 1997. *Market Profile of the Adhesive Industry*. Prepared for Wendy Hoffman, Regulatory Impacts Branch, Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460.

American Plywood Association - The Engineered Wood Association. 1999a. Web page information on product characteristics and manufacturing. Tacoma, WA: APA - The Engineered Wood Association. http://www.apawood.org/

American Plywood Association - The Engineered Wood Association. 1999b. *Engineered Wood Journal Online*. Tacoma, WA: APA - The Engineered Wood Association. Spring. http://www.apawood.org/news/journal/spring99.html

American Plywood Association - The Engineered Wood Association. 1999c. *Engineered Wood Journal Online*. Tacoma, WA: APA - The Engineered Wood Association. Fall. http://www.apawood.org/news/journal/fall99.html

American Plywood Association - The Engineered Wood Association. 1999d. *Market Outlook. Lumber, Structural Panels, and Engineered Wood Products: 2000 - 2002.* Tacoma, WA: APA - The Engineered Wood Association.

American Plywood Association - The Engineered Wood Association. 1998. *Engineered Wood Journal Online*. Tacoma, WA: APA - The Engineered Wood Association. Fall. http://www.apawood.org/news/journal/fall98.html

American Plywood Association - The Engineered Wood Association. 1997. *Design/Construction Guide: Residential & Commercial*. Tacoma, WA: APA — The Engineered Wood Association.

Bentley, Jerome T., C. C. Lawson, and D. Crocker (Mathtech, Inc.) 1992. *Economic Impacts of Alternative NESHAPS on the Wood Furniture Industry*. Prepared for U.S. Environmental Protection Agency, Cost and Economic Impact Section, Emissions Standards Division, office of Air Quality Planning and Standards. September.

Buongiorno, Joseph. 1996. "Forest sector modeling: a synthesis of econometrics, mathematical programming, and system dynamics methods. *International Journal of Foresting*, 12, pp. 329-343.

CINTRAFOR. 1999. "Asian Crisis Hits PNW: Export Revenues Down 27% Between 1998-1998." Fact Sheet #29. January. http://www.cintrafor.org/FS29.htm

Columbia Forest Products. 1999. "About our Company." Portland, OR. www.columbiaforestproducts.com

Composite Panel Association. 1998. *1997 Annual Shipments Report & Downstream Market Survey: U.S./Canada Particleboard & Medium Density Fiberboard Industry*. Gaithersburg, MD: Composite Panel Association. http://www.pbmdf.com/pubs/shipments97.html

Dirks, John. 1991. *Perspectives on Wood Furniture Production, Marketing and Trade: A Survey of Research Results*. CINTRAFOR Special Paper #1. http://www.cintrafor.org/SP01.htm

Dun & Bradstreet. 1999a. D-U-N-S Number Database. Murray Hill, NJ: Dun & Bradstreet. May 24. http://www.dnb.com/dunsno/dunsno.htm

Dun & Bradstreet. 1999b. *Industry Norms & Key Business Ratios 1998-1999*, Information for SIC Codes 2435, 2436, 2439, and 2493.

Eastin, Ivan, C. Lane, T. Waggener, R. Fight, J Barbour. 1996. *An Assessment of the Market for Softwood Clearwood Lumber Products*. CINTRAFOR Working Paper No. 59. http://www.cintrafor.org/WP59.htm

Financial Times Limited. 1999a. "Boise Cascade Corporation." Company Briefs/Company Financials. http://www.ft.com

Financial Times Limited. 1999b. "Georgia-Pacific Corporation." Company Briefs/Company Financials. http://www.ft.com

Financial Times Limited. 1999c. "Louisiana-Pacific Corporation." Company Briefs/Company Financials. http://www.ft.com

Financial Times Limited. 1999d. "Willamette Industries, Inc." Company Briefs/Company Financials. http://www.ft.com

Gale Business Resources. 1999. Online business database. Essays by industry SIC code downloaded from http://www.gale.com.

Howard, James L. 1999. *U.S. Timber Production, Trade Consumption, and Price Statistics 1965-1997.* General Technical Report FPL-GTR-116. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, 76p. July.

International Paper. 1998. "International Paper, Union Camp Corporation Announce Merger." Release, November 24. http://www.internationalpaper.com/ca/page/press_releases.cgi?funcs=links&ID=493957&back=archive

Louisiana-Pacific Corporation. 1999.
"Headquarters: Product Lines Overview" http://www.lpcorp.com/hq/products.html
"Louisiana-Pacific Corp. Successfully Completes Tender Offer for ABT Building Products Corp." Release No.: 112-2-9. February 24. http://www.lpcorp.com/pressrel/19990224_gen_pr.html
"Louisiana-Pacific to Acquire Evans Forest Products, Ltd." Release No.: 138-8-9. August 24. http://www.lpcorp.com/pressrel/19990824_gen_pr.html
"Louisiana-Pacific Corp. Successfully Completes Tender Offer for Le Groupe Forex." Release No.: 140-9-9. September 10. http://www.lpcorp.com/pressrel/19990910_gen_pr.html

McKeever, Davis B. 1997. *Engineered Wood Products: A Response to the Changing Timber Resource*. Pacific Rim Wood Market Report, November.

Midwest Research Institute. 1999. Memorandum from Becky Nicholson and Melissa Icenhour to Mary Tom Kissell and Larry Sorrels, U.S. EPA: "Preliminary facility-specific cost estimates for implementation of the plywood and composite wood products NESHAP." October 20.

Moody, Russell C. and J. Y. Liu. 1999. "Chapter 11: Glue Structural Members," *Wood handbook--Wood as an engineering material*. Gen. Tech. Rep. FPL-GTR-113. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.

PR NewsWire. 1999a.
"Boise Cascade to Acquire Furman." June 15.
"Boise Cascade Reports Sharply Increased Second-Quarter Earnings." July 15.
http://www.prnewswire.com/gh/cnoc/comp/109525.html

PR NewsWire. 1999b.
"Georgia-Pacific Group Reports Fourth Quarter and 1998 Results." January 26.
"Georgia-Pacific to Construct Oriented Strand Board Plant in Arkansas." February 23.
"Georgia-Pacific Group Reports Improved First Quarter Earnings and All-Time Quarterly Record for Building Products." April 22.
"Georgia-Pacific Completes Merger with Unisource Worldwide, Appoints Key Leadership; Sets Target for Resumption of Share Repurchases." July 6.
http://www.prnewswire.com

PR NewsWire. 1999c.
"Willamette Industries Reports Fourth Quarter Earnings." January 20.
"Willamette Industries Completes Darbo Acquisition." June 22.
"Willamette Industries to Build Particleboard Plant; Name New CFO." August 5
http://www.prnewswire.com/comp/971763.html

PR NewsWire. 1998. "Willamette Industries Finalizes Purchase of French Plant." March 4. http://www.prnewswire.com/gh/cnoc/comp/109525.html

PR NewsWire. 1997. "Willamette Industries to Acquire Mexico City Box Plant." December 15. http://www.prnewswire.com/comp/971763.html

Spelter, Henry. 1998. *Substitution*, Timber Processing, March.

Spelter, Henry, D. McKeever, and I. Durbak. 1997. *Review of Wood-Based Panel Sector in United States and Canada*, General Technical Report FPL-GTR-99. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 45p.

Spelter, Henry. 1996. "Emerging Nonwood Building Materials in Residential Construction." *Forest Products Journal*, 46(7/8).

Spelter, Henry and T. McKeever. 1996. "A Look at the Road Ahead for Structural Panels." C. C. Crow Publications, Inc., 11(5). October.

Spelter, Henry. 1995. "Capacity Changes in U.S. Particleboard, Southern Pine Plywood, and Oriented Strandboard Industries." *Canadian Journal of Forest Resources*, 25: 614-620.

U.S. Bureau of Labor Statistics. 1999. Web site. http://stats.bls.gov/ppihome.htm

U. S. Department of Commerce. 1999a. *1997 Census of Manufactures, Industry Series*:
Hardwood Veneer and Plywood, EC97M-3212A
Softwood Veneer and Plywood, EC97M-3212B
Engineered Wood Member (Except Truss) Manufacturing, 1997 Economic Census, Manufacturing Industry Series, EC97M-3212C
Truss Manufacturing, EC97M-3212D
Reconstituted Wood Products Manufacturing, EC97M-3212E

U. S. Department of Commerce. 1999b. *1997 Census of Manufactures, Industry Series*:
Adhesive Manufacturing, EC97M-3255B
Wood Office Furniture Manufacturing, EC97M-3372A

U.S. Department of Commerce. 1997. *Current Industrial Reports, Survey of Plant Capacity, 1997.*

U.S. Department of Commerce. 1995a. *1992 Census of Construction Industries, Industry Series: General Contractors — Single-Family Houses*, Industry 1521. CC92-I-1. Washington, D.C.: U.S. Government Printing Office. June.

U. S. Department of Commerce. 1995b. *1992 Census of Manufactures, Industry Series, Millwork, Plywood, and Structural Wood Members, Not Elsewhere Classified, Industries 2431, 2434, 2435, 2436, and 2439.* MC92-I-24B. Washington, D.C.: U.S. Government Printing Office.

U. S. Department of Commerce. 1995c. *1992 Census of Manufactures, Industry Series, Household Furniture, Industries 2511, 2512, 2514, 2515, 2517, and 2519.* MC92-I-25A. Washington, D.C.: U.S. Government Printing Office.

U. S. Department of Commerce. 1992. *Census of Manufactures, Subject Series: General Summary*, MC-92-SC-1.

U.S. Department of Commerce. No date. *Census of Manufactures*:
Industry 2435, Hardwood Veneer and Plywood
Industry 2436, Softwood Veneer and Plywood
Industry 2439, Structural Wood Members, N.E.C.
Industry 2493, Reconstituted Wood Products

U.S. Department of Commerce, International Trade Administration. 1999. *U.S. Industry &Trade Outlook.*

U.S. Department of Commerce, International Trade Administration. 1998. "Outlook Trend Tables." http://www.ita.doc.gov/industry/otea/usito98/tables.htm.

U.S. Department of Labor, Occupational Safety and Health Administration. No date. SIC descriptions. http://www.osha.gov/oshstats/sicser.html.

U.S. Environmental Protection Agency. 1998. *Industry Specific Information Collection Request (ICR) for the Development of Plywood and Particleboard Maximum Achievable Control Technology (MACT) Standards*.

U.S. Environmental Protection Agency. 1995. *Lumber and Wood Products*, Office of Compliance Sector Notebook Project.

U.S. Environmental Protection Agency. 1992. "Economic Impacts of the Alternative NESHAPS on the Wood Furniture Industry."

U.S. Small Business Administration. 1999. *Small Business Size Standards Matched to SIC Codes*, http://www.sba.gov/regulations/siccodes/siccodes.html.

WEFA. 1999. Informational Web site on softwood lumber. http://www.wefa.com/news/stories/99/lumber.cfm

Weyerhaeuser. 1999a. "Weyerhaeuser Completes Acquisition of MacMillan Bloedel; Haskayne to Join Weyerhaeuser Board of Directors. Release. November 1. http://www.weyerhaeuser.com/news/mb/default.asp

Weyerhaeuser. 1999b. "Facts About Weyerhaeuser." Tacoma, WA: Weyerhaeuser Company. http://www.weyerhaeuser.com/facts/weyer.htm

Willamette Industries, Inc. 1999. "Willamette Industries to Build $85 Million Facility in South Carolina." Release. http://www.wii.com/newsexp.htm

Youngquist, John A. 1999. "Chapter 10: Wood-Based Composite and Panel Products." *Wood handbook--Wood as an engineering material.* Gen. Tech. Rep. FPL-GTR-113. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.

3 REGULATORY ALTERNATIVES, EMISSIONS, EMISSION REDUCTIONS, AND CONTROL AND ADMINISTRATIVE COSTS

3.1 Regulatory Alternatives

3.1.1 Background

Section 112 of the Clean Air Act (CAA) requires that EPA establish NESHAP for the control of hazardous air pollutants (HAP) from both new and existing major sources. A major source of HAP is defined as any stationary source or group of stationary sources within a contiguous area and under common control that emits or has the potential to emit, considering controls, in the aggregate, 10 tons per year or more of any single HAP or 25 tons per year of combined HAP. The CAA requires the NESHAP to reflect the maximum degree of reduction in emissions of HAP that is achievable. This level of control is commonly referred to as the maximum achievable control technology, or MACT. The MACT floor is the minimum control level allowed for NESHAP and is defined in Section 112 (d) (3) of the CAA.

The requirements for new sources are potentially more stringent than those for existing sources. For new sources, Section 112(d)(3) of the CAA requires EPA to set standards for each category or subcategory that are at least as stringent as “the emission control that is achieved in practice by the best controlled similar source.” For existing sources, Section 112(d)(3) requires the HAP standards to be no less stringent than “the average emission limitation achieved by the best-performing 12 percent of the existing sources” for source categories or subcategories with at least 30 sources and “the average emission limitation achieved by the best-performing five sources” for source categories or subcategories with fewer than 30 sources.[1]

In a previous rulemaking, the EPA promulgated a final rule (59 FR 29196) that presented the Agency’s interpretation of the statutory language regarding the basis of the MACT floor.[2] The EPA’s interpretation of the “average emission limitation” is that it means a measure of central tendency, such as the median. If the median is used when there are at least 30 sources, then the emission level achievable by the source and its control system that is at the bottom of the top 6 percent of the best-performing sources (i.e., the 94th percentile) then becomes the MACT floor. For example, assume that there are 100 sources, and HAP emissions from approximately 15 of these sources (15 percent nationwide) are controlled using thermal oxidizers and the HAP emissions from the remainder of the sources are uncontrolled. In this example, the 94th percentile is represented by the control system applied to the source ranked at number 6 (6/100 = 6 percent). However, in this example, the same type of add-on control technology used by the source at the 94th percentile (thermal oxidizer) is used by sources ranked below the 94th percentile. Assuming that there are no significant design or operational differences between the different thermal oxidizers that would affect their performance, all 15 sources equipped with thermal oxidizers would be considered representative of the MACT floor. Thus, when determining the performance level of the MACT floor technology, EPA would evaluate the available data for any and all of the sources equipped with thermal oxidizers.

When there are less than 30 sources, the emission level achievable by the source and its control system that is the median of the 5 sources represents the MACT floor. For example, if there are 10 sources nationwide and the emissions from 2 of these sources are controlled with thermal oxidizers and the emissions from the remaining 8 are uncontrolled, then the MACT floor is "no emission reduction" because the top 5 sources include the 2 that are controlled, plus 3 that are uncontrolled. In this example, the median source (the source ranked "number 3") is uncontrolled.

3.1.2 Control Technologies and Practices in MACT Floor Determination

Control systems in use the PCWP industry include add-on control systems and incineration of process exhaust in an onsite combustion unit. The potential for pollution prevention also exists in the PCWP industry; however, there are no known and demonstrated pollution prevention techniques that can be universally applied across the industry. The emissions from PCWP process units are associated with the wood and/or resin processed. Thus, switching to alternative fuels (e.g., switching from wood fuel to natural gas) would not significantly reduce emissions and would not be economical for many facilities that use their wood waste as fuel. Facilities cannot readily switch wood types (e.g., from softwoods to hardwoods) for several reasons: (1) equipment at each facility is often designed for a particular wood type; (2) product characteristics would change; and (3) PCWP facilities are located near their wood source. Over the past decades, the PCWP industry and its resin suppliers have responded to pressure to reduce the HAP content of resins. It is expected that this trend will continue into the future (e.g., resins with lower HAP content are likely to be developed). Resin reformulation is a slow, trial-and-error process that must be completed by individual facilities and their resin suppliers so that product quality is maintained. At this time, no information is available to determine the degree of emission reduction that can be achieved through resin reformulation. The achievable emission reduction would be very facility-specific, and may not be comparable to the emission reduction achievable with add-on control systems because emissions from the wood would remain. At the present time, few (if any) facilities use pollution prevention measures to achieve an emission reduction comparable to that of add-on incineration-based control systems. Therefore, this analysis focuses on add-on control devices.

Available data on control device performance were reviewed to determine which add-on control systems are best at reducing HAP emissions. Because total hydrocarbons (THC), formaldehyde, and methanol are the most prevalent pollutants emitted from the PCWP industry and represent the majority of the available data on control device performance, the control systems were analyzed based on their ability to reduce emissions of these three pollutants. Although THC is not a HAP, control systems that are effective in reducing THC emissions are generally effective in reducing HAP emissions.

The available control device performance data for the PCWP industry shows that only two types of add-on air pollution control devices consistently and continuously reduce HAP emissions: incineration-based controls (including regenerative thermal oxidizers [RTOs], regenerative catalytic oxidizers [RCOs], and incineration of pollutants in onsite process combustion equipment [process incineration]) and biofilters. For control systems that use onsite process combustion equipment (e.g., power boilers or fuel cells) to reduce emissions, only those systems that route 100 percent of the process unit's exhaust to the combustion equipment are included in the "incineration-based controls" category. Several of the process incineration systems are fully integrated systems that combine heat/energy recovery with pollution control. Systems that only incinerate a portion of the process unit exhaust stream (e.g., less than 75 percent) are referred to as "semi-incineration" and are not included in the incineration-based controls category.

Those PCWP facilities that practice semi-incineration take a portion of the exhaust stream and then route these emissions to a burner for use as combustion air. In those situations, the HAP emissions in the slip stream are actually combusted. However, some facilities with direct-fired dryers (i.e., dryers that receive hot exhaust air directly from combustion source) that practice semi-incineration may also use the dryer exhaust gas slip stream (or fresh air) to cool the exhaust gas from the burners in "blend chambers." [3] When the exhaust gas is routed to the blend chamber, the HAP in the exhaust gas are not combusted in the dryer, and if the dryer emissions are uncontrolled, these HAP are ultimately emitted to the atmosphere. The amount of exhaust gas recycled either to the burner or to the blend chamber can vary over time. Decisions about how much of the recycled exhaust stream are used as combustion air and when and how much exhaust air is used in a blend chamber generally are made by the equipment operators and are affected by process conditions such as the moisture content of the incoming wood furnish (which affects the target dryer operating temperature) and the desired amount of water removal.[4] Thus, semi-incineration is used to maintain the heat balance in the drying system (e.g., combustion unit and dryer). There is a lack of detailed information on how the semi-incineration process works at each facility, and thus, the actual HAP emission reductions that are achieved at PCWP facilities that practice semi-incineration cannot be determined/verified. In addition, it may not be possible to retrofit semi-incineration onto existing process units, and therefore, semi-incineration may not be an option for process units that were not originally designed to incorporate semi-incineration. For the reasons stated above and for the purpose of establishing MACT floors for the PCWP source category, semi-incineration is not considered a verified control technique for reducing HAP emissions. However, as explained later in Section IV.B of this memorandum, there are only two process unit groups (bagasse fiberboard mat dryers and hardwood veneer dryers) where semi-incineration is the only available candidate for the MACT floor technology.

The available control device efficiency data show that control devices installed for particulate matter (PM) abatement had no effect on gaseous HAP or THC emissions.[5] These control devices include cyclones, multiclones (or multicyclones), baghouses (or fabric filters), and electrified filter beds (EFBs). The performance data for wet electrostatic precipitators (WESPs) and wet scrubbers installed for PM control also showed no effect on HAP and THC emissions. These wet systems may achieve short-term reductions in THC or gaseous HAP emissions, however, the HAP and THC control efficiency data, which range from slightly positive to negative values, indicate that the ability of these wet systems to absorb water-soluble compounds (such as formaldehyde) diminishes as the recirculating scrubbing liquid becomes saturated with these compounds.[5] One wet scrubbing system, a combination water tray tower/high energy venturi scrubber that uses treated water and is designed to minimize emissions of both PM and odorous compounds from a hardboard press, did achieve notable HAP and THC emissions reductions. This system reduces formaldehyde and methanol emissions by 65 percent and 50 percent, respectively, and reduces THC emissions by 86 percent.[5]

The THC, methanol, and formaldehyde control device performance data for incineration-based control and biofilters are presented in the MACT floor memo included in the public docket.[6] The information in this memo was extracted from a separate memorandum which provides information on the available control device performance data for the various types of control devices applied to PCWP process units. The performance data for the incineration-based controls and biofilters showed methanol and formaldehyde emission reductions equal to or greater than 90 percent, except in some cases where the pollutant loadings of the emission stream entering the control systems were very low. The performance data for THC showed that incineration-based control systems could achieve THC emission reductions equal to or greater than 90 percent. The THC emission reductions achieved with biofilters varied somewhat, with THC reductions ranging from 73 percent to 90 percent. Although biofilters are effective in reducing the HAP compounds emitted from process units in the PCWP industry, they can be less effective in reducing some of the less water-soluble non-HAP compounds, such as pinenes, that can make up a portion of the THC measurements.

The proposed MACT floor technology for the process units was either determined to be no emission reduction or equivalent to the emission reduction achievable with incineration-based control systems or biofilters. Although some process units are equipped with add-on controls that perform at a level somewhere between zero (no control) and the performance level achievable with incineration-based controls and biofilters, none of these control systems were identified as MACT floor control technologies because they (1) do not reduce HAP emissions (e.g., bag houses) or (2) do not reduce HAP emissions on a consistent basis (e.g., wet electrostatic precipitators), or (3) achieve lower HAP emission reductions than biofilters and incineration-based controls (e.g., semi-incineration). Therefore, the MACT floor analysis focused on incineration-based controls and biofilters.

For the purpose of establishing the performance level of the MACT floor control systems, all available data on incineration-based controls and biofilters were grouped together. This "group approach" was used because some of the control systems treat HAP emissions from multiple types of process units, such as primary tube dryers, reconstituted panel presses, and board coolers.

Determinations of the performance of the control system on emissions from each type of process unit were not possible. Also, for some process unit groups, limited data were available for the control systems applied to the process units in that group. By considering all of the performance data for incineration-based controls and biofilters together, the amount of available data upon which the MACT floor level of performance was based was maximized.

The available data for incineration-based controls and biofilters (provided in the MACT floor memo)[6] shows variability in performance from process unit to process unit and over time. In some cases, it was not possible to directly compare the performance of different control systems because data were not available for the same pollutant (i.e., not all test reports included data for THC, methanol, and formaldehyde). Comparison of the performance of the different types of incineration-based control systems with other incineration-based controls and with biofilters was also hampered by the fact that the uncontrolled emissions being treated by the different control systems varied with respect to pollutant loading (inlet concentration) and pollutant type. Because the control device efficiency is somewhat dependent on the amount of HAP entering the device, the variability in the uncontrolled emissions from process units both within and among the different process groups meant that the control device efficiencies also varied. With a few exceptions, when the concentration of methanol, formaldehyde, or THC in the uncontrolled emission stream was greater than 10 parts per million dry volume (ppmvd), the associated HAP emission reductions ranged from 90 to 99 percent. In general, lower control efficiencies were achieved when the inlet pollutant concentrations were below 10 ppmvd; however, in some cases, the control efficiency exceeded 90 percent even at the lower inlet concentrations.

To account for the variability in the type and amount of HAP in the uncontrolled emissions from the various process units and the effect of this variability on control system performance, it is recommended that the MACT floor performance level be based on all three of the pollutants analyzed and include maximum concentration levels in the outlet of the control systems as an alternative to emission reductions. The MACT floor performance level is a 90 percent reduction in THC or methanol or formaldehyde emissions. The maximum concentration level in the outlet of the MACT floor control system is 20 ppmvd for THC, or 1 ppmvd for methanol, or 1 ppmvd for formaldehyde. The 20 ppmvd is recommended as the alternative maximum concentration for THC because 20 ppmvd represents the practical limit of control for

THC. The 1 ppmvd is recommended as the maximum outlet concentration for both methanol and formaldehyde because this concentration is achievable by the MACT floor control systems and the method detection limits for these compounds using the National Council of the Paper Industry for Air and Stream Improvement (NCASI) impinger/canister emission test method (NCASI Method IM/CAN/WP-99.01) are less than 1 ppmvd.[7]

3.1.3 MACT Floor Options

The six recommended options for representing the MACT floor are shown in Exhibit 3-1. These six options reflect the emission reductions and maximum outlet pollutant concentrations achievable at the MACT floor for all process units with a MACT floor technology represented by incineration-based controls or biofilters. As shown in Exhibit 3-1, it is recommended that a restriction be placed on the use of the outlet concentration options for methanol and formaldehyde. The proposed restriction would be that the concentration of the pollutant (methanol or formaldehyde) entering the MACT control system must be at least 10 ppmvd for the facility to use the outlet concentration option. The purpose for this restriction is that some process units may have very low uncontrolled methanol or formaldehyde emissions, while still emitting significant quantities of HAP, and facilities with these process units could claim that they are achieving MACT floor levels of control without doing anything to reduce HAP emissions. All of the MACT floor control systems evaluated can meet at least one of the six control options for add-on control devices, based on the available data. Only a few of the MACT floor control systems evaluated can meet all six options; in those cases, the control systems tend to be applied to process units with both moderately high HAP emissions and moderately high THC emissions, which would allow them to meet the outlet concentration-based options for methanol and formaldehyde as well as the percent reduction options. Therefore, it is recommended that facilities be required to meet only one of the six emission options in Exhibit 3-1.

Exhibit 3-1. MACT FLOOR CONTROL OPTIONS

Pollutant	Reduce by	OR achieve emissions
methanol	90 percent	1 ppm[a]
...OR...		
formaldehyde	90 percent	1 ppm[a]
...OR...		
THC[b]	90 percent	20 ppm

[a] This option would only be applicable to units with uncontrolled emissions of that HAP that are 10 ppm.
[b] Mills will be allowed to adjust THC measurements to subtract methane.

3.1.4 Summary of MACT for Existing and New Process Units

Exhibit 3-2 summarizes MACT for each type of process unit at new and existing PCWP facilities. The MACT represents the level of control that would be required by the PCWP NESHAP. The technologies listed below achieve that control level.

Exhibit 3-2. SUMMARY OF MACT FOR PCWP PROCESS UNITS AT NEW AND EXISTING SOURCES

Process unit	MACT for process units at existing sources	MACT for process units at new sources
Tube dryers; Rotary strand dryers; Conveyor strand dryers; Green particle rotary dryers; Hardboard ovens; Softwood veneer dryers; Pressurized refiners	emission reduction achievable with incineration-based control[a]	emission reduction achievable with incineration-based control[a]
Reconstituted wood product presses	emission reduction achievable with incineration-based control[a] or biofilter	emission reduction achievable with incineration-based control[a] or biofilter
Fiberboard mat dryers (wood); Hardboard press preheat ovens	No emission reduction	emission reduction achievable with incineration-based control[a]
Reconstituted wood product board coolers	No emission reduction	emission reduction achievable with incineration-based control[a] or biofilter
Rotary agricultural fiber dryers; Dry particle rotary dryers; Paddle-type particle dryers; Hardboard humidifiers Fiberboard mat dryers (bagasse); Veneer kilns; Radio-frequency veneer redryers; Hardwood veneer dryers; Particleboard press molds; Particleboard extruders; Engineered wood products presses; Agriboard presses; Plywood presses; Stand-alone digesters; Atmospheric refiners; Blenders; Formers; Sanders Saws; Fiber washers; Chippers; Log vats; Lumber kilns	No emission reduction	No emission reduction

[a] Incineration-based control includes RTOs, RCOs, TCOs, TOs, and incineration of process exhaust in combustion unit.

3.1.5 Beyond the MACT Floor Options and Related Technologies

Because the control devices that represent MACT levels of control are the same for all process units that have a controlled MACT floor for both new and existing units, the only beyond the floor options considered were for existing process unit groups that had MACT floors equal to "no emission reduction." The annual total HAP emissions from the following equipment are very low compared to the emissions from other process units used in the PCWP industry:

agriboard dryers	particleboard press molds
dry particle rotary dryers	particleboard extruders
paddle-type particle dryers	engineered wood products presses
hardboard humidifiers	agriboard presses
bagasse fiber mat dryer	atmospheric refiners
veneer kilns	lumber kilns
RF veneer redryers	resin storage tanks
hardwood veneer dryers	other miscellaneous equipment (formers, sanders, saws, fiber washers, chippers, and log vats)

No beyond-the-floor control options were considered for these equipment because emissions from these process units would not be cost-effective to control. In addition, no beyond-the-floor analyses of wastewater operations, wastewater tanks, and miscellaneous coating operations were conducted because sufficient information is not available to make beyond-the-floor determinations and it is not known (or expected) that emissions from these operations would justify control.

Based on a review of the HAP emissions data for process units with MACT floors of no emission reduction, blenders and stand-alone digesters were selected for a beyond-the-MACT-floor analysis because these equipment emit higher levels of HAP emissions relative to other process units. Beyond-the-floor analyses were also conducted for process units with a MACT floor of no emission reduction for existing units and a MACT floor represented by the emission reduction achievable with incineration-based controls for new units. These process units include fiberboard mat dryers, press preheat ovens, and reconstituted wood products board coolers.

This analysis of beyond-the-floor options was based on the industry average exhaust flow for each process unit, the typical number of each process unit per plant, the industry average amount of HAP emitted from the process units, and assuming that an RTO would be used to control emissions from each process unit. The average exhaust flow rates and typical number of process units per plant were determined using the results from EPA's MACT survey. The average HAP emissions and emission reductions were determined using the methodology described in the baseline emissions memo.[9] The annualized RTO cost was calculated based on flow rate using the methodology described later in this chapter. The cost per ton values were calculated by dividing the total annualized cost (TAC) for the RTO by the HAP reduction. This analysis assumes that facilities will not be able to route the emissions from process units to an existing control device or to a new control device installed to meet the PCWP standards (i.e., that a separate RTO must be purchased to handle the additional flow from the process units). Exhibit 3-3 below presents the results of this analysis.

Exhibit 3-3. Cost-Effectiveness Analysis Of Beyond-The-Floor Control Options

Process Unit	Average flow, dscfm	Typical no. per plant	RTO TAC	Average HAP emitted, tpy	Tons HAP reduced, tpy	Cost effectiveness $/ton (1998 dollars)
Fiberboard mat dryer at FB plant	49,389	1	$471,187	8	7.6	
Fiberboard mat dryer at w/d HB plant	19,491	1	$370,952	12	11	
Fiberboard mat dryers (average)	34,440	1	$421,070	10	9.3	$30,076
Press preheat oven - w/d HB plant	21,812	1	$377,904	15	14	$26,520
Board cooler - PB	41,423	1	$442,096	5	4.8	
Board cooler - MDF	79,483	1	$599,447	3	2.9	
Board cooler (average)	60,453	1	$520,772	4	3.9	$133,531
Stand-alone digester - FB	7,587	2	$358,359	14	13	
Stand-alone digester - HB	7,587	2	$358,359	14	13	
Stand-alone digester (average)	7,587	2	$358,359	14	13	$26,944
Blender - PB	13,590	2	$394,486	45	43	
Blender - OSB	13,590	2	$394,486	11	10	
Blender (average)	13,590	2	$394,486	28	27	$14,610

In all cases, the emission reductions that could be achieved from requiring controls for these existing units did not appear to be justified by the cost. Many of the existing control devices at well-controlled facilities would not have the additional capacity to treat the emissions from these process units, and thus, these facilities would have to install new controls.

For more information, refer to the MACT memo for this proposed rule and the BID.[8]

3.1.6 Considerations of Possible Risk-Based Alternatives to Reduce Impacts to Sources

The Agency has made every effort in developing this proposal to minimize the cost to the regulated community and allow maximum flexibility in compliance options consistent with our statutory obligations. However, we recognize that the proposal may still require some facilities to take costly steps to further control emissions even though their emissions may not result in exposures which could pose an excess individual lifetime cancer risk greater than one in one million or which exceed thresholds determined to provide an ample margin of safety for protecting public health and the environment from the effects of hazardous air pollutants. We are, therefore, specifically soliciting comment on whether there are further ways to structure the proposed rule to focus on the facilities which pose significant risks and avoid the imposition of high costs on facilities that pose little risk to public health and the environment.

Industry representatives provided EPA with descriptions of three mechanisms that they believed could be used to implement more cost-effective reductions in risk. The docket for today's proposed rule contains "white papers" prepared by industry that outline their proposed approaches (see docket number A-98-44, Item # II-D-525). The Agency is taking comment on these approaches. We believe that two of the three suggested approaches warrant further consideration. We believe they could be used to focus regulatory controls on facilities with significant risks and avoid the imposition of high costs on facilities that pose little risk to public health or the environment. One of the approaches, an applicability cutoff for threshold pollutants, would be implemented under the authority of CAA section 112(d)(4); the other approach, subcategorization and delisting, would be implemented under the authority of CAA sections 112(c)(1) and 112(c)(9). The EPA requests comment on the technical and legal viability of these approaches, as well as any modifications to these approaches that commenters may wish to suggest. The maximum achievable control technology, or MACT, program outlined in CAA section 112(d) is intended to reduce emissions of HAP through the application of MACT to major sources of toxic air pollutants. Section 112(c)(9) is intended to allow EPA to avoid setting MACT standards for categories or subcategories of sources that pose little risk to public health and the environment. The EPA requests comment on whether the proposals described here appropriately rely on these provisions of CAA section 112. While both approaches focus on assessing the inhalation exposures of HAP emitted by a source, EPA specifically requests comment on the appropriateness and necessity of extending these approaches to account for non-inhalation exposures of certain HAP which may deposit from the atmosphere after being emitted into the air or to account for adverse environmental impacts. We are also interested in any information or comment concerning technical limitations, environmental and cost impacts, compliance assurance, legal authority, and implementation relevant to the approaches. We also request comment on appropriate practicable and verifiable methods to ensure that sources' emissions remain below levels that protect public health and the environment. We will evaluate all comments before determining whether either of the two approaches will be included in the final rule.

3.1.6.1 Applicability Cutoffs for Threshold Pollutants Under Section 112(d)(4) of the CAA

The first approach is an "applicability cutoff" for threshold pollutants that is based on EPA's authority under CAA section 112(d)(4). A "threshold pollutant" is one for which there is a concentration or dose below which adverse effects are not expected to occur over a lifetime of exposure. For such pollutants, section 112(d)(4) allows EPA to consider the threshold level, with an ample margin of safety, when establishing emissions standards. Specifically, section 112(d)(4) allows EPA to establish emission standards that are not based upon the maximum achievable control technology (MACT) specified under section 112(d)(2) for pollutants for which a health threshold has been established. Such standards may be less stringent than MACT. Furthermore, EPA has interpreted 112(d)(4) to allow us to avoid further regulation of categories of sources that emit only threshold pollutants, if those emissions result in ambient levels that do not exceed the threshold, with an ample margin of safety.[1]

A different interpretation would allow us to exempt individual facilities within a source category that meet the section 112(d)(4) requirements. There are three potential scenarios under this interpretation of the section 112(d)(4) provision. One scenario would allow an exemption for individual facilities that emit only threshold pollutants and can demonstrate that their emissions of threshold pollutants would not result in air concentrations above the threshold levels, with an ample margin of safety, even if the category is otherwise subject to MACT. A second scenario would allow the section 112(d)(4) provision to be applied to both threshold and non-threshold pollutants, using the 1 in a million cancer risk level for decisionmaking for non-threshold pollutants. A third scenario would allow a section 112(d)(4) exemption at a facility that emits both threshold and non-threshold pollutants. For those emission points where only threshold pollutants are emitted and where emissions of the threshold pollutants would not result in air concentrations above the threshold levels, with an ample margin of safety, those emission points could be exempt from the MACT standard. The MACT standard would still apply to non-threshold emissions from other emission points at the source. For this third scenario, emission points that emit a combination of threshold and non-threshold pollutants that are co-controlled by MACT would still be subject to the MACT level of control. However, any threshold HAP eligible for exemption under section 112(d)(4) that are controlled by control devices different from those controlling non-threshold HAP would be able to use the exemption, and the facility would still be subject to the parts of the standard that control non-threshold pollutants or that control both threshold and non-threshold pollutants.

Under the section 112(d) (4) approach, EPA would have to determine that emissions of each of the threshold pollutants emitted by PCWP sources at the facility do not exceed the threshold levels, with an ample margin of safety. The common approach for evaluating the potential hazard of a threshold air pollutant is to calculate a "hazard quotient" by dividing the pollutant's inhalation exposure concentration (often assumed to be equivalent to its estimated concentration in air at a location where people could be exposed) by the pollutant's inhalation Reference Concentration (RfC). An RfC is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure that, over a lifetime, likely would not result in the occurrence of adverse health effects in humans, including sensitive individuals. The EPA typically establishes an RfC by applying uncertainty factors to the critical toxic effect derived from the lowest- or no-observed-adverse-effect level of a pollutant.[2] A hazard quotient less than one means that the exposure concentration of the pollutant is less than the RfC, and, therefore, presumed to be without appreciable risk of adverse health effects. A hazard quotient greater than one means that the exposure concentration of the pollutant is greater than the RfC. Further, EPA guidance for assessing exposures to mixtures of threshold pollutants recommends calculating a "hazard index" by summing the individual hazard quotients for those pollutants in the mixture that affect the same target organ or system by

[1] See 63 FR 18754, 18765-66 (April 15, 1998) (Pulp and Paper Combustion Sources Proposed NESHAP)

[2] "Methods for Derivation of Inhalation Reference Concentrations and Applications of Inhalation Dosimetry." EPA-600/8-90-066F, Office of Research and Development, USEPA, October 1994.

the same mechanism.[3] Hazard index (HI) values would be interpreted similarly to hazard quotients; values below one would generally be considered to be without appreciable risk of adverse health effects, and values above one would generally be cause for concern. For the determinations discussed herein, EPA would generally plan to use RfC values contained in EPA's toxicology database, the Integrated Risk Information System (IRIS). When a pollutant does not have an approved RfC in IRIS, or when a pollutant is a carcinogen, EPA would have to determine whether a threshold exists based upon the availability of specific data on the pollutant's mode or mechanism of action, potentially using a health threshold value from an alternative source such as the Agency for Toxic Substances and Disease Registry (ATSDR) or the California Environmental Protection Agency (CalEPA).

In the past, EPA routinely treated carcinogens as non-threshold pollutants. The EPA recognizes that advances in risk assessment science and policy may affect the way EPA differentiates between threshold and non-threshold HAP. The EPA's draft Guidelines for Carcinogen Risk Assessment[4] suggest that carcinogens be assigned non-linear dose-response relationships where data warrant. Moreover, it is possible that dose-response curves for some pollutants may reach zero risk at a dose greater than zero, creating a threshold for carcinogenic effects. It is possible that future evaluations of the carcinogens emitted by this source category would determine that one or more of the carcinogens in the category is a threshold carcinogen or is a carcinogen that exhibits a non-linear dose-response relationship but does not have a threshold.

There are at least several options for establishing a hazard index limit for the section 112(d)(4) analysis that reflect to varying degrees total public exposure. One option is to allow the hazard index posed by all threshold HAP emitted by PCWP sources at the facility to be no greater than one. This approach assumes that no additional threshold HAP exposures would be anticipated from other sources in the vicinity or through other routes of exposure (i.e., through ingestion).

A second option is to adopt a "default percentage" approach, whereby the hazard index limit of the HAP emitted by the facility is set at some percentage of one (e.g., 20% or 0.2). This approach recognizes the fact that the facility in question is only one of many sources of threshold HAP to which people are typically exposed every day. Because noncancer risk assessment is predicated on total exposure or dose, and because risk assessments to focus only on an individual source, establishing a hazard index limit of 0.2 would account for an assumption that 20% of an individual's total exposure is from that individual source. For the purposes of this discussion, we will call all sources of HAP, other than the facility in question, "background" sources. If the facility is allowed to emit HAP such that its own impacts could result in HI values of one, total exposures to threshold HAP in the vicinity of the facility could be substantially greater than one due to background sources, and this would not be protective of public health, since only HI values below one are considered "safe" (i.e., without appreciable risk of harmful effects). Thus, setting the hazard index limit for the facility at some default percentage of one will provide a buffer which would help to ensure that <u>total</u> exposures to threshold HAP near the facility (i.e., in combination with exposures due to

---

[3] "Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures. Risk Assessment Forum Technical Panel," EPA/630/R-00/002. USEPA, August 2000. http://www.epa.gov/nceawww1/pdfs/chem mix/chem mix 08 2001.pdf

[4] "Draft Revised Guidelines for Carcinogen Risk Assessment." NCEA-F-0644. USEPA, Risk Assessment Forum, July 1999. pp 3-9ff. http://www.epa.gov/ncea/raf/pdfs/cancer_gls.pdf

background sources) will generally not exceed one, and can generally be considered to be without appreciable risk of adverse health effects. The EPA requests comment on using the "default percentage" approach and on setting the default hazard index limit at 0.2. The EPA is also requesting comment on whether an alternative HI limit, in some multiple of 1, would be a more appropriate applicability cutoff.

A third option is to use available data (from scientific literature or EPA studies, for example) to determine background concentrations of HAP, possibly on a national or regional basis. These data would be used to estimate the exposures to HAP from non-PCWP sources in the vicinity of an individual facility. For example, the EPA's National-scale Air Toxics Assessment (NATA)[5] and ATSDR's Toxicological Profiles[6] contain information about background concentrations of some HAP in the atmosphere and other media. The combined exposures from PCWP sources and from other sources (as determined from the literature or studies) would then not be allowed to exceed a hazard index limit of one.

As an alternative to the third option, a fourth option is to allow facilities to estimate or measure their own facility-specific background HAP concentrations for use in their analysis.

3.1.6.3 Subcategory Delisting Under Section 112(c)(9)(B) of the CAA

EPA is authorized to establish categories and subcategories of sources, as appropriate, pursuant to CAA section 112(c)(1), in order to facilitate the development of MACT standards consistent with section 112 of the CAA. Further, section 112(c)(9)(B) allows EPA to delete a category (or subcategory) from the list of major sources for which MACT standards are to be developed when the following can be demonstrated: 1) in the case of carcinogenic pollutants, that "no source in the category . . . emits [carcinogenic] air pollutants in quantities which may cause a lifetime risk of cancer greater than one in one million to the individual in the population who is most exposed to emissions of such pollutants from the source"; 2) in the case of pollutants that cause adverse noncancer health effects, that "emissions from no source in the category or subcategory . . . exceed a level which is adequate to protect public health with an ample margin of safety"; and 3) in the case of pollutants that cause adverse environmental effects, that "no adverse environmental effect will result from emissions from any source."

Given these authorities and the suggestions from the white paper prepared by industry representatives (see docket number A-98-44, Item # II-D-525), EPA is considering whether it would be possible to establish a subcategory of facilities within the larger PCWP category that would meet the risk-based criteria for delisting. Since each facility in such a subcategory would be a low-risk facility (i.e., if each met these criteria), the subcategory could be delisted in accordance with section 112(c)(9), thereby limiting the costs and impacts of the proposed MACT rule to only those facilities that do not qualify for subcategorization and delisting. Facilities seeking to be included in the delisted subcategory would be responsible for providing all data required to determine whether they are eligible for inclusion. Facilities that could not demonstrate that they are eligible to be included in the low-risk subcategory would be subject to MACT and possible future residual risk standards.

---

[5] See http://www.epa.gov/ttn/atw/nata

[6] See http://www.atsdr.cdc.gov/toxpro2.html

Establishing that a facility qualifies for the low-risk subcategory under section 112(c)(9) will necessarily involve combining estimates of pollutant emissions with air dispersion modeling to predict exposures. The EPA envisions that we would promote a tiered analytical approach for these determinations. A tiered analysis involves making successive refinements in modeling methodologies and input data to derive successively less conservative, more realistic estimates of pollutant concentrations in air and estimates of risk.

As a first tier of analysis, EPA could develop a series of simple look-up tables based on the results of air dispersion modeling conducted using conservative input assumptions. By specifying a limited number of input parameters, such as stack height, distance to property line, and emission rate, a facility could use these look-up tables to determine easily whether the emissions from their sources might cause a hazard index limit to be exceeded.

A facility that does not pass this initial conservative screening analysis could implement increasingly more site-specific but more resource-intensive tiers of analysis using EPA-approved modeling procedures, in an attempt to demonstrate that their facility does not exceed the hazard index limit. The EPA's guidance could provide the basis for conducting such a tiered analysis.[7]

Another approach would be to define a subcategory of facilities within the PCWP source category based upon technological differences, such as differences in production rate, emission vent flow rates, overall facility size, emissions characteristics, processes, or air pollution control device viability. If it could then be determined that each source in this technologically-defined subcategory presents a low risk to the surrounding community, the subcategory could then be delisted in accordance with 112(c)(9).

One concern that EPA has with respect to the section 112(c)(9) approach is the affect that it could have on the MACT floors. If all of the well-controlled, low-risk facilities are subcategorized, that could make the MACT floor less stringent for the remaining facilities. One approach that has been suggested to mitigate this effect would be to establish the MACT floor now based on controls in place for the category and to allow facilities to become part of the low-risk category in the future, after the MACT standard is established. This would allow low risk facilities to use the 112(c)(9) exemption without affecting the MACT floor calculation. EPA requests comment on this suggested approach.

If this section 112(c)(9) approach were adopted, the rulemaking would likely indicate that the rule does not apply to any source that demonstrates, based on a tiered approach that includes EPA-approved modeling of the affected source's emissions, that it belongs in a subcategory which has been delisted under section 112(c)(9).

3.2 Emissions and Emission Reductions

As mentioned in Chapter 1, the U.S. Environmental Protection Agency (EPA) is developing national emission standards for hazardous air pollutants (NESHAP) for the plywood and composite wood

[7]"A Tiered Modeling Approach for Assessing the Risks due to Sources of Hazardous Air Pollutants." EPA-450/4-92-001. David E. Guinnup, Office of Air Quality Planning and Standards, USEPA, March 1992.

products source category. This part of the RIA presents emission reductions expected to occur from compliance with the MACT floor alternative that is being proposed.

3.2.1 Some Results in Brief

The proposed plywood and composite wood products NESHAP will reduce HAP emissions by about 11,000 tons in the third year after its issuance.[9] The major HAP reduced, as mentioned in the rule preamble, are acrolein, acetaldehyde, formaldehyde, phenol, propionaldehyde, and methanol. In addition, nearly 27,000 tons of VOC (reported as total hydrocarbon) emissions will be reduced. Nearly 11,000 tons of CO emission reductions will occur, along with 13,000 tons of PM (coarse) emission reductions. There will also be 5,000 tons of additional NOx emissions and 4,000 tons of SO_2 emissions added to the atmosphere due to the additional incineration-based controls that may be necessary for affected facilities to meet the MACT floor alternative.

3.2.2 General Approach

The methodology used to estimate the HAP emission reductions associated with this proposed rule is summarized in this section. Before the emissions reductions could be estimated, the baseline emissions level for each pollutant had to be determined. This was conducted by first estimating emissions without considering current air pollution controls, and then calculating the emissions levels with current controls applied. The first, uncontrolled emission estimates, are developed without consideration of air pollution controls currently in use at wood products plants. Baseline estimates reflect the level of pollution control that is presently used. The remainder of this section discusses the general methodology used to estimate uncontrolled and baseline emissions.

Estimating uncontrolled and baseline emissions involves the following four steps:

(1) Identification of hazardous air pollutant (HAP) emission sources,

(2) Characterization of emission sources (e.g., assignment of throughput and other characteristics),

(3) Application of emission factors, and

(4) Calculation of emissions.

3.2.2.1 Identifying Emission Sources

Emission sources were identified based on responses to the EPA's maximum achievable control technology (MACT) surveys and available emissions test data. The EPA gathered plant-specific information with three MACT surveys. The results of the three surveys are documented in separate memoranda.[10,11,12] Available emissions test data include data from nearly 100 test reports collected through EPA's MACT survey, data from EPA's *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources* (commonly referred to as AP-42), and extensive data from the industry-sponsored test program performed by the National Council of the Paper Industry for Air and Stream Improvement (NCASI). Emissions were estimated for sources that were identified in the EPA's MACT survey (e.g., dryers, presses, board coolers) and for additional miscellaneous sources (e.g., digesters, refiners, fiber washers) for which applicable emission test data were available. Process flow diagrams submitted with the MACT surveys provided information about the presence (or absence) of miscellaneous sources at plants. The EPA's MACT survey also provided information on the control devices used for most unit operations.

Some plants have begun operation and other plants have added equipment and controls since EPA conducted the MACT survey. Such changes have been accounted for in the nationwide emission estimates. A separate memorandum summarizes the changes to plants that have occurred following the EPA's MACT survey.[13]

3.2.2.2 Characterizing Emission Sources

After the emission sources were identified, each source was assigned a throughput and further characterized. In most cases, plant-specific dryer and press throughput was provided in EPA's MACT survey. If the dryer or press throughput was claimed confidential or was not provided, then a default throughput was assigned. For dryers, the default throughput was the average throughput for the same type dryers for the product manufactured. [10,11,12] If available, plant production (or capacity if production was unavailable) was used as the default throughput for presses; otherwise, presses were assigned the average press throughput for the product manufactured.

Throughput for miscellaneous equipment was based on either dryer or press throughput, depending on the units of measure for the applicable emission factor (e.g., pounds per oven dry ton [lb/ODT] or pounds per thousand square feet [lb/MSF]). Collective throughputs for digesters, refiners, fiber washers, blenders, and formers were generally approximated as the total dryer throughput (ODT/yr) for the plant. Board cooler, sander, and saw throughput was generally approximated as the total press throughput (MSF/yr) for the plant. By assigning either the total dryer or press throughput to miscellaneous processes, no assumption about the number of miscellaneous operations (e.g., number of refiners) at each plant was necessary.

Following assignment of throughput for each emission source, sources were further characterized (as necessary for application of emission factors) based on wood species, resin type, or other characteristics. Further characterization of emission sources is discussed in the baseline emissions memo for this proposed rule. If characterization of an emission source was not possible due to claims of confidentiality or missing information in the survey response, then default characterizations were applied based on practices most commonly observed at other plants.

3.2.2.3 Applying Emission Factors

As emission sources were characterized, the available emission factors were reviewed for applicability to each emission source. The emission factors used in developing the nationwide estimates are documented in a separate memorandum.[14] Emissions were generally estimated for total hydrocarbon as carbon (THC as C , referred to as "THC" in this RIA) and the following HAP's:

acetaldehyde	methyl isobutyl ketone (MIBK)
acrolein	phenol
benzene	propionaldehyde
cumene	styrene

formaldehyde	toluene
methanol	m,p-xylene
methylene chloride	o-xylene
methyl ethyl ketone (MEK)	

When used in this document, the terminology "complete set" refers to the set of emission factors for the above list of HAP's, THC, and any other additional HAP's that may have been measured at levels above a test method detection limit.

Total HAP was taken to be the sum of the individual HAP's. If all test data for a pollutant at a source were below the test method detection limit (denoted as "BDL" in reference 5), then the emission factor was treated as zero. For a few specific sources, HAP's other than the ones listed above were tested for and detected. These HAP were included in the total HAP estimate for that source. Exhibit 3-4 illustrates how the total HAP emission factors were developed.

Exhibit 3-4. ILLUSTRATION OF TOTAL HAP CALCULATION FOR AN EMISSION SOURCE

HAP	Emission Factor (from reference 5)
acetaldehyde	0.0012
acrolein	BDL[a]
benzene	BDL
cumene	BDL
formaldehyde	0.015
methanol	0.076
methylene chloride	BDL
MEK	BDL
MIBK	BDL
phenol	0.0047
propionaldehyde	BDL
styrene	BDL
toluene	BDL
m,p-xylene	BDL
o-xylene	BDL
Total HAP	0.0012 + 0.015 +0.076 + 0.0047 = 0.097

[a] BDL (below detection limit); all test runs for this pollutant and this source were below the test method detection limit.

Test data were not available for all of the HAP's considered for some sources (i.e., a complete set of emission factors was not available). In some cases, it was necessary to apply emission factors for one source to a similar source for which factors were not available. In other situations, it was necessary to group emission factors so that emissions of all the likely pollutants could be estimated for a particular emission source. Grouped emission factors were calculated from emission test averages using the methodology described in the emission factor memo[14]. Specific application of the emission factors for each unit operation is discussed in the baseline emissions memo for this proposed rule.

3.2.2.4 Calculating Emissions

Applicable emission factors were used to estimate uncontrolled emissions from each unit operation as follows:

$$E = EF \times T / 2000$$

where:

E = annual emissions (ton/yr)
EF = emission factor (lb/ODT or lb/MSF-specified basis)
T = process throughput (ODT/yr or MSF/yr-specified basis)

To estimate baseline emissions, the emission reduction achieved by air pollution control devices (APCD's) in place on unit operations was taken into account. Control devices that achieve significant reduction of HAP and THC include biofilters and incineration-based controls (e.g., regenerative thermal oxidizers [RTO's], regenerative catalytic oxidizers [RCO's], thermal oxidizers [TO's], and thermal catalytic oxidizers [TCO's]). Emission factors were available for several, but not all, of the unit operations that are presently controlled with biofilters and incineration-based controls. If a complete set of emission factors based on inlet and outlet test data for a single control device was available, the set of emission factors was used to estimate baseline emissions. Otherwise, the achievable percent reduction in emissions for the control device was used as follows:

$$E = EF \times T / 2000 \times (1-R)$$

where:

R = percent reduction achievable with the control device (see table below)

Control device	HAP reduction	THC reduction
Biofilter	95%	80%
RTO, RCO, TO, & TCO	95%	95%

If only a portion of an exhaust stream was controlled (e.g., as with semi-incineration where only a portion of the exhaust is routed to a combustion unit), then controlled emissions were estimated for the controlled portion of the exhaust and uncontrolled emissions were estimated for the remaining exhaust.

Because plant-specific capture efficiency information is not readily available, presses and board coolers without a permanent total enclosure that are routed to an APCD were assumed to operate with 50 percent capture efficiency.

Following estimation of uncontrolled and baseline emissions for each unit operation, annual emissions for each facility were totaled. If there were facilities with no available information was available (e.g., plants that claimed their entire MACT survey confidential or plants that never responded to the survey), then the average facility-specific emissions for plants making the same product was used to approximate the emissions from plants with no available information. The emissions from all facilities were summed to obtain nationwide emission estimates.

3.2.3 Nationwide HAP Emission Estimates

Exhibit 3-5 presents the total nationwide uncontrolled and baseline emission estimates for each product type. Uncontrolled emissions are the emissions that occur before the application of a HAP emission control device. Baseline emission estimates take into account the HAP emission controls currently in place on HAP sources in the industry. Exhibits 3-6 and 3-7 present the nationwide uncontrolled and baseline speciated HAP emission estimates for each product type.

To estimate the emissions and emission reductions associated with compliance with this proposed rule, it is necessary to determine the number of major sources that may be subject to the rule. Major sources are facilities with the potential to emit 10 or more tpy of any single HAP or 25 or more tpy of any combination of HAP. The number of major sources was approximated using the uncontrolled emission estimates (scaled up to reflect potential to emit) for each facility.

The emission estimates presented in this chapter are based on equipment throughput at plant production levels. Plant capacity typically exceeds plant production. Thus, a facility's potential to emit may be greater than the emissions estimated for each facility at plant production levels. To account for this, an average ratio of plant production to plant capacity was determined based on the non-CBI responses to EPA's MACT survey. On average, plywood (hardwood and softwood) and reconstituted wood products plants were found to operate at around 75 percent of their plant capacity. Engineered wood products plants were found, on average, to operate at 60 percent of their capacity. For purposes of determining which facilities may be major sources based on potential to emit, the uncontrolled emission estimates for each facility were scaled up by 25 or 40 percent before comparison to the 10- or 25-tpy major source thresholds. Exhibit 3-8 presents the estimated number of major sources by product type.

Because of the uncertainty in the emission estimates and lack of knowledge about the specific operations at facilities the numbers of major sources presented in Exhibit 3-8 are merely estimates. Major source determinations depend on the types of operations at a facility and facility-specific factors. There may be operations and HAP emission sources at wood products facilities that have not been accounted for in the emission estimates (e.g., plants that manufacture furniture in addition to particleboard). Plants with additional onsite operations may be major sources regardless of their plywood and composite wood products operations. Then again, there may be plants that were determined to be major sources in this analysis that are not major sources due to uncertainty in the emission estimates or potential to emit. The purpose of the analyses discussed in this document is to estimate – on a nationwide scale – emissions from plywood and composite wood products plants and the number of major sources. On a nationwide scale, it is unlikely that the uncertainties in the emission estimates or number of major sources will have a significant impact on the direction of the proposed plywood and composite wood products rulemaking.

The reduction in emissions of total HAP and THC is the difference between baseline emissions and the emissions expected to remain following implementation of the MACT floor level of control identified for the PCWP standards. Baseline emissions reflect the level of air pollution control that is currently used at PCWP plants. The MACT floor control level reflects the level of control that will be used following implementation of the PCWP standards. The following assumptions were used when estimating emissions at the MACT floor control level: (1) plants will install RTO on all process units that require controls to meet the MACT floor; (2) presses at conventional particleboard, MDF, OSB, and hardboard plants will be fully enclosed by a PTE that captures and routes 100 percent of the emissions from the press area to an RTO; and (3) WESP will be installed upstream of RTO for new RTO installations on rotary strand dryers. The nationwide HAP and THC emission reduction was calculated by subtracting the emissions remaining at the MACT floor control level from the baseline emissions. Exhibit 3-9 presents the nationwide HAP and THC emissions reduction.[14]

3.2.4 Nationwide Emission Estimates - Non-HAP Species

As mentioned earlier in this chapter, there are reductions in pollutants other than HAPs as a result of compliance with this proposed rule. There are reductions of coarse particulate matter (PM_{10}), volatile organic compounds (VOC), and carbon monoxide (CO), and increases in nitrogen oxides (NOx), and sulfur dioxide (SO_2). The reductions of PM_{10} are estimated at 13,000 tons, the reductions of VOC (reported as total hydrocarbon) are estimated at 27,000 tons (see Exhibit 3-9), and the reductions of CO are estimated at 11,000 tons. The increase of NOx emissions is estimated at 5,000 tons, and there are potentially as many as 4,000 tons of additional SO_2 emissions. All emission estimates are estimated for the fifth year after the issuance of the proposed rule. The methodology used to prepare these estimates is contained in the BID for this proposed rule.[15]

Exhibit 3-5. UNCONTROLLED AND BASELINE HAP EMISSIONS ESTIMATES

Product	No. of plants[a]	Uncontrolled emissions, ton/yr[b]		Baseline emissions, ton/yr[c]	
		Total HAP	THC as C	Total HAP	THC as C
MDF	24	4,000	8,200	2,400	4,800
Particleboard[d]	51	5,700	13,000	5,400	13,000
Hardboard	18	3,500	5,800	3,300	5,500
Fiberboard	7	78	400	78	400
OSB	37	7,100	19,000	3,500	5,400
Softwood plywood	105	4,000	24,000	3,700	20,000
Hardwood plywood	166	150	640	150	640
EWP	39	310	990	290	790
Nationwide total[e]	447	25,000	73,000	19,000	50,000

[a] Some plants make multiple products and are counted once for each product they make (e.g., a particleboard and softwood plywood plant).
[b] Uncontrolled emissions represent the emissions that occur before the application of HAP emission control devices.
[c] Baseline emissions reflect the application of HAP emission controls in the industry as of April 2000.
[d] Includes conventional and molded particleboard.
[e] Nationwide emission totals may not exactly match sum due to rounding.

Exhibit 3-6. SPECIATED NATIONWIDE UNCONTROLLED HAP EMISSIONS BY PRODUCT TYPE

Product	Estimated HAP's emitted, ton/yr							
	Acetaldehyde	Acrolein	Formaldehyde	Methanol	Phenol	Propionaldehyde	Other HAP[a]	Total[f]
MDF	48	1	1,700	2,200	93	1	27	4,000
Particleboard[b]	230	56	1,300	3,800	150	20	160[c]	5,700
Hardboard	320	76	580	2,100	99	250	52[d]	3,500
Fiberboard	9	1	17	45	1	0	6	78
OSB	1,500	540	890	3,500	340	88	280[e]	7,100
Softwood plywood	450	26	280	2,900	150	24	170	4,000
Hardwood plywood	20	0	11	81	15	0	22	150
EWP	53	4	36	140	46	8	19[e]	310
Total[f]	2,600	700	4,800	15,000	890	390	730	25,000

[a] Other HAP's include benzene, cumene, methylene chloride, MEK, MIBK, styrene, toluene, m,p-xylene, and o-xylene.
[b] Includes conventional and molded particleboard.
[c] Includes HAPs listed in footnote "a" plus acetophenone, biphenyl, bis-(2-ethylhexyl phthalate), bromomethane, carbon disulfide, carbon tetrachloride, chloroform, chloromethane, di-n-butyl phthalate, ethyl benzene, hydroquinone, n-Hexane, 1,1,1-trichloroethane, and 4-methyl-2-pentanone.
[d] Includes HAPs listed in footnote "a" plus chloroethane, chloromethane, ethyl benzene, m.p-cresol, and o-cresol.
[e] Includes HAPs listed in footnote "a" plus MDI.
[f] Totals may not exactly match sum due to rounding.

Exhibit 3-7. SPECIATED NATIONWIDE BASELINE HAP EMISSIONS BY PRODUCT

Product	Estimated HAP's emitted, ton/yr							
	Acetaldehyde	Acrolein	Formaldehyde	Methanol	Phenol	Propionaldehyde	Other HAP[a]	Total[f]
MDF	29	1	1,000	1,300	51	0	17	2,500
Particleboard[b]	200	50	1,200	3,700	140	18	150[c]	5,400
Hardboard	270	61	570	2,100	96	200	48[d]	3,300
Fiberboard	9	1	17	45	1	0	6	78
OSB	570	200	370	2,000	210	32	69[e]	3,500
Softwood plywood	390	20	230	2,700	130	17	150	3,700
Hardwood plywood	20	0	11	81	15	0	22	150
EWP	47	4	30	140	46	7	16[e]	290
Total[f]	1,500	330	3,400	12,000	690	270	480	19,000

[a] Other HAP's include benzene, cumene, methylene chloride, MEK, MIBK, styrene, toluene, m,p-xylene, and o-xylene.
[b] Includes conventional and molded particleboard.
[c] Includes HAPs listed in footnote "a" plus acetophenone, biphenyl, bis-(2-ethylhexyl phthalate), bromomethane, carbon disulfide, carbon tetrachloride, chloroform, chloromethane, di-n-butyl phthalate, ethyl benzene, hydroquinone, n-Hexane, 1,1,1-trichloroethane, and 4-methyl-2-pentanone.
[d] Includes HAPs listed in footnote "a" plus chloroethane, chloromethane, ethyl benzene, m.p-cresol, and o-cresol.
[e] Includes HAPs listed in footnote "a" plus MDI.
[f] Totals may not exactly match sum due to rounding.

Exhibit 3-8. ESTIMATED NUMBER OF MAJOR SOURCES BY PRODUCT

Product	No. of plants[a]	No. of major sources[b]	No. of potentially non-major sources[b]
MDF	24	24	0
Particleboard[c]	51	42	9
Hardboard	18	18	0
Fiberboard	7	3	4
OSB	37	37	0
Softwood plywood	105	87	18
Hardwood plywood	166	0	166
EWP	39	12	27
Total	447	223	224

[a] Some plants make multiple products and are counted once for each product they make (e.g., a particleboard and softwood plywood plant).

[b] Major sources are defined as facilities with the potential to emit 10 or more tons per year (tpy) of any single HAP or 25 or more tpy of any combination of HAP. Sources with HAP emissions estimated to be below the 10/25 thresholds in this analysis are labeled as potentially non-major sources. The emission estimation methodology described in this document does not account for onsite operations (e.g., furniture manufacture) not included in the plywood and composite wood products source category.

[c] Includes conventional and molded particleboard. Five of the potentially non-major particleboard sources manufacture molded particleboard.

Exhibit 3-9. ESTIMATED NATIONWIDE REDUCTION IN TOTAL HAP AND THC

Product type	Total HAP (ton/yr)			THC (ton/yr)		
	Baseline[a]	MACT floor	Reduction	Baseline[a]	MACT floor	Reduction
Softwood plywood/veneer	3,700	3,043	657	19,631	9,709	9,922
Hardwood plywood/veneer	161	161	0[b]	640	640	0[b]
Medium density fiberboard	2,469	345	2,124	4,763	572	4,191
Oriented strandboard	3,513	753	2,760	5,362	1,755	3,607
Particleboard[c]	5,377	2,787	2,590	12,632	6,724	5,908
Hardboard	3,291	752	2,539	5,478	2,103	3,374
Fiberboard	78	78	0[b]	398	398	0[b]
Engineered wood products	298	230	68	793	617	176
TOTAL	18,933	8,196	10,737	49,706	22,529	27,178

[a] The baseline emissions presented in this table may differ slightly from the values presented in Exhibits 3-4 through 3-6 because of slight differences in calculation procedures (i.e., use of a total HAP emission factor instead of summing speciated HAP emissions) and rounding.

[b] There is no impact because no plants are impacted by the PCWP standards at the MACT floor control level.

[c] Includes conventional and molded particleboard.

3.3 Control Equipment and Costs

Traditional add-on pollution control devices are expected to be the types of control measures that firms will choose in order to comply with the proposed rule. Add-on air pollution control devices that are most likely to be used to comply with the plywood and composite wood products rule include incineration-based controls. Among these types of controls are regenerative thermal oxidizers (RTO), regenerative catalytic oxidizers (RCO), and process incineration. Biofilters is another add-on control that may be applied. The control device most commonly used to control emissions from plywood and composite wood products plants is the RTO. Therefore, it was assumed that most plants would install RTO's to comply with the rule. A number of RCO's and biofilters are also presently used by plywood and composite wood products plants, and plants may choose to install these technologies to comply with the plywood and composite wood products rule. There may be cost advantages to using RCO's or biofilters instead of RTO's for some plants. However, the cost analyses focus on use of RTO's for simplicity (e.g., to minimize the number of cost algorithms developed and to avoid judgements regarding which plants may choose a particular technology).

Several facilities with large capacity heat energy systems currently use process incineration as a method of emissions control. Facilities may elect to use process incineration to comply with the rule. However, the applicability of process incineration is limited to those plants that have or may later install large onsite heat energy systems. The capital and operating costs of process incineration are expected to be significantly lower than the costs of add-on controls.

The plywood and composite wood products rule contains emissions averaging provisions and production-based emission limits. It may be possible for some plants to reduce their control costs by complying with either the emissions averaging provisions or production-based emission limits. However, because there is no way to predict which plants might use the emissions averaging provisions or production-based emission limits, the cost estimates did not account for these options. Instead, the control cost estimates were developed assuming that all facilities would install RTO(s) to meet the 90 percent HAP reduction emission limit in the plywood and composite wood products rule.

Oriented strandboard plants typically install wet electrostatic precipitators (WESP's) upstream of rotary dryer RTO's to protect the RTO media from plugging. Thus, the capital and annual costs associated with WESP's were modeled for rotary strand dryers.

Enclosures must be installed around presses in order to ensure capture of the press emissions that are routed to a control device. Thus, the capital costs of permanent total enclosures (PTE's) were included in the costing analyses. Annual costs associated with PTE's (if any) were assumed to be minimal and were not included in the cost analyses.

This chapter presents the estimated nationwide capital and annualized costs for compliance with the PCWP rule. Compliance costs include the costs of installing and operating air pollution control equipment and the costs associated with demonstrating ongoing compliance (i.e., emissions testing, monitoring, reporting, and recordkeeping costs). Section 3.3.1 discusses the estimated air pollution control costs. Cost estimates associated with testing, monitoring, reporting, and recordkeeping are discussed in the Paperwork Reduction Act submission for the proposed PCWP standards and are summarized in Section 3.4.

3.3.1 Basis For Control Costs

As discussed above, add-on air pollution control devices most likely to be used to comply with the PCWP rule include incineration-based controls (e.g., RTO, RCO, and process incineration) or biofilters. The control device most commonly used to control emissions from PCWP plants is the RTO. Therefore, for costing purposes, it was assumed that most plants would install RTO's to comply with the rule. A number of RCO's and biofilters are also presently used by PCWP plants. In addition, several plants with large capacity heat energy systems currently use process incineration. However, the applicability of process incineration is limited to those plants that have, or may later install, large onsite heat energy systems. There may be cost advantages to using RCO's, biofilters, process incineration, other add-on control devices, or pollution prevention measures instead of RTO's for some plants. Plants may elect to use any of these technologies to comply with the rule, provided the technology limits HAP emissions to the levels specified in the rule. However, the cost analyses described in this chapter focus on use of RTO's due to their prevalence in the industry and to minimize the number of cost algorithms developed and to avoid judgements regarding which plants may choose a particular technology.

Oriented strandboard plants typically install WESP's upstream of rotary dryer RTO's to protect the RTO media from plugging. Thus, the capital and annualized costs associated with WESP's were modeled for rotary strand dryers. Available information indicates that WESP's are not necessary for protecting RTO's installed of other types of dryers (e.g., tube dryers) or on presses.[16] Therefore, with the noted exception of OSB dryers without WESP's, the existing particulate abatement equipment on process units was assumed to be sufficient for protecting the RTO media.[17]

Enclosures must be installed around presses to ensure complete capture of the press emissions before routing these emissions to a control device. Thus, the capital costs of permanent total enclosures (PTE's) were included in the costing analyses. Annualized costs associated with PTE's were assumed to be minimal and were not included in the cost analyses.

The following sections discuss the RTO, WESP, and PTE costs. Section 3.3.1.4 describes how plant-by-plant control costs were estimated, and Section 3.3.1.5 summarizes the nationwide control costs.

3.3.1.1 *RTO Costs*

An RTO cost algorithm was developed based on: (1) information from an RTO vendor with numerous RTO installations at PCWP plants, and (2) the costing methodology described in the EPA Air Pollution Control Cost Manual.[18,19] The RTO cost algorithm was used to determine RTO total capital investment (TCI) and total annualized cost (TAC) based on the exhaust flow to be controlled and annual operating hours. Development of the algorithm is discussed in Sections 3.4.1.1.1 and 3.4.1.1.2.

RTO Total Capital Investment.[18,19]

Equipment costs (including equipment, installation, and freight) were provided by the RTO vendor for four sizes of RTO's. The 1997 equipment costs were not escalated because the Vatavuk Air Pollution Control Cost Index (VAPCCI) for 1997 (107.9) was slightly greater than the preliminary VAPCCI for RTO's in fourth quarter 1999 (107.8). [20] According to the EPA Air Pollution Control Cost Manual, instrumentation is typically 10 percent of equipment cost (RTO and auxillary equipment); sales tax is typically 3 percent of the equipment cost; and freight is typically 5 percent of the equipment cost. Figure 3-1 presents the purchased equipment costs (PEC) supplied by the RTO vendor (minus freight), and shows that the equipment costs vary linearly with gas flow rate. The regression equation presented in Figure 3-1 was included in the RTO cost algorithm to calculate the equipment cost for the oxidizer and auxillary equipment for various gas flow rates. Instrumentation, sales tax, and freight were added to the calculated equipment costs to obtain the total PEC.

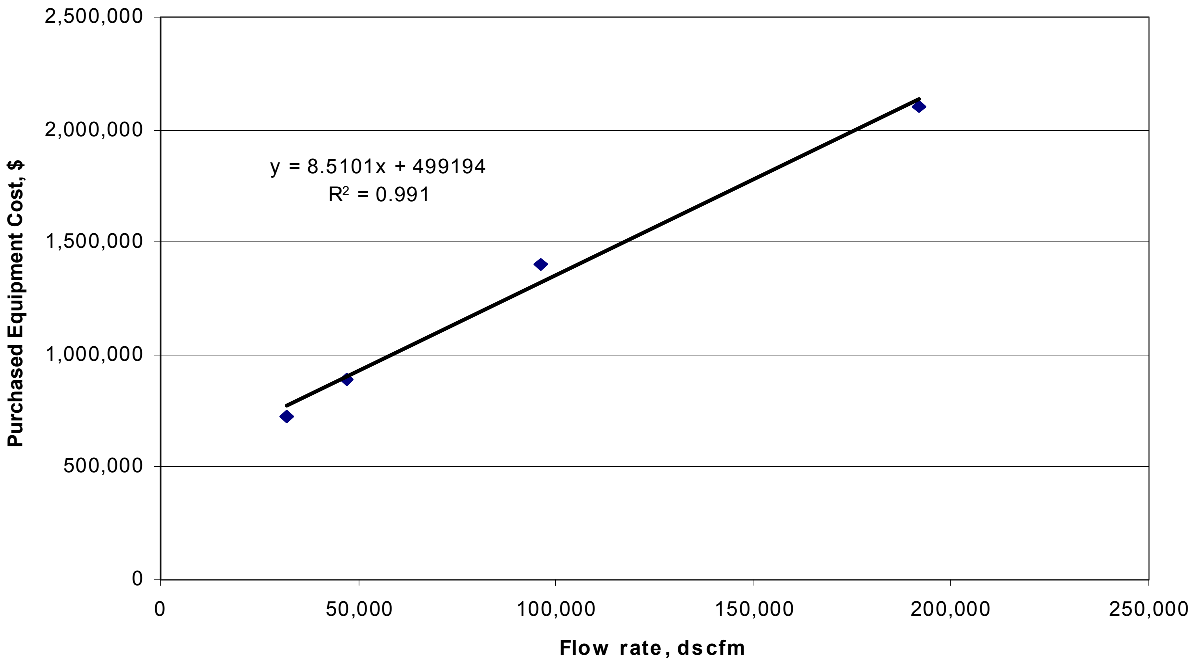


Figure 3-1. Variation in RTO purchased equipment cost with flow rate.

Direct installation costs for handling and erection, electrical, and piping were included in the equipment cost provided by the RTO vendor. Start-up costs were also included in the equipment cost provided by the RTO vendor. These costs are typically 22 percent of the PEC. Thus, these costs were subtracted from the PEC before further calculations based on the PEC were performed. Direct installation costs including foundation and support, insulation for ductwork, and painting were estimated according to the procedures in the EPA Air Pollution Control Cost Manual. Because PTE's were costed separately, no enclosure building was costed in the RTO algorithm. Site preparation costs and indirect installation costs (e.g., engineering, field expense, contractor fees, performance tests, and contengencies) were estimated according to the procedures in the EPA Air Pollution Control Cost Manual. The TCI was calculated by summing the PEC, direct and indirect installation costs, and site preparation cost.

RTO Total Annualized Cost

Total annualized costs consist of operating and maintenance labor and material costs, utility costs, and indirect operating costs (including capital recovery). Operating and maintenance labor and material costs were estimated based on the RTO vendor information because the RTO vendor assumptions led to higher costs than the EPA Air Pollution Control Cost Manual and were assumed to be more representative of the PCWP industry. The operator labor rate supplied by the RTO vendor was $19.50 per hour.

The RTO electricity use and natural gas use was provided by the RTO vendor for the four RTO sizes. Figures 3-2 and 3-3 present the relationships between flow rate and electricity and flow rate and natural gas use, respectively. As shown in the figures, there is a linear relationship between RTO electricity consumption and flow rate, and an exponential relationship between RTO fuel consumption and flow rate.

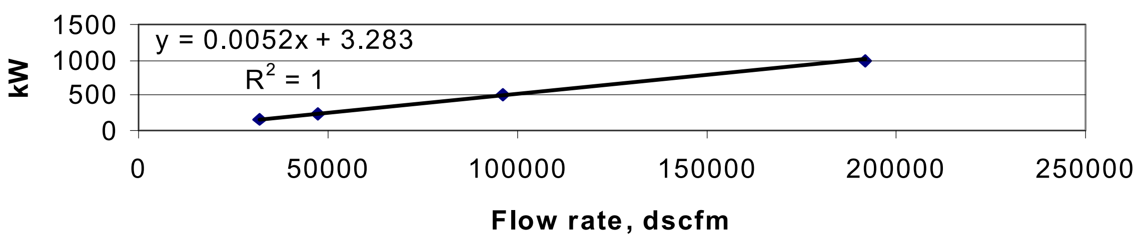


Figure 3-2. Relationship between RTO electricity consumption and flow rate.

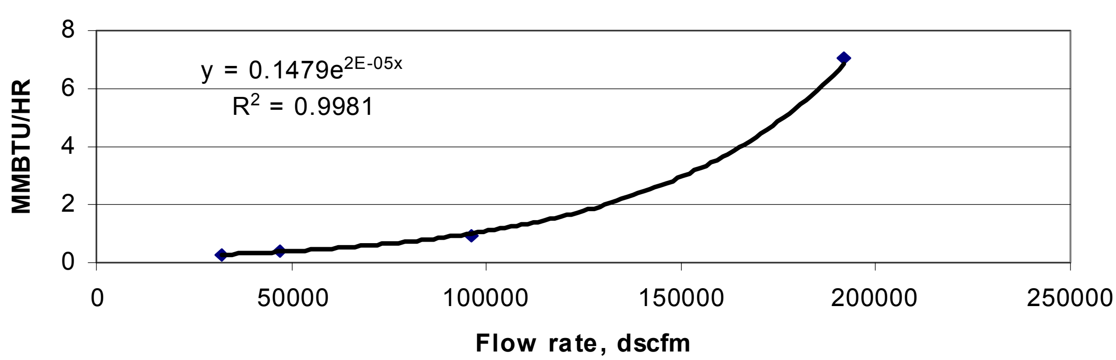


Figure 3-3. Relationship between RTO natural gas consumption and flow rate.

Electricity costs were estimated by the RTO vendor at $0.045 per kilowatt-hour (kWh). The RTO vendor estimated natural gas costs at $3 per million British thermal units (MMBtu). Both of these energy prices match closely with currently published nationwide average prices.[21,22] Thus, the electricity and natural gas prices supplied by the RTO vendor were used in the cost algorithm.

Indirect operating costs were estimated using the methodology described in the EPA Air Pollution Control Cost Manual. The capital recovery cost was estimating assuming an RTO equipment life of 15 years (based on the RTO vendor information) and a 7-percent interest rate. The TAC was calculated by summing the direct and indirect annual operating costs.

Application of the RTO Cost Algorithm to Estimate Capital and Annualized Costs.

The complete RTO cost algorithm, which predicts RTO capital and annualized costs as a function of operating hours and flow rate, was run several times assuming 8,000 operating hours per year and various flow rates. The 8,000-hr operating time was selected based on the results of the EPA's MACT survey, which show industry average operating hours of slightly less than 8,000-hr/yr.[10] Although several plants operate process lines more than 8,000 hr/yr, their equipment and control devices may or may not be operated for more than 8,000 hr/yr. Thus, 8,000 hr/yr was selected as the control device operating time for purposes of costing.

The TCI and TAC values generated for each flow rate using the RTO cost algorithm are presented in the BID for this proposed rule. A regression equation was developed based on the calculated TCI and TAC for each flow rate. Figures 3-4 and 3-5 present the relationships between flow rate and RTO capital costs and flow rate and annualized costs, respectively, and the associated regression equations.

3.3.1.2 *WESP Costs*

A WESP cost model was developed based on: (1) information from a WESP vendor with many WESP installations at wood products plants, and (2) the costing methodology described in the EPA Air Pollution Control Cost Manual for electrostatic precipitators (ESP's).[19,23] The cost model was used to determine TCI and TAC for WESP's used to control particulate emissions from OSB rotary dryers. The WESP vendor provided cost information for a WESP sized to treat 27,650 dry standard cubic feet per minute (dscfm) of OSB rotary dryer exhaust. This flow rate matches closely with the flow rates for

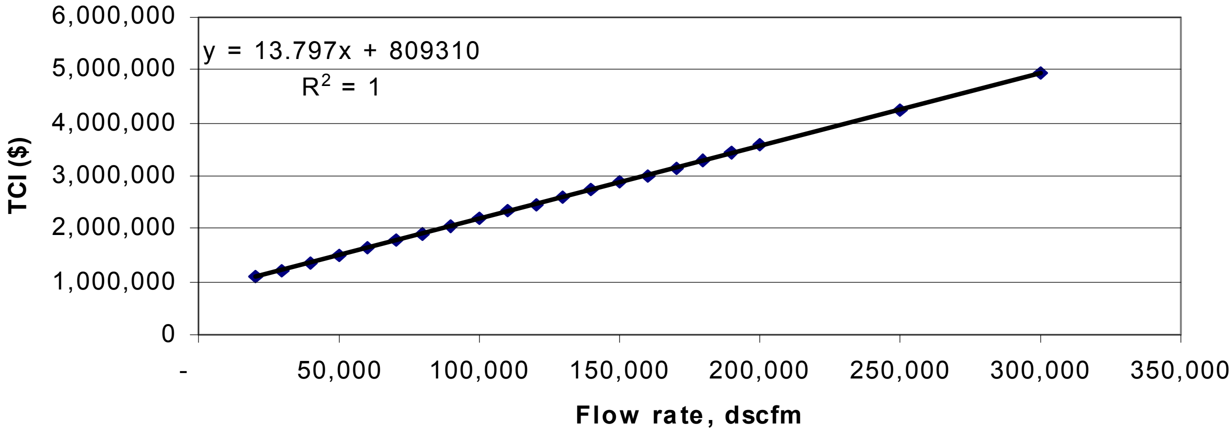


Figure 3-4. Variation in RTO total capital investment with flow.

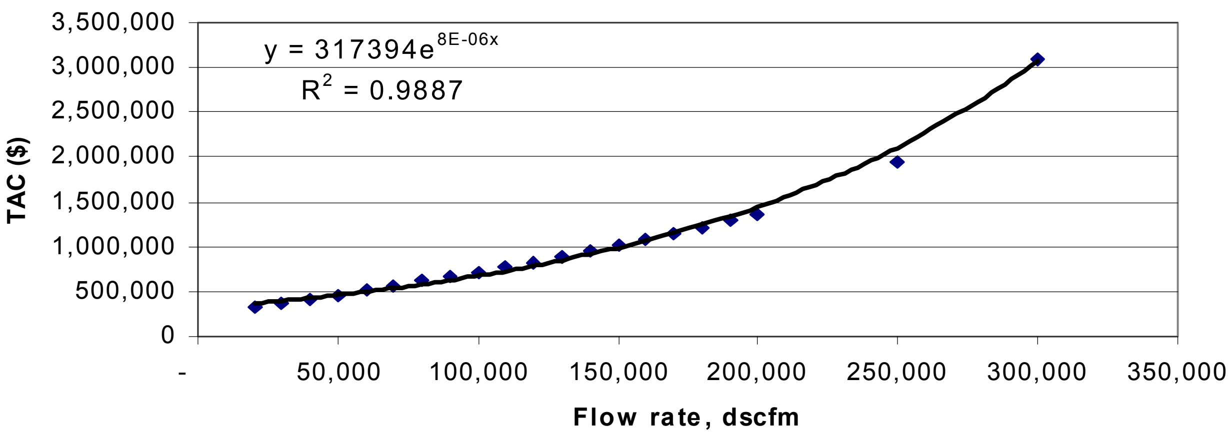


Figure 3-5. Variation in RTO total annualized cost with flow.

uncontrolled OSB. Thus, the model TCI and TAC could be applied for each dryer to be controlled (i.e., the model need not calculate different costs for varying flow rates). The WESP cost model is presented in the BID for the proposed rule. Development of the model is discussed below.

WESP Total Capital Investment.

The WESP and auxiliary equipment costs (which makeup the PEC) were provided by the WESP vendor. These PEC include the cost of the WESP; pumps, piping, and tanks; ducting (including the quench); fans; and a 1-gallon per minute (gpm) blowdown solids removal system. Instrumentation costs were also provided by the WESP vendor. Sales tax and freight were added into the total PEC based on the methodology described in the EPA Air Pollution Control Cost Manual.

The direct installation costs such as foundation and support, handling and erection, electrical, piping, insulation for ductwork, and painting were included in the PEC provided by the WESP vendor. It was assumed that no building would be necessary for the WESP and that there would be no additional site preparation costs. Several indirect costs were also included in the equipment cost supplied by the WESP vendor, including engineering, construction and field expense, start-up, and contingencies. Because WESP's are already widely used at OSB plants, it was assumed that no model study would be necessary for the WESP although the EPA Air Pollution Control Cost Manual mentions model-study costs for ESP's.

The cost of a performance test was included in the WESP cost model. According to the EPA Air Pollution Control Cost Manual, the performance test is typically 1 percent of the PEC. Thus, 1 percent of the model PEC (minus the direct and indirect installation costs included in the PEC) was used as the cost of the performance test. The direct and indirect costs were summed to arrive at the WESP TCI.

WESP Total Annualized Cost

The direct annualized costs include operating and maintenance labor and materials, utilities, and waste disposal. The operating labor cost was based on 1,146 hr/yr (provided by the WESP vendor) at $19.50/hr (the labor rate used in the RTO cost algorithm). The annual cost of operating materials, including caustic and defoamer, was provided by the WESP vendor. The maintenance labor rate was estimated as 110 percent of the operating labor rate. The maintenance hours per year were estimated based on information supplied WESP vendor. The cost of maintenance materials (including replacement of one pump seal per year, and one voltage controller every 4 years, and miscellaneous materials) was supplied by the WESP vendor.

The electricity necessary to power the WESP components (approximately 2,076,000 kWh/yr for all WESP components) was based on information provided by the WESP vendor. An electricity cost of $0.045/kWh was used (the same as used in the RTO cost algorithm). A $0.20/gal cost for makeup water was used based on the EPA Air Pollution Control Cost Manual. The WESP water recirculation rate, makeup water addition rate, and blowdown generation rates were provided by the WESP vendor. The EPA Air Pollution Control Cost Manual indicated that wastewater treatment costs may range from $1.30 to $2.15 /1,000 gallons. Methods of WESP wastewater treatment and disposal could include evaporation from settling ponds, discharge to a municipal water treatment facility, or spray irrigation. The wastewater treatment and disposal cost for the blowdown was assumed to be $2.15 per gallon. The wastewater percent solids of 7.6 percent was based on the average from the MACT survey responses.[11] It was assumed that the solids would ultimately be disposed in a landfill (although they could be burned onsite or used for soil amendment). The trucking cost for hauling sludge to landfill was estimated to be $0.20 yd3-mi.[22] The landfill was assumed to be 20 miles away, and a $20/ton landfill tipping fee was used.[22] The density of the solids was assumed to be 0.5 ton/yd3 for wet wood particulate (given that the density of water is 0.84 ton/yd3 and the density of wood is from 30 to 50 percent of the density of water).

The indirect operating costs were estimated based on the methodology described in the EPA Air Pollution Control Cost Manual. The capital recovery cost was estimated assuming a WESP equipment life of 20 years (based on the EPA Air Pollution Control Cost Manual and WESP vendor information) and a 7-percent interest rate. The TAC was calculated by summing the direct and indirect annual operating costs.

3.3.1.3 *Permanent Total Enclosure (PTE) Costs*

The capital costs associated with installation of a PTE were based on available information in the project files on the capital cost of PTE's for particleboard, MDF, and OSB presses.[24] These costs included the following elements:

- installed cost of the PTE (including fan system)
- ductwork
- instrumentation and wiring
- fire suppression (in some cases)
- site supervision
- start-up and testing

Based on the available cost information, the following algorithm was developed to estimate the PTE costs for various exhaust flowrates:

$$TCI_{PTE} = 1.2031 \times Q_{dscfm} + 425{,}760$$

where:

TCI_{PTE} = the total capital cost of the permanent total enclosure, $

Q_{dscfm} = design exhaust flow rate from PTE, dry standard cubic feet per minute

Available information on actual exhaust flow rates from PTE's installed around reconstituted wood product presses was used to develop model flow rates for the various press applications.[25] Information on press vent flow rates from unenclosed presses was available, but not used, because unenclosed press flow rates are altered when a PTE is installed around a press.[26] The cost algorithm was then applied to the model flow rates to estimate the capital costs of the model PTE's as shown in Exhibit 3-10. The costs were rounded to the nearest $1,000. In the case of the particleboard press PTE, the cost was set at $485,000 (instead of $481,000, which is the value derived from the cost algorithm) because the PTE model flow rate was similar to those for the MDF and hardboard presses, and applying the same cost to all three types of press PTE's simplified the costing analyses. Annualized costs were not developed for PTE's because the annualized cost of the fans is already accounted for in the estimated costs of the RTO's.

Exhibit 3-10. PRESS ENCLOSURE EXHAUST FLOW RATES AND CAPITAL COSTS

Equipment type	Flow rate, dscfm	PTE capital cost
Particleboard press	45,524	$485,000
OSB press	97,509	$543,000
MDF or dry/dry hardboard press	49,413	$485,000
Wet/dry or wet/wet hardboard press	49,209	$485,000

3.3.2 Plant-by-Plant Costing Approach

The control costs associated with the PCWP standards were estimated for each plant and were summed to arrive at a nationwide estimate of control costs. The PCWP standards apply only to major sources of HAP emissions. Therefore, cost estimates were developed for only those plants that were assumed to be major sources.[15] The information used to estimate the plant-by-plant control costs is described below.

3.3.2.1 *Application of Control Costs to Process Units*

The cost models discussed in Section 3.3.1 were applied to each plant that would likely need to install air pollution controls in order to meet the PCWP standards. Plant-specific information on process units (e.g., dryers, presses) and controls was taken from the MACT survey responses.[10,11,12] In addition, information about the presence of PTE's on presses was taken from the MACT survey responses.[10] If information about press enclosures was not provided in the MACT survey responses, or was claimed confidential, the press was assumed to be unenclosed if it was uncontrolled or enclosed if it was controlled for purposes of costing.

Some plants have begun operation and other plants have added equipment or controls since EPA conducted the MACT survey. Such changes were accounted for in the nationwide cost estimates. A separate memorandum summarizes the changes to plants that have occurred following the EPA's MACT survey.[13]

The process units and controls present at each plant were reviewed to determine which of the assumed what control equipment (i.e., RTO, WESP, or PTE) the plant would need to install to meet the PCWP standards based on the MACT floor control levels. The MACT floor control levels are based on the information presented in the BID for this proposed rule.[6] Exhibit 3-2 summarizes the process units for which control equipment would be required to meet the MACT floor and the control equipment costed for these process units. At each plant, the exhaust gas flow rates from the applicable uncontrolled process units listed in Exhibit 3-11 were summed to yield a plant-wide uncontrolled exhaust gas flow rate. Process units already equipped with controls to meet the MACT floor were not included in the plant-wide uncontrolled gas flow rate estimates. The procedures for estimating the uncontrolled gas flow rates from process units and the application of the cost algorithms is discussed in the following section.

Exhibit 3-11. CONTROL EQUIPMENT COSTED FOR PROCESS UNITS WITH CONTROLLED MACT FLOOR

Existing process units with control requirements	Control equipment costed	Notes
Tube dryers (primary and secondary)	RTO	Tube dryers are located at particleboard, MDF, and hardboard plants
Rotary strand dryers	WESP and RTO	Rotary strand dryers are located at OSB and LSL plants. Assumed that the WESP is not needed for plants that already have an RTO without a WESP. Assumed that plants that currently operate an EFB or multiclone alone (i.e., with no RTO) would install a WESP with the RTO.
Conveyor-type strand dryers	RTO	Conveyor strand dryers are located at OSB and LSL plants.

Rotary green particle dryers	RTO	Rotary green particle dryers are located at particleboard, MDF, or hardboard plants and process furnish with >30% (dry basis) inlet moisture content at dryer inlet temperature of >600°F
Hardboard ovens	RTO	Includes bake and tempering ovens
Softwood veneer dryers	RTO	Softwood veneer dryers are located at softwood plywood, hardwood plywood, LVL, and PSL plants and dry 50% (by volume, annually) softwood veneer
Pressurized refiners	None	The exhaust from pressurized refiners typically passes through a tube dryer and exits through the tube dryer control device. Therefore, it was not necessary to cost separate control equipment for pressurized refiners. Pressurized refiners are located at MDF and hardboard plants.
Reconstituted wood products presses	PTE and RTO	Reconstituted wood products presses are located at hardboard, MDF, OSB, and particleboard plants

Exhaust Flow Rate to Be Controlled

If provided in the non-confidential MACT survey responses, process-unit specific exhaust flow rate, temperature, and percent moisture were used to determine the dry standard flow rate for each process unit. If sufficient information was not provided in the MACT survey response to determine dry standard flow rates (or the information was claimed confidential), then default values were used for the flow rate. The default values were based on the average value for other similar process units at plants that provided enough non-confidential information to calculate the dry standard flow rate. Exhibit 3-12 summarizes the default flow rates used in the costing analyses. The average flow rates from press enclosures are described in Section 3.3.1 and were used for all presses.

Exhibit 3-12. DEFAULT FLOW RATES

Process line	Equipment type	Flow rate (dscfm)
Particleboard	Rotary green particle dryer	35,731
	Tube dryer	14,955
OSB	Rotary strand dryer	32,478
	Conveyor-type strand dryer	37,810
MDF	Primary tube dryer (single-stage or first stage of staged dryer)	79,173
	Secondary tube dryer (second stage of staged dryer)	18,195
Plywood	Softwood veneer dryer	12,062
Hardboard	Bake oven	4,742
	Tempering oven	4,055
	Primary tube dryer (single-stage or first stage of staged dryer)	37,436
	Secondary tube dryer (second stage of staged dryer)	31,728

Several plants have multiple process units requiring controls. The flow rates for these process units were summed and divided across control equipment as necessary. In most cases, the total dryer flow was assumed to be routed to one or more RTO's dedicated to controlling dryer exhaust and the total press flow was assumed to be routed to one or more RTO's dedicated to controlling press exhaust. Because RTO fuel costs increase exponentially with gas flow rate, RTO sizes were assumed to remain less than about 150,000 dscfm. (The largest RTO in mentioned in the MACT survey responses was around 150,000 dscfm.)

In some cases, dryers and presses were assumed to be routed to the same RTO, provided that the total dryer and press flow remained under 150,000 dscfm. For example, two RTO's (103,500 dscfm each) would be costed for a MDF plant with 2 dryers (79,000 each) and 1 press (49,000) assuming that the flow for both dryers and the press could be combined and split equally across the two RTO's. This approach seems reasonable given that several MDF plants currently route dryer and press exhaust to the same RTO.

Calculation of Nationwide Control Costs

The total plant-by-plant control cost was calculated by summing the control cost associated with each RTO, WESP, and PTE costed for each plant. The number of control devices at each plant depended on the number of process units and the exhaust flow to be controlled at the plant. In some cases, only one control device was costed, while in other cases, multiple control devices were costed for a plant.

Some plants claimed all relevant portions of their MACT survey responses confidential. In addition, a MACT survey response was not available for a few plants likely to be impacted by the PCWP standards. Without a non-confidential MACT survey response, information was not available to develop plant-specific cost estimates. Therefore, the average cost for all other plants manufacturing the same product was used to approximate the costs for plants for which there was no non-confidential plant-specific information.

The nationwide capital and annualized control costs were determined by summing the total plant-specific costs.

3.3.3 Summary of Nationwide Control Costs

Exhibit 3-13 summarizes the nationwide control costs for different product types. The nationwide total capital cost for control equipment is estimated to be $473 million and the nationwide total annual cost for control equipment is estimated as $136 million (1999 dollars). Exhibit 3-14 presents the dollars of total annualized costs per ton of HAP and THC reduced.

3.4 Testing, Monitoring, Reporting, And Recordkeeping Costs

Compliance with the PCWP standards must be demonstrated through performance testing, ongoing monitoring of process or control device operating parameters or emissions, periodic reporting to the government agency that implements the PCWP rule, and recordkeeping. There are capital and annualized costs associated with these testing, monitoring, reporting, and recordkeeping activities. These costs, which are estimated and documented in the supporting statement for the Paperwork Reduction Act submission, and are summarized in this section.[27]

Exhibit 3-13. ESTIMATED NATIONWIDE CONTROL COSTS FOR THE PCWP INDUSTRY

Product type	No. of plants[a]	No. of plants impacted[a,b]	Process units impacted	Control equipment	Total capital costs, $MM	Total annual costs, $MM
Softwood plywood/veneer	105	66	softwood veneer dryers	RTO	$87.1	$28.4
Hardwood plywood/veneer	166	0	N/A	no control	$0.0	$0.0
Medium density fiberboard	24	18	dryers, presses	RTO for dryers and PTE/RTO for presses	$71.3	$21.5
Oriented Strandboard	37	23	dryers, presses	WESP/RTO for dryers and PTE/RTO for presses	$94.6	$25.5
Particleboard (conventional and molded)	51	38	green rotary particle dryers, presses	RTO for dryers and PTE/RTO for presses	$125.2	$34.2
Particleboard (agriboard)	5	0	N/A	no control	$0.0	$0.0
Hardboard	18	18	tube dryers, presses, ovens	RTO for dryers and PTE/RTO for presses	$84.4	$23.5
Fiberboard	7	0	N/A	no control	$0.0	$0.0
Engineered wood products	41	3	softwood veneer dryers, strand dryers	RTO for veneer dryers and WESP/RTO for strand dryers	$10.3	$3.2
TOTAL:	454	166			$473	$136

[a] Some plants manufacture more than one product type. These plants are listed once for each product type manufactured.

[b] The number of plants impacted may be different from the number of plants nationwide for one of the following reasons: (1) some plants are not major sources; (2) some plants already have all of the necessary control equipment; or (3) a few plants are major sources but do not operate any process units for which there are control requirements (e.g., glu-lam plants).

Exhibit 3-14. DOLLARS (IN TOTAL ANNUALIZED COSTS) PER TON OF HAP AND THC REDUCED

Product type	HAP, $/ton	THC, $/ton
Softwood plywood/veneer	$43,000	$2,900
Hardwood plywood/veneer	NA	NA
Medium density fiberboard	$10,000	$5,100
Oriented Strandboard	$9,200	$7,100
Particleboard (all types)	$13,000	$5,800
Hardboard	$9,300	$7,000
Fiberboard	NA	NA
Engineered wood products	$47,000	$18,000
Overall industry	$13,000	$5,000

The annual costs associated with testing, monitoring, reporting, and recordkeeping activities include reporting and recordkeeping labor; annualized capital for monitoring equipment, file cabinets, and performance tests; and the operation and maintenance costs associated with monitoring equipment. The capital costs include capital for monitoring equipment, file cabinets and performance tests. Performance tests are considered to be capital costs because plants will typically hire a testing contractor to conduct the performance tests.

The total nationwide capital cost associated with testing, monitoring, reporting, and recordkeeping is estimated to be $5.8 million and the total nationwide annualized cost is estimated to be $5.6 million (1999 dollars). These costs were developed based on the information presented in the Paperwork Reduction Act submission for the first 3 years following the effective date of the PCWP rule. The costs apply for the 223 PCWP plants that are expected to be major sources. There are 57 facilities that incur monitoring, recordkeeping, and reporting costs but do not incur control costs from compliance with this proposed rule.

3.5 REFERENCES

1. United States Congress. Clean Air Act, as amended October 1990. 42 U.S.C. 7401 et seq. Washington, DC. U.S. Government Printing Office.

2. U. S. Environmental Protection Agency. National Emission Standards for Hazardous Air Pollutants for Source Category: Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry and Other Processes Subject to the Negotiated Regulation for Equipment Leaks; Determination of MACT "Floor." 59 FR 29196. Washington, DC. U.S. Government Printing Office. June 6, 1994.

3. Memorandum from K. Hanks and B. Nicholson, MRI, to P. Lassiter, EPA/ESD. April 16, 1998 (Finalized 5/28/98). Trip report for February 12, 1998 site visit to Timber Products Company particleboard and hardwood plywood plant in Medford, Oregon.

4. R. Nicholson, MRI, to D. Word, NCASI. February 17, 2000 (Confirmed via Email on 9/7/00). Contact report to (1) find out if oxygen measurement data were available from the NCASI MACT emissions test program, and (2) to get some information on typical oxygen concentrations in dryer and press exhaust at plywood and composite wood products plants.

5. Memorandum from R. Nicholson, MRI, to M. Kissell, EPA/ESD. May 26, 2000. Control Device Efficiency Data for Add-on Control Devices at PCWP Plants.

6. Memorandum from K. Hanks and B. Nicholson, MRI, to M. Kissell, EPA/ESD. July 13, 2000. Determination of MACT floors and MACT for the Plywood and Composite Wood Products Industry.

7. National Council of the Paper Industry for Air and Stream Improvement (NCASI) Method IM/CAN/WP-99.01, Impinger/Canister Source Sampling Method for Speciated HAPs at Wood Products Facilities. 1999.

8. Reference 6.

9. Memorandum from K. Hanks and D. Bullock, MRI, to M. Kissell, EPA/ESD. June 9, 2000. Baseline Emission Estimates for the Plywood and Composite Wood Products Industry.

10. Memorandum from D. Bullock, K. Hanks, and B. Nicholson, MRI to M. Kissell, EPA/ESD. April 28, 2000. Summary of Responses to the 1998 EPA Information Collection Request (MACT Survey) -- General Survey.

11. K. Hanks, B. Threatt, and B. Nicholson, MRI to M. Kissell, EPA/ESD. May 19, 1999. Summary of Responses to the 1998 EPA Information Collection Request (MACT Survey) -- Hardwood Plywood and Veneer.

12. K. Hanks, B. Threatt, and B. Nicholson, MRI to M. Kissell, EPA/ESD. January 20, 2000. Summary of Responses to the 1998 EPA Information Collection Request (MACT Survey) -- Engineered Wood Products.

13. Memorandum from K. Hanks, MRI, to Project Files. April 18, 2000. Changes in the population of existing plywood and composite wood products plants and equipment following the information collection request.

14. Memorandum from D. Bullock and K. Hanks, MRI, to M. Kissell, EPA/ESD. April 27, 2000. Documentation of Emission Factor Development for the Plywood and Composite Wood Products Manufacturing NESHAP.

15. Background Infomation Document for the Proposed Plywood and Composite Wood Products NESHAP. U.S. EPA/OAQPS, September 2000.

16. Suchsland, O., and G. Woodson, *Fiberboard Manufacturing Practices in the United States*, John Wiley & Sons, New York, 1991, pp. 151-153.

17. K. Corrigan, North Dakota Department of Health, Division of Environmental Engineering. February 11, 1997. Performance Test Report Review: Primeboard, Inc.

18. Facsimile from J. Seiwert, Smith Environmental Corporation, to L. Kesari, EPA/OECA. October 31, 1997. Revised emissions abatement systems RTO pricing (Smith Proposal BO7-95-156-1, Trinity Consultants)

19. EPA Air Pollution Control Cost Manual (Sixth Edition), U.S. Environmental Protection Agency, April 26, 2002. EPA -452/B-02-001. Found on the Internet at www.epa.gov/ttn/catc/products.html#cccinfo.

20. Vatavuk Air Pollution Control Cost Indexes (VAPCCI), *Chemical Engineering*, March 2000, p. 150.

21. Energy Information Administration, Form EIA-826, "Monthly Electric Utility Sales and Revenue Report with State Distributions."

22. Energy Information Administration, *Natural Gas Monthly*, February 2000, p. 60.

23. Letter and attachments from S. Jaasund, Geoenergy International Corporation, to B. Nicholson, MRI. March 28, 2000. Geoenergy WESP Capital and Operating Costs.

24. Memorandum from B. Nicholson, MRI, to Plywood and Composite Wood Products Project File. July 31, 2000. Cost of Permanent Total Enclosures. (Confidential Business Information)

25. Memorandum from B. Nicholson, MRI, to Plywood and Composite Wood Products Project File. July 31, 2000. Exhaust Gas Flowrate Information for Enclosed Presses. (Confidential Business Information)

26. Memorandum from D. Bullock and K. Hanks, MRI, to P. Lassiter, EPA/ESD. October 27, 1998. Trip report for visit to Temple-Inland Forest Products plant in Diboll, Texas.

27. Paperwork Reduction Act Submission, Supporting Statement, Plywood and Composite Wood Products, 2000.

4 ECONOMIC IMPACT ANALYSIS

4.1 Results in Brief

This economic impact analysis presents the results of modeling the effects of the proposed plywood and composite wood products NESHAP upon affected facilities, firms, markets, and industries. The analysis shows that product prices increase for each of the four industry sectors included in the economic model, from 0.9 percent for the softwood plywood industry to 2.5 percent for the particleboard and medium density fiberboard industry. Output is expected to decrease from 0.1 percent for the softwood plywood industry to 0.7 percent for the particleboard and medium density fiberboard industry. Exports of these products are expected to decline by no more than 0.7 percent for these four industries, while imports are expected to rise. Only one product line closure at an affected facility is expected, and employment at affected firms is expected to decline by only 0.3 percent. In addition, an analysis of effects of this proposal on the supply, distribution, or use of energy finds that these effects are not significant.

4.2 Introduction

The U.S. EPA is proposing a rule that addresses the emissions of hazardous air pollutants (HAPs) from facilities that produce plywood and composite wood products. As described in Chapter 3, the proposed rule will result in some facilities in this industry incurring costs associated with controlling HAP emissions. The addition of these control costs will directly affect the individual facilities because their costs of production will increase. In addition, the addition of compliance costs may also have an effect on the overall markets for plywood and wood composite products through market price changes. Depending on market conditions, these changes could occur if facilities with compliance costs increase their prices, reduce their output, or cease operations altogether.

This section presents estimates of the economic changes that are expected to occur as a result of the proposed NESHAP rule for the plywood and composite wood industry U.S. EPA, 1999a). The goal of the assessment is to develop estimates of the following impact measures.

- Market price changes
- Market quantity changes
- International trade effects
- Size and distribution of social costs

Chapter 2 presented a profile of the different sectors within the plywood and composite wood industry, which provides market information necessary to design and implement the EIA for this industry. The plywood and composite wood products manufacturing industry affected by the proposed NESHAP rule includes five distinct market sectors.

- Softwood Plywood and Veneer (SWPW)
- Oriented Strandboard (OSB)

- Other Wood Composites (OWC), including
    - Particleboard and Medium Density Fiberboard (PB/MDF)
    - Hardboard (HB)
- Engineered Wood Products (EWP)

For all but the EWP market sector, the Agency applied partial equilibrium (P/E) modeling techniques to estimate the economic impacts of the proposed NESHAP rule for plywood and wood composites. For reasons presented in Section 4.4 below, developing an estimate of the economic impacts of the proposed rule on the EWP sector required a qualitative approach.

Section 4.3 presents the inputs for the P/E economic analysis, including producer characterization, market characterization, and compliance costs of the regulation. Section 4.4 describes the approach to estimating the economic impacts on the SWPW, OSB, PB/MDF, and HB industry sectors, and Section 4.5 presents the results of the economic impact analysis. Section 4.6 presents the qualitative analysis of the EWP market sector.

4.3 Economic Impact Analysis Inputs

The first step of an impact assessment is developing information used to characterize the baseline conditions of the industry. Key information needed for EIA inputs is used to characterize the following.

- Individual producers
- Product markets
- Compliance costs

4.3.1 Producer Characterization

The primary source of baseline data on individual producers used in the EIA is a database developed using the data collected by 1998 ICR described in Chapter 2 (U.S. EPA, 1998). The information in the facility database allowed the characterization of facilities according to several features needed for the analysis, including major products (SWPW, OSB, etc), baseline production volumes, and facility capacity. The baseline year for the analysis is 1997 as it corresponds to the year for which plywood and composite wood producers provided this information.

For certain facilities, production and capacity information was not available, and was supplemented by additional research. Those facilities without specific production and capacity data were assigned an estimate based on the average production and capacity data for facilities within the same market sector and size category (as determined by employment).

4.3.2 Plywood and Composite Wood Markets

The Plywood and Composite Wood Products industry is a broad category encompassing the four distinct markets listed above: (1) SWPW, (2) OSB, (3) OWC, and (4) EWP. For reasons discussed in the EIA, the OWC sector is decomposed into two markets: PB/MDF and HB. The Agency developed P/E models representing each of these four markets.

Market level data used in this EIA are presented in Exhibit 4-1. The market prices and elasticities for each of the four markets were obtained from various industry market reports and economic literature as described in Chapter 2. Total market volumes used in the models for each product are the sum of the production of all identified U.S. facilities (from the facility database) and imports from foreign producers. Total U.S. production for each market is the total production of all facilities identified in the EPA's facility database. The production was also separated in to two subsets - the total production of affected facilities and the total production of unaffected facilities.[1] The source of foreign trade data on exports and imports of these products was presented in Chapter 2.

Exhibit 4-1: Baseline Characterization of Plywood and Composite Wood Markets: 1997

	Softwood Plywood	Oriented Strandboard	"Other Composites"	
			PB/MDF	HB
Market price (1997$/cubic meter)	$235	$185	$169	$1,322
Price Elasticity of Demand				
Construction	-0.1034	-0.1034	-0.1149	-0.1149
Manufacturing/Other	-0.2585	n/a	-0.2872	-0.2872
Price Elasticity of Supply	0.42	0.42	0.42	0.42
Market quantity (thousand cubic meters)	17,568,254	9,595,121	11,646,227	1,768,930
Domestic production	17,568,162	9,590,456	11,644,523	1,768,545
Affected	11,680,778	4,691,645	9,670,639	1,768,545
Unaffected	5,887,384	4,898,811	1,973,884	n/a
Exports	1370	148	333	371
Imports	92	4,666	1,705	385

Sources: U.S. EPA facility database; Section 2; and Appendix B of the Economic Impact Analysis.

4.3.3 Facility Compliance Costs

As described in Chapter 3, the Agency developed compliance costs estimates for those facilities that must control HAP emissions in accordance with the regulatory requirements of the proposed NESHAP rule. The EIA uses these costs to develop a "with regulation" market equilibrium scenario used to estimate changes in individual facility production, total market volumes, market price, and social costs. Typically, the Agency adjusts the compliance cost estimates from nominal dollars to baseline dollars using the plant cost indices to be consistent with the baseline industry characterization of the economic model (U.S. EPA, 1999b). In this case, there was virtually no change in the plant cost indices between the baseline year of 1997 and current period, so no adjustment was made to the costs used in this analysis.

[1] As mentioned in Chapter 1, some facilities in the "unaffected" category have monitoring, reporting, and record keeping costs of $25,194 per year.

4.4 Economic Impact Analysis Methodology

The following section presents a summary of the approach used to assess the economic impacts of the proposed NESHAP rule. The EIA contains a more detailed description of the methodology used to analyze the economic impact of this proposed regulation on each of the markets analyzed. The purpose of the EIA is to model the responses of individual producers and the overall market to the imposition of compliance costs. For this EIA, the agency used a market-based economic model that reflects the production choices producers make in the face of changes in their individual production costs and changes in overall market prices.

The economic model used in this analysis simulates the short run decisions of the producers in response to operating cost and price changes within a given market. For each of the four markets, the model used in this analysis assumes that the market is perfectly competitive, based on the conclusions drawn from the information in the industry profile. In a competitive market, each individual facility takes the price as determined by the market because they do not have the power to set the market price of the product. The approach used for this EIA assumes that the competitive market for each of the four products determines both prices and quantities (U.S. EPA, 1999b).

In the short run, a firm with an existing plant will decide, based on the market price, how much output to produce with its capital stock (e.g., fixed investment in the plant and equipment) considered as constant. In this decision, the firm considers the costs of inputs that vary with output levels, such as materials and labor (U.S. EPA, 1999b). When the market price is equal to the average variable (operating) costs, the firm is only recouping the cost of its variable inputs. When the price is less than the firm's variable costs, it will no longer produce output because it cannot recover all of its variable costs in the short run. When the market price exceeds variable costs, the firm can also recover a part of its fixed investment in the plant and equipment. In the long run, the firm must cover all of its fixed investment in the plant and equipment. Under this more stringent condition, the market price must exceed its average total costs, which include capital and variable input costs. In this analysis, which is short-run in timeframe, the model assumes that all firms wish to maximize its profits and will produce output using their existing plants as long as the market price even marginally exceeds their variable costs of producing output.

The market model developed by the Agency for this EIA is based on a series of equations that represent the market supply and demand functions for a given product. The demand functions use baseline price, total domestic production, import, and export data, as well as estimates of the price elasticity of demand for a given product as inputs. The market supply function is based on an estimated supply function for each plywood or wood composite product at all production facilities. The Agency developed a spreadsheet model for each of the four markets to represent the conceptual model described below. The EIA provides a description of this process.

Figure 4-1 shows a generalized upward-sloping supply function that characterizes the production function of each facility included in the analysis (affected and unaffected). In the EIA model, this function represents the marginal cost curve for each supplier of the product within the market. The minimum constraint on this function is zero, and the maximum constraint is each facility's capacity. If the market price is above a given facility's average variable cost, the facility will produce output up to the point where production equals the facility's production capacity. If a given facility's marginal production cost is above the market price, it will produce zero output (EPA, 1999b).

The model then aggregates the supply functions of the individual facilities within a market to represent the market level supply curve. Next, the model equilibrates the market demand curve and the market supply curve according to the baseline market price and quantity values. Figure 4-2 shows that market prices and quantities are set in the baseline according to the intersection of the supply and demand curves in the baseline (the period prior to the imposition of compliance costs on affected facilities). The baseline scenario equilibrium market price and quantity (P, Q) are the points on the

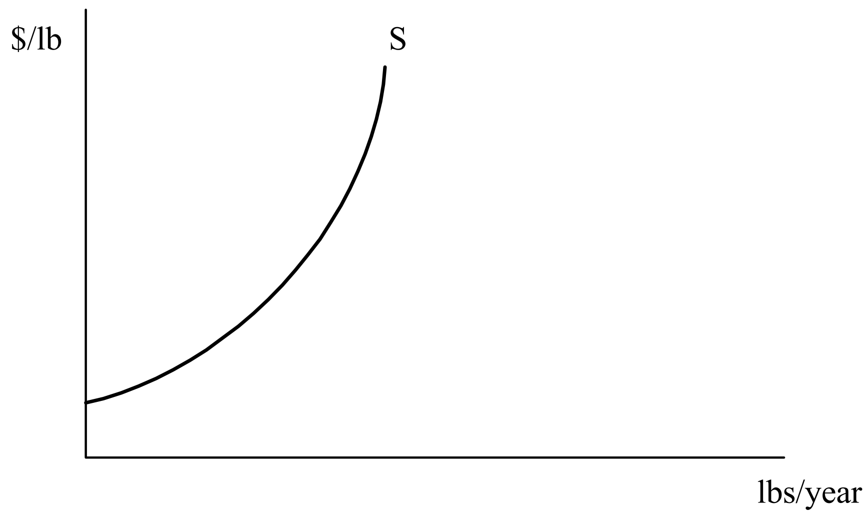


Figure 4-1. Supply Curves for Affected Facilities

Source: U.S. EPA, 1999b.

graph's axes points where the downward-sloping market demand curve (D^M) intersects with the upward-sloping market supply curve (S^M). In the baseline, at price P, the industry produces total output, Q, with affected facilities producing the amount q_a and unaffected facilities producing q_u (EPA, 1999b).

Next the same facility-specific supply functions in the model are recalculated after taking into account the increase in production costs associated with the imposition of annual compliance costs on some producers. The costs are expresses in terms of dollars per unit of output in the baseline (in this case per thousand cubic meter of product). Figure 4-1(b) show the effect of the compliance costs: the supply curve for the affected producers shift upward S_a to S_a' . This raises the point at which market price must cover variable production costs from p_a to p_a'. The supply curve S_u for the unaffected facilities remain the same. When the supply curves for the affected and unaffected facilities are aggregated to represent the market level supply curve, the market supply curve also shifts upward from S^M to $S^{M'}$. Using the original market demand curve, D^M, the new equilibrium price increases from P to P' and market output declines from Q to Q'. This reduction in market output is the net result from reductions at affected facilities and increases at unaffected facilities (EPA, 1999b). For more information on the economic impact analysis methodology, refer to Appendix B of this report.

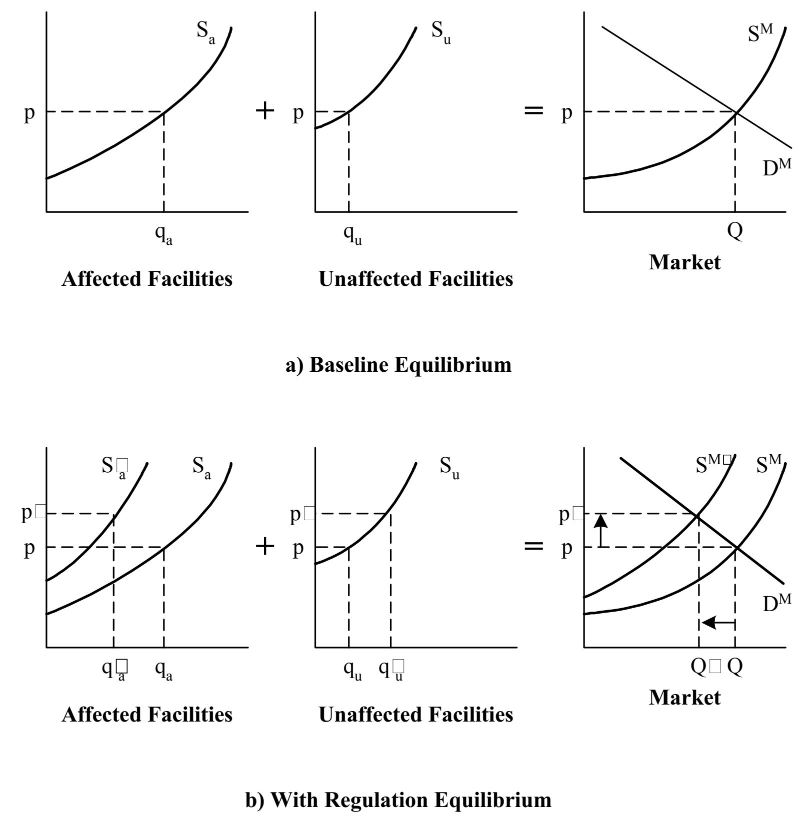


Figure 4-2. Market Equilibrium Without and With Regulation

Source: U.S. EPA, 1999b.

4.5 Economic Impact Analysis Results

The following section presents the results of the Agency's implementation of the EIA models described in the previous section. The results are presented at three levels: market, industry, and societal. The market level results present the impacts in terms of changes in price and quantity for each of the four markets. The industry level impacts include changes in revenues, production, employment, and number of operating production lines.

4.5.1 Market-Level Results

Exhibit 4-2 presents the expected impacts of the regulation at the market-level. These changes include the new price and quantity for each product and changes in foreign trade. In each market, prices increase and production quantities decrease due to the imposition of compliance costs on the affected producers. The reduction in market quantities of each product reflect reductions in domestic production (including production for exports) and increases in foreign imports. The reduction in domestic production reflects production decreases by affected producers and increases by unaffected producers (EPA, 1999b).

For softwood plywood, the market price is expected to increase by 0.9 percent, while market quantity declines by 0.1 percent, or 26,207 thousand cubic meters (or M cubic meters) per year. For oriented strandboard, the market price is expected to increase by 1.3 percent, while market quantity declines by 0.1 percent, or 12,945 M cubic meters per year. For particleboard and medium density fiberboard, the market price is expected to increase by 2.5 percent, while market quantity declines by 0.7 percent, or 78,595 M cubic meters per year. Finally, for hardboard, the market price is expected to increase by 1.0 percent, while market quantity will decline by 0.3 percent, or 4,727 M cubic meters per year.

Generally, increases in market price result in changes in foreign trade of these products: exports decrease and imports increase. Exhibit 4-2 shows that exports of softwood plywood from the United States are expected to decline by 0.2 percent (or 2 M cubic meters per year); exports of oriented strandboard are expected to decline by 0.1 percent (or 0.2 M cubic meters per year); exports of particleboard and medium density fiberboard are expected to decline by 0.7 percent (or 2 M cubic meters per year); and exports of hardboard are expected to decline by 0.2 percent (or 1 M cubic meter per year). Imports of each of these products to the United States are expected to increase as follows: SWPW by 685 percent (or 630 M cubic meters per year), OSB by 28.82 percent (or 1,345 M cubic meters per year), PB/MDF by 85 percent (or 1,451 M cubic meters per year), and HB by 100 percent (or 387 M cubic meters per year).

Exhibit 4-2. Market-Level Impacts of the Proposed NESHAP

Industry Sector	Baseline	With Regulation	Changes from Baseline	
			Absolute	Percent
Softwood Plywood				
Market price (1997$/cubic meter)	$235	$237.20	$2.20	0.9%
Market output (M cubic meters/yr)	17,568,254	17,542,048	-26,206	-0.1%
Domestic production	17,568,162	17,541,326	-26,837	-0.2%
Affected Facilities	11,680,778	11,629,258	-51,520	-0.4%
Unaffected Facilities	5,887,384	5,912,067	24,683	0.4%
Exports	1,370	1,368	-2	-0.2%
Imports	92	722	630	685.1%
Oriented Strandboard				
Market price (1997$/cubic meter)	$185	$187.43	$2.43	1.3%
Market output (M cubic meters/yr)	9,595,121	9,582,176	-12,945	-0.1%
Domestic production	9,590,456	9,576,165	-14,291	-0.1%
Affected Facilities	4,691,645	4,654,117	-37,528	-0.8%
Unaffected Facilities	4,898,811	4,922,048	23,237	0.5%
Exports	147.8	147.6	-0.2	-0.1%
Imports	4,666	6,011	1,345	28.8%

Exhibit 4-2. Market-Level Impacts of the Proposed NESHAP				
		With	Changes from Baseline	
Industry Sector	**Baseline**	**Regulation**	**Absolute**	**Percent**
Particleboard and Medium Density Fiberboard				
Market price (1997$/cubic meter)	$169	$173.29	$4.29	2.5%
Market output (M cubic meters/yr)	11,646,228	11,567,633	-78,595	-0.7%
Domestic production	11,644,523	11,564,477	-80,046	-0.7%
Affected Facilities	9,670,639	9,553,510	-117,129	-1.2%
Unaffected Facilities	1,973,884	2,010,967	37,083	1.9%
Exports	333	331	-2	-0.7%
Imports	1,705	3,156	1,451	85.1%
Hardboard				
Market price (1997$/cubic meter)	$1,322	$1,335.17	$13.17	1.0%
Market output (M cubic meters/yr)	1,768,930	1,764,203	-4,727	-0.3%
Domestic production	1,768,545	1,763,431	-5,114	-0.3%
Affected Facilities	1,768,545	1,763,431	-5,114	-0.3%
Unaffected Facilities	n/a	n/a	0	n/a
Exports	371	370	-1	-0.2%
Imports	385	772	387	100.5%

4.5.2 Industry-Level Results

Industry impacts associated with the proposed NESHAP for the plywood and composite wood industry are presented in Exhibit 4-3. Industry-level impacts include changes in revenue, production, numbers of operating product-lines, and changes in employment. The estimates for changes in production lines and employment are described in Section 4.5.3 below.

The EIA model estimates the change in prices and production levels after the imposition of the compliance costs on the affected facilities. Exhibit 4-3 shows that overall revenues for each industry increase slightly. Industry revenues increase because demand elasticities for these four markets mean that the change in price (in percentage terms) is greater than the percentage reduction in output. Affected facilities will experience an increase in revenues due to the increase in the market price, but this effect is likely to be offset by the increase in production costs. Changes in profits, however, could not be estimated due to lack of information on production costs at the facility level.

Exhibit 4-3. Industry-Level Impacts of the Proposed NESHAP				
			Changes from Baseline	
	Baseline	With Regulation	Absolute	Percent
Softwood Plywood				
Revenues ($ million/yr)	$4,128.5	$4,161	$32.4	0.78%
Production (M cubic meters/yr)	17,568162	17,541,326	-26,836	-0.15%
Operating product lines (#)	108	107	-1	-0.93%
Employment*	36,877	36,821	-56	-0.15%
Oriented Strandboard				
Revenues ($ million/yr)	$1,774.2	$1,794.9	$20.7	1.17%
Production (M cubic meters/yr)	9,590,456	9,576,164	-14,292	-0.15%
Operating product lines (#)	38	38	0	0.00%
Employment*	6,681	6,671	-10	-0.15%
Particleboard & Medium Density Fiberboard				
Revenues ($ million/yr)	$1,967.9	$2,004.0	$36.1	1.83%
Production (M cubic meters/yr)	11,644,523	11,564,477	-80,046	-0.69%
Operating product lines (#)	83	83	0	0.00%
Employment*	20,424	20,284	-140	-0.69%
Hardboard				
Revenues ($ million/yr)	$2,338.0	$2,354.5	$16.5	0.71%
Production (M cubic meters/yr)	1,768,545	1,763,431	-5,114	-0.29%
Operating product lines (#)	18	18	0	0.00%
Employment*	6,271	6,252	-18	-0.29%

*Baseline employment estimates are based total production and employment of all facilities in each market as reported in the EPA facility database. Average production per employee was calculated using the sum of facility-specific production and employment. Because facilities reported employment as a range, they are assigned an employment estimate using the mid-point of the reported range. Post-regulation employment was then estimated by dividing post-regulation production by the baseline production per employee.

4.5.3 Distribution of Impacts

The distribution of regulatory impacts is presented in Exhibit 4-4. This table presents the same information as in Exhibit 4-3, but provides details on how the rule impacts affected and unaffected facilities differently.

One important result from the EIA model is the projection of process line closures that could occur following promulgation of the proposed NESHAP rule. The model's estimate of process line closures may be sensitive to the accuracy of the baseline characterization of the facilities. Characteristics such as baseline production levels, revenues (as a function of production and price), the underlying supply function that represents production costs, and the compliance cost estimates are all factors that affect the distribution of the rule's impacts.

Exhibit 4-4: Distribution of Industry-Level Impacts of Proposed NESHAP: Affected and Unaffected Producers				
		With	Changes From Baseline	
	Baseline	Regulation	Absolute	Percent
Softwood Plywood				
Affected Process Lines				
Revenues ($ million/yr)	$2,745.0	$2,758.5	$13.5	0.49%
Production (M cubic meters/yr)	11,680,778	11,629,258	-51,520	-0.44%
Operating process lines (#)	66	65	-1	-1.52%
Employment*	24,519	24,411	-108	-0.44%
Unaffected Process Lines				
Revenues ($ million/yr)	$1,383.5	$1,402.4	$18.9	1.37%
Production	5,887,384	5,912,067	24,683	0.42%
Operating process lines (#)	42	42	0	0.00%
Employment*	12,358	12,410	52	0.42%
Oriented Strandboard				
Affected Process Lines				
Revenues ($ million/yr)	$868.0	$872.3	$4.4	0.50%
Production (M cubic meters/yr)	4,691,645	4,654,117	-37,528	-0.80%
Operating process lines (#)	20	20	0	0.00%
Employment*	3,268	3,242	-26	-0.80%
Unaffected Process Lines				
Revenues ($ million/yr)	$906.3	$922.6	$16.3	1.80%
Production	4,898,811	4,922,048	23,237	0.47%
Operating process lines (#)	18	18	0	0.00%
Employment*	3,413	3,429	16	0.47%
Particleboard & Medium Density Fiberboard				
Affected Process Lines				
Revenues ($ million/yr)	$1,634.3	$1,655.6	$21.2	1.30%
Production (M cubic meters/yr)	9,670,639	9,553,510	-117,129	-1.21%
Operating process lines (#)	53	53	0	0.00%
Employment*	16,962	16,756	-205	-1.21%
Unaffected Process Lines				
Revenues ($ million/yr)	$333.6	$348.5	$14.9	4.47%
Production	1,973,884	2,010,967	37,083	1.88%
Operating process lines (#)	30	30	0	0.00%
Employment*	3,462	3,527	65	1.88%

Exhibit 4-4: Distribution of Industry-Level Impacts of Proposed NESHAP: Affected and Unaffected Producers				
	Baseline	With Regulation	Changes From Baseline	
			Absolute	Percent
Hardboard				
Affected Process Lines				
Revenues ($ million/yr)	$2,338.0	$2,354.5	$16.5	0.70%
Production (M cubic meters/yr)	1,768,545	1,763,431	-5,114	-0.29%
Operating process lines (#)	18	18	0	0.00%
Employment*	6,271	6,252	-18	-0.29%
Unaffected Process Lines				
Revenues ($ million/yr)	n/a	n/a	n/a	n/a
Production	n/a	n/a	n/a	n/a
Operating process lines (#)	n/a	n/a	n/a	n/a
Employment*	n/a	n/a	n/a	n/a
Total				
Affected Process Lines				
Revenues ($ million/yr)	$7,585.3	$7,640.9	$55.6	0.73%
Production (M cubic meters/yr)	27,811,607	27,600,316	-211,291	-0.76%
Operating process lines (#)	157	156	-1	-0.64%
Employment*	51,020	50,662	-358	-0.70%
Unaffected Process Lines				
Revenues ($ million/yr)	$2,623.4	$2,673.4	$50.1	1.91%
Production	12,760,079	12,845,082	85,003	0.67%
Operating process lines (#)	90	90	0	0.00%
Employment*	19,233	19,366	133	0.69%
All Process Lines (net)				
Revenues ($ million/yr)	10,209	10,314	$105.6	1.03%
Production	40,571,686	40,445,398	-126,288	-0.31%
Operating process lines (#)	247	246	-1	-0.40%
Employment*	70,252	70,028	-225	-0.32%

n/a = not applicable
*Baseline employment estimates are based total production and employment of all facilities in each market as reported in the EPA facility database. Average production per employee was calculated using the sum of facility-specific production and employment. Because facilities reported employment as a range, they are assigned an employment estimate using the mid-point of the reported range. Post-regulation employment was then estimated by dividing post-regulation production by the baseline production per employee.

Exhibit 4-4 shows that one softwood plywood production line is expected to prematurely cease operations. The model does not predict any closures in all of the other product markets. The affected entity that closes following adoption of the regulation is a small SWPW producer that incurs higher control costs per unit of production than other SWPW production lines. This facility, with one process line, did not respond to the EPA's ICR survey. Therefore, it was necessary to estimate baseline production and compliance costs based on very little facility-specific information. Total baseline production of SWPW by the facility that closes was roughly 9,500 M cubic meters per year, or less than 0.05 percent of the 17,568,162 M cubic meters of SWPW produced by all SWPW facilities during 1997.

As a result of the closure and reductions in production at other affected facilities, the EIA model estimates a total net loss in employment of 225 employees (0.3 percent) attributable to the proposed NESHAP across all four market sectors. Affected facilities experience employment loss of 358, which is offset by employment gains at unaffected facilities of 133. Overall the four sectors together experience a 1 percent increase in revenues, and a 0.3 percent decrease in production.

4.5.4 Social Costs of the Proposed NESHAP

The social costs of a regulation are measured according to the impacts that it has on both consumers and producers. The proposed NESHAP rule, because it is expected to result in changes in both market price and market quantity, will impact the consumers and producers of softwood plywood and composite wood products. Social costs, also called welfare impacts, are the measure of overall gains and losses experienced by the two groups that may result from the imposition of costs associated with the regulatory requirements.

The economic benefits producers experience when participating in a market is called producer surplus. Producers experience impacts when their revenues change either because of a new market price, increased production costs, or both. These impacts change the amount of producer surplus relative to the baseline. Likewise, the economic benefits consumers experience is called consumer surplus. Consumer surplus changes when consumers experience impacts when the amount of product they consume or the product price changes.

The estimate of the social cost of the proposed NESHAP rule, presented in Exhibit 4-5, is the sum of the change in producer and consumer surplus. The EIA model estimates the social cost of the proposed NESHAP as $134.2 million annually (1999 dollars). These costs are distributed across both consumers and producers of plywood and composite wood products according to projected changes in market price and quantity associated with the proposed NESHAP.

Consumer surplus is reduced by $135.1 million annually due to the increase in prices and reductions in consumption. Consumers of softwood plywood are worse off by $38.7 million annually; consumers of oriented strandboard are worse off by $23.3 million annually; consumers of particleboard and medium density fiberboard and of hardboard are worse off annually by $49.8 million and $23.3 million, respectively.

Producers (in aggregate) are slightly better off because of the imposition of the proposed NESHAP, with an increase in producer surplus of just under $1 million annually. Essentially all of this is change associated with domestic producers.   Because the market prices for these products increase, certain individual domestic producers gain at the expense of their competitors. The size of this gain at any given facility depends on how much their production costs change (as a result of new compliance costs) relative to the change in market price and quantity that increases revenues. The benefit to foreign producers associated with higher market prices is quite small, under $100,000.

Exhibit 4-5: Distribution of Social Costs Associated with the Proposed NESHAP	
Stakeholder	**Change in Value ($ million -1999 dollars)**
Social Costs of Regulation (Change in consumer surplus + Change in producer surplus)	$-134.2
Total Change in Consumer Surplus	$-135.1
SWPW Consumers	$-38.7
OSB Consumers	$-23.3
PB/MDF Consumers	$-49.8
HB Consumers	$-23.3
Total Change in Producer Surplus	$0.9
Softwood Plywood	
Producer Surplus, total	$8.3
Domestic producers	$8.3
Affected Facilities	$-4.1
Unaffected Facilities	$12.4
Foreign producers	$0.0
Oriented Strandboard	
Producer surplus, total	$-1.4
Domestic producers	$-1.4
Affected Facilities	$-12.9
Unaffected Facilities	$11.5
Foreign producers	$0.0
Particleboard & Medium Density Fiberboard	
Producer surplus, total	$-5.2
Domestic producers	$-5.2
Affected Facilities	$-13.5
Unaffected Facilities	$8.3
Foreign producers	$0.0
Hardboard	
Producer surplus, total	$-0.8
Domestic producers	$-0.8
Affected Facilities	$-0.8
Unaffected Facilities	n/a
Foreign producers	$0.0

4.5.5 Energy Impact Analysis

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001), provides that agencies shall prepare and submit to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, a Statement of Energy Effects for certain actions identified as "significant energy actions." Section 4(b) of Executive Order 13211 defines "significant energy actions" as "any action by an agency (normally published in the Federal Register) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking: (1) (i) that is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action." The proposed rule is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. The basis for the determination is as follows.

As stated in Chapter 2, this proposed rule affects manufacturers in the softwood veneer and plywood (NAICS 321212), reconstituted wood products (NAICS 321219), and engineered wood products (NAICS 321213) industries. There is no crude oil, fuel, or coal production from these industries. Hence, there is no direct effect on such energy production related to implementation of this proposal. In fact, as mentioned in section IV.D. of this preamble, there will be an increase in energy consumption, and hence an increase in energy production, resulting from installation of regenerative thermal oxidizers (RTOs) and wet electrostatic precipitators (WESPs) likely needed for sources to meet the requirements of the proposed rule. This increase in energy consumption is equal to 718 million killowatt-hours/year (kWh/yr) for electricity and 45 million cubic meters/year (m^3/yr) for natural gas. These increases are equivalent to 0.012 percent of 1998 U.S electricity production and 0.000001 percent of 1998 U.S. natural gas production.[2] It should be noted, however, that the reduction in demand for product output from these industries may lead to a negative indirect effect on such energy production, for the output reduction will lead to less energy use by these industries and thus some reduction in overall energy production.

For fuel production, the result of this indirect effect from reduced product output is a reduction of only about 1 barrel per day nationwide, or a 0.00001 percent reduction nationwide based on 1998 U.S. fuel production data[3]. For coal production, the resulting indirect effect from reduced product output is a reduction of only 2,000 tons per year nationwide, or only a 0.00001 percent reduction nationwide based on 1998 U.S. coal production data. For electricity production, the resulting indirect effect from reduced product output is a reduction of 42.8 million Kilowatt-hours per year (kWh-yr), or only a 0.00013 percent reduction nationwide based on 1998 U.S. electricity production data. Given that the estimated price increase for product output from any of the affected industries is no more than 2.5 percent, there should be no price increase for any energy type by more than this amount. The cost of energy distribution should not be affected by this proposal at all since the rule does not affect energy distribution facilities. Finally, with changes in net exports being a minimal percentage of domestic output (0.01 percent) from the affected industries, there will be only a negligible change in international trade, and hence in

[2]U.S. Department of Energy, Energy Information Administration. Annual Energy Review, End-Use Energy Consumption for 1998. Located on the Internet at http://www.eia.doe.gov/emeu/aer/enduse.html.

[3] Ibid.

dependence on foreign energy supplies.   No other adverse outcomes are expected to occur with regards to energy supplies. Thus, the net effect of this proposed rule on energy production is an increase in electricity output of 0.012 percent compared to 1998 output data, and a negligible change in output of other energy types. All of the results presented above account for the passthrough of costs to consumers, as well as the cost impact to producers. These results also account for how energy use is related to product output for the affected industries.[4] More detailed information on the estimated energy effects and the methodology employed to estimated them are in the background memo[5] that provides such details for the proposed rule.

Therefore, we conclude that the proposed rule when implemented is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

4.6 Analysis of Economic Impacts on Engineered Wood Products Sector

4.6.1 Overview

The engineered wood products (EWP) sector is much different than the other four sectors examined in this analysis. Due to both the nature of the products and their markets as mentioned in Section 4.6.4 below, and the limited availability of data, a quantitative analysis was not performed.

EWP products are characterized by differentiated structural beam products, although some can also be used as columns. EWPs are produced by firms using differentiated production systems. There are a number of large firms with market power, allowing them to set prices. Although many of the products in this market sector can be substituted for one another to an extent, each product's design usually provides it with an advantage over others in the design of final structures. Product differentiation allows each product to dominate particular market niches, but also makes many of the products complements as well as substitutes. Even when substitution is possible, some large firms use their market power to influence purchase decisions and persuade consumers to purchase their products. Consequently, these products are not standard commodities as are products in the other plywood and composite wood sectors. Therefore, commodity prices and other standard information that is characteristic of competitive markets are not available. These factors limit the ability of EPA to quantify the impact of the proposed NESHAP rule on this sector using the same quantitative method applied to the other sectors.

Three of the fifty-three EWP facilities in the U.S. will have compliance costs are a result of the proposed NESHAP rule. This includes the country's two LSL plants, and one of the country's two PSL plants. Weyerhaeuser, Inc. purchased these four plants when they acquired Trus Joist MacMillan. (Weyerhaeuser-Trus Joist MacMillan will be referred to as W/TJM for the remainder of this report.) W/TJM is currently the only manufacturer of LSL and PSL in the world.

---

[4] U.S. Department of Energy, Energy Information Administration.   1998 Manufacturing Energy Consumption Survey. Located on the Internet at http://www.eia.doe.gov/emeu/mecs/mecs98/datatables/contents.html.

[5] U.S. Environmental Protection Agency. "Energy Impact Analysis of the Proposed Plywood and Composite Wood Products NESHAP." July 30, 2001.

4.6.2 Characteristics of EWP Products

EWPs include laminated veneer lumber (LVL), laminated strand lumber (LSL), parallel strand lumber (PSL), wood I-joists (I-J), and glue laminated timber (GL). These are value added lumber products designed to be used in applications that are not suitable for ordinary framing lumber. The design and composition of each of these products differ, providing them with different strength, stiffness, cost, and dimensional properties. Strength properties allow products to carry heavier loads without breaking. Strength is particularly important for uses such as carrying beams in floors or bridge girders, which are used to support structures. Stiffness prevents materials from shaking as objects are moved over them. This is particularly important in floors and bridge decks where structure shakes or squeaks are uncomfortable or dangerous. Each product's strength and stiffness is partially a function of its dimensional characteristics. For example, I-J are strong, stiff and typically less expensive than the other products. However, their structural integrity does not hold beyond certain lengths.

Laminated-Strand Lumber

W/TJM introduced LSL in 1992. Its dimensional characteristics match nominal 2x4 and 4x4 framing lumber, but it provides greater and more uniform strength and stiffness properties.[6] Unlike many of the other EWPs, one of the primary uses of LSL is in vertical applications, as a stud or column. PSL is also used in vertical applications, but its primary uses are in horizontal applications, as a beam. The uses of LSL are summarized in Exhibit 4-6.

Exhibit 4-6: Primary Uses and Substitutes for LSL

Application	**Uses**	**Substitutes**
Columns or studs	Wall, window, and door framing	Framing lumber, PSL, solid sawn lumber, steel
Headers	Garage door, other wide span doors and windows	Framing lumber, GL, LVL, PSL, steel
Beams	Light applications, low load bearing	Solid sawn lumber, GL, LVL, PSL, I-J
Rim Board	Floor systems, nailing surface for sheathing, decks and siding	Plywood

Source: http://www.trusjoist.com

Because W/TJM is the sole producer of LSL, very little information is available about their costs or profits. Exhibit 4-7 below identifies the production information that is known. Note that neither plant operates near full capacity. The two plants combined operate at less than 50 percent of their combined capacity (EWP survey). This may be due to a decline in demand or an immature market.

[6] LSL bending strength = 1700psi; stiffness (modulus of elasticity or MOE) = 1.3-1.5E.

Exhibit 4-7: Characteristics of LSL Plants		
Location	**Item**	
Deerwood, MN	Capacity	7,900,000 ft^3/yr
	Production	4,900,000 ft^3/yr
	Capacity	62%
	Employees	100-249
	Plant Age	1992 (estimate)
Chavies, KY	Capacity	14,900,000 ft^3/yr
	Production	5,400,000 ft^3/yr
	Capacity	36%
	Employees	250-499
	Plant Age	1992 (estimate)

Source: EPA facility survey, 1998.

Parallel-Strand Lumber

PSL is a slightly older technology than LSL. It was introduced to the market in the mid-1980's by W/TJM. PSL is a high performance beam and header product that can also be used as a column. It is designed with exceptional strength, stiffness characteristics that is capable of spanning much longer distances than most other EWPs.[7] Only GL can match or beat PSL's ability to carry heavy loads over long spans.[8] Furthermore, PSL is a balanced beam, which means it has no top or bottom. This property is particularly desirable to the residential framing industry. Balanced beams save on labor costs due to lower skill required to install the product, providing PSL with an edge over GL for a number of years. However, Anthony Forest Products recently developed a line of balanced GL beams with comparable strength and stiffness properties to PSL, and a number of other GL manufacturers have since done the same. This has lead to a competitive more environment. However, PSL still maintains a share of the residential market. Exhibit 4-8 summarizes the uses of PSL.

Exhibit 4-8: Primary Uses and Substitutes for PSL		
Application	**Uses**	**Substitutes**
Columns or studs	Wall framing, street lights	Steel, solid sawn lumber, steel
Headers	Garage door, other wide span doors and windows	GL,LVL, steel
Beams	Heavy applications, high load bearing	GL, steel, solid sawn lumber, LVL

Because W/TJM has been the only producer of this product, very little is known about their production costs and profits. Exhibit 4-9 below identifies the production information that is known about the two U.S. PSL production facilities.

[7] PSL bending strength = 2900psi; stiffness = 2.0E.

[8] GL bending strength = 2400-3000psi; stiffness = 1.8 - 2.1E

Exhibit 4-9: Characteristics of PSL Plants		
Location	**Item**	
Colbert, GA (affected by rule)	Capacity	3,000,000ft^3/yr
	Production	2,770,000ft^3/yr
	Capacity Factor	92%
	Employees	250-499
	Plant Age	mid-1980s (estimate)
Buckhannon, WV (not affected by rule)	Capacity	2,500,000ft^3/yr
	Production	1,929,000ft^3/yr
	Capacity Factor	77%
	Employees	250-499
	Plant Age	mid-1980s (estimate)

source: EPA facility survey, 1998.

Since PSL does compete directly with GL in some applications, there is slightly more information available on it than on LSL. There is one published source of EWP prices that includes some retail PSL delivered prices: Engineered Lumber Trends produced by The Irland Group in Winsor, ME. Exhibit 4-10 presents a comparison of retail prices for PSL and GL. However, it is not possible to estimate firm revenue using these prices because they are retail prices and there is considerable markup from the producer to retail level. The prices listed in the table below show that PSL is more expensive than GL.

Exhibit 4-10: Retail Prices of GL and PSL Beams Delivered to Los Angeles

Beam*	Width (inches)	Depth (inches)	Price per linear foot
PSL (strength = 2900psi stiffness = 2.0E)	3-1/2	11-7/8	$8.16
GL (strength = 2400psi stiffness = 1.8E)	3-1/8	12	$5.90
GL ** (strength = 3000psi stiffness = 2.1E)	3-1/8	12	$7.08

Source: Engineered Lumber Trends (December 1999)
*Beam bending strength measured in pounds per square inch and stiffness the beams modulus of elasticity or E
**Price of the 3000-psi GL is estimated by marking up the 2400psi GL by 20% based on conversations with GL manufacturers

W/TJM has stated that PSL could be manufactured using waste material from plywood and LVL. Other industry members dispute this due to the high quality material required for the product. They feel that there is actually considerable wasted material in the production process in order to acquire the high-quality wood fiber. Consequently, there are two conflicting arguments why PSL is able to sell their product at the higher price.

- Consumers view it as a superior product despite the availability of substitutes, providing it with a higher profit margin.
- W/TJM has used strategic behavior to maintain the price it requires to provide its product on the market.

4.6.3 Comparison to Other EWP Products

Substitution among EWPs is a complicated dynamic. While the products can be viewed as distinct commodities, they are integral components in the engineering design of a structure. Therefore, it is possible for two EWP products to be both substitutes and complements. This is particularly true for W/TJM's products because they sell both the individual products and entire framing systems that include either LSL or PSL, or both.

LSL is more comparable to framing lumber and solid sawn lumber than most other engineered wood products. As a header it competes with LVL, GL, and PSL. However, as a column or stud, it is fairly unique. It is also a very new technology, which may partially explain why competing firms have not developed comparable products to date. Furthermore, LSL is marketed as a complementary product to W/TJM's other engineered wood products (I-J, LVL, PSL) in various structures they design.

As an individual product, PSL has more direct substitutes than LSL. In shorter spanning applications (such as headers or floor joists) LVL, I-J, GL, or LSL can be substituted for each other depending on the application. In longer spanning applications, PSL competes with GL and steel. W/TJM also designed PSL to complement their other products in pre-designed framing systems. If an architect or engineer purchases the pre-designed framing system, PSL will be specified in the system. This eliminates the possibility of substitutes in these applications. These characteristics are discussed in greater detail below.

4.6.4 Market Characterization

The EWP sector is characterized by imperfect competition among firms, particularly. In the case of LSL and PSL, W/TJM is a monopoly producer because it operates all four facilities that produce products affected by the rule. Although a number of other products can be substituted for both LSL and PSL at the commodity level, W/TJM has a monopoly on these two products. In addition, they have some ability to control material choice within the residential framing market because they produce Computer Automated Design (CAD) programs used by architects, engineers, and lumber product distribution companies to design structures. The individual using the program is actually purchasing a complete architectural design, which competes with other architectural designs on the basis of total design cost. Other EWP companies have not developed such programs to the same extent that W/TJM has.

By pre-specifying its products as material inputs in these design packages, W/TJM assures that they are used in the structure. Moreover, the individual product prices are less important to W/TJM because the price the buyer using the program is concerned with is the price of the whole structure. Further, because W/TJM makes all the products used in the design, they can sell any one of the components at a loss provided the loss is made up by profits on the whole structure. In addition, W/TJM also sells pre-designed floor, roof, and wall systems that incorporate its EWP products.

Therefore, W/TJM is a price setter in both these markets. The high price of PSL allows producers of comparable GL a substantial markup over its costs. However, GL manufacturers offered the opinion that PSL could not raise its price without suffering a loss in demand . Those same producers believe that PSL is already selling at a loss to promote the sale of its other products, although this information cannot be confirmed. Another complicating factor is the purchase of TJM by Weyerhaeuser, Inc. Even if TJM had been selling PSL at a loss, Weyerhaeuser may not be willing to do this, particularly if costs increase due to the proposed NESHAP rule.

4.6.5 Appropriateness of Partial Equilibrium Economic Analysis for the EWP Market

It is not appropriate to use a partial equilibrium analysis to quantify the impact of the rule on the EWP sector. The EWP facilities that will have compliance costs due to the rule are not part of a competitive market. W/TJM has a monopoly on both PSL and LSL because they are the only company in the world producing both these products. Although the products compete to an extent with other EWPs, W/TJM is able to use its market power to influence consumer purchasing decisions and prices. Also, W/TJM may be able to absorb cost increases on one product with profits from another.

4.6.6 Analysis

The estimated total annual compliance costs for the three impacted EWP facilities are $3.2 million, which is only 2.4 percent of the overall cost of the rule of $142 million per year. Moreover, the costs are incurred by one of the largest wood products companies in the world. The costs incurred by W/TJM are less than 1 percent the corporation's total annual revenues, which now include revenues from the facilities purchased from TJM. Although the specific impact on W/TJM's profitability cannot be determined, it is likely that W/TJM can afford the costs at the corporate level.

The Agency cannot be certain of the impact that these cost increases will have on the markets for LSL and PSL. W/TJM could decide use their price setting power to increase the price of PSL and/or LSL. This could lead to a decrease in consumer surplus. However, it is important to note the distributional impact of this potential price increase. EWPs are often used in high end residential and commercial construction. They typically provide luxury features, such as squeak proof floors, large open rooms with high ceilings and no support columns.

Alternatively, W/TJM may choose not to raise the prices of PSL and LSL. For example, PSL is already more expensive than GL, a substitute product. A rise in PSL prices could lead to a loss in market share. Furthermore, production data showed that the PSL market is functioning at about 50 percent of its full capacity. These factors indicate that a PSL price increase may not be favorable to W/TJM. W/TJM could choose to absorb the cost increase with profits from its other products in the short run. In the long run they could abandon production of these products. In order to meet the demand for their pre-designed structural systems, they could either produce or buy a substitute product to use in the structural systems.

If W/TJM chooses to shut down these plants, there may be a number of unfavorable short run impacts. First, the closures could mean the loss of 600-1250 jobs, spread over three communities. EPA expects that the reduction in employment at these facilities would be offset by an increase in employment at a competing firm, but the community impacts may remain.

The impact of the proposed NESHAP rule on both consumers and the individual facilities and firms will depend upon corporate strategy. Given the acquisition of Trus Joist MacMillan by Weyerhaeuser, corporate decisions and long term strategy are more influential than what could be represented in a model.

4.6.7 Conclusions

Although the specific impacts to the EWPs sector cannot be determined, it is unlikely that substantial economic losses will result. The cost burden of this sector is minimal in comparison to the other sectors. Furthermore, the affected facilities are all owned by W/TJM, which has sufficient resources to handle the compliance costs. Even if W/TJM passes this cost on to consumers, the price increase is likely to be minimal as substitute products are available.

4.7 References

Abt Associates Inc. 1999. *Profile of the Plywood and Wood Composite Industries.* Prepared for Larry Sorrels, Innovative Strategies and Economic Group, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. December

Abt Associates Inc. 2000. *Economic Analysis Methodology for the Plywood and Wood Composite Industries.* Prepared for Larry Sorrels, Innovative Strategies and Economic Group, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. March.

U.S. Environmental Protection Agency. 1998. *Industry Specific Information Collection Request (ICR) for the Development of Plywood and Particleboard Maximum Achievable Control Technology (MACT) Standards*. Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. Environmental Protection Agency. 1999a. *OAQPS Economic Analysis Resource Document*. Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. Environmental Protection Agency. 1999b. *Economic Impact Analysis for the Polymers & Resins III NESHAP*. Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

5 SMALL BUSINESS IMPACTS

Under the requirements of the Regulatory Flexibility Act (RFA) of 1980, Federal regulatory agencies must give special consideration to small entities that are affected by regulatory actions. In 1996, amendments to the RFA under the Small Business Regulatory Enforcement Fairness Act (SBREFA) added certain requirements associated with analyses and procedures associated with determining whether a regulatory action will have a significant impact on a substantial number of small entities (U.S. EPA, 1999a, 1999b).

5.1 Results in Brief

The screening analysis of small business impacts presented in this chapter indicates that 17 of the 83 businesses affected by this proposed rule are small. Of these 17 small firms, ten have annual compliance costs of 1 percent or greater of their sales. Of these 10 firms, three have annual compliance costs of 3 percent or greater of their sales. Of the 32 facilities owned by these 17 small firms, only one is predicted to close in order to avoid incurring costs associated with compliance with the proposed rule. This analysis supports a certification of no significant impact on a substantial number of small entities (SISNOSE) for this rule because, while a few small firms may experience significant impacts, there will not be a substantial number incurring such a burden.

5.2 Introduction

The proposed NESHAP rule for the plywood and composite wood industries will affect the owners of the facilities that will incur compliance costs to control their HAP emissions. The owners, either firms or individuals, are the entities that will bear the financial impacts associated with these additional operating costs. The proposed rule has the potential to impact all firms owning affected facilities, both large and small. This section presents the results of EPA's small business impact analysis of the impact the proposed NESHAP for the Plywood and Composite Wood Industries on small businesses. The analysis was performed in two stages: a screening-level analysis, and an examination of impacts on small businesses developed using the models described in Chapter 4.

The screening analysis provides EPA with a preliminary estimate of the magnitude of impacts the proposed NESHAP may have on the ultimate domestic parent companies that own facilities EPA expects to be impacted by the standard. The analysis focused on small firms because they may have more difficulty complying with a new regulation or affording the costs associated with meeting the new standard. This section first describes the data sources used in the screening analysis, the methodology we applied to develop estimates of impacts, the results of the analysis, and conclusions about the results. The results of the impact assessment specific to small businesses that own affected facilities follows.

5.3 Screening Analysis Data Sources

The screening analysis was based on the following information:

- Industry Specific Information Request (ICR) for the Development of Plywood and Particleboard MACT Standards (U.S. EPA, 1998).
- Profile of the Plywood and Composite Wood Products Industries (Abt Associates, January 2000).
- Estimated Nationwide Costs of Control: Plywood and Composite Wood Products (MRI, April 14, 2000).
- Dun & Bradstreet, Ward's Business Directory, and Internet research on facility and firm employment and sales.

5.4 Screening Analysis Methodology

Cost Analysis

After summing annual compliance costs for each affected facility associated with a given parent firm, EPA developed ratios of firm-level compliance costs to firm-level sales. The preparation of cost to sales ratios is a typical part of screening analyses such as this one. The analysis incorporated firm level compliance costs from the most recent facility compliance cost estimates for all affected facilities. The firm sales data for the majority of the firms with affected facilities was obtained through a search of the Dun & Bradstreet (D&B) company database. The information obtained from D&B was supplemented with data from firm web sites and several other business databases available through the Internet (e.g., Zapdata, Hoover's Online, Thomas' Register, and Lycos Companies Online). For more information on these sources, refer to Appendix A of this report.

Profitability Analysis

For the second step in the screening analysis, EPA reviewed the profitability of only those firms with affected facilities with a cost to sales ratio (C/S) greater than 1 percent. Specifically, EPA examined a measure of profitability called the net profit margin, also known as the return on sales ratio (R/S), calculated by dividing net profit after taxes by annual net sales. Profitability data is not publicly available for those affected firms with cost /sales ratios greater than 1 percent because they are all privately held firms. EPA estimated profitability according to industry-wide average profitability measures available from public sources. Exhibit 5-1 presents the profitability measure of R/S by product category.

Exhibit 5-1: Net Profit Margins by Product Type

Product Category	1997 Return on Sales Ratio
Softwood, Plywood, and Veneer	1.7
Oriental Strandboard	3.5
Other Wood Composites	3.5
Engineered Wood Products*	5.0
Multiple Processes**	2.6

Notes:
Source: Dun & Bradstreet (1999). Indicator values are based on median values of the industrial sample.
*Includes 1998 data for Structural Wood Members, the only data reported for this sector.
**Firms with multiple product lines were assigned an R/S ratio based on the average of the R/S ratios for firms with Softwood Plywood and Other Wood Composite product lines.

5.5 Screening Analysis Assumptions

Because there were certain gaps in the data, EPA had to make assumptions regarding some affected firms' employment and sales data as follows.

- For those affected facilities for which no parent company data were available, EPA assumed that the facility represents the ultimate parent. EPA then assumed that the employees or the sales associated with the facility were the same for the parent firm.
- For 8 affected firms for which Dun & Bradstreet, Ward's, or Internet sales data was not available at the firm or facility level, EPA applied a sales estimate based on the average sales for firms in the same product and employee size category.
- For one affected firm, EPA obtained employment information for all three of its identified facilities and sales information for two of the three. EPA extrapolated the sales data on a dollar per employee basis from the two facilities with complete data to the facility with only employment data and added those sales to estimate the firm's total sales.

5.6 Screening Analysis Results

Cost Analysis

Based on the results of the C/S ratio test, EPA developed the following summary information.

- The total number and percent of affected firms with C/S ratios greater than 3 percent.
- The total number and percent of affected small firms with C/S ratios greater than 3 percent.
- The total number and percent of affected firms with C/S ratios greater than 1 percent.
- The total number and percent of affected small firms with C/S ratios greater than 1 percent.
- The median and mean C/S ratios for the following groups of firms:

- All firms.
- Small firms.
- Firms owning affected softwood plywood and veneer facilities.
- Firms owning affected oriented strand board facilities.
- Firms owning affected other wood composite products facilities.[1]
- Firms owning affected engineered wood product facilities.
- Firms owning affected facilities that make multiple products.

The screening analysis showed that of the 52 firms that own facilities incurring capital and monitoring, recordkeeping , and reporting (MRR costs), 17 of them (33 percent) are small firms according to the U.S. Small Business Administration's "Small Business Size Standards Matched to NAICS Codes" (U.S. SBA, 2000). Small firms with affected facilities had a median C/S of 1.22 percent. The remaining 35 firms (67 percent) are large, with a median C/S ratio of 0.33 percent. Overall, the weighted median C/S ratio for all firms is 0.62 percent. Exhibit 5-2 summarizes this information, along with the mean, maximum and minimum C/S by firm size category.

Exhibit 5-2: Affected Firms by Size

Firm Size[1]	Number of Affected Firms[2]	Percent of Total Affected Firms	Median C/S Ratio	Mean C/S Ratio	Maximum C/S Ratio	Minimum C/S Ratio
Small	17	33.0%	1.2%	2.3%	8.3%	0.53%
Large	35	67.0%	0.3%	0.6%	5.1%	0.01%
Total/ Weighted Average	52	100.0%	0.6%	1.2%	8.3%	0.01%

Notes:
[1]For those firms for which firm size information was not available, EPA assumed a typical firm size within the product type category.
[2]Based on affected facilities only. Includes the firm that has capital costs but no annual costs.

When screened by process type,[2] EPA found that the affected softwood plywood and veneer firms (40 percent of all firms), other composite wood firms (25 percent of all firms) and firms with multiple processes (29 percent of all firms) make up the majority of affected firms. The firms owning facilities that produce softwood plywood have the highest median C/S ratio, 0.82 percent, followed by the owners of other composite wood facilities, with a mean C/S ratio of 0.41 percent. See Exhibit 5-3 for a summary of the data by process type, including mean, maximum and minimum C/S ratios.

---

[1]Medium density fiberboard, hardboard, conventional particle board and molded particleboard.

[2]Firms categorized according to the process types associated with the affected facilities. Firms owing facilities with more than one process type were assigned to the "Multiple Processes" category.

Exhibit 5-3: Affected Firms by Process Type						
Process Type[1]	**Number of Affected Firms[3]**	**Percent of Total Affected Firms**	**Median C/S Ratio**	**Mean C/S Ratio**	**Maximum C/S Ratio**	**Minimum C/S Ratio**
Softwood Plywood/Veneer	21	40.4%	0.8%	1.1%	8.3%	0.01%
Oriented Strand Board	3	5.8%	0.2%	0.7%	1.9%	0.01%
Other Wood Composites[2]	13	25.0%	0.4%	2.1%	8.2%	0.03%
Engineered Wood Products	0	0.0%	n/a	n/a	n/a	n/a
Multiple Processes	15	28.8%	0.4%	0.6%	2.0%	0.01%
Total/Weighted Average[3]	52	100.0%	0.6%	1.2%	8.3%	0.01%

Notes:
[1]Firms categorized according to the process types associated with the affected facilities. Firms owing facilities with more than one process type were assigned to the "Multiple Processes" category.
[2]Includes Medium Density Fiberboard, Hardboard, and Particleboard (conventional and molded).
[3]Based on affected facilities only (facilities incurring capital and MRR costs). Includes one firm that has capital costs but no annual costs.

Of the four firms with C/S ratios of 3 percent or greater, three are small. Ten small firms have C/S ratios of one percent or greater out of 16 in this category. One large firm has a C/S ratio of 3 percent or greater and six of them have C/S ratios of one percent or greater. The other wood composite category has the most firms with C/S ratios of 3 percent or greater (three out of the four). The softwood plywood has seven firms followed by other wood composites with five firms with C/S ratios of one percent or greater (out of 16). The C/S screening results are presented in Exhibits 4 and 5, below. These tables also compare the number of affected firms (i.e., firms with facilities incurring only MRR costs as well as those incurring capital and MRR costs) to the estimated total number of firms nationally.

Exhibit 5-4: Affected Firms with C/S Ratios of 3 Percent or Greater				
Category	**Number of Firms Nationwide***	**Number of Affected Firms**	**Firms as a Percent of National Firms**	**Firms as a Percent of Affected Firms**
Firm Size				
Small	38	3	7.9%	17.6%
Large	42	1	2.4%	2.9%
Undetermined	3	n/a	n/a	n/a
Total/Weighted Average	83	4	4.8%	7.7%
Process Type				
Softwood Plywood/Veneer	30	1	3.3%	4.8%
Oriented Strand Board	2	0	0.0%	0.0%
Other Wood Composites	19	3	15.8%	23.1%
Engineered Wood Products	11	n/a	n/a	n/a
Multiple Processes	21	0	0.0%	0.0%
Total/Weighted Average	83	4	4.8%	7.7%

Notes:
See notes to Exhibits 5-2 and 5-3 above.
* Estimate.

Exhibit 5-5: Affected Firms with C/S Ratios of 1 Percent or Greater				
Category	Number of Firms Nationwide*	Number of Firms	Firms as a Percent of National Firms	Firms as a Percent of Affected Firms by Category
Firm Size				
Small	38	10	26.3%	58.8%
Large	42	6	14.3%	17.1%
Undetermined	3	n/a	n/a	n/a
Total/Weighted Average	83	16	19.3%	30.8%
Process Type				
Softwood Plywood/Veneer	30	7	23.3%	33.3%
Oriented Strand Board	2	1	50.0%	33.3%
Other Wood Composites	19	5	26.3%	38.5%
Engineered Wood Products	11	0	0.0%	n/a
Multiple Processes	21	3	14.3%	20.0%
Total/Weighted Average	83	16	19.3%	30.8%

Notes:
See notes to Exhibits 5-2 and 5-3 above.
* Estimate. In a few cases, a firm's process type changed when all facilities were taken into account.

Profitability Analysis

Based on the results of the profitability analysis performed as described above, EPA developed the following information.

- The total number and percent of affected firms[3] whose C/S ratio: 1) exceeds their profitability ratio by 50 percent or more; 2) is between zero and 50 percent; or 3) is less than or equal to their profitability ratio.
- The total number and percent of affected small firms whose C/S ratio: 1) exceeds their profitability ratio by 50 percent or more; 2) is between zero and 50 percent; or 3) is less than or equal to their profitability ratio.

When EPA compared the C/S ratio to the R/S ratio for those firms with C/S ratios greater than one percent, EPA found that in 14 of the 16 cases, the C/S ratio exceeded the R/S by over 50 percent. Two firms' C/S ratio exceeded their R/S ratio by between zero and 50 percent. Exhibit 5-6 presents these results in tabular form.

[3] That is, firms with C/S ratios greater than one percent.

Exhibit 5-6: C/S to R/S comparison for firms with C/S of one percent or greater						
	C/S exceeds R/S by over 50 percent		**C/S exceeds R/S by between 0 and 50 percent**		**C/S is less than or equal to R/S**	
Firm Size	**Number of Firms**	**Percent of Total Firms with Costs**	**Number of Firms**	**Percent of Total Firms with Costs**	**Number of Firms**	**Percent of Total Firms with Costs**
Small	10	58.8%	1	5.9%	0	n/a
Large	4	11.4%	1	2.9%	0	n/a
Total/ Weighted Average	14	26.9%	2	3.8%	0	n/a

Notes:
See notes to Exhibits 5-2 and 5-3 above.

EPA focused its review of the results for the 16 firms with C/S ratios greater than one percent. For 4 of the 10 small firms in this category, no sales data were available. EPA developed sales estimates for these firms according to the average sales for firms with the same number of employees in the same product category. It is possible that in reality, these firms have parent-level sales that differ from those assumed in the current analysis. However, based on extensive research into domestic parent-level employment and sales data, EPA expects that this information is not publicly available for these firms.[4] For the remaining 6 small firms with C/S ratios greater than one percent, EPA assumed that the domestic parent firm sales information obtained from D&B, Wards, or the other Internet sources are reliable for the purpose of this analysis.

EPA assumed that the firm size and sales data are reliable for 5 of the 6 large firms with C/S ratios greater than 1 percent. One firm, Sierra Pine (a California Limited Partnership), should be regarded as a special case. Sierra Pine recently purchased three affected facilities from Weyerhaeuser, greatly increasing the total costs associated with Sierra Pine. However, Sierra Pine's sales data is from a query of D&B data performed in late 1999. As a result, the sales associated with recent acquisition of the three plants are not reflected in Sierra Pine's sales data. If, for instance, Sierra Pine's total compliance costs were prorated to exclude the costs attributed to the plants previously owned by Weyerhaeuser, Sierra Pine's C/S would change from 4.9 percent to 1.7 percent.

EPA also tested the sales estimates applied to large firms. The one large firm for which EPA assumed sales had a C/S ratio well below one percent. In this case, the firm's actual sales would have to

[4]Research indicates that one of the small firms with particularly high impacts, Dominance Industries (d.b.a. Pan Pacific Products) is a single location private corporation owned Philip Ling. However, Dr. Ling is also the owner of a group of companies around the world and is the chairman of Malaysian-based Pan Pacific Asia Berhad, an investment holding company that also provides management services. Pan Pacific Asia's 1998 sales were $88 million (U.S.). The group manufactures and distributes timber logs and timber moldings. Other activities of the company are stockbroking and investment holding. While this information is not necessarily applicable to the ultimate domestic parent of Dominance Industries' affected facility, is indicates that the facility's owner has access to financial capital beyond what the sales from the facility generate.

be approximately half of the assumed sales in order for the firm's C/S ratio to exceed one percent. EPA believes that while the assumed sales are potentially higher than the actual sales of this firm, it is less likely that the firm has actual sales that would result in a C/S ratio over one percent.

EPA used industry-wide measures of profitability because such information is not available for privately held firms. Because all the affected firms with C/S ratios above one percent are privately held, firm-specific information regarding R/S is not publicly available. If firm specific profitability measures were available, it is likely that a comparison of firms' C/S ratio to their R/S ratio would produce significantly different results. It should be noted that while overall industry return on sales may be low, it is not necessarily the case for any given firm.

All ten small firms with C/S ratios of one percent or greater had a C/S ratio that exceeded the industry profitability measure of return on sales. For the three small firms whose C/S ratios were three percent or greater, the comparison of compliance costs and profitability measures showed that their C/S ratios exceeded the industry R/S by over 100 percent. This divergence between the C/S ratios for these firms and the industry R/S is an indicator that these three firms may experience high impacts as a result of incurring the costs of compliance associated with the proposed rule. However, the results of the economic impact analysis show that the affected facilities owned by these firms will continue to operate after controls have been applied to comply with the proposed rule. Therefore, the impact on these firms, while relatively high, are not enough to lead them to cease operations at these facilities.

5.7 Screening Analysis Conclusions

The Regulatory Flexibility Act (RFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's proposed rule on small entities, small entity is defined as: (1) a small business according to Small Business Administration size standards by 5-digit NAICS code of the owning entity (in this case, 500 employees); (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

After considering the economic impact of today's proposed rule on small entities, we certify that this action will not have a significant impact on a substantial number of small entities. In accordance with the RFA, we conducted an assessment of the proposed standard on small businesses in the industries affected by the rule. Based on SBA size definitions for the affected industries and reported sales and employment data, the Agency identified 17 of the 52 companies, or 32 percent, owning affected facilities as small businesses. These facilities incur capital and MRR costs associated with the proposed rule. There 31 other firms that only incur MRR costs; and all of these firms are small. Although small businesses represent 32 percent of the affected companies within the source category, they are expected to incur only 6 percent of the total industry compliance costs of $142 million. There are only three small firms with compliance costs equal to or greater than 3 percent of their sales. In addition, there are seven small firms with cost-to-sales ratios between 1 and 3 percent.

We performed an economic impact analysis to estimate the changes in product price and production quantities for the firms affected by this proposed rule. The analysis shows that of the 32 facilities owned by affected small firms, only one would be expected to shut down rather than incur the cost of compliance with the proposed rule. Although any facility closure is cause for concern, it should be noted that the baseline economic condition of the facilities predicted to close affects the closure estimate provided by the economic model. Facilities which are already experiencing adverse economic conditions for reasons unconnected to this rule are more vulnerable to the impact of any new costs than those that are not.

This analysis indicates that the proposed rule should not generate a significant impact on a substantial number of small entities for the coatings manufacturing source category for the following reasons. First, of the 10 small firms that have compliance costs greater than 1 percent of sales, only 3 have compliance costs of greater than 3 percent of sales. Second, the results of the economic impact analysis show that only 1 facility owned by a small firm out of the 32 facilities owned by affected small firms may close due to the implementation of this rule**.** The facility that may close rather than incur the cost of compliance appear to have low profitability levels currently. It also should be noted that the estimate of compliance costs for this facility is likely to be an overestimate due to the lack of facility-specific data available to assign a precise control cost in this case. In sum, this analysis supports today's certification under the RFA because, while a few small firms may experience significant impacts, there will not be a substantial number incurring such a burden.

Although this proposed rule will not have a significant economic impact on a substantial number of small entities, we minimized the impact of this rule on small entities in several ways. First, we considered subcategorization based on production and throughput level to determine whether smaller process units would have a different MACT floor than larger process units. Our data show that subcategorization based on size would not result in a less stringent level of control for the smaller process units. Second, in light of cost considerations, we chose to set the emission limitation at the MACT floor control level and not at a control level more stringent than the MACT floor control level. Thus, the control level specified in the proposed PCWP rule is the least stringent allowed by the CAA. Third, the proposed rule contains multiple compliance options to provide facilities with the flexibility to comply in the least costly manner while maintaining a workable and enforceable rule. The compliance options include emissions averaging and production-based emission limits which allow inherently low-emitting process units to comply without installing add-on control devices and facilities to use innovative technology and pollution prevention methods. Fourth, the proposed rule includes multiple test method options for measuring methanol, formaldehyde, and total HAP. We continue to be interested in the potential impacts of the proposed rule on small entities and welcome comments on issues related to such impacts.

5.8 Economic Impact Analysis Results for Small Businesses

Exhibit 5-7 provides a summary of the economic impact on small businesses associated with the estimated market adjustments due to compliance with the proposed NESHAP. As shown, the Agency's economic analysis indicates that the 17 small businesses that own 18 affected process lines will be affected as follows:

Exhibit 5-7: Economic Impacts on Small Businesses Associated with Projected Market Adjustments*

			Changes	from Baseline
	Baseline	With Regulation	Absolute	Percent
Revenues ($ thousands/yr)**	394,393	387,229	7,164	-1.82
Production (million m^3/yr)	1,791,408	1,737,969	53,439	-2.98
Compliance Costs ($ thousands/yr)	0	9,194	9,194	n/a
Operating Process Lines	18	17	1	-5.56
Employment loss (FTEs)	3,621	3,513	108	-2.98

Notes:
* Does not include small businesses that own facilities with MRR costs only.
** Estimated using production and price data in economic impact model
FTEs = full-time equivalents

The one process line closure predicted by the economic impact model is owned by a small business. This results in a 5.6 percent decrease in the number of process lines owned by small business. Overall, the small businesses' revenues decrease by just under 2 percent, their production decreases by just under 3 percent, and their total employment decreases by just under 3 percent, or 108 FTEs. The estimate of employment loss assumes that the production per employee at the affected facilities owned by small firms is the same as the industry average.

5.9 References

Abt Associates Inc. 2000a. *Small Business Screening Analysis for the Plywood and Wood Composite Industries: Revised Draft.* Prepared for Larry Sorrels, Innovative Strategies and Economic Group, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. June.

Abt Associates Inc. 2000b. Corporate employment and sales data collected through Internet business information resources, including Dun & Bradstreet, Hoover's On-line, Lycos Companies On-line, Thomas' Register, Ward's Business Directory, and Zapdata.com.

Abt Associates Inc. 1999. *Profile of the Plywood and Wood Composite Industries.* Prepared for Larry Sorrels, Innovative Strategies and Economic Group, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. December.

Midwest Research Institute. 1999. Memorandum from Becky Nicholson and Melissa Icenhour to Mary Tom Kissell and Larry Sorrels, U.S. EPA: "Preliminary facility-specific cost estimates for implementation of the plywood and composite wood products NESHAP." October 20.

Midwest Research Institute. 2000. "Estimated Nationwide Costs of Control: Plywood and Wood Composite Products." April 14.

U.S. Environmental Protection Agency. 1998. *Industry Specific Information Collection Request (ICR) for the Development of Plywood and Particleboard Maximum Achievable Control Technology (MACT) Standards*. Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. Environmental Protection Agency. 1999a. *OAQPS Economic Analysis Resource Document*. Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

U.S. Small Business Administration. 2000. "Small Business Size Standards Matched to NAICS Codes."

6 QUALITATIVE ASSESSMENT OF BENEFITS OF EMISSION REDUCTIONS

The emission reductions achieved by this environmental regulation will provide benefits to society by improving environmental quality. This chapter provides information on the types and levels of social benefits anticipated from the proposed plywood and composite wood products (PCWP) NESHAP, including the health and welfare effects associated with the HAPs and other pollutants emitted by affected sources.

In general, the reduction of HAP emissions resulting from the regulation will reduce human and environmental exposure to these pollutants and thus, reduce potential adverse health and welfare effects. This chapter provides a general discussion of the various components of total benefits that may be gained from a reduction in HAPs through this NESHAP. The rule will also achieve reductions of coarse particulate matter (PM_{10}), volatile organic compounds (VOC), and carbon monoxide (CO). There will also be emissions increases in nitrogen oxides (NOx) and sulfur dioxide (SO_2) associated with the use of incineration-based controls. The benefits and disbenefits of the PM, NOx, and SO_2 emissions reductions and increases are presented separately from the benefits associated with HAPs and CO. The benefits and disbenefits associated with PM, NOx, and SO_2, along with the benefits associated with HAPs and CO are presented in this chapter.

6.1 Identification Of Potential Benefit Categories

The benefit categories associated with the emission reductions predicted for this regulation can be broadly categorized as those benefits which are attributable to reduced exposure to HAPs, which are also VOCs, and those attributable to reduced exposure to other pollutants. Some of the HAPs associated with this regulation have been classified as probable or possible human carcinogens. As a result, one of the benefits of the proposed regulation is a reduction in the risk of cancer mortality from leukemia or other cancers. Other benefit categories include: reduced incidence of neurological effects and irritants associated with exposure to noncarcinogenic HAPs, reduced incidence of cardiovascular and central nervous system problems associated with CO. In addition to health impacts occurring as a result of reductions in HAP and CO emissions, there are welfare impacts which can also be identified. In general, welfare impacts include effects on crops and other plant life, materials damage, soiling, and acidification of estuaries. Each category is discussed separately in the following section.

6.2 Qualitative Description Of Air Related Benefits - HAPs and CO

The operation of plywood and composite wood product sources produces emissions of acrolein, formaldehyde, acetaldehyde, and phenol, among other HAPs. The qualitative health and welfare benefits of these HAPs, and CO reductions are summarized separately in the discussions below.

6.2.1 *Benefits of Reducing HAP Emissions*

According to emission estimates, the proposed regulation will reduce approximately 11,000 tons of emissions of acrolein, formaldehyde, acetaldehyde, phenol, and methanol at all affected plywood and composite wood products sources.

Human exposure to these HAPs may occur directly through inhalation or indirectly through ingestion of food or water contaminated by HAPs or through dermal exposure. HAPs may also enter terrestrial and aquatic ecosystems through atmospheric deposition. HAPs can be deposited on vegetation and soil through wet or dry deposition. HAPs may also enter the aquatic environment from the atmosphere via gas exchange between surface water and the ambient air, wet or dry deposition of particulate HAPs and particles to which HAPs adsorb, and wet or dry deposition to watersheds with subsequent leaching or runoff to bodies of water.[1] This analysis is focused only on the air quality benefits of HAP reduction. A summary of the range of potential physical health and welfare effects categories that may be associated with HAP emissions is provided in Exhibit 6-1. As noted in the table, exposure to HAPs can lead to a variety of acute and chronic health impacts as well as welfare impacts.

Exhibit 6-1. Potential Health And Welfare Effects Associated With Exposure To Hazardous Air Pollutants[2]

Effect Type	Effect Category	Effect End-Point	Citation
Health	Mortality	Carcinogenicity	EPA (1990)[3], Graham et al. (1989)[4]
		Genotoxicity	Graham et al. (1989)[5]
		Non-Cancer lethality	Voorhees et al. (1989)[6]
	Chronic Morbidity	Neurotoxicity	All morbidity end-points obtained from Graham et al. (1989)[7] Voorhees et al. (1989)[8], Cote et al. (1988)[9]
		Immunotoxicity	
		Pulmonary function decrement	
		Liver damage	
		Gastrointestinal toxicity	
		Kidney damage	
		Cardiovascular impairment	
		Hematopoietic (Blood disorders)	
		Reproductive/Developmental toxicity	
	Acute Morbidity	Pulmonary function decrement	
		Dermal irritation	
		Eye irritation	
Welfare	Materials Damage	Corrosion/Deterioration	NAS (1975)[10]
	Aesthetic	Unpleasant odors	
		Transportation safety concerns	
	Agriculture	Yield reductions/Foliar injury	Stern et al. (1973)[11]
	Ecosystem Structure	Biomass decrease	Weinstein and Birk (1989)[12]
		Species richness decline	
		Species diversity decline	
		Community size decrease	
		Organism lifespan decrease	
		Trophic web shortening	

6.2.1.1 *Health Benefits of Reduction in HAP Emissions*.

The HAP emission reductions achieved by this rule are expected to reduce exposure to ambient concentrations of acrolein, formaldehyde, acetaldehyde, and phenol, which will reduce a variety of adverse health effects considering both cancer and noncancer endpoints. Acrolein is classified as a possible human carcinogen, according to the *Integrated Risk Information System (IRIS)*[13], an EPA system for classifying chemicals by cancer risk. This means that there is some evidence to indicate that exposure to this chemical causes an increased risk of cancer in humans. Acrolein may also cause general respiratory congestion and upper respiratory tract irritation. Formaldehyde and acetaldehyde are classified as probable human carcinogens, according to IRIS. All of these HAPs are a concern to EPA because long term exposure to these chemicals have been linked with cases of leukemia in humans in an occupational setting. Therefore, a reduction in human exposure to acrolein, formaldehyde, and acetaldehyde could lead to a decrease in cancer risk and ultimately to a decrease in cancer mortality.

The remaining species of HAP emitted by plywood and composite wood products sources, phenol and methanol, have not been shown to cause cancer. However, exposure to these pollutants may still result in adverse health impacts to human and non-human populations. Noncancer health effects can be generally grouped into the following broad categories: genotoxicity, developmental toxicity, reproductive toxicity, systemic toxicity, and irritation. *Genotoxicity* is a broad term that usually refers to a chemical that has the ability to damage DNA or the chromosomes. *Developmental toxicity* refers to adverse effects on a developing organism that may result from exposure prior to conception, during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. *Reproductive toxicity* refers to the harmful effects of HAP exposure on fertility, gestation, or offspring, caused by exposure of either parent to a substance. *Systemic toxicity* affects a portion of the body other than the site of entry. *Irritation*, for the purpose of this document, refers to any effect which results in irritation of the eyes, skin, and respiratory tract.[14] In particular, methanol has been shown to be an irritant causing dizziness, headaches, and slight visual impairment.

For the HAPs covered by the proposed NESHAP, evidence on the potential toxicity of the pollutants varies. However, given sufficient exposure conditions, each of these HAPs has the potential to elicit adverse health or environmental effects in the exposed populations. It can be expected that emission reductions achieved through the subject NESHAP will decrease the incidence of these adverse health effects.

6.2.1.2 *Welfare Benefits of Reduction in HAP Emissions*.

The welfare effects of exposure to HAPs have received less attention from analysts than the health effects. However, this situation is changing, especially with respect to the effects of toxic substances on ecosystems. Over the past ten years, ecotoxicologists have started to build models of ecological systems which focus on interrelationships in function, the dynamics of stress, and the adaptive potential for recovery. This perspective is reflected in Exhibit 6-1 where the end-points associated with ecosystem functions describe structural attributes rather than species specific responses to HAP exposure. This is consistent with the observation that chronic sub-lethal exposures may affect the normal functioning of individual species in ways that make it less than competitive and therefore more susceptible to a variety of factors including disease, insect attack, and decreases in habitat quality.[15] All of these factors may contribute to an overall change in the structure (i.e., composition) and function of the ecosystem.

The adverse, non-human biological effects of HAP emissions include ecosystem and recreational and commercial fishery impacts. Atmospheric deposition of HAPs directly to land may affect terrestrial ecosystems. Atmospheric deposition of HAPs also contributes to adverse aquatic ecosystem effects. This not only has adverse implications for individual wildlife species and ecosystems as a whole, but also the humans who may ingest contaminated fish and waterfowl. In general, HAP emission reductions achieved through the proposed NESHAP should reduce the associated adverse environmental impacts.

6.2.2 *Benefits of Reduced CO Emissions Due to HAP Controls*

As is mentioned above, controls that will be required on plywood and composite wood products sources to reduce HAPs will also reduce emissions of CO. The EPA Staff Paper for CO provides a summary of the health effects information pertinent to the NAAQS for CO[16]. This information is a summary of information from the CO Criteria Document (CD)[17], which provides a critical review of a wide variety of health effects studies, including a limited number of newer health effects studies, as well as older studies. Some were conducted at extremely high levels of CO (i.e. much higher than typically found in ambient air); however, the focus of this Staff Paper is on those key controlled-exposure laboratory studies and newer epidemiology studies, which were conducted with human subjects at COHb levels that are most relevant to regulatory decision making.

Based on the CD, staff concludes that human health effects associated with exposure to CO include cardiovascular system and central nervous system (CNS) effects. In addition, consideration is given in the CD to combined exposure to CO, other pollutants, drugs, and the influence of environmental factors. Cardiovascular effects of CO are directly related to reduced oxygen content of blood caused by combination of CO with Hb to form COHb, resulting in tissue hypoxia. Most healthy individuals have mechanisms (e.g. increased blood flow, blood vessel dilation) which compensate for this reduction in tissue O_2, although the effect of reduced maximal exercise capacity has been reported in healthy persons at low COHb levels. Several other medical conditions such as occlusive vascular disease, chronic obstructive lung disease, and anemia can increase susceptibility to potential adverse effects of CO during exercise.

Effects of CO on the CNS involve both behavioral and physiological changes. These include modification of visual perception, hearing, motor and sensorimotor performance, vigilance, and cognitive ability. Developmental toxicity effects of low-level ambient CO exposures, though not well studied in humans, may pose a threat to the fetus. Finally, environmental factors (e.g. altitude, temperature), drug interaction, and pollutant interaction also can play a role in the public health impact of ambient CO exposure. There is little new information on these effects.

Exhibit 6-2 is a summary of key health effects and studies which have been identified as being most pertinent to a regulatory decision on the NAAQS for CO[18]. Each of the key studies is considered in light of limitations discussed in the CD and the Staff Paper. For example, epidemiological studies are limited by factors such as exposure uncertainties and confounding variables, and many of the controlled exposure studies of CO health effects have been hampered by uncertainties regarding COHb measurements, relatively small sample sizes, and lack of "real world" exposure conditions.

Exhibit 6-2. Key Health Effects Of Exposure To Ambient Carbon Monoxide

Target Organ	Health Effects[a,b]	Tested Population[c]	References
Lungs	Reduced maximal exercise duration with 1-h peak CO exposures resulting in ≥2.3% COHb (GC)	Healthy individuals	Drinkwater et al. (1974) Raven et al. (1974b) Horvath et al. (1975)
Heart	Reduced time to ST segment change of the ECG (earlier onset of myocardial ischemia) with peak CO exposures resulting in ≥2.4% COHb (GC)	Individuals with coronary artery disease	Allred et al. (1989a,b; 1991)
Heart	Reduced exercise duration because of increased chest pain (angina) with peak CO exposures resulting in ≥3% COHb (CO-Ox)	Individuals with coronary artery disease	Anderson et al. (1973) Sheps et al. (1987) Adams et al. (1988) Kleinman et al. (1989, 1998*) Allred et al. (1989a,b; 1991)
Heart	Increased number and complexity of arrhythmia (abnormal heart rhythm) with peak CO exposures resulting in ≥6% COHb (CO-Ox)	Individuals with coronary artery disease and high baseline ectopy (chronic arrhythmia)	Sheps et al. (1990)
Heart	Increased hospital admissions associated with ambient pollutant exposures	Individuals >65 years old with cardiovascular disease	Schwartz and Morris (1995*) Morris et al. (1995*) Schwartz (1997*) Burnett et al. (1997*)
Brain	Central nervous system effects, such as decrements in hand-eye coordination (driving or tracking) and in attention or vigilance (detection of infrequent events), with 1-h peak CO exposures (≈5 to 20% COHb)	Healthy individuals	Horvath et al. (1971) Fodor and Winneke (1972) Putz et al. (1976, 1979) Benignus et al. (1987)

[a]The EPA has set significant harm levels of 50 ppm (8-h average), 75 ppm (4-h average), and 125 ppm (1-h average). Exposure under these conditions could result in COHb levels of 5 to 10% and cause significant health effects in sensitive individuals.
[b]Measured blood COHb level after CO exposure.
[c]Fetuses, infants, pregnant women, elderly people, and people with anemia or with a history of cardiac or respiratory disease may be particularly sensitive to CO.
[d]This table is a reproduction of Table 6-7 of the CD (p. 6-36, U.S. EPA, 1999a).

*Newer studies, published since completion of the last CO NAAQS review.

Although acute poisoning induced by CO can be lethal and is probably the best known health endpoint of CO, this only occurs at very high concentrations of CO (greater than 100 ppm, hourly average), which are not pertinent to the setting of the NAAQS. In the ambient air, exposures to lower-levels of CO predominate (generally, less than 50 ppm, hourly average or less than 20 ppm, 8-hr average), and at these levels the best documented adverse health endpoint in human subjects is the decrease in time to onset of reproducible exercise-induced angina pectoris (chest pain). Adverse effects have been demonstrated in individuals with CAD at 3 to 6% COHb by optical (CO-Ox) methods of measurement[19]. Indicators of myocardial ischemia (as detected by electrocardiographic changes as ST segment depression) and associated angina were statistically significant in a multi-center study at 2.4% COHb (GC) and showed a dose-response relationship with increasing COHb levels. In some individuals with CAD and high levels of baseline ectopy (chronic arrhythmia), increased number and complexity of exercise-related arrhythmias that may present an increased risk of sudden death have been observed at $\geq$ 6% COHb (CO-Ox). Results of these human exposure studies and reports of workers routinely exposed to combustion products provide support for recent epidemiology research suggesting day-to-day variations in ambient CO concentrations are related to cardiovascular hospital admissions and daily mortality, especially for individuals over 65 years of age[19]. Uncertainties about the association between these health endpoints and ambient CO and the relative influence of indoor vs. outdoor CO have not been resolved and will require further research.

Very little data are available demonstrating human health effects in healthy individuals caused by or associated with exposures to low CO concentrations. Decrements in maximal exercise duration and performance in healthy individuals have been reported at COHb levels of $\geq$ 2.3% an d $\geq$ 4.3% (GC), respectively; however, these decrements are small and likely to affect only athletes in competition. No effects were seen in healthy individuals during submaximal exercise, representing more typical daily activities, at levels as high as 15 to 20 % COHb[20]. Most recent evidence of CNS effects induced by exposure to CO indicates that behavioral impairments in healthy individuals should not be expected until COHb levels exceed 20% (CO-Ox), well above what would be caused by typical ambient air levels of CO[21]. Evidence of CO-induced fetal toxicity or of interactions with high altitudes, drugs, other pollutants, or other environmental stresses remains uncertain or suggests that effects of concern will occur in healthy individuals only with exposure to very high levels of CO[22].

Exhibit 6-3 summarizes the population groups potentially at risk to low level CO exposures (i.e., resulting in COHb levels below 5%) based on current evidence and mechanistic considerations. The table includes the cardiovascular disease group, which is most clearly defined as an "at risk" population based a collection of studies, and other groups which may be more susceptible to CO based on more limited and uncertain evidence and plausible biological mechanisms. Except for persons with angina pectoris and peripheral vascular disease, there is little specific experimental evidence to clearly demonstrate increased risk for CO-induced health effects at levels below 5% COHb. However, it is reasonable to expect that individuals with preexisting illness or physiological conditions which limit oxygen absorption or oxygen transport to body tissues would be somewhat more susceptible to the hypoxic (i.e., oxygen starvation) effects of CO. Exhibit 6-3 provides population estimates for each subpopulation and a brief summary of why each group is suspected of being potentially more susceptible than healthy individuals to CO exposures.

The current health effects evidence suggests that the population group at greatest risk from exposure to ambient levels of CO is individuals with stable exercise-induced angina. Given the likely mechanisms of CO effects on the cardiovascular system, individuals with other indications of ischemic heart disease and those with silent ischemia are considered to be similarly at risk for low-level ambient CO exposures.

Exhibit 6-3. Summary of Subpopulations Potentially at Risk[a]

Groups at Risk to Low-level CO	Rationale	U.S. Population Estimates	% of U.S. Population[b]	References
Coronary Heart Disease(CHD)	Strongest evidence is for the group with symptomatic angina pectoris, although the predominant type of ischemia (ST segment depression) is asymptomatic (i.e, silent) putting individuals unknowingly at risk.	Prevalence of diagnosed ischemic heart disease was 8 million in 1994. Prevalence of silent ischemia was about 3 to 4 million in 1989. 481,000 fatalities were caused by heart attacks in 1995.	About 3.1% About 1.4%	DHHS, 1995 DHHS, 1990 American Heart Assn, 1989, 1997
Congestive Heart Failure (CHF)	Evidence associates ambient CO levels with hopitalization for CHF.	5 million Americans have CHF, with about 400,000 new cases/yr	About 2 %	American Heart Assn., 1997
Cerebrovascular Disease	This condition is associated with limited blood flow to the brain; CO may increase O_2 deprivation.	3 million in 1994	About 1.2%	DHHS, 1995
Anemias	O_2 carrying capacity of blood is already compromised, increasing the likelihood of CO-induced hypoxia.	4.7 million in 1994	About 1.8%	DHHS, 1995
Chronic Obstructive Lung Disease	These subgroups have reduced reserve capacities for dealing with cardiovascular stresses and have reduced O_2 supply in blood which may hasten onset of CO-induced hypoxic effects.	Bronchitis - 14 million Emphysema - 2 million Asthma - 14.6 million (above for 1994)	About 5.5% About 0.8% About 5.7%	DHHS, 1995
Fetuses and Young Infants	Some human and several animal studies report adverse effects in offspring (e.g., reduced birthweight, increased mortality)	3.9 million live births per year in 1998	About 1.5%	DHHS, 2000

[a]All subgroups listed are not necessarily sensitive to CO exposure at normal ambient levels.
[b]Percentages were calculated based on 1995 U.S. population base of 256 million and assumed the absolute numbers in the previous column were the same for 1995. Neither the absolute numbers nor the percentages can be added because of significant overlap among these groups.

6.3 Qualitative Description of Effects from Reductions and Increases in Emissions from Other Pollutants Due to HAP Controls

As is mentioned above, controls that will be required on PCWP sources to reduce HAPs will also reduce emissions of other pollutants, namely: PM_{10}, $PM_{2.5}$, and increase NOx and SO_2 emissions. For more information on these non-HAP emissions and emission reductions, please refer to Chapter 3 of this RIA, the preamble for this proposal, and the docket for this proposal. The effects associated with exposure to PM (both coarse and fine), NOx, and SO_2 emissions are presented below.

6.3.1 Effects of NOx Emissions.

Emissions of NOx produce a wide variety of health and welfare effects (EPA,1999b). Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infection (such as influenza). NOx emissions are an important precursor to acid rain and may affect both terrestrial and aquatic ecosystems. Atmospheric deposition of nitrogen leads to excess nutrient enrichment problems ("eutrophication") in the Chesapeake Bay and several nationally important estuaries along the East and Gulf Coasts. Eutrophication can produce multiple adverse effects on water quality and the aquatic environment, including increased algal blooms, excessive phytoplankton growth, and low or no dissolved oxygen in bottom waters. Eutrophication also reduces sunlight, causing losses in submerged aquatic vegetation critical for healthy estuarine ecosystems. Deposition of nitrogen-containing compounds also affects terrestrial ecosystems. Nitrogen fertilization can alter growth patterns and change the balance of species in an ecosystem.

Nitrogen dioxide and airborne nitrate also contribute to pollutant haze, which impairs visibility and can reduce residential property values and the value placed on scenic views.

NOx in combination with volatile organic compounds (VOC) also serve as precursors to ozone. Based on a large number of recent studies, EPA has identified several key health effects caused when people are exposed to elevated levels of ozone. Short-term exposures (1-3 hours) to high ambient ozone concentrations have been linked to increased hospital admissions and emergency room visits for respiratory problems. Repeated exposure to ozone can also make people more susceptible to respiratory infection and lung inflammation and can aggravate preexisting respiratory disease, such as asthma. Prolonged exposure to ozone can cause repeated inflammation of the lung, impairment of lung defense mechanisms, and irreversible changes in lung structure, which could lead to premature aging of the lungs and/or chronic respiratory illnesses such as emphysema, chronic bronchitis, and chronic asthma.

Children are at most risk from ozone exposure because they typically are active outside playing and exercising, during the summer when ozone levels are highest. Further, children are more at risk than adults from ozone exposure because their respiratory systems are still developing. Adults who are outdoors and moderately active during the summer months, such as construction workers and other outdoor workers, also are among those most at risk. These individuals, as well as people with respiratory illnesses such as asthma, especially children with asthma, can experience reduced lung function and increased respiratory symptoms, such as chest pain and cough, when exposed to relatively low ozone levels during periods of moderate exertion. In addition to human health effects, ozone adversely affects crop yield, vegetation and forest growth, and the durability of materials. Ozone causes noticeable foliar damage in many crops, trees, and ornamental plants (i.e., grass, flowers, shrubs, and trees) and causes reduced growth in plants.

Particulate matter (PM) can also be formed from NOx emissions. Secondary PM is formed in the atmosphere through a number of physical and chemical processes that transform gases such as sulfur dioxide, NOx, and VOC into particles. Scientific studies have liked PM (alone or in combination with other air pollutants) with a series of health effects. Coarse particles can accumulate in the respiratory system and aggravate health problems such as asthma. Fine particles penetrate deeply into the lungs and are more likely than coarse particles to contribute to a number of the health effects. These health effects include premature death and increased hospital admissions and emergency room visits, increased respiratory symptoms and disease, decreased lung function, and alterations in lung tissue and structure and in respiratory tract defense mechanisms. Children, the elderly, and people with cardiopulmonary disease, such as asthma, are most at risk from these health effects.

PM also causes a number of adverse effects on the environment. Fine PM is the major cause of reduced visibility in parts of the U.S., including many of our national parks and wilderness areas. Other environmental impacts occur when particles deposit onto soil, plants, water, or materials. For example, particles containing nitrogen and sulfur that deposit onto land or water bodies may change the nutrient balance and acidity of those environments, leading to changes in species composition and buffering capacity.

Particles that are deposited directly onto leaves of plants can, depending on their chemical composition, corrode leaf surfaces or interfere with plant metabolism. Finally, PM causes soiling and erosion damage to materials.

Thus, emissions of NOx can lead to some of the effects mentioned above - either those directly related to NOx emissions, or the effects of ozone and PM resulting from the combination of NOx with other pollutants.

6.3.2 Benefits of PM Reductions.

Scientific studies have linked PM (alone or in combination with other air pollutants) with a series of health effects (EPA, 1996). Coarse (PM_{10}) particles can accumulate in the respiratory system and aggravate health problems such as asthma. Fine ($PM_{2.5}$) particles penetrate deeply into the lungs to contribute to a number of the health effects. These health effects include premature death and increased hospital admissions and emergency room visits, increased respiratory symptoms and disease, decreased lung function, and alterations in lung tissue and structure and in respiratory tract defense mechanisms. Children, the elderly, and people with cardiopulmonary disease, such as asthma, are most at risk from these health effects.

PM also causes a number of adverse effects on the environment. Fine PM is the major cause of reduced visibility in parts of the U.S., including many of our national parks and wilderness areas. Other environmental impacts occur when particles deposit onto soil, plants, water, or materials. For example, particles containing nitrogen and sulfur that deposit onto land or water bodies may change the nutrient balance and acidity of those environments, leading to changes in species composition and buffering capacity.

Particles that are deposited directly onto leaves of plants can, depending on their chemical composition, corrode leaf surfaces or interfere with plant metabolism. Finally, PM causes soiling and erosion damage to materials.

Thus, reducing the emissions of PM from PCWP can help to improve some of the effects mentioned above - either those related to primary PM emissions, or the effects of secondary PM generated by the combination of SO_2 with other pollutants in the atmosphere.

6.3.3 Effects of SO_2 Emissions.

High concentrations of sulfur dioxide (SO_2) affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children and the elderly. SO_2 is also a primary contributor to acid deposition, or acid rain, which causes acidification of lakes and streams and can damage trees, crops, historic buildings and statues. In addition, sulfur compounds in the air contribute to visibility impairment in large parts of the country. This is especially noticeable in national parks.

PM can also be formed from SO_2 emissions. Secondary PM is formed in the atmosphere through a number of physical and chemical processes that transform gases, such as SO_2, into particles. The effects of secondary PM exposures due to SO_2 emissions are the same as those of directly emitted PM.

6.4 Lack Of Approved Methods To Quantify HAP Benefits

The most significant effect associated with the HAPs that are controlled with the proposed rule is the incidence of cancer. In previous analyses of the benefits of reductions in HAPs, EPA has quantified and monetized the benefits of reduced incidences of cancer [23, 24]. In some cases, EPA has also quantified (but not monetized) reductions in the number of people exposed to non-cancer HAP risks above no-effect levels[25].

Monetization of the benefits of reductions in cancer incidences requires several important inputs, including central estimates of cancer risks, estimates of exposure to carcinogenic HAPs, and estimates of the value of an avoided case of cancer (fatal and non-fatal). In the above referenced analyses, EPA relied on unit risk factors (URF) developed through risk assessment procedures. The unit risk factor is a quantitative estimate of the carcinogenic potency of a pollutant, often expressed as the probability of contracting cancer from a 70 year lifetime continuous exposure to a concentration of one $\mu g/m^3$ of a pollutant. These URFs are designed to be conservative, and as such, are more likely to represent the high end of the distribution of risk rather than a best or most likely estimate of risk.

In a typical analysis of the expected health benefits of a regulation (e.g., the Heavy-Duty Engine /Diesel Fuel Regulatory Impact Analysis), health effects are estimated by applying changes in pollutant concentrations to best estimates of risk obtained from epidemiological studies. As the purpose of a benefit analysis is to describe the benefits most likely to occur from a reduction in pollution, use of high-end, conservative risk estimates will lead to a biased estimate of the expected benefits of the regulation. For this reason, we will not attempt to quantify the health benefits of reductions in HAPs unless best estimates of risks are available. While we used high-end risk estimates in past analyses, recent advice from the EPA Science Advisory Board (SAB) and internal methods reviews have suggested that we avoid using high-end estimates in current analyses. EPA is working with the SAB to develop better methods for analyzing the benefits of reductions in HAPs.

While not appropriate for inclusion in our primary quantified benefits analysis, to estimate the potential baseline risks posed by the PCWP source category and the potential impact of applicability cutoffs, EPA performed a “rough” risk assessment for 185 of the 223 facilities in the PCWP source category. There are large uncertainties regarding all components of the risk quantification step, including location of emission reductions, emission estimates, air concentrations, exposure levels and dose-response relationships. However, if these uncertainties are properly identified and characterized, it is possible to provide estimates of the reduction in inhalation cancer incidence associated with this rule. It is important to keep in mind that these estimates will only cover a very limited portion of the potential HAP effects of the rule, as they exclude non-inhalation based cancer risks and non-cancer health effects.

The HAP included in this “rough” risk assessment were acetaldehyde, acrolein, benzene, formaldehyde, manganese, methanol, methylene chloride, and phenol. Of these HAP, four are presently not considered to have thresholds: acetaldehyde, benzene, formaldehyde, and methylene chloride.

Of the 185 facilities assessed, 148 facilities were found to pose cancer risks equal to or greater than 1 in 1,000,000 to their surrounding population. Forty-six facilities were predicted to pose cancer risks of 1 in 100,000 or greater, and two PCWP facilities were found to pose cancer risks equal to or greater than 1 in 10,000.

If this rule, as proposed, is implemented at all PCWP facilities, annual cancer incidence would be reduced from about 0.09 cases/year to about 0.02 cases/year, while the number of people at or above a cancer risk level of 1 in a million would be reduced from about 900,000 to 150,000. In addition, the number of people exposed to hazard index (HI) values equal to or greater than 1 was estimated to be reduced from about 270,000 to about 30,000, and the number of people exposed to HI values of 0.2 or greater was predicted to decrease from about 1,500,000 to about 250,000. [Details of these analyses are available in the docket.] EPA has not tried to monetize this reduced incidence of inhalation cancer for several important technical reasons. The primary reasons include the lack of information on the latency period for the onset of the disease and the fact that we have no information on the proportion of fatal versus nonfatal cancers which may occur. These factors prevent us from providing monetized estimates.

For non-cancer health effects, previous analyses have estimated changes in populations exposed above the reference concentration level (RfC). However, this requires estimates of populations exposed to HAPs from controlled sources. Due to data limitations, we do not have sufficient information on emissions from specific sources and thus are unable to model changes in population exposures to ambient concentrations of HAPs above the RfC. As a result, we are unable to place a monetary value of the HAP related benefits associated with this rule.

6.5 Summary

The HAPs that are reduced as a result of implementing the proposed plywood and composite wood products NESHAP will produce a variety of benefits, some of which include: the reduction in the incidence of cancer to exposed populations, neurotoxicity, irritation, and crop or plant damage. The rule will also produce benefits associated with reductions in CO. Human health effects associated with exposure to CO include cardiovascular system and central nervous system (CNS) effects, which are directly related to reduced oxygen content of blood and which can result in modification of visual perception, hearing, motor and sensorimotor performance, vigilance, and cognitive ability. Although we are unable to place a monetary value on these benefits, the information on the variety of effects associated with these pollutants and the level of reductions anticipated from the proposed NESHAP indicate that the benefits of the rule will be substantial.

6.6 REFERENCES

1. U.S. Environmental Protection Agency. Regulatory Impact Analysis for the National Emissions Standards for Hazardous Air Pollutants for Source Categories: Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry and Seven Other Processes. Draft Report. Office of Air Quality Planning and Standards. Research Triangle Park, NC. EPA-450/3-92-009. December 1992.

2. Mathtech, Inc. Benefit Analysis Issues for Section 112 Regulations. Final report prepared for U.S. Environmental Protection Agency. Office of Air Quality Planning and Standards. Contract No. 68-D8-0094. Research Triangle Park, NC. May 1992.

3. U.S. Environmental Protection Agency. Cancer Risk from Outdoor Exposure to Air Toxics. Volume I. EPA-450/1-90-004a. Office of Air Quality Planning and Standards. Research Triangle Park, NC. September 1990.

4. Graham, John D., D.R. Holtgrave, and M.J. Sawery. "The Potential Health Benefits of Controlling Hazardous Air Pollutants." In: Health Benefits of Air Pollution Control: A Discussion. Blodgett, J. (ed). Congressional Research Service report to Congress. CR589-161. Washington, DC. February 1989.

5. Reference 4.

6. Voorhees, A., B. Hassett, and I. Cote. Analysis of the Potential for Non-Cancer Health Risks Associated with Exposure to Toxic Air Pollutants. Paper presented at the 82nd Annual Meeting of the Air and Waste Management Association. 1989.

7. Reference 4.

8. Reference 6.

9. Cote, I., L. Cupitt and B. Hassett. Toxic Air Pollutants and Non-Cancer Health Risks. Unpublished paper provided by B. Hassett. 1988.

10. NAS. Chlorine and Hydrogen Chloride. National Academy of Sciences, National Research Council. Chapter 7. 1975.

11. Stern, A. et al. Fundamentals of Air Pollution. Academic Press, New York. 1973.

12. Weinstein, D. and E. Birk. The Effects of Chemicals on the Structure of Terrestrial Ecosystems: Mechanisms and Patterns of Change. In: Levin, S. et al. (eds). Ecotoxicology: Problems and Approaches. Chapter 7. pp. 181-209. Springer-Verlag, New York. 1989.

13. U.S. Environmental Protection Agency. Integrated Risk Information System; website access available at www.epa.gov/ngispgm3/iris.

14. Reference 1. p. 3-5.

14. Reference 1. pp. 8-4 to 8-5.

15. U.S. Environmental Protection Agency. Ecological Exposure and Effects of Airborne Toxic Chemicals: An Overview. EPA/6003-91/001. Environmental Research Laboratory. Corvallis, OR. 1991.

16. U.S. Environmental Protection Agency; Staff Paper for the Carbon Monoxide NAAQS; Office of Air Quality Planning and Standards, Research Triangle Park, N.C.; 2000.

17. U.S. Environmental Protection Agency; Criteria Document for Carbon Monoxide; Office of Air Quality Planning and Standards, Research Triangle Park, N.C.; 1999.

18. Reference 17 at Section 6.9.

19. Reference 18.

20. Reference 18.

21. Reference 18.

22. Reference 18.

23. U.S. Environmental Protection Agency. 1992. Draft Regulatory Impact Analysis of National Emissions Standards for Hazardous Air Pollutants for By Product Coke Oven Charging, Door Leaks, and Topside Leaks. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

24. U.S. Environmental Protection Agency. 1995. Regulatory Impact Analysis for the Petroleum Refinery NESHAP. Revised Draft for Promulgation. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

25. Reference 24.