ECONOMIC IMPACT ANALYSIS OF ALTERNATIVE POLLUTION CONTROL TECHNOLOGY FOR THE WET PROCESS HARDBOARD AND INSULATION BOARD SUBCATEGORIES OF THE TIMBER PRODUCTS INDUSTRY

report to

U.S. ENVIRONMENTAL PROTECTION AGENCY

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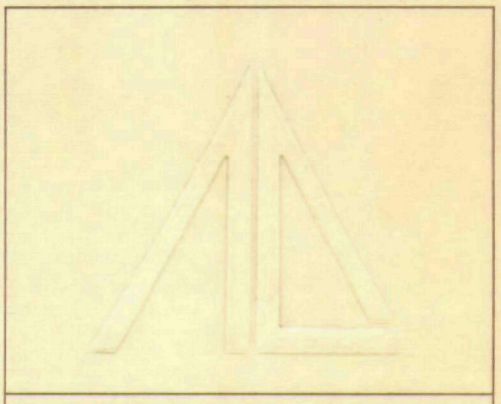

Arthur D. Little, Inc.

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ECONOMIC IMPACT ANALYSIS OF ALTERNATIVE POLLUTION CONTROL TECHNOLOGY FOR THE INSULATION BOARD AND WET PROCESS HARDBOARD SUBCATEGORIES OF THE TIMBER PRODUCTS INDUSTRY

U.S. ENVIRONMENTAL PROTECTION AGENCY

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Contract No. 68-01-4194

Arthur D Little Inc

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I EXECUTIVE SUMMARY

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II INDUSTRY CHARACTERIZATION — INSULATION BOARD

A. INDUSTRY DEFINITION

The insulation board industry (a subset of the building board industry, SIC 2261) is comprised of establishments engaged in the production of structural and decorative fiberboard products constructed from interfelted ligno-cellulosic fibers and having a density of less than 31 pounds per cubic foot.

B. TYPES OF FIRMS

1. Size of Firms.

Twelve companies, one of which is privately held, operate the 17 insulation board plants in the United States (the plants are identified in Table II-3). Eleven of these companies are large diversified corporations, five have major interests in forest products and six have major interests in other building products. There are only two multi-plant companies; Celotex, the largest producer operates four plants and U.S. Gypsum operates three.

The percentage of sales revenues contributed to each company by insulation board products is quite variable. Although they may hold sizeable insulation board capacity, most of the companies are involved in many other businesses and cannot be considered to have significant capital committed to the industry relative to their total business. Annual sales of the 12 companies, including sales from other operations

such as lumber, plywood, and non-wood products, range from $2 million to over $3.6 billion as shown in Table II-1. This table also shows each company's sales derived from insulation board.

2. Integration/Diversification.

The major forest products firms are normally fully integrated back to timber ownership or control and forward to distribution systems. Insulation board is usually manufactured to take advantage of the volumes of locally available waste from other wood products mills and to broaden the company's product line.

Four of the forest products firms (Abitibi, Boise Cascade, Georgia Pacific, and Weyerhaeuser) have major capital interests in various segments of the paper industry as well as a full spectrum of building products. Temple Industries, a subsidiary of Time, Inc., is a producer of a wide range of solid wood products.

Five of the building products firms involved in the insulation board industry (U.S. Gypsum, National, Kaiser Gypsum, Flintkote and Celotex, a Division of Jim Walter Corporation) are highly diversified into both residential and nonresidential building materials. Armstrong Cork has major interests in both residential and commercial interior finishing materials including floor coverings, wall coverings, and furniture. The general building products firms produce insulation board to complement their product line. While these firms are characterized by well-developed captive distribution systems, they generally are not integrated back to timber control. The remaining company, Huebert Fiberboard, is privately held and insulation board apparently constitutes the major business of the company.

TABLE II-1

SALES BY INSULATION BOARD MANUFACTURERS
(1977; $ Million)

Company	Total Corporate	Insulation Board[2]
Abitibi Paper Co., Ltd.	880	12
Armstrong Cork	981	31
Boise Cascade	2316	16
Celotex/Jim Walter[1]	525/1422	59
Flintkote	587	16
Georgia Pacific	3675	16
Huebert Fiberboard	2	2
Kaiser Gypsum	212	12
National Gypsum	748	15
Temple/Time Inc.	340/1038	17
U.S. Gypsum	1177	21
Weyerhaeuser	3283	23

[1]Fiscal year ended August 31

[2]At 80% of capacity and $97/MSF, 1/2"

Source: Dun and Bradstreet Directory, 1978
Directory of Corporate Affiliates, 1978

C. PRODUCT DESCRIPTION

1. Types of Products.

Insulation board is known in the marketplace under many different names including fiberboard, sheathing board, backer board, and asphalt board. There are seven principal types of insulation board products that can be described as follows:

1. Building Board — general purpose product for interior construction.
2. Insulating Roof Deck — a three-in-one component which provides roof deck, insulation, and a finished interior ceiling surface. Insulation board sheets are laminated together with waterproof adhesives.
3. Roof Insulation — insulation board designed for use on flat roof decks.
4. Ceiling Tile — insulation board embossed and decorated for interior use. It is also valued for acoustical qualities.
5. Lay-in-Panel — a finished tile board used in suspended ceilings.
6. Sheathing — a board used in exterior construction due to its insulative, bracing strength, and noise control qualities and its low price.
7. Sound Deadening Insulation Board — a special product designed for use in buildings to control noise levels.

The American Society for Testing and Materials, American National Standards Institute, U.S. National Bureau of Standards, and other agencies set standard specifications for the above product categories and others.

2. Market Size and Future Growth.

Since 1965, total U.S. production as reported by the Bureau of the Census, has fluctuated between a low of 1.16 million tons (3.0 billion square feet, 1/2" basis) in 1970 to a high of 1.55 million tons (3.9 billion square feet) in 1973. (Table II-2). In 1971 and 1972 it appeared that the insulation board industry was slowly losing its market and steadily becoming more unprofitable as plants continued to close. Six plants have closed since 1960 and operations at two more plants were severely cut back in 1977. Since 1975 per capita consumption of insulation board has fluctuated between 11.3 and 13.5 pounds per person while total U.S. production in 1976 was still below the 1973 peak, as shown in Table II-2. While the future trend for insulation board is a declining one, the current (1978) high levels of housing construction and the demand for insulation stabilized production levels.

Currently, trade directories indicate that 64% of the world's insulation board capacity is located in the United States. Government data on insulation board imports and exports are unreliable; the volumes are small and offsetting hence data are not shown. However, imports have generally been less than 2.5% of domestic production according to U.S. Forest Service data.

Interior products account for 30% of the total production (on a 1/2 inch basis) and are mainly prefinished building board and ceiling tile. Exterior products, principally sheathing board and roof insulation board, represent 58% of production. The remaining 12% includes insulation board used in industrial applications, principally trailer (mobile home) board.

TABLE II-2

PRODUCTION OF INSULATION BOARD 1965-1976

Year	Production		
	Total[2] (000 Tons)	Per Capita (Pounds)	Per $ Billion of New Construction[1] (000 Tons)
1965	1258	12.9	15.9
1966	1155	11.7	14.5
1967	1176	11.8	15.1
1968	1133	11.3	13.8
1969	1352	13.3	16.4
1970	1219	11.9	15.5
1971	1446	14.0	16.9
1972	1529	14.6	16.6
1973	1547	14.7	16.6
1974	1295	12.2	16.2
1975	1240	11.7	17.9
1976	1450	13.5	19.8

[1]Constant 1967 dollars.

[2]Annual growth rate 1.6%

Note: Government import/export data are unreliable. The volumes are generally offsetting and less than 2.5% of sales; therefore, the data are not shown.

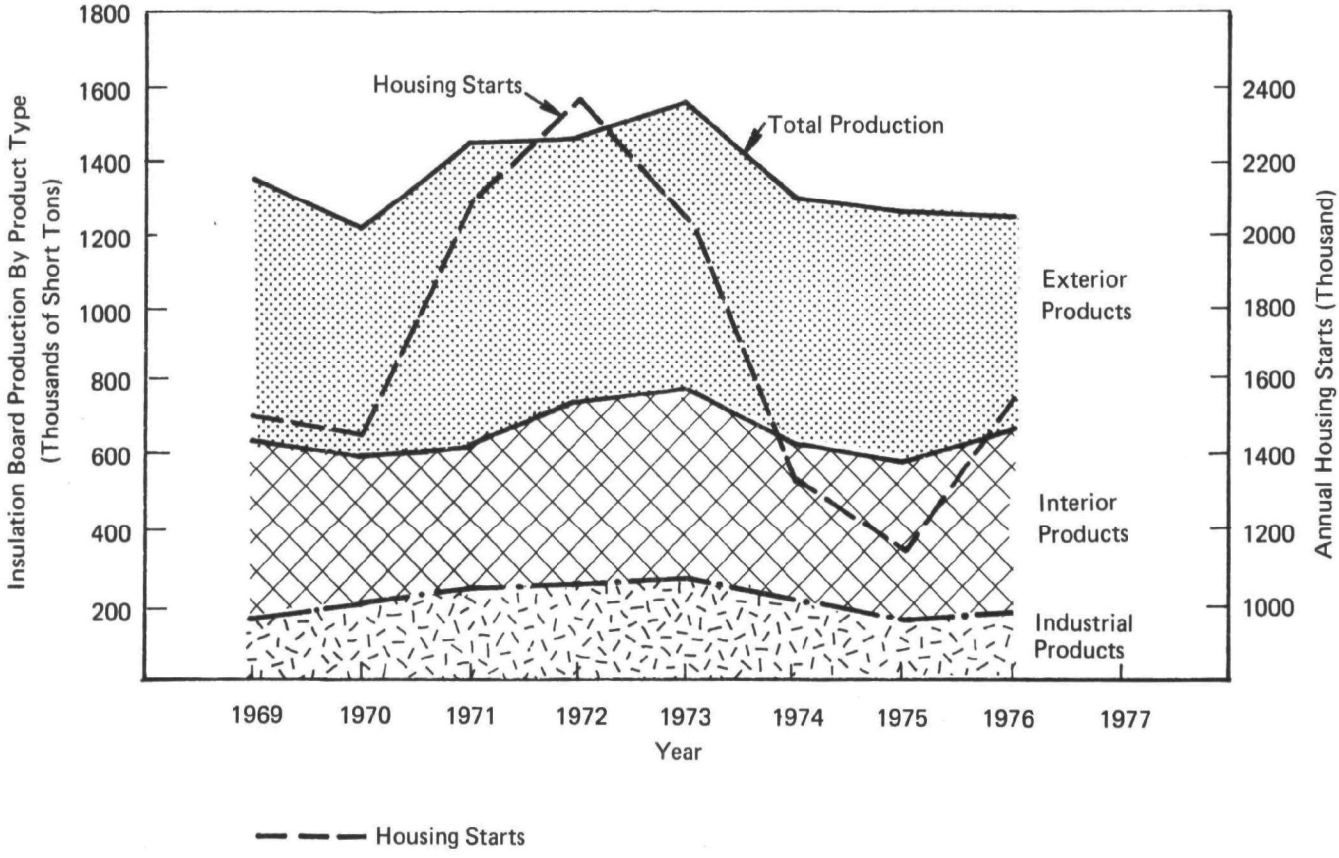
Source: "The Demand and Price Situation for Forest Products 1976-1977"
USDA, Forest Service Miscellaneous Publication 1357

Production of insulation board in these three product classes and housing starts is shown in Figure II-1[1].

The largest of interior products market has traditionally been non-acoustical ceiling tile and lay-in panels. This particular market has dropped from 530 million square feet in 1972 to 321 million square feet in 1976, largely as a result of stricter flame spread requirements adopted in building codes. The product, which had been widely used in nonresidential construction, is now limited to the residential repair and remodeling market. Improvements in some fire resistance qualities have helped the acoustical tile market grow from 172 million square feet to 201 million square feet over the 1972-1976 period and kept regular tile products from losing even more of their market. Sound deadening board has suffered heavy market losses with volume slipping from 114 million square feet to 46 million square feet over the same period. The future of the interior products markets is highly dependent on the ability of the manufacturers to develop a better fire resistant board. Arthur D. Little forecasts the interior products market will decline 5-6% annually through 1982.

The largest of the exterior products markets is sheathing. In this application, insulation board is frequently used as a backup to brick veneer. Sheathing volume decreased from 1,608 million square feet to 1,368 million square feet over the period 1972 to 1976; however, it should be noted that 1972 insulation board sheathing production was the highest in the past nine years. The availability of price-competitive products and the fact that many building codes permit exterior wood sidings to

[1]For a more detailed breakdown, see Appendix Table A-1.



Source: U.S. Department of Commerce, *Current Industrial Reports,* M26A.

FIGURE II–1 INSULATION BOARD PRODUCTION

provide rack[1] resistance, previously provided by plywood sheathing or brick, are acting to cut back the insulation board sheathing market. Also, insulation board sheathing products have an R-value of approximately 2.64 (°F ft^2. Btu/inch). This is considerably lower than most true insulation products like fiberglass and foams. Furthermore, the sheathing panels are usually 1/2 inch thick with a resulting R-value of only 1.32, which is below what is being required in energy conserving construction.

Gypsum sheathing is insulation board's chief competitor in the sheathing market. The 1977-1978 housing boom, however, has caused a shortage of gypsum with the result being more insulation board is currently used than would otherwise have been the case. Gypsum is a good example of a preferred cost competitive product. New products such as foil backed structural foams are also competing in the sheathing market. On the other hand, roof insulation board has made a recovery with production going from a nine-year low of 261 million square feet in 1972 to 549 million square feet in 1976. As a result, the total exterior products market volume has increased 1.6% over the 1972-1976 period. The exterior product demand will weaken as housing construction slows and as capacity comes on stream from competing products (approximately 10 plywood mills and at least two foam panel plants are currently under construction). In view of these downward pressures on demand, Arthur D. Little forecasts the exterior products market to drop by 2.5-3.0 percent annually through 1982.

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[1]Racking strength – the ability of the structural unit to withstand shear and bending stresses resulting from various building loads.

The industrial market for insulation board has dropped from a nine-year high of 718 million square feet in 1972 to 418 million square feet in 1976. Most of this loss is due to a drop of 243 million square feet over the 1972-1976 period in the trailer board market, which was largely a result of flame spread requirements in mobile homes. The use of insulation board for expansion joint strips has also fallen off dramatically. Arthur D. Little estimates that the industrial market will decrease 7-8 percent annually through 1982.

The insulation board industry is indirectly affected by the level of hardboard imports; should the hardboard demand growth require more domestic capacity, existing insulation board capacity can, in specific cases, be converted to produce hardboard. A general conversion from hardboard to insulation board capacity, although it is not likely, may also occur on a limited basis during periods of weak demand for hardboard.

In evaluating the overall growth rate, it should be remembered that most insulation board is used in remodeling or new construction and is thus cyclical in demand. Various historic growth rates were calculated, based on data in Table A-1, using a least squares time trend line to minimize the influence of cyclicality. The market for exterior insulation board products grew at 0.74% per year over the 1969-1976 period while interior and industrial products grew at an annual rate of 0.55% and -1.6% respectively. The annual growth rate for total production over the 1969-1976 period was 0.35%. At the same time, the economy in general has experienced real growth of about 3.0% per year, which reflects the fact that insulation board has been losing market share to competitive products for

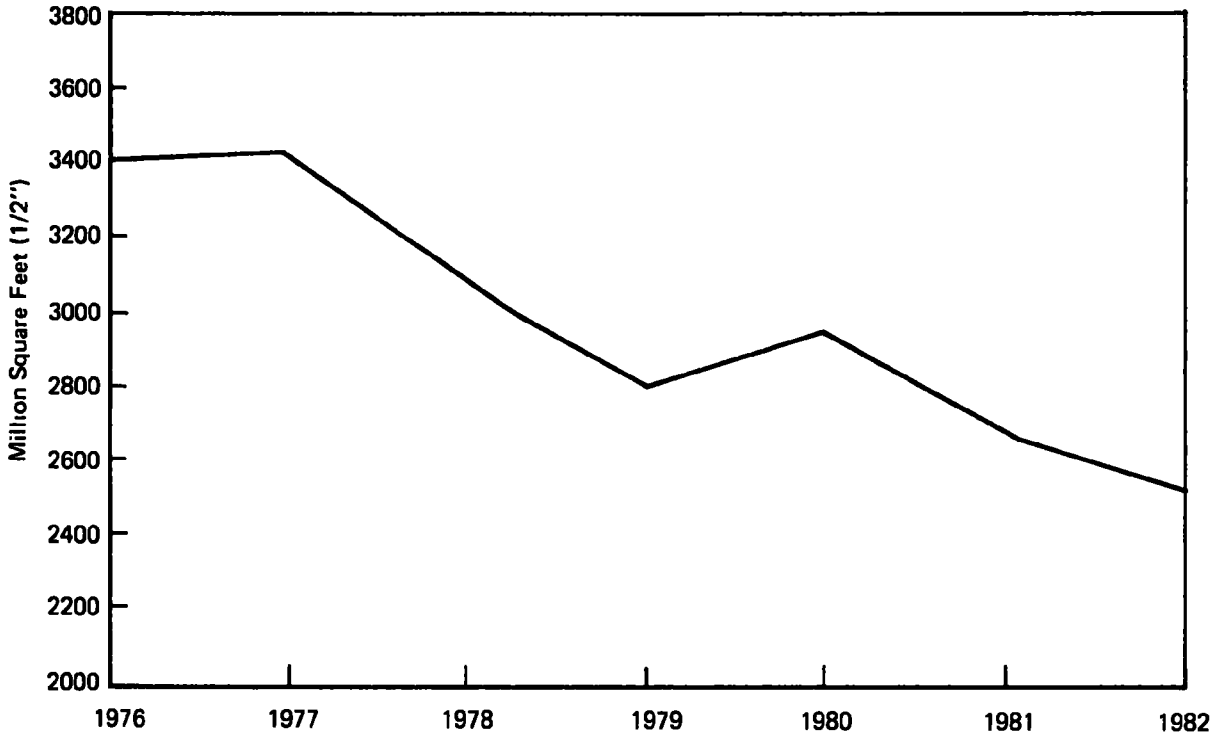
a long time due to the reasons discussed earlier. The factors which have contributed to the current favorable supply/demand balance for insulation board are temporary; a strong housing market combined with the shortage of gypsum sheathing will not persist. Further competition from competing products will become more intense. In view of these considerations, the aggregated market for insulation board is projected to decline at an average rate of 5% annually through 1982 as shown in Figure II-2. However, the cyclical nature of construction activity will cause short-term growth and contraction in demand typical of most building materials.

D. PLANT CHARACTERISTICS OF THE EXISTING INDUSTRY

1. Process Technology.

The basic operating technology of the industry is very similar to the fourdrinier paper process and has not changed substantially since its inception. A cylinder screen type of mat forming system is also used and has had some impact on the volume of process water required. Some improvements have also taken place in the fiber refining stage of the production process.

Technical developments that have a significant impact on the industry will arise from the market in terms of product substitution or requirements for changes in product characteristics rather than minor production process improvements.



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

FIGURE II–2 INSULATION BOARD DEMAND, 1976–1982

2. Size of Plants.

Table II-3 lists each plant in the industry by owner, location and capacity. Existing plant capacities range from 54 million to 400 million square feet (on a 1/2 inch thick basis). The mix of structural and tile products at a given mill can have a substantial impact on the stated mill capacity figure; a mill that produces interlocking ceiling tile will produce 20% less board than an identical mill producing sheathing due to trim losses and product configuration. Plants producing pre-finished building board and lay-in ceiling tile will also have trim losses considerably in excess of sheathing mills. Stated capacity figures must be considered with this in mind.

3. Age Distribution.

Table II-4 contains an age distribution of plants.[1] Age is a factor in overall plant efficiency. Twelve of the plants are over 20 years old and all but one are over ten years old.

4. Location.

Ten of the 17 plants are located in the South and the remainder are in Maine, Michigan, Minnesota, Pennsylvania, and Oregon. This distribution developed because of the availability of wood fiber close to the market and insignificant competition for wood resources in the South at the time the plants were constructed. The sites are evenly distributed between rural, suburban, and urban areas.

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[1]The Celotex plant in Marrero is excluded from this analysis because it does not use wood fiber as a raw material but is included in the discussion in order to present a complete picture of the industry.

TABLE II-3

INSULATION BOARD PLANTS IN THE UNITED STATES, 1977

Company	Location	Annual[1] Capacity (MMSF-1/2")	Other Products Manufactured
Abitibi	Blountstown, FL[3]	150	
Armstrong Cork	Macon, GA	400[2]	
Boise Cascade	International Falls, MN	210	Hardboard
Celotex	Dubuque, IA	737	
Celotex	Marrero, LA[4]		
Celotex	L'Anse, MI		
Celotex	Sunbury, PA[3]		
Flintkote	Meridan, MS	200	
Georgia Pacific	Jarratt, VA	210	Hardboard(1978)
Huebert Fiberboard	Boonville, MO	50	
Kaiser Gypsum	St. Helens, OR	150	
National Gypsum	Mobile, AL	192	
Temple Industries	Diboll, TX	220	Hardboard
U.S. Gypsum	Lisbon Falls, ME	271	Hardboard (all facilities)
U.S. Gypsum	Pilot Rock, OR		
U.S. Gypsum	Greenville, MS		
Weyerhaeuser	Broken Bow(Craig), OK	300	Hardboard
	Total	3090	

[1]These are approximate capacities as they depend upon product mix. Figures quoted are for mills operating 24 hours/day, 6-2/3 days/week, 50 weeks/year.

[2]Understated due to heavy tile production. If operated as a sheathing mill, capacity would increase 20%.

[3]No effluent.

[4]Not considered in this analysis

Sources: 1976 Directory of the Forest Products Industry, American Board Products Association, and Arthur D. Little, Inc. estimates.

TABLE II-4

AGE DISTRIBUTION OF INSULATION BOARD PLANTS

Age (Years)	Number of Plants
0-19	5
20-29	5
30+	7
Total	17

TABLE II-5

EMPLOYMENT LEVEL OF INSULATION BOARD PLANTS

Number of Employees	Number of Plants
0-199	5
200-299	5
300-399	3
400+	4
Total	17

Source: EPA financial 308 survey data

Wood resources that are owned or controlled under long-term contracts typically supply 30-50% of the plants' raw fiber needs. The balance of each plant's fiber requirement is made up by open market purchases. Four of the mills are part of multi-plant forest products production complexes and derive a substantial portion of their fiber requirements from the waste of other operations.

5. Employment.

The 1972 Census of Manufactures indicates the industry supported 6,100 employees on a payroll of $59 million. As shown in Table II-5 most of the plants operate with over 200 employees; however, relative to the more basic wood products, such as lumber and plywood production, it is one of the less labor-intensive segments of the industry.

E. CHARACTERISTICS OF NEW PLANTS

In the past nine years, only one new insulation board plant has opened. Since 1960, six plants have shut down. In 1976 and 1977 two large plants announced major cutbacks in their operations. In 1978 Georgia Pacific is expected to divert some of the wet process capacity in Jarratt, Virginia from insulation board to hardboard siding but will operate both production lines. No companies have announced any intentions, plans, or desires to build additional insulation board capacity.

F. COMPETITIVE STRUCTURE

1. Market Structure.

The industry has become more concentrated since 1960 when 23 insulation board plants were operated by 17 firms. Currently, as Table II-6 shows, the top three firms control 47% of industry capacity and the top

TABLE II-6

CONCENTRATION IN THE INSULATION BOARD INDUSTRY

Firm	% Capacity
Celotex	24
Armstrong Cork	13
Weyerhaeuser	10
U.S. Gypsum	9
Temple	7
All Others (7)	37
Total	100

Sources: American Board Products Association, and Arthur D. Little, Inc. estimates

five firms control 63%. As product demand declines and plants close or convert to other products, the industry is expected to become more concentrated.

2. Pricing Mechanism.

The economic justification for construction of insulation board plants was based on the use of waste from other forest products mills as the basic raw material supply. While this raw material was initially very inexpensive, increased competition for wood chips, as well as rising energy, labor and pollution control costs have increased insulation board costs since 1972. Table II-7 exhibits the price history for three insulation board products for the period 1965-1976.

Insulation board prices are usually quoted on a dollar per thousand square feet basis, f.o.b. shipping point with full freight allowed to the destination. Insulation board sheathing prices increased 57% between 1965 and 1976 with a 30% increase occurring since 1973. The price of ceiling tile has also increased 57% since 1965, but registered only a 15% increase since 1973. It should be noted that ceiling tile prices reflect the higher value-added manufacturing steps and are more than double the price of sheathing; therefore, while the percentage increases for the 1965-1976 period are equal, the absolute dollar price increases for ceiling tile are more than double the price increases for sheathing.

The major pricing constraint for insulation board is created by price levels of substitute products rather than intra-industry competition. The price comparisons must be made on the basis of performance value, not unit costs. The triple role of insulation board as a structural,

TABLE II–7

PRICES OF SELECTED INSULATION BOARD PRODUCTS[1]

(dollars per thousand square feet)

Year	1/2 Inch[2] Sheathing	Roof Insulation[3] Board	Ceiling Tile[4]
1965	37.09	63.78	83.05
1966	36.45	65.15	83.75
1967	36.01	65.02	87.24
1968	38.17	64.17	91.78
1969	40.73	65.15	97.88
1970	36.91	67.16	103.38
1971	37.78	66.06	109.14
1972	42.06	66.19	112.28
1973	44.98	67.56	113.32
1974	49.23	84.59	117.16
1975	50.20	100.13	121.87
1976	58.31	107.80	130.42
1977	66.05	N/A	N/A
1978(Mar.)	74.87	N/A	N/A

[1]f.o.b. mill with freight allowed to destination.

[2]standard density, 1/2" x 2' x 8' to 4' x 9' with asphalt impregnation or water resistant coating, manufacturer to wholesaler.

[3]1" x 2' x 4', asphalt treated, manufacturer to roofing contractor.

[4]1/2" x 1' x 1', 1 x 2', or 1 x 3', factory painted plain surface, beveled edges, manufacturer to wholesaler or retailer.

Source: U.S. Bureau of Labor Statistics

decorative, and insulation product make price comparisons particularly difficult. To illustrate, the March 1977 price for 1/2 inch insulation board sheathing was $58.71 per thousand square feet, while the price of 1/2 inch plywood sheathing was $190. On this basis, the insulation board appears to be a better value. However, in use, a siding material must be applied over the sheathing. An alternative wall construction is to use fiber glass insulation and a plywood or hardboard siding product that provides both the strength of the sheathing, a finished outside wall, and a better R-value for the complete wall. The construction costs of the fiber glass/siding wall are lower than a sheathing/siding wall and the higher quality insulation will result in lower long-term heating costs. Ultimately, what appeared to be a major price advantage for insulation board becomes insignificant. Gypsum sheathing has been very competitive with insulation board on a price/utility basis for years and has established itself as the preferred sheathing material in many areas. Structural foams are also beginning to appear on the market and will also compete strongly on a performance value basis with insulation board.

Commercial structures have used large quantities of insulation board in the past for ceiling tile, lay-in panels, and roof deck insulation. Fire code restrictions have severely cut back the use of the material in these applications. The insulation board roof decking has also met with strong competition from perlite and rigid fiber glass boards. Until a fire retardant insulation board ceiling tile is on the market and widely accepted in building codes, the price of insulation will not stimulate demand and plastic or mineral board substitutes will dominate the nonresidential market.

3. Price Elasticity of Demand.

Price changes in insulation board from 1965-1976 have been moderate compared to price changes of lumber, plywood, and other wood products with which it competes. Evidence of this situation, as shown in Table II-8, appears in the fact that while the 1976 wholesale price index (WPI) for insulation board products was 160.8, (1967=100) the WPI for all construction products had risen to 187.7 but the general inflation index was at 159.0. Thus, while insulation board prices have lagged behind those for other construction materials, they have kept pace with general inflation and thus have experienced no real price increases. There are several factors that contribute to this situation.

First, there is a cost-price relationship which may have allowed the industry to maintain its accepted level of profitability without increasing prices due to improved plant efficiency and the resulting lower costs. However, given the recent history of wood costs, competition for fiber, and costs of finishing materials, it is not likely that this will continue to be a major factor.

Secondly, the industry may have absorbed the impact of lower margins per unit by increasing production volumes with added shifts at the same facilities and low cost incremental investments to increase capacity. The closure of six plants since 1960 while production continued to increase slightly is an indication this has happened, to a limited degree, in the remaining plants. This course of action could, depending on volume-price relationships, result in level rates of return as a consequence of lower per unit margins on greater volumes produced at the same facility.

TABLE II-8

PRICE INDEXES FOR SELECTED INSULATION BOARD PRODUCTS[1,5]

(1967 = 100)

Year	All Construction Materials Price Index	1/2 inch[2] Sheathing	Roof Insulation[3] Board	Ceiling[4] Tile	All Insulation Board	Percentage Change Over Previous Year
1965	95.8	103.0	98.1	95.2	98.2	--
1966	98.8	101.2	100.2	96.0	98.4	0.2
1967	100.0	100.0	100.0	100.0	100.0	1.6
1968	105.6	106.0	98.7	105.2	103.0	3.0
1969	111.9	113.1	100.2	112.2	108.8	5.6
1970	112.5	102.5	103.3	118.5	110.5	1.6
1971	119.5	104.9	101.6	125.1	114.4	3.6
1972	126.6	116.8	101.8	128.7	119.0	3.9
1973	138.5	124.9	103.9	129.9	121.7	2.3
1974	160.9	136.7	130.1	134.3	133.9	10.0
1975	174.0	139.4	154.0	139.7	144.0	7.5
1976	187.7	161.9	165.8	149.5	161.0	11.8
1977	204.9	183.4	N/A	N/A	177.9	10.5
1978(March)	221.9	207.9	N/A	N/A	196.8	10.6

[5]See footnootes 1,2,3, and 4 on Table 6

[6]Changes in composite index for all insulation board products

Source: U.S. Bureau of Labor Statistics

Finally, there is a market-price relationship. Insulation board may have to keep down its prices to meet competition from substitute products such as gypsum and maintain its market shares. While there is probably some cross-elasticity of demand between insulation board and competing products, price is not the principal reason for utilizing insulation board.

4. Barriers to Entry of New Firms.

Insulation board is capital intensive compared with the production of other solid wood products such as plywood and lumber. Other than capital requirements, significant barriers include securing a wood source and, depending on the product line, the scale of the required marketing effort. Tile products would require a larger sales effort than sheathing because of the proprietary nature of the product.

5. Other Regulatory Factors.

It should also be noted that a result of government timber policy restricting the harvest of federal timber on the West Coast would be to lower supplies and push up prices of lumber and plywood. This would probably result in increasing demand for fiberboard and would allow substantial price increases. An easing of government timber policy that would allow a higher level of removals from West Coast forests, which is equally likely at this time, would have the opposite effect.

G. FINANCIAL PROFILE

The range of sales and plant book values for insulation board plants is shown in Table II-9, as well as the pro-forma cost of manufacture. Plant sales vary directly with production. However, plant book values differ for similar size plants due to plant age and other factors.

While the distribution of manufacturing cost differs by size of plant, there appear to be significant differences in relative cost due to other factors. A number of insulation board plants appear to be operating at a loss and operating margins overall are small compared with hardboard plants. The future outlook for insulation board demand indicates that the financial condition of some insulation board plants will worsen as capacity utilization rates fall. It is also likely that insulation board plants will shut down or convert to other products in the face of falling demand.

TABLE II–9

FINANCIAL PROFILES

($000)

	INSULATION BOARD	
SALES (1976)	$8,500,000 (range $3-30 Million)	
CAPACITY	125 Million Square Feet	
CAPACITY BASE	1/2"	
Pro-forma Cost of Manufacture	**Median Value**	**Range of Values**
Sales	100%	100%
Cost of Sales		
Labor	25	15-31
Materials	35	30-50
Depreciation	4	2-8
Other Expenses	20	2-44
Total Cost of Sales	84	
Gross Margin	16	8-24
Selling G&A	10	7-18
Interest Expense	--	
Profit Before Tax	6	<0-13
Tax	3	
Profit After Tax	3%	<0-7
Plant Book Value ($000)	7,000	500-25,000

SOURCE: EPA Financial 308 Survey data.
Excludes plants producing both insulation board and hardboard.

III INDUSTRY CHARACTERIZATION — WET PROCESS HARDBOARD

A. INDUSTRY DEFINITION

In characterizing the wet process segment of the hardboard industry, it should be emphasized that wet process mills are only one segment of the hardboard production capacity. The industry[1] is composed of two segments, wet process and dry process, that serve the same markets with similar products and are largely operated by the same companies. The wet process hardboard industry is comprised of establishments producing hardboard in densities generally between 31-65 pounds per cubic foot from inter-felted wood fiber using a wet forming and either a wet or dry pressing process. The dry process segment of the industry uses a dry forming and pressing process to manufacture hardboard.

B. TYPES OF FIRMS

1. Size of Firm.

There are 15 producers operating 28 wet and dry process plants. (These are identified in Table III-1) The industry is composed of three private firms and several large corporations. Seven of the 15 hardboard producers operate more than one hardboard plant. Wet process plants represent 16 of the 28 facilities and are operated by eleven producers; four of these producers operate more than one wet process plant.

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[1]Standard Industrial Classification 2499, "Wood Products Not Elsewhere Classified" includes, among other industries, medium density fiberboard, wet process hardboard, and dry process hardboard. SIC data does not distinguish among these three industries.

TABLE III-1

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1977 HARDBOARD PRODUCTION CAPACITY

(million square feet - 1/8" basis)

WET-WET PLANTS[1]

Company	Location	Annual Capacity
Abitibi[2]	Alpena, MI	200
Abitibi	Roaring River, NC	315
Evans Products	Corvallis, OR	110
Forest Fiber	Forest Grove, OR	114
Masonite	Laurel, MS	1850
Masonite	Ukiah, CA	560
Superior Fiber	Superior, WI	158
Superwood	Duluth, MN	380
Superwood	N. Little Rock, AK	130
Champion International	Dee, OR	76
	Subtotal	3893

WET-DRY PLANTS[2]

Abitibi[2]	Alpena, MI	329
Boise Cascade	International Falls, MN	700
Temple	Diboll, TX	244
Weyerhaeuser	Craig, OK	175
U.S. Gypsum	Danville, VA	230
U.S. Gypsum	Pilot Rock, OR	86
U.S. Gypsum	Greenville, MS	155
	Subtotal	1919
	Total - Wet Process	5812

DRY PLANTS[3]

Boise Cascade	Phillips, WI	80
Celotex	Paris, TN	195
Champion International	Catawba, SC	225
Champion International	Lebanon, OR	107
Georgia Pacific	Conway, NC	265
Georgia Pacific	Coos Bay, OR	201
Louisiana Pacific	Oroville, CA	150
Masonite	Towanda, PA	490
Publishers Forest Prods.	Anacortes, WA	52
Superwood	Bemidji, MN	90
Weyerhaeuser	Doswell, VA	315
Weyerhaeuser	Klamath Falls, OR	290
	Total Dry Process Capacity	2460
	Total Hardboard Capacity	8272

[1]The Masonite mills and the Abitibi mill in Alpena, MI use combinations of the wet-wet and wet-dry processes.

[2]There are wet-wet and wet-dry operations at this location.

[3]Does not include medium density fiberboard (MDF) plants as it is a different product used in different applications.

Sources: 1976 Directory of the Forest Products Industry, American Board Products Association, and Arthur D. Little, Inc. estimates.

The larger corporations involved in the wet process board industry include Masonite, Champion International, Weyerhaeuser, and U.S. Gypsum. In terms of production capacity, the largest private company, Superwood, is the fourth ranked producer in the industry while the two remaining private firms are among the smallest producers.

Available information shows that total annual sales for companies in the wet process segment of the hardboard industry, including sales from operations such as lumber, plywood, paper, chemicals, and others, range from $25 million to over $3.6 billion as shown in Table III-2. The relative importance of a particular plant to a particular firm is thus a unique factor in each case, as also shown in Table III-2.

2. Ownership/Integration/Product Diversification.

Twelve of the wet process hardboard mills are owned by 8 publicly held corporations; the four remaining mills are owned by three private companies.

The public corporations are frequently integrated back to raw material sources as owners of woodlands and they typically supply 35-45 percent of their raw material needs from these captive sources. The private companies are also likely to own limited woodlands but do not typically derive as large a percentage of their wood requirements from these sources.

Six of the parent companies operate captive distribution systems that handle a portion of their output. The remaining producers sell their products through independent wholesalers or through the captive distribution systems of other companies.

TABLE III–2

1977 HARDBOARD SALES

(All Producers, $MM)

Company	Total Corporate Sales*	Total** Hardboard Sales	Wet Process** Hardboard Sales
Abitibi Paper Co. Ltd.	800	72	72
Boise Cascade	2316	66	60
Celotex/Jim Walter[1]	525/1422	17	-
Champion International	3127	34	7
Evans Products	941	9	9
Forest Fiber	N/A	9	9
Georgia Pacific	3675	40	-
Louisiana Pacific	794	13	-
Masonite[2]	445	247	206
Publishers/ Times Mirror Co.	NA/976	5	-
Superior Fiber/ Carlson Companies Inc.	NA/650	13	13
Superwood	N/A	-	44
Temple/Time Inc.	340/1038	21	21
U.S. Gypsum	1177	40	40
Weyerhaeuser	3283	66	15

[1]Fiscal year ends August 31

[2]Fiscal year ends October 31

Sources: *Dun and Bradstreet Directory, 1978, Directory of Corporate Affiliations, 1978

**Arthur D. Little estimates, based upon an operating rate of 100% and the prices shown in Table III-7.

In addition to hardboard products, all of the parent companies are involved in the production and distribution of a wide range of other competing and non-competing wood products and various building materials. Many hardboard operations are parts of forest products production complexes that may produce various combinations of lumber, plywood, particleboard, fiberboard, pulp, or paper. The parent companies generally have a strong orientation towards forest products (five are involved in the paper industry) and may produce other building materials such as gypsum board. Three of the firms are significantly diversified beyond building materials businesses.

C. PRODUCT DESCRIPTION

1. Types of Hardboard Products.

Hardboard products can be divided into five classes on the basis of water resistance, modulus of rupture, and tensile strength. The five classes listed in order of decreasing strength properties, include:

tempered
standard
service-tempered
service
industrialite

The hardboard products described serve four general markets: interior paneling, exterior siding, industrial and do-it-yourself. Most of the mills have fabricating facilities associated with them to produce prefinished paneling, panel stock, siding, perforated board, embossed, molded, and/or cut-to-size products.

Hardboard serves a very wide range of end uses requiring an estimated 800 different sets of specifications. Marketing efforts have usually been aimed at displacing traditional products such as gypsum, plaster, stucco, and plywood in specific applications. Hardboard is challenging and being challenged by these products and others in various markets and applications.

Interior paneling may be manufactured from any of the five classes of hardboard in thicknesses of 1/8 to 1/4 inch. Panels up to 5 feet wide and 12 feet long are available. It is estimated that hardboard was used as the substrate in 20-40% of the interior paneling sold in 1973, with its major competition being inexpensive lauan plywood, domestic hardwood plywood, and thin particleboard. It is used for both wood-grain prints and tileboard panels. The surface of the panel may be embossed to provide a surface texture or pattern before the desired finish is applied. The hardboard manufacturer may produce and sell prefinished paneling, unfinished paneling stock, or both.

Siding is manufactured specifically for exterior use. Lap siding is manufactured in thicknesses of 3/8 inch and greater, widths of 4 to 12 inches, and lengths up to 16 feet in two-foot increments. Panel siding is fabricated in sheets 4 feet wide, 4 to 12 feet long and is usually 1/4 inch thick or thicker. Hardboard was introduced to the siding market in the late 1940's and now competes against PVC, aluminum, brick, stucco, plywood, and other wood siding materials. Textures simulating most other siding materials, as well as improved finishes, have increased hardboard's market share in residential siding and will probably

continue to do so. Hardboard siding is now also gaining market share in mobile home applications and Arthur D. Little expects this trend to continue.

The industrial market for hardboard encompasses a very wide range of end-user and OEM (original equipment manufacturer) applications including: displays, furniture, transportation, electronics, interior construction, factory equipment, and toys. The list of actual and possible uses is extremely diversified. Most industrial markets require the hardboard manufacturer to meet a unique set of specifications pertaining to board characteristics and/or fabrication requirements. The industrial market is so diversified that competition from substitute products in any one segment has only minimal impact on the overall hardboard market.

2. Market Size and Future Growth.

Recent economic trends have been generally favorable to the industry. Per capita consumption has increased 3.7% annually since 1964. Tables III-3 and III-4 show production and consumption data for the years 1964-1976. Shipments from domestic plants totalled 7.1 billion square feet in 1976 reflecting an average annual growth rate of 9.4% since 1964. The industry slowdown in 1974 and 1975 was followed by a strong recovery in 1976.

Import data from Table III-3 indicate that imports are very sensitive to economic conditions. It is apparent that imports suffered a severe market share setback in 1974-1976 and are only beginning to recover; in 1976 imports were only 6.5% of consumption. Brazil is by far the largest

TABLE III-3

SHIPMENTS, IMPORTS, AND APPARENT CONSUMPTION -- 1964-1976

(million square feet - 1/8" basis)

	U.S. Shipments	Imports	Apparent Consumption	Imports as a % of Consumption
1964	2689	471	3160	14.9
1965	2921	572	3493	16.4
1966	3083	443	3526	12.6
1967	3038	426	3464	12.3
1968	3710	648	4358	14.9
1969	4247	708	4955	14.3
1970	4384	457	4841	9.4
1971	5225	634	5859	10.8
1972	5798	1070	6868	15.6
1973	6475	1039	7514	13.8
1974	6057	750	6807	11.0
1975	6238	277	6515	4.3
1976	7066	494	7560	6.5

Source: American Board Products Association

TABLE III–4

CAPACITY UTILIZATION BY HARDBOARD INDUSTRY – 1967-1976

(million square feet - 1/8" basis)

	Annual Capacity	U.S. Shipments	Capacity Utilization (%)
1967	4555	3038	67
1968	4648	3710	80
1969	5019	4247	85
1970	5335	4384	82
1971	6000	5225	87
1972	7791	5798	74
1973	7781[1]	6475	83
1974	7771[1]	6057	78
1975	7771	6238	80
1976	8272	7066	85

[1]Arthur D. Little, Inc. estimates.

Source: American Board Products Association

source of hardboard imported by the United States; the USSR, Sweden, and Canada are also of significance with Poland, Romania, Korea, and a number of other countries selling hardboard in U.S. markets in varying quantities. Reliable export data are unavailable but levels are believed to be below 2% of domestic production. The United States will remain a net importer of hardboard, despite the recent drop in imports, due to the relatively low cost of hardboard purchased from foreign sources.

Operating rates for the domestic producers are shown in Table III-4. Capacity utilization declined significantly in 1972 due to a 30% increase in capacity in that year, and again in 1974 due to market conditions. Precise data on 1977/1978 are unavailable but the industry is believed to have operated at 85-95% rates.

Historically, losses in one market have been offset to a greater or lesser extent by gains in another. For example, hardboard continues to lose automotive markets; the technological trend toward light automobiles has resulted in the use of lightweight plastics in applications where hardboard was formerly the dominant material. On the other hand, the minimal quantities of petrochemical adhesives and relatively low energy intensity required in hardboard manufacture protect the industry from what could be a severely negative impact of increased resin costs on plastics and other siding products such as brick and have helped to stimulate demand for hardboard siding.

In evaluating the overall growth rate, it should be remembered that roughly 60% of hardboard is used directly in construction or is affected

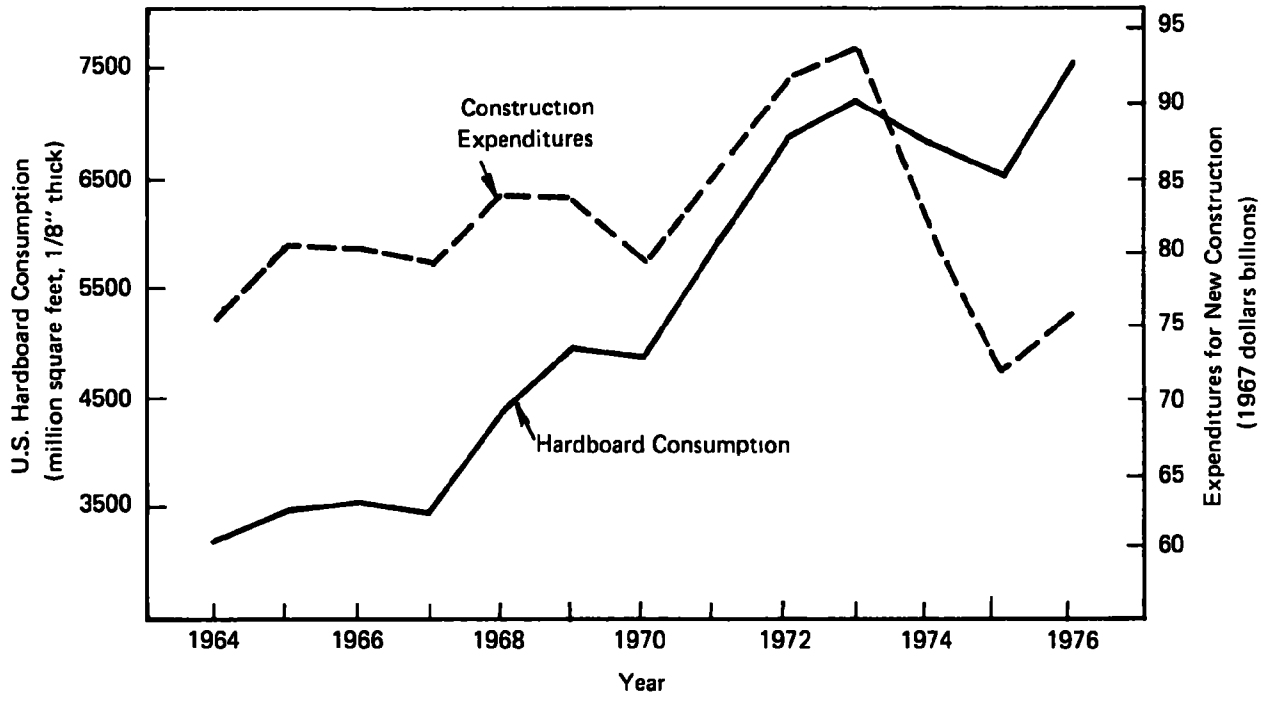
by construction demand, while most of the remainder is used in industrial applications. Shipments of hardboard do follow the trends of the construction industry but the volatility of hardboard shipments is dampened somewhat by its industrial market. This relationship is shown graphically in Figure III-1. Analysis of 1964-1976 shipments and consumption using a least squares linear-time trend results in annual growth rates of 9.4% and 8.5%, (standard error of estimates were 7% and 10%) respectively. Growth rates in the 1972 to 1976 period for shipments and consumption were roughly 4% and 1.5% respectively due to an industry slowdown in 1974 and 1975. The slower growth rates for consumption are a result of changes in the level of imports which vary widely and have recently decreased substantially.

The consumption growth rates indicate that hardboard's share of the construction materials market has increased. The economy in general experienced a growth rate of about 3.0% per year for the period, and construction in 1976 remained below 1972 levels. This market share growth trend can be expected to continue, and long-term growth in consumption will average 2.5-3.0% annually through 1982 with short-term trends following the construction cycle (see Figure III-2).

D. PLANT CHARACTERISTICS OF THE EXISTING INDUSTRY

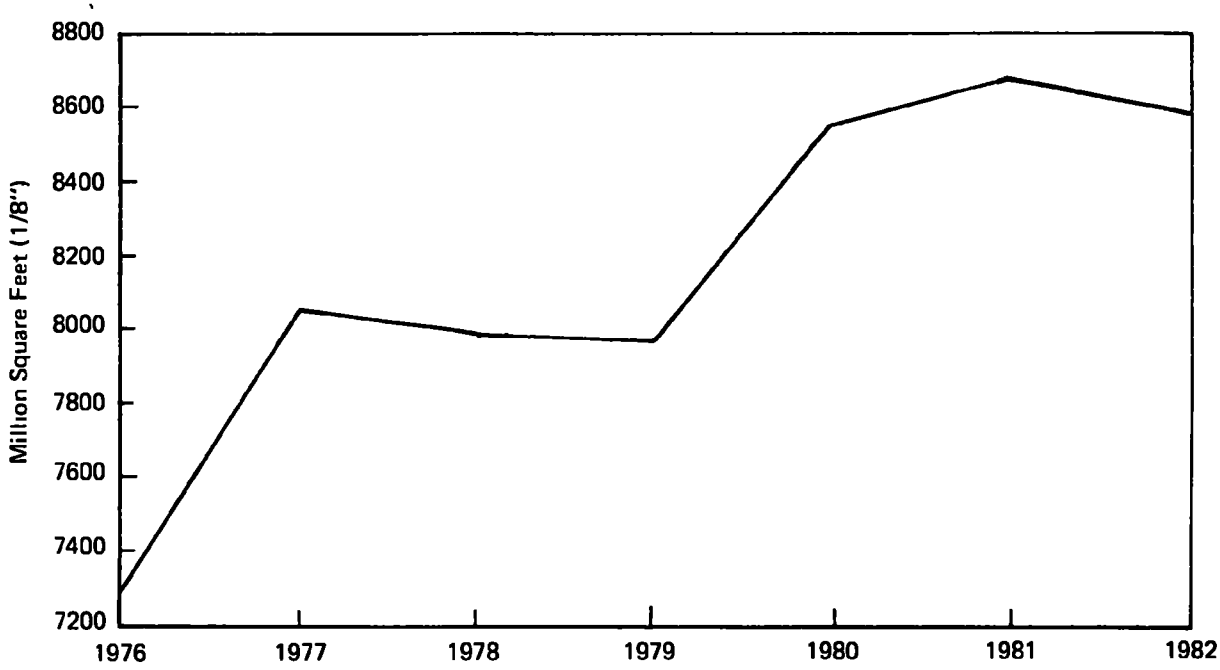
1. Process Technology.

Wet process mills are those operations that use a pulping process that requires large amounts of water and a wet mat forming system similar in some respects to the fourdrinier paper forming process. In wet-wet



Source: U.S. Department of Commerce, American Board Product Association.

FIGURE III–1 HARDBOARD CONSUMPTION AND CONSTRUCTION EXPENDITURES – 1964–1976



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

FIGURE III–2 TOTAL HARDBOARD DEMAND, 1976–1982

mills, the wet mat is pressed between a flat hot platen and a rigid screen that will allow steam to escape from the board. The board produced in this manner is called an S1S or screen back board. In wet-dry mills, the same mat described above is dried before pressing so it can be pressed between two flat hot platens producing a board with a smooth surface on both sides (S2S). In dry process mills, the mat is formed from dry fibers in an air inter-felting process. The dry mat is pressed between two flat hot platens thus producing an S2S board. One mill uses a dry-wet process in which the mat is dry formed, as described above, then water is added and it is pressed between a flat hot platen and a screen resulting in an S1S board. Furthermore, insulation board capacity may be converted to produce wet process hardboard (and vice versa).

Technical developments in wet process hardboard have been limited and slow. As a result of design changes in caul plates used in wet pressing operations, wet-wet mills can produce a S2S hardboard with minimal sanding. This development allows wet-wet mills to compete in S2S markets against wet-dry and dry-dry mills.

Developments that hold potential for lower costs are important to this industry because of the product substitution possible in most markets; likewise, adverse cost developments are of equal significance. The full impact of energy costs, for example, on energy-intensive pulping processes (e.g., the explosion process) may affect hardboard's cost effectiveness relative to substitute products in the future.

There are no foreseeable technical developments that will have a major impact on the hardboard industry. The technology of the wet

process hardboard industry has remained generally static since the development of dry process mills eliminated many of the water pollution problems facing the industry. Dry process technology is a threat to the wet process mills to the extent that it makes possible the manufacturing of hardboard which competes with the products of the wet process mills without incurring water pollution abatement costs. This problem will be partially offset by air pollution control expenditures that will be required for dry process mills. It is, of course, theoretically possible to convert a wet process mill to a dry process mill; however, the capital costs involved would make the operation both uneconomic and uncompetitive; thus, conversion to dry processes is an unlikely response to revised effluent regulations.

2. Size/Age/Location.

A typical wet process plant produces 230 million square feet (MMSF - 1/8 inch) annually, while individual plant capacities range from 52-1850 MMSF. (Table III-1) Although the largest plant is also the oldest (Masonite started operations in Laurel, Mississippi in 1926), generally, the older plants tend to be smaller.

Table III-5 shows the age distribution of wet process hardboard plants. Prior to 1948 only three hardboard plants were in operation in the United States and they all used a wet process. Of the six plants built in the 1948-1957 period, five were wet process mills and one was a dry process mill. The next decade brought six wet and five dry process mills. Since 1968 two wet process mills have been built (both in 1970) while six dry process mills have started production. Currently there are

TABLE III–5

DISTRIBUTION OF HARDBOARD PLANTS BY PLANT AGE

Year of Start-up	Number of Plants	
	Wet*	Dry**
Prior to 1948	3	0
1948-1957	5	1
1958-1967	6	5
1968 to present	2	6
Total	16	12

TABLE III–6

EMPLOYMENT IN WET PROCESS HARDBOARD PLANTS

Number of Employees	Number of Plants
0-199	8
200-399	5
400+	3
Total	16

Source: *EPA financial 308 survey.
**Arthur D. Little estimates

sixteen wet process mills (including seven wet-wet, six wet-dry, and three operations using both processes) and twelve dry process mills in the United States. Additions to existing mills did not necessarily use the same process; three mills are actually a combination of wet forming and both dry and wet press lines. This gives these mills additional flexibility in meeting market demands by producing either S1S or S2S hardboard. Most of the older plants have been continually expanded and modernized so age is not a valid indication of efficiency.

The first two plants were constructed in Mississippi and used roundwood as their fiber source. Later expansion of the industry in the North Central states depended on inexpensive hardwoods while mills in the Pacific states used wastes from softwood lumber and plywood operations as fiber sources. The fact that hardboard mills are evenly spread throughout these regions is indicative of the wide range of wood species being used in hardboard and the significance of low cost fiber to the producer. Most of the plants are located on rural sites but several are in urban and suburban areas.

3. Employment.

Most plants employ between 100 and 300 workers and staff as shown in Table III-6. Employment figures for each mill are dependent upon the size and product mix of the facility.

E. CHARACTERISTICS OF NEW CAPACITY

1. Recent Capacity Additions.

No new wet hardboard plants have come on stream since 1970; however, several locations have added substantial capacity. In addition to large

capacity expansions in 1972, Masonite completed a 175 MMSF expansion of its wet process plant in Ukiah, California in 1977. Abitibi also completed small expansions of the Alpena and Roaring River facilities. The 100 MMSF addition to the Weyerhaeuser plant in Doswell, Virginia was the only dry process expansion. Boise Cascade diverted some of the insulation board capacity at International Falls, Minnesota, to add 100 MMSF to its hardboard capacity. At least five plants added incremental volumes to their siding production capacity.

Announced plans for capacity additions in 1979 include construction of a 66 MMSF of 7/16 inch wet process hardboard siding mill at Georgia Pacific's insulation board plant in Jarratt, Virginia. Temple Industries has also announced a $21 million addition to its wet process facility to produce hardboard siding. No further information has been made public about these projects or any others.

2. Process Economics of New Capacity.

It is extremely unlikely that anyone would build a wet process S2S mill. Capacity addition would most likely take the form of incremental expansion of existing facilities or perhaps the conversion of insulation board capacity. However, process economic models were constructed for greenfield expansion, conversion of an insulation board plant and incremental expansion.

Table III-7 contains the capital investment and the operating cost for each of the wet process hardboard expansion methods. The parameters of any expansion or conversion are extremely variable and unique to every case. Thus the data shown in Table III-7 are not applicable to any specific situation. Incremental operating costs per thousand square feet

TABLE III–7

PROCESS ECONOMICS OF NEW WET PROCESS HARDBOARD CAPACITY

	Greenfield Mill	Conversion of Insulation Board Mill	Incremental Expansion
Design Production (MMSF, 1/8")	293	234	117
Capital Investment	$50 million	$25–28 million	$15–20 million
Operating Cost ($ millions)			
Labor	10.2	9.0	3.7
Wood	4.2	3.4	1.7
Other Materials	4.2	3.4	1.7
Energy	3.6	3.2	1.3
Other Costs	2.0	1.6	0.8
	24.2	20.6	9.2
Operating Cost/MSF	$82.59	$88.03	$78.63
Investment/ MSF	$170.65	$113.70	$149.57

Source: Arthur D. Little estimates. See Appendix A-2 for assumptions underlying costs.

are lowest for capacity added through incremental expansion, followed by that for a greenfield mill and insulation board plant conversion. Investment cost per thousand square feet are highest for a greenfield plant and lowest for an insulation board plant conversion.

F. COMPETITIVE STRUCTURE

1. Market Structure.

The five largest firms control 70.5% of the total hardboard production capacity. Masonite Corporation, by far the largest firm in the industry, controls 35.1% of the total hardboard capacity and 41.5% of the wet process hardboard capacity, as shown in Table III-8. Wet process mills represent 70.3% of the total U.S. hardboard capacity.

2. Pricing Mechanism.

Table III-9 exhibits the price history for tempered hardboard. The ability of the industry to pass increases in production costs on to the marketplace is of major importance in considering the question of whether or not hardboard producers will be able to continue operations with the burden of additional pollution control costs.

Prices are quoted on a dollars per thousand square feet basis and are usually based on standard units and sizes. Prices are generally f.o.b. mill with full rail freight allowed to the destination. Due to the wide range of end uses, prices, and customer categories, hardboard prices are set at a number of levels depending on the class of trade of the purchaser. Frequently specific hardboard prices involve a complicated schedule of discounts and extras dependent upon the size of the load, packaging, style of the product, degree of fabrication, quality, etc.

TABLE III–8

HARDBOARD INDUSTRY CAPACITY

Firm	Percent of Total Capacity	Wet Process	
		Percent of Capacity	Percent of Firm's Hardboard Capacity
Masonite	35.1	41.5	83.1
Abitibi	10.2	14.5	100.0
Weyerhaeuser	9.4	3.0	22.4
Boise Cascade	8.5	12.0	89.7
Superwood	7.3	8.8	85.0
U.S. Gypsum	5.7	8.1	100.0
Champion	4.9	1.3	18.6
Temple	2.9	4.2	100.0
Superior Fiber	1.9	2.7	100.0
Evans	1.3	1.9	100.0
Forest Fiber	1.4	2.0	100.0
	88.6[1]	100.0	81.7[2]

[1]Four other firms are operating only dry process mills.

[2]Average

Source: American Board Products Association

TABLE III-9

TEMPERED HARDBOARD PRICES

Year	Price[1] MSF - 1/8"	Percent Increase Over Previous Year	Price[2] Index	All Construction Materials Price Index
1963	61.956	--	103.8	93.6
1964	61.001	1.6	102.2	94.7
1965	60.941	0.1	102.1	95.8
1966	60.822	(.2)	101.9	98.8
1967	59.688	(1.9)	100.0	100.0
1968	58.633	(1.8)	98.3	105.6
1969	59.969	2.3	99.8	111.9
1970	61.001	1.7	102.2	112.5
1971	60.345	(1.1)	101.1	119.5
1972	61.001	1.1	102.2	126.6
1973	62.792	2.9	105.2	138.5
1974	70.432	12.5	118.0	160.9
1975	70.253	0.3	117.0	174.0
1976	78.430	11.6	131.4	187.7
1977	85.175	8.6	142.7	204.9
1978(March)	91.562	7.5	153.4	221.9

[1]Manufacturers' price to jobber or wholesaler delivered to destination or f.o.b. mill with freight allowed

[2]1967 = 100

Source: U.S. Bureau of Labor Statistics, Wholesale Price Indices.

It should be noted that the largest producer does exert some control over product design trends, frequency of price changes, and price leadership. As explained earlier, the industry serves a very wide range of end uses requiring an estimated 800 different sets of specifications; this makes direct competition between manufacturers selling to the industrial market uncommon in practice and unlikely to occur in the future. Hardboard marketing efforts have traditionally been aimed at displacing entrenched products such as lumber and plywood in specific applications using pricing as an incentive; now, hardboard is challenging and being challenged by plastics and metals for various applications. Consequently, a major pricing factor is the possibility of substitution of competitive materials by and for hardboard. Price competition can be a factor in sales to retail yards handling large volumes of hardboard.

3. Price Elasticity of Demand.

Price changes in hardboard from 1967 to 1976 have been far less frequent and quite moderate compared with price changes of lumber, plywood, and other products with which it competes. Evidence of this situation appears in the fact that while the wholesale price index for construction materials in 1976 was 187.7, the wholesale price index for tempered hardboard was only 131.4, as shown in Table III-9. It should be noted that the GNP deflator for 1976 was 1.59 of the 1967 level which shows hardboard prices have failed to keep pace with general economic conditions. There are several factors that contribute to this situation.

First, cost of production have not increased as rapidly as general inflation, which may have allowed the industry to maintain its accepted

level of profitability without increasing prices. This situation will probably not continue given the likely real increases in wood costs and increased competition for fiber in the future. However, the costs of producing substitute materials are likely to increase even faster than hardboard production costs.

Secondly, the incremental additions taking place in 1976, 1977 and 1978 suggest that the industry may have absorbed the anticipated impact of lower margins per unit by adding shifts. This course of action would result in stabilized rates of return as a consequence of lower per unit margins on greater volumes produced at any individual facility.

Finally, there is a market-price relationship. Hardboard producers may have to keep down their prices to meet competition from substitute products and maintain market shares. Price apparently varies somewhat independently of consumption and in different magnitudes as shown in the random pattern of price-consumption correlations. Obviously, demand is not totally price inelastic, but within reasonable bounds prices can be adjusted without adverse impact on overall demand.

The ability of hardboard manufacturers to pass on the additional costs of pollution abatement depends on the amounts involved. Any increase in costs will result in higher levels of competition from substitute products and a more cautious approach to the commitment of capital for capacity expansions. Decreases in market share, if they occur, would be slow in industrial applications, since products must be redesigned, and relatively fast in construction applications.

4. Barriers to Entry of New Firms.

Relative to other solid wood products mills, hardboard is a capital intensive industry. The most significant barriers to the entry of new firms, however, are the market structure, the magnitude of the sales effort required, and securing a fiber source. A new company would have to develop new markets or "buy" market share from competitors; given the recognition of the existing producers in the marketplace, it could be a costly and difficult task at best. There is the alternative of selling the production of a new producer through the existing producers distribution systems, as is done in the case of other wood products. This would be an undesirable position for a new producer for both production and marketing reasons.

5. Other Regulatory Factors.

It should also be noted that a result of government policy restricting the cut of federal timber on the West Coast will be to push prices of lumber and plywood upward, thereby relieving some pressure against hardboard price increases. An easing of government timber policy that would allow a higher level of removals from West Coast forests, which is equally likely, would have the opposite effect.

G. FINANCIAL PROFILE

The range of sales and plant book values for wet process hardboard plants are shown in Table III-10. While sales vary directly with production, plant book values will differ for plants of similar size, primarily because of age of plant.

The pro-forma costs of production for wet process hardboard are also shown in Table III-10. There was no observable difference in the distribution of costs between plants that will be required to undertake pollution control expenditures for BAT-Toxic regulations and plants that will be in compliance. Differences in the distribution of cost arise in part from plant size differences and plant location (local cost) factors.

TABLE III–10

FINANCIAL PROFILE

WET PROCESS HARDBOARD PLANTS

	WET PROCESS HARDBOARD	
1976 SALES ($000)	$16,000	(range $6,000 - >$120,000)
1976 CAPACITY	200 Million square feet	
CAPACITY BASE	1/8"	

Pro-Forma Cost of Manufacture	Median Value	Range
Sales	100%	100%
Cost of Sales		
Labor	20	15-50
Materials	30	19-50
Depreciation	5	2-5
Other Expenses	20	5-28
Total Cost of Sales	75	
Gross Margin	25	15-36
Selling G&A	11	7-25
Interest Expense		0-4
Profit Before Tax	14	8-24
Tax	7	
Profit After Tax	7	1-13
Plant Book Value ($000)	10,000	900 - >$40,000

Source: Derived from the EPA Financial 308 Survey.

IV COST OF COMPLIANCE WITH REVISED WATER EFFLUENT REGULATIONS

A. INTRODUCTION

The purpose of this chapter is to describe the current water effluent method of disposal used by insulation board and wet process hardboard plants, and to summarize the cost of compliance developed by the technical contractor. These data were used to estimate the economic impact of the revised water effluent regulations described in Chapter V. Also described are the control options for new sources and their associated costs of compliance.

B. CURRENT EFFLUENT STATUS

Table IV-1 depicts the current method of water effluent disposal used by wet process hardboard and insulation board plants. Plants producing both insulation board and wet process hardboard are classified according to the predominant product volume and are referred to throughout as "combination" plants.

Most (8) of the wet process hardboard plants discharge into navigable water, while two plants discharge into municipal sewers and two plants recycle their waste water. The insulation board plants are distributed across all categories with three discharging into navigable water, five into municipal sewers, three disposing on site (e.g., spray irrigation) and two recycling their waste water.

TABLE IV-1

INSULATION BOARD AND

WET PROCESS HARDBOARD

CURRENT METHOD OF WATER EFFLUENT DISPOSAL

Current Water Effluent Disposal	Insulation Board Only		Wet Process Hardboard Only		Combination	
	Number of Plants	% Total	Number of Plants	% Total	Number of Plants	% Total
Navigable Water	2	16%	8	66%	3	75
Municipal Sewer	5	42	2	17		
No-Discharge	5	42	2	17	1	25
Total	12	100%	12	100%	4	100%

*1 combination insulation board/hardboard plant.

**2 combination hardboard/insulation board plants.

SOURCE: Derived from Financial 308 data.

C. POLLUTION CONTROL OPTIONS - EXISTING PLANTS

1. Cost Models

Many plants presently have pollution control equipment in place and for several plants, current treatment will be sufficient to meet revised effluent guidelines.[1] However, six plants producing wet process hardboard alone may be required to install new equipment to meet revised water effluent regulations.

Since there are so few plants in the wet process hardboard sector that must undertake compliance activities, costs of compliance were generated by the technical contractor for each impacted plant. The cost estimation method was to use one or more of the plants that have higher levels of water effluent treatment in place as models. The cost of installing the model treatment process was then estimated for impacted plants. Table IV-2 depicts the relationship between the pollution control options and model treatment plant. The plant indicated as a "special case" in Table IV-2 has a pollution control system in the process of construction, which may or may not be similar to the model treatment plants.

The wet process hardboard control options represent different degrees of stringency. Option 1, modelled on plant 2099, calls for a screen, first settling basin, an aerated lagoon, and second settling basin. Option 2, modelled on plant 2006, consists of two consecutive aerated lagoons followed by a settling basin. Option 3, modelled on plant 2010, consists of a screen, an equilization basin, a primary clarifier, activated

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[1] Economic Impact Analysis of Alternative Pollution Control Technology for the Wood Preserving Subcategories of the Timber Products Industry, Draft Report to the U.S. Environmental Protection Agency, November 1978.

TABLE IV-2

MODEL PLANT TREATMENT OPTIONS

IMPACTED PLANT	MODEL TREATMENT PLANT	CURRENT DISCHARGE METHOD	PROPOSED DISCHARGE METHOD
WET PROCESS HARDBOARD			
Option 1	2099		
Option 2	2006		
Option 3	2010		
Plant 2002		Direct*	Direct
Plant 2003		Direct	Direct
Plant 2004		Direct*	Direct
Plant 2006		Direct	Direct
Plant 2013	Special Case	Indirect	Pretreatment
Plant 2099		Direct*	Direct

*Some useable treatment equipment in place.

sludge removal, a secondary clarifier, an aerated lagoon and a faculative lagoon; in addition, the sludge is processed through an aerobic digestor, a sludge thickener and a vacuum filter, prior to disposal.

2. Costs of Compliance

As indicated in Table IV-3, the differences among the control option costs for wet process hardboard plants are significant, and this appears to be due to differences in the size of facilities. Plant 2013 is currently in the process of installing a pollution control system, and it is shown as having equal cost under each option. Under the least stringent EPA option, only two plants (2003 and 2004) would be impacted. Under Option 2, plant 2099 would be added to the list of impacted plants while plants 2002 and 2006 would be added to the list under Option 3.

D. POLLUTION CONTROL OPTIONS - NEW SOURCES

1. Cost Models

A candidate new source performance standard for insulation board and wet process hardboard plants calls for zero discharge. The control technology is the same for mechanical refining insulation board, and thermo-mechanical insulation board, while that for S1S wet process hardboard and S2S wet process hardboard is similar. It consists of the following steps:[1]

[1]Ibid

TABLE IV-3

COST OF COMPLIANCE FOR PLANTS

IMPACTED BY REVISED EFFLUENT REGULATIONS

($000)

	Investment			Operating Costs
Option 1	Total	Land	Other Investment	
Plant 2003	$2,165.0	--	$2,165.0	$1,116.7
2004	198.0	--	198.0	87.1
Option 2				
Plant 2003	$2,307.8	--	$2,307.8	$1,195.3
2004	346.5	--	346.5	144.2
2099	373.5	$ 8.5	365.0	98.1
Option 3				
Plant 2002	$3,904.6	$25.0	$3,879.6	$ 884.6
2003	7,027.1	40.0	6,987.1	2,102.2
2004	2,674.7	25.0	2,649.7	469.0
2006	3,243.3	25.0	3,218.3	642.7
2099	2,773.9	25.0	2,748.9	517.7

- Screening;
- Neutralization;
- Nutrient addition;
- Aerated lagoon (two aerated lagoons for hardboard);
- Faculative lagoon; and
- Spray irrigation.

The characteristics of the model insulation board and hardboard plants are shown in Table IV-4.

2. Costs of Compliance

The costs of compliance for new insulation board and wet process hardboard plants are summarized in Table IV-5. The total investment required includes the cost of land at about $2,200 per acre.

TABLE IV-4

MODEL PLANTS FOR NEW SOURCE PERFORMANCE STANDARDS INSULATION BOARD AND WET PROCESS HARDBOARD

PLANT TYPE	DESIGN PRODUCTION (tons/day)	WASTEWATER FLOW (000 gal./day)	RAW BOD WASTELOAD (lbs./day)	RAW TSS WASTELOAD (lbs./day)
Mechanical Refining				
Insulation Board				
Plant 1	250	0.5	7,510	9,170
Plant 2	600	1.2	18,000	22,000
Thermo-mechanical Refining				
Insulation Board				
Plant 1	200	0.5	22,400	6,410
Plant 2	400	1.0	44,800	12,800
S1S Wet Process Hardboard				
Plant 1	100	0.3	7,710	3,040
Plant 2	300	0.8	23,100	9,110
S2S Wet Process Hardboard				
Plant 1	250	1.5	32,500	7,510

TABLE IV-5

COST OF COMPLIANCE

NEW INSULATION BOARD AND

WET PROCESS HARDBOARD MILLS

($000)

PLANT TYPE	TOTAL INVESTMENT	OPERATING COST	ACRES OF LAND REQUIRED
Mechanical Refining			
Insulation Board			
Plant 1	$2,336	$ 690	245
Plant 2	4,044	1,304	575
Thermo-mechanical Refining			
Insulation Board			
Plant 1	$2,862	$1,366	245
Plant 2	5,491	2,976	575
S1S Wet Process Hardboard			
Plant 1	$1,953	668	135
Plant 2	2,915	848	405
S2S Wet Process Hardboard			
Plant 1	$5,075	2,005	720

V ECONOMIC IMPACT OF COMPLIANCE WITH REVISED WATER EFFLUENT REGULATIONS

A. INTRODUCTION

The cost of compliance estimates generated by the technical contractor (summarized in Chapter IV) were combined with plant financial profiles and economic characteristics of the industry (see Industry Description, Chapter III) to produce an estimate of the economic impact of revised water effluent regulations on the insulation board and wet process hardboard sectors of the timber industry.

Since there are so few plants in the insulation board and wet process hardboard sectors, and only six wet process hardboard plants must incur costs to comply with revised water effluent regulations, an analysis of economic impact was performed for each affected plant. No combination plants will incur costs.

The potential economic impacts discussed in this chapter include:

- price increases;
- demand shifts;
- financial considerations;
- plant closure;
- capacity expansion;
- market structure;
- employment and community impacts.

B. PRICE INCREASES

1. Level of Increases

Table V-1 contains estimates for each affected plant of the long-run price increases required to recover the incremental costs of compliance with revised regulations as well as 1976 revenue and production for each plant. In most cases the 1977 price indicated in Table V-1 represents the average for wet process hardboard as of year-end 1977.

The price increase required to recover the cost of compliance varies widely among wet process hardboard plants. For the wet process hardboard plants, Options 1 and 2 will produce a substantially lower impact upon costs than Option 3. Since plant 2013 is currently in the process of installing a pollution control system, its required revenue is the same under all options.

Plants 2003 and 2004 are required to make expenditures for pollution control under all three options. The required price increase to recover costs for Option 3 is two times as high for plant 2003 and eight times as high for plant 2004 than that for Option 1.

The differences in required price increase from plant to plant for a given model treatment can be explained by a combination of in-place treatment, production scale or special circumstances. Generally, smaller plants and plants with less adequate treatment equipment will incur disproportionate compliance costs for a given model treatment. Plant 2013 is installing equipment appropriate for its specific situation.

TABLE V-1

REVENUE REQUIRED TO RECOVER

THE COST OF COMPLYING WITH REVISED REGULATIONS

FOR HARDBOARD PLANTS

Plant Type/Code	(1) 1976 Revenue ($000)	1977 Price /MSF	Recovery of Compliance Cost Required Δ Revenue/MSF	Recovery of Compliance Cost % Δ 1977 Price
Option 1				
Plant 2003	$29,900	$73	$ 3.80	5%
Plant 2004	8,400	73	1.10	2
Plant 2013*	20,400	73	6.10	8
Option 2				
Plant 2003	$29,900	$73	$ 4.20	6%
Plant 2004	8,400	73	1.80	3
Plant 2013*	20,400	73	6.10	8
Plant 2099	5,500	73	2.60	4
Option 3				
Plant 2002	$20,000	$73	$ 7.30	10%
Plant 2003	29,900	73	8.85	12
Plant 2004	8,400	73	9.60	13
Plant 2006	9,400	73	11.60	16
Plant 2013*	20,400	73	6.10	8
Plant 2099	5,500	73	16.20	22

*This plant is in the process of installing a pollution control system, and those specific costs were used in the analysis.

SOURCE: Arthur D. Little, Inc. estimates.

The relative difference between the highest cost and lowest cost options also differs from plant to plant. This reflects the differences in control equipment in place from plant to plant.

2. Obtainability of Increase

Thus far, the discussion has focused on what long-run price increases are necessary to recover the cost of compliance with revised water effluent regulations. An important consideration in evaluating economic impact is determining if and when price increases can be obtained.

The first step in the evaluation of whether or not price increases can be obtained was to compare the productive capacity in plants that are required to make expenditures for revised regulations with those that are not. Table V-2 showed the capacity of plants impacted by Option 3 compared with that of plants currently in compliance. Wet process hardboard plants impacted by revised regulations represent 27% of the 1976 total hardboard (wet and dry) capacity and 28% of the total 1976 production. This fact alone would indicate potential difficulties in obtaining price increases. However, wet process and other hardboard plants have enjoyed high operating rates from 1976 to 1978. The total hardboard segments had an operating rate of 92% in 1976 while the impacted plants operated at 95% of capacity.

Under the less stringent control options for wet process hardboard, fewer plants are impacted and thus less capacity is controlled by impacted plants. The impacted plants represent 14% of hardboard capacity under Option 1, and 15% of capacity under Option 2.

TABLE V-2

DISTRIBUTION OF HARDBOARD CAPACITY

IMPACTED VS. NON-IMPACTED PLANTS

OPTION 3

	1976 Capacity (1/8" - MMSF)	% Total	1976 Production 1/8" - MMSF	% Total	1976 Capacity Utilization
WET PROCESS					
Impacted Plants (6) [1]	1,650	20%	1,375	20%	83%
Plants in Compliance (10)	4,156	50	3,550	50	85
Total Wet Process (16)	5,812	70%	4,925	70	85
DRY PROCESS 12	2,460	30	2,141	30	87
TOTAL HARDBOARD	8,272	100%	7,066	100%	85%

[1] Includes two combination plants.

SOURCE: Derived from Financial 308 Letter data and Table III-4.

While current operating rates are important, future growth in demand and capacity expansion will indicate the probable supply/demand balance likely at the time the plants are required to make the pollution control investments. As discussed in the industry description, hardboard demand will continue to grow at an average rate of 5% a year, while fluctuating with the business cycle for the construction industry. Insulation board, on the other hand, is a product in long-term decline. By 1984, demand for insulation board will be 65% of the 1976 level and the industry operating rate would be at about 60% if all plants were in operation. The demand for hardboard will be about 25% higher in 1983 than in 1976 and an additional1100-1200 MMSF of capacity will be required to meet the demand.

It is not contemplated that any greenfield plants will be constructed to add to hardboard capacity. The probable method of expansion is incremental increases in capacity at existing plants and conversion of insulation board capacity to hardboard capacity. (Coincidentally, the increased hardboard capacity required by 1984 is about the same in MMSF as the slack insulation board capacity that will exist by then (1,200 MMSF), although only a small proportion of this capacity can practicably be converted to hardboard.) The total cost of production and derived selling prices based upon long-run total cost indicate that the price of hardboard must rise to a level substantially higher than the levels indicated in Table V-1.[1]

---

[1] See Section F, CAPACITY EXPANSION.

Since hardboard is expected to be in tight supply on average over the next five to ten years, and the cost of new capacity cannot be supported by current market prices,[1] then prices can be expected to eventually cover the increased costs of existing hardboard producers.

The increases in hardboard price (measured in 1976 dollars) under Options 1 and 2 will not be sufficient to negate its competitive advantage over plywood. However, even when demand is price inelastic, some reductions in demand can occur. Under Option 3, while hardboard will still be lower in cost than some substitutes, the price increases required will be large enough so that some substitution could occur.

C. FINANCIAL CONSIDERATION

When an industry can recover cost increases through price increases without impacting demand, the economic impact is less severe than would otherwise be the case. However, plants may suffer adverse economic impact if price increases lag cost increases and if companies are unable to finance the compliance investment.

The profitability of wet process hardboard plants impacted by revised regulations was analyzed as if price increases did not occur and the results of this evaluation are shown in Figure V-1. In general, plant profitability will be reduced, but a plant will still cover its cash costs and depreciation, assuming the 1976 operating results are representative of cost conditions likely to prevail in 1984. Under Option 3 for wet process hardboard, two plants would just about break even as shown in Figure V-1.

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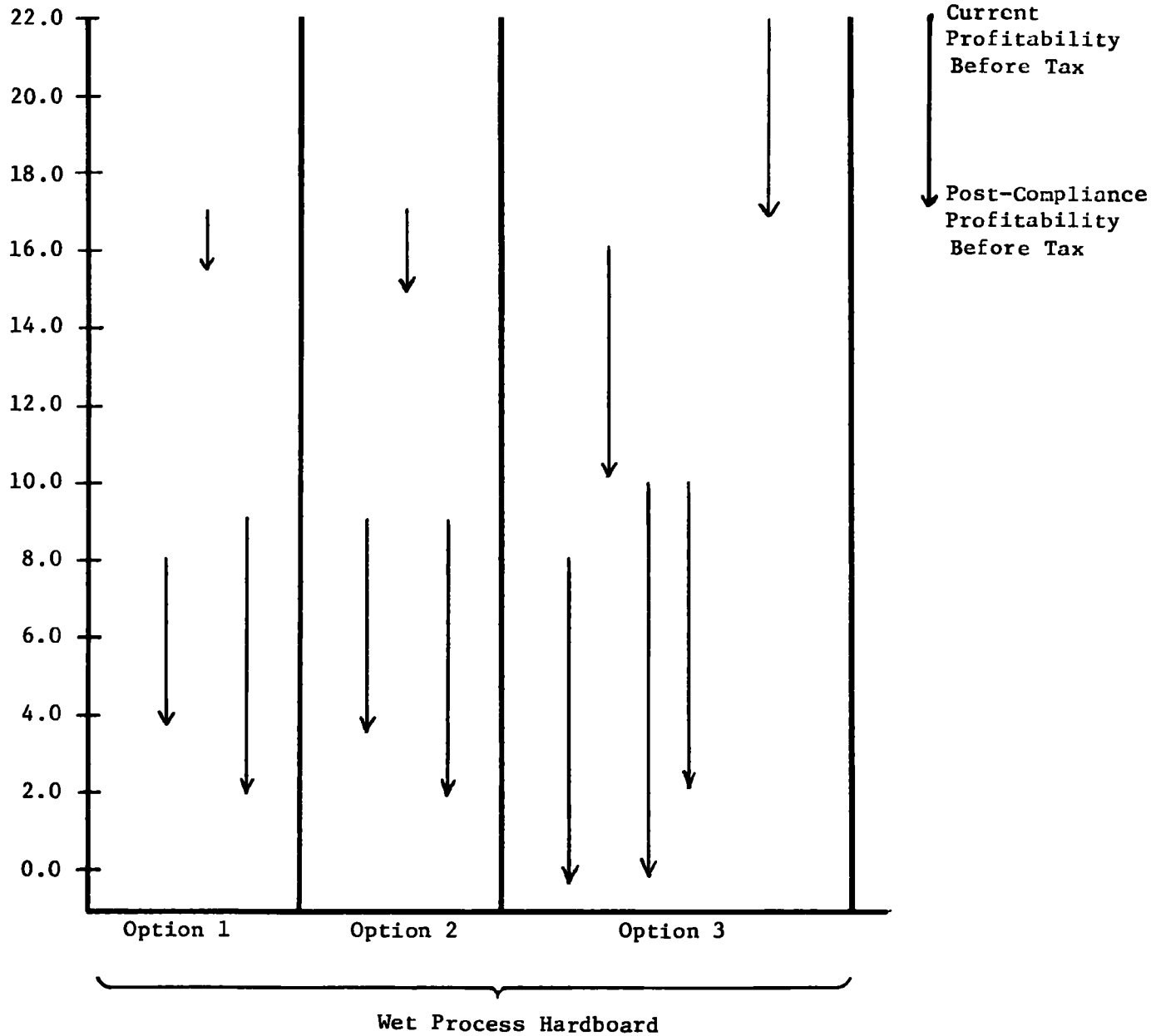
[1]See Section F, CAPACITY EXPANSION.

FICURE V-1

POST-COMPLIANCE PROFITABILITY

WITH NO PRICE INCREASE

(1976 COST STRUCTURE)



SOURCE: Arthur D. Little, Inc. estimates.

Most of the insulation board and wet process hardboard plants are parts of larger corporations which generate cash flow in excess of the required pollution control investment and which also have some ability to generate external funds. However, a parent company might be reluctant to divert funds from other operations to hardboard plants. For this reason and the fact that a few plants are part of smaller coporations, it is advisable to examine the relationship between plant cash flow and the required compliance investment.

For the impacted plants not currently in the process of installing a pollution control system, the investment required for revised effluent regulations was divided by cash flow to construct the percentages shown in Figure V-2. For wet process hardboard plants, the investment associated with Options 1 and 2 are less than or equal to 1976 cash flow, while the investment associated with Option 3 is over three times cash flow.

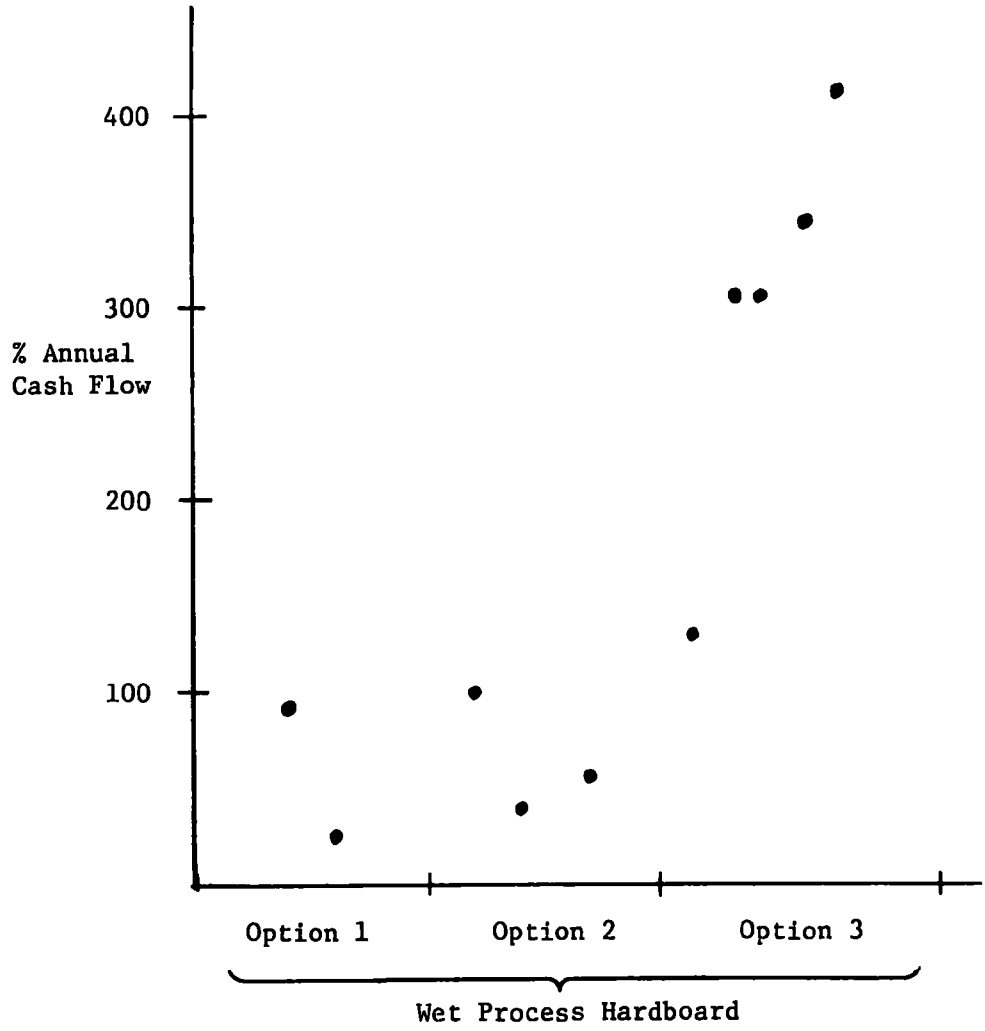
The impacted wet process hardboard plants will eventually recover the costs of compliance through higher prices which will probably also provide a sufficient rate of return on investment. However, Option 3 will cause a cash drain from other operations.

D. PLANT CLOSURE

The evaluation of whether or not a plant will close down as a result of pollution control regulation (or any other event) is at best an imprecise estimate based upon an external view of a plant's situation.

FIGURE V-2

INVESTMENT REQUIRED FOR
COMPLIANCE WITH REVISED EFFLUENT REGULATIONS
COMPARED WITH PLANT CASH FLOW



SOURCE: Arthur D. Little, Inc. estimates.

Of necessity, the evaluation is based upon financial criteria without knowledge and consideration of a corporation's policies and goals. To illustrate, a corporation may decide to close or sell off an apparently profitable plant if the plant's business does not meet its long-term objectives. On the other hand, a corporation may elect to invest in and operate a marginal plant which provides a source of equipment or materials for its other operations, to retain control over the source of supply.

Under Options 1 and 2, no plant closures are foreseen for the two or three plants not presently installing a pollution control system. Under Option 3, no closures are foreseen, provided the plants can obtain external financing.

E. CAPACITY EXPANSION

In Chapters II and III, the discussion of the hardboard and insulaboard industry segments indicated that no greenfield mills are likely to be built for either of the two product types. Insulation board demand is facing a long-term decline and faces significant excess capacity by the 1980's, and thus no new capacity will be built.

Capacity expansion for hardboard will most likely occur through incremental expansion of existing hardboard mills and secondly from conversion of insulation board capacity. The reason for this is primarily related to the high cost of new capacity compared with current market prices, and while this relationship would be exacerbated by pollution control costs, they are of secondary importance.

Table V-3 depicts the long-run price required to recover the incremental pollution control cost for a new mill, an insulation board plant conversion and an incremental expansion. The required increment to cover pollution control costs does not differ for the new source compared to conversion and expansion, under a total recycle option. However, the baseline plant cost translates into a higher, long-run required price-per-ton for a new facility.

All expansion methods shown in Table V-3 require a higher product price than the current market prices, suggesting that capacity increases will lag demand growth such that market price will rise to cover the costs of new capacity. The March 1978 market price was 91.56 per MSF; prices must rise by 28% to support an incremental expansion by the lowest cost method. This increase is greater than that required by impacted hardboard plants to recover costs of pollution control costs under all of the options studied.

F. MARKET STRUCTURE

The number and size of insulation board plants will be unaffected by revised regulations. The number of hardboard plants will remain unchanged as a result of revised regulations. New capacity will be built at existing plants and will not be influenced significantly by revised regulations.

G. EMPLOYMENT AND COMMUNITY IMPACTS

No plant closures are anticipated and thus no unemployment will result from revised regulations for insulation board and hardboard segments.

TABLE V-3

COST OF NEW HARDBOARD CAPACITY

NEW MILL VERSUS INCREMENTAL EXPANSION

		CAPACITY MMSF	INCREMENTAL INVESTMENT ($000)	ANNUAL OPERATING COSTS ($000)	LONG-RUN PRICE ($/MSF)
1.	New Plant				
	Baseline Plant	293	$57,000	$24,300	$136
	Water Effluent Control	--	5,075	2,005	11
					$147
2.	Conversion of Insulation Board Plant				
	Baseline Conversion Cost	234	$27,000	$20,440	$117
	Water Effluent Central (Option 3)[1]	--			7-11
					$124 - $128
3.	Incremental Expansion				
	Baseline Expansion	117	$17,500	$ 8,370	$106
	Water Effluent Control (Option 3)[1]				9-12
					$115 - $118

[1]Based on range for similar size plants.

SOURCE: Arthur D. Little, Inc. estimates.

APPENDIX A

SUPPLEMENTARY DATA

PAGE NOT

AVAILABLE

DIGITALLY

TABLE A-2

DERIVATION OF UNIT COST

WET PROCESS HARDBOARD NEW CAPACITY

LABOR HOURS

1. Greenfield Mill

	Manhours/Ton
Logging	2.72
Manufacture	14.72
Transportation	2.08
	19.52

2. Conversion of Insulation Board to Hardboard

   Increase manhours by 10%: 21.42 manhours/incremental ton

3. Incremental Expansion

   Decrease manhours by 10%: 17.57 manhours/incremental ton

ENERGY REQUIREMENTS

1. Greenfield Mill

	Million BTU's
Gross Manufacturing Requirements	21.551
Energy Generated from Residue	.797
	20.754

2. Conversion of Insulation Board to Hardboard

   Increase BTU's by 10%: 22.829 million BTU's

3. Incremental Expansion

   Decrease BTU's by 10%: 18.679 million BTU's

WOOD REQUIREMENTS

300 tons of chips/day = 107 MBF/day
.84 MSF/day

APPENDIX B

EPA FINANCIAL 308 SURVEY

308 QUESTIONNAIRE
INSULATION BOARD

i. Name of Plant _____

ii. Address of Plant _____
Street

_____
City State Zip

iii. Name of Respondent* _____ Title _____

iv. Address of Respondent _____
Street City State Zip

v. Telephone No. of Respondent _____
Area Code Number

vi. Parent Company _____

vii. Is this plant engaged in the manufacture of insulation board?

Yes ☐ Continue with Questionnaire

No ☐ Do not fill out the questionnaire but return after completing this page, through Question vii.

viii. To assert your claim of confidentiality, please check off the box corresponding to the questions that in the company's opinion require confidential treatment.

1	☐	5	☐	9	☐	13	☐	19	☐
2	☐	6	☐	10	☐	14	☐	20	☐
3	☐	7	☐	11	☐	15	☐	21	☐
4	☐	8	☐	12	☐	18	☐	22	☐

NOTE: Upon receipt by EPA, this page will be separated from the remainder of the questionnaire so that data processing and use is conducted on a coded basis.

For Use by EPA
Code Number _____

*Person to be contacted in case of questions.

308 QUESTIONNAIRE
INSULATION BOARD

Company Code _____
(For EPA Use)

A. GENERAL INFORMATION

1. Is this insulation board (IB) plant a stand-alone operation or part of a multi-plant complex?

   Stand-Alone ☐ Multi-plant Complex ☐

   If part of a multi-plant complex, approximately what percentage of total complex sales revenue was represented by insulation board in the fiscal year ending 1976? _____ %

2. Is this plant at an urban, suburban or rural location? _____

   Urban ☐ Suburban ☐ Rural ☐

3. What year did the plant begin operation? _____

B. SALES AND PRODUCT MIX

4. What were total sales for this insulation board (IB) plant during 1976?

Under $8 Million	$8-12 Million	$13-20 Million	$21-28 Million	Over $28 Million
☐	☐	☐	☐	☐

5. Which of the following product types were produced at this IB plant during 1976?

	Produced At Plant	Approximate Percent of *Sales*					
		< 10	10-30	31-50	51-70	71-90	> 90
Insulation Board							
a. Structural	☐	☐	☐	☐	☐	☐	☐
b. Decorative	☐	☐	☐	☐	☐	☐	☐
c. Other	☐	☐	☐	☐	☐	☐	☐

6. Are any changes (other than normal business fluctuations) planned over the next five years in IB production process or product mix?

   Yes ☐ No ☐ (If no, go to Part C)

   If yes, please describe: _____

   _____

C. PLANT CAPACITY AND PRODUCTION

7. Annual Capacity: The amount of thousands of square feet of insulation board which could have been produced in this plant during 1976 if the IB plant was operated fully 6-2/3 days/week, 24 hours/day, (350 days or 8400 hours/yr.).

Insulation Board (1/2" Basis)

Thousands of Square Feet				
< 100,000	100,000-150,000	150,001-200,000	200,001-250,000	250,001-300,000
☐	☐	☐	☐	☐
300,001-350,000	350,001-400,000	400,001-450,000	450,001-500,000	> 500,000
☐	☐	☐	☐	☐

8. Actual Production in 1976: The amount of thousands of square feet of insulation board which were produced in this IB plant during 1976:

Insulation Board (1/2" basis) _____ thousands of square feet

9. Did this IB plant have any unusual downtime during 1976, e.g., labor strikes, accidents, et cetera?

No ☐ (Go to 10)
Yes ☐

Number of Weeks of Unusual Downtime					
< 1	1-2	3-4	5-6	7-8	> 8
☐	☐	☐	☐	☐	☐

10. Average number of employees during 1976:

	< 25	26-50	51-75	76-100	101-150	> 150
Production Workers	☐	☐	☐	☐	☐	☐
Other Employees	☐	☐	☐	☐	☐	☐

11. a. Typical number of production days per week:

1-4 ☐ 5 ☐ 6 ☐ 7 ☐

b. Please state number of weeks at each shift level (the total should add to 52 weeks)

No. of Weeks

(1) _____ at 0 shifts (shut down or no insulation board production)

(2) _____ at 1 shift

(3) _____ at 2 shifts

(4) _____ at 3 shifts

(5) _____ at 4 shifts

52 weeks Total [(1) + (2) + (3) + (4) + (5)]

D. REVENUES AND EXPENSES

12. Income Statement

Please check the box which most closely approximates your costs as a percentage of sales. (Use an approximate allocation of data are available at the plant level.)

	Approximate Percent of *Sales*					
	< 16	16-20	21-25	26-30	31-35	> 35
a. *Direct Wages, Salaries and Related*	☐	☐	☐	☐	☐	☐
	< 40.0	41-45	46-50	51-55	56-60	> 60
b. *Materials* (logs, wood, other materials, inventory charges)	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	6-7	> 7
c. *Depreciation*	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	6-7	> 7
d. Other Plant Expenses (Including rent, fuel and energy)	☐	☐	☐	☐	☐	☐
	< 10	10.0-20.0	21.0-25.0		25.1-30.0	> 30
e. *Operating Margin*	☐	☐	☐		☐	☐
	< 8	8-10	11-13		> 14	
f. *Selling, General and Administration* (Including allocation from Parent)	☐	☐	☐		☐	
	0	1-2	3-4	5-6	7-8	> 8
g. Interest Expense	☐	☐	☐	☐	☐	☐
h. *Other Income (Expense)*	☐	☐	☐	☐	☐	☐
	< 3	3-9	10-12	13-15	16-17	> 17
i. *Profit Before Tax*	☐	☐	☐	☐	☐	☐
	< 1	2-3	4-5	6-7	8-9	> 9
j. Taxes	☐	☐	☐	☐	☐	☐
	< 2	2-4	5-10	11-15	>15	
k. *Profit After Tax*	☐	☐	☐	☐	☐	

13. How representative is 1976 profit before tax compared to the 1971-1975 period:

Much Better than Average	☐
Better than Average	☐
About the Same	☐
Worse than Average	☐
Much Worse than Average	☐

14. What Depreciation Method is used?

		Equipment	Buildings
a. Book Basis:	Straight-Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other: _____ (Please Specify)	☐	☐
b. Tax Basis:	Straight Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other: _____ (Please Specify)	☐	☐
c. Pollution Control Expenditures:			
	Accelerated Over 5 Years	☐	☐
	Same as Other Equipment	☐	☐

15. Annual Cost of Pollution Control and other Regulations Affecting Insulation Board Production Process and Costs at this IB Plant:

	Don't Know	None	Fiscal Year Ending 1976	Fiscal Year Ending 1977*
a. Direct Costs				
(1) Water Pollution Regulations:				
(a) Annual Operating Costs**	☐	☐	_____	_____
(b) Annual Depreciation Charges**	☐	☐	_____	_____
(c) Obligations to Municipalities	☐	☐	_____	_____
(2) Air Pollution Regulations:				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____

*Please estimate the 1977 value if unknown at this time.

**Include the cost associated with shared facilities, including Industrial Waste Recovery Systems.

	Don't Know	None	Fiscal Year Ending 1976	1977*
(3) Solid Waste Disposal (Total, including waste water sludge and wood waste):	☐	☐	_____	_____
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
(4) Other Regulations Affecting Production Processes and Production Costs (Please Specify). _____				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
b. Indirect Costs (e.g., environmental research, consultants, litigation)	☐	☐	_____	_____

16. How does this plant discharge of *process waste water*?

a. Discharge into navigable water ☐
b. Discharge into municipal sewer ☐
c. Disposed on plant site ☐
d. Disposed off plant site ☐
e. Process waste is recycled (no discharge) ☐
f. Other ☐ Please specify _____

17a. If you do not discharge *process waste water* into a municipal sewer, do you have the option to connect?

Yes ☐ No ☐ Don't Know ☐

b. If you do have the option to connect to a municipal sewer, what is the initial capital investment cost?

$ _____ Don't Know ☐

c. If you discharge any wood treating *process waste water* into a sewer system, on what basis are your sewer charges made?

Flat annual fee ☐
Gallon of effluent ☐
Other ☐ Please specify _____

*Please estimate the 1977 value if unknown at this time.

d. If you discharge into a municipal sewer, what were your total sewer charges in 1976?

$ _____

e. If you discharge *process waste water* into navigable waters, do you have an *NPDES permit*?

Yes ☐ No ☐ Don't Know ☐

f. Do you own or have available for purchase about one acre of land at or adjacent to this facility that could be used for an effluent treatment system?

Yes ☐ No ☐

If yes, what is the current market value per acre? $ _____

18. *Unusual Production Costs*

Are there any circumstances peculiar to this plant which result in unusual production costs (other than unusual downtime described in Q. 9)?

Yes ☐ No ☐

If Yes, please describe: _____

_____

_____

19. Distribution of Corporate Assets and Liabilities

a. What was the value of the company's *total assets* at the end of the 1976 fiscal year? $ _____

b. What was the value of the company's *total liabilities* and net worth at the end of the 1976 fiscal year (accounts payable, debt due within the year, etc.)? $ _____

c. What was the value of debt maturing in one year? $ _____

d. What was the corporation's debt/equity ratio? _____:1

20 Value of Assets for this Insulation Board Plant

a. *Gross Fixed Assets*: Original Cost (Book Value) of plant and equipment dedicated to insulation board $ _____

b. Accumulated *depreciation* - _____

c. Net *Fixed Assets (Gross Fixed Assets* less cumulative *depreciation* = Current Book Value) $ _____

d. *Total Assets*: Net *Fixed Assets*, Cash Receivables, inventory, other costs) $ _____

21. Capital Investment Criteria for IB Plant

a. What basis is used to evaluate the IB plant's profitability (*return on investment*)?

☐ *Total Assets* (As above, 20.d) less current liabilities

☐ Book Value of Net *Fixed Assets* (As above, 20.c)

☐ Replacement Cost

☐ Salvage Value

☐ Other (Specify)

b. What is the target internal pre-tax rate of return on capital required for investment in this plant? _____ % At what ROI would you consider closing the plant? _____ %

c. If rate of return criteria are not used, what is the required *payback period* for investment? _____ Years or ☐ Useful Life. At what payback period would you consider closing the plant? _____ Years

22. Capital Investment for IB Plant (including capitalized maintenance)

	(1) Total Investment	(2) Plant Capitalized Maintenance of Major Expansion	(3) Water Pollution Control	(4) Other Environmental Regulation Impacting Production Processes
Planned 1977	_____	_____	_____	_____
Total Actual 1972-76	_____	_____	_____	_____

308 QUESTIONNAIRE
WET PROCESS HARDBOARD

i. Name of Plant _____

ii. Address of Plant _____
Street

_____
City State Zip

iii. Name of Respondent* _____ Title _____

iv. Address of Respondent _____
Street City State Zip

v. Telephone No. of Respondent _____
Area Code Number

vi. Parent Company _____

vii. Is this plant engaged in the manufacture of wet process hardboard?

Yes ☐ Continue with Questionnaire

No ☐ Do not fill out the questionnaire but return after completing this page through Question vii.

viii. To assert your claim of confidentiality, please check off the box corresponding to the questions that in the company's opinion require confidential treatment.

1	☐	5	☐	9	☐	13	☐	19	☐
2	☐	6	☐	10	☐	14	☐	20	☐
3	☐	7	☐	11	☐	15	☐	21	☐
4	☐	8	☐	12	☐	18	☐	22	☐

NOTE: Upon receipt by EPA, this page will be separated from the remainder of the questionnaire so that data processing and use is conducted on a coded basis.

For Use by EPA

Code Number _____

*Person to be contacted in case of questions.

C. PLANT CAPACITY AND PRODUCTION

7. Annual Capacity: The amount of thousands of square feet of the product which could have been produced in this plant during 1976 if the plant was operated fully 6-2/3 days/week, 24 hours/day (350 days or 8400 hours/yr.).

Wet Process Hardboard (1/8" Basis)

Thousands of Square Feet				
< 100,000	100,000-150,000	150,001-200,000	200,001-250,000	250,001-300,000
☐	☐	☐	☐	☐
300,001-350,000	350,001-400,000	400,001-450,000	450,001-500,000	> 500,000
☐	☐	☐	☐	☐

8. Actual Production in 1976: The amount of thousands of square feet of the product which were produced in this plant during 1976:

Wet Process Hardboard (1/8" basis) _____ thousands of square feet

9. Did this WPH plant have any unusual downtime during 1976, e.g., labor strikes, accidents, etc?

No ☐ (Go to 10)
Yes ☐

Number of Weeks of Unusual Downtime					
< 1	1-2	3-4	5-6	7-8	> 8
☐	☐	☐	☐	☐	☐

10. Average number of employees during 1976:

	< 25	26-50	51-75	76-100	101-150	> 150
Production Workers	☐	☐	☐	☐	☐	☐
Other Employees	☐	☐	☐	☐	☐	☐

11. a. Typical number of production days per week:

1-4 ☐ 5 ☐ 6 ☐ 7 ☐

b. Please state number of weeks at each shift level (the total should add to 52 weeks):

No. of Weeks

(1) _____ at 0 shifts (shut down or no wet process hardboard production)
(2) _____ at 1 shift
(3) _____ at 2 shifts
(4) _____ at 3 shifts
(5) _____ at 4 shifts

52 Weeks Total [(1) + (2) + (3) + (4) + (5)]

308 QUESTIONNAIRE
WET PROCESS HARDBOARD

Company Code _____
(For EPA Use)

A. GENERAL INFORMATION

1. Is this wet process *hardboard* (WPH) plant a stand-alone operation or part of a multi-plant complex?

   Stand-Alone ☐ Multi-plant Complex ☐

   If part of a complex, approximately what percentage of total *sales* at this complex was from wet process hardboard in the 1976 fiscal year? _____ %

2. Is this plant at an urban, suburban or rural location?

   Urban ☐ Suburban ☐ Rural ☐

3. What year did the plant begin operation? _____

B. SALES AND PRODUCT MIX

4. What were total *sales* (net f.o.b.) for this wet process hardboard (WPH) plant during 1976?

Under $5 Million	$5-10 Million	$11-20 Million	$21-30 Million	More than $30 Million
☐	☐	☐	☐	☐

5. Which of the following product types were produced at this WPH plant during 1976?

S1S Products	Produced At Plant	Approximate Percent of *Sales*					
		<10	10-30	31-50	51-70	70-90	>90
a. Siding	☐	☐	☐	☐	☐	☐	☐
b. Panelling	☐	☐	☐	☐	☐	☐	☐
c. Industrial Board	☐	☐	☐	☐	☐	☐	☐
d. Other S1S	☐	☐	☐	☐	☐	☐	☐
S2S Products							
e. Siding	☐	☐	☐	☐	☐	☐	☐
d. Panelling	☐	☐	☐	☐	☐	☐	☐
g. Industrial Board	☐	☐	☐	☐	☐	☐	☐
h. Other S2S	☐	☐	☐	☐	☐	☐	☐

6. Are any changes (other than normal business fluctuations) planned over the next five years in production process or product mix at this WPH plant?

   Yes ☐ No ☐ (If no, go to Part C)

   If yes, please describe _____

   _____

   _____

D. REVENUES AND EXPENSES

12. Income Statement

Please check the box which most closely approximates your costs as a percentage of sales. (Use an approximate allocation if data are unavailable at the plant level.)

	This WPH Plant's Cost as an Approximate Percent of *Sales*					
	< 16	17-19	20-23	24-26	27-29	> 29
a. *Direct Wages, Salaries and Related*	☐	☐	☐	☐	☐	☐
	< 20	21-27	28-33	34-40	41-47	> 47
b. *Materials* (logs, wood, other materials plus inventory charges)	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	6-7	> 7
c. *Depreciation*	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	5-6	> 7
d. Other Plant Expenses (Including rent, fuel and energy)	☐	☐	☐	☐	☐	☐
	< 30	31-35	36-40	41-45	46-50	> 50
e. *Operating Margin*	☐	☐	☐	☐	☐	☐
	< 5	6-7	8-10	11-12	13-15	> 15
f. *Selling General and Admin.* (Including Allocation from Parent)	☐	☐	☐	☐	☐	☐
	0	1-2	3-4	5-6	> 6	
g. Interest Expense	☐	☐	☐	☐	☐	
h. *Other Income (expense)*	☐	☐	☐	☐	☐	
	< 10	11-14	15-19	19-24	25-30	
i. *Profit Before Tax*	☐	☐	☐	☐	☐	
	< 4	5-6	7-9	10-12	13-15	
j. Taxes	☐	☐	☐	☐	☐	
	< 4	5-6	7-9	10-12	13-15	
k. *Profit After Tax*	☐	☐	☐	☐	☐	

13. How representative is 1976 profit before tax compared to the 1971-1975 period:

Much Better than Average	☐
Better than Average	☐
About the Same	☐
Worse than Average	☐
Much Worse than Average	☐

14. What depreciation method is used?

		Equipment	Buildings
a. Book Basis:	Straight-Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other. _____ (Please Specify)	☐	☐
b. Tax Basis	Straight Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other. _____ (Please Specify)	☐	☐
c. Pollution Control Expenditures:			
	Accelerated Over 5 Years	☐	☐
	Same as Other Equipment/Bldgs.	☐	☐

15 Annual Cost of Pollution Control and other Regulations Affecting WPH Production Process and Production at this Plant:

	Don't Know	None	Fiscal Year Ending 1976	Fiscal Year Ending 1977*
a. Direct Costs				
(1) Water Pollution Regulations:				
(a) Annual Operating Costs**	☐	☐	_____	_____
(b) Annual Depreciation Charges**	☐	☐	_____	_____
(c) Obligations to municipalities	☐	☐	_____	_____
(2) Air Pollution Regulations				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____

*Please estimate 1977 expenditures if they are not known.

**Include the cost associated with shared facilities, including Industrial Waste Recovery Systems.

	Don't Know	None	Fiscal Year Ending 1976	1977*
(3) Solid Waste Disposal (Total, including waste water sludge and wood waste):	☐	☐	_____	_____
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
(4) Other Regulations Affecting Production Processes and Production Costs (Please Specify): _____				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
b. Indirect/Overhead Costs (Environmental research, consulting fees, litigation, etc.)	☐	☐	_____	_____

16. How does this plant dispose of *process waste water*?

a. Discharge into navigable water ☐
b. Discharge into municipal sewer ☐
c. Disposed on plant site ☐
d. Disposed off plant site ☐
e. Process waste water is recycled (no discharge) ☐
f. Other ☐ Please specify _____

17.a If you do not discharge *process waste water* into a municipal sewer, do you have the option to connect?

Yes ☐ No ☐ Don't Know ☐

b. If you do have the option to connect to a municipal sewer, what is the initial capital investment cost?

$ _____ Don't Know ☐

c. If you discharge any *process waste water* into a sewer system, on what basis are your sewer charges made?

Flat annual fee ☐
Gallon of effluent ☐
Other ☐ Please specify _____

*Please estimate the 1977 value if unknown at this time

d. If you discharge into a municipal sewer, what were your total sewer charges in 1976?

$_____

e. If you discharge *process waste water* into navigable waters, do you have an *NPDES Permit*?

Yes ☐ No ☐ Don't Know ☐

f. Do you own or have available for purchase about one acre of land at or adjacent to this facility that could be used for an effluent treatment system?

Yes ☐ No ☐

If yes, what is the current market value per acre? $ _____

18. *Unusual Production Costs*

Are there any circumstances peculiar to this plant which result in unusual production costs (other than unusual downtime described in Q. 9)?

Yes ☐ No ☐

If Yes, please describe: _____

_____

_____

19. Distribution of Corporate Assets and Liabilities

a. What is the value of the corporation's total accounts receivable? $ _____

b. What is the value of the corporation's total current liabilities (accounts payable, debt due within the year, etc.)? $ _____

c. What is the value of debt maturing in the current fiscal year? $ _____

d. What is the corporate debt/equity ratio? _____ :1

20. Value of Assets (Wet Process Hardboard Plant):

a. *Gross Fixed Assets*· Original Cost (Book Value) of plant equipment dedicated to wet process hardboard $ _____

b. Accumulated *depreciation* - _____

c. Net *Fixed Assets (Gross Fixed Assets* less cumulative *depreciation*–Current Book Value) $ _____

d. *Total Assets*: Net *Fixed Assets*, Cash Receivables, inventory, other costs) $ _____

21. Capital Investment Criteria for WPH Plant

a. What basis is used to evaluate the plant's profitability (return on investment)?

☐ Net Assets (Total Assets, as above in 20.d, less Current Liabilities)

☐ Book Value of Net Fixed Assets (as above in 20.c)

☐ Replacement Cost

☐ Salvage Value

☐ Other (Specify) _____

b. What is the target internal pre-tax rate of return on capital required for investment in this plant? _____ % At what ROI would you consider closing the plant? _____ %

c. If rate of return criteria are not used, what is the required *payback period* for investment? _____ Years or ☐ Useful Life

22. Capital Investment for WPH Plant (including capitalized maintenance)

	(1) Total Investment	(2) Plant Capitalized Maintenance of Major Expansion	(3) Water Pollution Control	(4) Other Environmental Regulation Impacting Production Processes
Planned 1977	_____	_____	_____	_____
Total Actual 1972-76	_____	_____	_____	_____

RESPONSES TO EPA FINANCIAL SURVEY

Questionnaires Mailed to 18 Companies:

19 Wet Process Hardboard
16 Insulation Board

Response Rate: 100%

Applicable Responses:

17 Wet Process Hardboard
16 Insulation Board