Asbestos: Industry Profile

Final Report

Prepared for

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Innovative Strategies and Economics Group
MD-15
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This report contains portions of the economic impact analysis report that are related to the industry profile.

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SECTION 1

INTRODUCTION

The asbestos industry is undergoing a period of transition including significant changes in its basic market conditions. More specifically, increases in fiber prices, energy costs, regulation and legal action coupled with an ever-growing consumer awareness of the health hazards posed by asbestos have served to constrict both the supply of and demand for asbestos products.

Asbestos products are manufactured from the basic raw material asbestos ore. The manufacture of asbestos products is primarily included by the Standard Industrial Classification (SIC) code 3292. This industry is comprised of establishments primarily engaged in the manufacture of asbestos textiles, asbestos building materials, except asbestos paper, insulating materials for covering boilers and pipes, and other products composed wholly or chiefly of asbestos.[1] Establishments primarily engaged in manufacturing asbestos paper are classified in industry 2621 while those manufacturing gaskets and packing are included in industry 3053.

1.1 REGULATED ENTITIES AND POLICY ALTERNATIVES

Although asbestos products manufacturing facilities are considered to be an area source, not a major source, the EPA recognizes the significant risk and adverse health effects resulting from hazardous air pollutants in asbestos products manufacturing.

The regulations that EPA is considering would affect those asbestos products manufacturers and fabricators that were previously identified as part of the already existing asbestos

NESHAP. No new sources are expected to be identified. Although no specific regulatory alternatives have officially been identified, some possible alternative include requiring hepa-filters as a final control device and more enhanced monitoring of existing pollution control devices. The EPA is required to pass some regulatory control for the asbestos products industry no later than 4 years after enacting of the Clean Air Act, which was signed into legislation in 1990.

1.1.1 Regulatory Environment

Environmental and liability issues continue to affect the asbestos industry as the safe use of asbestos remains a major concern. Federal regulatory action on asbestos has taken a variety of forms. Regulations have been promulgated by the EPA, Consumer Product Safety Commission (CPSC), Department of Transportation (DOT), Food and Drug Administration (FDA), Mine Safety and Health Administration (MSHA), and the Occupational Safety and Health Administration (OSHA).

Under the authority of the Clean Air Act (1970), the Administrator of the Environmental Protection Agency (EPA) had the authority to designate substances as "hazardous air pollutants." One of the three substances named first to the list on March 31, 1971, was asbestos.[2] EPA was the first Federal agency to address the growing controversy about the effects of asbestos dust upon the health of humans by promulgating a National Emission Standard for Hazardous Air Pollutants (NESHAP) in 1973. It prohibited visible emissions from asbestos mills and from nine different manufacturing industries, specified certain work practices for demolition of structures that contain friable asbestos, limited to less than 1 percent the asbestos content of spray-on materials used for certain insulation applications, and prohibited most uses of asbestos tailings for suracing roadways. In the same year, EPA cited asbestos as a potential source of water pollution (38 FR 22606). Since this time, a number of additional regulatory actions have been imposed on the asbestos products industry in an attempt to minimize the hazards of asbestos exposure.

Following is a brief review of the most significant regulatory actions affecting this industry.

Under the EPA rule on asbestos in school buildings published in the Federal Register (FR) of May 27, 1983, inspections and identification of friable asbestos-containing material are required of all public and private elementary and secondary schools.[3] In testimony before the Senate Subcommittee on Toxic Substances and Environmental Oversight, the EPA testified in 1983 that within a year it would propose a ban on certain asbestos products. However, in 1985, the EPA announced its intention to refer the occupational safety or consumer risks associated with asbestos to OSHA and the Consumer Product Safety Commission (CPSC) in effect placing an indefinite hold on EPA's pending proposals to ban certain asbestos-containing products and the phaseout of the remaining uses of asbestos over a 10-year period.

In 1983, OSHA published its Emergency Temporary Standard (ETS), which lowers, by a factor of four, the permissible level of workplace exposure to asbestos which was later ruled invalid by the Fifth Circuit Court in 1984. On April 10, 1984 OSHA published its long-awaited proposal to revise the standard for occupational exposure to asbestos.

In 1989, EPA issued a final rule banning the manufacture, importation, processing and distribution of most asbestos-containing products on July 12, 1989. The ban was to be implemented in three stages. The first stage, effective August 27, 1990, bans asbestos-containing flooring and roofing felt, pipeline wrap, asbestos-cement corrugated and flat sheet, vinyl asbestos floor tile, and asbestos clothing. The second stage, effective August 25, 1993, would ban asbestos-containing gaskets, transmission components, and original equipment drum and disk brake components. The third stage, effective August 26, 1996, would ban asbestos-cement pipe, commercial and corrugated asbestos paper, roll board and mill board, asbestos-cement shingle, asbestos-containing roof and non-roof coatings, brake blocks, and after-market drum and disk brake components.[4] However, in 1991, the U.S. Court of Appeals for the Fifth

Circuit overturned EPA's 1989 ruling indicating that EPA did not adequately evaluate the health risks posed by asbestos substitutes or adequately assess the costs and benefits of alternatives to a complete ban on the use of asbestos.

The asbestos NESHAP has been updated and revised a number of times since its promulgation in 1973 and most recently in November of 1990. The revisions require daily monitoring of visible emissions for milling, manufacturing, and fabrication operations; weekly inspections of air cleaning devices; and recordkeeping. In addition, the auto industry and the EPA recently established a framework to achieve a voluntary phase-out of the use of asbestos in new cars, trucks, buses, and motorcycles.[5]

This profile begins by characterizing the supply side of the asbestos products industry including the stages of the production process, major factors of production, product characteristics, and costs of production. Section 3 characterizes the demand for asbestos products. The organization of the asbestos products industry is then discussed in Section 4, including a description of U.S. manufacturing plants and the firms that own these plants. Finally, in Section 5, historical statistics on the U.S. production and consumption of asbestos products are presented as well as data on the foreign trade of asbestos products.

SECTION 2
THE SUPPLY SIDE OF THE ASBESTOS PRODUCTS INDUSTRY

In this section, we describe the production process for asbestos products as well as the primary, secondary and consumer industries characteristic of the asbestos products industry. The section concludes with a discussion of the various types of asbestos fibers and costs of production.

2.1 PRODUCTION PROCESS

The asbestos industry is organized in the following manner. First, asbestos ore is mined and then milled to achieve a homogeneous, graded input, which is shipped to primary industries. These primary industries then process and modify the raw asbestos fiber to produce an intermediate or finished product. Secondary industries may then be required to complete the final processing of the product into a finished good. This finished good or product is then sold to consumer industries which then apply, install, erect, or consume the product without further modification. All of these operations have the potential for releasing asbestos fibers to the atmosphere.

The diagram below illustrates movement within the asbestos industry:

		Primary	Secondary	Consumer
Mining	—> Milling	—> Industries	—> Industries	—> Industries

Figure 2-1 illustrates the current use of asbestos products in primary, secondary, and consumer industries.

Figure 2-1. Use of asbestos products in primary secondary, and consumer industries.[6, 7]

The types of asbestos products still manufactured today include the production of asbestos raw fibers (milling), friction products, coatings and sealants, gaskets and packings, and reinforced plastics. Asbestos is also used by some plants in the production process of chlorine. Since 1987, the

asbestos cement pipe/sheet industry has been declining, and within the last year, the last two remaining plants closed down. Some cement pipe was still produced in 1992. Similarly, asbestos vinyl floor tile and textile products have also stopped being produced in the last 5 years.

Nearly all asbestos products are used in the manufacture of other final goods, and most are purchased by the construction and automobile industries. The primary automobile manufacturers and the automotive after market--the secondary fabrication of asbestos friction material products--demand the majority of asbestos friction materials. Some vinyl-asbestos flooring used to be sold directly to the consumer, as are a few asbestos paper products such as rollboard. Generally, though, asbestos products may be considered intermediate goods. Asbestos paints, asbestos coatings, and asbestos sealants do not undergo further processing after leaving the primary manufacturing plant. Several of the asbestos paper products receive further processing before final sale.

2.1.1 Mining

In the United States most asbestos ore is mined in surface operations. Surface mining methods are used where the asbestos-containing ore lies near the surface and is not bound within massive rock deposits. Such ore can be bulldozed or removed by a power shovel. Coarse ore is crushed to a size that can be accommodated by the mill. The crushed ore streams are moved to driers to remove moisture from the ore (up to 30 percent by weight). The dried ore is then stored.

There are two mines in operation today: one owned by the Vermont Asbestos Group (VAG) in Orleans County, Vermont and one owned by KCAC, Inc., formerly Union Carbide, in San Benito County, California. The VAG also operates a mill at the mine site, but operation at this facility is marginal. VAG reported that in 1993, they operated 10 hours a day, 70 days a year.

KCAC, Inc., also operates both a mine and mill. However, these facilities are located in different cities. The Coalinga Mine is located in Coalinga, California, and the mill in King City, California.

In Vermont and the Copperopolis district of California, open pit mining is used, and blasting is required to loosen the overburden for removal. Holes are drilled for placement of explosives. Secondary blasting may follow initial blasting to reduce large boulders to manageable size. The ore is loaded by mechanical shovels into ore-hauling trucks and transported to a stockpile at a primary jaw crusher.[8]

Large amounts of ore are held to provide a cushion between variations in fiber demand and mine production over time, which stem primarily from cyclical changes in construction. Conveyors and trucks are used at mine and mill sites to move ore from mines to mills. Typically, asbestos fibers are shipped from the mills in 100-pound multiwall bags made of paper or plastic and pressure packed to reduce bulk, damage and dust.

2.1.2 Milling

Asbestos milling is a complex operation primarily involving separation of fiber from rock and classifying fiber by length; the basic method has changed little over the past several years.[9] Milling, primarily carried out by fiberizers or crushers, frees the fibers from the rock and separates them from each other. The longest grades of fiber are not mechanically milled but hand separated or cobbed from surrounding rock.

Separation of asbestos fibers from rock typically is initiated by conveying mine ore by a large hopper and pan feeder to a primary, jaw-type crusher. Outputs of these crushers are conveyed to a wet-ore storage pile exterior to the

mill. This stockpile usually contains sufficient ore to sustain mill operation for an extended time. Wet ore is extracted from the bottom of the wet-ore stockpile by a vibrating-chute feeder in an underground tunnel. The wet ore is then exposed to a drying current of hot air.

The dried ore is conveyed by belt to a vibrating screen that sizes the ore for fine crushing. A rock circuit then serves to separate asbestos fibers from the rock as well as to grade fibers according to length. Asbestos fibers are separated into numerous standard grades and cleansed further in this rock circuit. The fibers are then machine packaged either by compressing the material into a dense bundle or by blowing the material into bags.

2.1.3 Manufacturing

Primary manufacturers will receive asbestos fibers from a particular mill or mills and perform a wide variety of operations on the fibers to produce a primary product. Some examples of these manufactured materials include:

- asbestos paper
- asbestos friction materials
- asbestos-cement product
- vinyl asbestos floor tile

- asbestos-reinforced plastics
- asbestos coatings and sealants
- asbestos gaskets and packing
- asbestos textile
- chlorine.*

The primary raw materials used by the asbestos manufacturing industry are listed in Table 2-1. Because asbestos fibers are a nonrenewable resource, asbestos manufacturers receive a domestic depletion allowance of 22 percent.**,[10] Because demolition and removal partially degrades the asbestos filaments, asbestos fibers are not recycled.

TABLE 2-1. MATERIALS CONSUMED BY ASBESTOS PRODUCT MANUFACTURES IN 1987 AND 1982[11]

	1987		1982	
Material	(10^3 Mg)	(10^6)	(10^3 Mg)	(10^6)
Asbestos fiber	NA	16.6	241.6	64.9
Portland cement	NA	3.3	152.4	10.1
Vegetable oils	NA	NA	NA	NA
Pigment	NA	NA	11.5	7.2
Plastics resins	NA	NA	194.3	61.2

2.1.4 Fabrication

Asbestos product fabrication refers to operations that use products from primary manufacturers and fabricate them into end products or for some final use. In general,

*Asbestos is used in the manufacturing process for chlorine.

**A depletion allowance affords a lower Federal corporation tax upon income earned from the sale of exhaustible (depleting) resources. The percentage of depletion permitted, or depletion allowance, is a fixed deduction from annual gross income.

operations involved in secondary fabrication are similar to finishing operations of the primary manufacturing segments. They may use such operations as grinding, sawing, sanding, punching, pressing, or slitting, depending on the fabricated product desired.[12] In many cases, primary manufacturers fabricate their own products or the products of other primary manufacturers. These activities include operations such as the application of a vinyl coating to flooring felt to form a completed floor covering and the use of asbestos paper to form gaskets.

Field fabrication of asbestos products is sometimes required, which involves occasional cutting and machining of A/C pipe and A/C sheet during installation of a pipeline or at a construction site and cutting of roofing and flooring products during installation.

2.2 TYPES OF ASBESTOS

Asbestos is a term used to describe six naturally occurring minerals exploited commercially for their desirable physical properties. The six minerals are the serpentine mineral chrysotile and the amphibole minerals grunerite asbestos (also referred to as amosite), riebeckite asbestos (also referred to as crocidolite), anthophyllite asbestos, tremolite asbestos, and actinolite asbestos.[13] Individual mineral particles, however processed and regardless of their mineral name, are not demonstrated to be asbestos if the length to width ratio is less than 20:1.[14]

Chrysotile is the only commercial asbestos mineral belonging to the serpentine group while the remaining five commercial asbestos minerals belong to the amphibole mineral group. These are grunerite asbestos, riebeckite asbestos, anthophyllite asbestos, tremolite asbestos and actinolite asbestos. Chrysotile, the principal variety of commerce, is graded and grouped according to fiber length. Most of the

groups are divided into several subgroups to comprise the commercial specifications.[15]

2.3 COSTS OF PRODUCTION

The cost of asbestos fibers may constitute a significant share of the costs of a particular manufactured product. For instance, despite the low volume content in asbestos-cement pipe, asbestos accounts for about one-third of the product's cost due to the high price of asbestos-cement fiber. On the other hand, despite the high proportional content of asbestos in friction materials, asbestos accounts for a small cost share due to the low quality of the fiber used. Table 2-2 gives the asbestos fiber cost share as a percentage of total cost for several product categories.

In conclusion, it is significant that a pronounced trend of increased tort litigation against asbestos product manufacturers has occurred that has substantially affected their cost of doing business. Accordingly, this trend has become an integral constituent determining the supply conditions of the firms.

TABLE 2-2. ASBESTOS IN ASBESTOS MANUFACTURES BY WEIGHT AND COST OF PRODUCT

Products	Weight Share[a]	Value Share[b]
Asbestos coatings and sealants	10-12	4
Asbestos friction material	40-80	14
Asbestos textiles	75-100	8
Asbestos roofing felt	85-87	30
Asbestos-cement siding and sheets	12-25	45
Asbestos-cement pipes	15-25	32
Asbestos resilient flooring:		
Vinyl-asbestos tile	5-20	4
Asbestos felt	85	4

[a]Asbestos content as percentage of product by weight. Weight shares are from product-specific profiles.
[b]Asbestos cost as percentage of product cost. Value shares are RTI estimates.

SECTION 3
DEMAND FOR ASBESTOS PRODUCTS

This section characterizes the demand side of the market for asbestos products. We describe the asbestos products' characteristics, the uses and consumers of asbestos products, and the substitution possibilities in consumption.

3.1 PRODUCT CHARACTERISTICS

As Lancaster describes, goods are of interest to the consumer because of the properties or characteristics they possess with these characteristics taken to be an objective, universal property of the good.[16] Therefore, the demand for a commodity is not simply for the good itself but instead for a set of characteristics and properties that is satisfied by a particular commodity.

Asbestos has been used in a wide variety of products because of its high tensile strength, chemical and thermal stability, high flexibility, low electrical conductivity, and large surface area.[17] Products made from asbestos were more heat resistant (and often incombustible), more resistant to chemical attack (particularly for alkalis), stronger (asbestos acted as a physical reinforcer), and less conductive (asbestos had a low dielectric constant). In addition, they were more viscose (asbestos stiffened compounds and coatings), faster setting (asbestos hastened water drainage in asbestos-cement pipe production), and more cost efficient than many non-asbestos products.[18]

3.2 USES AND CONSUMERS OF ASBESTOS PRODUCTS

The construction industry is the major consumer of asbestos fiber in the form of asbestos-cement pipe, coatings, compounds, packings, and roofing products. These end uses

accounted for 68 percent of the asbestos consumed in the United States in 1992.[19]

Asbestos is used only after processing to release the fibers from the rock matrix and from each other. The processed chrysotile fibers are grouped by fiber length and their respective end uses are shown in Table 3-1. Asbestos consumption by product in 1988 and 1992 is illustrated in Figure 3-1.

TABLE 3-1. USES OF CHRYSOLITE FIBERS[20]

Group	Use
1,2,3	Fireproof textiles, clothing, theater curtains, different types of packings, woven brake linings, clutch facings, electrical insulation materials, and high-pressure and marine insulation.
4	Asbestos cement pipe, which is used mainly in transporting water, such as municipal waterworks, irrigation, and conservation projects.
5	Asbestos cement sheets, low pressure asbestos cement pipes, and molded products. It is also used in some paper products such as pipe insulation, wrappings, and other products, including brake linings and gaskets.
6	Asbestos cement products, gaskets, brake linings, vinyl sheet backings, and millboard.
7	Molded brake linings and clutch facings, as a filler in vinyl and asphalt floor tile, and in asphalt compounds, joint and insulation cements, roof coatings, plastics, and caulking compounds.

A wide variety of asbestos-containing civilian products also have military applications. Examples include friction materials (brakes and clutches), electrical and thermal insulations, packings and gaskets, asbestos-reinforced plastics, etc., for use on military vehicles, ships, rockets, missiles and in military construction.

Note: 1992 asbestos consumption data available only for selected products.

Figure 3-1. Asbestos consumption by product for selected years.[21]

In 1985, the Bureau of Mines published projections and forecasts for the U.S. asbestos demand by end use. These figures are presented in Table 3-2 along with the actual U.S. consumption in 1992. As the table illustrates, by 1992, the consumption of asbestos products has fallen well below the projected demand for the year 2000. U.S. consumption of

TABLE 3-2. PROJECTIONS AND FORECASTS FOR U.S. ASBESTOS DEMAND BY END USE--2000 (10^3 metric tons)[22,23]

End Use	1983	2000				
			Contingency Forecast for United States			
			Forecast Range			
		Statistical Projections[a]	Low	High	Probable	1992
Asbestos cement pipe	26	0	25	150	100	1.7
Asbestos cement sheet	10	0	0	30	16	*[c]
Coatings and compounds	23	61*	25	70	50	0.9
Flooring products	45	0	25	90	70	0
Friction products	48	2	50	160	120	9.9
Insulation	1	-	0	5	2	0
Packing and gaskets	12	0	0	30	10	3.3
Paper	2	0	0	10	2	*
Plastics	1	0	10	50	25	*
Roofing products	6	0	0	10	5	16.3
Textiles	1	0	0	4	2	0
Other	42	0	0	100	43	0.6
Total[b]	217	-	185	700	450	32.8

aStatistical projections, provided by the Branch of Economic Analysis, are derived from regression analyses based on 9-year or 23-year historical time series data and from forecasts of economic indicators, such as the GNP and FRB index. A statistical projection of zero indicates that demand will vanish at or before the year 2000, based on the historical relationship. Projection equations with a coefficient of determination (r-squared) less than 0.70 are indicated by an asterisk (*).

asbestos decreased 6 percent from 34,765 tons in 1991 to 32,780 tons in 1992. Slight increases in consumption were observed in the production of coatings and compounds, friction products, packing and gaskets, and roofing products. Consumption in asbestos-cement products, paper, plastics, and miscellaneous application declined. Approximately 98.5 percent of the asbestos consumed domestically was chrysotile. The remainder was crocidolite.[24]

The peak year for apparent asbestos fiber consumption was in 1973 when 794,000 Mg were consumed. Domestic consumption of asbestos from 1957 to 1992 is graphed in Figure 3-2.[25,26]

Figure 3-2. U.S. apparent consumption of asbestos, 1957 to 1992.

From 1973 to 1992, a study deadline in consumption occurred. Consumption rose slightly in 1984, probably due to increased demand in the construction market resulting from a strong national economy. Consumption began to decline again in 1985, and has fallen steadily through 1992. This can be attributed to several factors, one of the most important of which is the growing public awareness of the health hazard posed by airborne asbestos fibers. Increased public concern coupled with increased costs of manufacture due to safety and health regulations will likely cause domestic consumption of asbestos to continue to decline, although data on the trend do not provide enough information to warrant any strong conclusion.

3.3 SUBSTITUTION POSSIBILITIES IN CONSUMPTION

The environmental problems with asbestos make markets vulnerable to substitutes. Manufacturers gradually have been replacing asbestos with substitute materials, redesigning old products to eliminate the need for asbestos, or designing new products that require neither asbestos nor asbestos substitutes. However, economic, manufacturing, performance and/or technical difficulties must be considered before asbestos is replaced by a substitute material or product. A suitable substitute must approach the strength, chemical inertness, durability, and cost of asbestos.

Examples of materials substituted for asbestos include aramis fiber, carbon fiber, cellulose fiber, ceramic fiber, fibrous glass, several varieties of organic fiber, steel fibers, and wollastonite.[27] Examples of alternative products include aluminum, vinyl, and wood siding; aluminum and fiberglass sheet; asphalt coatings; ductile iron pipe; polyvinylchloride pipe; prestressed and reinforced concrete pipe, and semimetallic pipe.[28]

Although it is certainly true that many asbestos-containing products have few or poor substitutes, it is also true that the products that account for the bulk of fiber use in the United States face competitive markets. Of total U.S. estimated asbestos consumption in 1992, approximately 55 percent was used in the manufacture of asbestos-cement pipe, asbestos-cement sheet, and roofing felt.[29] Both asbestos-cement pipe and asbestos-cement sheet have many close substitutes as basic building materials.[30] Asbestos roofing felt competes with organic felt, fiberglass felt, and roofing systems other than the built-up variety. Consequently, it is likely that overall demand for asbestos will be fairly price responsive.

For some asbestos products however, the demand will be more inelastic, particularly in the area of gasketing materials, where few substitutes are available. Friction materials often have been cited as products with very poor asbestos-substitution possibilities, but this may no longer be the case for all friction materials. Clearly, continuing research and development in the industry is aimed at replacing asbestos containing products with substitutes that function in a suitable fashion. As progress is made in these efforts, further downward pressure on overall asbestos consumption might be expected in the United States.

SECTION 4
ORGANIZATION OF THE ASBESTOS PRODUCTS INDUSTRY

In this section, we describe the structure of the asbestos products industry, the manufacturing plants' characteristics, and firm characteristics.

4.1 MARKET STRUCTURE

The market structure of an industry pertains to the number of firms in the industry, the market shares of those firms, and the extent to which those firms perceive a threat of potential competition from new entrants. Market structure is of interest because of the effect it has on the behavior of producers and consumers. A market is generally considered to be the locus where producers and consumers interact to trade goods and services.

The shares of shipments accounted for by the 4, 8, 20, and 50 largest companies for SIC code 3292 are reported in

TABLE 4-1. SHARE OF VALUE OF SHIPMENTS BY NUMBER OF COMPANIES: SIC CODE 3292[31]

			Percent accounted for by				
	Companies (number)	Total ($10^6$$)	4 Largest Companies	8 Largest Companies	20 Largest Companies	50 Largest Companies	Herfindahl Index for 50 Largest Companies
1987	50	386.5	72	85	94	100	1750
1982	77	842.8	51	70	92	99	914
1977	86	882.1	42	64	90	98	NA
1972	88	763.4	50	71	91	99	NA
1970	NA	587.0	54	75	NA	NA	NA
1967	81	575.0	55	75	94	99	NA

Table 4-1. These concentration ratios are often used as a

measure of the competitive structure of an industry. When a few firms produce a large portion of industry output, this is often interpreted as an indication that the industry is oligopolistic, rather than purely competitive. The interpretation should be modified to consider the concentration of producers in the individual product markets, rather than in the aggregated multi-product industries. For example, one company may produce a small portion of industry output, but a large portion of the output in one product market. It would be a mistake to conclude a perfectly competitive market structure based on industry-level concentration measures, which are usually reported at the multi-product industry level (e.g., 4-digit SIC), rather than the individual product level. However, the existence of high concentration measures at the industry level may be a good indication of some oligopolistic market power. The 1987 Census of Manufactures reports that in 1987, the four largest firms collectively held 72 percent of the market. Walter Adams suggests that an industry might be considered highly concentrated when the four-firm concentration ratio exceeds 50 percent.[32]

The Herfindahl Index has the merit of combining information about the market shares of all firms in the market, not just the largest four or the largest eight firms. The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry group or industry is at the top. Census of Manufactures data report that the Herfindahl Index for the asbestos products industry increased from 914 in 1982 to 1,750 in 1987 suggesting that the market has become more concentrated at the top by a few suppliers.[33]

4.2 ASBESTOS PRODUCERS

Asbestos is produced in the United States by two companies, KCAC, Inc., San Benito County, California, and Vermont Asbestos Group Inc. (VAG), Orleans County, Vermont (see Table 4-2).[34] Domestic production is limited to chrysotile, one of six commercial varieties of asbestos. KCAC operates a mine in a highly sheared serpentinite composed of matted, short fiber chrysotile and unfractured serpentinite (also referred to as a mass fiber deposit). The ore is stripped, and wet processing is used to beneficiate the fiber. VAG operates an open pit mine in a serpentinite-containing cross-fiber veins of chrysotile. Dry milling is used to process the fiber. While the California company produces only short fiber chrysotile, the Vermont company produces a wide range of chrysotile grades.

TABLE 4-2. U.S. ASBESTOS MINES AND MILLS IN OPERATION IN 1993

Mining Company	Type of Mining	Mine Location	Mill Location	Fiber Type
California		Calaveras[a]		
Union Carbide Corp.	Open Pit	Eastern San Benito County	King City	Grade 7
Vermont Asbestos Groups	Open Pit	Morrisville	Same	Grades 4-7

[a]The Calaveras mine closed down in 1987.

California is the leading asbestos-producing State, accounting for about 70 percent of domestic fiber production. The Calaveras mine in Calaveras, California, was the largest domestic producer prior to its closure in 1987. The chrysotile asbestos content of ore varies across deposit locations. The lowest concentration is found in the Vermont ore, which is less than 4 percent asbestos by weight.

The Coaling area mines of California have been estimated to have a 100-year supply of short chrysotile fibers. However, no current technology exists to render the short fibers as industrially useful as the longer fibers. Some asbestos ore in Vermont is not currently profitable to mine because it is covered by overburden. Additional production might take place if the price of raw asbestos fibers increased.

4.3 MANUFACTURING PLANTS

Asbestos products manufacturing plants tend to be highly specialized. Nearly all the large plants--those with more

than 100 employees--belong to the major firms within the industry. These facilities also produce minor amounts of nonasbestos products. In particular, paper plants incorporate both asbestos and non-asbestos production. The small manufacturer's typical plant tends to be a single-product operation serving a specific industry within a restricted geographical region.

The manufacture of asbestos-cement pipe and asbestos-cement sheet required large, capital-intensive plants. Paper products and friction materials plants are often much smaller. Friction materials plants may employ fewer than a dozen workers. Paper plants operating with only one machine employ as few as 50 workers.

The most recent aggregate data available for the asbestos industry indicate that capital expenditures increased 35 percent from 1989 to 1991 but decreased 39 percent between 1990 and 1991. Capital expenditures of all industries followed a similar pattern (see Table 4-3).

TABLE 4-3. EXPENDITURES ON NEW PLANTS AND EQUIPMENT FOR ASBESTOS INDUSTRY (SIC 3292) AND ALL MANUFACTURING INDUSTRIES[35]
(million dollars)

Industry/Purpose	1989	1990	1991
Asbestos industry (SIC 3292)			
Total new expenditures	14.0	18.9	11.6
New structures and additions	0.6	1.4	0.6
New machinery and equipment	13.5	17.5	10.6
All manufacturing industries	97,186	101,953	98,916

Over 100 patents currently control the manufacture of asbestos products. Most recently, patents have been issued for control technologies to reduce worker exposure to asbestos dust. According to executives of asbestos manufacturing firms, little research and development within the industry currently is directed toward new manufacturing processes or new applications of asbestos products. This, to some extent, is in response to asbestos litigation that effectively discourages further involvement with asbestos and, therefore, any further asbestos product innovation or development. Hence, the potential for technical innovation in the production processes or for the use of asbestos manufactures in new applications is minimal. Consequently, research and development efforts by asbestos manufacturers are directed instead toward developing substitute materials and products comparable in cost-effectiveness to asbestos manufacturers. The Asbestos Institute does, however, sponsor research in new uses of asbestos.

Asbestos manufacturers experience seasonal variations of demand roughly paralleling the seasonal variations of construction work. However, asbestos manufacturers operate on consistent production schedules that do not reflect demand fluctuations. Inventories are built up during periods of low demand and are drawn down during times of heavy construction industry demand. This sort of inventory control enables manufacturers to avoid erratic construction schedules and, therefore, to utilize capacity more efficiently. Hence, nearly all asbestos products are delivered from inventory rather than produced to order. However, certain specialty products such as asbestos papers and gasketing are often cut

to the purchaser's size specifications.*** Asbestos-cement pipe is offered in a variety of diameters, and asbestos millboard and commercial papers are offered in several combinations of weight and thickness. Asbestos textiles are sold as yarns in a variety of sizes. Asbestos-cement sheet, vinyl asbestos floor tile, and asbestos roofing felts are cut to desired sizes during installation.

4.3.1 Employment

Employment data for the asbestos products industry (SIC 3292) during the 10-year period 1982-1992 are presented in Table 4-4. The data indicate that employment in the industry has been declining relatively steadily. In 1992, employment in SIC 3292 was 76 percent lower than in 1982. This fact, when compared to the employment change over the same period for all manufacturing, indicates a marked decline in asbestos products industry employment relative to employment in the overall economy.

Employment in SIC 3292 accounts for only a very small share of total U.S. employment. In 1987, less than 0.01 percent of all U.S. jobs were in SIC 3292. The industry's share of all manufacturing jobs was also small--0.02 percent.

Within the asbestos product manufacturing sectors, workers in the asbestos-cement and asbestos papers industries

***Most asbestos gasketing paper is sold to fabricators who subsequently produce a final product. Several asbestos products, such as asbestos-cement pipe and sheet, asbestos roofing felts, and asbestos flooring felts, are highly durable products due to the tensile strength of the asbestos fibers used to make them. Asbestos-cement pipe and sheet are strong, resilient, flexible, inert, and fire and corrosion resistant. Asbestos roofing felts and flooring felts, due to their dimensional stability and rot resistance, will last the lifetime of the roofing or flooring products for which they are underlayerments. The majority of the other asbestos products may be considered durable goods.

TABLE 4-4. EMPLOYMENT IN ASBESTOS PRODUCTS (SIC 3292), 1982 TO 1992[36]

Year	Employment	Average earnings ($)
1982	12,900	$8.78
1983	11,900	9.18
1984	12,000	9.70
1985	10,500	9.94
1986	8,900	10.22
1987	8,700	10.35
1988	8,300	10.67
1989	6,900	11.10
1990	6,200	11.04
1991	4,100	11.49
1992	3,100	12.62

are primarily semiskilled, and workers in the friction materials sector are less skilled. Manufacturers hire unskilled workers and train them to handle the asbestos manufacturing machines. Most workers in the asbestos industry are union members, primarily represented by the United Auto Workers, the AFL-CIO, and the Papermakers' Union.[37]

4.3.2 Current Trends

The overall historical trend in the use of asbestos products is clear. Because of an apparent rapid substitution away from asbestos products, output has declined at an annual rate of more than 10 percent since 1972, despite the fact that real GNP has increased at an average annual rate of 2.56 percent. Although forecasting is speculative, data indicate that most asbestos products will continue to experience declining outputs in the next few years. More specifically, the Bureau of Mines reports that in 1993, domestic consumption will continue to decrease, although at a much slower rate than in previous years.[38] Foreign markets should remain strong in the near future.[39]

4.4 FIRM CHARACTERISTICS

4.4.1 Product Diversification

Diversification arises for two reasons. First, diversification constitutes a response behavior to risk aversion because it provides a base of revenue less vulnerable to a downturn in any particular market. Diversification also may occur as the result of firm's desire to apply its existing capabilities to the manufacture of a new product line. In the asbestos industry, most of the prominent firms may be described as diversified.

Currently, many asbestos firms are attempting to become more diversified. They are focusing research and development efforts toward producing viable cost-effective substitutes for asbestos and asbestos products, with some measure of success. At present, substitutes are available for nearly every asbestos product.

Although it seems clear that the effects of product controls will be less severe on a diversified firm, the overall impact of controls will depend on the particular financial organization of the diversified firms as well as the number and degree of nondiversified firms.

4.4.2 Ownership

The legal form of ownership affects the cost of capital, availability of capital, and effective tax rate faced by the firm. Business entities that own asbestos manufacturing facilities will generally be one of three types of entities:

- sole proprietorships,
- partnerships, and
- corporations.

Each type has its own legal and financial characteristics that may influence how firms are affected by the regulatory alternatives. Table 4-5 provides information about the legal form of ownership of firms for the relevant SIC codes 3292. Figure 4-1 compares the legal form of ownership of all firms in the U.S. and the asbestos products industry.

TABLE 4-5. LEGAL FORM OF FIRM ORGANIZATION IN THE ASBESTOS PRODUCTS INDUSTRY: 1987[40]

	Legal Form of Organization				
Item	Corporation	Sole Proprietorship	Partnerships	Other	Total
Single facility firms	32	2	0	0	34
Multifacility firms	16	0	0	0	16
All firms	48	2	0	0	50

4.4.2.1 Sole Proprietorship. A sole proprietorship consists of one individual in business for him/herself who contributes all of the equity capital, takes all of the risks, makes the decisions, takes the profits, or absorbs the losses. Behrens reports that sole proprietorships are the most common form of business.[41] The popularity of the sole proprietorship is in large part due to the simplicity of establishing this legal form of organization. For 1987, Internal Revenue Service (IRS) data indicate that nonfarm sole proprietorships represented almost 72 percent of U.S. businesses but accounted for only 6 percent of business receipts. The 1987 Census of Manufactures reports, however, that very few firms in the U.S. asbestos products industry are sole proprietorships—only 2 of the 50 firms under SIC 3292. This type of business organization accounts for a minimal proportion of the industry

Figure 4-1. Comparison of the legal form of organization for firms in the U.S. and asbestos products industry: 1987.[42, 43]

at 4 percent.

Legally, the individual and the proprietorship are the same entity. From a legal standpoint, personal and business debt are not distinguishable. From an accounting standpoint, however, the firm may have its own financial statements that reflect only the assets, liabilities, revenues, costs, and taxes of the firm, aside from those of the individual.

When a lender lends money to a proprietorship, the proprietor's signature obligates him or her personally of all of his/her assets. A lender's assessment of the likelihood of repayment based on the firm and the personal financial status of the borrower is considered legal and sound lending practice because they are legally one-and-the-same. Table 4-6 highlights the advantages and disadvantages of this ownership type.[44]

TABLE 4-6. ADVANTAGES AND DISADVANTAGES OF THE SOLE PROPRIETORSHIP[45]

Advantages	Disadvantages
Simplicity of organization	Owner's possible lack of ability and experience
Owner's freedom to make all decisions	Limited opportunity for employees
Owner's enjoyment of all profits	Difficulty in raising capital
Minimum legal restrictions	Limited life of the firm
Ease of discontinuance	Unlimited liability of proprietor
Tax advantages	

Note: A brief evaluation of these advantages and disadvantages is available in Steinhoff and Burgess (1989).

4.4.2.2 Partnerships. For 1987, IRS data on business tax returns indicate that partnerships represented only 9 percent of U.S. businesses and accounted for an even smaller percentage

of business receipts--4 percent. For 1987, the Census of Manufactures reports no partnerships for SIC code 3293.

A partnership is an association of two or more persons to operate a business. In the absence of a specific agreement, partnerships mean that each partner has an equal voice in management and an equal right to profits, regardless of the amount of capital each contributes. A partnership pays no federal income tax; all tax liabilities are passed through to the individuals and are reflected on individual tax returns. Each partner is fully liable for all debts and obligations of the partnership. Thus, many of the qualifications and complications present in analyses of proprietorships (e.g., capital availability) are present--in some sense magnified--in analyses of partnerships. Table 4-7 lists the advantages and disadvantages of this ownership type.

TABLE 4-7. ADVANTAGES AND DISADVANTAGES OF THE PARTNERSHIP[46]

Advantages	Disadvantages
Ease of organization	Unlimited liability
Combined talents, judgement, and skills	Limited life
Larger capital available to the firm	Divided authority
Definite legal status of the firm	Danger of disagreement
Tax advantages	

Note: A brief evaluation of these advantages and disadvantages is available in Steinhoff and Burgess (1989).

4.4.2.3 Corporations. According to IRS business tax returns for 1987, corporations represented only 19.7 percent of U.S. businesses but accounted for 90 percent of all business receipts. For 1987, the Census of Manufactures reports that 48 of 50 firms listed under SIC code 3292 for asbestos products are corporations.[47] Therefore, corporations represent the vast majority of the business entities involved in manufacturing asbestos.

Unlike proprietorships and partnerships, a corporation is a legal entity separate and apart from its owners or founders. Financial gains from profits and financial losses are borne by owners in proportion to their investment in the corporation. Analysis of credit availability to a corporation must recognize at least two features of corporations. First, they have the legal ability to raise needed funds by issuing new stock. Second, institutional lenders (banks) to corporations assess credit worthiness solely on the basis of the financial health of the corporation--not the financial health of its owners. A qualification of note is that lenders can require (as a loan condition) owners to agree to separate contracts obligating them personally to repay loans. Table 4-8 highlights the advantages and disadvantages of this ownership type.

TABLE 4-8. ADVANTAGES AND DISADVANTAGES OF THE CORPORATION[48]

Advantages	Disadvantages
Limited liability to stockholders	Government regulation
Perpetual life of the firm	Expense of organization
Ease of transferring ownership	Capital stock tax
Ease of expansion	
Applicability for both large and small firms	

Note: A brief evaluation of these advantages and disadvantages is available in Steinhoff and Burgess (1989).

4.4.3 Size Distribution

Table 4-9 presents the size distribution of the 54 facilities in SIC code 3292 as reported by number of employees.

More recent data can be expected in January as the results of the ICR sent out to firms in the industry are compiled. The survey asks the firms to report the total number of employees employed at the facility as well as the number of employees

involved in the asbestos-containing production activities at the facility. The ICR is due back on January 15, 1994.

4.4.4 Vertical and Horizontal Integration

The extent to which firms in an industry are vertically integrated influences both the difficulty of new entry and their competitive position vis-a-vis one another. In general, vertical integration increases the difficulty of new entry and bestows some comparative advantage on the integrated firms. Vertical integration is a potentially important dimension in firm-level impacts analysis because the regulation could affect a vertically integrated firm on several levels. For example, a regulation may affect companies for whom asbestos products production is only one of several processes in which the firm is involved. A regulation that increases the cost of producing the asbestos fiber will also affect the cost of manufacturing the primary products and in turn, fabricating the secondary products.

Relative to the total number of primary asbestos product manufacturing firms, few are fully integrated from mining to product distribution.

Only the largest companies in the industry are vertically integrated from mining/milling to product manufacturing while the smaller companies purchase the milled asbestos and use it to manufacture asbestos-containing products. More specific data on the extent of vertical integration within the industry will be available in January 1994 as the results from the ICR sent to firms in this industry are compiled.

TABLE 4-9. ASBESTOS PRODUCTS INDUSTRY GENERAL STATISTICS BY EMPLOYMENT SIZE OF ESTABLISHMENT (1987)[49]

Average no. of Employees	Establishments		Employees		Payroll		Value added		Value shipments		Capital expenditures	
	Number	Cum.%	Number (10^3)	Cum.%	$10^6	Cum.%	$10^6	Cum.%	$10^6	Cum.%	$10^6	Cum.%
1-4	7	13.0	N/A	N/A	.2	.2	.5	0.2	1.3	0.3	N/A	
5-9	12	35.2	0.1	2.5	1.7	1.9	4.3	2.4	8.5	2.5	0.3	2.0
10-19	13	59.3	0.2	7.5	3.9	5.9	9.6	7.1	16.8	6.9	0.7	6.7
20-49	9	75.9	0.3	15.0	6.3	12.3	13.2	13.6	25.3	13.4	0.6	10.7
50-99	5	85.2	0.3	22.5	6.4	18.7	18.4	22.7	32.3	21.8	0.9	16.8
100-499	4	92.6	0.6	37.5	11.7	30.6	42.1	43.4	75.0	41.2	1.3	26.2
500-999	4	100.0	2.5	100.0	68.4	100.0	114.6	100.0	227.3	100.0	11.0	100.0
Total	54		4.0		98.7		202.6		386.5		14.9	

NA = not available

Horizontal integration is also a potentially important

dimension in firm-level impact analysis for either or both of two reasons:

- A diversified firm may own facilities in unaffected industries. This type of diversification would help mitigate the financial impacts of the regulation.
- A diversified firm could be indirectly as well as directly affected by the regulation. For example, if a firm is diversified in manufacturing pollution control equipment (an unlikely scenario), the regulation could indirectly and favorably affect it.

Wherever possible, firms that produce asbestos-containing products are diversifying into nonasbestos-containing products. For example, many firms who manufacture asbestos roofing products are now phasing out that production and replacing it with the manufacture of asphalt-type roofing. Likewise, brake manufacturers are attempting to phase out their asbestos-containing brakes and diversifying into other product lines such as semi-metallic brakes. However, some relatively big money-maker asbestos products are still manufactured; as a result, not all firms are diversifying.

SECTION 5
ASBESTOS PRODUCTS MARKET

Asbestos and asbestos products are produced and consumed domestically as well as traded internationally. Therefore, domestic producers export some asbestos products to other countries, and foreign producers supply their asbestos products to U.S. markets. This section includes data on value, quantity and price trends over the past decade for asbestos, where statistics are available.

5.1 PRODUCTION

Table 5-1 reports asbestos world production by country. World production of asbestos was 3,120,524 tons, down 12 percent from that of 1991. Russia, Canada, and Kazakhastan were the largest producers of asbestos, followed by China, Brazil, Zimbabwe, and the Republic of South Africa. Canada, Kazakhastan, and Russia, accounted for approximately 73 percent of the world production in 1992 while the United States accounted for 0.5 percent of world production of asbestos.

5.1.1 Domestic Production

In 1973, U.S. production of asbestos fiber was at an all time high; however, production had declined by 50 percent by 1983. More recently, domestic production decreased 22 percent

TABLE 5-1. ASBESTOS: WORLD PRODUCTION, BY COUNTRY[a,50] (metric tons)

Country[b]	1988	1989	1990	1991	1992[c]
Argentina	2,328	225	300[e]	250[e]	250
Bosnia and Herzegovina[d]	—	—	—	—	1,000
Brazil	227,653	206,195	232,332[e]	233,100[c]	233,000
Bulgaria	300	300	500[e]	500[c,e]	500
Canada	710,357	701,227	685,627	689,000[e]	585,000
China[c]	150,000[e]	181,000[e]	221,000[e]	230,000[e]	240,000
Colombia[c,f]	7,600	7,900	8,000	8,000	8,000
Cyprus	14,585	—	—	—	—
Egypt	166	312	369	450[e]	450
Greece	71,114	73,300[e]	65,993[e]	5,500[c,e]	—
India	31,123	36,502	26,053[e]	24,094[e]	25,000
Iran[c]	3,410[e,g]	3,300	2,800[e]	3,000[e]	3,000
Italy	94,549	44,348	3,862	3,000[c,e]	1,500
Japan[c]	5,000	5,000	5,000	5,000	5,000
Kazakhastan[b]	—	—	—	—	300,000
Korea, Republic of	2,428	2,361	1,534	1,500[c]	1,600
Russia[h]	—	—	—	—	1,400,000
Serbia and Montenegra[d]	—	—	—	—	1,700
South Africa, Republic of	145,678	156,594	145,791	148,525[e]	123,951[g]
Swaziland	22,804	27,291	35,938	13,888[e]	35,000
Turkey	50[c]	—	—	—	—
U.S.S.R.[c,i]	2,600,000	2,600,000	2,400,000	2,000,000	—
United States (sold or	18,233	17,427	W	20,061	15,573
Yugoslavia[j]	17,030	9,111	6,578	5,500[c]	—
Zimbabwe	186,581	187,006[e]	160,861[e]	141,697[e]	140,000
Total	4,310,989[e]	4,259,399[e]	4,002,538[e]	3,533,065[e]	3,120,524

See footnotes on following page.

from 20,061 tons in 1991 to 15,573 tons in 1992. Table 5-2

TABLE 5-1. ASBESTOS: WORLD PRODUCTION, BY COUNTRY[a,50] (metric tons) (continued)

W Withheld to avoid disclosing company proprietary data.

[a] Marketable fiber production. Table includes data available through April 19, 1993.

[b] In addition to the countries listed, Afghanistan, Czechoslavakia, North Korea, and Romania also produce asbestos, but output is not officially reported, and available general information is inadequate for the formulation of reliable estimates of output levels.

[c] Estimated.

[d] Formerly part of Yugoslavia; data were not reported separately until 1992.

[e] Revised.

[f] Estimated fiber production, based on reported crude production, was as follows in metric tons: 1988—152,896; 1989—158,149; 1990—159,600; 1991—160,332; and 1992—160,000 (estimated)

[g] Reported figure.

[h] Fomerly part of the U.S.S.R.; data were not reported separately until 1992.

[i] Dissolved in December 1991.

[j] Dissolved in April 1992.

TABLE 5-2. SALIENT ASBESTOS STATISTICS
(Metric tons and 10^3)[51]

	1988	1989	1990	1991	1992
United States					
Production (sales)					
Quantity	18,233	17,427	W	20,061	15,573
Value[a]	W	W	W	$7,691	$6,138
Exports and reexports[b] (unmanufactured)					
Quantity	31,544	27,004	27,965	25,636	24,860
Value	$8,468	$7,690	$7,964	$7,424	$6,724
Exports and reexports of asbestos products[b]					
Value	$194,858	$153,081	$120,328	$116,015	$134,102
Imports for consumption[c] (unmanufactured)					
Quantity	85,326	55,306	41,348	34,765	31,602
Value	$21,528	$14,031	$10,773	$8,900	$7,210
Consumption, apparent[d]	71,354	55,306	41,348	34,765	32,780
World					
Production	4,310,989[d,g]	4,259,399[d,g]	4,002,538[d,e,g]	3,533,065[c,g]	3,120,524[c,f]

W Withheld to avoid disclosing company propritary data.
[a] F.o.b. mine.
[b] F.A.S. value.
[c] U.S. Customs declared value.
[d] Production, plus imports, minus exports, plus adjustments in Government and industry stocks.
[e] Does not include U.S. production.
[f] Estimated.
[g] Revised.

reports U.S. production quantity and value as well as world

production. Producers are granted a depletion allowance[****] of 22 percent on domestic production and 10 percent on foreign production.[52]

5.1.2 Foreign Production (Exports)

The total value of asbestos fibers and asbestos products exported and reexported was $104,826,000, an increase of 14 percent from that of 1991 (see Table 5-2). Table 5-3 reports U.S. exports and reexports of asbestos and asbestos products. The largest increase in export value, almost $19 million or 22 percent, was observed under the brake and clutch lining categories. Brake linings and disk pads accounted for 79 percent of the value of all exported manufactured asbestos products. Table 5-4 lists the countries importing U.S. asbestos fibers and products in 1991 and 1992. Canada was the largest importer of unmanufactured fibers and manufactured products, followed by Japan, Mexico, the United Kingdom, and the Federal Republic of Germany.

[****] A depletion allowance affords a lower Federal corporation tax upon income earned from the sale of exhaustible (depleting) resources. The percentage of depletion permitted, or depletion allowance, is a fixed deduction from annual gross income.

TABLE 5-3. U.S. EXPORTS AND REEXPORTS OF ASBESTOS AND ASBESTOS PRODUCTS[53]

	Quantity (metric tons)	Value (10^3)
1991		
Unmanufactured		
Asbestos[b]	25,636	$7,424
Manufactured		
Asbestos fibers	NA	772
Brake linings and disk brake pads[c]	NA	86,980
Clutch facings and linings[d]	NA	6,637
Clothing, cord, fabric, and yarn	NA	724
Gaskets, packing and seals	NA	6,841
Panel, sheet, title, and tube[e]	NA	4,651
Paper and millboard	NA	1,155
Other articles[f]	NA	8,254
Total[g]	XX	116,015
1992		
Unmanufactured		
Asbestos[b]	24,860	6,724
Manufactured		
Asbestos fibers	NA	512
Brake linings and disk brake pads[c]	NA	105,840
Clutch facings and linings[d]	NA	8,940
Clothing, cord, fabric, and yarn	NA	748
Gaskets, packing and seals	NA	5,567
Panel, sheet, title, and tube[e]	NA	4,560
Paper and millboard	NA	925
Other articles[f]	NA	7,011
Total	XX	134,102

NA Not available. XX Not applicable.

[a] F.A.S. value.
[b] Includes crudes, fibers, stucco, sand, and refuse.
[c] Includes asbestos and cellulose fiber brakes and similar materials.
[d] Includes clutches and other friction materials, excluding brakes and pads.
[e] Includes asbestos-cement and cellulose fiber cement products.
[f] Includes asbestos and cellulose fiber products.
[g] Data may not add to totals shown because of independent rounding.

TABLE 5-4. COUNTRIES IMPORTING U.S. ASBESTOS FIBERS AND PRODUCTS[a,54] (10^3)

Country	1991			1992		
	Unmanufactured fiber	Manufactured products[b]	Total[c]	Unmanufactured fiber	Manufactured products[b]	Total[c]
Australia	10	1,083	1,093	10	1,355	1,365
Brazil	434[d]	2,914	3,348	408	1,345	1,753
Canada	366	50,833	51,199	442	57,655	58,097
Germany	58	3,363	3,421	-	2,949	2,949
Japan	3,758	11,395	15,154	3,047	15,707	18,754
Korea, Republic of	386	2,513	2,899	205	2,121	2,326
Kuwait	—	51	51	-	277	277
Mexico	1,259	7,652	8,910	1,065	9,630	10,695
Saudi Arabia	10	3,278	3,289	251	2,202	2,453
Thailand	59[d]	261	320	81	356	437
Turkey	—	64	64	-	151	151
United Kingdom	21	4,829	4,850	42	4,168	4,209
Venezuela	—	259	259	13	662	675
Other	1,064	27,520	28,584[d]	1,161	35,524	36,685
Total[c]	7,424	116,015	123,439	6,724	134,102	140,826

[a] F.A.S. value.
[b] Also includes products manufactured using asbestos substitutes.
[c] Data may not add to totals shown because of independent rounding.
[d] Revised.

TABLE 5-5. UNITED STATES ASBESTOS PRODUCTION AND DEMAND 1954-1992 (10^3 Mg)[55, 56]

Year	Apparent consumption	Domestic production
1954	657	42
1955	709	41
1956	660	38
1957	657	39
1958	621	40
1959	684	42
1960	643	41
1961	604	48
1962	659	48
1963	657	60
1964	738	92
1965	721	107
1966	730	114
1967	654	112
1968	741	110
1969	711	114
1970	666	113
1971	688	118
1972	734	120
1973	794	136
1974	767	103
1975	552	90
1976	658	104
1977	610	92
1978	583	91
1979	561	93
1980	369	80
1981	349	76
1982	243	64
1983	217	70
1984	226	57
1985	162	57
1986	120	51
1987	84	50
1988	71	18
1989	48	17
1990	41	NA
1991	35	20
1992	33	16

5.2 CONSUMPTION

5.2.1 Domestic Consumption

The apparent, or domestic consumption, for 1954 through 1992 is compared to U.S. production in Table 5-5. U.S. consumption of asbestos decreased 6 percent from 34,765 tons in 1991 to 32,780 tons in 1992. Slight increases in consumption were observed in the production of coatings and compounds, friction products, packing and gaskets, and roofing products. Consumption in asbestos-cement products, paper, plastics, and miscellaneous applications declined.

The construction industry is the major consumer of asbestos fiber in the form of asbestos cement pipe, coatings, compounds, packings, and roofing products. These end uses accounted for 68 percent of the asbestos consumed in the United States.

The average unit value of domestically produced asbestos increased 3 percent from $383 per ton in 1991 to $394 per ton in 1992.[57] Table 5-6 summarizes historical as well as current asbestos fiber prices. Changes in fiber prices have remained by and large consistent with other construction materials.

TABLE 5-6. ASBESTOS PRICES[58, 59]

	June 1983	June 1984	June 1985	June 1986	June 1987	June 1988	June 1989	Dec. 1992
No. 3	1215	1258	1135	1115	1169	1259	1200	1138
Spinning fiber	1985	2028	1830	1799	1886	2032	2096	1374
No. 4	875	876	791	777	815	878	905	848
Asbestos cement fiber	1215	1217	1098	1131	1219	1258	1297	1099
No. 5	575	576	520	511	535	577	595	506
Paper fiber	680	682	615	604	634	683	704	667
No. 6	421	422	381	374	392	423	436	412
Paper and shingle								
No. 7	130	130	117	115	121	130	134	141
Short	251	252	227	223	234	252	260	274

Note: Prices as expressed in Canadian dollars have not changed. Only fluctuating exchange rates make them appear to change.

5.2.2 Foreign Consumption (Imports)

The United States has been historically dependent upon foreign sources for about 90 percent of its requirements for all grades and types of asbestos. The only current source of low-iron, spinning-grade chrysolite asbestos is Zimbabwe. The only source of commercial grades and quantities of amosite is limited to an area in the Transvaal, Republic of South America. Although the United States is an asbestos-importing country, there is some export trade, because domestic chrysolite producers have significant markets in Japan and Latin America. There are some reexports of foreign fibers.

TABLE 5-7. U.S. IMPORTS FOR CONSUMPTION OF ASBESTOS FIBERS, BY TYPE, ORIGIN, AND VALUE[a,61]

Type	Canada		South Africa, Republic of		Other		Total	
	Quantity (metric tons)	Value (10^3)	Quantity (metric tons)	Value (10^3)	Quantity (metric tons)	Value (10^3)	Quantity (metric tons)	Value (10^3)
1990	40,380	$10,052	835	$544	133	$177	41,348	$10,773
1991								
Chrysotile								
Crude	176	137	—	—	—	—	176	137
Spinning fibers	683	193	—	—	53	81	736	274
All other	27,872	7,356	—	—	23	37	27,895	7,393
Crocidolite (blue)	73	12	209	152	—	—	282	164
Other (unspecified asbestos type)	5,676	932	—	—	—	—	5,676	932
Total	34,480	8,630	209	152	76	118	34,765	8,900
1992								
Chrysotile								
Crude	41	19	—	—	—	—	41	19
Spinning fibers	507	172	—	—	207	271	714	443
All other	26,036	5,618	—	—	53	68	26,089	5,686
Crocidolite (blue)	—	—	104	83	368	255	472	338
Other (unspecified asbestos type)	4,286	724	—	—	—	—	4,286	724
Total	30,870	6,533	104	83	628	594	31,602	7,210

Table 5-7 reports the U.S. imports of asbestos fibers by type, origin and value. Canada provided 98 percent of the asbestos imported into the United States. The Republic of South Africa and Zimbabwe supplied the remaining amount. The customs unit value for imported chrysolite ranged from $209 per ton to $468 per ton and the customs unit value for imported crocidolite was $800 per ton (see Table 5-8). No tariffs are levied on imported asbestos, and no special taxes are levied on the asbestos industry.[60]

TABLE 5-8. CUSTOMS UNIT VALUES OF IMPORTED ASBESTOS[62]
($/metric ton)

	1988	1989	1990	1991	1992
Canada					
Chrysotile					
Crude	635	167	782	776	468
Spinning	756	387	291	372	339
Other	227	227	259	265	209
South Africa, Republic of					
Amosite	—	3,728	—	—	—
Crocidolite	609	631	651	582	800

SECTION 6

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