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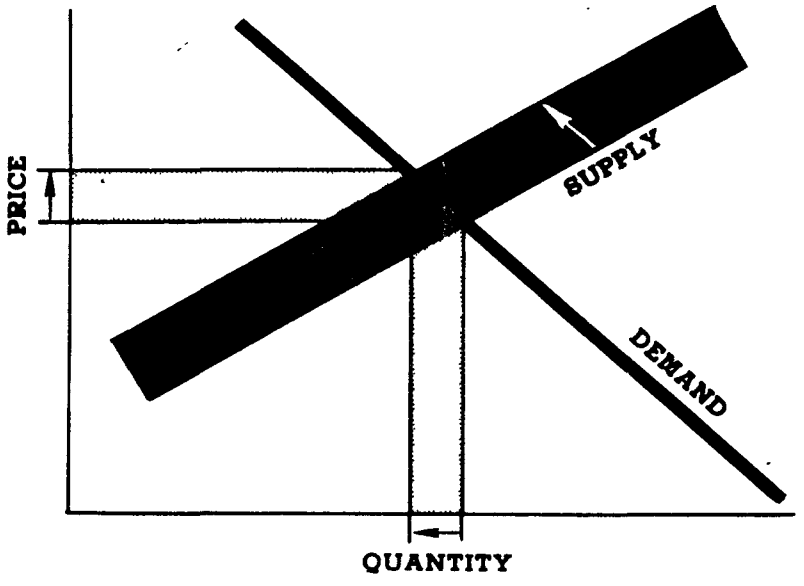
ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES

THE TIMBER PROCESSING INDUSTRY PHASE II



U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Planning and Evaluation
Washington, D.C. 20460

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ECONOMIC ANALYSIS
of
PROPOSED EFFLUENT GUIDELINES

THE TIMBER PROCESSING INDUSTRY
PHASE II

Report to

U.S. Environmental Protection Agency
Office of Planning and Evaluation
Washington, D.C. 20460

August 1974

This report has been reviewed by the Office of Planning and Evaluation, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

PREFACE

The attached document is a contractors' study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under Sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Development Document") supporting the issuance of proposed regulations under Sections 304(b) and 306. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports proposal of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of Sections 304(b) and 306 of the Act. Presented in the Development Document are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Task Order No. 17, Contract 68-01-1541 by Arthur D. Little, Inc. Work was completed as of August 1974.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under Sections 304(b) and 306 of the Act for the subject point source category. The study is not an official EPA publication. It will be considered along with the information contained in the Development Document and any comments received by EPA on either document before or during proposed rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

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I. EXECUTIVE SUMMARY

This is a summary of the Contractor's final analysis of the economic impact on certain Timber Products Processing Industry sectors to meet proposed 1977 and 1983 Effluent Guidelines.

A. SCOPE OF WORK

The industry sectors analyzed include:

- Insulation Board (only – SIC-2661)
- Sawmills and Planing Mills, General (SIC-2421)
- Hardwood Dimension and Flooring Mills (SIC-2426)
- Special Product Sawmills (SIC-2429)
- Millwork (SIC-2431)
- Prefabricated Wood Structures (SIC-2433)
- Particleboard (SIC-2492)

In addition, since new proposed Guidelines for wet log handling and storage have been developed which affect segments of this industry previously studied (Contractor's report to the EPA of August 1973), the following two sectors were also analyzed to determine the economic impact of these costs:

- Hardwood Plywood and Veneer (SIC-2435), and
- Softwood Plywood and Veneer (SIC-2436).

All of these sectors were studied to define the structure of the industry and to estimate the nature and severity of the costs of compliance. Based upon estimated levels of costs, it was clear that for five of the industry sectors effects of effluent abatement were minimal and, thus, detailed analysis of economic impact was not warranted. Therefore, only the following four sectors were analyzed in detail with regard to economic impact:

- Insulation Board
- Hardwood Plywood and Veneer
- Softwood Plywood and Veneer
- Sawmills and Planing Mills – General

B. CONCLUSIONS

It is necessary to consider the Timber Products Processing Industry not as a single industry but rather as separate, only partially interrelated sectors. The products are generally noncompetitive; the sectors are in differing states of growth; and, the companies active in one sector are not necessarily active in another. Thus, each of the sectors requires a separate analysis of economic impact.

In general, the costs of compliance as reported in the Development Document are not overwhelming for these industry sectors. Since these industry sectors do not utilize large amounts of process water, the incremental capital and operating costs necessary to meet abatement Guidelines are not large. However, within specific sectors the effect on operations can be significant, since certain sectors, such as hardwood plywood and veneer manufacturing, are the province of the small, independent business which is quite sensitive to relatively small cost increments. Further, unlike the other sectors, insulation board manufacture does consume large quantities of process water and thus does face relatively large costs of compliance.

Since small operators are so sensitive to modest cost increments, the analysis of economic impact was performed via a series of iterative analyses to test the effect of different Guidelines (and their attendant costs) on the most sensitive sectors. These sensitivity analyses demonstrated the critical points at which minimal effects became plant closures. Thus, it is important to note that the conclusions presented here are quite specific to the particular levels of costs incorporated into the analyses.

There will be essentially no impact on total production in any of these industry sectors. Where companies will close, they will be few in number, and will be smaller firms with relatively little impact on total industry output. In addition, these industry sectors are characterized by moderate levels of capacity utilization, e.g., 70-80% of total capacity. Thus, any production deficiency resulting from plant closures will be offset by the remaining facilities.

Excepting small price increases by insulation board (0.5-4.0%) and particleboard (0.15%) manufacturers, prices will not be increased; rather, plants will absorb pollution abatement costs. However, profit margins will not be significantly affected since costs of compliance are generally not large.

Unemployment effects will impact mainly on the states of the mid-South and Southeast. However, the total effect of unemployment will not be large; only two communities within this region will be affected.

Abatement costs will not affect balance of trade; export trade is minimal. Imports are significant only in the hardwood veneer and plywood and lumber sector. But, in those sectors the balance of trade will be affected more significantly by other factors than by abatement costs.

1. Industry Segments

The objective of segmenting the industry was to group plants into categories which might be affected differently by effluent control requirements. For these industry sectors, the costs of compliance can be directly related to the type of process performed. Each of the nine industry sectors studied performs different operations and has different effluent

practices, and thus faces different costs of compliance. Therefore, our analysis focused on each of the nine sectors as separate segments.

For insulation board manufacture, each of the eight plants was analyzed individually. For the other eight major sectors segmentation was based on operating characteristics of plants within subsectors, particularly focusing on those firms of small size with limited financial capability to meet even modest levels of cost. Representative model plants were developed for each of the operating subsegments.

2. Financial Profiles

More than 20 financial profiles were developed to represent model plants within the various major segments. These model plants have widely-ranging characteristics as follows:

- Annual Sales: $100,000-$15MM+
- After Tax Income: $4,500-$1MM
- Net Assets: $100,000-$15MM+
- Number of Employees: 20-400+

3. Pricing

Pricing dynamics vary considerably within the various sectors. Basically, however, they are characterized by nearly commodity product pricing with the marketplace setting price levels in response to the total industry supply/demand balance.

For insulation board, regional pricing for standard products is practiced. The cost of a standard product to a given buyer varies by location of supplier, among other factors, since the supplier pays the end product freight charges. For hardwood plywood and veneer, prices vary among the subsectors depending on the character of the product as a specialty or a commodity item. Commodity type products are priced in the marketplace, whereas specialties have some degree of price stability and some brand loyalty can be maintained. However, prices of domestic hardwood plywood products are basically influenced by the cost and availability of imported product. Millwork products also have a degree of uniqueness to them and can be value-priced; however, substitute materials such as plastics strongly affect millwork suppliers' ability to maintain profit margins. Prelaminated wood structures also can be specialty, differentiated products. Softwood plywood is almost the classic commodity product in that it is traded on futures markets, and the prices respond very rapidly to total supply/demand balance and cycle dramatically in response to shifts in that balance.

The remaining products represent sawmill products of varying degrees of specialness. The products are all in a mature state of growth and significantly influenced by both imports (primarily from Canada), and significant penetration of substitute products (e.g.,

wall-to-wall carpeting over plywood replacing hardwood flooring). General purpose sawmill products (softwood and hardwood) prices vary substantially depending on level of new construction activity; in contrast, prices of the other special products are more stable.

4. Methodology

To accomplish the economic impact analysis we have developed data on the structure of these industry sectors and an analytical model to focus on the following two central issues:

- The probability that costs of compliance will be passed on to consumers via increased end product costs or will be absorbed by operators, resulting in a lower level of profitability; and
- If costs cannot be passed through, the extent to which the effect on financial condition and limitations of capital availability will force plant closures, thus causing unemployment and community effects.

Since there are many small, privately-held firms in this industry for which data is not generally available on operations or financial position, we had to develop new data on the various industry segments through a series of surveys of firms within the individual sectors, plus interviews with industry associations and others knowledgeable of industry practice. This was supplemented by background and interpretive data which we have accumulated over time.

The conclusion that prices are likely (or not likely) to be able to be passed on is a relatively straightforward economic analysis. Table III.B.1 presents the price increase analysis matrix which we used to derive price increase conclusions. However, even if prices are not likely to be increased and costs are absorbed with relatively well-documented financial effects, it is more difficult to reach conclusions regarding plant closures. The plant closure analysis matrix which we used to structure these decisions is presented in Table III.C.1. This analysis is complicated by the fact that small, family-owned and operated, one-plant firms which are common in these industry sectors, show remarkable "staying power" in the face of significant negative financial effects. The extent of subjective commitment to the business is an extremely difficult factor to measure and assess. Standard business reasoning, such as effect of abatement costs on key profitability ratios (e.g., return on net assets, profit margin) can be used to focus on the key issues, but the factors related to the nature of the small firms in this business were used necessarily as subjective elements to supplement the objective analysis.

5. Costs of Compliance

Costs of compliance vary dramatically from sector to sector. Insulation board manufacture is a wet process, performed in large operations. Capital costs of abatement for

plants in this sector run to $1.5MM; annual operating costs can be more than $400,000. In contrast, the estimated capital required to achieve BPT in the plywood and sawmill sectors is less than $15,000, and operating costs are less than $5,000. However, since many firms in these categories are so small, the effects of the cost burden are as significant.

6. Economic Impact Analysis

a. Insulation Board

Although insulation board mills use large quantities of process water, the costs required to meet effluent Guidelines will not cause a severe dislocation in the industry.

- *Price Effects:* Implementation of BPT Guidelines will result in price increases ranging from 0% to 4% for eight (of 18) facilities. This will allow the plants to maintain present rates of return on net assets. In addition, the equivalent price increases to meet BAT Guidelines will be implemented and will range from 1% to 4.5%.

- *Financial Effects:* Since price increases will be implemented, there will be no effect on plant profitability. The availability of capital could make one plant marginal, with a 50% probability of closure.

- *Production Effects:* The one marginal plant representing about 4% of industry production might close (50% probability) by 1977. However, this loss in capacity will be almost entirely counterbalanced by the addition of a planned new facility in 1976.

- *Employment Effects:* From 0 to 200 workers could be unemployed.

- *Regional Effects:* The plant likely to close is located in an area of considerable forest products activity with reemployment options. Some retraining will be required, presenting a more difficult situation for older workers, but little long term unemployment should result.

- *Balance of Payment Effects:* Zero.

b. Hardwood Plywood and Veneer

This industry sector is typified by small operations, owned and operated by independent businessmen. For example, a typical container-grade veneer plant employs 10-20 persons, has a net asset base of $100-200,000, generates $100-150,000 of annual sales revenues and an annual cash flow of less than $10,000. The small firms in all four subsectors of this industry are in tenuous financial positions.

- *Price Effects:* The costs of compliance will not be passed on through increases in end product prices. End uses are quite competitive, and abatement costs fall unequally on firms within the sectors.

- *Financial Effects:* Absorption of the costs of compliance will not impact the financial condition of most of the firms in this sector. However, manufacturers of container grade veneer (used in packaging) are in the most tenuous financial condition and will feel a significantly negative financial effect.

- *Product Effects/Plant Closures/Employment Effects:* Since many firms in this sector are very small, they are particularly sensitive to small increments of cost. In general, there is relatively little effect on the industry at levels of capital investment up to the $10-15,000 range. Beyond that level, the effect becomes severe. Similarly, the balance shifts toward significant impact at a level of $5,000 incremental annual operating costs. Since the proposed technologies have costs associated with them close to these balance points, Table S.1 is presented to demonstrate the effect on the industry of varying levels of compliance costs. As the table demonstrates for the proposed effluent regulation (Guideline Option II), 2 plant closures will result with 40 persons unemployed. The higher cost Guideline Option III, which was evaluated during the course of this analysis, would represent a severe impact on plants in sector (i.e., 20 plant closures, 990 persons unemployed). However, even in that case, although 22% of the container grade veneer manufacturers would withdraw from production, the remaining plants could compensate for the lost production, since the industry is operating at about 75% of capacity.

- *Regional Effects:* Based on the relatively mature average age of employees, we would expect that only 30% of the persons unemployed would be able to find other comparable employment. These plants and the unemployed persons are located in small communities in the states of the mid-South and Southeast, yielding about 2 impacted communities in this region.

- *Balance of Trade Effects:* Zero.

c. Softwood Plywood and Veneer

Our survey of this industry indicates that approximately 50% of the plants will have to make an investment to comply with proposed Guidelines. However, the costs are moderate; we have not been able to identify any mills which would be forced to close due to financial inability to comply.

TABLE S-1

HARDWOOD PLYWOOD AND VENEER – PLANT CLOSURE AND EMPLOYMENT EFFECT FOR VARYING LEVELS OF COMPLIANCE COSTS

Guideline Option	Sector	No. Plant Closures	No. Employees Displaced	No. Employees in Sector
I. Process Changes Only	V	0	0	
(Maximum Cost: capital = $5,500 yearly = $3,000)	0	0	0	—
	Total	0	0	0
II. I + Recirculation from Wet Decks*	V	2	40	4%
(Maximum Cost: capital = $14,100 yearly = $3,870)	0	0	0	—
	Total	2	40	0.1%
III. II + Screening from Wet Decks and Log Ponds	V	11	220	22%
(Maximum Cost: capital = $24,100 yearly = $3,870)	0	9	770	2%
	Total	20	990	2.4%

V = Commercial Grade Veneer
0 = Other Sectors
*Proposed Guideline
Source: Arthur D. Little, Inc., estimates.

- *Price Effects:* Prices in this industry are established as a function of supply and demand and are not directly impacted by shifts in cost of manufacture. Thus, prices will not be increased to reflect incremental costs of effluent abatement.

- *Financial Effects:* The average cost of compliance is minimal, e.g., incremental annual costs are less than 0.1% of annual sales. The industry will not face a capital availability problem, since compliance can be reached by expending approximately 1% of annual capital investment.

- *Production Effects:* There will be no plant closures or reduction in production.

- *Employment Effects:* Zero.

- *Regional Effects:* Zero.

- *Balance of Payment Effects:* Zero.

d. Sawmills and Planing Mills, General

Compliance with effluent Guidelines will not impact firms in this industry. The firms are able to comply with Guidelines for mill operations with no additional capital investment; the investment necessary to meet the Guidelines for log storage activities is not severe.

- *Price Effects:* End product prices are highly competitive, and the costs of abatement are unequally distributed throughout the industry. Thus, the industry will not pass on compliance costs through higher end product prices.

- *Financial Impacts:* Absorption of costs of compliance will reduce profitability between 2.8% and 8.6%, depending upon the size of the mill and its operating characteristics. This is not a serious impact. Further, there will not be a capital availability problem, since the necessary level of capital expenditure represents approximately 5% of the annual capital expenditures the industry will make for productivity improvements.

- *Production Effects:* Zero.

- *Employment Effects:* Zero.

- *Regional Effects:* Zero.

- *Balance of Trade Effects:* Zero.

c. Other Sectors

1. Hardwood Dimension and Flooring Mills

a. Hardwood Flooring

Firms in this sector will have to make effluent abatement investment only if they also operate sawmills. Further, only those firms also utilizing wet deck log storage will have to make the maximum investment ($8,600 capital costs; $3,000 annual costs). Only the larger firms in this industry will have to make this investment. For the firms affected, capital costs represent less than 2% of total assets; annual operating costs are less than 0.1% of sales revenues. These firms will be able to make this investment; thus, there will be no impact on this sector.

b. Hardwood Dimension

Dimension producers are potentially subject to water pollution abatement costs only if they also operate sawmills employing wet storage techniques or if they engage in extensive gluing activities.

In each case, only a small number of firms in this sector are likely to be affected and those affected will either be financially able to bear the burden or have alternate means of complying.

- *Price Effects:* Since the costs of compliance are unequally distributed across the firms in this industry sector, it will not be possible to pass on cost increases due to effluent abatement.

- *Financial Effects:* To all but the smallest firms (i.e., those less than 20 employees), the absorption of the costs of compliance is negligible.

- *Production Effects:* No plants are likely to be forced to close.

- *Employment Effects:* Zero.

- *Regional Impacts:* Zero.

2. Special Product Sawmills

The key group of manufacturers in this section to focus upon are those companies producing shakes and shingles. While there are many small mills in this sector, the companies only face the costs of compliance for log handling and storage. Incremental annual costs will represent 0-15% of annual cash flow and 0-3% of annual sales revenues; incremental capital costs will be 0-9% of net assets. Thus, the companies will invest, and there will be no impact on the sector.

The other manufacturers incorporated in this sector, those companies which produce cooperage stock (the material from which barrels and kegs are produced) do not use wet storage practices. Thus, there is no effluent pollution problem, no cost of compliance, and no impact.

3. Particleboard

Particleboard is manufactured by a dry process and utilizes very little process water. The product is in high demand, i.e., output should increase at between 10-15% per year through 1980.

The costs of compliance are insignificant. Capital costs of effluent abatement represent 0.4% of the necessary investment to build a new plant of minimum economic size. Further, total yearly costs represent 0.15% of the average selling price (1972) achieved by the plant with the lowest unit selling price. Much higher levels of cost could be passed on through price increases.

There will be no economic impact of effluent abatement in this sector.

4. Millwork

Operations in the various millwork subsectors do not include sawmilling, nor do they include extensive gluing operations requiring water for cleanup. Further, the firms are relatively large, in good financial position, and generally tied into municipal treatment plants.

There is no noticeable economic impact in this sector.

5. Prefabricated Wood Structures

Although extensive gluing is encountered in the production of laminated beams, the manufacturing process is quite capital intensive. Thus, the maximum costs of $2,000 for capital investment and $480 in total yearly costs, represent insignificant ratios to capital invested in operations (<1%) and other operating costs (<1%).

There will be no economic impact due to effluent abatement in this sector.

7. Limits to the Analysis

The two key problems limiting the accuracy of the present analysis are based on:

- A limited availability of data; and,
- The nature of the industry.

We conducted representative surveys of the industry to enable us to deal with the data limitation factor. Since there are thousands of firms in the industry, many of them not identified by industry associations, Department of Commerce or other sources, we have focused on those firms most likely to be impacted. The consistency of our data suggests that this can be accomplished within a relatively narrow band of error.

The second problem, the nature of the industry, makes it difficult to project plant closures, as noted in Section I.B.4 above. However, since the costs are modest and even these small firms can bear the burdens, the difficulty of accurately projecting plant closures is less important. If new Guidelines would cause increased costs to be borne by companies in this sector, then this would be a more sensitive issue.

Thus, although data was somewhat limited and the nature of the industry forced us to use subjective as well as objective analysis, we believe the analysis as presented is accurate within a fairly narrow band of error (±10%).

II. INDUSTRY SEGMENTS

A. INSULATION BOARD

1. Industry Structure

a. Product Definition[1]

Insulation board is a form of fiberboard, which in turn is a generic term applied to sheet materials constructed from ligno-cellulosic fibers. (The terms "insulation board" and "fiberboard" are used interchangeably by industry and in this report.) It can perhaps best be classified on the basis of density, and most broadly as "compressed" and "noncompressed." Compressed fiberboards (hardboards) have a density over 25 lb/ft^3 and noncompressed fiberboards (insulation boards) have a density of less than 25 lb/ft^3. Insulation boards are usually manufactured in thicknesses between 3/8 and one inch. On a basis of density, insulation board may be subdivided into semi-rigid insulation board and rigid insulation board with densities of 9.5 lb/ft^3 and 9.5 to 25 lb/ft^3, respectively. Semi-rigid insulation board is normally used only for insulation purposes while rigid insulation board may be used for sheathing, interior paneling, and as a base for plaster or siding.

Due to increased demand for insulation board and its varied uses, there are now 10 basic types of insulation board products as cited by the Acoustical and Insulating Materials Association. The principal types include:

1. *Building board* – General purpose product for interior construction.

2. *Insulating roof deck* – A three-in-one component which provides roof deck, insulation, and finished inside ceiling. (Insulation board sheets are laminated together with waterproof adhesives.)

3. *Roof insulation* – Insulation board designed for flat roof decks.

4. *Ceiling tile* – Insulation board embossed and decorated for interior use. It is also useful for acoustical qualities.

5. *Lay-in-panels* – A ceiling tile used for suspended ceilings.

6. *Sheathings* – Boards used extensively in construction due to its insulative, bracing strength, and noise control qualities.

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1. Product Definition as contained in the Development Document.

7. *Sound deadening insulation board* - Special product designed explicitly for use in buildings to control noise level.

The American Society for Testing and Materials sets standard specifications for the above categories and others.

b. Production and Shipments of Insulation Board

According to the Acoustical and Insulating Materials Association, the principal trade association representing manufacturers of insulation board in the United States, product shipments on a 1/2" basis reached an all-time high of 3.7 billion square feet in 1972. (Table II.A.1) Shipments data for the past ten years, with an estimate for 1973, indicate little change throughout the period until 1971. The past three years indicate significant growth but this impression must be tempered by reference to the levels of housing starts and general construction experienced in the United States in the same years. In fact, a closer examination of the data indicates that the market share of insulation board remained fairly level through the 1960's but then began to erode in 1968 and now may be stabilizing at the lower level.

TABLE II.A.1

INSULATION BOARD SHIPMENTS, 1967 – 1973
(million square feet – 1/2" basis)

1964	2582
1965	2642
1966	2456
1967	2454
1968	2715
1969	2682
1970	2634
1971	3222
1972	3707
1973 (estimate)	3500

Source: Acoustical and Insulating Materials Association.

At an average mill net value of $60 per thousand square feet, 1/2" basis, for all products, the approximate value of shipments was $220 million in 1972.

Exports of insulation board, mainly to adjacent foreign countries, are shown in Table II.A.2. Exports represent an insignificant proportion of total production, less than 2% on a tonnage basis. Imports of insulation board are about the same order of magnitude.

TABLE II.A.2

EXPORTS OF INSULATION BOARD,* 1970-1972

	000's Tons	$ Million
1970	19.2	4.6
1971	24.6	6.5
1972	25.8	6.3

*Made from wood or vegetable fiber and having a density of less than 31 pounds per cu ft.

Source: Dept. of Commerce Schedule "B".

Apparent consumption of insulation board is shown in Table II.A.3. Measuring consumption on a per new dwelling unit (conventional and mobile home) basis confirms the sharp drop in market share since new dwelling units together account for more than half of insulation board demand, with new residential units taking at least 40%. (Of the balance, 20%-30% is used in residential remodeling; about 10% in new and remodeled non-residential construction and the remaining 5% or so in miscellaneous and industrial uses.)

TABLE II.A.3

APPARENT CONSUMPTION OF INSULATION BOARD, 1964-1972
(thousands of tons)

	Domestic Production	Exports	Imports	Apparent Consumption	Consumption Per New Dwelling Unit
1964	1215	19	23	1218	0.71
1965	1258	16	23	1265	0.73
1966	1155	18	24	1161	0.82
1967	1176	16	25	1185	0.76
1968	1333	17	36	1352	0.73
1969	1352	24	34	1362	0.71
1970	1219	19	35	1235	0.66
1971	1446	25	35	1457	0.57
1972	1548	26	35	1558	0.53

Source: U.S. Forest Service.

c. Applications

Table II.A.4 displays the production of insulation board by type for the period 1968 to 1972. (It should be pointed out that the totals indicated in this table are higher than

TABLE II.A.4

PRODUCTION OF INSULATING BOARD
(density less than 31 pounds per cu. ft.*)

SIC Code		1972 Short Tons	1972 Thousand sq. ft. 1/2" basis	1971 Short Tons	1971 Thousand sq. ft. 1/2" basis	1970 Short Tons	1970 Thousand sq. ft. 1/2" basis	1969 Short Tons	1969 Thousand sq. ft. 1/2" basis	1968 Short Tons	1968 Thousand sq. ft. 1/2" basis
	Structural insulating board, total	1,528,534	3,917,742	1,445,835	3,838,953	1,218,531	3,193,714	1,352,314	3,594,675	1,333,305	3,476,067
	Insulating boards for the retail trade or for use directly in building construction, total	1,265,721	3,199,718	1,196,334	3,147,684	1,004,667	2,608,405	1,163,875	3,068,502	1,157,218	2,996,804
	Interior products, total	486,371	1,285,782	470,183	1,251,552	386,830	1,021,376	455,502	1,201,352	435,735	1,135,197
2661111	Building board, 7/16" or thicker, mostly painted or factory finished	162,828	397,859	130,909	327,439	112,926	282,996	152,932	367,554	132,518	302,653
2661113	Wallboard, under 7/16" thick, except shinglebacker	(D)	(D)	23,247	57,829	28,756	70,492	30,040	74,933	28,990	71,265
2661115	Sound-deadening board, nominal 1/2" thick, natural finish	40,412	113,882	36,399	100,683	28,555	79,980	34,712	95,697	32,839	89,351
2661121	Tile, except acoustical	196,027	530,440	204,807	554,996	154,448	413,256	158,477	436,685	158,927	436,961
2661123	Acoustical tile and lay-in panels, acoustical	59,942	171,780	63,579	177,605	50,922	143,173	63,480	181,815	70,942	201,935
2661129	Other (including plank, trim, moldings, and other insulating board for retail or for use directly in interior building construction)	(D)	(D)	11,242	33,000	11,223	31,479	15,861	44,668	11,519	32,972
	Exterior products, total	779,350	1,938,461	726,151	1,896,132	617,837	1,587,029	708,373	1,867,150	721,483	1,861,607
2661131	Sheathing board	631,489	1,607,572	559,902	1,438,930	436,306	1,074,829	469,770	1,169,164	491,872	1,180,347
2661133	Shinglebacker	23,150	62,479	17,168	46,782	18,004	47,008	31,035	78,204	28,684	73,256
2661135	Roof insulation board, preformed above deck	122,057	261,482	145,610	401,560	159,943	455,786	202,084	605,629	193,255	591,936
2661136	Insulating roof deck[2]	2,654	6,928	3,471	8,860	3,584	9,406	5,484	14,153	7,672	16,068
2661138	Insulating fiberboard formboard[2]										
	Insulating boards for industrial uses (for further manufacture, processing, or assembly), total	262,813	718,024	249,501	691,269	213,864	585,309	188,439	526,173	176,087	479,263
2661151	Insulating siding base	(D)	(D)	18,160	47,094	14,947	36,396	7,483	21,821	7,616	22,368
2661153	Trailer board	157,081	418,811	161,906	444,061	117,234	307,194	118,982	342,449	95,804	276,463
2661155	Backer board for siding made of metal[2]	51,525	150,693								
2661157	Insulating board for processing into expansion joint strips[2]	22,017	61,662	69,435	200,114	81,683	241,719	61,974	161,903	72,667	180,432
2661159	Insulating board for all other industrial uses such as automobile industry, furniture industry, etc.[2]	(D)	(D)								

*25 pounds per cu. ft. and under represented 78%, 75%, 82%, 84% and 95%, respectively in 1968 to 1972 on a square foot, 1/2" basis.

Source: U.S. Dept. of Commerce Current Industrial Reports "Pulp, Paper, and Board" – M26A (69).

those shown in Table II.A.1 as there is no precise overlap.) This table refers to board products with a density of 31 pounds per cubic foot or less but the proportion of production in the density range 25 to 31 pounds per cubic foot is reducing and amounted to 5% of the total in 1972 on a square foot basis.

Interior products account for about 1/3 of the total (on a 1/2" basis) and are mainly acoustical tile and lay-in panels and factory-finished building board. Exterior products, principally sheathing board and roof insulation, represent 50% of the total; the balance includes mobile home and other industrial boards.

Future shipments of insulation board will show little growth over the remainder of this decade and will, in fact, lose some of their current volume in the short term. The short term loss will be primarily because the product is dependent on the size and growth of the residential building sector and it is unlikely that housing starts will reach the record level set in 1972 before the end of this decade. In the long term, the market share that insulation board will retain must depend on a careful analysis of its relative competitiveness on a performance and cost basis with alternative materials. In that context, insulation board is threatened both by changing performance requirements and by improved and/or more economic products which are available, e.g. integral siding, glass fiber acoustic tiles and gypsum wallboard.

The functional aspects of sheathing are declining in importance and with this decline fiberboard is losing some of its advantages. Sheathing is a sheet material fastened to the outside of a frame structure to provide rack resistance, thermal insulation, and extra cover between the outside and inside of the structure. It is never exposed to the elements or to sight; the outside is covered with masonry or siding and the inside by insulation and interior finish. As insulation standards become more stringent, alternative products such as fiberglass become more practical and economic. Nor is the strength of sheathing as important as it once was. More and more codes permit the exterior siding, such as plywood or hardboard, to provide the required rack resistance. Thus, the builder is able to reduce the construction labor component by utilizing one composite product where two had been traditional.

Insulation board fiberboard ceiling tiles and lay-in panels are being restricted increasingly to residential repair and remodeling uses as flame spread requirements become more stringent in the non-residential building sectors. In the commercial building sector, fiberboard tiles and panels are restricted to light commercial construction but even these uses will be incorporated into code and fire requirements. Residential applications during the next few years, however, are unlikely to be affected within the foreseeable future, although some minor errosion of market share will take place as alternative materials take advantage of the promotional emphasis on brand name, ease of maintenance, etc.

Fiberboard applications in the mobile home include rumbleboard, bottomboard and ceiling board. In all three applications, fiberboard is being replaced by other materials or the application is being eliminated altogether. Rumbleboard, found only in relatively high-cost

mobile homes, fits between the ceiling and the metal shelf of the unit and serves to reduce the tin can type rumble from vibrations during high wind and rain storms. Most units that presently use it are eliminating its use altogether but some substitution is taking place by paper/polystyrene sandwich panels in order to reduce material costs. Bottomboard, required by industry standards, fits underneath the joists of the unit to prevent dust, insects, etc., from rising off the ground into the home and offers a minor insulation function. Increasingly, however, fiberboard is being replaced either by lower cost materials, such as heavy-duty paperboard or foam core paper/polystyrene sandwich.

The third application of fiberboard in the mobile homes is as a ceiling panel. Fiberboard is also threatened in this application because of the potential fire hazards it presents but, to date, there are no practical, economic alternatives for viable substitutes. It is likely that the design of the mobile home will change in the immediate future to allow for better fire detection and protection devices and additional means of egress in order to improve the fire performance of the home, reducing the immediate pressure to replace fiberboard.

Thus, the fiberboard usage in mobile homes is likely to decrease in market share but, because the number and size of units manufactured will increase steadily in the foreseeable future, fiberboard products will experience a modest growth in this application.

Perhaps the largest loss in both market share and absolute volume will occur in roof deck insulation applications. This type of insulation is usually in the form of a rigid board applied to the top of the structural deck of flat roof buildings and is then covered with a built-up asphalt and felt roof. Historically, roof deck insulation has been made of wood fiber or rigid fiberglass but in recent years fiberglass and perlite board products have aggressively taken over much of this market while fiberboard has been decreasing rapidly. We anticipate this trend to continue and possibly even to accelerate as the growing demands for improved insulation (given added impetus by the energy crisis) allow a growing market opportunity for plastic roof deck insulation such as urethane and styrene.

On balance, therefore, we expect the trend in insulation board shipments to decline relative to 1972.

d. Distribution

The products used in new construction are distributed through retail and wholesale outlets serving the homebuilders and non-residential contractors. The principal outlets include the manufacturers' warehouses and retail building materials dealerships. Sales to mobile home manufacturers and other industrial users, such as metal siding manufacturers who use fiberboard as a backer, are on a direct shipments basis much as many OEM products are. Finally, the repair and remodeling sector, including the homeowner and do-it-yourselfer, is served through the traditional mass merchandise and retail store channels.

2. Industry Segments

The Development Document adopted a unit process approach to segment the timber processing industries under analysis. The categorizations considered include:

- Process variation.
- Nature of raw materials.
- Plant size and age.
- Nature of water supply.
- Plant location and land availability.
- Water usage.

After considering these factors, the industry was segmented on the basis of the potential impact produced by the most critical of these subcategories.

With respect to the manufacture of insulation board, the following unit process segments were isolated.

1. Wet decking of logs.

2. Log storage in ponds.

3. Manufacture of insulation board with no steaming of raw material furnish and no hardboard production.

4. Insulation board production which employs steaming or has hardboard production.

5. Finishing operations which employ water soluble materials.

3. Types of Firms

Thirteen companies operate the 18 production facilities, only one of which is privately held. The remaining companies are all major diversified corporations, frequently with a heavy concentration of sales and assets in the forest products industries sector. Consequently, the fiberboard proportion of each company's sales is relatively small, although the product is important to an individual company since it allows that company to offer a more complete building materials package to the marketplace and permits the efficient and profitable utilization of wood wastes.

Based on reported data, the companies having a significant share of industry capacity are:

Firm	% Industry Capacity
Celotex	19
Boise Cascade	13
Armstrong Cork	12
Weyerhaeuser	8
United States Gypsum	8
Temple Industries	7
Total	67%

4. Types of Plants

Insulation board is manufactured in 18 plants throughout the U.S. with a heavy concentration in the South. Table II.A.5 lists these plants and Table II.A.6 summarizes their

TABLE II.A.5

INSULATION BOARD PLANTS IN THE UNITED STATES

Company	Plant Location	1972[1] Capacity (MMSF-1/2")	Other Products Manufactured	
			Mineral Board	Hardboard
Abitibi	Blounstown, Fla.	110		
Armstrong Cork	Macon, Georgia	500		
Boise Cascade	Internat'l Falls, Minnesota	520		✓
Celotex	Dubuque, Iowa	130		
Celotex	Marrero, La.	440		
Celotex	L'Anse, Michigan	155	✓	
Celotex	Sunbury, Pa.	175		
Flintkote	Meridian, Miss.	220		
Huebert Fiberboard	Boonville, Mo.	48		
Johns-Manville	Jarratt, Virginia	180		
Kaiser Gypsum	St. Helene, Oregon	124	✓	
National Gypsum	Mobile, Alabama	260	✓	
Simpson Timber	Shelton, Washington	100		
Temple Industries	Diboll, Texas	300		✓
United States Gypsum	Lisbon Falls, Maine	100		
United States Gypsum	Greenville, Miss.	90	✓	✓
United States Gypsum	Pilot Rock, Oregon	80		✓
Weyerhaeuser	Craig, Oklahoma	325		✓

1. Insulation Board only. These insulation board capacities are approximate only as most plants can convert production to manufacture other products.

Sources: 1973 Directory of the Forest Products Industry and Arthur D. Little, Inc., estimates.

TABLE II.A.6

SUMMARY OF INSULATION BOARD PLANT CHARACTERISTICS
(total plants – 18)

Location

Location	Number of Plants
Northeast	2
North Central	4
South	9
West	3
Total	18

Capacity Categories

Capacity	Number of Plants
0-199 Tons/Day	7
200-299	4
300-399	4
400 and above	3
Total	18

Process Categories

Process	Number of Plants
I – Little or no steaming of furnish; no hardboard	8
II – Extensive steaming of furnish; no hardboard	5
III – No steaming of furnish; produce hardboard	1
IV – Steam furnish; produce hardboard	4
Total	18

Product Mix

Product	Number of Plants
Finished interior fiberboard	14
Structural fiberboard	18
Hardboard	5
Mineral Board	5
Total	Not Additive

Age of Equipment

Age	Number of Plants
0-9 years	1
10-19 years	9
20-29 years	6
30 and over	2
Total	18

Employment Level

Number of Employees	Number of Plants
0-99 employees	2
100-199 employees	3
200-299 employees	5
300-399 employees	3
400 and over	5
Total	18

principal characteristics. (A nineteenth producer presently has only a small proportion of its total production in wood fiberboard and has indicated its withdrawal from this sector in the near-term future.)

In addition to manufacturing fiberboard, five of these facilities also produce mineral board (not covered by this study) and five plants manufacture hardboard. This economic impact analysis covers those facilities having the capability to manufacture hardboard as these facilities have the alternative to convert production between fiberboard and hardboard manufacture. In fact, the insulation board capacities shown in Table II.A.5 are only approximate as this option of conversion implies that management will respond to market demand in formulating the product mix. Only one plant – that of United States Gypsum at Greenville, Mississippi – produces all three products. In terms of process sub-category, which is important for evaluating the economic impact, 9 plants steam their raw material furnish.

The average fiberboard capacity for the industry is approximately 310 million square feet, 1/2" basis, per plant with only four of the 18 facilities larger than this. The average age of equipment in each facility is generally high compared to most manufacturing industries; the average for all plants is 19 years, and the newest, Abitibi's, just started up after complete renovation. However, Weyerhaeuser has announced the construction of a new plant at Plymouth, North Carolina for start-up in 1976. Its capacity is planned at 260 MMSF, and is part of an integrated pulp and paper/forest products complex.

5. Financial Profile

The financial profile of a typical insulation board plant, including its production of mineral board and hardboard, is shown in Table II.A.7.

TABLE II.A.7

TYPICAL FINANCIAL PROFILE, INSULATION BOARD PLANT

Net Sales		100.0%
Cost of Goods Sold	80.0	
GS&A	10.5	
		90.5
Operating Profit		9.5
Other Charges		0.2
Provision for Income Tax		4.4
Net Income on Sales		4.9%
Return on Net Assets		10.5%

Source: Arthur D. Little, Inc., estimates.

The variation among plants in the industry is:

- Asset-net values vary from $2.0MM to over $15MM, depending on age and size. (Mean = $7.2MM)
- The returns on net assets range from 2% to over 20%, but average about 10.5% (after tax).
- The cost of goods sold varies from 70% to 87% of net sales.
- Net profits after tax range between 2% and 15% of net sales. (Mean = 4.9%)

Table II.A.8 shows the recent investment profiles of the public corporations and the relationship of annual investments (1971 and 1972) to net assets. On average, a company reinvests approximately 15 cents each year for every dollar of net assets.

TABLE II.A.8

INVESTMENT PROFILES OF PUBLIC COMPANIES

	1971 ($ Million)			1972 ($ Million)		
	Investment[1]	Net Assets[2]	%[4]	Investment[1]	Net Assets[2]	%[4]
Abitibi	10.9	225.6	4.8	9.5	230.4	4.1
Armstrong Cork	38.5	300.1	12.8	40.6	290.4	14.0
Boise Cascade	115.6	588.5	19.6	53.6	460.1	11.7
Celotex (Jim Walter)[3]	18.7	293.2	6.4	61.0	352.6	17.3
Flintkote	29.6	209.0	14.2	39.1	212.7	18.4
Johns Manville	51.9	306.1	17.0	74.4	377.0	19.7
Kaiser	8.5	114.5	7.4	10.2	115.8	8.8
National Gypsum	11.4	206.7	5.5	14.3	202.3	7.1
Temple Industries	6.6	45.8	14.4	9.5	50.5	18.8
United States Gypsum	27.4	339.1	8.1	33.4	346.4	9.6
Weyerhaeuser	319.5	1056.9	30.2	193.2	1134.7	17.0
TOTAL	638.6	3685.5	17.3	538.8	3772.9	14.3

1. Land, plant, equipment, buildings, etc., but not including timberlands.
2. With allowances for accumulated depreciation.
3. Fiscal years ending August 31, 1972 and 1973.
4. Annual Investment ÷ Net Assets

Source: Company Annual Reports.

Assigning alphabet letters to specific plants in the industry, the following is the dispersal of the 18 plants in terms of net assets per employee:

Less than $15,000	–	A, B, P
$15-20,000	–	D, F, H
$20-30,000	–	C, E, K, S
$30-40,000	–	G, J, L, M
Not available	–	N, Q, R, T

Net assets per dollar of sales revenues ranges from 0.3 to 1.0 for those plants which made data available.

6. Pricing

Fiberboard product prices are quoted on a dollars per thousand square feet basis f.o.b. the shipping point with full freight allowed to the destination. Dealer prices for a 1/2" 4' x 8' insulating board on a carload basis will range from $56 per MSF to $82 for the more expensive building board. A typical price for 1/2" asphalt-coated insulating sheathing is $60; ceiling tiles will vary greatly in price depending on the acoustical and aesthetic treatment but range from $100 to $200 per MSF. On a full netback basis, after allowing for freight and discounts, finished board prices averages $100/MSF and structural, $50/MSF. Prices for products being marketed to the industrial and mobile home sectors (OEM sectors) will be negotiated directly with the customer. While prices have increased relative to 1967, the rate of increase has been in line with the movement of the all commodities price index.

Direct price comparisons with competing materials is difficult to make. Historically, fiberboard has been more economic for certain defined performance requirements but now, in the midst of a changing situation, the insulating and structural functions fiberboard has provided traditionally are being offered more efficiently by other products (for example, glass fiber insulation in residential construction) or is being eliminated altogether (as in mobile home applications). Therefore, while it is still an economic product, fiberboard is losing its market position on the basis of performance value.

B. PLYWOOD AND VENEER

Plants incorporated into SIC 2435-hardwood and SIC 2436-softwood include plants manufacturing plywood and veneer, or just plywood or veneer, of interior and/or exterior grades, and of softwood or hardwood species.

The description of the plywood and veneer industry sector in this section considers both hardwood and softwood products and markets. One objective of this analysis is to demonstrate the distinctness of hardwood and softwood plywood, by contrasting the two sectors. In recognition of this distinctness, these two sectors are analyzed separately in the economic impact analysis sections (Section V.B. Hardwood and Section V.C. Softwood).

This is an industry of many small operations, most of them owned and operated by family interests. Department of Commerce information is sketchy, and data generally available on the industry concentrates on the operations of large manufacturers. Our first analysis in this area (August 1973) demonstrated that the impact was most likely to fall on smaller operations.

Thus, it was necessary to develop new background information through surveys of the industry distributed and collected for us by the Hardwood Plywood Manufacturers Association and the American Plywood Association. The data from the surveys represents, according to industry sources, the most comprehensive body of data available on the industry.

1. Industry Structure

a. Products

Hardwood and softwood products are basically non-substitutable. Hardwood is used primarily in decorative applications, while softwood is used in structural applications.

Hardwood plywood is used for interior grade products. The product is considered a hardwood plywood product as long as it has a hardwood veneer (surface); however, the core can be either hardwood or a softwood laminate or lumber or particleboard. Hardwood plywood is finished to different degrees depending upon its end use. Sanded and stained hardwood plywood can be used as tongue and groove flooring or can be made into interior wall paneling, and moldings. These are relatively high-quality uses. Hardwood veneer and finished hardwood plywood is used in moderate-high quality furniture. Lower grades of hardwood plywood are used in industrial applications, for container and packaging products.

Softwood plywood is manufactured in both interior and exterior grades, the primary differentiation being the composition of the adhesives used to bind the laminates and, to some extent, finishing techniques, both of which serve to increase moisture resistance levels. Interior grades are used for such products as flooring underlayment, sub-flooring and paneling. Exterior grades are used for siding, sheathing, and roof decking.

b. Markets

Markets for hardwood plywood products are furniture, interior wall paneling, other decorative applications, and flooring. These markets utilize the hardwood plywood primarily as a decorative material. In most cases, hardwood plywood is a well-established product in these markets, having gained access to the markets via substitution for solid wood products many years ago. The substitution effect is nearly complete. Thus, the growth of hardwood plywood consumption will parallel or be slightly less than the overall market growth within these sectors.

The hardwood plywood markets are less subject to wide cyclical economic swings and represent a broader base of industries than is the case for softwood plywood. This broader base makes the demand for hardwood plywood more stable (less subject to the substantial year-to-year variations that affect softwood plywood).

Softwood plywood markets can be defined as follows:

- Residential construction: 52% – sheathing, siding, underlayment;
- General construction: 14% – concrete footing;
- Industrial uses: 20% – shipping containers, packaging uses;
- Agricultural and other: 14% – furniture, boats, paneling.

Perhaps 10% out of the 14% in the agricultural and other category is for products frequently purchased by a consumer and utilized for residential repairs and remodeling uses. Thus, the residential construction uses account for, in total, more than 60% of total uses, and total construction uses account for about three-quarters of the total consumption.

Agricultural, industrial and non-construction markets normally do not fluctuate widely on a year-to-year or on a seasonal basis. Residential repair and remodeling activity also tends to be relatively stable, although less so than the previous categories. However, new residential construction is an extremely volatile industry in the United States. With its substantial dependence on construction activity, softwood plywood demand, and prices, are heavily exposed to the vagaries of wide demand swings. Table II.B.1 demonstrates graphically this volatility. For example, new housing starts dropped by more than 20% in 1966 vs. 1965, and rose by more than 40% in 1971 vs. 1970, and another 14% in 1972 vs. 1971.

TABLE II.B.1

NEW HOUSING STARTS

Year	Starts (1,000)	Change (%)
1960	1,300	
1961	1,360	+ 5.3
1962	1,500	+ 9.3
1963	1,640	+10.0
1964	1,560	− 4.9
1965	1,510	− 3.3
1966	1,200	−20.8
1967	1,320	+10.5
1968	1,540	+16.9
1969	1,500	− 2.9
1970	1,470	− 2.2
1971	2,080	+42.1
1972	2,400	+14.2

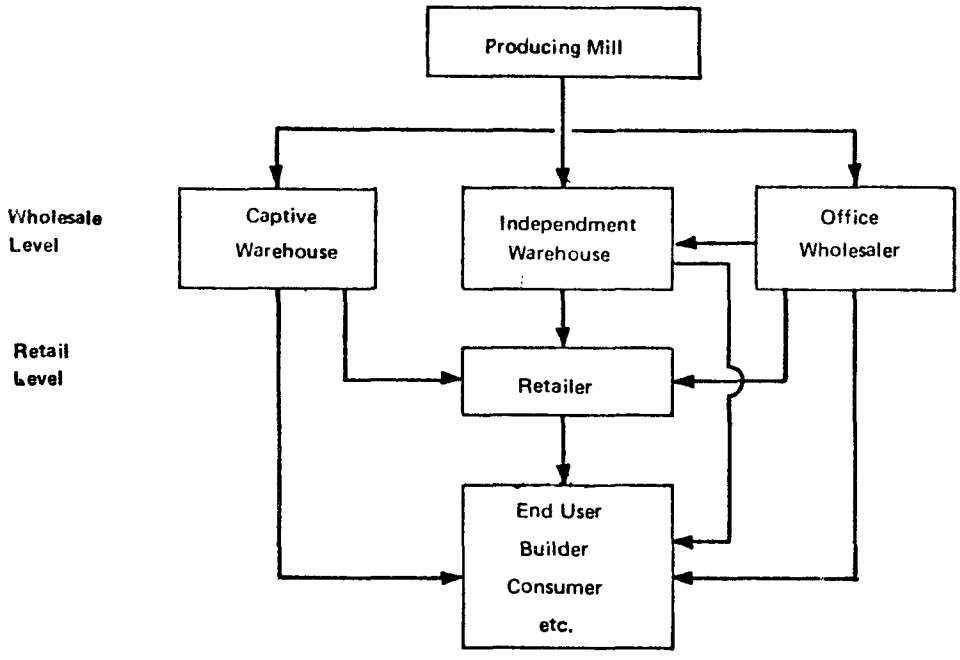
Source: U.S. Department of Commerce

c. Marketing

Softwood plywood is basically a commodity product. With the exception of redwood plywood, which has particular attributes such as workability, weather resistance, and appearance, the softwood plywood species are largely interchangeable products. The major product categories relate to the type of adhesive used (designed for interior or exterior conditions), the finish of the sheet (rough for construction and industrial use, smooth for interior, cabinetry and finish work), and the appearance of the face (such as the number and size of knots and cracks, and the thickness of the sheets). The products are graded at the mill by the producer. Independent inspectors visit mills on a spot basis to ensure that grading standards are maintained.

A demonstration of the commodity nature of plywood is the recent acceptance of trading in plywood futures contracts on the Chicago Commodities Exchange. Other forest products commodities, such as pulp, are also traded on the Exchange. Specialty products, such as specialty papers and pre-finished plywood panels, are not traded as futures.

Figure II.B.1 depicts plywood distribution channels. A captive warehouse is a warehouse owned by the producing mill. Georgia-Pacific, Champion International (U.S. Plywood), and Weyerhaeuser are examples of three firms which own captive warehouses. An independent warehouse refers to a wholesaler which is an independently-owned firm, performing the same activities as a captive warehouse, but handling a number of producers' products. An office wholesaler is generally a small, independently-owned firm which operates as a middleman between the mill and retailers or other large end users, such as contractors. An office wholesaler maintains no inventory, and serves to facilitate the match between user and mill. Even more than the other sectors, an office wholesaler sells relatively large unit volumes at relatively low margins.



Source: American Plywood Association

FIGURE II.B.1 PLYWOOD DISTRIBUTION PATTERNS

The distribution pattern is in practice considerably more complicated than that depicted in Figure II.B.1. For example, some retailers have joined together to form cooperatives which are then able to buy in carload quantities at volume discounts from the producing mill. In such cases, the mill will ship directly to the cooperative and/or its individual members, bypassing the captive warehouse entirely. Similarly, large contractors, either acting in concert or independently, can also buy directly from the producing mill.

Our latest data indicates the following importance of the three primary wholesale members in the distribution chain:

- Captive: 45-50% of total shipments
- Independents: 20%
- Office: 15%

Approximately 15-20% of the total value of shipments went directly from the producing mill to the retailer and end user. The primary trend which is developing in terms of distribution patterns is the increasing importance of captive warehouses, the lessening of importance of office wholesalers, and the increasing capability of the producing mill to service the retailer or end user directly.

d. Substitute Products

In a general sense, the following sort of substitution chain applies: plywood substitutes for lumber, and composition wood products (particleboard, hardboard, and softboard) replace plywood. However, the residential construction industry is particularly traditional in its use of materials and adopts substitutes only gradually. More specifically, hardwood plywood used in furniture faces competition from solid wood in high-quality markets, from plastics and plastic laminates in low-moderate quality markets, and from composition board products with a hardwood or printed veneer. In other decorative uses, hardwood plywood faces generally the same competitive mix.

In all uses hardwood plywood, domestically produced, faces its real competition from relatively low-cost imports. While total hardwood consumption has risen considerably during the period of the last 20 years, domestic production has remained relatively constant. Imports have absorbed the major portion of the increase.

Softwood plywood does not face the same import substitution threat. However, softwood plywood used in siding faces substantial competition from plastics (vinyls and vinyl-clad products), aluminum, steel and hardboard and solid wood (clapboard) siding, the product plywood has replaced. In sheathing applications, softwood plywood can be substituted by softboard (insulation board), gypsum board; in certain areas of the country sheathing is being eliminated entirely. Softwood plywood faces relatively little competition in general construction markets where it is used as concrete footing and should not in the near future, barring a major change in building technology. In industrial applications, which include shipping and packaing containers, the competition is plastics and solid wood products, on purely price-based factors.

e. Production

Softwood plywood production is outlined in Table II.B.2. As this table indicates, softwood plywood production over the period 1958-1972 has risen by 190%, or a 9% annual rate of growth. Where data was available, a percent utilization ratio was indicated. The comparison of operating rates to year-end prices is a further description of the commodity nature of these products. For example, an 84% operating rate in 1970 relates to a $57/MSF price for standard, exterior grade Douglas Fir plywood, 3/8" basis. The same product sold for $102 in 1968 at a 95% operating rate, and at $105 at a 100% operating rate in1972. By February/March of 1973, the same product sold in the range of $145-$155, and the industry's operating rate was well in excess of rated capacity.

TABLE II.B.2

DOMESTIC PRODUCTION OF SOFTWOOD PLYWOOD

Year	Domestic Production (MMSF-3/8")	% Total Capacity	Year End Price ($/MSF)
1958	6,340	83	
1965	11,680	–	
1966	13,140	–	49
1967	12,960	80	60
1968	14,810	95	102
1969	14,205	88	60
1970	14,960	84	57
1971	16,408	98	80
1972	18,303	100	105

per cent change + 190% = + 9%/yr.

1. Based on Standard Douglas Fir, Exterior Grade Plywood, 3/8" basis.

Source: American Plywood Association; Crow's Plywood Guide, 1973.

The softwood veneer industry is concentrated in the states of California, Oregon, and Washington. Technically it is necessary to distinguish between mills which produce only veneer for sale or use elsewhere and mills which also make plywood at the site. The latter type of producer is covered under our analysis of softwood plywood mills.

The 1972 Preliminary Report of the Census of Manufactures indicates that shipments of veneer that year equalled 5.2 billion square feet (3/8" basis) with a value of $303.1 million. This is an average value of $58.64 per thousand square feet.

Estimates of the total number of mills producing veneer only vary widely. The Census data reports a total of 227 establishments operating in the softwood plywood and veneer industry and we are aware of 192 firms which produced softwood plywood. This leaves (apparently) 35 firms which produced veneer only. However, one knowledgeable trade source has identified 38 mills producing veneer only (in 1973) while another source believes there may be as many as 70 such producers. In the absence of any better data we use the estimate of 38 producers as the best approximation of industry size.

During 1972 the 38 known producers are estimated to have produced 2.8 billion square feet (3/8" basis) of veneer as follows:

Product	# Producers	Output
Green Veneer Only	30 mills	2,133.2 million ft.
Dry Veneer	8 mills	685.0 million ft.
	38 mills	2,818.2 million ft.

Value of all mills output = $165.3 million (2,818.2 million ft. x $48.64/thousand)
Average output per mill = 74.6 million feet
Value of output of average mill = (74.6 million ft. x $58.64/thousand) = $43 million

The balance of the softwood veneer shipped by the softwood plywood and veneer industry (2.4 billion feet) is believed to have been shipped by plywood mills which were "balancing out" their veneer supplies and inventories to meet production needs. In effect these mills were "trading" veneer within the industry since many bought as well as sold in order to meet their needs.

All of the 38 softwood veneer mills identified are located in the Northwest and for the purpose of analyzing efficient discharge, their operating characteristics and conditions faced are identical to those of Northwest softwood plywood mills except no glueing takes place.

Domestic production of hardwood plywood, as depicted in Table II.B.3 has not increased dramatically in the past 20 years. Domestic production has increased by 60% in the 20-year period 1951-1971, a 2.5%/year annual rate. However, total consumption of hardwood plywood has risen substantially, by 360% in the same period, a 6-1/2% per year annual rate of growth. Imports, rising from 49 million square feet in 1951 to 2.6 billion square feet in 1971, have accounted for the major portion of the increase.

TABLE II.B.3

DOMESTIC PRODUCTION AND IMPORTS OF HARDWOOD PLYWOOD

Year	Domestic Production (MMSF-3/8")	Net Imports (MMSF-3/8")
1951	1,197	49
1955	1,355	442
1960	1,102	715
1965	2,049	1,047
1966	2,076	1,254
1967	1,916	1,244
1968	2,009	1,896
1969	1,869	2,107
1970	1,758	2,047
1971	1,930	2,545
per cent change	+ 60%	51-71: +5,200% 65-71: + 240%

Source: U.S. Department of Commerce.

Table II.B.4 depicts hardwood plywood and veneer production by product category. The basic data for the table comes from two sources, namely, the HPMA survey and supplementary data from the Department of Commerce. This table segments the industry into four sectors. The two major categories are veneer manufacturing and hardwood plywood and veneer manufacturing. Each of these major categories is then divided into two subcategories, each based on the fact that firms in these categories produce either specialty/semi-specialty products or standard/lower value-added products.

For Sectors I & II Veneer, the commercial grade products are sometimes referred to as "fancy face" veneers and are used in high-quality applications, such as furniture top and side panels. Container grade veneer is of lower quality, and is used for packaging application where appearance is not paramount.

In Sectors III & IV, the semi-specialty and specialty grade products are higher value-added products, requiring more hand labor, sold in varying sizes and shapes, including curved shapes, and are generally finished or semi-finished products. Stock panels are those products generally produced in a relatively standard range of sizes, with little or no final finishing.

TABLE II.B.4

HARDWOOD PLYWOOD AND VENEER PRODUCTION BY PRODUCT CATEGORY

Category	Estimated Production – 1972	
	$\$ \times 10^6$	$ft^2 \times 10^6$
I. Commercial Grade Veneer	145	4,175
II. Container Grade Veneer	10	420
	155	4,595
III. "Stock" Plywood Panels	260	1,760
IV. Specialty Plywood Products	115	440
	$375	2,200
Total	$530	not additive

Sources: Department of Commerce, HPMA Survey, Arthur D. Little, Inc., estimates.

Distinctions between manufacturers of commercial or container grade veneer are straightforward in terms of product mix, and in terms of economic factors. For the manufacture of plywood there is more of a gray area where the product line from stock panel producers overlaps with the product line of semi- and specialty-grade products. However, in spite of this overlap, the industry segments do describe basic operations within the industry and do yield an analytical framework appropriate to assess impact.

f. Future Demand

Hardwood plywood faces a relatively stable market demand, due to its position as a relatively mature product in generally mature market sectors. Thus, a stable 1-2% per year growth rate can be projected.

The growth rate of domestic hardwood plywood production could rise substantially above this level if imports would plateau. Such a development is possible due to rapidly rising prices for imported plywood. This price rise is due largely to the siphoning of the output of Southeast Asia/Oceania producers to Japan rather than into United States markets. If this trend continues and if productive capacity is not increased to meet the added Japanese demand, then imports will taper off and the market growth rate could rise above the 1-2% per year we project at present.

Softwood plywood market demand and prices fluctuate widely on an annual, seasonal, and daily basis. Certainly, month-to-month or quarter-to-quarter graphs of these prices show wide variation. As noted in Section II.B.1.b above, this is largely due to the heavy dependence on residential construction activity. Thus, our projection is for a 4-6% per year annual increase in demand for softwood plywood, but the pattern will be one of wide cycles, around a 4-6% per year trend line.

Although this growth rate represents a decrease from the 9% per year of the 1950's through the mid-1960's, it represents only a modest decrease of the 6-7% per year average during the late 1960's and early 1970's. We project increasing usage of softwood plywood in residential construction in all categories, including single family homes, mobile and modular housing, and multi-family homes. These increases in consumption of plywood will enhance the ability for softwood plywood to grow at a rate greater than the residential construction activity growth rate for the period.

2. Types of Firms

The hardwood plywood and veneer industry is best characterized as a small-company business. There are nearly 500 firms active in the hardwood industry sector versus about half that many softwood producers. After the largest company in this sector, Georgia-Pacific, is considered, the size of the firms falls off rapidly. (For the purposes of this discussion, we have not separated the plants that Georgia-Pacific was forced to spin off to Louisiana-Pacific.) Hardwood plywood producers frequently service narrow, regional markets, e.g., a cluster of firms in the mid-South servicing the furniture industry. These firms tend to be located in the Eastern sector of the United States, both North and South, which is where the hardwood timber species predominate.

Table II.B.5 illustrates the concentration in this industry. While 152 firms have less than 20 employees, these 152 firms represent only 3% of the total value of shipments. Similarly, while 246 establishments (37% of the total number) have 100 or more employees, they account for 63% of the total value of shipments.

TABLE II.B.5

PLYWOOD INDUSTRY (SIC 2432)
CONCENTRATION PATTERNS

Plant Size Patterns – 1967

Number of Employees	Number of Establishments	Value of Ship. in %
1-19	152	3
20-99	269	34
100 and over	246	63
	667	100

Concentration Ratios – % Total Shipments

	1967	1966	1963
4 largest firms	26	24	23
8 largest firms	37	33	31
20 largest firms	50	–	42
50 largest firms	65	–	58

Source: 1967 Census of Manufactures

As the concentration ratios show, the four largest firms account for about one quarter of total production; the 20 largest firms account for half of total production. The trend has clearly been toward greater concentration in the industry, which will continue.

The concentration patterns within the hardwood plywood industry sector indicate a considerably less concentrated industry than for softwood plywood. Table II.B.6 indicates market shares for the major firms in each industry. Georgia-Pacific, which accounted for 20% of the domestic hardwood plywood production in 1972, is clearly the leader in this segment. The companies that follow trail by substantial market shares. The companies beneath Boise-Cascade, which is the fifth largest in the industry with only a 2% market share, exhibit market shares of 1-1/2% or less.

The picture is different than this for softwood plywood. Again, Georgia-Pacific is the leader with a 15% market share, but the top eight firms account for a 50% market share, the top 10, 54%. There are eight firms here with a 2% market share or more, double the number present in the hardwood plywood industry.

Much of this is due to the fact that four out of the five major hardwood plywood producers (excepting Roseburg) have their own marketing distribution (captive warehouse) outlets. All five of the leading hardwood manufacturers are integrated to wood fiber. Similarly, the four leading softwood plywood producers all have captive marketing outlets, and all of the top five producers are integrated to woodlands. This degree of integration affords the majors

TABLE II.B.6

PLYWOOD INDUSTRY MARKET SHARES – 1972

Hardwood Plywood	Percent
Georgia-Pacific	22
Champion International	6
Weyerhaeuser	5
Roseburg	2
Boise-Cascade	2
	37
Softwood Plywood	
Georgia-Pacific	16
Boise-Cascade	8
Weyerhaeuser	7
Champion International	6
Willamette	5
Roseburg	4
International Paper	3
Vanply	3
Potlach	2
	54

Source: Arthur D. Little, Inc., estimates.

greater control over volume produced and sold. For example, having captive woodlands insulates a firm from wood availability problems more so than a firm which must buy on the open market. Similarly, in a weak market, a firm's captive distributor can emphasize its own product. The ability to gain market access and to control or moderate wood price effects is an extremely important advantage to a firm operating in this industry.

3. Types of Plants

The typical hardwood plywood plant is a small, privately-owned mill producing 5-10 million square feet of product per year. This is in contrast to the production pattern in the softwood plywood sector, which is typified by a mill of 100 million square feet output per year. Based on our survey results, the mean production of softwood plywood plants was 95 MMSF 3/8" (1973). Based on an arithmetic average of 1972 production, the "typical" plant produced:

- hardwood plywood: 11.6 MM square feet 3/8"
- softwood plywood: 95.3 MM square feet 3/8"

Further, softwood plywood plants tend to be part of multi-plant operations owned by broad-based forest products companies.

Mills producing veneer for sale only are believed to be confined exclusively to the Pacific Northwest. Their operations are centered in Oregon although some mills are located in Washington and California. The physical operations of a veneer mill are identical to those of a Northwest softwood plywood producer with two important exceptions - (1) veneer mills do not glue up plywood and therefore do not have glue discharges and (2) most veneer mills (an estimated 79%) sell green veneer only and will not have effluent discharges from veneer dryer washdown water. The costs of compliance for veneer mills will be considerably lower than for softwood plywood mills as a result of these differences.

Table II.B.7a depicts the operating characteristics of plants within the four hardwood plywood and veneer segments. Table II.B.7b presents an extrapolation of raw data from our survey of plant sizes within each of our four categories. As the table indicates, container grade veneer mills tend to be quite small and have a low value of net assets per plant (60% have less than $500,000 in value of assets). Commercial grade veneer manufacturers tend to be significantly larger (64% have net assets of greater than $500,000). Hardwood plywood and veneer manufacturers are more evenly distributed.

TABLE II.B.7a

HARDWOOD PLYWOOD AND VENEER MANUFACTURING[1] INDUSTRY STRUCTURE

Category	# Plants	# Empls.[2]	1972 Est'd Prod'n. $MM	1972 Est'd Prod'n. Ft.^{2} x 10^6	Productivity Ratios: $ Assets/Plant ($ x 10^3) Ave.	$ Assets/Plant ($ x 10^3) Range	Prod'n./Plant (Ft.^{2} x 10^6) Ave.	Prod'n./Plant (Ft.^{2} x 10^6) Range	# Emp./ Plant Ave.	$A/$10^3$ Ft.^{2} Ave.	$A/$10^3$ Ft.^{2} Range	Comments
Veneer Mfgrs.												
A. Commer. Veneer	250	16,500	145	4,175	1,365	125-8,000	48	1.25-163	65	39	8-180	– High quality product; $35/$10^3$ ft.^{2} "average" selling price.
B. Container Grade	50	1,000	10	420	235.	105-600	2.5	0.75-5.75	20	165	88-333	– Lower quality product; $24/$10^3$ ft.^{2} "average" selling price.
Total Veneer	300	17,500	155	4,595								
Hardwood Plywood Manufacturers												
A. "Stock" Panels	75	9,000	260	1,760	2,100	300-7,000	83	1.5-273	175	48	36-70	– Standard products; "average" selling price $250/$10^3$ ft.^{2} (3/8" basis).
B. Semi- and Spec. Grade Panels	115	14,750	115	440	1,750	200-10,000	16	0.8-60	293	218	37-875	– Specialty products, including finishing, curves; "average" selling price $400/$10^3$ ft.^{2} (3/8" basis).
Total Plywood	190	23,750	375	2,200								
GRAND TOTAL	490	41,250	530	Not Additive								

1. HPMA Survey – March/April 1974.
2. Ratio Production Emp./Total Empl. – 0.83 (1967 *Census of Manufactures).*

Source: HPMA, ADL estimates; Note: Productivity ratios and other 1974 survey data believed to be skewed toward larger plants.

TABLE II.B.7b

SIZE DISTRIBUTION OF PLANTS - NET ASSETS BASIS

Category		Net Assets $ x 10^3 100-500	500-1,000	1,000 and Over
I. Veneer Manufacturing				
A. Commercial Grade	% Segment	36%	30%	34%
	# Plants	90	75	85
B. Container Grade	% Segment	60%	20%	20%
	# Plants	30	10	10
II. Hardwood Plywood and Veneer Manufacturing				
A. Stock Panels	% Segment	18%	27%	55%
	# Plants	14	20	41
B. Semi and Specialty Grade	% Segment	21%	41%	38%
	# Plants	24	47	44

1. Extrapolated from Survey.

Sources: HPMA Survey, March-April, 1974, Arthur D. Little, Inc., estimates.

4. Financial Profiles

The task of developing a financial profile in this industry is complicated by the large number of mills of varying sizes and technological sophistication, and a substantial variation in product line. The individual firm can produce only veneer, or only plywood, or both products. Similarly, part of a plant's operations can be the production of semi-finished or pre-finished products, such as tongue and groove hardwood flooring. It is difficult to separate the costs of the production of the finished product from the cost of manufacture of the basic product.

Table II.B.8 presents the financial profile of a softwood plywood and veneer mill if constructed at the end of 1972. The mill's capacity was put at 125 million square feet, 3/8" basis. A price level was assumed to be $100/MSF. As the income statement indicates, at that price level net profits, after tax, were $800,000 on a total revenue base of $12.6 million, or 6.4% of net sales.

Profitability is extremely sensitive to the assumed price level. For example, at a price of $175/MSF, a price level which was achieved in February/March of 1973, total revenues would have been $19,375,000. Assuming the same costs, net profits after tax would have been $4.4 million, or 22% of net sales. Conversely, the mill would be only breaking even at a price level of $90/MSF.

TABLE II.B.8

FINANCIAL PROFILE:
SOFTWOOD PLYWOOD AND VENEER MILL

Characteristics:

- Products: rough sanded and S2S
- Annual Production: 125 MM sq. ft., 3/8" basis
- Annual Sales: $12.6 MM
- Employees: 275
- Net Assets: $10 MM

Income Statement – 1972:

		%		$MM
Net Sales		100.0		12.6
Cost of Sales				
Operating Expenses				
Cost of Goods Sold	76.7		9.7	
GS & A	11.6		1.3	
	88.3		11.0	
Operating Profit		11.7		1.6
Other Charges		–		–
Profit Before Income Tax		11.7		1.6
Provision for Income Tax		5.6		0.8
Net Profit		6.1		0.8
Return on Net Assets		6.0		

Source: Arthur D. Little, Inc., estimates.

That these profitability figures are representative of the softwood industry is attested to by a study done by the National Forest Products Association of Washington, D.C. in March 1971. Their study, commenting on softwood lumber and plywood prices, indicated that, "The majority of plywood producing units operated at a loss during most of 1970." Prevailing price levels for softwood plywood products during 1970 were below $100/MSF.

Table III.B.9 presents comparable financial data on veneer and plywood mills during the year 1971, as compiled by Robert Morris Associates. In this case, profits before taxes were 2.9% for mills with assets of $1-10 million, and 3.6% for mills in all size categories.

Tables II.B.10 through II.B.13 present financial profiles for representative firms within each of the four hardwood plywood and veneer segments as described above. These profiles have been developed to represent operations within these sectors and tend to be somewhat smaller than the average mill as computed from our survey data. This is an attempt to account for the underrepresentation in the survey of smaller sized firms. As these tables demonstrate, none of the representative operations in these segments are unusually profitable. However, with the exception of a container grade veneer (Table II.B.11) while the plants show modest profitability (return on net assets ranging from 4% to 8.8%), the companies do have a reasonable amount of financial strength, particularly as compared against the expected cost of compliance (cash flows ranging from $67,500 to $100,000).

TABLE II.B.9

FINANCIAL PROFILE:
VENEER AND PLYWOOD MILL, 1971

	Assets	
	$1MM-$10MM Income Statement	All Sizes
Net Sales	100.0	100.0
Cost of Sales	89.0	87.6
Gross Profit	11.0	12.4
Other Expenses, Net	8.1	8.8
Profit Before Income Taxes	2.9	3.6

Source: Robert Morris Associates, 1972.

TABLE II.B.10

FINANCIAL PROFILE:
HARDWOOD VENEER MFG. – SEMI AND
SPECIALTY GRADE

	%	$ x 10^3
Net Sales	100.0	1,500
Cost of Goods Sold	86.0	1,290
GS & A	10.0	150
	96.0	1,440
Operating Profit	4.0	60
Provision for Income Tax	2.0	30
Return on Net Assets	4.0%	
Cash Flow	$67,500	
Net Assets:	$750,000	
No. of Employees:	60	
Annual Production:	45,000,000 $ft.^2$ (surface measure)	

Source: Arthur D. Little, Inc., estimates.

TABLE II.B.11

FINANCIAL PROFILE:
HARDWOOD VENEER MFG. – CONTAINER GRADE

	%	$ x 10^3
Net Sales	100.0	90
Cost of Goods Sold	88.0	79
GS & A	7.0	6
	95.0	85
Operating Profit	5.0	5
Provision for Income Tax	2.5	2.5
Net Income	2.5	2.5
Return on Net Assets	2.0%	
Cash Flow	$8,750	
Net Assets:	$125,000	
No. of Employees:	10	
Annual Production:	3,000,000 ft.^{2} (surface measure)	

Source: Arthur D. Little, Inc., estimates.

TABLE II.B.12

FINANCIAL PROFILE:
HARDWOOD PLYWOOD AND VENEER MFG. –
STOCK PANELS

	%	$ x 10^3
Net Sales	100.0	1,700
Cost of Goods Sold	84.9	1,443
GS & A	10.0	170
	94.9	1,613
Operating Profit	5.1	87
Provision for Income Tax	2.5	43
Net Income	2.6	44
Return on Net Assets	8.8%	
Cash Flow	$69,000	
Net Assets:	$500,000	
No. of Employees:	35	
Annual Production:	7,000,000 ft.^{2} (3/8" basis)	

Source: Arthur D. Little, Inc., estimates.

TABLE II.B.13

FINANCIAL PROFILE:
HARDWOOD PLYWOOD AND VENEER MFG. –
SEMI-SPECIALTY AND SPECIALTY PRODUCTS

	%	$ x 10^3
Net Sales	100.0	2,000
Cost of Goods Sold	83.0	1,660
GS & A	11.0	220
	94.0	1,880
Operating Profit	6.0	120
Provision for Income Tax	3.0	60
Net Income	3.0	60
Return on Net Assets	7.5%	
Cash Flow	$100,000	
Net Assets:	$800,000	
No. of Employees:	60	
Annual Production:	5,000,000 ft.^{2} (3/8" basis)	

Source: Arthur D. Little, Inc., estimates.

Container grade veneer manufacturers are very small firms in tenuous financial position, unless they are owned by a container manufacturer or other captive user. The cash flow for the representative firms is only $8,750 per year; the return on net assets is 2.0%.

5. Pricing

Softwood plywood prices exhibit almost classic supply/demand commodity market responses. Softwood plywood prices at a given time are determined by the following considerations:

- Distribution channels are not controlled by producers. Prices to retailers, consumers, contractors, etc. cannot be maintained or set by even the largest manufacturers.

- Plywood is a commodity product. Users are generally unconcerned with the identity of the producer; there is little brand loyalty; price competition is severe.

- Residential construction, the dominant end use market for softwood plywood, fluctuates sharply both annually and seasonally. Since efficient production must be accomplished at a relatively level output, and since large inventories are costly, it is difficult for producers to compensate for short-term demand changes.

As a result, softwood plywood prices have historically varied considerably in response to supply/demand conditions. Prices change daily in what is essentially an auction market. Most sales are made by telephone with buyers shopping among suppliers for the lowest price. Producers seek to maintain "order books," which will allow the mill to ship as rapidly as it produces. If the "order book" gets thin, i.e., the backlog of orders is small, then producers lower prices. Conversely, if demand is strong, prices rise.

The ceiling on prices is reached as alternate materials become economic and plywood markets erode. Particleboard, hardboard, lumber, and other wood fiber building boards can displace plywood in certain uses. Further, alternative construction techniques or building designs can be employed using stone, metal, stucco, and asbestos products. Or, of course, some construction projects may be deferred until building and building material costs recede to more "palatable" levels.

Nonetheless, there are many advantages to plywood which continue to make it an attractive building material. Plywood is easily workable, is a versatile material, and pound-for-pound, due to its alternative grain laminating construction, exhibits great strength.

Hardwood plywood prices exhibit far less volatility than do softwood plywood prices. Markets for these products are more mature and more stable. Pressure from low cost imports has also acted to inhibit price increases.

The cost of manufacture is not the primary determinant of hardwood or softwood plywood prices. Rather, manufacturing costs determine that point at which a mill will shut down, thereby reducing supply, or a "mothballed" mill will start up. As prices have risen in recent years, mills have begun to peel smaller and smaller logs, a step which would not be possible without new machinery and prices high enough to make peeling smaller logs economical. Similarly, many mills ceased production during the price trough of 1970. Interestingly enough, many of the same mills came back on-stream during the strong demand market of 1972.

C. SAWMILLS AND PLANING MILLS, GENERAL

For 1972 the U.S. Department of Commerce reported there were 8,018 establishments in the United States falling into this category. Of this group 31% had 1 to 3 employees, 21% had 4 to 7 employees, and 25% had 8 to 19 employees. 1694 firms employed 20 or more persons.

However, the most extensive listings we have secured identifying industry participants aggregate fewer than 2,000 firms which are estimated to account for well over 90% of production. Trade sources believe the Commerce Department totals are swelled by the inclusion of seasonal and part-time operators who perform minimum processing operations either from owned woodlots (farmers, perhaps) or with portable equipment transported by truck from site to site. We are unable to verify this fact as there is no known accounting of these allegedly transient firms. Thus, this section will necessarily focus upon those producing units listed in the trade directories and/or who are members of the principal trade associations.

The industry is readily divided into segments by type of product, markets served, geographic area of production, and producer group. The most important division is between *softwoods* and *hardwoods* which have historically accounted for approximately 80% and 20% of production respectively. These products are largely used by different markets and produced in different geographic areas by a different group of companies.

1. Industry Structure — General*

a. Production

The production of lumber in the United States in 1972 totaled 38.035 billion board feet, up 3% from 1971. Total industry production, shown in Table II.C.1, has tended to remain relatively stable for the last two decades and has averaged 36.221 billion board feet since 1965.

Despite its substantial volume of production, the United States is a large net importer of lumber, chiefly of softwoods from Canada. In 1972 imported softwood is estimated to have supplied 23% of U.S. domestic consumption. That same year imports of hardwoods supplied 6% of domestic consumption.

Softwoods from Canada represented 99% of U.S. imports and hardwoods from that country totaled 34% of imports. Canada purchased 24% of softwoods and 57% of hardwoods exported while Japan purchased 34% of U.S. softwood exports.

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*For both softwood and hardwood species.

TABLE II.C.1

U.S. LUMBER PRODUCTION
(billion board feet)

Year	Total	Softwoods	Hardwoods
1972	38.035	31.222	6.813
1971	36.998	30.039	6.949
1970	34.668	27.530	7.138
1969	35.597	28.281	7.316
1968	36.473	29.285	7.188
1967	34.741	27.311	7.430
1966	36.492	28.754	7.738
1965	36.762	29.295	7.467
1960	32.880	26.650	6.230
1955	37.380	29.815	7.565
Average – 1965-1972	36.221	28.965	7.254

Source: U.S. Department of Commerce, Current Industrial Reports, *Lumber Production and Mill Stocks,* Series MA-24T.

Net imports of lumber have increased by 86% since 1965 although most of the gain occurred in 1971 and 1972. Substantial increases in new residential construction during those two years had a dramatic impact on demand and prices for lumber, and pushed imports up. U.S. imports and exports of lumber are shown in Table II.C.2.

In 1971 shipments by companies classified in SIC 2421 had a dollar value of $4.5 billion and 169,700 persons were employed by these producers. The industry is quite susceptible to changes in the level of construction activity in the United States; thus 1971 shipments were 20% higher in value than 1970 which itself was 11% lower than 1969. Dollar statistics tend to be misleading, however, since prices fluctuate widely and it is more common to discuss production in units. Lumber, the main product, is measured in *board feet* (a 12" x 12" x 1" unit of measure) which is the industry standard.

The production of lumber in one form or another is the main activity of sawmill and planing mill operators. Rough and dressed lumber produced in 1971 represented 80% of the dollar value of shipments of SIC product class 2421. "Wood chips," the second largest product category, totaled 8% of the value of products shipped and all other products equalled 12%.

Wood chips are produced from waste generated in the manufacturing process and are used in the production of paper, particleboard, and hardboard. Chips are produced almost exclusively as a by-product, and, although important in value, are usually not produced directly from logs.

TABLE II.C.2

IMPORTS AND EXPORTS OF LUMBER, 1965-1972
(billion board feet)

Year	Total	Softwoods	Hardwoods
Imports			
1972	9.426	8.977	0.449
1971	7.619	7.246	0.370
1970	6.116	5.769	0.339
1969	6.304	5.849	0.449
1968	6.156	5.808	0.346
1967	5.146	4.798	0.344
1966	5.200	4.776	0.421
1965	5.233	4.895	0.334
Exports			
1972	1.424	1.196	0.228
1971	1.097	0.927	0.154
1970	1.291	1.152	0.116
1969	1.135	1.018	0.106
1968	1.159	1.025	0.107
1967	1.134	0.955	0.159
1966	1.024	0.860	0.148
1965	0.922	0.777	0.125
Net Imports			
1972	8.002	7.781	0.221
1971	6.522	6.319	0.216
1970	4.825	4.617	0.223
1969	5.169	4.831	0.343
1968	4.997	4.783	0.239
1967	4.012	3.843	0.185
1966	4.176	3.916	0.273
1965	4.311	4.118	0.209

Source: *Fingertip Facts and Figures,* National Forest Products Association, February 1972 and 1973.

Probably the largest single "NSK" product of sawmills and planing mills would be products made from bark. This too is a by-product, normally removed prior to the sawing of the log. Most bark is sold for landscaping use either for commercial and public buildings (the largest volume market) or for residential homes and gardens. Some sawdust is sold for miscellaneous uses but in general it is burned (as is some bark) or presents a disposal problem. Cut stock is lumber cut to nonstandard, customer specified sizes. The kitchen cabinet industry is the largest user of softwood cut stock. (See Table II.C.3.)

TABLE II.C.3

VALUE OF SHIPMENTS OF SIC 2421: 1971

		Value of Product Shipments (million dollars) 1971	Percent
2421	Sawmill and Planing Mill Products	$4,500.7	100
24211	Rough Lumber and Sawed Ties	949.5	21
24212	Dressed Lumber	2,644.0	59
24215	Wood Chips	364.4	8
24217	Softwood Cut Stock	130.7	3
24218	Softwood Flooring and Other General Sawmill Planing Mill Products	61.6	1
24219	Contract or Custom Sawing of Logs Owned by Others	45.6	1
24210	Sawmill and Planing Mill Products, N.S.K.	305.4	7

Source: Annual Survey of Manufacturers, 1971.

b. Regionality

Geographically, 70% of softwoods are produced in the western United States (see Table II.C.4), with the South accounting for another 27% of domestic production. During 1972, production from the states of California, Oregon, and Washington represented 80% of western softwood production with the balance spread throughout the Intermountain states.

The principal species cut in the west are Douglas Fir, Ponderosa Pine, and Redwood. Other species harvested include Western White Pine, White Fir, Sugar Pine, Spruce, Hemlock, Larch, and Cedar. Douglas Fir is mainly produced on the western slopes of the Cascade Mountains in Oregon, Washington, and California and this area is sometimes referred to as the "Douglas Fir" or "Coast" region. The area east of the Cascades including the Intermountain states is termed the "Western Pine" or "Inland" region while production of Redwood occurs in Northern California.

The most important species cut in the South is Southern Pine, which accounts for 96% of southern softwood produced. This area of the country is usually termed the "Southern Pine Region." Production in the South is more evenly spread than in the West. The leading states are Alabama, Arkansas, Georgia, North Carolina, and Texas which together accounted for 61% of 1972 production.

TABLE II.C.4

U.S. LUMBER PRODUCTION BY REGION
1972 vs. 1955
(billion board feet)

	U.S. Total	West[1]	South[2]	Total West and South
All Species				
1972	38.035	22.125	12.624	34.749
1955	37.380	20.703	13.270	33.973
1972 %	100%	58%	33%	91%
Softwoods				
1972	31.222	21.986	8.291	30.277
1955	29.815	20.647	7.976	28.623
1972 %	100%	70%	27%	97%
Hardwoods				
1972	6.813	0.139	4.333	4.472
1955	7.565	0.056	5.292	5.348
1972 %	100%	2%	64%	66%

1. States of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, South Dakota, Washington, Oregon, California, Alaska, and Hawaii.
2. States of Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas.

Source: U.S. Department of Commerce, Current Industrial Reports, *Lumber Production and Mill Stocks,* Series MA-24T.

2. Softwood Lumber

a. Industry Structure

(1) Softwood Markets. The market for softwood lumber is dominated by the U.S. construction industry which consumes in excess of 75% of softwood lumber produced. Of this amount, over half moves directly into new or maintenance construction usage and most of the balance is "remanufactured" into millwork, kitchen cabinets, prefabricated structures or some other intermediate product before going into construction use. About 25% of softwood lumber is used by other manufacturing industries. Table II.C.5 identifies the distribution of shipments for SIC 2421 and 2429 during 1975.

Table II.C.5A identifies the major segments of the construction industry. Residential construction represents 44% of the total and this market sector is the largest user of lumber.

TABLE II.C.5

1972 DISTRIBUTION OF SHIPMENTS
SIC 2421 SAWMILLS AND PLANING MILLS, GENERAL
AND
SIC 2429 GENERAL PURPOSE SAWMILLS, NEC

Buyers	Percent of Purchases
Iron Ore Mining	.1%
Nonferrous Ore Mining	.4
Coal Mining	.4
Crude Oil & Product Mining	–
Chemical & Fert Mining	–
Maintenance Construction	14.9 *
Logging Camps & Contractor	2.7 *
Sawmill & Planing Mills	12.9 *
Hardwood Dimensions & Flooring	3.8
Millwork Plants	9.3 *
Veneer & Plywood Plants	1.9 *
Prefabricated Wood Products	3.0 *
Wooden Containers	2.4
Wood Preservative & Miscellaneous Products	5.5 *
Household Furniture	6.1
Office Furniture	1.4
Pulp Mills	.9
Paper Mills, Excluding Building Products	2.7
Paperboard Mills	3.2
Coated & Converted Paper Products	–
Building Paper, Allied Mills & Wall Paper	.4
Fiber Cans	–
Paints & Allied Products	–
Gum & Wood Chemicals	1.1
Other Agricultural Chemicals	–
Printing Ink	–
Gasoline, Jet Fuel, Kerosine	–
Distillate & Residual Fuel Oil	–
Lubricating Oil & Greases	–
Tire & Inner Tubes	–
Miscellaneous Rubber Products	–
Fabric Plastic Products	–
Shoes & Other Leathers	.1
Glass, Except Containers	.4
Glass Containers	.1
Hydraulic Cement	–
Brick & Structure Clay Tile	–
Ceramic Wall & Floor Tile	–
Clay & Nonclay Refractory	–
Other Structure Clay Products	–
Vitreous Plumbing Fixture	–
Miscellaneous Pottery & Porcelains	–
Concrete Block & Brick	–
Other Concrete Products	.2
Ready-Mixed Concrete	.1

* All uses estimated to principally end in new or maintenance construction. Total 50.1% of shipments.

TABLE II.C.5 (Continued)

Buyers	Percent of Purchases
Lime	–
Gypsum Products	–
Cut Stone & Stone Products	–
Asbestos Products	–
Mineral Wool	–
Abrasive & Other Minerals	.1%
Iron & Steel	.5
Metal Containers	–
Enam Sanitary & Plumbing	–
Heat Equipment, Except Electric	–
Fabricated Structure Steel & Metal Doors	.1
Fabricated Platework	–
Sheet, Architecture, Miscellaneous Metal Work	.2
Stamp & Screw Machine Products	.3
Hardware, Plating, Wire Products	.2
Valves, Pipe Fittings	–
Steam Engines & Turbines	–
Internal Combustion Engine NEC	–
Farm Equipment	.2
Construction Equipment	–
Mining Machinery	–
Oilfield Machinery	–
Materials Handling Equipment	–
Machine Tools – Cutting	–
Machine Tools – Forming	–
Dies, Tools & Accessories	.1
Metalworking Equipment – Welding	–
Food Products Machinery	–
Textile Equipment & Machinery	.1
Woodwork Equipment & Machinery	–
Paper Equipment & Machinery	–
Printing Equipment & Machinery	.1
Special Industry Machinery	.1
Pumps & Compressors	.1
Blowers & Exhaust Fans	–
General Industry Machinery – Fans, Filters	.1
Nonelectric Machine Shop Products	–
Computers & Calculating Machines	–
Duplicating & Other Office Machines	–
Vending & Airconditioning Equipment	.2
Electric Appliances & Motors	.1
Household Refrigerators & Freezers	.1
Household Laundry Equipment	–
Electric Light & Wire Equipment	–
Telephone & Telegraph Equipment	–
Radio & TV Communications Equipment	–
Battery, X-ray, Electric Equipment	–
Truck & Bus Bodies	.1
Truck Trailers	–
Aircraft	–
Ship Building & Repair	.1
Boat Building	.2

TABLE II.C.5 (Continued)

Buyers	Percent of Purchases
Locomotives & Railroad Cars	.1%
Mobile Homes & Campers	.8
Car Trailers, Snowmobiles	–
Engineering & Laboratory Instruments	–
Mechanical Measuring Instruments	–
Automatic Temperature Control Instruments	–
Orthopedic & Surgery Appliances	–
Matches, Clocks, & Parts	–
Optical, Photocopy, Photographic	–
Jewelry, Toys, Sport, Miscellaneous	1.0
Electric Utilities	.1
Wholesale & Retail Trade	.9
Real Estate & Rental	.3
Total	81.8%
Components	
Inventory	.4%
New Construction	27.2
Federal Defense	
Competitive Imports	-12.4%
Exports	3.0
Total	18.2%
Category	
Single-Family Residential	14.0%
Two to Four Unit Residential	1.3
Garden Apartments	2.7
High-Rise Apartments	.2
Alterations & Additions	3.4
Nonhousekeeping Units	.3
Industrial	.1
Office & Warehouse	3.3
Stores, Restaurants, Garages	.3
Religious	.1
Private Educational	.1
Hospital & Institutional	.1
Other Nonresidential	.1
Farm, Including Residences	.5
Oil & Gas Well Drilling	.1
Railroad	.1
Telephone & Telegraph	.2
Electric Utilities	1.1
Gas & Petroleum Pipelines	–
All Other Private	.1
Highway	1.1
Military	–
Conservation	–
Sewer Systems	–

TABLE II.C.5 (Continued)

Category	Percent of Purchases
Water Systems	—
Public Residential	.1%
Public Industrial	—
Public Educational	.4
Public Hospital	—
Other Public Structures	.2
Miscellaneous Public Construction	.2
Total	27.2%

Source: Arthur D. Little, Inc., input-output model.

New single family units and new, low-rise multi-family units require substantial quantities of lumber mainly. for structural and framing purposes. In the past lumber was also used extensively for subflooring, exterior siding, and roof decking but these uses have moved heavily toward composite materials such as plywood, particleboard, and hardboard. In addition lumber has lost markets to metal products such as aluminum siding, steel studs and joists. However, softwood lumber still accounted for over 23% of the materials bill for new single-family construction in 1969 as reported by *Construction Review.*

The U.S. construction market is extremely sensitive to interest rates and year-to-year construction activity is inversely correlated with the cost of money. Table II.C.6 lists housing starts and mobile home production from 1965 through 1972 and shows the substantial annual variations which occur.

(2) Shipments. As housing is the major softwood lumber market, followed by manufacturing, shipments show a concentration of movement from producing regions into the states where construction activity is strongest and where manufacturing operations using lumber are concentrated. Further, since freight costs are a major factor in the delivered cost of lumber, producing areas serve those regions where relative freight costs are lowest or where competitive costs are equal.

Table II.C.7 shows new housing construction by area during 1972 and reveals that the South and West were the leading housing areas with 41% and 25% of total activity respectively. Table II.C.8 lists manufacturing use of all lumber by region in 1960. Again the South is the leading consumption area at 32%, followed by the North Central states with 29% of usage.

Table II.C.9 shows shipments of softwood lumber by destination during 1972 from mills of western origin and selected Southern Pine mills. Producers located in the West shipped 45% of their product into that same region with the North Central and South receving 26% and 16% of western output. Those Southern Pine mills reporting shipped 77% of their output to users in the South, the nation's largest consuming area.

TABLE II.C.5A

VALUE OF CONSTRUCTION – 1972
(billions of dollars)

	Amount	Percent
Total Construction	$123.836	100%
Private		
Residential		
New Single-family	27.669	22
New Multi-family Units	17.067	14
Additions and Alterations	7.420	6
Non-housekeeping	2.030	2
Subtotal	$ 54.186	44%
Nonresidential		
Industrial	4.676	4
Commercial	13.462	11
Hospital and Institutional	3.172	3
Other	2.726	2
Subtotal	$ 24.036	19%
Farm	.902	1
Public Utilities	13.575	11
All Other Private Construction	.941	1
Total Private	$ 93.640	76%
Public		
Buildings	11.500	9
Highways and Streets	10.448	8
Military Facilities	1.080	1
Conservation and Development	2.172	2
Other Public Construction	4.996	4
Total Public	$ 30.196	24%

Source: Construction Review, U.S. Department of Commerce.

TABLE II.C.6

NEW HOUSING IN THE UNITED STATES, 1965-1972
(thousands of units)

	Conventional Starts				
	Total Conventional	Single-family	Multi-family	Mobile Home Production	Total All Types
1965	1,510	965	545	216	1,726
1966	1,196	780	416	217	1,413
1967	1,322	845	477	240	1,562
1968	1,545	900	645	318	1,863
1969	1,450	811	639	413	1,863
1970	1,469	815	654	401	1,870
1971	2,085	1,153	932	497	2,582
1972	2,379	1,311	1,068	576	2,955

Source: Construction Review, U.S. Department of Commerce.

TABLE II.C.7

NEW HOUSING CONSTRUCTION BY REGION – 1972

West	25%
North Central	19
South	41
Northeast	14
	100%

Source: Construction Review, U.S. Department of Commerce.

TABLE II.C.8

LUMBER USED IN MANUFACTURING BY REGION – 1960
(hardwoods and softwoods)

West	17%
North Central	29
South	32
Northeast	23
	100%

Source: Regional Wood Use by Manufacturing Industries, U.S. Forest Service Research Note WO-7, December 2, 1965.

Truck movement of lumber predominates in the South while rail shipments are more common in the West. Table II.C.10 shows the regional differences which are chiefly due to the distance between production and consumption areas.

(3) Lumber Distribution. Producers of softwood lumber do not control the wholesale and retail distribution of their products. Instead, independent wholesalers and retailers dominate the movement of these materials between producers and users. Table II.C.11 shows the distribution channels used by western mills during 1972. The pattern for southern softwood mills is quite similar.

The U.S. County Business Patterns reports there were more than 12,000 wholesalers and 20.000 retailers of lumber and building materials operating in the United States in 1971. We estimate softwood lumber is handled by at least half of the wholesalers and more than 90% of the retailers reported.

Although wholesalers purchase most softwood production, they do not take actual delivery of most of the material. The wholesaler performs mostly as a sales and financing intermediary and the actual physical movement of most lumber is direct from the producer to the retailer, factory, or company-owned distribution yard.

b. Types of Firms

During 1972 the top ten U.S. producers of softwoods manufactured almost 8 billion board feet of lumber, just over 25% of total industry production. These companies are listed in Table II.C.12 along with the number of U.S. mills operated and their estimated output. The Weyerhaeuser Company was the nation's largest producer accounting for 8% of the U.S. domestic production. In second place at 4% was Louisiana-Pacific, a newly-created firm spun off from Georgia-Pacific, now the country's six largest producer.

TABLE II.C.9

SHIPMENTS OF LUMBER BY DESTINATION – 1972

Western Mills

	Coast Region	Inland Region	Total
West	47.5%	42.5%	44.8%
North Central	21.4	30.6	26.3
South	16.5	16.1	16.3
Northeast	8.9	10.1	9.5
Export	5.7	.7	3.0
	100.0%	100.0%	100.0%

Southern Pine Mills
(125 reporting mills producing 3.2 billion board feet in 1972)

West	–
North Central	19.4%
South	76.9
Northeast	2.5
Export	1.2
	100.0%

Sources: Western Wood Products Association, 1972 Statistical Yearbook; Southern Forest Products Association, Distribution of Southern Pine Shipments 1972.

TABLE II.C.10

SHIPMENTS OF SOFTWOOD LUMBER BY RAIL, TRUCK, AND WATER – 1972

	Western Mills (%)	125 Southern Pine Mills (%)
Rail	60.3	28.7
Truck	33.5	71.3
Water	6.2	–
	100.0	100.0

Source: Western Wood Products Association, 1972 Statistical Yearbook; Southern Forest Products Association, Distribution of Southern Pine Shipments, 1972.

TABLE II.C.11

DISTRIBUTION CHANNELS FOR WESTERN SAWMILLS – 1972

	Percent of Shipments
Direct to User	6.2
Direct to Retailer	12.7
Wholesaler	60.5
Company-owned Distribution Yards	10.6
Factory, for Further Manufacture	10.0
	100.0

Source: Western Wood Products Association, 1972 Statistical Yearbook.

The term "integrated production" refers to a company's ability to make many different products from the tree, not necessarily to production of different products on the same site. The most important products besides lumber produced from the tree are pulp and paper, followed by plywood, particleboard, hardboard, and insulation board. The ability to use as much of the log as possible for its best application is an important element in the profitability of a forest products company. Of the top ten U.S. lumber producers in 1972, seven were also pulp and paper manufacturers and an eighth was the leading hardboard producer.

However, the material demands of plants depending on waste wood are great and very few lumber mills generate enough waste to fully supply these plants. Pulp and papermills in

TABLE II.C.12

TOP TEN U.S. SOFTWOOD LUMBER PRODUCERS – 1972

	Number of Mills	Estimated Production (billion board feet)	Percent of Total Production
Weyerhaeuser Company	22	2.392*	7.7
Louisiana Pacific	26	1.266	4.0
Boise Cascade	19	0.864	2.8
U.S. Plybood	16	0.628	2.0
Potlatch Forests	15	0.603	1.9
Georgia-Pacific	26	0.555	1.8
Pack River	12	0.501	1.6
Edward Hines Lumber	11	0.400	1.3
St. Regis Paper Company	5	0.398	1.3
Masonite Corporation	11	0.389	1.2
Total	163	7.996	25.6
Total Softwood Produced–1972		31.222	

*Includes very small amount of hardwood not reported separately.

Sources: Forest Industries, op cit.; Forest Products Industry Directory; and Arthur D. Little, Inc. estimates.

particular use enormous volumes of waste wood and must depend on a wide geographic area for chips in order to supply their needs. Chips are, of course, a by-product of mills and, in areas where very small timber prevails, wood fiber is ground directly from logs as well.

Perhaps the most integrated producer of forest products in the United States is Weyerhaeuser Company with 20 domestic sawmills currently operating. Of this group, 7 mills are totally isolated from other facilities while the other 13 mills share common sites with 11 plywood mills, 5 pulp mills, 3 particleboard plants, and one hardboard plant. Weyerhaeuser's emphasis on common site production is substantially stronger than the balance of the industry. Table II.C.13 indicates the total number of establishments counted as sawmills and planing mills (SIC 2421), pulp and paper mills (SICs 261 and 262), and veneer and plywood mills (SIC 2432) during 1971 in Oregon, Washington, and California. Based on these statistics and a survey of more than 200 mills listed in trade directories, we estimate nearly 90% of Western sawmills are independent units and do not share the mill site with another principal producing facility.

Sawmills operating in the South are also largely independent units, perhaps more so than in the West. This is because Southern mills are smaller and more numerous.

In the future, new western mills are expected to be built as isolated units and the trend in construction is toward building "satellite" mills closely proximate to the timber source.

TABLE II.C.13

NUMBER OF ESTABLISHMENTS BY SELECTED SIC CODES AND STATES – 1971

	Number of Establishments		
	SIC 2421 Sawmills and Planing Mills, General	SIC 261 and 262 Pulp and Paper Mills	SIC 2432 Veneer and Plywood Mills
Oregon	331	12	123
Washington	215	23	47
California	260	22	33
Total	806	57	203

Source: County Business Patterns 1971, U.S. Department of Commerce.

The trend in timber utilization has consistently been toward removing more and more of the total tree from the forest for conversion to various products. The economics of transportation favor smaller mills closer to the forest.

A current trend in the South, however, is to build sawmills at pulp and paper plants where whole logs have previously been ground to pulp. New sawmilling equipment allows very small logs to be economically processed into lumber and chips; producers are adapting to this change. We do not expect this trend to materially affect the balance between independent and common site facilities. In general, therefore, sawmills cannot be expected to share effluent disposal facilities and expenditures with other forest products plants.

c. Types of Plants

The size of the softwood producing units located in the western United States and in the Southern Pine region are listed in Table II.C.14. The West is clearly dominated by larger units with almost half of the mills producing more than 50 million board feet annually. In contrast slightly more than one-third of the Southern Pine mills are estimated to produce less than 10 million board feet annually while only about 6% produce more than 50 million board feet per year.

The most important factor influencing mill sizes in the South versus the West is the size and species composition of the woodlands supplying timber to the mills. Western forests, unlike those in the South, tend to be large and homogeneous in species composition. "Clear cutting" is commonly practiced in the West. This practice entails harvesting all of the trees on a given area of land at one time rather than selectively harvesting only some species or sizes. During 1972 western producers depended on federally-owned timber for over 50% of the lumber produced (see Table II-C-15) and access to the immense forests under government ownership is an important facet of the western industry.

TABLE II.C.14

SOFTWOOD LUMBER PRODUCTION BY MILL SIZE – 1972

Western U.S. Mills

Size (annual production in board feet)	Number of Mills	Percent of West	Estimated Total Production (billion bd. ft.)
Under 10 Million Feet	49	8%	
10 to 25 Million Feet	102	17	
25 to 50 Million Feet	78	13	20.741
Over 50 Million Feet	284	48	
Not Reported	82	14	
Total	595	100%	

Southern Pine Mills

Size (annual production in board feet)	Number of Mills		Percent of South	Estimated Total Production (billion bd. ft.)
Under 10 Million Feet	154		34%	
10 to 20 Million Feet	116		26	
20 to 30 Million Feet	30	64	14	5.637
30 to 50 Million Feet	34			
Over 50 Million Feet	29		6	
Not Reported	88		20	
Total	451		100%	

26.378

Average Production per Mill per Year

Western U.S. Mills	34.86 million board feet
Southern Pine Mills	12.50 million board feet

Sources: Forest Industries, May 29, 1973; Southern Pine Inspection Bureau Roster, July 1, 1973. Listing believed to cover 70% of Southern Pine production. Arthur D. Little, Inc. estimates.

TABLE II.C.15

SOURCES OF TIMBER FOR LUMBER PRODUCED – WESTERN MILLS

	Inland Region (%)	Coast Region (%)	Total (weighted average, %)
Company Owned	18.7	38.4	27.8
Federal	65.7	34.5	51.2
Other	15.6	27.1	20.9
	100.0	100.0	100.0

Source: Arthur D. Little, Inc., estimates.

In contrast Southern mills must depend almost exclusively on privately owned woodlands for their timber base since government ownership of timber acreage in the South is estimated at only about 10% of usable forest land. Further, southern forests are largely mixed in species content and it is far more difficult to assemble a large timber supply to justify construction of a large mill.

Lumber mills do not normally maintain large stocks of finished or semi-finished products. Lumber is a product which must be kept dry and, because of its bulk, an enormous investment in storage space and sheds would be necessary to store much finished product. Table II.C.16 shows year-end inventories of lumber and contrasts them with annual production. Inventories are usually at a higher level in the winter months since demand is seasonally lower then.

Mill stocks of lumber move inversely with demand although, as can be seen, gross inventories are not sufficient to cope with annual shifts in demand. Unfilled orders for lumber mills usually average about 40% of gross inventories for softwood and slightly higher for hardwood producers. Thus, actual "free" stocks available to cope with demand swings are lower still.

Cutting of timber for lumber production is also difficult to adjust in the short run. Western producers, who depend on government timber, are tied to cutting contracts which normally average about three years in duration. Government sales are budgeted in advance and, although some allowance is made for increased sales in periods of high demand, the logistics of getting the logs cut and out of the forest hinder efforts to adjust production. In the last several years hardwood producers have also been severely impacted by adverse weather and domestic production has fallen while prices have gone up.

d. Financial Profiles

Profits of softwood sawmills are difficult to separate from the overall performance of integrated producers or are closely guarded by the many privately held concerns which make

TABLE II.C.16

GROSS INVENTORIES OF SOFTWOOD AND HARDWOOD LUMBER AT YEAR END
1965-1972

Year	Softwoods		Hardwoods	
	Inventory (billion board feet)	Inventory as % of Domestic Production	Inventory (billion board feet)	Inventory as % of Domestic Production
1965	4.539	15%	1.066	14%
1966	4.652	16%	1.033	13%
1967	4.351	16%	1.400	19%
1968	4.166	14%	.838	12%
1969	4.704	17%	.650	9%
1970	4.848	18%	1.478	21%
1971	4.282	14%	.984	14%
1972	3,593	12%	.387	6%

Source: Arthur D. Little, Inc., estimates.

up the bulk of production. It is also difficult to identify the costs and profit contribution resulting from sawmill processing, waste product utilization, and timber production. Finally, given the dramatic swings in price which occur from year to year, it is extremely misleading to look at costs and profits without taking into account these large cyclical swings in price.

Table II.C.17 presents operating data for a group of 60 Southern Pine mills for 1972. Examination of this data clearly shows the wide variability between costs of different operations both large and small.

TABLE II.C.17

COST TO PRODUCE, SHIP AND SELL SOUTHERN PINE LUMBER

For the Calendar or Fiscal Year 1972
Arrayed from Low to High Production
52 Respondents Representing 60 Mills

	Production 1972 M Bd Ft	LOG SCALE—PER M FBM (a) Stumpage	Logging and Hauling	TOTAL	Purchased Logs	Procurement Expense	Less Logs Sold	TOTAL Logs to Log Yard	Add Log Yard Costs	TOTAL Logs to Sawmill	OVERRUN—LOG SCALE USED Percent	Doyle	Scribner	International	Decimal C	Other	TARGET SCALE—PER M FBM TOTAL Logs to Sawmill	(b) Less Sale of By-products	Net Logs to Sawmill
NOTES																			
Cost Center reflects entire Costs for that center including (1) Direct Labor (2) Indirect Labor (3) Supplies (4) Electric Power or Gas Purchased (5) Depreciation and (6) Insurance, Burden for Maintenance, Machine Shop, etc. included in Indirect Labor	**0 to 10 Million Ft**																		
	2 000	$ 60 00	$ 30 00	$ 90 00	$ 85 00	$ 5 00	$ —	$ 90 00	$ 2 50	$ 92 50	20	X	X	—	—	—	$ 75 00	$ 10 00	$ 65 00
	2 552	72 00	38 00	110 00	110 00	—	—	110 00	5 00	115 00	30	X	—	—	—	—	88 00	11 00	77 00
	4 400	45 00	30 00	75 00	75 00	—	—	75 00	3 00	78 00	0	—	—	—	X	—	78 00	19 00	59 00
	4 830	—	—	—	78 83	—	—	78 83	4 11	82 94	46	X	—	—	—	—	56 48	7 04	52 44
	4 800	—	—	—	87 00	2 75	—	89 75	1 50	91 25	34	X	—	—	—	—	68 44	13 00	55 44
	5 100	80 00	25 00	105 00	100 00	—	—	105 00	N R	105 00	20	—	X	—	—	—	91 80	9 00	82 80
	6 253	60 00	43 00	103 00	—	2 00	—	105 00	1 25	106 25	40	X	—	—	—	—	75 90	13 50	62 40
	6 930	79 80	42 21	122 01	88 06	2 18	—	110 71	N R	110 71	47	X	—	—	—	—	56 68	—	56 68
	7 282	60 00	29 00	89 00	80 00	—	—	80 00	5 00	85 00	3	—	X	—	X	*	85 00	6 00	79 00
	7,918	—	—	—	100 00	—	—	100 00	N R	100 00	78	X	—	—	X	—	56 58	9 58	47 00
	8 482	64 12	31 10	95 22	89 04	—	—	91 25	N R	94 25	N R	—	X	—	—	—	81 08	17 90	63 18
	8 501	70 74	43 69	114 43	—	—	—	114 43	2 94	117 37	38	X	—	—	—	—	85 32	30 92	54 40
	8 702	72 98	26 02	98 98	98 92	—	82 14	99 69	5 00	104 69	19	X	—	—	—	—	88 35	10 54	77 71
	9 057	N R	N R	N R	N R	N R	N R	81 17	7 05	88 22	30	—	X	—	—	—	57 85	9 73	56 13
	9 768	90 00	20 51	110 51	75 00	—	77 04	108 47	N R	108 47	N R	—	X	—	—	—	108 47	32 87	75 60
N R Not Reported— Cost Centers Combined— Not available, etc.	**10 to 20 Million Ft**																		
* Undertun	10 260	—	—	—	112 25	1 15	83 45	114 88	N R	114 88	32	—	X	—	—	—	77 40	17 15	60 25
† Herring Cavant	10 716	58 00	25 00	83 00	75 00	4 26	—	86 98	N R	86 98	30	X	—	—	—	—	67 21	5 93	61 28
‡ Warehing	10 892	67 42	30 00	97 42	105 00	2 58	—	102 50	2 50	105 00	10	—	X	—	—	—	94 50	17 00	77 50
§ Cost Centers reported do not add to Total	11 577	54 67	32 12	86 79	95 62	3 00	80 00	87 60	1 25	88 85	20	X	—	—	—	—	71 58	11 03	60 55
¶ Cost Centers reported do not add—Depreciation of $16 08 included in Total	11 947	—	—	—	75 80	1 00	—	76 80	1 50	78 30	31	X	—	—	—	—	54 03	8 56	45 47
** Cost Centers reported do not add—Plant General and Depreciation of $15 65 included in Total	14 614	81 08	27 47	108 55	105 19	—	—	105 19	2 27	107 46	26	X	—	—	—	—	84 98	6 31	78 67
†† Cost Centers reported do not add—Sundry of $4 03 included in Total	15 000	75 00	30 00	105 00	100 00	3 00	—	103 00	3 00	103 00	35	X	—	—	—	—	80 66	5 00	75 06
‡‡ Cost Centers reported do not add—Depreciation of $4 70 included in Total	15 114	75 94	25 51	101 45	93 40	1 62	—	97 26	2 99	100 25	27	X	—	—	—	—	70 42	10 58	59 84
§§ Cost Centers reported do not add—Sundry of $7 80 included in Total	16 000	60 00	40 00	100 00	100 00	10 00	—	110 00	5 00	115 00	10	—	X	—	—	—	119 00	12 00	97 00
	17 028	48 96	34 66	83 62	83 52	1 52	71 18	82 15	N R	82 15	11	—	X	—	—	—	72 75	42 32	30 43
	20 to 30 Million Ft																		
	25 251	72 77	34 55	107 32	106 93	—	—	107 26	N R	107 26	14	—	X	—	—	—	93 89	41 98	51 91
	25 309	73 18	21 44	94 62	—	1 91	—	96 53	2 73	99 26	50	X	—	—	—	—	68 18	5 81	62 37
	28 200	73 45	24 55	98 00	97 69	2 38	87 64	98 00	6 47	104 47	39	X	—	—	—	—	75 44	6 66	68 78
	28 778	63 78	30 00	93 78	—	3 98	—	97 76	6 63	104 39	49	X	—	—	—	—	70 05	11 58	58 48
	30 to 40 Million Ft																		
	30 000	103 92	31 54	135 46	135 16	21 65	—	139 23	1 74	140 97	57	X	—	—	—	—	89 47	24 30	65 17
	30 066	47 69	32 60	80 29	—	—	—	80 29	8 15	88 44	0	—	X	—	—	—	89 44	39 10	49 34
	34 375	78 99	25 75	104 74	N R	1 36	(4 09)	102 01	N R	102 01	55	X	—	—	—	—	65 91	9 09	56 82
	34 495	56 71	37 78	94 49	—	1 44	—	95 93	3 05	98 98	48	X	—	—	—	—	66 76	18 72	48 22
	37 056	70 00	37 87	107 87	95 15	—	—	107 32	3 96	111 28	54	X	—	—	—	—	72 13	6 45	65 68
	38 600	86 00	28 92	114 92	—	4 84	—	117 96	2 20	120 16	69	X	—	—	—	—	79 30	12 38	66 72
	39 954	64 35	30 66	95 01	—	N R	N R	95 01	N R	95 01	42	X	—	—	—	—	66 41	14 97	51 94
	40 to 50 Million Ft																		
	40 225	72 59	34 96	107 55	N R	N R	—	107 55	N R	107 55	35	X	—	—	—	—	60 28	3 40	56 88
	45 000	68 00	30 00	98 00	90 00	2 70	—	95 50	2 50	98 00	40	X	—	—	—	—	69 37	7 03	61 34
	45 000	75 18	27 21	102 39	101 35	—	—	102 09	17 46	119 55	36	X	—	—	—	—	85 69	13 45	72 43
	46 113	46 83	23 57	70 40	—	—	—	70 13	10 27	80 67	51	—	—	X	—	—	84 30	5 85	78 45
	49 101	72 23	30 00	102 23	113 66	3 00	—	81 50	7 60	92 10	39	X	—	—	—	—	63 24	17 11	46 23
(a) Stumpage—Own Timber at Fair Market Value, otherwise actual cost of timber cut	**50 to 75 Million Ft**																		
(b) By products—Includes Bark Chips Shavings Sawdust	52 516	—	—	—	103 14	1 88	—	105 02	2 68	107 70	43	X	—	—	—	—	71 10	2 83	68 27
(c) Labor Cost Excludes Logging, Selling & General Administrative	58 257	N R	N R	N R	N R	N R	N R	N R	N R	N R	N R	N R	N R	N R	N R	—	87 12	37 92	49 20
** Cost Centers reported do not add—Overhead of $7 02 included in total	61 792	49 08	43 38	92 46	126 03	4 53	19 00	124 35	7 13	131 48	N R	N R	—	—	—	—	75 95	36 19	40 75
	71 093	50 30	27 75	77 75	100 43	—	—	81 79	3 68	88 37	52	X	—	—	—	—	58 33	5 70	52 63
	73 608	75 00	44 05	119 05	118 81	—	—	119 03	2 61	121 64	43	X	—	—	—	—	84 82	12 46	72 36
TOTAL PRODUCTION for the 52 Companies, representing 60 mills, amounted to 1 640 613 M Board Feet	**75 Million Ft. & Over**																		
	78 004	58 20	29 80	88 00	—	—	—	88 00	3 58	91 58	23	—	—	—	—	*	70 70	21 70	49 00
	78 840	48 76	23 72	72 48	75 02	—	—	73 61	4 04	77 65	1	—	—	X	—	—	78 43	54	77 89
	81 671	60 00	28 48	88 48	70 71	2 31	—	88 17	3 35	91 52	5*	—	—	X	—	—	96 34	30 46	65 88
	85 332	64 56	30 31	94 87	90 52	1 87	86 87	96 45	1 98	98 43	21	—	X	—	—	—	81 62	24 89	56 73
	89 041	73 05	32 18	105 23	97 88	6 80	111 92	118 04	N R	118 04	54	X	—	—	—	—	63 51	7 50	61 51
	100 835	113 00	25 70	138 70	115 25	9 06	—	142 82	7 18	150 00	48	X	—	—	—	—	102 73	15 78	86 95
Number of Companies Reporting	52	44	44	44	38					51		33	13	3	3	2	52	51	52
Number of Mills Represented	60	51	51	51	43					58							60	59	60
RANGE HIGH	100 835	113 00	44 05	138 70	135 16					150 00							110 00	42 32	98 00
LOW	2 000	45 00	20 51	70 40	70 71					77 65							54 03	54	30 43
MEAN AVERAGE	31 550	68 02	31 14	99 16	96 09					102 12							77 58	15 16	62 71
Companies reporting Doyle Log Scale		28	28	28	24					33									
Mean Average — Doyle Log Scale		72 49	31 55	104 04	98 44					105 00									
Companies reporting Scribner Log Scale		11	11	11	11					13									
Mean Average — Scribner Log Scale		65 05	30 70	95 75	93 39					98 82									

TABLE II.C.17 (Continued)

COST TO PRODUCE, SHIP AND SELL SOUTHERN PINE LUMBER

For the Calendar or Fiscal Year 1972
Arrayed from Low to High Production
52 Respondents Representing 60 Mills

BOARD MEASURE—PER M FEET

Production 1972 M Bd Ft	Sawmill	Green Chain	Green Stacking	Kiln-Air Drying	Shed-Yard Inventory	Planing Mill	Shipping	Total Log Mfg & Ship	Selling & Gen— Admin	TOTAL COST of Lbr Shipped	Net Selling Price (Optional)	Net Income or Loss (Optional)	(c) Labor Cost Per M
6 to 10 Million Ft													
2 000	$ 25 00	$ 7 00	$ 5 00	$ 8 00	$ 10 00	$ 13 00	$ N R	$ 133 00	$ 15 00	$ 148 00	$ 155 00	$ 7 00	$ 77 50
2 552	12 00	8 00	4 00	9 00	4 00	5 00	6 00	[5]126 00	14 00	140 00	143 50	3 50	88 99
4,400	27 00	4 00	4 00	3 00	3 00	13 00	N R	113 00	8 00	121 00	133 00	12 00	24 99
4 800	17 78	4 54	N R	4 44	3 22	8 34	6 12	96 88	16 18	113 06	125 84	12 78	23 99
4 800	21 00	3 00	2 00	N R	N R	7 00	N R	88 44	4 50	92 94	—	—	N R
5 100	28 00	N R	N R	N R	N R	21 00	N R	131 00	15 00	146 00	168 00	22 00	19 61
5 253	11 30	N R	6 53	2 20	3 75	5 50	9 00	100 88	3 25	104 13	—	—	N R
6 900	17 61	4 21	2 03	4 15	4 55	8 00	N R	[5]120 04	8 39	128 43	130 01	1 58	N R
7 282	35 00	4 00	7 25	NONE	1 00	12 00	7 00	145 25	4 25	149 50	149 50	NONE	29 90
7 918	14 68	4 51	N R	N R	N R	16 96	9 87	93 02	14 96	107 98	105 68	(2 32)	26 47
8 482	15 01	N R	N R	18 99	N R	10 27	7 16	113 61	22 83	136 44	—	—	N R
8 501	16 28	N R	9 66	7 96	5 98	10 96	N R	105 22	34 86	140 08	—	—	29 57
8 702	14 41	N R	N R	9 89	4 05	8 70	5 68	120 44	4 09	123 53	141 88	17 35	25 62
9 057	26 30	5 18	6 32	4 39	5 13	10 54	3 08	119 07	9 63	128 70	132 97	4 27	37 71
9,768	28 29	5 38	N R	N R	N R	8 42	N R	117 69	5 09	122 78	148 48	25 70	19 17
10 to 20 Million Ft													
10 260	25 52	N R	N R	N R	15 35	9 29	13 14	123 55	17 78	141 33	175 13	33 80	29 14
10 718	18 29	N R	N R	N R	9 72	9 09	N R	98 36	6 04	104 40	118 65	14 25	27 99
10 882	24 02	5 97	2 38	2 99	3 58	17 91	2 24	136 59	61	137 20	147 88	10 68	23 45
11 577	17 80	1 00	1 50	1 25	2 01	12 55	12 48	108 64	32 70	141 34	146 50	5 16	N R
11 947	23 62	5 70	2 05	2 65	2 13	8 57	N R	90 19	5 16	95 35	—	—	25 51
14 634	17 77	2 69	1 38	2 98	8 75	7 51	3 24	122 99	8 18	131 17	129 52	(1 65)	30 48
15 000	19 83	11 26	3 73	5 00	N R	7 72	N R	123 10	20 24	143 64	185 96	42 32	35 99
15 114	8 12	1 88	1 87	5 95	3 08	5 34	2 91	97 19	26 27	123 46	—	—	24 65
16 000	22 00	4 28	2 74	4 10	N R	6 86	2 16	140 16	8 00	148 16	154 61	6 45	N R
17 028	25 13	N R	N R	2 33	8 56	9 62	7 68	83 75	15 90	99 65	128 92	29 27	20 60
20 to 30 Million Ft													
25 251	26 49	N R	N R	32 26	N R	N R	N R	110 66	N R	110 66	—	—	23 72
26 309	12 24	N R	N R	21 16	N R	N R	N R	95 79	10 97	106 76	117 55	10 79	N R
28 200	18 03	N R	N R	7 68	N R	7 30	1 57	[6]110 36	3 78	114 14	129 67	15 53	15 58
28 778	9 25	2 61	1 16	5 14	7 38	7 86	2 58	94 46	15 33	109 79	129 85	20 06	27 42
30 to 40 Million Ft													
30 000	16 20	2 00	2 90	1 17	3 47	8 34	2 99	102 24	13 75	115 99	—	—	N R
30 066	9 26	3 25	1 62	3 05	N R	8 45	N R	74 97	25 24	100 21	118 07	17 86	30 65
34 375	13 94	N R	2 12	2 33	N R	5 89	2 89	83 99	34 45	118 44	132 75	12 31	19 37
34 455	15 37	N R	N R	4 05	5 24	6 66	N R	79 34	1 89	81 23	121 79	40 56	14 19
37 086	18 84	1 26	1 15	2 42	13 51	7 75	3 57	[5]123 17	7 72	130 89	138 63	7 74	20 40
38 600	13 22	3 91	N R	6 58	N R	5 96	2 54	[5]115 01	1 90	116 91	—	—	N R
39 954	N R	N R	N R	N R	N R	38 19	7 50	97 63	4 87	102 50	112 69	10 19	19 65
40 to 50 Million Ft													
40 225	16 72	7 56	N R	5 70	4 92	13 14	N R	104 92	13 12	118 04	133 00	14 96	34 11
45 500	18 10	N R	N R	5 88	N R	7 50	N R	92 82	10 04	102 86	134 52	31 66	N R
45 856	10 75	1 21	2 01	2 94	3 33	6 39	6 51	[7]122 42	14 55	136 97	134 41	(2 56)	22 35
46 153	6 46	N R	65	1 66	26	4 59	1 25	[5]97 35	4 00	101 35	116 59	15 24	7 87
49 101	17 23	2 10	3 14	5 24	N R	9 01	2 19	85 14	12 99	98 13	115 22	17 19	25 69
50 to 75 Million Ft													
52 516	16 12	7 08	N R	N R	N R	10 26	N R	101 71	2 30	104 01	—	—	19 59
58 257	75 21	N R	N R	N R	N R	9 87	N R	134 28	1 80	136 08	—	—	15 65
61 792	20 17	20	1 71	3 00	06	4 29	91	[5]75 00	5 65	[5]80 01	—	—	16 01
71 093	12 90	3 33	N R	5 44	3 24	6 05	2 92	86 51	N R	86 51	—	—	12 80
73 608	11 16	2 65	1 78	3 88	6 93	10 29	2 53	[5]118 64	7 73	126 37	136 85	10 48	20 29
75 Million Ft & Over													
78 004	33 77	2 47	5 64	2 47	2 11	18 01	5 35	118 82	7 68	126 50	124 95	(1 55)	32 92
78 840	11 16	2 53	2 35	1 02	2 75	5 58	4 38	[5]115 46	4 00	119 46	134 48	15 02	25 65
81 671	10 92	3 53	N R	5 89	1 19	6 70	8 40	97 71	19 47	117 18	—	—	21 73
85 332	17 20	2 50	1 45	3 24	5 05	8 02	1 16	95 35	9 65	105 00	125 05	20 05	23 11
89 041	13 26	2 33	1 32	3 52	6 52	6 61	2 35	97 42	5 29	102 71	—	—	14 58
100 835	17 41	4 61	3 10	1 96	1 96	12 14	2 01	130 14	2 53	132 67	—	—	14 52

TOTAL PRODUCTION for the 52 Companies representing 60 mills amounted to 1 640 613 M Board Feet

Number of Companies Reporting	52	52	52
Number of Mills Represented	60	60	60
RANGE HIGH	100.835	145 25	149 50
LOW	2,000	74 97	80 01
MEAN AVERAGE	31,550	107 89	118 36

NOTE. No attempt has been made to formulate averages from cost information reported for "Cost Centers" of Sawmill through Shipping because of inconsistency of responses, such as, "combining of departments" "not available," etc

Companies reporting Doyle Log Scale
Mean Average — Doyle Log Scale

Companies reporting Scribner Log Scale
Mean Average — Scribner Log Scale

NOTES

Cost Center reflects entire Costs for that center including (1) Direct Labor, (2) Indirect Labor, (3) Supplies, (4) Electric Power or Gas Purchased, (5) Depreciation and (6) Insurance Burden for Maintenance, Machine Shop, etc., included in Indirect Labor

N R Not Reported— Cost Centers" Combined—Not available, etc
. Underrun
[3] Herring Davant
[4] Weighing
[5] Cost Centers reported do not add to Total
[6] Cost Centers reported do not add— Depreciation of $16 08 included in Total
[7] Cost Centers reported do not add— Plant General and Depreciation of $16 65 included in Total
[8] Cost Centers reported do not add— Sundry of $4 03 included in Total
[9] Cost Centers reported do not add— Depreciation of $4 70 included in Total
[10] Cost Centers reported do not add— Sundry of $7 80 included in Total

(a) Stumpage—Own Timber at Fair Market Value, otherwise actual cost of timber cut
(b) By products—Includes Bark Chips, Shavings, Sawdust
(c) Labor Cost—Excludes Logging, Selling & General Administrative

** Cost Centers reported do not add— Overhead of $7 02 included in total

Table II.C.18 presents estimates of "typical" operating costs for a large western mill for 1970 and 1971. The swings in prices and costs again highlight the difficulty of relying on any one year's results to base a decision.

TABLE II.C.18

ESTIMATED COSTS FOR A "TYPICAL" LARGE WESTERN MILL: 1970 AND 1971
($ per thousand board feet)

	1970	1971
Stumpage	$ 80	$ 40
Logging and Hauling Costs	30	30
Delivered Log Cost to Mill	$110	$ 70
Log Cost Corrected for 33% Realization Overrun	82	52
Sawmill Conversion Costs	30	30
Total Costs	$112	$ 82
Realization (price)	$ 80	$100

Source: Arthur D. Little, Inc., estimates.

Table II.C.19 presents a comparison of all U.S. manufacturing activities and lumber and wood products manufacturing activities in terms of profit on sales and equity since 1965. The return on sales and equity for this industry is slightly lower than for all U.S. manufacturing industries and in each case, the standard deviation (measure of fluctuation) is greater.

"Investment" in the industry is also difficult to measure. The lumber industry has been the slower growing portion of the forest products industry for several decades and many producing units have been in the same location for 30 or more years. Because most mills are constantly maintained with equipment replaced and upgraded, neither the age of the facility nor the book value of the investment fairly reflects the economic usefulness of the plant.

Industry sources estimate the capital cost of a new 50 million board foot mill (excluding land and timber resources) in the Western United States to be approximately $5-6 million. Of this amount, about $3-4 million would be for the sawmill, planing mill, and dry kilns with the balance allocated to log storage, sorting, and handling facilities. The investment in a minimum size facility producing a limited product line (20 million feet of studs, chips, and bark) would probably be about $2 million distributed as follows:

TABLE II.C.19

CORPORATE PROFITS AFTER TAXES
1965-72

	As Percent of Sales		As Percent of Stockholders Equity	
	All U. S. Manufacturing	Lumber and Wood Products	All U. S. Manufacturing	Lumber and Wood Products
1965	5.6%	3.9%	13.0%	10.0%
1966	5.6	3.8	13.5	10.0
1967	5.0	3.4	11.7	8.6
1968	5.1	5.3	12.1	14.6
1969	4.8	4.8	11.5	13.2
1970	4.0	2.5	9.3	5.9
1971	4.2	4.4	9.7	11.3
1972	4.3	5.1	10.6	15.9
Mean	4.8	4.2	11.4	11.1
Standard Deviation	.6	.9	1.5	3.1

Source: Western Wood Products Association, 1972 Statistical Yearbook.

Log Handling, Sorting, and Storage Facilities	$ 400- 450,000
Sawing Facilities	400- 450,000
Kilns	500,000
Planer Mill	200,000
De-barking and Bark Handling Facilities	250,000
Chipping and Chip Handling Facilities	100,000
Total (not including land or transit links such as railroad spur, etc.)	$1,850-1,950,000

Capital investment in the entire sawmill and planing mill industry has not been great in recent years. Table II.C.20 lists capital expenditures since 1965 for SIC 2421. Expenditures tend to coincide with profitability and showed a substantial upswing in 1971 and continued during 1972.

TABLE II.C.20

CAPITAL EXPENDITURES FOR SAWMILLS AND PLANING MILLS
($ millions)

	SIC 2421 Sawmills and Planing Mills
1965	$172.8
1966	163.5
1967	129.4
1968	180.3
1969	210.5
1970	189.1
1971	232.2
Mean	182.5
Compound Growth	5.05%

Source: Industry Profiles, U.S. Department of Commerce.

e. Pricing

The market for softwood lumber is notoriously volatile with significant swings in price occurring in short periods of time. Construction activity in regions suffering severe winters such as the Midwest, Mountain States, and East is quite seasonal and prices vary accordingly. Similarly, larger shifts in price resulting from annual variations in housing demand overlay cyclical swings on the normal seasonal pattern.

Table II.C.21 shows price indexes of Douglas Fir, Southern Pine, other softwoods, and selected other construction materials since 1966. Lumber has varied more in price than the index of all construction materials and, as shown by the standard deviations of the indexes from 1966 through 1972, was also the most volatile of the wood-based building materials.

This price volatility results directly from the inability of lumber producers to adjust production levels to meet the wide swings in housing demand which occur. Table II.C.22 presents indexes and standard deviations (measures of variability) of conventional and all types of housing produced in the United States from 1966 through 1972. The standard deviation of annual activity for this sector is greater than the same measure of fluctuation for softwood lumber prices and demonstrates the problem lumber producers face in forecasting and coping with demand.

There are several factors inherent in the supply of raw material (timber) which further curtail the ability of the industry to cope with large shifts in demand and these will be discussed in more detail. In analyzing this sector of the forest products industry, however, one must be aware that the free market, economic supply-demand mechanism for de-

TABLE II.C.21

INDEXES OF WHOLESALE PRICES OF MATERIALS USED IN CONSTRUCTION, BY SELECTED GROUPS AND COMMODITIES
(1967 = 100)

Period	All Construction Materials	Softwood Lumber			Selected Hardwood Lumber	Millwork			Plywood	
		Douglas Fir	Southern Pine	Other		Group Index	General Millwork	Prefabricated Structural Members	Group Index	Softwood
					Annual Averages					
1966	98.8	96.8	100.2	97.5	116.2	98.0	98.7	94.8	104.0	106.1
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.6	120.3	113.7	123.5	107.7	105.8	105.8	107.8	115.7	129.2
1969	111.9	131.7	126.0	139.0	127.7	117.8	117.6	119.2	122.5	139.2
1970	112.5	108.8	114.5	115.1	116.8	116.0	115.6	118.0	108.5	113.6
1971	119.5	137.6	133.8	145.3	114.4	120.7	121.4	117.5	114.7	127.2
1972	126.6	161.1	151.1	177.0	130.4	128.4	129.1	124.9	130.7	154.9
					Monthly Indexes					
1972										
January	123.2	148.2	142.4	161.3	120.6	124.9	126.0	119.4	120.2	137.9
February	124.2	151.4	145.7	166.0	121.5	125.5	126.0	122.8	125.1	145.8
March	124.9	153.6	148.5	168.3	121.7	125.8	126.7	121.6	128.9	153.3
April	125.7	156.3	150.9	171.4	126.6	126.6	127.7	121.6	128.9	153.3
May	126.2	159.1	151.6	173.1	129.1	127.6	128.9	121.6	130.3	155.6
June	126.6	160.8	151.6	175.8	132.7	128.4	129.8	122.0	131.7	157.9
July	127.2	165.4	152.2	178.3	134.6	129.6	130.5	125.1	132.9	160.5
August	127.8	166.8	153.3	182.9	135.0	130.0	130.5	127.5	135.9	162.1
September	128.0	167.3	154.4	184.5	135.3	130.2	130.8	127.5	134.6	159.7
October	128.3	167.9	154.8	186.3	135.3	130.7	130.9	130.0	134.6	159.7
November	128.4	168.1	156.3	187.2	135.8	130.9	131.0	130.0	133.3	157.4
December	128.5	168.3	156.3	189.3	136.5	130.7	130.9	129.7	132.3	155.2

TABLE II.C.21 (Continued)

Period	All Construction Materials	Softwood Lumber			Selected Hardwood Lumber	Millwork			Plywood	
		Douglas Fir	Southern Pine	Other		Group Index	General Millwork	Prefabricated Structural Members	Group Index	Softwood
					Monthly Indexes (continued)					
1973										
January	129.4	169.5	156.9	190.1	140.2	131.4	131.7	130.0	134.1	160.5
February	132.3	188.3	164.5	204.9	158.7	133.4	133.4	133.5	149.4	186.1
March	136.2	208.5	171.5	220.7	169.3	134.8	134.7	135.4	176.8	245.6
April	139.1	214.1	181.4	237.7	180.3	141.2	138.5	154.2	182.5	252.6
May	140.8	219.8	186.6	248.7	188.1	146.5	144.8	154.2	177.7	242.2
June	140.1	217.2	194.9	243.7	192.5	147.7	146.3	154.2	154.9	189.5
July	138.6	212.6	191.8	234.3	194.3	148.3	147.1	153.9	138.0	153.7
August	138.9	216.1	198.4	226.4	222.1	148.3	147.2	153.6	140.1	163.9
September	140.1	223.9	203.5	232.6	227.6	149.0	147.9	154.1	138.2	159.5
October	140.4	216.9	202.7	229.2	229.0	149.4	148.4	154.1	134.6	153.5
					Mean					
1966-1972	110.7	122.3	120.0	128.2	116.2	112.4	112.5	111.7	113.7	124.3
					Standard Deviation					
1966-1972	10.1	23.0	18.6	28.0	10.6	11.3	11.5	11.1	10.7	19.3

Source: Construction Review, U.S. Department of Commerce; Arthur D. Little, Inc., calculations.

TABLE II.C.22

INDEX OF NEW HOUSING IN THE UNITED STATES: 1966-1972
(1967 = 100.0)

	Total Conventional	Total All Types
1966	90.5	90.5
1967	100.0	100.0
1968	116.9	119.3
1969	109.7	119.3
1970	111.1	119.7
1971	157.7	165.3
1972	180.0	189.2
Mean	123.7	129.0
Standard Deviation	32.6	35.4

Source: Construction Review, ADL calculations.

termining price works. Lumber prices are not set by a concentration of a few suppliers or customers nor are cost increases simply "passed along." In the long term, industry production levels are adjusted to balance timber costs and supply, processing costs, and prices. In the short term producers and customers endure wide swings in price and profits rise or fall for suppliers, distributors, and users accordingly.

3. Hardwood Lumber

The hardwood lumber industry is distinct from the softwood industry in several important respects, namely:

- Scale of operating mills – hardwood producers are much smaller companies running small plants.
- End use markets served – hardwood producers serve mainly the furniture and industrial (mainly shipping usage) markets, not construction.
- Greater vulnerability to displacement products.

a. Industry Structure

(1) Production. Total production of hardwood lumber in the United States has been declining almost steadily for seven years. The recent high was in 1966 when production totalled 7.738 billion board feet. By 1972 production was off 12% to 6.813 billion board

feet and preliminary data for 1973 indicate the decline may have accelerated. Prospects for 1974 are also regarded as clouded as the industry continues to suffer from a shortage of logs due to floods and rains which have impaired logging conditions.

On a regional basis, 64% of production occurs in the South. The second most important producing area is the Northeast and Northcentral Regions with 34% of industry output. Table II.C.23 shows hardwood production by region and lists the principal species cut.

TABLE II.C.23

HARDWOOD PRODUCTION BY PRINCIPAL REGION AND SPECIES, 1972

	Northeast and North Central Regions	South Region
Species	1972	1972
Hardwoods, Total	2,341	4,333
Ash	64	84
Basswood	50	16
Beech	97	85
Birch	85	17
Cottonwood and Aspen	196	77
Elm	85	64
Gum, Black and Tupelo	11	308
Gum, Sweet (red and sap)	8	336
Hard Maple	358	77
Soft Maple	142	51
Oak	973	2,160
Yellow Poplar	76	552
Walnut	39	16
Other Hardwoods	157	490

Source: Op cit, Current Industrial Reports.

Commerce Department statistics lump hardwoods and softwoods together making it difficult to determine precisely the value of hardwood shipments. However, trade sources estimate an average price of $160 per thousand board feet could be applied to 1972 production and this would indicate a value of shipments of about $1.1 billions or just over 20% of SIC 2421.

It is extremely difficult to secure an accurate count of the number of hardwood mills in operation. Trade association membership covers fewer than 200 producers and the most comprehensive trade directory located listed only 675 hardwood mills. Sources familiar with the industry believe nearly twice this number of firms operate regularly and perhaps another 500 to 1,000 produce seasonally or intermittently.

(2) End-Use Markets. Two uses account for the bulk of the market for hardwood lumber – furniture and industrial shipping. Other markets include stock for hardwood flooring and transportation equipment such as truck trailers, etc. Table II.C-24 indicates the estimated distribution of sales by market segment.

TABLE II.C.24

HARDWOOD LUMBER END-USE MARKETS

Furniture	34-45%
Shipping	
Pallets	15-20%
Boxes, Crates and Cases	10-15%
Transportation	
Equipment	5-10%
Flooring	3- 5%
Miscellaneous	balance

Sources: Hardwood Lumber Manufacturer's Association National Oak Flooring Manufacturer's Association. The Outlook for Timber in the United States and Arthur D. Little, Inc., estimates.

b. Types of Firms

Producers of hardwood lumber are generally small, independent, family-owned companies. The markets served require specialized (short production run) products, and are highly regional, creating a business environment more appealing to this type of producer. This contrasts with the softwood sector in which the major forest product firms are most active.

c. Types of Plants

Table II.C.25 lists the breakdown of mill sizes reported for the 675 producers identified. Using the previously mentioned average price of $160 per thousand board feet for 1972, we estimate 70% of the mills identified would have had sales less than $1.2 million in 1972 and 30% would have had sales under $400,000. Clearly hardwood lumber is manufactured in much smaller plants than is softwood lumber. Table II.C.26 lists the locations of these mills by state.

d. Financial Profiles

Investment and Operating Costs. Hardwood lumber mills, as previously mentioned, are much smaller than softwood mills. Consequently, the total capital invested in the industry is much lower proportionally than for hardwood producers. Furthermore, the

TABLE II.C.25

675 HARDWOOD PRODUCERS BY MILL SIZE, 1972

Board Feet Produced (million feet)	Estimated Dollar Sales Range (million dollars)	Number of Firms	Percent of Firms
0 to 2.5	$0 to $ .4	203	30%
2.51 to 5.0	.4 to .8	204	30
5.1 to 7.5	.8 to 1.2	74	11
7.51 to 10.0	1.2 to 1.6	61	9
10.1 to 15.0	1.6 to 2.4	45	7
15.1 to 30.0	2.4 to 4.8	25	4
30.1 to 50.0	4.8 to 8.0	16	2
Over 50.0	Over 8.0	6	1
Not Reported	–	41	6

Source: Hardwood Purchasing Handbook 1974, National Hardwood Magazine, Inc., Memphis, Tennessee.

equipment and facilities required for a successful hardwood operation are much less extensive. Hardwood mills generally do have debarking and chipping equipment, but because much of the product (perhaps more than 50%) is shipped rough, most mills have not invested in dry kilns or in planing facilities.

The membership directory of the Southern Hardwood Lumber Manufacturers Association indicates 44 of the 79 plants covered or 56% had dry kilns which are expensive to acquire. These mills are reflective of the larger producers but in aggregate we believe less than 30% of regular producers have invested in this equipment.

Trade sources estimate the investment in a new hardwood mill could range from a low of less than $100,000 for a very small unit performing minimal processing steps up to about $750,000 for a facility capable of producing 8 million board feet per year.

TABLE II.C.26

675 U.S. HARDWOOD LUMBER MANUFACTURERS

BY STATE

State	Number of Plants per State
Alabama	30
Arkansas	27
California	1
Colorado	1
Connecticut	1
Florida	2
Georgia	20
Illinois	21
Indiana	37
Iowa	9
Kansas	6
Kentucky	36
Louisiana	28
Maine	10
Maryland	10
Massachusetts	5
Michigan	22
Minnesota	11
Mississippi	22
Missouri	22
New Hampshire	4
New Jersey	2
New York	36
North Carolina	37
Ohio	37
Oklahoma	2
Oregon	9
Pennsylvania	57
Rhode Island	1
South Carolina	11
Tennessee	56
Texas	9
Vermont	13
Virginia	21
Washington	5
West Virginia	26
Wisconsin	29

Source: Op. cit., Hardwood Purchasing Handbook 1974.

Table II.C.27 based on industry credit evaluations, lists the estimated financial strength for 104 randomly selected hardwood lumber producers. Again this data points out the small size of producing units as 45% of the firms are estimated to have "financial strength" under $500,000 and an additional 38% are unaccounted for.

TABLE II.C.27

ESTIMATED FINANCIAL STRENGTH OF
104 HARDWOOD LUMBER PRODUCERS

Net Worth	Number of Firms	Percent
Under $35,000	6	6
$ 35,000 to $ 125,000	18	17
$125,000 to $ 500,000	23	22
$500,000 to $1,000,000	5	5
Over $1,000,000	12	12
Net Worth Undetermined	40	38
Total	104	100%

Sources: Op. cit., 1974 Hardwood Purchasing Handbook (names selected at random) and The Lumbermen's Redbook, Spring 1973, Lumbermen's Credit Association, Inc., Chicago, Illinois.

e. Pricing

There is considerably more stability to the demand for hardwood lumber than for softwoods. Furniture sales are correlated with new construction but the relationship is not direct; furniture demand is more closely tied to long-term demographic characteristics of the U.S. population such as age and income distribution, rate of family formation, etc. The outlook for the furniture industry is for steady increases in real demand through 1980 averaging as much as 6% per year and furniture represents an increasingly important market for producers.

Flooring demand has been declining almost steadily for over a decade and now accounts for such a small part of consumption it is not an important factor. Oak and maple

floors are losing market share to wall to wall carpeting although the latter is shorter lived.

Demand for hardwoods for shipping use is tied to industrial output and to materials handling technology. Pallets are the largest shipping usage and their use has broadened as more warehousing and shipping rely on mechanical means of materials handling.

Hardwood lumber used for shipping and manufacturing applications generally does not have to be finished nor does it have to be kiln dried. As a result much hardwood is air dried and is not run through a planer mill.

Imported hardwoods now account for about 6% of domestic demand, chiefly for furniture use. Furniture producers have been forced to seek other sources of supply due to hardwood lumber shortages. In addition furniture producers have shifted to alternate materials, chiefly particleboard, softwood lumber (Eastern White Pine and Ponderosa Pine), and plastics (frames for upholstered chairs and sofas). We estimate softwood lumber now accounts for about 25% of total furniture/lumber usage.

Some material shifts are due to style factors or labor economies (e.g., use of plastic molded decorated parts instead of carved wood) but hardwood shortages have forced most of the switch. Industrial users can switch even more readily to softwoods for pallets, crates, dunnage, etc. and have done so.

In essence, the presence of imports and the ready substitutability of other materials and products for hardwood lumber acts as a severe constraining effect on hardwood lumber prices.

D. HARDWOOD DIMENSION AND FLOORING MILLS

This section deals with mills producing hardwood flooring and hardwood lumber cut to a specified dimension for use in household furniture. Also included are hardwood frames for furniture use and lumber cut to size for a variety of miscellaneous manufacturing uses. During 1972, 585 plants operated in this industry and employed about 26,000 persons.

1. Industry Structure

Table II.D.1 lists shipments in this SIC code for 1967 and 1971. Dollar sales actually declined over that period with a substantial drop occurring in the flooring sector.

TABLE II.D.1

SHIPMENTS OF SIC 2426
HARDWOOD DIMENSION AND FLOORING MILLS
1967 AND 1971
($ millions)

Product	1967	1971	Percent of 1971 Shipments
Hardwood Flooring	$129.2	$ 91.2	28%
Hardwood Dimension Stock:			
Furniture	176.3	219.8	66
Other Industrial	53.6		
Hardwood Dimension and Flooring, n.s.k.	24.3	20.6	6
Total	$370.2	$331.6	100%

Sources: 1967 Census of Manufactures; 1971 Annual Survey of Manufacturer.

Table II.D.2 presents the end use markets for this sector during 1972. New construction and maintenance construction together accounted for 43.9% of purchases while the

TABLE II.D.2

1972 DISTRIBUTION OF SHIPMENTS
SIC 2426 HARDWOOD DIMENSION
AND FLOORING MILLS

Buyers	Percent of Purchases
Maintenance Construction	4.9%
Ordnance	3.4
Lodging Camps & Contractor	.1
Sawmill & Planing Mills	5.5
Hardwood Dimensions & Flooring	.4
Millwork Plants	1.5
Wooden Containers	.1
Wood Preservative – Miscellaneous Products	6.2
Household Furniture	36.5
Office Furniture	3.2
Gum & Wood Chemicals	–
Fabric Plastic Products	–
Ready-Mixed Concrete	–
Farm Equipment	–
Electric Light & Wire Equipment	–
Motor Vehicles	–
Jewelry, Toys, Sport, Miscellaneous	.1
Wholesale & Retail Trade	.6
Real Estate & Rental	.3
Total	6.3%

Components

Inventory	.2%
New Construction	39.0
[illegible]	[illegible]
[illegible]	[illegible]
Total	[illegible]

[illegible]

[illegible]	22.1%
[illegible]	[illegible]
[illegible]	3.2
[illegible]	1.4
[illegible]	2.8
[illegible]	–
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	–
[illegible]	.4
[illegible]	1.0
Total	[illegible]

[illegible]

household and office furniture industries purchased 39.7% of output. The balance of production (adjusted for imports and exports) went to miscellaneous manufacturing industries and is properly regarded as "dimension stock" also.

The apparent disparity between shipments of flooring (28% of shipments) and purchases of flooring (44% of purchases) is explained by industry members as an error in the census data. Trade sources believe dimension shipments are overstated somewhat due to the categorization of some hardwood flooring as "dimension" when it is shipped by a company whose principal business is dimension manufacture. Although there is some overlap, the flooring and dimension businesses are largely separate.

The flooring industry in the United States is not prospering. Sales of oak flooring declined 78% in the 17 year period from 1955 through 1972 and partial data for 1973 indicates the rate of decline increased that year. Table II.D.3 lists orders, production, and shipments of oak flooring for that period. Oak is estimated to supply over 90% of the U.S. usage of hardwood flooring with maple providing the balance.

TABLE II.D.3

TREND OF OAK FLOORING
(strip type – both finished and unfinished)

Year	Orders (thousand feet)	Production (thousand feet)	Shipments (thousand feet)
1955	1,188,781	1,220,204	1,207,164
1960	827,454	878,931	847,388
1965	818,338	778,086	783,299
1966	618,090	685,643	654,368
1967	547,048	551,220	552,218
1968	496,538	459,286	485,098
1969	380,629	393,107	387,778
1970	304,436	315,189	306,736
1971	323,301	306,603	320,921
1972	265,194	244,787	261,147
1973 (11 mo.)	169,061	174,363	173,725

Source: National Oak Flooring Manufacturers Association, Memphis, Tennessee.

Flooring is sold through building materials wholesalers and retailers. It is the largest sector of the hardwood lumber industry going directly into construction (mostly residential) but it has not benefited from recent increases in housing demand. Table II.D.4 lists the distribution of shipments by region.

TABLE II.D.4

OAK FLOORING SHIPMENTS BY GEOGRAPHIC REGION 1971

	Percent
Northeast	
New England	10.9%
Middle Atlantic	27.6
North Central	
East North Central	17.9
West North Central	4.0
South	
South Atlantic	26.1
East South Central	6.2
West South Central	1.9
West	
Mountain	.7
Pacific	3.2
Export	1.5

Source: Op. cit., National Oak Flooring Manufacturers Association.

Hardwood dimension is sold either directly to furniture and industrial plants (about 75 to 80% of shipments) or to wholesalers. Dimension producers tend to be located close to the raw material they depend on which is where the wood furniture industry is located.

The exception is producers of frames which are more evenly distributed according to population. Many frames are sold to firms which finish them by adding cushioning and upholstery to produce covered furniture. Frames and upholstered furniture are bulky to ship and are produced close to consuming areas.

2. Types of Firms

Firms which are active in the segment are primarily small, independent operators. No manufacturer dominates the industry. For example, firms with one or two flooring machines have about two-thirds of capacity currently operating. Table II.D.5 indicates the industry to be utilizing only about 60% of equipment in place.

TABLE II.D.5

OAK FLOORING MANUFACTURERS: DISTRIBUTION OF PRODUCTION CAPACITY AND CURRENT OPERATING STATUS

Number of Machines	Number Of Firms	Total Number Of Machines In Group	Number of Machines Currently Operating	Percent Operating
1	36	36	24	67
2	11	22	10	45
3-5	4	16	12	75
Total	51	74	46	62

3. Types of Plants

Table II.D.6 lists the number of plants and employees participating in SIC 2426 during 1972 by state. Based on the number of known flooring mills we have also estimated the number of plants principally engaged in dimension manufacture by state. Using the sales data presented in Tables II.D.1 and II.D.2 we calculate the average sales per flooring plant in 1971 to have been about $2.5 million and the average dimension sales per plant to have been about $500,000. The average number of employees per plant is 45.

The hardwood business is extremely fragmented. The 1972 distribution of firms by employment size for SIC 2426 indicates almost half of the plants had fewer than 20 employees.

Hardwood Dimension and Flooring Mills

No. of Employees	No. of Mills	Percent of Mills
1- 3	80	14
4- 7	78	13
8- 19	125	21
20- 49	127	22
50- 99	101	17
100-249	65	11
250-499	7	1
500+	2	–
Total	585	100%

Source: Op Cit, County Business Patterns 1972.

TABLE II.D.6

1972 DISTRIBUTION OF PLANTS AND EMPLOYMENT
SIC 2426 HARDWOOD DIMENSION AND FLOORING

State	No. of Employees	No. of Reporting Units	No. of Known Flooring Mills	No. of Estimated Dimension Plants
U.S. Total	26,082	585[1]	59	428
Alabama	813	15	5	10
Alaska	–	–	–	–
Arizona	–	–	–	–
Arkansas	2,557	39	9	30
California	473	20	0	20
Colorado	–	–	–	–
Connecticut	–	–	–	–
Delaware	–	–	–	–
District of Columbia	–	–	–	–
Florida	292	6	1	5
Georgia	784	18	3	15
Hawaii	–	–	–	–
Idaho	–	–	–	–
Illinois	387	21	2	19
Indiana	(D)	19	0	19
Iowa	–	–	–	–
Kansas	–	–	–	–
Kentucky	1,889	25	2	23
Louisiana	(D)	11	0	11
Maine	–	–	–	–
Maryland	–	–	–	–
Massachusetts	–	–	–	–
Michigan	(D)	22	2	20
Minnesota	–	–	–	–
Mississippi	1,789	19	1	18
Missouri	866	23	6	17
Montana	–	–	–	–
Nebraska	–	–	–	–
Nevada	–	–	–	–
New Hampshire	101	7	–	7
New Jersey	151	10	1	9
New Mexico	–	–	–	–
New York	(D)	21	1	20
North Carolina	3,379	69	2	67
North Dakota	–	–	–	–
Ohio	414	11	0	11
Oklahoma	–	–	–	–
Oregon	346	9	0	9
Pennsylvania	–	–	1	–
Rhode Island	–	–	–	–
South Carolina	(D)	11	0	11
South Dakota	–	–	–	–
Tennessee	3,742	60	13	47
Texas	193	11	0	11

TABLE II.D.6 (Continued)

State	No. of Employees	No. of Reporting Units	No. of Known Flooring Mills	No. of Estimated Dimension Plants
Utah	–	–	–	–
Vermont	–	–	–	–
Virginia	1,889	25	8	17
Washington	227	6	0	6
West Virginia	394	9	0	9
Wisconsin	–	–	2	–
Wyoming	–	–	–	–

1. Includes Guam, Puerto Rico, and U.S. Territories.

Sources: 1972 County Business Patterns, Maple Flooring Manufacturers Association, and National Oak Flooring Manufacturers Association.

Among producers the principal difference in operations is whether or not the producer also operates a hardwood lumber mill. Out of the 59 flooring producers identified, 18 (30%) are believed to operate lumber mills as well. The balance buy lumber and produce flooring from it.

Assuming the same proportion of these mills (40%) have wet decks as do hardwood lumber mills in general, the total number of firms likely to be impacted would be only about 8 to 10 mills.

If 40% of those hardwood dimension producers with sawmills employ wet decks or log ponds (this is the same proportion of hardwood lumber manufacturers using this method of log handling), then only 4-6% of all hardwood dimension producers would be faced with pollution control expenditures for log handling and storage purposes.

A second important distinction concerning dimension producers is whether they are engaged in extensive gluing activities. An analysis was made of a trade directory listing of 255 hardwood dimension producers which identified the principal products and equipment of each plant. The plants listed were sorted according to whether they had "extensive gluing activities" or not. For this purpose, operation of edge gluers, electronic gluers or production of panels and doors are examples of "extensive gluing operations" while utilization of finger joint machines are not.

The analysis showed 29% of the 255 plants fell into the category of those engaged in "extensive gluing operations." Listed below are the employment size categories of the two groups:

No. of Employees	No. of Plants With "Extensive Gluing Operations"	No. of Plants Without "Extensive Gluing Operations"	Total Firms
0–15	1	41	42
16–30	20	33	53
31–50	7	36	43
51–99	24	28	52
100+	22	17	39
Not reported	–	26	26
Total	74	181	255

Source: Op Cit, 1974 Hardwood Purchasihg Handbook.

These 74 plants would be the number expected to be affected by the Effluent Guidelines.

4. Financial Profiles

Table II.D.7 presents an estimate of total assets for a group of firms in the industry. Our analysis for financial strength continues as follows: The average capital expenditure per employee made in 1972 was $501.66. This means that a firm employing ten persons if it followed the industry average for new capital expenditures would have spent about $5,000 in 1972. Our analysis of those firms with extensive gluing activities in terms of employment

TABLE II.D.7

ESTIMATED FINANCIAL STRENGTH OF OAK AND MAPLE FLOORING MANUFACTURERS WHO ALSO OPERATE SAWMILLS

Estimated Net Assets	Number of Manufacturing Firms	Percent of Total
Over $1,000,000	8	44
$500,000 to $1,000,000	2	11
$125,000 to $ 500,000	2	11
$ 35,000 to $ 125,000	1	6
$ 500 to $ 35,000	0	0
Net Assets Undetermined	5	28
	18	100%

Sources: Op. cit., National Oak Flooring Manufacturers Association, Maple Flooring Manufacturers Association, and Lumbermen's Redbook.

size shows only one firm employing 0 to 15 persons which falls into the category of being an extensive gluer. The next group is 20 firms with 16 to 30 employees. At an average of $500 of capital expenditures per employee the 20 firms would have expended from $8,000-$15,000 each for new capital equipment in 1972. All other firms with the exception of the one small firm would be above that category and we feel it is reasonable to expect the larger firms spent more than $15,000 in 1972.

5. Pricing

Prices are determined by the cost of raw material (lumber in most cases, timber in some) which are affected more by industrial demand than by shifts in housing, and by the cost of converting the product. Due to decreased hardwood log supplies, prices have moved up in recent years.

There is no index of dimension prices because there are no standard products. Prices reflect the cost of lumber and converting costs tempered by demand. During the last several years, shortages of lumber and strong furniture demand have pushed prices up sharply.

E. SPECIAL PURPOSE SAWMILLS

This section deals principally with producers of two products – *shingles and shakes* (hereafter referred to as "shingles") and *cooperage* stock (the material from which barrels and kegs are produced). In 1967 firms in this category shipped $115.6 million of goods but by 1971 shipments had dropped to $99.3 million.

1. Industry Segments

The U.S. County Business Patterns reported 452 firms in this category in 1971 and total industry employment of 6,185 persons. Small firms dominate the industry in terms of employment as reflected in the distribution of firms by employment size shown below:

Employment Size Category	1-3	4-7	8-19	20-49	50-99	100-249	250-499	500+
Number of Reporting Units	138	83	136	71	20	4	–	–
% of Reporting Units	31%	18%	30%	16%	4%	1%	–	–
		79%						

Source: 1971 County Business Patterns.

The industry should be segregated into categories according to principal product manufactured for the following reasons:

1. Shingle producers do not manufacture cooperage nor vice versa.
2. The manufacturing technologies are quite different.
3. Shingle manufacture is centered in the West (Oregon and Washington had 45% of the units reported in SIC 2429 in 1971) while cooperage is produced in the Eastern U.S.
4. Shingles are made from softwood (mainly cedar) while cooperage is made from hardwood (mostly oak).

2. Shingle Producers

During 1967, shingles shipped had an aggregate value of $60.9 million and domestic industry production totalled about 3.5 million "squares" which is the unit of production. This level of production was estimated to equal about 50% of U.S. consumption with the balance imported entirely from Canada (British Columbia). Red cedar is the raw material for 95% of the shingles produced.

Shingles are sold almost exclusively for usage in new construction and for maintenance (roof repair). As a result, prices tend to be volatile depending upon the building cycle. In addition old growth Red Cedar, the principal raw material, is not in plentiful supply and total U.S. production capacity is limited by this decreasing resource.

Sales are generally made to wholesalers or sales agents as very few producers are large enough to control their own distribution. Consumption is regional and during 1971 four states accounted for over 67% of consumption.The leading consuming states were California (34%), Texas (19%), Washington (9%), and Oregon (4%).

a. Types of Firms

Firms active in this industry sector are small, independent and family-owned and operated. This is a specialized, low-barrier to entry, low-margin business sector. The active firms have been in the business through several generations and are managing to continue operations in spite of the declining market.

b. Types of Mills

Shingle producers are distinguished most by their very small size. The industry trade association is the Red Cedar Shingle and Handsplit Shake Bureau and their 1973 membership roster lists 226 firms operating in Oregon, Washington, and Idaho. These producers are believed to represent over 90% of U.S. production, implying average sales per firm are only $200,000-$250,000. About 30% of shingle producers or 75 firms will be affected by the proposed regulations. Of this group, 10% operate using log or mill ponds.

Most shingle mills may not be affected because they utilize dry decks only for log storage. An inventory of association members showed 160 mills (71%) used dry decks only, 44 mills (19%) used wet decks, and 22 mills (10%) have log or mill ponds. This means only 29% of producers will be affected if the proposed regulations are put into effect.

Table II.E.1 presents the same analysis of estimated plant value for the 66 firms identified who would be affected by the proposed regulations.

c. Financial Profiles

The most important equipment shingle producers utilize is *shingle machines* and *shake resaws*. The current cost of these machines is about $20,000 and $10,000 respectively and such equipment usually represents about 40% of the total value (exclusive of land) of a mill. Table II.E.2 below is a distribution of the estimated replacement cost and estimated total value of plant (exclusive of land) for the association member mills. Using this method of estimating assets employed, we calculate over 70% of producers have a replacement value of plant under $100,000 indicating the very small scale of operations which prevail.

TABLE II.E.1

DISTRIBUTION OF AFFECTED SHINGLE MILLS BY
ESTIMATED REPLACEMENT VALUE OF
TOTAL PLANT ASSETS

Estimated Replacement Value of Total Plant Assets	No. of Mills With Wet Decks	No. of Mills With Log or Mill Ponds	Total Percent
Up to $50,000	11	3	21%
$ 51,000 to $100,000	11	5	24
$101,000 to $200,000	15	8	35
$201,000 to $500,000	4	5	14
Over $500,000	1	1*	3
Not Reported	2	—	3
Total	44	22	

*Has both wet deck and log pond.

Sources: Op. cit., Arthur D. Little, Inc., estimates and Red Cedar Shingle and Shake Bureau.

d. Pricing

There is no pattern of price leadership by any single dominating firm. Prices are set based on market demand for and supply of competitive materials, e.g., aluminum and vinyl clad siding, or plywood and hardboard exterior paneling. The individual producer of shingles has virtually no influence on the price of its end product.

3. Cooperage Producers

Cooperage mills are located mainly in the Eastern states near sources of oak lumber. Many mills in fact are actually portable facilities which are moved from site to site rather than permanently situated.

TABLE II.E.2

DISTRIBUTION OF SHINGLE MILLS BY
ESTIMATED REPLACEMENT VALUE OF
PRINCIPAL MACHINERY AND TOTAL PLANT ASSETS

Replacement Cost of Shingle and Shake Machines	Estimated Total Value of Plant Assets (exclusive of land)	No. of Firms	Percent of Firms
Up to $20,000	Up to $50,000	118	52%
$21,000 to $ 40,000	$ 51,000 to $100,000	45	20
$41,000 to $ 80,000	$101,000 to $200,000	34	15
$81,000 to $200,000	$201,000 to $500,000	12	5
Over $200,000	Over $500,000	2	1
Not Reported	–	15	7
Total		226	100%

Sources: Arthur D. Little, Inc., estimates and Red Cedar Shingle and Shake Bureau, Seattle, Washington.

Staves are produced from bolts or billets which are logs that have been bucked to the desired length. They are not debarked prior to sawing nor is the residue usually chipped. Very few mills are believed to wet deck logs and none are known to use log ponds.

Whiskey producers are the largest market for barrels and are estimated to consume over three fourths of industry production. The other important markets utilize barrels for a variety of industrial shipping purposes.

Most cooperage producers make staves and heading (barrel ends) only and do not carry the manufacturing process forward to also make barrels and kegs. Table II.E.3 indicates the proportion of cooperage producers estimated to make various cooperage products.

TABLE II.E.3

% OF 69 COOPERAGE PRODUCERS
MAKING SELECTED PRODUCTS

	#	%
Tight Staves and Heading	44	75
Tight Barrels and Kegs	16	27
Slack Staves	3	5
Slack Heading	2	3
Slack Barrels and Kegs	4	7
Total	69	n.g.

Source: The Associated Cooperage Industries of America

The estimated financial strength of 69 cooperage producers identified is shown in Table II.E.4. Because of their small size and the mobile nature of the industry, very few producers are rated by financial reporting services.

TABLE II.E.4

ESTIMATED FINANCIAL STRENGTH OF 69
COOPERAGE PRODUCERS

Net Assets	#	%
Up to $35,000	2	3
$35,000 to $125,000	4	7
$125,000 to $500,000	3	5
$500,000 to $1,000,000	–	–
Over $1,000,000	7	12
No Net Assets Determined	14	24
Not Reported	28	48
	58	

Source: The Associated Cooperage Industries of America, St. Louis, Missouri, Op Cit, Lumbermen's Redbook.

Cooperage production does not involve use of wet decks or log ponds and therefore no water pollution is known to result.

F. PARTICLEBOARD

1. Industry Structure

a. Product Definition*

Particleboards are board products which differ from conventional fiberboards in that they are composed of distinct particles of wood or other ligno-cellulosic materials which are bonded together with an organic binder. The "particles" vary in size and must be distinguished from the fibers used in insulation and hardboard. Other terms used for particleboard include chipboard, flakeboard, silverboard, shaving board, and wood waste board. Particleboard is a highly engineered product which can be formed to meet varied specifications. As a result of its being produced in wide density ranges, it is usually divided into categories of low density (0.25 to 0.40 g/cm^3) (15 to 25 lb/ft^3), medium density (0.40 to 0.80 g/cm^3) (25 to 50 lb/ft^3), and high density (0.80 to 1.20 g/cm^3) (50 to 75 lb/ft^3).

Low density particleboards are manufactured specially for their lightness of weight for use either as panel material, where heat or sound insulation is important, or as a core in veneered constructions where weight savings are important. These boards are usually manufactured in thicknesses of no greater than 2.5 cm (1 inch).

Most of the particleboard currently produced can be classified as medium density board having a density some 10 to 20 percent higher than that of the species of wood or material used. This density range yields the most desirable properties per unit weight and is easiest to produce. The mat-formed board may be homogeneous throughout its thickness with respect to the particles used; or it may be composed of two or three different layers. Extruded particleboard, however, must use the same type of particle throughout its thickness because of the nature of its production.

High density particleboard is quite similar to hardboard in density, appearance, and application, the basic difference being one of bond. It is usually produced in the same thicknesses as conventional hardboard, and the small sized particles which are used may approach wood fiber in size.

b. U.S. Production and Shipments

Production and shipments of particleboard have experienced a faster rate of growth than any other forest product over the past decade. For example, production (3/4" basis) has increased from 496 million square feet in 1963 to a high of 3117 million square feet in 1972, an annual increase of 22%. Every year in this period has shown an increase over the previous one and, although the rate of growth has slowed with time, it is still a great deal

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*As contained in the Development Document.

TABLE II.F.1

SHIPMENTS OF PARTICLEBOARD, 1966-1972

Year	Million Square Feet (3/4" basis)	$ Million	Average Value ($/MMSF) Actual	Relative*
1966	883.2	88.7	100	108
1967	1050.9	97.1	92	92
1968	1371.2	141.9	104	103
1969	1615.3	200.8	124	140
1970	1662.2	159.4	96	74
1971	2299.6	206.3	90	67
1972	3013.4	289.6	96	69

*Relative to All Commodities price index, 1967 = 100.

Source: U.S. Department of Commerce "Current Industrial Reports" Series MA-24L.

faster than the growth being experienced by its consuming industries. The shipments of particleboard in the period 1966-1972 are shown in Table II.F.1. The value of shipments, in current dollars, indicates a declining trend in average value per thousand square feet of board; this decline is all the more significant when viewed on a constant dollar basis, i.e., relative to the all commodities price index.

Historically, the western region of the United States has been the principal producing area. Particleboard plants were established to utilize waste from saw mills and other forest product operations. The regional distribution of production, shown in Table II.F.2, indicates that the recent growth in production has been much more rapid in the southern states, especially the West South Central region which includes Arkansas, Texas and Louisiana. For example, Western states' production of particleboard decreased from 55% of the total in 1968 to 44% in 1972; production in the West South Central states increased from 10.5% to 18.5% in the same period.

TABLE II.F.2

PRODUCTION OF PARTICLEBOARD, BY REGION 1968-1972
(1000 sq. ft., 3/4" basis)

	1972	1971	1970	1969	1968
East	210,902	178,899	153,197	164,023	132,449
South Atlantic	605,635	420,578	315,644	289,248	242,980
East South Central	347,394	258,654	169,436	155,186	122,034
West South Central	574,361	402,990	238,990	226,232	150,539
West	1,378,955	1,132,638	886,281	881,370	776,986
TOTAL U.S.	3,117,247	2,393,760	1,763,548	1,716,059	1,424,988

Source: U.S. Department of Commerce "Current Industrial Reports" Series MA-24L.

Floor underlayment board, used as a base to carpeting and resilient flooring in residential construction, represented nearly 40% of the 1968 production but this proportion dropped to 30% in 1972, despite the considerable growth experienced by the residential sector (+60%) during that period. (Table II.F.3) The growth rate of 14.5% compares to that of about 27% for industrial grades; the latter increased their proportion of the total from 61% to 70%. Floor underlayment grades are predominately in the 5/8" size while industrial board for furniture and other manufacturing industries is distributed between many thicknesses with an even concentration in the 3/4" and 5/8" sizes. It is anticipated that the proportion of underlayment grades will continue to decline and will thus result in a higher average unit value on a constant dollar basis.

TABLE II.F.3

PRODUCTION OF PARTICLEBOARD BY TYPE, 1968 & 1972
(MMSF, 3/4" basis)

	1968		1972	
Product	MMSF	%	MMSF	%
Total	1391	100	3117	100
Floor Underlayment	547	39.4	941	30.1
5/8" board	384	27.6	644	20.6
3/8" board	82	5.9	130	4.1
Other	82	5.9	168	5.3
Industrial and Other	844	60.6	2176	69.8
3/4" board	N.A.	-	708	22.7
5/8" board	N.A.		676	21.6
1/2" board	N.A.		238	7.6
Other	N.A.	-	553	17.7

Source: U.S. Department of Commerce "Current Industrial Reports" Series MA-24L

It is significant to note that particleboard manufactured by the mat forming process represents all but 38 million square feet of total 1972 production of 3.1 billion square feet. Extruded board has not enjoyed any long-term growth and, in fact, decreased from a total of 49 million square feet in 1965 to 38 million square feet in 1972. This extruded board is almost entirely of captive production by furniture manufacturers in the Southern states, although one new plant came on stream in California in 1972.

Domestic trade in particleboard between the U.S. and foreign countries has been negligible and is mostly with bordering countries. As Table II.F.4 shows, exports have increased considerably in the period 1970-1972, from 11.8 million square feet to 53.8 million square feet, but still represent an extremely small proportion of total U.S. production (1.7%). The value of exports "free alongside ship" totalled 6.3 million dollars in 1972. Imports have also grown in recent years but still represented less than 1% of the value of apparent consumption in 1972.

TABLE II.F.4

EXPORTS AND IMPORTS OF PARTICLEBOARD

	Exports		Imports	
Year	MMSF	$MM	MM Lbs.	$MM
1970	11.8	1.6	10.2	0.6
1971	23.9	3.2	23.9	1.4
1972	53.8	6.3	33.8	1.9

Note: Export value "free alongside ship." Import value is market value in foreign country, excluding, freight, insurances, taxes, duties.

Source: U.S. Department of Commerce Schedule "B".

c. Applications

Particleboard's rapid growth has been due in part to the overall growth of industrial and construction activity in the past few years, but mainly to its displacement of other materials in both of these markets. The product that is threatened most severely by particleboard is softwood plywood, but hardwoods are also being displaced in furniture applications. This displacement has been taking place on the basis of more favorable economics but the particleboard industry has at the same time been improving the quality of various grades. For example, underlayment grades have improved performance and are gaining acceptability in the past five years; these have rapidly displaced softwood plywood in residential and mobile home construction as prices for the latter have continued to increase. In furniture applications, industrial corestock grades have also improved in performance and furniture manufacturers are able to work the board into various forms without affecting its structural integrity.

The largest single application of particleboard is in underlayment, both conventional and mobile home decking. These two applications represent approximately 30% of total particleboard consumption. An additional 5% also serves the construction industry, but mostly for interior applications such as shelves, partitions and doors. The furniture and cabinet applications represent approximately 55% of consumption with kitchen and other cabinet manufacturers and household furniture each taking approximately 20% and commercial and institutional furniture applications, the remainder. The balance (10%) of U.S. consumption is mostly in industrial, do-it-yourself and miscellaneous applications.

Much of recent particleboard market growth has been stimulated by the growth of the consuming industries. For example, housing starts increased from 1.5 million units in 1970 to 2.4 million units in 1972, an aggregate growth of 60%, in comparison to the growth of particleboard at 80%. Although future growth will still be largely dependent on that anticipated in the construction, cabinet and furniture industries, particleboard will continue

to grow at a much more rapid rate than the customer industries and will be used increasingly in newer applications.

Housing starts are unlikely to reach the levels set in 1972 before the end of the decade and so considerable downward pressure will be placed on the underlayment sector of the particleboard industry. However, the U.S. Forest Service has projected unit demand for particleboard in residential construction to grow as follows:

	(Square Feet, 3/4" Basis)		
Year	1- and 2-Family	Multifamily	Mobile Homes
1970	250	55	560
1980	420	70	650
1990	590	85	715

Source: U.S. Department of Agriculture: *Outlook for Timber in the U.S.*

The growth of the furniture industry will range from 4% for household furniture to 8% for commercial and institutional and 10% for the cabinet industry, but the growth of particleboard consumption in these sectors is likely to be at least twice these rates. In summary, we anticipate that the unit growth in particleboard consumption will average 12% to 15% per year for the remainder of this decade.

The medium density fiberboard (40 to 45 lbs./cu. ft.) proportion of particleboard shipments, currently representing about 12% of total production, will grow very rapidly as much of new plant additions and capacity expansions are in this specialty type of board serving the furniture corestock industry.

d. Marketing and Distribution

The distribution channels used to market particleboard are mainly dependent on whether new construction, OEM or remodeling markets are being served. Particleboard used as underlayment in new construction is distributed through building materials wholesalers and retailers and sold to homebuilders. Physical distribution from the plant to the wholesalers is mainly by rail, with some local truck shipments. A similar channel of distribution serves the remodeling and do-it-yourself purchasers but the unit sales at the retail level are in considerably smaller volumes.

OEM markets, principally the cabinet, furniture and mobile home industries, are served by direct shipments after prices and contractual details are established between the mills and the customers. A large proportion (perhaps one-half) of the industrial board is cut-to-size to customer specifications by the manufacturer before shipment and edge banding may also take place. Some distribution is carried out through wholesalers, especially in the case of kitchen cabinet manufacturers and other small industrial customers which do not qualify for

the volume quantities demanded for direct shipments. Some pooling of shipments can also take place for these users.

2. Types of Firms

Manufacturers of particleboard span the spectrum of industrial firms in terms of size, diversification, assets and form of ownership. The following principal groupings can be identified:

- Major integrated forest products companies, such as Champion International and Weyerhaeuser, who operate many facilities and who utilize waste from their other operations in making the board.

- Other major forest products corporations, such as Masonite and American Forest Products, with only one facility.

- Small firms which are divisions or subsidiaries of larger corporations, such as Kirby Lumber and Wickes Forest Industries.

- Furniture companies which operate a particleboard plant largely for captive consumption, such as Bassett and Broyhill.

About 38 companies operate the 75 plants, with Georgia Pacific owning 6 locations with a total capacity of 416 million square feet (11% of industry). The largest four companies operate 36% of capacity.

3. Types of Plants

The particleboard industry presently consists of 74 manufacturing facilities, 67 producing a mat formed board and the remainder, an extruded type. These plants are listed in Table II.F.5, together with the capacity, product trade names and uses for each.

Total industry capacity was approximately 3.3 billion board feet in 1972 and capacity utilization approximately 91%. Medium density fiberboard and other specialty boards represented about 20% of total capacity. Announced capacity additions, listed in Table II.F.6 (including 11 new plants), will increase industry capacity to approximately 4.7 billion square feet by 1976; capacity utilization in 1973 through 1976 will be lower than the 1972 level, especially in the West, but will reach 90% shortly.

The geographic distribution of manufacturing capacity is shown in Table II.F.7. More than half of the plants are located in the South with only 8 in the East and the remainder in the West. The principal manufacturing state is Oregon, with North Carolina having the second largest concentration of facilities. Future additions to capacity are dispersed but again with heavy concentration in the South and West.

TABLE II.F.5

PARTICLEBOARD PLANTS (MAT FORMED) – U.S.A.

Company	Location	Capacity (MMSF-3/4" basis)	Tradenames	Uses
American Forest Products Corp.	Martell, Calif.	100		
Basset Furniture	Bassett, Va.	20		Corestock, furniture
Boise Cascade Corp.	LaGrande, Oregon	170	BCC underlayment, BCC industrial BCC mobile home decking	
Broyhill Furniture	Lenoir, N.C.	30		Corestock, furniture
Carolina Forest Products, Inc.	Wilmington, N.C.	12	Shav-Bond, Dina-Shav	Furniture, toys, lumber banking, custom routing & shaping
Cascade Fiber Co.	Eugene, Oregon	52	Firlok, Fircraft	Underlayment, furniture core
Champion International	Redding, Calif.	43	Fiber Face Novoply, Novowood, Novodeck, Corteza	Doors, Cabinet and furniture, stock, shelving, games, underlayment, store fixtures
Champion International	Gaylord, Michigan	98	Novoply, Novowood, Novodeck	Core stock, furniture, shelving, cabinets, coach floor, doors
Champion International	North Oxford, Miss.	104	Novoply, Novowood, Novodeck	Core stock, furniture, shelving, cabinets, coach floor, doors
Champion International	South Boston, Va.	70	Novoply, Novodeck	Core stock, furniture, shelving, cabinets, coach floor, doors
Cladwood Co.	Virginia, Minn.	13	Cladwood	Exterior siding & building board
Cladwood Co.	Sweet Home, Oregon	10	Cladwood	Siding for home and industrial uses; soffet, gables and all ext. use.
Clear Fir Products Co.	Springfield, Oregon	10	Custon-Carv Plantons, Denswood, Castwood	Shelving, decorative material, door panels

TABLE II.F.5 (Continued)

Company	Location	Capacity (MMSF-3/4" basis)	Tradenames	Uses
Collins Pine Co.	Chester, Calif.	24	Collins Flakeboard, Collins Coreboard, Collins Door-core	Core stock, door stock
Evans Products Co.	Missoula, Mont.	76	Evans, Evans Dyna-Bord	Industrial core stock, underlayment
Florida Plywood	Greenville, Fla.	10		
Georgia Pacific Corp.	Crossett, Ark.	33	Georgia Pacific Particleboard	Underlayment & core
Georgia-Pacific Corp.	Ukiah, Calif	85		
Georgia Pacific Corp.	Vienna, Ga.	85	G-P Particleboard	Core stock & underlayment
Georgia Pacific Corp.	Louisville, Miss	55	G-P Particleboard, G-P floor underlayment, Georgia-Pacific Mobile Home Underlayment	Core stock & underlayment
Georgia-Pacific Corp.	Taylorsville, Miss.	90		
Georgia-Pacific Corp.	Russellville, S.C.	100	G-P Particleboard	Underlayment & core stock
Giles & Kendall Inc.	Maysville, Ala.	7	Cedarline	Closet lining & decorative paneling
Golden State Building Products	Redlands, Calif.	30	Econline, Edgetite	Floor underlayment, furniture core, spec. applications
Hambro Forest Products Inc.	Crescent City, Cal.	23	Cresdek, Crestflake, Creslay	Mobile home decking, industrial, underlayment
Humboldt Flakeboard	Arcata, Calif.	85	Humboldt Flakeboard, Mobil-dek, X-57 Modular	Cabinets, furniture laminates, shelving, mobile home flooring
International Paper Co.	Malvern, Ark.	70	Long-bell, Flakelock, Filcote	Industrial core stock, cabinets, countertops, fixtures, partitions, underlayment

TABLE II.F.5 (Continued)

Company	Location	Capacity (MMSF-3/4" basis)	Tradenames	Uses
International Paper Co.	Greenwood, S.C.	75	Long-bell, Flakelock, Filcote	Industrial corestock, cabinets, countertops, fixtures, partitions, underlayment, gen'l. const.
International Paper Co.	Longview, Wash.	12	Long-bell	Underlayment, gen'l. const.
Kroehler Mfg. Co.	Meridian, Miss.	18	Maxi-Board	Furniture mfg.
Louisiana Pacific Corp.	Urania, La.	72	Georgia-Pacific Particle-board, G-P Flakeboard, G-P mobile home decking	Core stock & underlayment
Louisiana Pacific Corp.	Corrigan, Texas	90		
Masonite Corp.	Waverly, Va.	65	Presdflake, Masonite Underlayment	Furniture, toys, mobile home & commercial const & underlayment
Mexwood Products Inc.	Albuquerque, N.M.	30		Underlayment, core stock
Nu-Woods Inc.	Lenoir, N.C.	22	Lignabond, Homo, Super 3/Layer	Furniture
Olinkraft Inc.	Lillie, La.	102	Tuf-flake	Underlayment, mobile home-decking, industrial
Pack River Co.	Sandpoint, Idaho	20	TENEX, Ranch N' Cabin	Interior wall paneling ceiling tile, utility board
Permaneer Corp.	Hope, Ark.	18		All output used internally
Permaneer Corp.	Black Mountain, N.C.	18	Dor-Core	Output used internally; Dor-Cor & drawer sides sold externally
Permaneer Corp.	Brownsville, Oregon	27		All output used internally
Permaneer Corp.	Dillard, Oregon	34		All output used internally
Permaneer Corp.	White City, Oregon	45		All output used internally
Permaneer Corp.	Jackson, Texas	18		All output used internally

TABLE II.F.5 (Continued)

Company	Location	Capacity (MMSF-3/4" basis)	Tradenames	Uses
Rodmann Industries Inc.	Marinette, Wisc.	20	Resincore	Furniture
Roseburg Lumber Co.	Roseburg, Oregon	300	Resin-tite	Furniture core stock, industrial applications
The Singer Co.	Trumann, Ark.	21		Furniture Parts
Southwest Forest Industries	Flagstaff, Ariz.	24	Kachinaboard	Printing, laminating, furniture, cabinets, drawer parts
Stoors Wood Products	Evanston, Ind.	17	Trimwood	Corestock, furniture stock, cut-to-size, door stock, dinette seats
Temple Industries	Thompson, Ga.	100		
Temple Industries	Diboll, Texas	85		
Temple Industries	Pineland, Texas	10		
Tenn-Flake Corp.	Middlesboro, Ky.	50	Tenn-Flake	Core mat'l for vinyl, high pressure laminates, printing and embossing
Tenn-Flake Corp.	Morristown, Tenn.	9	Tenn-Flake	Core mat'l for vinly, high pressure laminates, printing and embossing
Timber Products Co.	Medford, Oregon	60	Thunderboard, Totemboard, T.P. Board	
Union Camp Corp.	Franklin, Va.	61		
Ward Industries Inc.	Miami, Okla.	31		Industrial
Westvaco Crop.	Tyrone, Pa.	4	Cedarfresh	Closet lining, decorative paneling
Weyerhaeuser Co.	Adel, Ga.	35	Timblend, Versabord	Furniture parts, core stock, floor underlayment, mobile home decking
Weyerhaeuser Co.	Broken Bow, Okla.	100		
Weyerhaeuser Co.	Klamath Falls, Oregon	56	Versabord, Timblend	Furniture core, floor underlayment

TABLE II.F.5 (Continued)

Company	Location	Capacity (MMSF-3/4" basis)	Tradenames	Uses
Weyerhaeuser Co.	Springfield, Oregon	90	Versabord, Timblend, Vinylhue	Underlayment, industrial, mobile home underlayment, vinyl substrate
Weyerhaeuser Co.	Marshfield, Wisc.	50	Timblend, door core, mobile home deck	Furniture corestock, door core, floor underlayment
Wickes Forest Industries	Chowchilla, Calif.	35		
Willamette Industries, Inc.	Ruston, La.	70	Duraflake South	Industrial, furniture decking, countertops, underlayment
Willamette Industries, Inc.	Albany, Oregon	160	Duraflake	Industrial and furniture requirements, decking underlayment
Willamette Industries, Inc.	Bend, Oregon	103	Alpine, Korpine, Florpine	Industrial corestock for furniture and cabinet requirements
American of Martinsville	Martinsville, Va.	10	Particle Board	Core stock in wood furniture
Dixie Chipboard Co.	Rural Hall, N.C.	12		Corestock, lumber banded furniture stock, cut-to-size panels, tubular partitions and door cores
Georgia-Pacific Corp. Williams Furniture Div.	Sumter, S.C.	12.5		Furniture parts
Jasper-American Mfg. Co.	Henderson, Ky.	7	Stylemasters	Lumber edge banded, table tops, kitchen cabinet doors, door cores
Lane Co., Inc.	Altavista, Va.	15	Lanewood	Furniture, core stock
Lenoir Chair Co. Pacemaker Div. Broyhill Industries	Newton, N.C.	4		Furniture
Woodcore, Inc.	Scottdale, Pa.	1.2	Scotbord	Core stock

Source: 1973 Directory of Forest Products Industry, July 1973 issue of Forest Industries.

TABLE II.F.6

ANNOUNCED ADDITIONS AND EXPANSIONS –
PARTICLEBOARD PLANTS

Blandin Wood Products	Grand Rapids, Minn.	– new
Champion International	Gaylord, Mich.	
Champion International	Bonner, Mont.	– new
Fibreboard Products	Rocklin, Calif.	– new
Georgia-Pacific	Whiteville, N.C.	– new
Georgia Pacific	Montacello, Ga.	– new
Golden State Building Products	Redland, Calif.	
Holly Hill Lumber	Holly Hill, S.C.	– new
Kirby Lumber	Silsbee, Tex.	
Louisiana-Pacific	Oroville, Calif.	– new
MacMillan Bloedel	Pine Hill, Ala.	– new
Medford	Medford, Ore.	– new
Olinkraft	Monroeville, Ala.	– new
Plum Creek Lumber	Columbia Falls, Mont.	– new
Permanee	Hope, Ark.	
Willamette Industries	Bend, Ore.	

TABLE II.F.7

GEOGRAPHIC DISTRIBUTION OF U.S. PARTICLEBOARD PLANTS

	Mat Formed	Extruded
Middle Atlantic	1	1
East North Central	4	–
West North Central	1	–
South Atlantic	14	5
East South Central	7	1
West South Central	13	–
Mountain	4	–
Pacific	23	–
	67	7

Plant capacities range from 7 million square feet, 3/4" basis, to the largest at 300 million square feet (Roseburg Lumber in Roseburg, Oregon). The largest concentration is in those facilities sized at between 25 and 100 million square feet of annual capacity. The average unit capacity is approximately 45 million square feet, 3/4" basis, but newer facilities are constructed at about 70 million square feet each.

4. Financial Profiles

In 1972, the average mill net price for particleboard in the United States, after appropriate discounts, was approximately $93. A typical plant with an annual capacity of approximately 70 million square feet, 3/4" basis, would have a net asset value of about $9 million and annual net sales of $6.0 million. Table II.F.8 illustrates the typical financial profile for such a facility.

TABLE II.F.8

FINANCIAL PROFILE – PARTICLEBOARD PLANT

		%		$ (1,000)
Net Sales		100.0		6,000
Cost of Goods Sold	63.0		3,780	
G.S. & A.	10.0		600	
		73.0		4,380
Operating Profit		27.0		1,620
Provision for Income Tax		13.5		810
Net Income on Sales		13.5		810
Return on Net Assets		9.1		

Net Assets: $9,000,000
Annual Capacity: 70,000,000 SF (3/4" basis)
Employees: 200

Source: Arthur D. Little, Inc., estimates.

1972 represented a good "typical" year for analyzing the financial performance of the industry; 1973 undoubtedly was more profitable. A combination of lower capacity utilization rates, especially in the West, and steeply increasing raw materials and resin costs will dampen performance to 1971-72 levels in the period 1974-1976. It is thus important to base the economic impact analysis on 1972, a representative year.

5. Pricing

Price setting in the particleboard industry depends very largely on the product being considered. Underlayment and mobile home decking are regarded as commodities and the products are priced to reflect market demand, the costs of substitute materials and capacity utilization rates. Underlayment and mobile home decking products thus vary greatly in price from year to year, even from week to week. The average selling price in constant dollars, however, has declined steadily over the past decade until 1972 but has increased sharply since then. The steady decline in prices resulted primarily from increased efficiency in the

industry as manufacturing processes became more sophisticated and automated (the industry is relatively young) but also as additions to capacity shrunk the competitive radius for a particular mill to a regional, rather than a national one. Two levels of prices are prevalent in the United States today – those representing plants located in the South and East and those for the West.

Consumption of underlayment is largely related to housing starts and thus it is concentrated in the more populous regions, especially the Northeast and Midwest where product acceptability and house design have been favorable. Thus, freight equalization from regional manufacturers takes place and f.o.b. mill prices for Southern suppliers are a great deal lower than for those in the Northwest. Delivered prices, however, will generally be equivalent.

The following f.o.b. mill prices, after appropriate discounts, existed in December, 1972, and December, 1973 for underlayment grades:

5/8" Particleboard Underlayment (S/MSF)

	West	South
December 1972	53	38
December 1973	120	100

The steep increases in prices to some extent reflected price decontrols but also resulted from the relative unavailability of plywood (many customers were on allocation during 1973) and the resulting strong demand for particleboard by furniture manufacturers. These price levels will not be maintained during 1974; prices should drop to about $80 and $65 for the West and South, respectively, reflecting the steep decline in housing starts this year, then remain relatively stable but reflecting the cyclicality of housing starts.

The pricing for corestock and industrial grades is very different from that of underlayment, and historically more stable. The product is used in various structural applications where physical characteristics and performance (such as wear, durability, screwholding, abrasive resistance, tensile strength, smoothness, etc.) are extremely important. Customer requirements will vary depending upon the end use of the product and thus a great deal of product differentiation, and even the use of brand names, takes place. A furniture manufacturer, for example, will examine and test a range of boards before selecting those that meet his specifications. He will then negotiate a contract to reflect price, quantities and delivery schedules with the suppliers. Any manufacturer wanting its particleboard to be selected by a potential customer must thus submit the product for performance and economic evaluation.

Thus, although product prices fall in a number of general ranges to reflect different levels of quality, there is no quoted market price for corestock grades and most prices are negotiated directly to reflect both the performance standards and the services (cutting to

shape, edge banding, etc.) that the manufacturer will provide. Prices for corestock grade are higher than for underlayment.

Table II.F.9 shows the actual average selling prices prevalent for underlayment and corestock grades originating in both the West and South during 1972 and developed in our surveys at that time. It is interesting to note the reversal in the relationship between these prices from each region. For example, underlayment grade from the West is 50% more expensive than from the South on a mill net value after appropriate discounts. The reverse is true for the corestock grades. Southern products are more expensive. This pricing strategy reflects in part the principal concentrations of demand for each type of product. Underlayment grades are largely being shipped to the Midwest and Northeast while corestock grades will serve the furniture industry concentrated in the South. Thus, in order for the Western mills to compete with the South for the corestock grades, a larger allowance for freight must be made. In addition, however, the southern mills have the capabilities to produce a higher quality, and thus a more expensive product than plants in the West.

TABLE II.F.9

PARTICLEBOARD PRODUCTION AND VALUES, 1972
(3/4" basis, mill net values after discounts)

	Underlayment			Corestock & Other			Total		
	MMSF	$/MSF	$MM	MMSF	$/MSF	$MM	MMSF	$/MSF	$MM
West	320	54	17.3	1059	90	95.3	1379	82	112.6
South and East	621	38	23.6	1117	130	145.2	1738	97	168.8
United States	941	43	40.9	2176	111	240.5	3117	90	281.4

Source: U S. Department of Commerce "Current Industrial Reports," Series MA-24L, and Contractor estimates.

G. MILLWORK

This sector covers producers of millwork products which includes mainly window units, parts, and farms; doors; finished wood mouldings; and cabinet work and architectural millwork. Table II.G.1 lists the principal millwork product categories shipped during 1967 and 1971.

TABLE II.G.1

MILLWORK SHIPMENTS BY TYPE OF PRODUCT: 1967 AND 1971
($ million)

	1967	1971
Windows, parts, and frames	246.0	351.6
Doors	404.9	547.8
Finished wood mouldings	195.7	365.6
Cabinet work to be built in and architectural millwork	249.5	415.1
Millwork N.S.K.	241.0	260.1
Total	1,337.1	1,940.2

Sources: 1967 Census of Manufactures, 1971 Annual Survey of Manufacturers.

These firms are not likely to be affected by the proposed regulations because:

a. They do not use glue extensively.

b. Many are small "garage shop operators" or ancillary to other activities (i.e., a door shop owned by a retail lumber dealer) and

c. Almost all firms are located within cities and have access to city waste disposal facilities.

1. Industry Structure

A large number of firms participate in the millwork industry. During 1972 the U.S. County Business Patterns reported there were 2,729 firms employing 78,153 persons in the United States in this industry. Table II.G.2 shows the distribution of firms and employment by state. Although the states which are producers of lumber have a sizable share of employment, the industry is fairly broadly dispersed across the United States.

An analysis of industry shipments shows the dependence of millwork producers on new construction. The Arthur D. Little, Inc. input-output model analysis shows 82% of demand associated with new construction and an additional 4% with maintenance construction (see Table II.G.3). Within the construction sector, 67.2% is the result of new residential construction, a highly cyclical industry.

TABLE II.G.2

1972 DISTRIBUTION OF FIRMS AND EMPLOYMENT
SIC 2431 MILLWORK AND
SIC 2433 PREFABRICATED WOOD STRUCTURES

State	Millwork SIC 2431		Prefabricated Wood Structures SIC 2433	
	No. of Employees	No. of Reporting Units	No. of Employees	No. of Reporting Units
U.S. Total	78,153	2,729	33,848	703
Alabama	1,478	50	1,275	24
Alaska	–	–	–	–
Arizona	1,434	35	613	11
Arkansas	283	9	301	6
California	8,052	382	2,366	55
Colorado	(D)	27	370	8
Connecticut	409	37	165	9
Delaware	(D)	2	–	–
District of Columbia	(D)	5	–	–
Florida	3,568	163	1,596	47
Georgia	997	51	1,230	28
Hawaii	221	10	–	–
Idaho	792	19	(D)	6
Illinois	2,911	132	941	19
Indiana	1,799	49	2,289	36
Iowa	2,032	15	(D)	17
Kansas	489	30	–	–
Kentucky	687	18	181	4
Louisiana	1,077	42	244	8
Maine	–	–	–	–
Maryland	1,267	41	(D)	8
Massachusetts	1,252	75	(D)	11
Michigan	1,505	84	1,514	42
Minnesota	3,406	69	701	18
Mississippi	661	27	509	8
Missouri	1,577	50	469	12
Montana	387	9	117	6
Nebraska	357	20	160	9
Nevada	–	–	–	–
New Hampshire	660	18	706	5
New Jersey	1,873	102	(D)	5
New Mexico	(D)	21	(D)	3
New York	3,333	184	1,863	32
North Carolina	1,395	63	1,210	14
North Dakota	–	–	(D)	2
Ohio	(D)	75	2,819	43
Oklahoma	895	30	203	9
Oregon	4,495	77	389	12
Pennsylvania	106	14	215	4
Rhode Island	(D)	13	–	–
South Carolina	954	35	311	10
South Dakota	(D)	10	(D)	2
Tennessee	1,528	47	430	13
Texas	6,767	179	950	32

TABLE II.G.2 (Continued)

State	Millwork SIC 2431 No. of Employees	Millwork SIC 2431 No. of Reporting Units	Prefabricated Wood Structures SIC 2433 No. of Employees	Prefabricated Wood Structures SIC 2433 No. of Reporting Units
Utah	369	24	148	6
Vermont	–	–	–	–
Virginia	2,868	48	1,671	18
Washington	3,057	99	887	27
West Virginia	–	–	–	–
Wisconsin	–	–	–	–
Wyoming	–	–	–	–

Sources: 1972 County Business Patterns, Maple Flooring Manufacturers Association, and National Oak Flooring Manufacturers Association.

The industry can be segregated into three categories for purposes of determining the impact of the proposed water pollution control standards:

- manufacturers of mouldings
- manufacturers of doors and windows
- local producers and assemblers of door units, window units, and cabinetry.

Moulding production is the most concentrated of the sectors and this product represents about 20% of millwork industry production. Ponderosa Pine is the species of wood used most commonly and is estimated to represent 85% of production.

2. Types of Firms

The industry is quite fractionated with the 8 largest companies producing only 13% of output in 1970. Among producers of moulding, 35 companies are believed to possess 80% of industry capacity but none of these firms are dominant.

Moulding producers purchase rough lumber to process and although many producers are owned by companies which also produce lumber, most moulding plants are separate. The "shop" and "moulding and better" grades used to make mouldings represent only a small fraction of the lumber produced from a log. No moulding plant would use the entire output of one sawmill. For this reason if a moulding plant and sawmill do share a site, the larger producing unit would be the sawmill.

TABLE II.G.3

1972 DISTRIBUTION OF SHIPMENTS
SIC 2431 MILLWORK

Buyers	Percent of Shipments
Maintenance Construction	3.9%
Logging Camps & Contractor	–
Sawmill & Planing Mills	1.2
Hardwood Dimensions & Flooring	–
Millwork Plants	.4
Veneer & Plywood Plants	1.6
Prefabricated Wood Products	.4
Wooden Containers	.3
Wood Preservative & Miscellaneous Products	.2
Household Furniture	1.1
Office Furniture	.4
Fiber Cans	–
Fabric Plastic Products	–
Brick & Structure Clay Tile	–
Concrete Block & Brick	–
Fabricated Structure Steel & Metal Doors	.4
Fabricated Platework	–
Sheet, Architecture, Miscellaneous Metal Work	–
Stamp & Screw Machine Products	–
Hardware, Plating, & Wire Products	.3
Blowers & Exhaust Fans	–
Nonelectric Machine Shop Products	–
Vending & Aircondition Equipment	–
Other Household Appliances	–
Electric Light & Wire Equipment	–
Boat Building	.8
Mobile Homes & Campers	4.3
Surgical & Medical Instruments	–
Jewelry, Toys, Sport, Miscellaneous	.5
Wholesale & Retail Trade	2.6
Real Estate & Rental	.2
Total	**18.3%**
Components	
Inventory	.4%
New Construction	81.9
Competitive Imports	–
Exports	.3
Total	**81.7%**
Category	
Single-Family Residential	42.8%
Two to Four Unit Residential	1.2
Garden Apartments	7.5
High-Rise Apartments	1.3

TABLE II.G.3 (Continued)

Category	Percent of Shipments
Alterations & Additions	14.4%
Nonhousekeeping Units	1.9
Industrial	.4
Office & Warehouse	1.2
Stores, Restaurants, Garages	1.0
Religious	.5
Private Educational	.3
Hospital & Institutional	1.0
Other Nonresidential	.6
Farm, Including Residences	1.2
Railroad	—
Telephone & Telegraph	.1
Electric Utilities	.1
Gas & Petroleum Pipelines	—
All Other Private	.1
Military	—
Conservation	.1
Sewer Systems	3.0
Water Systems	—
Public Residential	.3
Public Industrial	—
Public Educational	2.0
Public Hospital	.3
Other Public Structures	.8
Miscellaneous Public Construction	.2
Total	81.9%

Source: Arthur D. Little, Inc., input-output model.

Gluing operations in moulding plants are confined to the "finger joining" of small pieces of lumber and are not conducted on a large scale. We believe moulding plants do not use wash water as described in the proposed regulations and will not be affected. Most moulding plants are located within the city limits of incorporated communities and have city waste disposal facilities available.

Local producers of windows and door units and cabinetry are small operations. In the trade they are referred to as "door shops" and "cabinet shops." Door shops typically buy sets of door jambs and premanufactured doors which are then assembled by mechanical means into "pre-hung" units for sale to contractors or to retailers. They also produce garage doors on a local scale and some produce custom doors such as louvered doors.

Cabinet shops produce a variety of miscellaneous cabinetry such as book shelves, built-in closets, bathroom and kitchen cabinetry, commercial cabinetry for store and industrial use, etc. They are almost custom furniture manufacturers and their operations involve mostly mechanical means of assembly with only nominal glue usage. No sawmilling is undertaken for either group and lumber and plywood are the principal raw materials used.

Local producers of doors during 1972 may have produced from $400 to $500 million in product that year. Locally produced cabinetry and architectural millwork probably equalled this amount bringing the total for the two to between $800 million and $1 billion in sales or roughly 40-50% of the entire industry.

3. Types of Plants

Table II.G.4 shows the distribution of plants by employment size for millwork. This table shows that 70% of the producers have fewer than 20 employees.

TABLE II.G.4

DISTRIBUTION OF MILLWORK PRODUCERS BY EMPLOYMENT SIZE

No. of Employees	No. of Plants	% Plants
1-3	684	25
4-7	510	19
8-19	709	26
20-49	475	17
50-99	188	7
100-249	119	4
250-499	35	1
500 and over	9	–
Total	2,729	100

Plants producing wood windows and doors are the category most affected by the proposed standards. Although not engaged in sawmilling activities (hence not subject to log handling pollution problems) these producers do employ glue; however, the plants are generally large with a wide product line. Table II.G.5 lists the product offerings of 69 millwork manufacturers who are members of the National Woodwork Manufacturers Association. Besides the products these firms produce 75% also provide prefinishing services such as water repellant treating, factory prefinishing and priming.

4. Financial Profiles

Table II.G.6 lists the distribution of estimated financial strengths for the 69 millwork producers who are members of the National Woodwork Manufacturers Association. 45% of these firms fall into the "over $500,000" category.

TABLE II.G.5

PERCENT OF 69 WOODWORK MANUFACTURERS
PRODUCING VARIOUS PRODUCTS

Product	Number of Manufacturers	Percent of Total Number of Manufacturers
Frames, Doors	32	46.4%
Frames: Windows	22	31.9
Doors Hardwood	37	53 6
Doors: Softwood	33	47.8
Sash	28	40.6
Window Units	29	42 0
Services	53	76.8
Total No. of Manufacturers	69	

Source: National Woodwork Manufacturers Association, Chicago, Illinois

TABLE II.G.6

ESTIMATED FINANCIAL STRENGTH OF 69 WOODWORK MANUFACTURERS

Estimated Net Assets	Number of Manufacturing Firms	%
Over $1,000,000	25	36
$500,000 to $1,000,000	6	9
$125 000 to $500,000	12	17
$35 000 to $125,000	4	6
Net Assets Undetermined	22	32
Total	69	100

Sources: Op. cit., National Woodwork Manufacturers Association and Dun & Bradstreet's Redbook.

5. Pricing

Prices in the millwork industry in general are determined by the cost of raw materials and the cost of converting tempered by demand. The main cost is lumber and the price of this material varies widely. Although the grade of Pine used is consumed principally by the millwork industry, the price of this material is affected by construction lumber prices. Millwork producers (and industrial users) must pay enough for the product to prevent it being diverted into structural use, and this causes Pine prices to fluctuate with construction lumber prices.

Profits in the industry move coincidentally with prices. During periods of strong demand producers usually experience difficulty in securing adequate raw material supplies but are able to secure high prices for their products. During slow housing construction periods, raw materials are readily available but overcapacity is the rule and prices and profits are low.

More than most sectors of the wood based building materials industry, millwork has been under attack from a variety of displacement products. Wooden windows have already largely been displaced by aluminum windows and are estimated to have only about 30% of the market currently. Mouldings, particularly prefinished mouldings, have very recently lost substantial market share to extruded plastics. Hardwood flush doors are losing share to printed hardboard and particleboard faced doors while plastic window parts and cabinetry parts (including plastic doors) are being accepted. The impetus for this displacement has been recent high prices in millwork.

H. PREFABRICATED WOOD STRUCTURES

This section deals with the manufacture of prefabricated wood structures which is chiefly comprised of glue laminated beams, roof trusses, and housing component parts such as wall sections, etc. Truss and component producers will be unaffected by the proposed regulations, because they are not engaged in sawmilling and the method of manufacture commonly used employs mostly mechanical fasteners. Producers of glue-laminated beams are affected due to their use of glue.

1. Industry Structure

In previous years, up to 1972, this category also included producers of pre-cut and prefabricated wooden buildings. Their output accounted for 65% of 1967 production in SIC 2433 and in 1971, we estimate prefabricated buildings represented about the same proportion of output although industry production had more than doubled.

For the 1972 Census of Manufactures, this SIC code was changed to delete prefabricated and precut buildings. It is this SIC definition which we are using for this report; hence it is necessary to recast prior years' census data to allow for this change. Table II.H.1 presents the estimated breakdown of production of prefabricated structures for 1967 and 1971.

TABLE II.H.1

SHIPMENTS OF PREFABRICATED WOOD STRUCTURES
1967 AND 1971
($ Million)

	1967	1971
Glued Laminated Lumber	$ 39.3	89.4
Sawn Lumber	5.9	
Combination of Glued Laminated and Sawn Lumber	17.8	
Roof Trusses made of Saw Lumber; Light Construction	41.6	266.8
Other Wood Components	49.9	
Ready Cut and Prefabricated Buildings[1]	291.2	600.0
Total	$447.8	956.2

1. Omitted from consideration in this section.

Sources: 1967 Census of Manufactures, 1971 Annual Survey of Manufactures, Arthur D. Little, Inc., Estimates.

Producers of prefabricated structures can be divided into three categories according to type of product produced. Manufacturers of glue-laminated beams are the most identifiable due to the uniqueness of their product. Glued beams consist of pieces of lumber glued and pressed together to carefully engineered and specified measurements meeting rigid strength requirements. Beams 60 feet long, several feet thick and wide, are common and make striking architectural/structural components.

Beams are produced to customer order and not normally inventoried in quantity. The new construction market, both residential and nonresidential, takes virtually all of industry production.

Beams are expensive to ship long distances because of their unusual dimensions and plants tend to be spread across the country. However the style of construction employing glue laminated beams is more popular in the West and there is a concentration of plants in Oregon and Washington.

2. Types of Firms and Plants

The investment in equipment and facilities to produce beams is substantial and many of the producers are large concerns. Included are important lumber producers such as Boise Cascade, Bohemia Lumber, Koppers Company, Potlatch Forests, Roseburg Lumber, and Weyerhaeuser Company.

The second important category of prefabricated wood structure product is roof trusses. These are fabricated structural members most commonly used to support the roof of a single family or low-rise residential dwelling. Trusses can be fabricated on the site and in fact, the only real distinction between a "manufactured" truss and those produced on site is the locus of production.

Trusses are fastened together mechanically with the joining done with nails or with metal plates. The most inexpensive approach to truss manufacture requires only a "jig" in which to lay precut lumber to shape, a saw to cut the lumber to length, and a hammer or nailing machine. A more expensive facility for larger production might automate the process of joining the lumber.

Because of the low capital investment needed and the broad market acceptance of trusses, many building materials retailers have entered into production themselves. A 1971 study showed 15% of building materials retailers engaged in the manufacture of trusses, prehung doors, or prefabricated buildings. That same study also showed the market acceptance of such components indicating trusses, prehung doors, and prefabricated buildings were handled by 50%, 70%, and 15% of dealers respectively.

The third important category of prefabricated wood structural product is components such as wall sections, floor and roof sections, etc. This group of products are also sold exclusively to new construction and are a step closer to the prefabricated house since most are made to customer order.

Joining of these components is also done mechanically and the required investment to enter this business is small, ranging from $5-10,000 for a simple operation up to $200-300,000 for a highly automated facility.

3. Financial Profiles

Table II.H.2 presents the estimated financial strength of a group of producers of beams, trusses, and components. This distribution indicates that both very small and very large concerns compete in this business.

4. Pricing

Prices of prefabricated wood structures are strongly influenced by lumber costs. On average we estimate material costs are at least 60% of the FOB plant price of components and trusses, and somewhat less for beams. Since producers must pay the market price for their raw material, shifts in the housing market cause prices to fluctuate.

TABLE II.H.2

ESTIMATED FINANCIAL STRENGTH OF PRODUCERS OF PREFABRICATED WOOD STRUCTURES

	#	%
Trusses		
Under $35,000	1	2
$35,000 – $125,000	1	2
$125,000 – $500,000	8	20
$500,000 – $1,000,000	2	5
Over $1,000,000	13	32
Net Assets Undetermined / Not Reported	16	39
Total	41	100
Laminated Beams		
Under $35,000	–	–
$35,000 – $125,000	2	6
$125,000 – $500,000	3	9
$500,000 – $1,000,000	–	–
Over $1,000,000	12	35
Net Assets Undetermined / Not Reported	17	50
Total	34	100
Prefab Housing Components		
Under $35,000	1	2
$35,000 – $125,000	3	7
$125,000 – $500,000	10	24
$500,000 – $1,000,000	3	7
Over $1,000,00	8	19
Net Assets Undetermined / Not Reported	17	40
Total	42	100
TOTAL (Trusses, Laminated Beams and Prefab Housing Components)		
Under $35,000	2	2
$35,000 – $125,000	6	5
$125,000 – $500,000	23	19
$500,000 – $1,000,000	5	4
Over $1,000,000	33	28
Net Assets Undetermined / Not Reported	50	42
Total	119	100

III. METHODOLOGY

All of the sectors covered under this assignment were studied to define the structure of the particular industry and to estimate the nature and severity of the costs of compliance. Based upon the levels of cost to comply, it was clear that for five of the industry sectors, the effects of effluent abatement were minimal. These sectors are:

- Particleboard
- Millwork
- Hardwood Dimension and Flooring Mills
- Special Product Sawmills
- Prefabricated Wood Structures

That these industry sectors would be only minimally impacted is demonstrated by the fact that:

- Particleboards are manufactured by a dry process, utilizing little process water. Capital costs of abatement represent 0.4% of the necessary investment to build a new plant of minimum economic size; total annual costs represent only 0.5% of the average 1972 selling price achieved by the plant with the lowest unit selling price.

- Millwork operations do not include sawmilling nor wet log handling and storage practices nor extensive gluing operations; therefore, cost of compliance and impact is essentially zero. Capital costs are 1-2% of net assets; Annual costs <0.1% of sales revenues.

- Most hardwood dimension and flooring manufacturers do not also operate sawmills. Only the larger firms operate sawmills and utilize wet log storage and handling processes; only those firms will be affected. These firms are in strong enough financial position to make necessary investments, since capital costs are 1-2% of net assets and annual costs are <1% of sales revenues.

- Special product sawmills do not generally use wet storage practices and can readily make the investments to comply with process changes, since the maximum annual cost if <0.5% sales revenues, and capital costs are <9% net assets.

- Prefabricated wood structures manufacture require extensive gluing only in the production of laminated beams, a very capital-intensive process. The capital costs of abatement ($2,000) are insignificant as compared to total capital investment in operations (<1%) annual costs ($480) are similarly insignificant (<1%).

A. SURVEY TECHNIQUES

Approaches to data gathering had to be developed specifically for each of the sectors studied since the sectors vary considerably in terms of data available and number of firms involved, e.g., 18 insulation board manufacturers vs. more than 8,000 sawmill operators.

1. Insulation Board

Since only 18 mills are covered under the proposed Guidelines, it was possible to interview either in person, by phone, via a mail questionnaire or through a combination of these devices, each of the 18 mills. Thus, the financial profiles, abatement cost effects, and profitability effects were determined for each of the firms and plants in the sector.

2. Hardwood Plywood and Veneer

Many of the 490 manufacturers of hardwood plywood and veneer are small firms operating small mills. Information on these small operators is generally incomplete. Thus, we prepared a survey which was distributed by the Hardwood Plywood Manufacturers Association to all known manufacturers of hardwood plywood and veneer, irrespective of their membership in the HPMA.* During March and April 1974, approximately 490 surveys were distributed. We received 142 responses to the survey, representing 29% of the total industry.

Respondents were generally willing to answer questions and provide the necessary background data. However, although nearly 30% of the firms in the industry responded and many very small firms responded:

- The survey data suggests that very small firms are underrepresented in our sample.

For example, an arithmetic average of 1972 production of 2.2 million square feet (3/8-inch basis) and 190 producing plants, suggests that a typical plywood plant would produce 11.6 million square feet. Arithmetic averages from our survey indicate an average plywood plant to be closer to 40 million square feet in annual production. Thus, although we have used the survey to structure our sector generalizations, we do focus upon the problems of the very small firms and have attempted to adjust our analysis to incorporate such firms.

Basically, the survey intended to identify for individual facilities:

- Operations performed and product mix.

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*HPMA membership tends to consist of larger manufacturers.

- Location.
- Capacity and annual production.
- Capital investment.
- Other facilities on a common site.
- Access to municipal sewers.
- Log handling practices.
- Land availability.

Using this data we were able to develop a detailed structure of the industry and its several subsegments. According to industry sources, the data represents the most complete information ever collected on the industry.

3. Softwood Plywood and Veneer

The analysis of economic impact in this sector is based on an intensive survey of softwood plywood and veneer mills conducted during April and May 1974, based on a survey prepared by the contractor and conducted through personal mill visits by the American Plywood Association. The survey was distributed to 150 mills (75% of the operating units). The completed questionnaires were processed and tabulated under the contractor's supervision. One hundred fourteen usable questionnaires were returned.

Data was gathered regarding operating parameters of the individual mills, such as 1973 capital expenditures and production. In addition, the questionnaire gathered data on the current effluent practices and the costs of compliance which mills estimate they would have to bear to meet proposed Guidelines.

4. Sawmills and Planing Mills – General

To improve upon the extant data base, we conducted a survey of 195 softwood and hardwood sawmills by telephone during March 1974. The mills surveyed were selected at random from trade directories, and an effort was made to make the sample as representative as possible. The number of mills interviewed by state is shown in Table III.A.1.

A total of 144 softwood mills and 51 hardwood mills were interviewed. The sample of softwood mills equals approximately 10% of the total number of mills estimated to be

TABLE III.A.1

SURVEY SAMPLE BY TYPE OF MILL AND LOCATION

Area	Softwood Mills	Hardwood Mills
Northwest		
California	21	–
Idaho	8	–
Montana	8	–
Oregon	28	–
Washington	12	2
Subtotal	77	2
Other U.S.		
Alaska	2	–
Alabama	6	5
Arizona	1	–
Arkansas	4	5
Colorado	3	–
Florida	1	–
Georgia	8	1
Maine	1	–
Michigan	4	4
Mississippi	6	1
New Mexico	2	–
North Carolina	4	3
Louisiana	2	–
Maryland	–	3
Kentucky	–	5
Ohio	–	2
Pennsylvania	–	7
South Carolina	5	4
Tennessee	1	4
Texas	8	–
Virginia	6	2
Wyoming	2	–
Wisconsin	1	2
Missouri	–	1
Subtotal	67	49
Total Sample	144	51

operating in the industry; the sample of hardwood mills equals approximately 5% of those mills known to be operating.* These samples are sufficient for statistical reliability.

B. PRICE EFFECTS

The analysis of the ability to pass cost increases on to consumers is based on consideration of the parameters listed in Table III.B.1.

If the annual treatment cost (before tax) represents a significant percentage of the selling price, it will be difficult to pass this on to consumers. This is particularly true in an industry which is characterized by high price elasticity of demand. In price insensitive industries, a 15% price increase can be readily passed on. In the Timber Products Processing Industry sectors, a ratio of before tax treatment costs to selling price of 10% seriously hampers the ability to pass on the cost increase.

The existence of readily-substituted products will limit the ability to pass on price increases.

Similarly, a low demand growth rate implies a mature industry sector, with established consumer purchasing patterns. Particularly if demand is elastic, the ability to pass on price increases will be limited.

A uniformly low operating rate within the industry would also constrain such increases. Companies with low operating rates are more likely to absorb cost increases in an attempt to maintain present rates or increase them rather than attempting to pass through cost increases.

A critical factor in this analysis is the extent to which plants within the industry have to absorb comparable abatement costs. If costs are unequally distributed throughout an industry, producers which do not have to make an investment or can make less of an investment, obtain a strategic cost advantage. A low-cost producer will tend to absorb abatement costs, particularly if the abatement costs to the low-cost producer are smaller than for the industry as a whole, to put the other plants in the industry at a cost disadvantage.

If products are sold within an industry on the basis of price rather than quality of service, then cost increases are likely to be absorbed rather than passed through. Similarly, if market shares are generally small for any individual firm or plant, then price competition is likely to be severe and cost increases are likely to be absorbed.

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* We estimate approximately 1,000 hardwood mills are operating full-time and are identifiable; industry sources estimate there may be an additional 1,000 mills which operate at various times but are not identifiable through conventional sources. Similarly, although approximately 5,000 softwood sawmills are reported by the Department of Commerce, only about 1,500 are operating full-time and are identifiable.

TABLE III.B.1

PRICE INCREASE ANALYSIS MATRIX

Parameter	Condition for Constraint
Before Tax Treatment	
Cost-% Selling Price	High, e.g., greater than 10%
Substitute Products	High occurrence; ready substitution
Industry Capacity Utilization	Low; e.g., operating rate less than 80%
Demand Growth	Low, e.g., less than GNP
Foreign Shipments	High
Abatement Cost Differences Within Industry	Unequal distribution of costs
Price Elasticity of Demand	High
Basis for Competition	Price
Market Share Distribution	Fragmented

The ability for firms in these industries to pass on cost increases is to a significant extent a macroeconomic consideration, i.e., heavily influenced by the total supply/demand balance. In a strong market, such as the last half of 1972 or first quarter 1973 demand was generally strong enough to accept substantial price increases. Conversely, in a weak market (1971 and the first half 1972) firms had to absorb most cost increases. Thus, the final determination of price effects was heavily influenced by analysis of supply/demand factors.

C. PLANT CLOSURE EFFECTS

If costs of abatement cannot be passed on to consumers or if capital is not available, then the management of individual plants must decide whether to continue operations at lower levels of profitability, or to shut down. This decision depends on the magnitude of financial impact on operations. The factors incorporated into our analysis of plant closures are listed in Table III.C.1.

Three of the parameters in Table III.C.1 deserve specific attention.

- Extent of integration – If a plant is part of an extensive woodlands operation, it is likely to be kept open even if financial impacts or capital requirements are relatively severe. For example, an insulation board manufacturing plant can be an efficient consumer of otherwise low-value waste product (sawdust, shavings, etc.) from a sawmill or planing mill located on a common site.

- Other facilities on a common site – An isolated plant is most vulnerable for the reasons described in the integration discussion above.

- Ownership – A large, multi-industry firm would tend to make a shutdown decision based on "rational" business analysis, such as effects on profitability. Such a firm would likely have specific criteria for each of its operating facilities to meet. However, a private owner tends to have greater "staying power," a greater personal commitment to staying in business even if profitability is substantially reduced. This is true for such subjective reasons as pride in successive family ownership, but also for such specifically economic reasons as the fact that this may be a particular family's sole or primary source of income.

TABLE III.C.1

PLANT CLOSURE ANALYSIS MATRIX

Parameter	Condition for Closure
After Tax Treatment Cost—% Net Income	High, e.g., greater than 15%
Cash Flow	Negative
Capital Cost of Abatement—% Net Assets	High, e.g., greater than 30%
Extent of Integration	None – Low
Other Facilities on Common Site	Isolated Plant
Ownership	Large, multi-industry firm

To accomplish the impact analysis, these factors were assigned different orders of importance based on the specific characteristics of individual industry sectors. That is, a small privately-held firm has different profitability criteria than a large, multi-industry, publicly-held firm, e.g., magnitude of cash flow is the important issue to a privately-held firm. Further, the management of such firms is not likely to perform a discounted cash flow analysis as part of its stay-open/shut-down decision making. And, cash flow has a different meaning for a private enterprise which frequently elects to pay higher salaries and more encompassing fringe benefits rather than reporting profits on its income statement. Profitability ratios can be used as a guide when analyzing such firms, but certainly do not define the final story. Thus, whereas insulation board manufacture is dominated by large plants, large firms, and manages as a publicly-held enterprise, hardwood, plywood and veneer manufacture is the province of the small, privately held firm; plant closure decisions in the two segments are likely to be based on substantially different criteria.

IV. COSTS OF COMPLIANCE

The costs of compliance vary considerably among these several sectors. Costs of effluent control are estimated in the Development Document based on the following unit processes:

- Wet log storage and handling, i.e., ponding and wet decking
- Processing operations, e.g., sawmilling or veneer drying
- Finishing operations, e.g., gluing, application of surface coatings, and application of sealers, stains, dyes, primers, and fillers.

In addition, since insulation board manufacture represents a distinctly different process and generates large volumes of process water, guidelines and attendant costs were developed specifically for the manufacture of insulation board. Further, since particleboard manufacture is also a different manufacturing procedure, distinct guidelines and costs were developed for this product as well.

The details of abatement costs are presented and discussed for the specific industry sectors within the specific economic impact analysis in Section V. However, Table 1, prepared by the EPA from this Contractor's estimates, presents a summary of the potential incremental pollution control costs for operations within the sectors under consideration.

As Table IV-1 indicates, the level of costs associated with the proposed guidelines is generally modest, even for small operations which are typified by manufacturers of container-grade veneer. In no other sector does the annual cost represent more than 4% of annual sales revenues. For container-grade veneer manufacturers, and one insulation board mill, capital costs of abatement represent a significant percent of net assets, i.e., 11% for container grade veneer, 26% for the one insulation board mill. In all other cases, capital costs of abatement represent less than 10% of net assets.

TABLE IV-1

POTENTIAL INCREMENTAL POLLUTION CONTROL COST

Segment	Total No. Plants	Plants No. Affected	Capital Cost (000's)	% Net Assets	Annual Cost (000's)	% Sales
Insulation Board BPT	18	8	$400-3,500	3-26	0-800	.5-4
BAT			132	1	20	- .1
Sawmills	7,323[b]					
Softwood	1,400	285	3-8.6	Less than .1%[e]	1-3	.01-4
Hardwood	1,000	120	3-8.6	Less than .14[e]	1-3	.5-3.3
Hardwood Plywood & Veneer[c]						
Commercial Grade Veneer	250	142	3-14.1	.4-1.9	1.-3.9	.05-.25
Container Grade Veneer	50	28	3-14.1	2.4-11	1.-3.9	.9-4.3
Plywood & Veneer Stock Panels	75	32	3-16.2	.6-3.2	1-4.4	.05-.25
Plywood & Veneer Semi & Speciality Grade	115	48	3-16.2	.4-2	1-4.4	.05-.22
Softwood Plywood & Veneer[c]	230	84	3-44	Less than .4	1-11	Less than .1
Hardwood Dimension & Flooring						
Hardwood Flooring	59	5	8.6	1.7[e]	3	.1
Dimension	526	11	3-14.1		1-3.9	.2-.8 .5-1.5
Special Purpose Sawmills	452	75	3-8.6	3-8.6	1-3	
Particle Board	74	74	13.4-35	.4-[e]	4.8-14	Less than .15
Millwork	2,729	680	2	1-2[d]	.48	Less than 0.1
Prefabricated Wood Structures	236	75	2	Less than [d] 1	.48	Less than 0.1

a. BPT and NSPS costs are the same. BAT effluent limitations are identical to BPT (zero discharge) except in the case of Insulation Board.

b. 1971 Census of Manufactures (more than 10 employees). Most of these mills are seasonal or part time operations, and are not likely to be affected by wet log storage guidelines. The 2400 mills shown represent well over 90%of industry capacity.

c. Includes costs associated with Phase I guidelines.

d. As percent of toal assets

e. As percent of new plant

Source: EPA, Arthur D. Little, Inc. estimates

V. ECONOMIC IMPACT ANALYSIS

A. INSULATION BOARD

1. Cost of Compliance

After examining the potential subcategorization of the insulation board plants in the United States, the Development Document concluded that such factors as plant age, location, product mix, plant capacity, etc., were not sufficiently variable to result in identifiable differences in effluent quality. Thus, the principal subcategorization adopted was based on process technology in use and the 18 manufacturing facilities were classified as follows:

- Little or no steaming of furnish and no hardboard production -- 8 facilities.
- Steaming or hardboard production -- 10 facilities.

Most of these facilities produce mineral board and/or hardboard in addition to the insulation board and the total capacity on a tons-per-day basis for each facility includes that for all three products. However, most facilities do not separate the effluent deriving from each product and thus the analysis of water quality did not differentiate among products.

Examination of the treatment technology presently in use for each of the eighteen facilities shows that five plants discharge into municipal systems or expect to do so by July 1, 1977 (BPT), two plants either have or will implement a closed system by that date, two plants practice spray irrigation as a means of water disposal, and of the remaining eight plants, one plant uses bagasse as its raw material and is not covered by the proposed Guidelines. Two already meet BPT control and treatment technology but would have to make additional investment to satisfy BAT, and the other six must do both. The eight plants are:

National Gypsum; Mobile, Alabama
Johns-Manville; Jarrett, Virginia
Armstrong Cork; Macon, Georgia
Kaiser Gypsum; St. Helene, Oregon
Boise Cascade; International Falls, Minnesota
Simpson Timber; Shelton, Washington
Weyerhaeuser; Craig, Oklahoma
Temple Industries; Diboll, Texas

The approach in conducting the economic analysis was thus to examine the technology in use at each of the remaining eight facilities and decide on what equipment and processes must be installed to meet the proposed Guidelines. The resulting investment and operating costs were then used to measure the potential economic impact. Many of the criteria used in assessing impact incorporate the implications of conversations held with industry executives on options and likely actions open to individual firms.

Certain assumptions were made in this analysis:

- The cost and efficiency of the equipment selected is as shown in the Development Document.

- The size and cost of equipment required by an individual plant would be directly related to that needed for the model plant of 300 ton-per-day capacity, using linear escalations based on flow rates to estimate both investment and operating costs. In practice, of course, some economies of scale can and would be achieved, but we have not been given data on the effect of scale, and, further, believe such data would not alter the substance of our conclusions.

- It is probably possible to reduce the process water flow rates in order to limit the required treatment investment but the conditions under which this can and would be done will be unique to each plant and depend on product mix, equipment layout, and other factors. We have thus not assumed any reduction in the quantities of process water used, except where companies gave us specific data in this regard.

- All estimates of required price increases assume that the current returns on net assets will be maintained by each producer to recover the full incremental costs.

- Investment and operating cost estimates are in mid-1973 dollars and are 25% above the August, 1971, costs used in the Development Document. This factor allows for both the effects of inflation and the increased costs of construction. The recommended alternative technologies, capital investment requirements and total yearly costs for the model plant with a capacity of 300 tons per day and a flow rate of 3,120 gallons per ton, are shown in Table V.A.1.

2. Price Effects

Implementation of the BPT Guidelines (1977) would result in price increases ranging from 0.5% to 4% for the eight plants, based on 1973 fob selling prices and assuming that the current return on net assets is maintained (Table V.A.2). The full range is equivalent to

TABLE V.A.1

MODEL PLANT – INVESTMENT AND YEARLY COSTS OF COMPLIANCE
(Mid 1973 $)

Plant Capacity – 300 Tons/Day
Flow Rate – 3120 Gallons/Ton

	BPT (1977) and New Source	BAT (1983)
Subcategory I		
Guideline Alternative	C-1	D-2
Technology	Activated Sludge	Removal of SS
Total Investment Cost (000's)	1193	1325
Total Yearly Cost (000's)	378	398
Subcategory II		
Guideline Alternative	C-1	D-2
Technology	Activated Sludge	Removal of SS
Total Investment Cost (000's)	1370-1451	1502-1583
Total Yearly Cost (000's)	453- 490	473- 510

Source: Development Document.

TABLE V.A.2

SUMMARY OF ECONOMIC IMPACT

	Total BPT (1977)	Total BAT (1983)
Investment Required		
Range ($MM)	0 – 1.5	0.1 – 5.7
% of Net Assets	0 – 28	1 – 32
Total Yearly Costs		
Range ($MM)	0 – 0.8	0 – 1.1
Price Increase %	0 – 4	neg. – 4.5
Max. Price Increase ($/MSF)	0 – 2	0 – 2.25

Source: Arthur D. Little, Inc., estimates.

$0.25 to $2 per thousand square feet, 1/2" basis; we believe that price increases can be made without any reduction in the future market size or rate of growth discussed earlier. These price increases are solely attributable to the water pollution control expenditures and do not reflect other price increases that may be necessitated by air pollution control costs, increases in raw materials or labor costs, or other reasons.

Price increases to cover the costs of implementing 1983 Guidelines will range up to 4.5% ($0.50 to $2.25 per thousand square feet) if the current returns on net assets are to be maintained. We conclude that price increases of this order of magnitude will be implemented, although plants do have the opportunity of changing their product mix in order to sell relatively more of the finished products which enjoy higher average revenues and profits. No other secondary price effects are anticipated.

3. Financial Effects

a. Potential Effects on Profitability

If competitive conditions for an individual facility are such that the above mentioned price increases cannot be achieved, water pollution control costs would have to be absorbed and thus would reduce profitability. For both BPT and BAT requirements, the direct effect of cost absorption would be to make two plants marginally profitable on the basis of return on net assets.

Because we project a full pass through of costs of compliance profitability will not be affected.

b. Availability of Capital

The total capital required to implement BPT Guidelines would be in excess of $6 million among the eight plants. Relative to net plant assets, individual plant investment requirements range from 0 to 28%. If a plant is operating in isolation of any other forest products operations and if that company has no unusual pressures on its capital availability, it is probable that any capital required for pollution control expenditures ranging up to 15% or 20% of current net plant assets would be provided. In the range of 20% to 40%, the company would look very closely at other potential expenditures, realizable product prices, future demand, and competing alternatives for capital utilization. Beyond 40%, the chances are very good that a company would consider closing a plant or curtailing capacity. It should be pointed out that the required water pollution control investments are sometimes a large proportion of what a company might typically invest in any one year, and are often considered "non-productive" investments.

On the basis of these criteria and other considerations, such as product mix and the availability of raw materials, two plants can be regarded as marginal; one of these two facilities is part of an integrated forest products complex, considerably lessening the likelihood of closure. The second marginal plant will probably have to review its options more closely before reaching a decision; we estimate that a 50% probability of closure exists for that facility.

By 1983, the total capital required to implement BAT Guidelines, would be in excess of $10 million. As the incremental investment requirements to meet BAT Guidelines ($4 million total) are minimal, it can be concluded that no incremental impact due to capital requirements is anticipated by 1983.

4. Production Effects

a. Curtailment of Production

Pollution abatement costs are unlikely to result in curtailment of total production by the insulation board industry.

b. Plant Closures

Based on the analysis presented in previous paragraphs, (V.B.3.b) we estimate that plant closures would represent about 4% of insulation board production in the United States today.

c. Industry Growth

Independent of the market environment and its impact on future industry growth, discussed earlier, price increases as a result of water pollution abatement costs are likely to result in little or no incremental effect. Obviously, however, the volume of industry sales will be reduced in proportion to the withdrawal of capacity as a result of plant closings but the loss will be compensated for in part by market trends away from insulation board and also by the start-up of a new facility in 1976 (by Weyerhaeuser).

5. Employment and Regional Effects

Closure of the one marginal facility in the West could result in the unemployment of up to 200 workers. Almost all of these workers can be classified as plant hourly or non-relocatable supervisory personnel who would have to seek new employment locally. It is unlikely that new insulation board plants would be built at or near the present location although it is possible that another type of forest products operation could be located there.

6. Balance of Payments Effects

Even with the eventuality of plant closures, it is unlikely that the present balance of payments position will be affected. The new plant which will be built by 1976 by Weyerhaeuser will compensate for the possible shortfall in production that might be necessitated by a reduction in capacity and thus eliminate the need for incremental imports. In addition, current manufacturers may enjoy better prices with less available United States capacity and thus be encouraged to maintain their current production levels of insulation board rather than to convert to alternative products.

B. HARDWOOD PLYWOOD AND VENEER

1. Costs of Compliance

Table V.B.1 presents the costs of compliance for a representative hardwood plywood mill. (The costs are as presented in the Development Document.)

The technology recommended* here is recirculation to contain wet deck water. An estimated capital investment of $8,600 plus a total yearly cost of $3,000 is the estimated cost level for compliance. These costs will be borne by any veneer or plywood manufacturing mill which utilizes wet decks for its log inventory. Companies utilizing dry decking are not controlled. Ponds are controlled to the extent that large floatable solids must be "screened out." This can be accomplished by using a submerged weir. All mills using pond storage are believed to have a weir or other techniques to achieve this level of control; thus, no incremental abatement costs are incorporated for ponds.

Table V.B.1a describes the log handling practices for firms in these segments. There appears to be no pattern within the two major segments to differentiate specialty vs.

TABLE V.B.1

HARDWOOD PLYWOOD MILL COSTS OF COMPLIANCE

For Mill Operations

Manufacturing Location	Recommended Treatment	Lbs./Day BOD Load	Capital Investment	Land Cost	Yearly Operating Cost	Total Yearly Cost
Log Vats	Lagoon Treatment	47	$3,000	$2,500	$600	$ 870
Glue Washwater	Recycle	0	2,000	–	300	480
Dryer Washwater	Lagoon Treatment	0.60	50	–	50	50
TOTAL			$5,050	$2,500	$950	$1,400
		For Log Handling and Storage Operations				
Wet Decks	Recirculation		$8,600	–	$3,000	$3,000

Based on a 5 MMSF/Yr. hardwood plywood mill (3/8" basis)

*See Development Document for details.

TABLE V.B.1a

PLYWOOD AND VENEER[1] LOG HANDLING PRACTICES

Category		Access to Municipal Sewers		Log Handling		
		No	Yes	Dry Deck	Wet Deck	Ponds
I. Veneer Manufacturers						
A. Commercial Grade	% plants	33%	67%	47%	36%	17%
B. Container Grade	# plants[1]	99	201	141	108	51
II. Hardwood Plywood & Veneer Manufacturers						
A. "Stock" Panels	% plants	29%	71%	47%	18%	35%
B. Semi & Specialty Grade	# plants[1]	55	135	89	35	66
		154	336			

1. Extrapolated from Survey.

Source: HPMA Survey – March-April 1974; Arthur D. Little, Inc., estimates.

non-specialty product producers on the basis of these factors. Similarly, there does not appear to be a definitive trend based on the size of plant related to these factors. Thus, in distributing costs across the industry, the information on log handling practices can be applied directly to the industry sectors and does not need to be corrected for the smaller, unrepresented firms. Our survey data indicates that 67% of veneer manufacturers (this extrapolates to 201 plants within the industry sector), and 71% of the plywood and veneer manufacturers (this extrapolates to 135 plants), presently have access to municipal sewers and can thereby save the costs necessary to introduce process changes, such as recycling of dryer washwater, related to mill operations. The companies which will have to absorb the major portion of the impact are those companies which do not have access to municipal sewers and practice wet decking for log handling. It is interesting to note that 36% of veneer manufacturers (108 plants) use wet decks, whereas one half as many – 18% (35 plants) – hardwood plywood and veneer manufacturers use wet decks. But, in both cases, major portions of the industry have no costs to bear at all; they are already in compliance.

Figure V.B.1 distributes the costs of compliance across the various industry segments. Cost factor A equals costs due to process changes. Cost factor B refers to costs to meet log handling guidelines. As the figure indicates, only 12% (36 plants) of the veneer manufacturers are forced to absorb the maximum level of costs, which is:

- Capital = $14,100
- Annual = $ 3,870

Similarly, only 5% (10 plants) of the hardwood plywood and veneer manufacturers have to absorb the maximum level of costs, which is:

- Capital = $16,150
- Annual = $ 4,400

Further, 43% (129 plants) of the veneer manufacturers have no cost of compliance, and 58% (111 plants) of the hardwood plywood and veneer manufacturers also have a zero cost of compliance.

2. Price Effects

The likelihood of cost increases being passed on as increased prices for consumers is analyzed in Table V.B.1b. the methodology of this analysis is discussed in section III above. Our conclusion based on this analysis for all segments is:

- There will be no increase in end product prices due to compliance with effluent guidelines; rather, costs of compliance will be absorbed by the manufacturers.

Industry Segment	Municipal Sewer Tie-In	Cost Factor A (Process Changes) Capital	Cost Factor A (Process Changes) Annual	Log Handling Practices	Cost Factor B (Log Handling) Capital	Cost Factor B (Log Handling) Annual	Total Cost Capital	Total Cost Annual	No. of Plants	% of Total
Veneer Manufacturers					$ 0	$ 0	$ 0	$ 0	129	43%
	67% Yes	0	0	64% Dry Decks or Ponds	8,600	3,000	8,600	3,000	72	24%
				36% Wet Decks	0	0	5,500	870	63	21%
	38% No	$5,500	$870	64% Dry Decks or Ponds						
				36% Wet Decks	8,600	3,000	14,100	3,870	36	12%
									300	100%
Plywood Manufacturers					$ 0	$ 0	$ 0	$ 0	111	58%
	71% Yes	0	0	82% Dry Decks or Ponds						
				18% Wet Decks	8,600	$3,000	8,600	3,000	24	13%
	29% No	$7,550	$1,400	82% Dry Decks or Ponds	0	0	7,550	1,400	45	24%
				18% Wet Decks	8,600	3,000	16,150	4,400	10	5%
									190	100%

Source: Arthur D. Little, Inc., Estimates.

FIGURE V B.1 COST BURDEN DISTRIBUTION FLOW CHART

TABLE V.B.1b

PRICE INCREASE ANALYSIS MATRIX

Price Increase Constraints					
Factor	Condition for Constraint	Commercial Grade Veneer	Container Grade Veneer	Stock Plywood Panels	Spec. & Semi-Specialty Plywood
Ratio of BT Treatment*		Low	Moderate	Low	Low
Cost to Selling Price (%)	High	< 1%	4.3%	< 1%	< 1%
Substitute Products	High occurrence	Moderate	High	High	Moderate
Capacity Utilization	Low	Moderate	Low	Moderate	Moderate
Captive Usage	Low	High	Low	Moderate	Low
Demand Growth	Low	Low	Low	Low	Moderate
Foreign Competition	High	High	None	High	High
Abatement Cost Differences	Unequal	Unequal	Unequal	Unequal	Unequal
Price Elasticity of Demand	High	Moderate	High	Moderate	Moderate
Basis for Competition	Price	Quality, Price	Price	Price	Quality, Price
Market Share Distribution	Fragmented	Fragmented	Fragmented	Fragmented	Fragmented
Number of Producers	Many	Many	Moderate	Many	Moderate

*Maximum level of expenditure.

For 3 out of the 4 segments (container grade veneer is the exception), the ratio of before tax treatment cost to selling price is a low, insignificant amount (less than 1%). Thus, for those segments, the need to increase prices is negligible. However, for manufacturers of container grade veneer, the ratio of treatment cost to selling price is significant (4.3%).

For container grade veneer, the price increase analysis matrix indicates that for every factor, except two, container grade veneer meets the condition for constraint. For the other two factors (ratio of treatment cost to selling price = moderate; number of producers = moderate), container grade veneer scores in the moderate category, rather than in the high category. Clearly the balance of evidence indicates that no price increase is likely.

The most important factors inhibiting a price increase for container grade veneer include the fact that abatement cost differences will not be absorbed equally by the industry, i.e., 43% of the segment will absorb no costs at all, 12% of the industry will absorb the maximum expenditure. There are substitute products, and demand is quite price elastic, indicating that product acceptance and sales volume is quite sensitive to price increases. Further, the basis for competition, among suppliers of container grade veneer, as well as among other competitive packaging materials, is price; since there is little if any product uniqueness the lowest cost material will be used.

Thus, prices will not be increased to reflect the rising operating costs due to pollution control. Rather, these costs will affect the financial condition of firms operating in these segments.

3. Financial Effects

Each segment of the industry has been discussed above and a representative financial profile has been developed, and discussed, in Section II.B (Tables II.B.10-13). Since the cost of compliance will have to be absorbed by firms operating in these segments, the income statements and balance sheets have been reanalyzed to compute the effect of this absorption of cost. Tables V.B.2a and 2b assess the financial impact on firms due to the absorption of costs of compliance.

Commercial grade veneer manufacturers are not seriously impacted by the absorption of the cost of compliance. For example, the net profit margin (net after tax income – % net sales) decreases only by 0.1%, to absorb the maximum cost burden. Similarly, profitability, expressed as return on net assets, decreases by only 0.3%, to go from no cost to maximum cost. It is worth noting that treatment cost does represent a significant percent of net after tax income (13.4% in the maximum case). However, even in the most severe case, cash flow remains at a level of $65,600 per year, and the necessary capital investment in abatement equipment represents a small percentage of net assets (2.7%). Thus, the impact on the financial condition of mills with commercial grade veneer operations is not serious.

TABLE V.B.2a

FINANCIAL IMPACT ASSESSMENT

Veneer Manufacture

Cost Factor / Code	Commercial Grade V_1	V_2	V_3	V_4	Total	Container Grade V_5	V_6	V_7	V_8	Total
Capital	0	$8,600	$5,500	$14,100	–	0	$8,600	$5,500	$14,100	–
Annual	0	$3,000	$ 870	$ 3,870	–	0	$3,000	$ 870	$ 3,870	–
# Plants	108	60	52	30	250	22	11	11	6	50
% Total	43%	24%	21%	12%	100%	43%	24%	21%	12%	100%
# Employ	7,095	3,960	3,465	1,980	16,500	440	220	220	120	1,000
Net Income – % Sales	2.0%	1.9%	2.0%	1.9%		2.5%	1.1%	2.3%	0.6%	
RONA[1] – %	4.0%	3.9%	4.0%	3.7%		2.0%	0.8%	1.7%	0.4%	
Treatment Inv./Net Assets – %	–	2.0%	0.7%	2.7%		–	6.9%	4.4%	11.3%	
Treatment Cost/Net Inc. – %	–	10.3%	2.9%	13.4%		–	60.0%	34.8%	77.4%	
Cash Flow ($1,000)	$67.5	$66.5	$67.0	$65.6		$8.75	$7.25	$8.32	$6.81	

Key:

Sector	Discharge Characteristics
V_1, V_5	Municipal System; Dry Decking or Pond Storage
V_2, V_6	No Municipal System; Dry Decking or Pond Storage
V_3, V_7	Municipal System; Wet Decking
V_4, V_8	No Municipal System; Wet Decking

1. Return on Net Assets = Net Income ÷ Net Assets.

Source: Arthur D. Little, Inc., estimates.

TABLE V.B.2b

FINANCIAL IMPACT ASSESSMENT

Plywood and Veneer Manufacture

Cost Factor	Code	Stock Panels					Semi/Specialty Products				
		P_1	P_2	P_3	P_4	Total	P_5	P_6	P_7	P_8	Total
Capital		0	$8,600	$7,550	$16,150	–	–	$8,600	$7,550	$16,150	–
Annual		0	$3,000	$1,400	$ 4,400	–	–	$3,000	$1,440	$ 4,400	–
# Plants		34	19	14	8	75	53	29	21	12	115
% Total		58%	13%	24%	5%	100%	58%	13%	24%	5%	100%
# Employ		5,220	1,170	2,160	450	9,000	8,550	1,915	3,540	735	14,750
Net Income – % Sales		2.6%	2.5%	2.5%	2.4%		3.0%	2.9%	2.9%	2.9%	
RONA[1] – %		8.8%	8.6%	8.6%	8.3%		7.5%	7.4%	7.4%	7.2%	
Treatment Inv./Net Assets – %		–	3.0%	1.5%	4.5%		–	1.9%	1.9%	2.8%	
Treatment Cost/Net Inc. – %		–	7.0%	3.2%	10.2%		–	5.0%	2.3%	7.3%	
Cash Flow		$69.0	$68.0	$68.8	$67.3		$100.0	$99.0	$99.3	$97.8	

Key:

Sector	Discharge Characteristics
P_1, P_5	Municipal System; Dry Decking or Pond Storage
P_2, P_6	No Municipal System; Dry Decking or Pond Storage
P_3, P_7	Municipal System; Wet Decking
P_4, P_8	No Municipal System; Wet Decking

1. Return on Net Assets = Net Income ÷ Net Assets.

Source: Arthur D. Little, Inc., estimates.

In contrast, container grade veneer manufacturers face a serious, negative effect on their financial condition due to absorption of costs of compliance. For example, net profit margin drops from 2.5% in the base case (V_5 = zero cost of compliance) to 0.6% in the maximum case. Further, cash flow, which was a marginal $8,750 in the base case, drops to even closer to the breakeven point, $6,810, in the maximum case (V_8). The fact that the capital investment in abatement equipment represents more than 11% of net assets, and perhaps as much as 30-40% of net fixed assets, in the worst case, indicates a serious impact.

Container grade veneer manufacturers which have to invest significant capital for abatement (categories V_6 and V_8) will not be able to finance abatement investments out of cash flow. Those firms which are not sufficiently liquid will be forced to resort to debt to cover capital investment needs. Being in tenuous financial condition, with such investments in non-productive equipment representing a substantial percentage of the value of net plant and equipment, these firms are likely to confront a capital availability problem.

Thus, firms in container grade categories V_6 and V_8 (34% of the plants, 17 plants, 340 employees) will be most seriously affected.

Generally manufacturers of plywood and veneer, either of stock panels or specialty products, have a strong enough financial condition to absorb costs of compliance with no serious financial impact. In fact, firms in this sector of the industry could finance the capital appropriation necessary out of cash flow, and would not have to face capital markets to raise the necessary funds.

Thus, with the exception of firms in container grade veneer categories V_6 and V_8, plants in this industry will not be severely impacted, financially, by absorbing the costs of compliance.

4. Production Effects

Since there is relatively little advantage to be gained by reducing output at a hardwood plywood or veneer plant, production effects will evidence themselves in plant closures rather than production limitations. The magnitude of plant closures is dealt with as a three-stage process, namely;

- to determine those segments in which plant closures are likely based on financial impact;

- from that financial impact analysis, to develop a preliminary number of plant closures, allocating plants into a high probability of impact category;

- to refine the preliminary closure analysis by deducting baseline closures* and determining the type and number of plants within high impact categories which would invest in abatement rather than shutdown.

Table V.B.3 summarizes the financial impact discussed in the previous section in terms of the plant closure analysis. As the table indicates, only for container grade veneer manufacturers is the resultant financial condition poor enough to suggest a relatively large degree of plant closures. Cash flow, at $6,810 (Table V.B.2a), is essentially at a breakeven level. The ratios of treatment cost to net income, and abatement investment to net fixed investment, are high enough to indicate a capital availability problem.

Based on Tables V.B.2 and 3, Table V.B.4a, an estimate of the number of plants which would fall into a high probability of impact category was developed. For the container grade manufacturers (segment I.B.), segments V_6 and V_8 are those segments identified as most tenuous financially. With this first level analysis, all the plants in those two categories are considered preliminary plant closures.

Table V.B.4b takes the preliminary analysis to the final step, i.e., a determination of the net plant closures. To accomplish this step, an estimate of baseline closures was made based on discussions with the industry, and the development of a list of known closures during the last five years by the HPMA. There is some tendency for plants to come in and out of production depending upon prevailing prices, but this is not nearly as strong a trend as is true in softwood plywood manufacture, or in lumber production.

As Table V.B.4b demonstrates, the only impact will be on manufacturers of container grade veneer. Plant closures here will represent 2% of the number of plants and persons employed (2 plants, 40 employees).

To graphically illustrate the point that plants in this industry would be impacted at a very modest additional increment of compliance cost (e.g., $10,000 incremental capital) the following Table V.B.5 is presented as extracted from a prior analysis of economic impact. Of course, most of the plants (11 out of 20; 55%) categorized as likely closures are container grade veneer manufacturers.

* Baseline closures refer to those operations which are economically marginal and would be forced to close based on low profitability or operating losses, independent of the requirement to meet effluent guidelines.

TABLE V.B.3

PLANT SHUTDOWN ANALYSIS MATRIX

Factor	Plant Shutdown Decision: Condition for Shutdown	Commercial Grade Veneer	Container Grade Veneer	Stock Plywood Panels	Spec. & Semi-Specialty Plywood
Ratio of AT Treatment* Cost to AT Net Income (%)	High	12.9%	77.4%	10.8%	7.3%
Cash Flow (Including Treatment Costs)	Negative	Positive	Breakeven	Positive	Positive
Ratio of Investment in Treatment* Facilities to Net Fixed Investment (%)	High	2.7%	11.3%	4.5%	2.8%

*Maximum level of expenditure.

TABLE V.B.4a

PRELIMINARY PLANT CLOSURE ANALYSIS MATRIX

Sector	# Plants	%	# Employees
I. Veneer Mfg.			
A. Commercial Grade	0	0	0
B. Container Grade			
V_6, V_8 (100% of sector)	17	35%	340
Subtotal	17	35%	340
II. Plywood & Veneer Mfg.			
A. Stock Panels	0	0	0
B. Semi & Spec. Plywood	0	0	0
Subtotal	0	0	0
GRAND TOTAL	17		340

TABLE V.B.4b

NET PLANT CLOSURE ANALYSIS MATRIX

Sector	# Plants	%	# Employees
I. Veneer Manufacture			
A. Commercial Grade			
Preliminary Estimate	0		0
less: Base-Line Closures	0		0
Net Closures – I.A.	0		0
B. Container Grade			
Preliminary Estimate	17		340
less: Base-Line Closures	2		40
	15		300
less: 85% – invest. in abatement	13		260
Net Closures – I.B.	2	4%	40
Subtotal Net Closures – I.A,B	2	1%	40
II. Plywood & Veneer Manufacture			
A. Stock Panels			
Preliminary Estimate	0		0
less: Base-Line Closures	3		360
Net Closures – II.A.	0		0
B. Semi & Specialty Plywood			
Preliminary Estimate	0		0
less: Base-Line Closures	3		390
Net Closures – II.B.	0		0
Net Closures – II.A,B	0		0
TOTAL NET CLOSURES – I & II	2	.4%	40

TABLE V.B.5

HARDWOOD PLYWOOD AND VENEER – PLANT CLOSURE AND EMPLOYMENT EFFECT FOR VARYING LEVELS OF COMPLIANCE COSTS

Guideline Option	Sector	# Plant Closures	# Employees Displaced	# Employees in Sector
I. Process Changes Only	V	0	0	
(Maximum Cost:	O	0	0	
capital = $5,500				
yearly = $3,000)				
	Total	0	0	0
II. I + Recirculation from				
Wet Decks[1]	V	2	40	4%
(Maximum Cost:	O	0	0	
capital = $14,100				
yearly = $ 3,870)				
	Total	2	40	0.1%
III. II + Screening from				
Wet Decks & Log Ponds[2]	V	11	220	22%
(Maximum Cost:	O	9	770	2%
capital = $24,100				
yearly = $ 3,870				
	Total	20	990	2.4%

V = Commercial Grade Veneer
O = Other Sectors

1. Proposed Guideline
2. Guideline requiring a significant amount of screening of very small particles.

Source: Arthur D. Little, Inc., estimates.

We do not anticipate secondary effects on users of container grade veneer. There is a certain amount of underutilized capacity in the industry which could be employed to make up this loss of production. Further, users have options of using other packaging materials to accomplish their objectives.

5. Employment Effects

Plant closures will cause 40 employees to be displaced as indicated in Section V.4.

Not all of the persons displaced will be unable to find comparable employment. These mills tend to employ a relatively high percentage of older, relatively low-skill employees; we estimate that approximately 30% of the employees will be able to find other comparable jobs. Approximately two-thirds of the administrative employees should be able to find comparable employment, while only about a quarter of the production workers will be able to do so.*

*Approximately 20% of total employment represents administrative employees.

Our estimate that 70% of the employees will be unlikely to find other comparable employment is a relatively high ratio. It is so high due to the older age distribution and low skill level of the employees. Additionally, many of these operations are located in small, remote communities in which there are not a lot of readily-available employment alternatives.

6. Resultant Regional Effects

Since only two plant closures are likely, there will be no noticeable community impacts due to plant closures and subsequent unemployment.

However, Table V.B.6 presents an estimate of the regional distribution of employee displacement if other Guidelines were implemented at higher levels of costs, yielding significant impacts. As the table demonstrates, 47% of the plant closures and dislocated persons would be located in the states of the mid-South, i.e., the Carolinas, Virginia, Kentucky, and Tennessee. Most of the plant closures would be located in rural communities.

Our prior studies of investment patterns in the forest products industry in the United States suggest that for several reasons, including wood availability and generally lower operating costs, the domestic forest products industry will be investing relatively more heavily in the states of the South and Southeast than in any other region. This suggests that workers displaced from these plants could be utilized in new plants. However, the lead time from investment decision to plant start-up for a pulp and paper mill is 3-5 years; it is about 12-18 months for a large saw mill or veneer and plywood mill. Thus, while there will be some new opportunities available in these regions, they will not be available immediately. Further, rather than being located in a number of small communities distributed throughout the region, they will tend to be concentrated as larger complexes in fewer communities.

Skills applicable to work in a plywood and veneer mill are, on balance, translatable into other manufacturing operations. Certain operations, such as the actual peeling of veneer from a debarked log, are high-skill occupations. However, the bulk of the operations performed in a plywood mill can be readily learned. Thus, employees displaced from plants will generally not have skills so specific they could only find employment in another plywood plant, nor would they be in demand as highly-skilled labor.

TABLE V.B.6

POTENTIAL REGIONAL EMPLOYEE DISPLACEMENT DISTRIBUTION

Region	Plant %
Mid-South	47
North Central	21
Southeast	16
Northeast	11
Rest	5
	100

Secondary effects should be minimal in this industry. Most of the small plants are relatively self-contained, even to the extent of having their own logging crews. The closure of a small veneer mill will probably not imply displacement of logging personnel as well. Also, many of the persons who supply logs to plywood and veneer mills are farmers and other landowners who cut logs to augment their income but are not solely dependent on logging fees to support their families. Further, in the case of the container grade veneer segment where there is loss of production, there are alternative sources of packaging materials and additional container grade veneer capacity to avoid secondary impacts due to loss of supply.

7. Balance of Trade Effects

Hardwood plywood imports account for approximately 75% of the total domestic consumption of hardwood plywood. The imported product competes on the basis of lower price due to substantially lower labor costs and ready availability of quality peeler logs. In the past 20 years there has never been a substantial export of domestically-produced hardwood plywood. We do not anticipate a shift in this basic trend.

We anticipate no effect on balance of payments due to pollution abatement cost requirements. Only two plant closures are projected; the net effect will not be a significant reduction in industry output or growth. Thus, domestic supply will not be materially affected and, for that reason, imports will not materially increase. Further, both plants are container grade veneer manufacturers, a product for which exports and imports are virtually nonexistent.

In effect, the balance of payments will not be materially affected by pollution abatement requirements under the assumptions used for this analysis. Other factors have a far more important influence on the balance of trade here than do environmental control costs.

C. SOFTWOOD PLYWOOD AND VENEER

This analysis is based on an intensive survey of softwood plywood mills conducted during April and May 1974. The survey was presented to 150 softwood mills and was administered by the quality control inspection field service of the American Plywood Association. The questionnaire was prepared by Arthur D. Little and the completed questionnaires were processed under our supervision. 114 questionnaires were returned and were usable. In addition, since some veneer mills are not integrated with plywood manufacturing (38 mills) we contacted these isolated mills separately.

The purposes of these surveys was to determine the effluent practices of these mills and to enable us to estimate the specific compliance costs which these mills must bear in order to meet the proposed Guidelines. In addition data was gathered about 1973 capital expenditures and 1973 production (million square feet 3/8ths inch basis) to allow us to estimate the economic affects of compliance.

1. Costs of Compliance

a. Industry Survey Results

The survey results have been cross tabulated by the following characteristics:

- *Mill Size*
  Each question is separately tabulated by the volume of 1973 production in million square feet 3/8ths inch basis. The categories used are small (under 40 million square feet), medium (40 to 99 million square feet), and large (over 100 million square feet).

- *Type of Operation*
  Responses are shown separately for plants producing plywood products only versus plants located at sites where other wood processing activities occur.

- *Water Pollution Impacts*
  The tabulations are divided into three categories: mills with no impact, mills with impact due to log handling and storage, and mills with impacts resulting from manufacturing processes.

- *Geographic Area*
  Tabulations were made separately for Western mills and Southern mills.

b. Capital Expenditures Pattern

Plywood mills spent heavily for capital improvements for pollution control as well as plant expansion during 1973. Out of 100 mills responding to the question of their 1973 expenditures, 76 made expenditures for air pollution, 62 made expenditures for water pollution, and 86 made expenditures for safety (under the Federal OHSA requirements). Interestingly only 59 mills made capital expenditures for the purpose of improving plant productivity during that year indicating the higher priority which was attached to pollution and safety expenditures.

For the plants responding, a total of $127,345,000 in expenditures were made in 1973 by 95 of the plants. Of these funds, 80% were expended for new or replacement productive facilities while the remaining 20% were used to control air and water pollution or to increase plant safety. Air pollution was a priority item during 1973 as it received 14% of the money spent. In comparison water pollution expenditures equalled only 3% of the total as did safety expenditures. These results are consistent with our prior analyses – that air pollution control was a far more serious problem than water pollution or safety. However, the results also showed that water pollution and safety are not totally overshadowed by air pollution requirements and together amount to a sizable portion of capital equipment expenditures.

A breakdown on a regional basis shows that the Southern plants tended to spend considerably more funds for pollution control and safety as compared to productive facilities than did plants in the West. However, the results for the Western plants are somewhat misleading as there were several large new mills constructed in the West and a larger portion of the cost of a new plant tends to be for productive facilities than for pollution control or safety.

For the three plants constructed during 1973, the total capital expended was $64,800,000 and of this total, only 7% was expended for pollution control or safety, while 93% went to construction of productive facilities. In comparison a total of $62,545,000 was spent at 92 existing plants and fully 1/3 of this was spent for pollution control or safety. At these existing plants air pollution expenditures were 23% of the total, more than twice the level expended for water pollution and safety which received 5% each.

The capital costs of compliance for the 63 mills not in compliance are estimated to be $1,175,000. This compares to $43,860,000 reported spent by those mills in 1973 for all capital equipment and is equal to 3% of that sum. The average Western mill is expected to spend $18,000 for equipment and $4,000 for operating expenses while the average Southern mill will spend $20,000 for equipment and $4,000 for operating expenses. For each group the total capital costs of compliance are equal to 3% of the funds actually expended for new facilities in 1973. We feel there is no significant difference in the likely impact on mills in the South as opposed to the West; they can be treated as a group.

Examination of the capital spending patterns of the 63 mills not in compliance showed the following expenditures reported were made in 1973:

Type	Amount	Percent
Air Pollution Control	$11,793,000	27
Water Pollution Control	2,168,000	5
Safety	1,952,000	4
New Productive Equipment	27,947,000	64
Total	$43,860,000	100

c. Findings

The findings are further summarized in Appendix A to this report.

d. Softwood Veneer

Table V.C.a. estimates the incidence of direct discharging and the costs of compliance to reach BPT for veneer mills. The 21 mills expected to be affected represent 55% of the total number of plants (38) estimated to be in operation.

2. Price Effects

Prices in the plywood industry are established as a function of supply and demand and are not directly impacted by increases or decreases in production costs. Any change in cost will have an impact first on supply and second on price but only in the long run. However, the expected change in operating costs for the incurring violations is so small in our estimation as to be almost completely negligible. The typical annual costs of compliance are a matter of only a few cents per thousand square feet produced. This is equal to 0.1% of annual mill sales. This change in cost will not have any measurable impact on supply nor ultimately on price.

Table V.C.1 presents the price increase analysis matrix for softwood plywood and veneer. The evidence is not strong for a cost pass-through price increase. Therefore we anticipate no price increases due to the added costs of complying with the proposed effluent Guidelines.

TABLE V.C.a.

MILLS EXPECTED TO BE AFFECTED AND CORRECTIVE COSTS – SOFTWOOD VENEER

Effluent Practice	# of Veneer Mills Likely Impacted	Capital Cost of Corrective Measures	Total Sector Capital Cost	Annual Operating Cost	Total Sector Operating Cost
I. Wet Deck Discharges to Stream or River	2	$ 8,600	$ 17,200	$ 3,000	$ 6,000
II. Log Pond Discharges to Stream or River	12	3,000	36,000	500	6,000
III. Veneer Dryer Discharges (8 mills only)	2	11,300	22,600	3,280	6,560
IV. Log Washing Effluent Discharges	–	–	–	–	–
V. Hydraulic Debarker Discharges	2	15,000	30,000	3,000	6,000
VI. Treatment Pond Discharges	3	3,000	9,000	500	1,500
Total	21[1]	$40,900	$114,800	$10,280	$26,060

1. Total # mills in industry = 38.

Source: Arthur D. Little, Inc., estimates.

TABLE V.C.1

PRICE INCREASE ANALYSIS MATRIX FOR SOFTWOOD PLYWOOD AND VENEER

Parameter	Condition for Constraint	Plywood	Veneer
BT Treatment Cost ÷ Selling Price	High	Low; < 0.1%	Low; < 0.2%
Substitute Products	High Occurrence	Moderate	Moderate
Capacity Utilization	Low	High	High
Captive Usage	Low	Low	None
Demand Growth	Low	Moderate – High	Moderate – High
Foreign Competition	High	Low – None	None
Abatement Cost Differences	Unequal	Moderately Unequal	Moderate
Price Elasticity of Demand	High	Moderate	Moderate
Basis for Competition	Price	Price	Price
Market Share Distribution	Fragmented	Moderately Fragmented	Fragmented

3. Financial Effects

a. Effect on Profitability

Absorption of costs of compliance will not have any notable or measurable impact on either industry profits or profits for the average mill.

b. Effect on Availability of Capital

Our findings indicated that 63 out of 114 softwood plywood mills reporting would require investment to reach BPT. This number represents 55% of the group. However, their total capital expenditures in 1973 represented only 34% of the total expended in the industry. This is because these mills tended to be existing mills while a sizable portion of industry capital expenditures are made for the construction of completely new mills. The mills not in compliance were expected to have to spend an amount equal to 2% of their 1973 capital expenditures to bring them into compliance with the recommended Guidelines; therefore the likely capital drain on the entire industry to make such expenditures is equal to approximately 1% of the total industry capital expenditures. This level of expenditure will not have a measurable effect on the availability of capital for the entire industry or for those units affected.

It is necessary to examine the situation faced by individual mills to determine if the burden for any single producer will be too great and/or whether producers will be able to technically comply with the proposed regulations.

Our first measure to determine whether a mill might encounter financial difficulty is based on estimated profitability. To estimate profitability for 1973 we used the average selling price for 3/8ths inch standard exterior Douglas Fir plywood as reported by *Random Lengths Yearbook* which was $112 in 1973 and multiplied that figure by our projected profit before income taxes attained in 1972 as described in Section II.B. This yields an estimated net profit before income taxes for our typical mill of 11.7% of sales. Multiplying these two figures indicates the average mill should produce a profit of about $13.10 per thousand square feet of production and it is against this standard that we measured possible economic impact.

The calculation showing dollar costs of compliance per thousand square feet of production for the 63 mills not in compliance shows only two mills which will be required to expend more than $1 of capital for each thousand feet of production. These are mills which respectively are expected to spend $7.50 and $1.36 per thousand feet produced in 1973. All other mills are expected to spend under $1.00 of capital per thousand square feet of production or less than 1% of their 1973 sales.

The two mills which appeared to be financially vulnerable were contacted by telephone. The first mill suffered from a log pond overflow and expected to spend $15,000 to screen these discharges. In fact the manager of that mill reported that the mill actually had two log ponds, the second of which was being converted to a catch basin for the first and that when this conversion was complete (expected to be finished by late summer 1974) no more overflows would reach a stream or river. Therefore this mill would, at that time, be in compliance with the proposed Guidelines and would not be required to expend funds for compliance purposes.

The second mill considered to be financially impacted produced 11 million square feet of plywood in 1973. This mill also suffered from a log pond overflow and was also taking steps to bring discharge under control by alternate means. The mill manager reported the principal source of water for this pond was clear cooling water discharged from the mill. This producer was constructing ditches around the pond to divert that cooling water elsewhere and stop overflows from this one acre pond, thereby bringing the mill into compliance.

These were the only two mills considered to be vulnerable on a financial basis and, based on our further interviews with the managers, we do expect closure. (It is interesting to note as well that the steps these mills were taking to bring themselves into compliance could be used by a number of their mills; thus lowering the expected total costs of compliance to the industry.)

For veneer mills the analysis yields the same conclusion. The maximum capital expenditure for a veneer mill would represent only 2% of net assets. Most mills could readily finance that amount out of cash flow. Further, the annual increase in operating costs is only 0.2% of sales revenues, at maximum.

4. Production Effects

The only other basis which might preclude compliance would be a lack of land to construct lagoons for log conditioning water discharges. Six mills were discharging log conditioning overflows to a stream or river. The questionnaire for each was examined to determine if the mill either had a log or treatment pond to which conditioning waters could be diverted or if land was owned or available to construct a treatment pond. Of the six mills suffering from this problem 4 had log ponds or treatment ponds where we assume the log conditioning water could be discharged and the remaining two reported they were able to purchase more than 18 acres of land adjacent to the mill sites which could be used for lagoon construction. Since less than one acre of land is estimated to be required for lagoon construction this is clearly sufficient to bring the mills into compliance. Therefore, on a technical basis, we conclude no mills would be required to close due to a lack of ponds to accept log conditioning discharges or due to a lack of land to construct such ponds.

Since we concluded above that financial effects where minimal, there will be no closures of mills resulting from institution of the recommended guidelines. Table V.C.2 summarizes the plant closure circumstance for the segment as a whole.

Therefore, there will be no lost production, no plants closed, and no measurable effect on industry growth.

TABLE V.C.2

PLANT CLOSURE ANALYSIS MATRIX
SOFTWOOD PLYWOOD AND VENEER

Parameter	Condition for Closure	Softwood Plywood Segment
AT Treatment Cost ÷ AT Net Income	High	Low; 0-4%
Cash Flow	Negative	Positive, Strong
Degree of Integration	Low	Moderate
Abatement Investment ÷ Net Fixed Investment	High	Low; < 1%
Other Facilities on Common Site	Isolated	Moderate
Ownership	Large, Multi-industry	Large, Multi-industry

5. Employment Effects

There will be no losses of jobs due to implementation of the proposed guidelines.

6. Resultant Regional Effects

There will be no difference between regions of the country in terms of the measurable effects of the proposed guidelines.

7. Balance of Payments Effects

The effect of the proposed guidelines is so minimal that there will be no measurable effect on the U.S. balance of payments.

D. SAWMILLS AND PLANING MILLS, GENERAL – SIC 2421

This section estimates the economic effect on the hardwood and softwood sawmill industries of complying with recommended effluent control standards. The suggested standards are developed for discharge of waste waters from "mill operations" and from "log storage activities." Our analysis indicates the industry will be fully able to comply with the required standards for mill operations, since essentially no processing changes or investment in equipment will be required.* However, to control waste water from log storage activities, a number of firms will be required to invest in abatement facilities. This analysis focuses on these standards.

1. Costs of Compliance

It is assumed that mills employing more than one form of wet log storage (i.e. ponds and wet decks) will be able to channel the effluent from both sources into one facility. It is also assumed that the required expenditure per violating mill will be $8,600 capital investment; $3,000 annual charges.* Some mills will be able to employ smaller installations and will not be required to spend the full sum. To the extent this occurs this analysis represents a "worst case" calculation. Finally there will undoubtedly be some mills which will be able to comply with the required standards without installing any facilities through the use of water collection or diversion systems or by changing their method of operation. Presumably a mill will follow an alternate course only when that course is less costly than that required by the proposed screening technology. Again to the extent this occurs this analysis represents a "worst case" situation.

To improve the available data base, we conducted a survey of 195 softwood and hardwood sawmills by telephone during March 1974. The mills surveyed were selected at random from trade directories and an effort was made to make the sample as representative as possible. The number of mills interviewed by state is shown in Table V.D.1. A total of 144 softwood mills and 51 hardwood mills were interviewed. The sample of softwood mills is roughly equal to 10% of the total number of mills estimated to be operating in the industry while the sample of hardwood mills is equal to about 5% of those mills known to be operating.** We feel a 10% sample of the softwood mills is sufficient for statistical reliability and a 5% sample of the hardwood mills known to be operating is also sufficient.

*See Development Document for details.

**We estimate approximately 1,000 hardwood mills are operating full time and known to be identifiable; industry sources estimate there may be an additional 1,000 mills who operate at various times but are not identifiable through conventional trade sources.

SAWMILL SURVEY

TABLE V.D.1

SURVEY SAMPLE BY TYPE OF MILL AND LOCATION

Area	Softwood Mills	Hardwood Mills
Northwest		
California	21	–
Idaho	8	–
Montana	8	–
Oregon	28	–
Washington	12	2
Subtotal	77	2
Other U.S.		
Alaska	2	–
Alabama	6	5
Arizona	1	–
Arkansas	4	5
Colorado	3	–
Florida	1	–
Georgia	8	1
Maine	1	–
Michigan	4	4
Mississippi	6	1
New Mexico	2	–
North Carolina	4	3
Louisiana	2	–
Maryland	–	3
Kentucky	–	5
Ohio	–	2
Pennsylvania	–	7
South Carolina	5	4
Tennessee	1	4
Texas	8	–
Virginia	6	2
Wyoming	2	–
Wisconsin	1	2
Missouri	–	1
Subtotal	67	49
TOTAL SAMPLE	144	51

Our survey shows there will be significant regional differences in the impact of the proposed regulations. For example, as shown in Table V.D.2, 53% of the softwood mills surveyed in the Northwest could be affected by the proposed log handling and storage regulations.* In contrast only 13% of the softwood mills operating in the balance of the United States are expected to be affected. None of the hardwood mills operating in the

TABLE V.D.2

LOG STORAGE METHODS EMPLOYED

	Northwest Softwood	%	Other Softwood	%	Northwest Hardwood	%	Other Hardwood	%
Mills Potentially Impacted:								
Ponds Method								
Ponds Only	5	6	–	–	–	–	–	–
Pond, Wet Deck and Dry Deck	6	8	–	–	–	–	–	–
Pond and Wet Deck	4	5	–	–	–	–	2	4
Pond and Dry Deck	1	1	–	–	–	–	–	–
	16	20	–	–	–	–	2	4
Other Wet Methods								
Wash Logs and Dry Deck	1	1	–	–	–	–	–	–
Wet Deck Only	23	30	4	6	–	–	6	12
Wet Deck and Dry Deck	7	9	5	7	–	–	4	8
	31	40	9	13	–	–	10	20
Subtotal	47	61	9	13	–	–	12	24
Mills Not Impacted Dry Methods	30	39	58	87	2	100	37	76
Total	77	100	67	100	2	100	49	100

*I.e., these mills use wet handling and storage techniques. Since the EPA has suggested that wet decking operations be "decontrolled," only those firms operating pond will be impacted, i.e., 21% of Northwest softwood mills.

Northwest will be affected (there are very few hardwood mills in that area) while 24% of those operating in the balance of the U.S. operate in a fashion which would cause them to be affected by the log storage regulations.

Table V.D.3 shows additional detail on the operations of mills employing wet deck log storage. Most significant is the fact that the majority of mills employing wet deck storage already recirculate log spray water. In the Northwest 19 of 40 mills reporting (48% of the group) have installed systems for recirculating log spray water; among softwood mills operating elsewhere in the United States, fully 89% presently recirculate log spray water while; 50% of the hardwood mills do so as well.

It is also significant that the use of log spray equipment tends to be a seasonal operation. Northwest softwood mills spray logs an average of only 4.8 months per year (the median producer reported spraying for 12 months). Among hardwood mills the mean and median number of months logs were sprayed was the same, seven months.

TABLE V.D.3

WET DECK OPERATIONS

	Northwest Softwood Mills	Other U.S. Softwood Mills	Other U.S. Hardwood Mills
Number of Mills	40	9	12
Size in Acres			
Range	2 – 100.0	0.5 – 10.0	0.5 – 10.0
Mean	13.5	3.6	3.2
No. Months Deck is Sprayed			
Range	2 – 12	1 – 12	3 – 12
Mean	4.8	8.3	7.0
Median	4.0	12.0	7.0
No. of Mills Who Recirculate Spray Water	19	8	6
Percent Recirculating Spray Water	48%	89%	50%

Table V.D.4 provides additional information on operators using log or mill ponds for storage. Among Northwest softwood mills 7 out of 18 reporting indicated their ponds never overflowed while only 1 had a pond which always overflowed. The balance incurred occasional or seasonal water discharges. Among other U.S. softwood mills 3 out of 7

TABLE V.D.4

POND OPERATIONS

	Northwest Softwood Mills		Other U.S. Softwood Mills	Other U.S. Hardwood Mills
No. Log or Mill Ponds[1]	15		–	2
Size in Acres:				
Range	1/4 – 40		–	NR
Mean	7.2		–	NR
No. Oxidation/Sedimentation Ponds	18		7	6
Size in Acres:				
Range	1 – 15		1/4 – 1	1/2 – 1
Mean	4.3		.75	.75
Do Ponds Overflow				
Always	1		–	–
Occasionally	8	11	3	1
Seasonally	2		–	–
Never	7		3	4
No Answer	–		1	1
	18		7	6

NR = Not reported

1. Excludes mill using inland lake.

reporting indicated no overflows; one did not answer; and three had occasional overflows.* Only one out of six hardwood mills with an oxidation-sedimentation pond stated that facility overflowed while four reported theirs did not. We assume mills employing oxidation-sedimentation ponds only will not require additional investment to meet effluent guidelines. In that case we note that 40% of mills reporting will apparently not be required to install screening equipment for log ponds.

Table V.D.5 analyzes the mills reporting according to whether or not other wood converting facilities were located and operated at the site of the sawmill. In the Northwest only 38% of the softwood mills expected to be affected were located at sites where other wood converting facilities operate. In the balance of the United States 33% of the softwood mills affected shared their sites with other wood converting operations. The opposite was

*This data applies to oxidation-sedimentation ponds only since no softwood mills operating outside the Northwest used log or mill ponds for log storage.

TABLE V.D.5

HARDWOOD AND SOFTWOOD MILLS WITH MULTIPLE FACILITIES AT SITE

	Mills Potentially Impacted			Mills Not Impacted			Total Mills		
	Total	Number With Multiple Facilities	Percent	Total	Number With Multiple Facilities	Percent	Number of Mills	Number With Multiple Facilities	Percent
Northwest Softwood	47	18	38	30	16	53	77	34	44
Other U.S. Softwood	9	3	33	58	25	43	67	28	42
Northwest Hardwood	–	–	–	2	1	50	2	1	50
Other U.S. Hardwood	12	8	67	37	15	41	49	23	47
							195	86	44

true for the hardwood mills expected to be affected, however, with 67% of those mills sharing common mill sites. In total, for all mills reporting (both those expected to be affected and those not expected to be affected), 56% were stand-alone operations and 44% shared the mill site with some other facility.*

Mills surveyed were asked to report their total 1973 lumber production in board feet. One hundred sixty-one mills answered this question and 34 did not. Table V.D.6 shows the results for those mills reporting. The answers indicate that mills affected by the proposed regulations tend to be somewhat larger than the average. In the Northwest, for example, the mean production in 1973 for mills expected to be affected was 50,000,000 board feet while the average for those not affected was 41,000,000 board feet. In this situation we do not view the difference in unit production to be significant for economic impact purposes. In the balance of the United States, however, the mean production for softwood mills expected to be affected was 35,000,000 board feet in 1973 while the mean production for those not expected to be affected was only 16,000,000 feet. In this case we believe significance can be attached to the difference in unit production; it reflects the fact that larger mills are more complex in their operations and more inclined to invest in spraying equipment to protect larger log inventories.

TABLE V.D. 6

1973 REPORTED PRODUCTION
(million board feet)

	Mills Impacted				Mills Not Impacted			
	Number	Production			Number	Production		
	Reporting	Range	Mean	Median	Reporting	Range	Mean	Median
Northwest Softwood	40	6-198	50	40	29	7-112	41	40
Other U.S. Softwood	7	15- 75	35	32	45	.2- 48	16	10
Northwest Hardwood	–	–	–	–	2	w	w	w
Other U.S. Hardwood	10	3.5- 32	13	8	28	1.5- 15	6	6

w = withheld to prevent accidental disclosure

A similar pattern is found among hardwood lumber producers with those affected reporting a 1973 mean production of 13,000,000 board feet as compared to an average of only 6,000,000 board feet for those not expected to be affected. In the case of the hardwood mills, however, the median mill size was only 8,000,000 board feet for those affected as compared to 6,000,000 board feet for those not expected to be impacted. We caution, again, that in the hardwood situation a number of unidentified, smaller producers will be affected as well.

*The implication of the data relates to our opinion that mills with multiple operations on a single site will be more resistant to pressure for closure, vis-a-vis "stand-alone" facilities.

2. Price Effects

The industry will absorb the increased costs due to expenditures required for water pollution control, it will not be able to pass these costs along to consumers. The rationale for this conclusion is:

- Fewer than half of the total producers operating in the industry will be required to make such expenditures. Because of the extremely competitive nature of the business we do not expect these producers to be able to increase their prices without losing business to their competitors.

- Prices in the industry are historically established by the relationship between supply and demand and not by the cost of production. As costs go up or demand declines prices and supply are adjusted to reflect the new economics of the industry. Because of this pricing mechanism the results of a small cost change such as this cannot be directly traced to any specific shift in price.

- The level of expenditure involved in this situation is so small as to make virtually no impact on very large producers; while it may have some impact on the smaller firms their prices are not established independently and they would be unable to adjust their prices without coming under increased competitive pressure.

For these reasons we feel there will be no directly measurable price effects as a result of these regulations.

3. Financial Effects

Table V.D.7 reports capital equipment expenditures made in 1973. On average the annual capital equipment expenditures reported were significantly larger than those required under the proposed regulations. For example, for Northwest softwood mills which made air pollution control equipment expenditures in 1973 (16 mills), the mean cost of these facilities was $151,000; for those making water pollution control equipment expenditures (18 mills), the average cost was $184,000; and for producers purchasing new production equipment, the mean cost was $1,083,000. A much lower expenditure level prevailed among softwood mills operating elsewhere in the United States although again the figures were considerably higher than the $8,600 maximum expected under the proposed regulation.* A similar pattern exists for hardwood mills.

Table V.D.8 presents a summary of the capital expenditures we estimate will be required to control water pollution among sawmills.

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*See Development Document for cost details and rationale.

TABLE V.D.7

CAPITAL EXPENDITURES IN 1973
(all mills)

	Northwest Softwood Mills	Other U.S. Softwood Mills	Hardwood Mills	All Mills
Air Pollution Control Equipment:				
No. Reporting Expense	16	2	2	20
Mean Cost ($1,000)	$151	NR	$200	$156
Other Pollution Control				
No. Reporting Expense	18	–	6	24
Mean Cost ($1,000)	$184	$14	$ 70	$156
Capital Equipment:				
No. Reporting Expense	6	3	2	11
Mean Cost ($1,000)	$1083	$222	$115	672
Other Pollution As Percent Total Capital Expenditures	15	6	38	19

TABLE V.D.8

SUMMARY OF ESTIMATED WATER POLLUTION CONTROL CAPITAL EXPENDITURE REQUIREMENTS FOR SAWMILL INDUSTRY

	Northwest Softwood	Other U.S. Softwood	Other U.S. Hardwood
Total Mills Operating	650	750	1,000
Percent Potentially Impacted	52[1]	13	24
No. Potentially Impacted	338	98	240
Estimated Total Capital Investment Required ($ million)[2]	$ 2.9	$ 0.8	$ 2.1
Estimated Total All Mills		$ 5.8	
Average Annual Capital Expenditures for Sawmills and Planing Mills (1965-1971) ($ million)		$182.50	
Water Pollution Capital Expenditures as Percent Total Annual Capital Expenditure		0.9%	

1. Adjusted for Northwest softwood ponds which do not overflow.
2. No. mills x $8,600 each.

Based on the results of our survey we have estimated that 52% of the approximately 650 softwood mills operating in the Northwest will be obliged to spend $8,600 each. For the group this represents a total of $2.9 million to be expended by 338 plants. For the balance of the softwood industry, 13% of the group (98 mills) are expected to spend $0.8 million. In the case of hardwood mills we are estimating expenditures will be required by 240 mills for a total of $2.1 million.

In aggregate all mills operating in the United States are expected to spend $5.8 million for water pollution control equipment. In comparison the entire industry has averaged annual capital expenditures of $182.5 million during the period 1965 to 1971. This means the estimated required expenditures for water pollution control equal only 0.9% of the average capital expenditures made by the industry each year.

On the basis of this factor we conclude the proposed standards will not have a significant impact across the industry as a whole, or at least not as measured against historical capital expenditures. However, because the costs of compliance fall unevenly across the industry, i.e., not all mills will be forced to make expenditures, it is, necessary to carry the analysis further and compare the required expenditure against estimated sales and profits for the mills impacted.

a. Northwest Softwood Mills

Table V.D.9 estimates the financial impact of the proposed log storage regulations on the Northwest softwood mills reporting in our survey. The two columns of the table estimate the results of the required expenditure on the average size mill reported expected to be impacted and the smallest mill reporting expected to be impacted. In the first case the average mill produced 50 million board feet in 1973, and we have estimated sales for that mill at $6.3 million with after tax profits of $265,000. In this case the required expenditure of $8,600 represents 0.1% of 1973 sales and 2.8% of estimated 1973 after tax profits.

The parameter of abatement expenditure as a percent of after tax income was used as a closure decision criterion, because:

- Net value of assets data was unavailable;
- The industry practices rapid write-off of such expenditures;
- Showing the impact on the income statement of expensing the abatement expenditure is a "worst case" analysis which, as noted above, will yield the maximum impact; to the exent there is an impact, actual impact will be less.

In the case of the smallest Northwest softwood mill reported expected to be impacted 1973, production was 6 million board feet with estimated dollar sales of $760,000. We have estimated after tax profits for that mill at $32,000. The estimated investment of $8,600 represents 1% of 1973 sales and 23% of estimated after tax profits.

TABLE V.D.9

FINANCIAL IMPACT OF LOG STORAGE REGULATIONS ON NORTHWEST SOFTWOOD SAWMILLS

	Average Mill Reported Impacted	Smallest Mill Reported Impacted
Sales in Thousand Board Feet 1973	50,000	6,000
Estimated Dollar Sales (S million)[1]	$6.300	$0.760
Estimated Dollar Profits After After Taxes[2]	.265	.032
Required Expenditures as Percent of Sales	1%	1.0%
Required Expenditures as Percent of After Tax Profits	2.8%	23.5%

1. Based on 1973 average prices for Douglas Fir studs as reported in Random Lengths.
2. Based on 1965-1972 average of 4.2% of sales from Western Wood Products Association and Commerce Department Reports.

In neither case will the expenditure have a serious impact on these mills. In the case of the average mill reporting in the Northwest this expenditure is so small as to be inconsequential. In the case of the smallest mill expected to be impacted the expenditure represents a sizable portion of one year's estimated after tax profits but it is not greater than the mills likely capability to pay. Although we do not have cash flow information on Northwest softwood mills we note that most mills charge the cost of logs into the mill at a "market" price and to the extent that mills own fee timber they enjoy additional cash flow from that as well.

b. Other Softwood Mills

Table V.D.10 estimates the economic impact of the proposed regulations on softwood mills operating elsewhere in the United States. These are essentially Southern Pine mills

TABLE V.D.10

FINANCIAL IMPACT OF LOG STORAGE REGULATIONS ON OTHER U.S. SOFTWOOD MILLS

	Average Mill Reported Impacted	Smallest Mill Reported Impacted
Sales in Thousand Board Feet	35,000	15,000
Estimated $ Sales (million)[1]	$5.010	$2.150
Estimated $ Profits After Taxes[2]	.210	.090
Required Expenditure as Percent of Sales	. .3%	.3%
Required Expenditure as Percent of After Tax Profits	3.5%	8%

1. Based on 1973 average prices for Southern Pine studs.
2. Based on 1965-1972 average reported profit of 4.2% for Lumber and Wood Products Companies, op cit.

operating in the southeastern United States. Again the results are reported for the average mill expected to be impacted as well as the smallest mill expected to be impacted. The average producer in 1973 manufactured 35 million board feet of lumber with an estimated sales value of $5.010 million. We have estimated its after tax profits at $210,000 and the required expenditure represents only 0.1% of estimated sales and 3.5% of after tax profits. This expenditure level will not seriously impact the average mill reporting.

In the case of the smallest softwood mill operating in the southern United States the production in 1973 was 15 million board feet with an estimated sales value of $2,150,000. We have estimated after tax profits at $90,000 and the required expenditure is 0.3% of sales or 8% of after tax profits. This expenditure will not seriously impact this producer.

Table V.D.11 provides additional operating data for small Southern Pine sawmills based on a 1972 survey undertaken by the Southern Forest Products Association. The data presented is for 11 mills producing 0 to 10 million board feet each of lumber and the results are reported for the average producer (6.225 million board feet) and as well as for the range of producers. Annual sales revenues for the average producer were $868,000 and net income was $58,000. In this case the required expenditure of $15,000 represents 0.8% of the producer's sales and 13% of producer's profit. This expenditure is bearable, even for the very small Southern Pine producer.

It should be noted that among the operating results shown for the 11 Southern Pine mills one mill did suffer an operating loss of $2.32 per thousand board feet produced. Obviously, if a mill is presently operating at a loss a requirement that an additional $8,600 be expended for water pollution control contributes to the financial instability of the

TABLE V.D.11

1972 OPERATING RESULTS FOR 11 SOUTHERN PINE MILLS PRODUCING 0 TO 10 MILLION FEET

	Range	Average
Production (million feet)	2.0–9.8	6.225
Sales Price Per Thousand	$105.66–$168.00	$139.44
Total Costs Per Thousand	$107.98–$149.50	$130.00
Net Income Per Thousand	($2.32) –$ 25.70	$ 9.44
Sales for Average Producer	$868,014	
Net Income for Average Producer	$58,764	
Required Expenditure as Percent of Average Producer's Sales	0.8%	
Required Expenditure as Percent of Producer's Profit	13%	

producer. That mill can reasonably be expected to close in a short period of time anyway; such a mill would be considered a base line closure; the necessity to spend for pollution control would not be the central factor causing mill closure. Such firms, considered "base line closures," are subtracted from any gross closure estimate to yield a net closure figure due to effluent abatement.

c. Hardwood Mills

Table V.D.12 presents an estimate of the financial impact of the proposed regulations on U.S. hardwood producers. During 1973 the average mill expected to be impacted produced 13 million board feet of lumber with an estimated sales value (based on 1972 prices) of $2.080 million. We have estimated that the required expenditure of $8,600 represents only 0.4% of estimated 1973 sales and 10% of estimated after tax profits which were $87,000. For the average hardwood mill we believe the cost of complying with the proposed regulations will not be too large a burden to bear.

The analysis indicates a greater impact on the smallest hardwood mill reporting expected to be impacted. In 1973 this mill produced 3.5 million board feet with an estimated sales value of $560,000. We estimate the profits after taxes for this producer were $23,000. The required expenditure for pollution control facilities represents 1.5% of this producer's sales and 37% of its after tax profits. However, even the small hardwood producers will be able to comply with the proposed regulations without suffering excessively.

d. Total Industry

On an industry-wide basis the $10 million we have estimated will be required to bring all producers into compliance is not an overwhelming burden. As previously noted this expenditure level represents only about 5% of the annual amount the industry has historically expended on new capital equipment; this is not a serious diversion of capital.

TABLE V.D.12

FINANCIAL IMPACT OF LOG STORAGE REGULATIONS ON U.S. HARDWOOD PRODUCERS

	Average Mill Reported Impacted	Smallest Mill Reported Impacted
Sales in Thousand Board Feet (1973)	13,000	3,500
Estimated Dollar Sales (million)[1]	$2.080	$0.560
Estimated Dollar Profits After Taxes	.087	.023
Required Expenditure as Percent of Sales	0.4%	1.5%
Required Expenditure as Percent of After Tax Profits	10%	37%

1. Based on 1972 average estimated sales price of $160 per thousand board feet.

4. Production Effects

We estimate there will be no loss of production due to implementation of these regulations. We do not expect any mills to close as a result of these standards; the diversion of capital involved is significant enough to seriously slow industry growth.

5. Employment Effects

Based on the conclusion there will be no plant closures there will be no employees displaced as a result of these standards.

6. Resultant Regional Effects

We anticipate no regional affects due to implementation of the proposed standards.

7. Balance of Payments

No measurable impact is anticipated on the United States balance of payments as a consequence of these regulations.

E. OTHER SECTORS

These sectors are those portions of the Timber Products processing industry not expected to be affected, based on the analysis of industry structure; i.e., the issues were obvious enough at that level of analysis to obviate the need for a detailed examination of economic impact.

1. Hardwood Dimension and Flooring Mills

There are a total of 585 hardwood dimension and flooring mills reported by the Census of Manufactures in 1967. We are able to identify 59 flooring producers leaving a maximum of 526 firms which could be hardwood dimension mills.

a. Hardwood Flooring

Firms in this sector will have to make effluent abatement investment only if they also operate sawmills. Further, only those firms also utilizing wet deck log storage will have to make the maximum investment ($8,600 capital costs; $3,000 annual costs). Only the larger firms in this industry will have to make this investment. For the firms affected, capital costs represent less than 2% of total assets; annual operating costs are less than 0.1% of sales revenues. These firms will be able to make this investment; thus, there will be no impact on this sector.

b. Hardwood Dimension Manufacturers

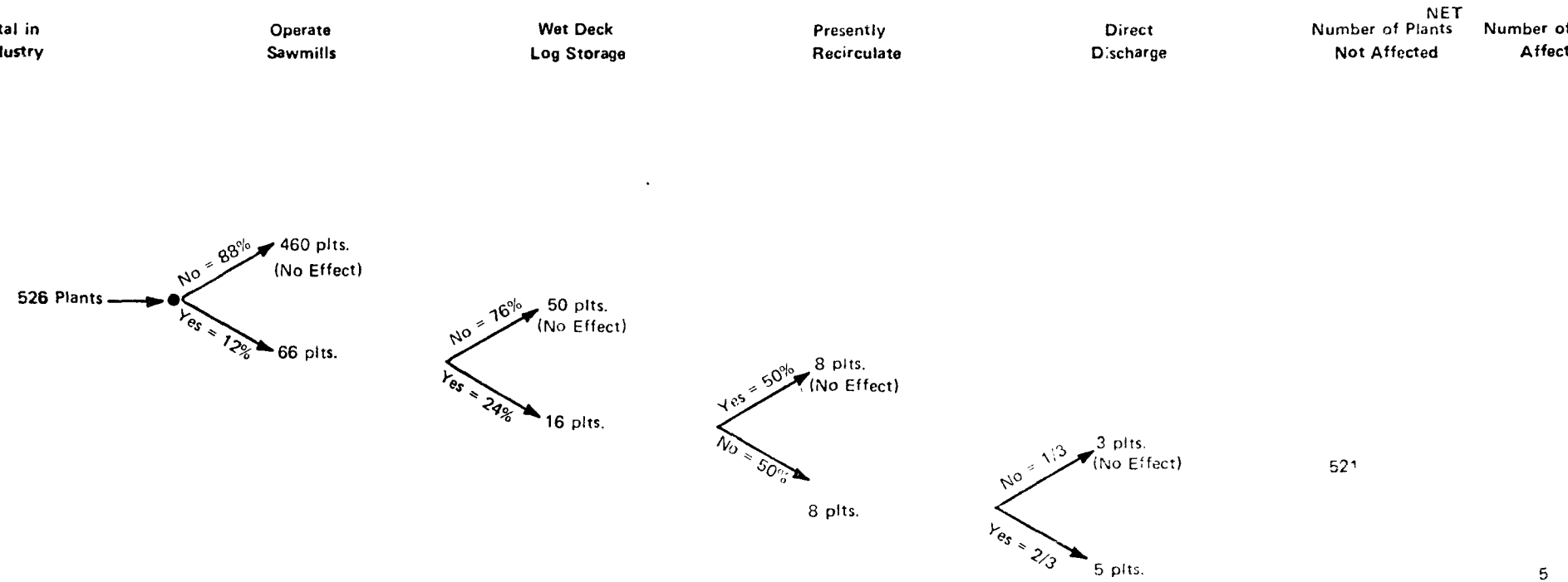
1. Costs of Compliance

Dimension producers are potentially subject to water pollution abatement costs only if they also operate sawmills employing wet storage techniques or if they engage in extensive gluing activities.

In each case, only a small number of firms in this sector are likely to be affected and those affected will either be financially able to bear the burden or have alternate means of complying at lower cost.

2. Wet Decks

A survey of the Hardwood Dimension Manufacturers Association revealed 32% of the members of this association also operated hardwood sawmills. However, firms which are members of the Hardwood Dimension Manufacturers Association tend to be much larger than the average producer, and we estimate that no more than 10-15% of all hardwood dimension manufacturers also operate sawmills. Figure V.E.1 graphically depicts the ensuing analysis which indicates that 5 plants (1% of total) will be affected.



Source: Arthur D. Little, Inc., estimates.

FIGURE V.E.1 PLANTS AFFECTED BY PROPOSED EFFLUENT GUIDELINES FOR LOG HANDLING AND STORAGE – HARDWOOD DIMENSION MANUFACTURERS

A survey of hardwood sawmill operators showed only 24% employ wet decks for their log storage. Multiplying 24% x 10-15% = 2-4% of the total number of hardwood dimension plants which also have wet decks.

Our analysis of hardwood sawmills with wet decks showed 50% were already recirculating their spray water. If 50% of the hardwood dimension mills with wet decks do currently recirculate spray water this would lower the total number of hardwood dimension mills which would be impacted from 2-4% to 1-2%.

Finally, our analysis of Southern plywood operators showed that of mills which operated in the South and did not recirculate their spray water, 1/3 allowed the unrecirculated spray water to run into a pond or on to dry land while 2/3 allowed it to run into a stream or river. This means that of the hardwood dimension manufacturers still potentially impacted, 1/3 would probably not be affected because the water from their operations is likely to go somewhere other than to a stream or river and 2/3 of those might be allowing their unrecirculated spray water to run into a stream or river. However, 2/3 of 1-2% means that only about 1% of the total hardwood dimension manufacturers are likely to be affected by the proposed regulations.

The expenditure expected to be required to install recirculating equipment for a mill presently spraying the wet deck but not recirculating is $8,600. Most hardwood dimension mills do not operate sawmills. In order for a dimension manufacturer to be in the sawmill business, it must be considerably larger than the average hardwood dimension plant. This means it has more assets and a bigger business base to draw on for the funds necessary to make an $8.600 investment. The mills that are still impacted have the financial strength required to invest $8,600 in a recirculating system.

The recently released 1972 Census of Manufactures covering hardwood dimension and flooring indicates that in 1972 firms manufacturing both hardwood dimension and flooring expended $15.1 million on new capital expenditures that year. This is out to an average of $16,000 per firm. Obviously the larger firms spent more and the hardwood dimension plants operating sawmills would fit into the larger category. This means that for the 1% of the firms affected, the capital expenditure requirement is much less than 50% of the likely amount they expended in 1972, perhaps as little as 10-20%.

3. Gluing

The capital cost of compliance for firms with extensive gluing operations which are direct discharging is estimated at $9,000. (This is the cost level estimated for the smaller "model" plant as contained in the Development Document.)

A survey of hardwood dimension manufacturers showed 29% were engaged in extensive gluing operations. Our analysis of those firms with extensive gluing operations, in terms of employment size, showed that firms that did extensive gluing are much larger firms than

the industry average. The industry average showed that half the firms had fewer than 20 employees; our analysis showed that 2/3 of those with extensive gluing activities had more than 30 employees, a significant difference in firm size.

Besides expending the required funds as a means of compliance, the options to a firm engaged in gluing also include:

- The firm could drop the product line which requires the extensive gluing. Since a wide variety of products are offered for sale from hardwood dimension plants, it is quite possible some firms could stop gluing and still not damage their businesses materially.

- The firm could reduce its consumption of water used in glue makeup and glue washing as some producers in the softwood plywood industry have done. This would mean they would not be obliged to install expensive recirculating equipment nor would they be obliged to install evaporating ponds; rather they could collect a small amount of water which is used in washup and makeup and dispose of it at land fill sites.

The majority of firms will be successful in changing their operations to avoid the necessity to install glue control equipment. The balance of the firms which are engaged in extensive gluing activities have the financial strength to comply with these requirements; capital investment for abatement is less than 2% of net assets, annual costs are less than 0.3% of sales revenues.

- *Price Effects:* Since the costs of compliance are unequally distributed across the firms in this industry sector, it will not be possible to pass on cost increases due to effluent abatement.

- *Financial Effects:* The absorption of the costs of compliance is negligible, since only large firms face these costs.

- *Production Effects:* No plants are likely to be forced to close.

- *Employment Effects:* None

- *Regional Impacts:* None.

2. Special Product Sawmills

The key group of manufacturers in this section to focus upon are those companies producing shakes and shingles. While there are many small mills in this sector, the companies only face the costs of compliance for log handling and storage. Incremental annual costs will

represent 0-15% of annual cash flow and 0-3% of annual sales revenues; incremental capital costs will be 0-9% of net assets. Thus, the companies will invest, and there will be no impact on the sector.

The other manufacturers incorporated in this sector, companies which produce cooperage stock (the material from which barrels and kegs are produced), do not use wet storage practices. Thus, there is no effluent pollution problem, no cost of compliance, and no impact.

3. Particleboard

Particleboards are manufactured by a dry process and utilize very little process water. The product is in high demand, i.e., output should increase at between 10-15% per year through 1980.

The costs of compliance are insignificant. Capital costs of effluent abatement represent 0.4% of the necessary investment to build a new plant of minimum economic size. Further, total yearly costs represent 0.15% of the average selling price (1972) achieved by the plant with the lowest unit selling price. Much higher levels of cost could be passed on through price increases.

There will be no economic impact of effluent abatement in this sector.

4. Millwork

Operations in the various millwork subsectors do not include sawmilling, nor do they include extensive gluing operations requiring water for cleanup. Further, the firms are relatively large, in good financial position, and generally tied into municipal treatment plants. Thus, costs of compliance are essentially zero.

There will be no noticeable economic impact in this sector.

5. Prefabricated Wood Structures

Although extensive gluing is encountered in the production of laminated beams, the manufacturing process is quite capital intensive. Thus, the maximum costs of $2,000 for capital investment and $480 in total yearly costs, represent insignificant ratios to capital invested in operations (< 1%) and other operating costs (< 1%).

There will be no economic impact due to effluent abatement in this sector.

VI. LIMITS OF THE ANALYSIS

This analysis faces a generic problem common to all forward looking analyses, i.e., the difficulty of projecting future events. In addition, the two central problems limiting the accuracy of the present analysis are:

- A limited availability of data in suitable form; and
- The nature of the industry segments.

A. DATA LIMITATIONS

Data on these industry sectors is generally present only in a broad, descriptive format. What information is available of a detailed nature tends to focus on the operations and characteristics of larger firms and their large plants. However, these industry sectors are typified by small, privately-owned firms which are more likely to be affected by effluent guidelines than their larger counterparts. Thus, as noted in Section III on methodology, it was necessary to gather new data through a series of industry surveys.

Since insulation board manufacturers are few in number (18), it was possible to contact each of the operations individually and to develop specific data on a plant-by-plant basis. The operators were quite cooperative, and we believe the data accurately represents the operating and financial characteristics of the sector.

However, in the other sectors there were too many firms (e.g., more than 8,000 sawmills) to contact each installation separately. Thus, we performed representative surveys of the industry rather than a comprehensive survey as done for insulation board. The data developed from these surveys represents what we believe is an accurate description of the industry segments.

For example, while we were able to identify only 2,500 sawmills in operation, out of more than 8,000 reported by the Department of Commerce (1972 Preliminary Census of Manufactures), our surveys suggest that the 2,500 firms are those firms operating full time in this industry sector, and those firms which will be affected by the proposed Effluent Guidelines. The remaining firms are largely seasonal operators or other part-time operators not really affected by the proposed Guidelines.

Similarly, the hardwood plywood and veneer survey was intended to cover all manufacturers in this industry, and it was distributed to all known manufacturers. However, the useful responses came mainly from the medium-sized and large-sized producers. Thus, it was necessary to adjust our representative plant models to incorporate smaller firms. This adjustment was made based on the characteristics of those small mills which did respond, and specific discussions with industry sources in terms of the characteristics and problems of the small mills.

Excepting the insulation board manufacturing sector, these industries are composed of small, privately-held, family-managed firms, which is an additional data limitation. Due to the fragmented nature of the industry and the fact that privately-held firms do not publish as much data as do publicly-held firms, it is difficult to get accurate financial data. Even where financial data is available, that data is not always directly comparable to similar data from publicly-held firms, since a small firm may choose to pay its principals higher salaries and fringe benefits, rather than reporting such earnings as net income, which is the more standard practice for a publicly-held corporation. As such, net income and, more importantly, annual cash flow may be understated for these firms.

However, the costs of compliance are relatively modest and the technological alternatives relatively straightforward. Further, the consistency of our data within the various industry sectors gives us confidence that is indeed representative. Thus the analysis can be used to judge the economic impact of proposed Effluent Guidelines on the industry.

B. NATURE OF THE INDUSTRIES

The most difficult issue to analyze in these sectors is the likelihood of plant closure. A large, multi-industry, publicly-held firm such as those active in insulation board manufacture tends to make a shutdown decision based on objective business analysis, such as effects on profitability or importance of a product line to overall corporate strategy. Such a firm would likely have specific criteria for each of its operating facilities to meet. However, a private owner tends to have a greater subjective commitment to staying in business even if profitability is substantially reduced. This is true for such factors as commitment to a facility which has been operated by the family for generations, and for such specifically economic reasons as the fact that this may be a particular family's sole or primary source of income. Further, the privately-held firm considers the magnitude of cash flow as the important issue, rather than profitability ratios. The management of such firms is not likely to perform a discounted cash flow analysis as part of its shutdown decision-making.

Thus, the factors listed in the plant closure analysis matrices (see Table III.C.1) can be used as a guide and to highlight the central issues related to plant closure, but must be assigned different weights when analyzing the decision-making process and the likelihood of closure for a publicly-held firm versus a private enterprise. Where costs approach a level of significance, such as for hardwood plywood and veneer (particularly commercial grade veneer manufacture) the plant closure analysis becomes more suggestive than definitive. On balance, however, the costs of compliance are relatively modest, not relatively high, and the plant closure decision is more straightforward.

C. RANGE OF ERROR ESTIMATES

Table VI.C.1 suggests the range of error for the different portions of this analysis. The parameter used to measure range of error is what we term "substantive" range of error, i.e., it covers the range of error for those sensitive issues which critically influence the final conclusion on economic impact. Thus, for example, while the range of error in terms of number of sawmills actually in operation is at least moderate (± 20%) and likely broad (>± 20%), we do know about the firms most likely to be affected, and the conclusions on economic impact for those operations are quite accurate. The substance of the analysis would not change even if the "unknown" producers were identified.

TABLE VI.C.1

RANGE OF ERROR ESTIMATES

Industry Segment	Substantive Range of Error[1]	Most Variable Portions of the Analysis
Insulation Board	Narrow	Price Increase Analysis
Hardwood Plywood & Veneer	Narrow	Plant Closure Analysis
Softwood Plywood & Veneer	Narrow	Number of Veneer Mills in Operation
Sawmills	Narrow	Number of Mills in Operation
Other	Narrow	Number of Mills in Operation

1. Narrow: ± 10%; Moderate: ± 20%; Broad: >± 20%.

Source: Arthur D. Little, Inc., estimates.

For insulation board, the most variable portions of the analysis relate to the price increase analysis. In this case we project that individual plants will be able to implement specific price increases and thereby will maintain their present returns on investment. However, since firms have the option of changing their product mix or absorbing cost increases to gain a strategic advantage vis-à-vis regional competition, we cannot with full confidence indicate the the firms will increase prices; rather, our analysis suggests they can increase prices if they desire to, and most will probably elect to do so.

At the present levels of costs of compliance, hardwood plywood and veneer manufacturers will not be significantly impacted. However, the small, privately-held firms, particularly those manufacturing container grade veneer, could be impacted by modest abatement investment cost increases (an additional $10,000); thus, in the case of increased costs the plant closure analysis would become a far more sensitive issue. At present levels of cost, the plant closure analysis and the entire economic impact analysis is accurate within a narrow band of error (± 10%).

For none of the other sectors does the fact that our information is not comprehensive regarding numbers of mills in operation affect the substantive range of error. We have identified and focused upon those firms and plants most likely to be affected. The total number of mills in operation is an interesting piece of data for completeness, but is not a crucial factor to determine the economic impact.

APPENDIX A

SOFTWOOD PLYWOOD SURVEY FINDINGS

(1) Sample Analysis: The sample response, 76% of those contacted, corresponds reasonably well with the known distribution of mills by production size. For example, eight mills producing under 40 million square feet annually in 1973 responded to the questionnaire and during 1972 it was estimated there were only 12 mills in the country producing less than 40 million square feet of softwood plywood. Sample respondents also appear to be reasonably distributed geographically. Eight-five mills responded in the Western United States out of an estimated 131 mills operating in that area. This is equal to 65% of the units. In the South 27 mills responded out of an estimated 61 operating in that area or 44% of the universe. In each case the proportion of mills responding is felt to be sufficient for statistical validity.

It is significant that of the 114 mills, responding 37% performed plywood operations exclusively while 63% were located at sites where other wood processing activities were performed. Obviously to the extent mills are capable of sharing pollution control facilities with other converting activities they will seek to do so, and our survey response indicates this might be possible for a large proportion of the industry.

The survey sample also strongly indicates that mills with log storage or log processing operations will be likely to spread the costs of pollution control across other facilities. This possibility is indicated by the extent of the usage of common log yards. For example, 58 plywood mills were located at sites where sawmills were also located and of that group 52 of the sawmills used the same log yard as the plywood mill; 4 plywood mills were located at pulp mill sites and two used the same log yards; 6 plywood mills were located at plywood prefinishing plant sites and 2 used the same log yard; 26 plywood mills were located at sites where log sorting and merchandising took place and 19 used the same log yard; and 12 mills were located at sites where other operations took place with 9 of these mills using the same log yard.

(2) Usage of Public Sewers: Usage of public sewers does not appear to be a viable discharge option for plywood mills. Out of 111 mills answering this question only 48 were served by public sewers at their sites and of this group only 18 were allowed to use public sewers for waste water from manufacturing operations.

(3) Log Storage Methods: Ninety-nine of the 105 mills responding to this question stored logs at the plywood mill site. Of the 105 responding only 21 used dry decks exclusively while 84 employed some form of wet storage.

(4) Frequency of Pond Overflows: The responses to this question indicate that mills employing ponds are likely to encounter an overflow although usually only on a seasonal or occasional basis. Out of 39 mills reporting they had ponds only 8 indicated those ponds

never overflowed while 20 showed seasonal overflows. Three showed occasional overflows, and 8 ponds overflowed constantly. Cross tabulation for the geographic area indicates that all of the ponds identified were located in the West and no plywood mills in the South employed pond storage.

Further, mills employing ponds as a method of storage generally do suffer from overflows which would be identified as water pollution violations. Twenty-six of the 31 reporting overflows indicated these waters flowed into a stream or river.

(5) Wet Deck Usage: A total of 36 mills responded to the question "how many months is the wet deck sprayed?" Only 6 mills sprayed for the full 12 months and 4 of these were located in the South. The median number of months that wet decks were sprayed was 5 months although there was a slight difference between the Western and Southern mills reporting with the Western mills indicating a median of 5 months of spraying and the Southern mills indicating a median of 6 months per year of spraying.

There is a mixed pattern with respect to the usage of spray water recirculating systems. Eleven of the 35 mills reporting indicated they recirculated all of the log deck spray water while 16 of the mills recirculated none of these waters. The balance of the operators fell somewhere in between. On a regional basis the Southern mills were more likely to recirculate some portion of the spray water than the Western mills but overall there does not appear to be a significant difference.

However, unrecirculated spray water tends to be diverted away from streams or rivers. Of 24 mills responding to this question only 8 allowed unrecirculated spray water to flow into a stream or river while 7 diverted these waters to treatment ponds or log storage ponds and 9 diverted them on to dry land.

(6) Log Washing Operations: Log washing was performed only by Western mills. In total only 7 out of 103 reporting indicated that logs were washed at the mill site, and of this group 2 mills recirculated all of the log wash water. Further analysis of the disposal of unrecirculated log wash water indicated only 1 mill discharging unrecirculated log wash water to a stream or river. The others disposed of this effluent in a log storage pond or onto dry land.

(7) Hydraulic Debarking: The practice of hydraulic debarking was somewhat wider spread than anticipated. Thirteen out of 109 mills reporting (12%) indicated using hydraulic debarking equipment. Eleven of these were in the West although 2 Southern mills indicated using hydraulic methods exclusively. Effluent from this source was generally not recirculated. Of the 9 mills indicating the disposal of unrecirculated debarking water, 5 discharged into a stream or river while 4 discharged into a log storage pond.

(8) Log Conditioning: Log conditioning, in one form or another, is practiced by almost 60% of the industry although there is a significant disparity between the West and

the South. Forty-four out of 76 reporting in the West (58% of the group) reported they *did not* condition logs while 26 out of 27 mills reporting in the South *did* condition logs. This result is consistent with our earlier findings and basically represents a difference in the species of log used in plywood mills. These results tend to confirm the industry claim that Southern Pine logs must almost always be conditioned prior to peeling while many Western species do not have this requirement.

Only 15 out of 60 mills answering indicated they were currently able to recirculate all of their log conditioning water and more than half (32 out of 60) presently recirculated none of this discharge.

However, only 6 out of 45 mills reporting discharged log conditioning waters into streams or rivers. The balance discharged to some intermediate point such as a treatment pond, log storage pond, or used dry land disposal techniques.

(9) Veneer Dryers: Veneer dryers were used by 110 of the 114 plywood mills. Of this group 16 mills were equipped to recirculate all veneer dryer wash water while 87 were currently equipped to handle none of it. Only 22 of 88 mills responding indicated their veneer dryer wash down water discharged to a stream or river while the other 66 mills utilized some other method of disposal.

(10) Glue Operations: One hundred ten out of 112 mills responding to this question engaged in some form of gluing activity. A surprisingly large percentage of those mills responding (55 out of 109) indicated they presently recirculated all glue wash waters. Of the remainder 31 mills claimed they recirculated none of it while the balance recirculated some portion but not all. These results indicate a relatively high degree of existing compliance.

Only 7 out of 53 mills responding indicated using sewers for glue wash water disposal and none of the mills dumped glue wash water into streams or rivers. Six of the seven violating mills were located in the Western United States.

(11) Treatment Ponds: Ninety-nine producers responded to this question. Out of the group, 47 had no facility for treating waste water in any way at the plant site while the balance used a variety of sources. The most commonly used treatment technology was some form of oxidation-sedimentation pond and 34 of the producers reported having such ponds at the plant site. In addition 13 producers used some form of dry land disposal, 6 used chemical treatment, and another 6 had some other form of waste water treatment facilities.

Only 15 out of 32 treatment ponds for which results were reported did not overflow. Of the balance 7 overflowed constantly while the remainder overflowed seasonally or occasionally. Mills in both the West and South suffered from overflow problems although a slightly higher percentage of the Southern mills appeared able to completely control treatment pond overflows.

Fifteen out of 16 responding mills indicated their treatment ponds overflowed into a stream or river.

APPENDIX B

INDUSTRY IMPACT SUMMARIES

TABLE B-1

HARDWOOD PLYWOOD AND VENEER -- PLANT CLOSURE AND EMPLOYMENT EFFECT
FOR VARYING LEVELS OF COMPLIANCE COSTS

Guideline Option	Sector	No. Plant Closures	No. Employees Displaced	No. Employees in Sector
I. Process Changes Only	V	0	0	
(Maximum Cost: capital = $5,500 yearly = $3,000)	0	0	0	
	Total	0	0	0
II. I + Recirculation from Wet Decks*	V	2	40	4%
(Maximum Cost: capital = $14,100 yearly = $3,870)	0	0	0	
	Total	2	40	0.1%
III. II + Screening from Wet Decks and Log Ponds	V	11	220	22%
(Maximum Cost: capital = $24,100 yearly = $3,870)	0	9	770	2%
	Total	20	990	2.4%

V = Commercial Grade Veneer
0 = Other Sectors
*Proposed Guideline
Source: Arthur D. Little, Inc., estimates.

TABLE B-2

INDUSTRY SUMMARY

Industry: Insulation Board Only – SIC Code 2661

No. of Plants in Segment	18	
Percent Total Plants in Industry	85%	
No. of Plants Direct Discharging	9	
Percent Total Plants in Segment	50%	
No. of Plants with BPT Treatment in Place	2	
Percent Total Plants in Segment	11%	
	BPT	**BAT**
Cost of Pollution Abatement		
Capital Costs for Segment		
Total Capital Cost	12.7	19.2
Total Capital Expenditures as Percent of Average Annual Investment	n.a.	n.a.
Total Capital Expenditures as Percent of Total Capital In Place	10	15
Annualized Costs for Segment		
Total Incremental Increase Including Capital Charges	3.9	4.9
Total Incremental Increase Excluding Capital Charges	3.0	3.5
Total Incremental Increase Including Capital Charges as Percent of Sales	1.8	2.2
Expected Price Increase		
Expected Increase Due to Pollution Control	2.0%	4.0%
Plant Closures		
Total Closures Anticipated	1	–
Percent Reduction of Segment Capacity Due to Closures	4.0%	–
Employment		
Total Number of Employees Affected		–
Percent of Total Employees in Segment		–
Community Effects	–	–
Impact on Industry Growth	–	–
Balance-of-Trade Effects	–	–

TABLE B-2 (Contined)

INDUSTRY SUMMARY

Industry: Hardwood Plywood and Veneer – SIC Code 2435

No. of Plants in Segment	490
Percent Total Plants in Industry	100%
No. of Plants Direct Discharging	251
Percent Total Plants in Segment	51%

	BPT, BAT
No. of Plants with BPT Treatment in Place	239
Percent Total Plants in Segment	49%
Cost of Pollution Abatement	**($ x 10^6) BPT, BAT**
Capital Costs for Segment	
Total Capital Cost	2.5
Total Capital Expenditures as Percent of Average Annual Investment	11%
Total Capital Expenditures as Percent of Total Capital In Place	0.7%
Annualized Costs for Segment	
Total Incremental Increase Including Capital Charges	0.6
Total Incremental Increase Excluding Capital Charges	0.5
Total Incremental Increase Including Capital Charges as Percent of Sales	0.1
Expected Price Increase	
Expected Increase Due to Pollution Control	–
Plant Closures	
Total Closures Anticipated	2
Percent Reduction of Segment Capacity Due to Closures	0.1%
Employment	
Total Number of Employees Affected	40
Percent of Total Employees in Segment	0.1%
Community Effects	1
Impact on Industry Growth	–
Balance-of-Trade Effects	–

TABLE B-2 (Continued)

INDUSTRY SUMMARY

Industry: Softwood Plywood and Veneer – SIC Code 2436

No. of Plants in Segment	192 plywood, 38 veneer
Percent Total Plants in Industry	100%
No. of Plants Direct Discharging	122
Percent Total Plants in Segment	53%
No. of Plants with BPT Treatment in Place	
Percent Total Plants in Segment	48%

	BPT, BAT
Cost of Pollution Abatement	
Capital Costs for Segment	
Total Capital Cost	$2,095,000
Total Capital Expenditures as Percent of Average Annual Investment	0.9%
Total Capital Expenditures as Percent of Total Capital In Place	< 0.1%
Annualized Costs for Segment	
Total Incremental Increase Including Capital Charges	$ 250,000
Total Incremental Increase Excluding Capital Charges	< 250,000
Total Incremental Increase Including Capital Charges as Percent of Sales	0.1%
Expected Price Increase	
Expected Increase Due to Pollution Control	–
Plant Closures	
Total Closures Anticipated	–
Percent Reduction of Segment Capacity Due to Closures	–
Employment	
Total Number of Employees Affected	–
Percent of Total Employees in Segment	–
Community Effects	–
Impact on Industry Growth	–
Balance-of-Trade Effects	–

TABLE B-2 (Continued)

INDUSTRY SUMMARY

Industry: Sawmills and Planing Mills – SIC Code 2421

No. of Plants in Segment	2,500
Percent Total Plants in Industry	100%
No. of Plants Direct Discharging	635
Percent Total Plants in Segment	25%
No. of Plants with BPT Treatment in Place	1,875
Percent Total Plants in Segment	75%

	BPT, BAT
Cost of Pollution Abatement	
Capital Costs for Segment	
Total Capital Cost	$3,795,200
Total Capital Expenditures as Percent of Average Annual Investment	2.1%
Total Capital Expenditures as Percent of Total Capital in Place	< 0.1%
Annualized Costs for Segment	
Total Incremental Increase Including Capital Charges	$1,000,000
Total Incremental Increase Excluding Capital Charges	<1,000,000
Total Incremental Increase Including Capital Charges as Percent of Sales	0.1%
Expected Price Increase	
Expected Increase Due to Pollution Control	–
Plant Closures	
Total Closures Anticipated	–
Percent Reduction of Segment Capacity Due to Closures	–
Employment	
Total Number of Employees Affected	–
Percent of Total Employees in Segment	–
Community Effects	–
Impact on Industry Growth	–
Balance-of-Trade Effects	–

TABLE B-3

INDUSTRY SUMMARY – OTHER SECTORS

Industry: Hardwood Dimension and Flooring

SIC Code: 2429

No. of Plants in Segment	585
% of Total in Segment	100%
No. of Plants With BPT Treatment in Place	569
% of Total Plants in Segment	97%

	BPT, BAT
Cost of Pollution Abatement	
Capital Costs for Segment	
Total Capital Cost	<$100,000
Total Capital Expenditure as % of Average Annual Investment	1.0%
Total Capital Expenditure as % of Total Capital in Place	<0.1%
Annualized Costs for Segment	
Total Incremental Increase Including Capital Charges	< 50,000
Total Incremental Increase Excluding Capital Charges	< 50,000
Total Incremental Increase Including Capital Charges as % of Sales	<0.1%
Expected Price Increase	–
Plant Closure	–
Unemployment	–
Community Effects	–
Impact of Industry Growth	–
Balance-of-Trade Effects	–

TABLE B-3 (Continued)

INDUSTRY SUMMARY – OTHER SECTORS

Industry: Special Purpose Sawmills

SIC Code: 2429

No. of Plants in Segment	452
% of Total Plants in Industry	100%
No. of Plants Direct Discharging	66
%of Total Plants in Segment	15%
No. of Plants with BPT Treatment in Place	386
% of Total Plants in Segment	85%

Cost of Pollution Abatement	BPT, BAT
Capital Costs for Segment	
Total Capital Cost	$450,000
Total Capital Expenditures as % of Average Annual Investment	< 1.0%
Total Capital Expenditures as % of Total Capital in Place	< 0.1%
Annualized Costs for Segment	
Total Incremental Increase Including Capital Charges	$150,000
Total Incremental Increase Excluding Capital Charges	<150,000
Total Incremental Increase Including Capital Charges as % of Sales	0.5%
Expected Price Increase	
Expected Increase Due to Pollution Control	–
Plant Closures	
Total Closures Anticipated	
% Reduction of Segment Capacity Due to Closures	–
Employment	
Total No. of Employees Affected	
% of Total Employees in Segment	–
Community Effects	–
Impact on Industry Growth	–
Balance-of-Trade Effects	–

TABLE B-3 (Continued)

INDUSTRY SUMMARY

Industry: Prefabricated Wood Structures

SIC Code: 2433

No. of Plants in Segment	236	
% of Total Plants in Industry	100%	
No. of Plants Direct Discharging		
% of Total Plants in Segment	Negative	
No. of Plants with BPT Treatment in Place	161	
% of Total Plants in Segment	68%	
Cost of Pollution Abatement		**BPT, BAT**
Capital Costs for Segment		
Total Capital Cost		<$25,000
Total Capital Expenditures as % of Average Annual Investment		< 1.0%
Total Capital Expenditures as % of Total Capital in Place		< 0.1%
Annualized Costs for Segment		
Total Incremental Increase Including Capital Charges		< 50,000
Total Incremental Increase Excluding Capital Charges		< 50,000
Total Incremental Increase Including Capital Charges as % of Sales		<0.1%
Expected Price Increase		
Expected Increase Due to Pollution Control		–
Plant Closures		
Total Closures Anticipated		
% of Reduction of Segment Capacity Due to Closures		–
Employment		
Total No. of Employees Affected		
% of Total Employees in Segment		–
Community Effects		–
Impact on Industry Growth		–
Balance-of-Trade Effects		–

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15. Supplementary Notes

16. Abstracts

An analysis of the economic impact on certain timber products processing industry sectors (insulation board, hardwood & softwood plywood & veneer, general purpose sawmills, special purpose sawmills, hardwood dimension & flooring mills, particleboard, millwork, and prefabricated wood structures), to meet 1977 and 1983 Effluent Guidelines. Only modest impacts are expected at present levels of cost and proposed standards. Effects are concentrated on insulation board manufacturers, small hardwood plywood and veneer producers, and small sawmill operators. For small firms, abatement capital and operating costs are not severe, but at modest increments (e.g., $10,000 additional investment), many plant closures are likely to result. As is, plant closures are few (3 of 10,000+), and price increases to consumers minimal (only likely for insulation board and particleboard products).

17. Key Words and Document Analysis. 17a. Descriptors

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17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

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