Asphalt Roofing and Processing Revised Industry Profile

Draft Report

Prepared for

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SECTION 1

INTRODUCTION

This industry profile provides information to support the economic impact analysis (EIA) of a proposed National Emission Standard for Hazardous Air Pollutants (NESHAP) regarding asphalt roofing and processes. Asphalt roofing products fall under the North American Industry Classification System (NAICS) 324122 Asphalt Shingle and Coating Materials Manufacturing. According to the 1997 Economic Census of Manufacturing, in 1997, 248 establishments owned by 149 companies produced products that are categorized in NAICS 324122 (U.S. Department of Commerce, Bureau of the Census, 1999). In 1997, these firms employed 13,316 workers and shipped products valued at $4.9 billion (U.S. Department of Commerce, Bureau of the Census, 1997).

Asphalts are desired in roofing products primarily for their waterproofing properties. They are used as saturants and coatings for shingle and roll goods, as mopping asphalts in membrane roofing, and as roof coatings. The various products classified under the Asphalt Shingle and Coating Materials Manufacturing Industry (NAICS 324122) are listed in Table 1-1. Asphalt roof coatings and mopping asphalts, which are melted and used in applying built-up roofing, will not be covered by this NESHAP rule; therefore, they are not included in this report except where economic data include these products and more disaggregated data are unavailable. The rule primarily affects the production of asphalt-saturated felt, roll roofing, shingles, and modified bitumen membranes.

Asphalt shingles are widely used because they are one of the least expensive roofing options (Kroschwitz and Howe-Grant, 1991). Asphalt shingles represent approximately 52 percent of the value of shipments of the entire asphalt shingle and coating materials manufacturing industry (NAICS 324122). Other significant findings of this report are that the asphalt shingle and coating materials manufacturing industry is unconcentrated, and that foreign trade represents an insignificant fraction of the activity in the U.S. asphalt roofing product market.

Table 1-1. Types of Products in Asphalt Shingle and Coating Materials Manufacturing Industry (NAICS 324122)

Product	8-Digit NAICS Code
Roofing asphalts and pitches, coatings, and cements (NAICS 3241221)	
Roofing asphalt	324122 1 1
Fibrated and nonfibrated asphaltic roofing coatings	324122 1 2
Other roofing asphalts and pitches, coatings, and cements	324122 1 3
Prepared asphalt and tar roofing and siding products, including saturated felts and boards for nonbuilding use (NAICS 3241222)	
Asphalt smooth-surfaced roll roofing and cap sheets, organic and fiberglass base	324122 2 1
Asphalt mineral-surfaced roll roofing and cap sheets, organic and fiberglass base	324122 2 2
Asphalt strip shingles, organic base (excluding laminated), all weights	324122 2 3
Asphalt strip shingles, inorganic base (excluding laminated), 215 to 235 lb-sales square	324122 2 4
Asphalt strip shingles, inorganic base (excluding laminated), all other weights	324122 2 5
Laminated or multilayered asphalt strip shingles and individual shingles	324122 2 6
Other prepared asphalt and tar products for roofing and siding	324122 2 7

Source: U.S. Department of Commerce, Bureau of the Census. 1999. *1997 Economic Census: Manufacturing Industry Series—Asphalt Shingle and Coating Materials Manufacturing.* EC97M-3241C. Washington, DC: Government Printing Office. <http://www.census.gov/prod/ec97/97m3241c.pdf>.

This industry profile report is organized as follows. Section 2 includes a detailed description of the production process for the individual asphalt roofing products, with a brief discussion of the inputs to the production process and costs of production. Section 3 describes the characteristics, uses, and consumers of asphalt roofing products as well as substitution possibilities. Section 4 discusses the organization of the industry and provides facility- and company-level data. In addition, small businesses are reported separately for use in evaluating the impact on small businesses to meet the requirements of the Regulatory Flexibility Act (RFA) as amended in 1996 by the Small Business Regulatory Enforcement and Fairness Act (SBREFA). Section 5 contains market-level data on prices and quantities and discusses trends and projections for the industry.

SECTION 2

THE SUPPLY SIDE

The asphalt roofing products affected by the proposed NESHAP rule include asphalt-saturated felt, surfaced and smooth roll roofing, fiberglass and organic (felt-based) shingles, and modified bitumen membranes. With the exception of modified bitumen membranes, most asphalt roofing products are produced in a similar manner. The production process typically involves six stages, and asphalt is the primary input. The production process and the associated costs of production are the focus of this section.

2.1 Types of Products and Services

This section provides the characteristics of each output from the production processes. The four affected asphalt roofing products are discussed in greater detail below.

2.1.1 Asphalt Felt Characteristics

Asphalt felts are used as inner roof coverings and serve as protectants and sealants. They are suited for this use because they are water repellent, able to tolerate temperature fluctuations, and resistant to breakdown and decay caused by exposure to the elements (Hillstrom and Ruby, 1994).

2.1.2 Roll Roofing Characteristics

Both surfaced and smooth roll roofing are outer roof coverings commonly used for low-cost housing and utility buildings in place of asphalt shingles. They are purchased in rolls that are 36 to 38 feet long and approximately 36 inches wide, thereby simplifying the roof application process (Scharff, 1996).

2.1.3 Asphalt Shingle Characteristics

Asphalt shingles have different characteristics depending on their base, such as organic felts and glass-fiber base mats. Organic felts are produced from paper fibers, rags, wood, or a combination of the three, while glass-fiber base mats are manufactured from inorganic, thin glass fibers. If the base is organic, the shingle has the lowest possible

American Society Testing and Materials (ASTM) fire-resistant rating, referred to as a Class C rating. The organic-based shingle is also considered to be flexible, even in cold weather. The fiberglass shingle has the highest fire-resistance rating (Class A), which means roofing is able to tolerate severe exposure to fire originated from sources outside the building (Scharff, 1996). Unlike the organic-base shingles, it is quite inflexible in cold weather.

Whether organic or fiberglass, asphalt shingles are commonly manufactured as strip shingles, interlocking shingles, and large individual shingles. Strip shingles are rectangular, measuring about 12 inches in width and 36 inches in length. The three-tab shingle is the most common strip shingle. The three-tab shingle gives the appearance of three separate shingles and is stronger and easier to apply. Interlocking shingles come in various shapes and with different locking devices, which provide not only a mechanic interlock but also resistance to strong winds (Scharff, 1996). As for large individual shingles, they are generally rectangular or hexagonal in shape (Kroschwitz and Howe-Grant, 1991).

2.1.4 Modified Bitumen Membrane Characteristics

Modified bitumen membranes have a number of uses. They can be applied as the primary material for new roofs, as a cover for existing roofs, and as cap sheets in built-up roofing (BUR) applications (Scharff, 1996). For each of these applications, styrene-butadiene-styrene (SBS)-based membranes are installed using hot asphalt, a torch, cold process adhesives, or self-adhesives. Atactic polypropylene (APP)-based membranes are usually installed with a torch or cold process adhesives. Both SBS- and APP-based membranes are purchased in rolls and are usually applied in multiple layers (Kroschwitz and Howe-Grant, 1991). Advantages of modified bitumen membranes over other roofing materials are their versatility in both steep and low-slope roofing applications and their puncture resistance, durability, and weatherability.

2.2 Asphalt as a Primary Input

Asphalt is the primary material input to the production of asphalt roofing products. It is made of saturants, asphaltenes, and resins. The properties that make asphalt suitable for roofing are its softness, flexibility, and strength. Asphalt has the ability to expand and contract with the application surface. This is because asphalt contains saturants, which are light oils that make it soft and flexible. On the other hand, asphaltenes (high molecular weight cyclic aromatic compounds containing nitrogen, oxygen and/or sulfur in their molecular structure [Phoenix Chemical Corporation, 2001]) provide asphalt body, rigidity,

and strength while resins bond the saturants and asphaltenes and give asphalt its resilience (Scharff, 1996).

The quality of the asphalt depends on the source of the crude oil used in its production. A crude oil with a high flash point is desired, because combustion and vaporization of such light oils are most probable at higher flash points. Lower flash points result in a harder asphalt flux that is better suited for paving applications than for roofing (Hillstrom and Ruby, 1994).

2.3 Asphalt Blowing

Prior to initiating the operations necessary for producing asphalt roofing products, the asphalt is prepared through a process called "blowing." Asphalt is blown or oxidized to increase its softening temperature and its consistency, or penetration value, so that it will not flow off the roof in hot weather (Kroschwitz and Howe-Grant, 1991). The blowing process, which involves the oxidation of asphalt flux by bubbling air through it when it is in liquid form, results in an exothermic reaction that requires cooling. Oxidation may take place over a time period spanning from 1 to 10 hours, depending on the desired characteristics of the roofing asphalt. The softening point and penetration rate of asphalt depend on how long it is allowed to oxidize (MRI, 1995). In addition, the presence of catalysts affects the rate of oxidation because catalysts speed up this process. After oxidation occurs, the asphalt is ready to enter into the asphalt roofing production process.

Figure 2-1 illustrates the emissions sources of the blowing process, which are the asphalt flux storage tanks and the blowing stills (Kroschwitz and Howe-Grant, 1991). Both particulate matter (PM) and volatile organic compounds (VOCs) are emitted from these sources. The oxidation of asphalt may also contribute to the emission of hazardous air pollutants (HAPs) if catalysts are present during oxidation.

2.4 Production Processes for Asphalt Roofing Products

After asphalt is prepared through the blowing process, it is used in the production of asphalt-saturated felt, surfaced and smooth roll roofing, fiberglass and organic (felt-based)

EMISSION SOURCE	SCC
ASPHALT BLOWING: SATURANT	3-05-001-01
ASPHALT BLOWING: COATING	3-05-001-02
ASPHALT BLOWING: (GENERAL)	3-05-001-10
FIXED ROOF ASPHALT STORAGE TANKS	3-05-001-30, -31
FLOATING ROOF ASPHALT STORAGE TANKS	3-05-001-32, -33

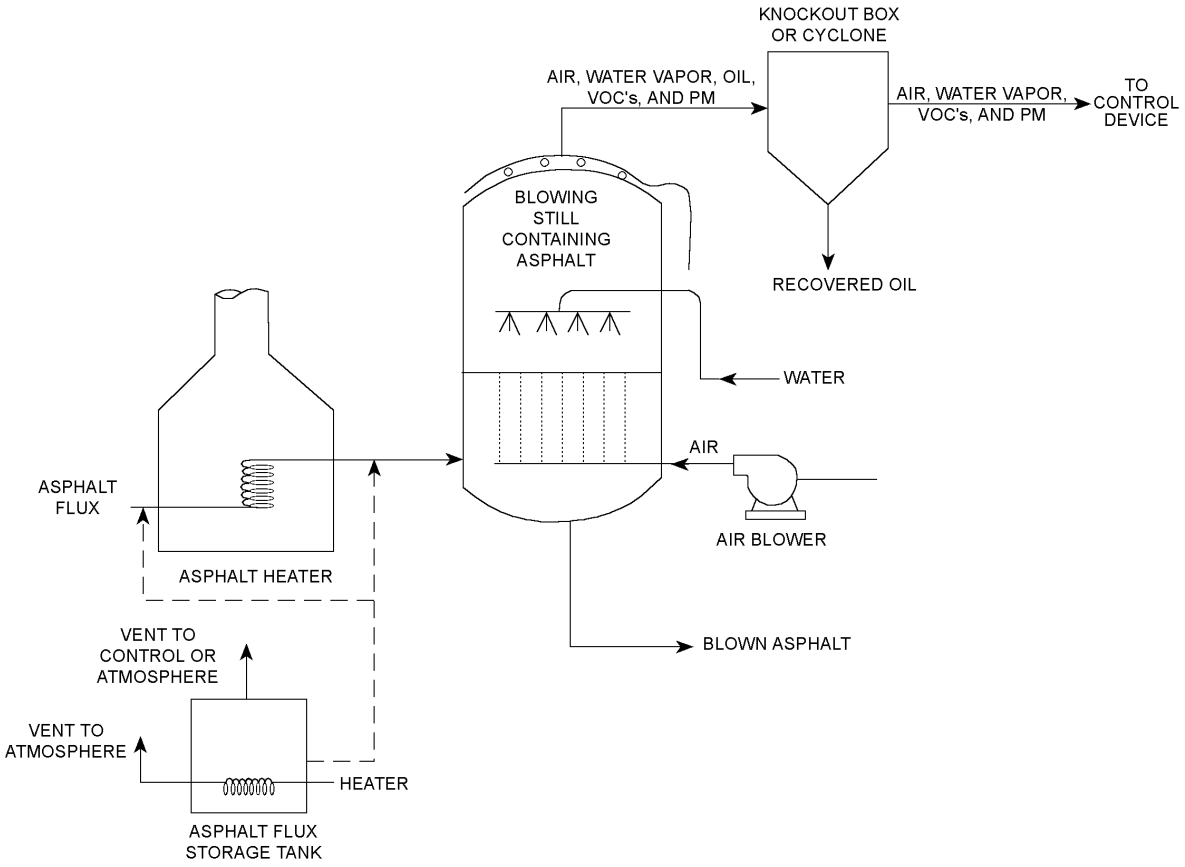


Figure 2-1. Flow Diagram of the Asphalt Blowing Process

Source: Midwest Research Institute (MRI). 1995. AP-42, 5th Edition, Volume 1, Chapter 11 Mineral Products Industry. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Cary, NC: Midwest Research Institute.

shingles, and modified bitumen membranes. For each of these products, with the exception

of modified bitumen membranes, production typically consists of the following six primary operations:

- **felt saturation**: using low softening point asphalt to saturate either organic or fiberglass felts/mats;
- **coating**: applying coating/modified asphalt and a mineral stabilizer on the felts/mats;
- **mineral surfacing**: applying mineral surfacings to the bottom of the felts/mats;
- **cooling and drying**: using water-cooling and air-drying procedures to bring the product to ambient temperatures;
- **product finishing**: formatting the designated asphalt roofing products; and
- **packaging**.

The specific production process for each of the asphalt roofing products is the focus of the remainder of this section.

2.4.1 Asphalt-Saturated Felt

One of the most basic asphalt roofing products is asphalt-saturated felt. It is produced using a blotter-like paper, called felt, that is made of cellulosic materials. The production process, as shown in Figure 2-2, begins with the unwind stand, where the felt is unrolled onto the dry looper (Kroschwitz and Howe-Grant, 1991). From the dry looper, the felt passes through the saturator, which is a tank filled with a very soft or low softening point asphalt called saturant (Kroschwitz and Howe-Grant, 1991). The felt then moves over a series of rollers, where the bottom rollers are submerged into hot asphalt at a temperature of 205 to 250°C (400 to 480°F). The next step in the production process involves heating the asphalt to ensure that it has penetrated the felt. Finally, the saturated felt passes through water-cooled rolls onto the finish floating looper and then is rolled and cut on the roll winder (Kroschwitz and Howe-Grant, 1991). As Figure 2-2 shows, PM and VOC emissions from this process are primarily generated by the saturator and the heaters.

2.4.2 Surfaced and Smooth Rolls

Surfaced and smooth rolls can be produced using either organic felt or a fiberglass mat as the base or substrate. Figure 2-3 illustrates the typical production process for surfaced

EMISSION SOURCE	SCC
DIPPING ONLY	3-05-001-11
SPRAYING ONLY	3-05-001-12
DIPPING/SPRAYING	3-05-001-13
DIP SATURATOR, DRYING-IN DRUM, WET LOOPER, AND COATER	3-05-001-16
DIP SATURATOR, DRYING-IN DRUM, AND COATER	3-05-001-17
DIP SATURATOR, DRYING-IN DRUM, AND WET LOOPER	3-05-001-18
SPRAY/DIP SATURATOR, DRYING-IN DRUM, WET LOOPER, COATER, AND STORAGE TANKS	3-05-001-19
FIXED ROOF ASPHALT STORAGE TANKS	3-05-001-30, -31
FLOATING ROOF ASPHALT STORAGE TANKS	3-05-001-32, -33

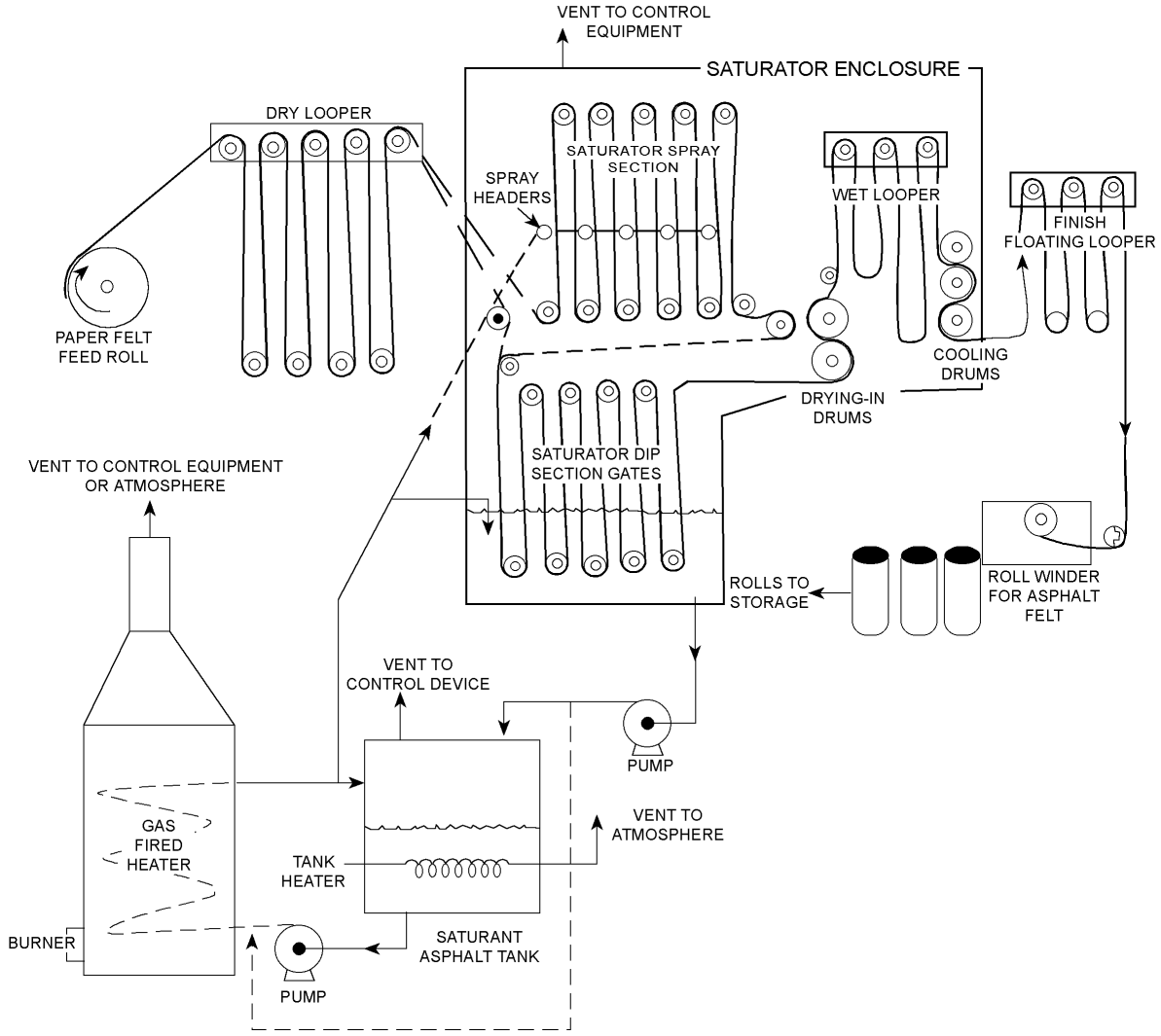
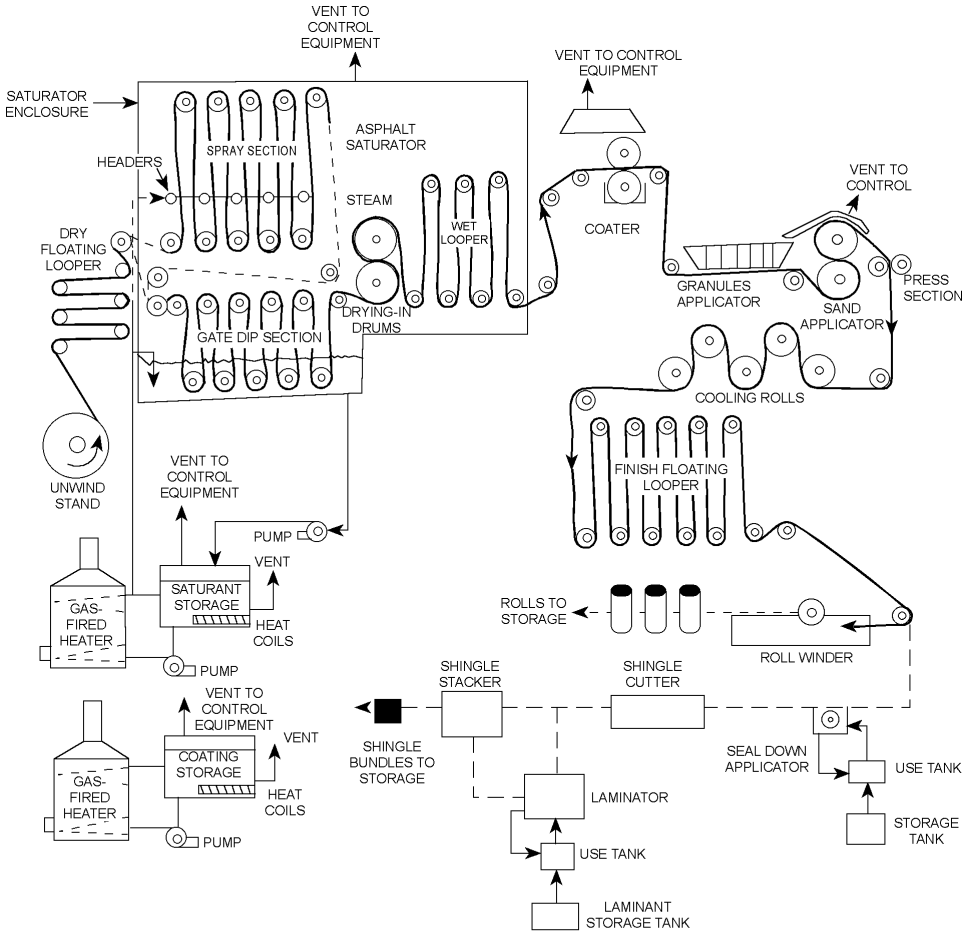


Figure 2-2. Flow Diagram of the Asphalt-Saturated Felt Production Process

Source: Midwest Research Institute (MRI). 1995. AP-42, 5th Edition, Volume 1, Chapter 11 Mineral Products Industry. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Cary, NC: Midwest Research Institute.



EMISSION SOURCE	SCC
FELT SATURATION: DIPPING ONLY	3-05-001-03
FELT SATURATION: DIPPING/SPRAYING	3-05-001-04
DIPPING ONLY	3-05-001-11
SPRAYING ONLY	3-05-001-12
DIPPING/SPRAYING	3-05-001-13
DIP SATURATOR, DRYING-IN DRUM, WET LOOPER, AND COATER	3-05-001-16
DIP SATURATOR, DRYING-IN DRUM, AND COATER	3-05-001-17
DIP SATURATOR, DRYING-IN DRUM, AND WET LOOPER	3-05-001-18
SPRAY/DIP SATURATOR, DRYING-IN DRUM, WET LOOPER, COATER, AND STORAGE TANKS	3-05-001-19
FIXED ROOF ASPHALT STORAGE TANKS	3-05-001-30, 31
FLOATING ROOF ASPHALT STORAGE TANKS	3-05-001-32, -33

Figure 2-3. Flow Diagram of the Organic Shingle and Roll Manufacturing Production Process

Source: Midwest Research Institute (MRI). 1995. AP-42, 5th Edition, Volume 1, Chapter 11 Mineral Products Industry. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Cary, NC: Midwest Research Institute.

or smooth rolls that use organic felt as the substrate (Kroschwitz and Howe-Grant, 1991). The first stage in the production process is asphalt saturation of felt. If a fiberglass mat is the substrate however, then the felt saturation step is excluded. After this step is completed, either the saturated felt or fiberglass mat passes into the coater. The coater applies a filled asphalt coating, which is prepared by mixing coating asphalt or modified asphalt and a mineral stabilizer in approximately equal proportions. The coater releases the filled coating onto the top of the felt or mat. Squeeze rollers then apply filled coating to the bottom of the felt or mat and distribute it evenly to form a thick base coating onto which surfacing materials will adhere.

If surfaced rolls are being manufactured, the asphalt sheet produced by the coater passes through the granule applicator next. Smooth roll production excludes this step. During the granule application stage, surfacing material is applied by dispensing granules onto the hot, coated surface of the asphalt sheet. Sand, talc, or mica is also applied to the sheet as it passes through the press roll, which forces the granules into the coating (Kroschwitz and Howe-Grant, 1991).

Following the application of surfacing material for surfaced roll production, or the coating stage for smooth roll production, the asphalt sheet passes through the final production stages. The sheet is first cooled rapidly on water-cooled rolls and/or by using water sprays. Then, if surfaced rolls are being produced, the sheet passes through air pressure-operated press rolls used to embed the granules firmly into the coating. Asphalt sheets for both surfaced and smooth roll production are then air dried. A strip of asphalt adhesive is applied next, the purpose of which is to seal the loose edge of the roofing after it is installed. These processes are facilitated by a finish looper, which allows continuous movement of the sheet as it passes through each of these final production stages. It also serves to further cool and dry the sheet. The final stage of roll roofing production is the formation of the rolls. This takes place by passing the roofing sheet through a winder, where rolls are formed.

Figure 2-3 illustrates the emission points of this production process. The asphalt storage tanks, blowing stills, saturators, coater-mixer tanks, and coaters emit both PM and VOCs. Adhesive applicators are also sources of trace quantities of PM and VOCs. PM is emitted by surfacing operations and materials handling as well (Kroschwitz and Howe-Grant, 1991).

2.4.3 Shingles

Organic felt and fiberglass mat-based shingle manufacturing involves the same production processes as surfaced and smooth roll roofing, with the exception of the final roll formation step. Instead of forming rolls with the roofing sheets, the sheets are passed through a cutter, which cuts the sheet into individual shingles. If the shingles are going to be made into laminated products, they must also pass through a lamination stage where laminant is applied in narrow strips to the bottom of the sheet (Kroschwitz and Howe-Grant, 1991).

Each of the emissions sources from the manufacture of surfaced and smooth roll roofing is applicable to shingle production as well. These sources are indicated in Figure 2-3. In addition to these sources, emissions are produced by the laminant applicators used in shingle production. These applicators are sources of trace quantities of PM and VOCs.

2.4.4 Modified Bitumen Membranes

The production of modified bitumen membranes consists of modifying the asphalt (also known as bitumen); combining the modified asphalt with a reinforcement; and then applying fillers, fire retardant additives, and/or surfacing. Asphalt is generally modified by either thermoplastic or elastomeric polymer, such as atactic polypropylene (APP), styrene block copolymer (SBC), styrene-butadiene-styrene (SBS), or styrene-butadiene-styrene (SBS) (Scharff, 1996). The most commonly used polymers are APP and SBS. SBS is an elastomer that has better cold-weather flexibility and melts at a low temperature. It also has higher tensile strength but poorer elongation than the APP modifier. APP is a thermoplastic polymer that softens when heated and melts at a very high temperature (FacilitiesNet, 2000b). APP modifiers can be exposed to the weather, whereas SBS modifiers must have surface protection against ultraviolet radiation. Both of these modifiers raise the softening point of asphalt without reducing its flexibility or weatherability (FacilitiesNet, 2000a).

After the asphalt has been modified, a reinforcement is added. The reinforcements most commonly used in modified bitumen production are polyester and fiberglass mats. Both polyester and fiberglass mats are used with SBS-modified bitumen, while polyester mats are most commonly used with APP-modified bitumen (Kroschwitz and Howe-Grant, 1991). Polyester mats are superior to fiberglass mats as reinforcements in modified bitumen

membranes because polyester has higher elongation and higher puncture resistance than fiberglass. However, fiberglass has higher tensile strength than polyester.

Following the addition of reinforcement to the modified asphalt, fillers, fire-retardant additives, and/or surfacing may be applied. Surfacing is an important component of the membrane because it protects the membrane from external elements. Surfacing may either be applied during production of the membrane or during installation of the product. If it is applied during production, possible surfacing materials include granules that are pressed onto the top surface of the membrane; a thin layer of fiberglass; or sheets of copper, aluminum, or stainless steel. Surfacing applied during application of the membrane may consist of a coat of asphalt, loose aggregate, or a liquid aluminum roof coating (Kroschwitz and Howe-Grant, 1991).

2.5 Major By-Products, Co-Products, and Input Substitution Possibilities

The asphalt roofing production process produces no significant by-products or co-products, and there are very few input substitution possibilities. One type of input that does allow for substitution opportunities is the type of mat used in manufacturing asphalt shingles, roll roofing, and modified bitumen membranes. This mat may have either an organic or a fiberglass base. As described above, organic felts are less fire-resistant and more flexible than fiberglass felts. The mineral surfacing found on asphalt products can also vary. Talc and mica are the most frequently used mineral surfacings, but coarse mineral granules, such as slate and rock granules, can be used as well (Hillstrom and Ruby, 1994). Alternative surfacing granules mainly affect the appearance of the roof. The polymer used in modifying asphalt for modified bitumen production also has input substitution possibilities because APP, SBC, SBS, or SBR can be used as the modifier (Scharff, 1996). However, APP and SBS are the most popular modifiers and offer different flexibility and strength characteristics (FacilitiesNet, 2000b).

2.6 Costs of Production and Plant Size Efficiency

In this section, the costs of production as reported in the 1997 Economic Census of Manufacturing for the asphalt roofing industry, historical costs for the industry, and plant size efficiency are examined. These figures are reported for NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing, which includes asphalt coatings and mopping asphalts. These two products are included in this section because more disaggregated data are not available.

2.6.1 Costs of Production

The three primary costs of production for the asphalt roofing industry are the following: capital expenditures; labor expenses; and cost of materials, including the cost of the input asphalt. Each of these cost categories is discussed below for the asphalt roofing industry.

- As shown in Table 2-1, capital costs in 1997 for the asphalt roofing industry totaled approximately $150 million, or about 4 percent of total cost expenditures (U.S. Department of Commerce, Bureau of the Census, 1995b). Buildings and other structures accounted for 24 percent of capital costs, while 76 percent of these costs can be attributed to machinery and equipment expenditures.

- The asphalt roofing industry spent approximately $623 million in 1997 on labor for a total of 16 percent of total expenditures on costs of production. About 20 percent of labor costs was spent on fringe benefits, and the remaining expenditures went toward the annual payroll.

- Cost of materials for the asphalt roofing industry totaled $3 billion in 1997 for a total of nearly 80 percent of total costs of production. Materials, parts, containers, etc. accounted for the most significant portion of this cost (32 percent). Expenditures on resales accounted for 5 percent of total costs, while fuel expenditures accounted for 1 percent. Other material costs included $44 million (1 percent) for purchased electricity and $8 million (0.2 percent) for contract work.

2.6.2 Historical Statistics for Costs of Production

Table 2-2 provides the primary costs of production for the asphalt roofing industry for the years 1990 through 1998 in both current and constant 1999 dollars. In general, costs of production in real terms have increased over the past 9 years. Table 2-2 also shows the production costs for each year as a percentage of value of shipments. These percentages have been relatively flat, fluctuating between 73 percent and 79 percent. In 1998, costs of production accounted for 73 percent of the value of shipments.

2.6.3 Economies of Size

Table 2-3 provides information on the efficiency of plant size for those facilities in NAICS 324122. Using the value added per production worker as a measure of efficiency,

Table 2-1. 1997 Production Costs for NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing

	1997 (in 10^6)	Percentage of Total Cost of Production
Total cost of production	$3,835	100.0%
Total capital expenditures	$150	3.9%
Buildings and other structures	$36	0.9%
Machinery and equipment	$114	3.0%
Total labor expenditures	$623	16.2%
Annual payroll	$498	13.0%
Fringe benefits	$125	3.3%
Total cost of materials	$3,063	79.9%
Materials, parts, containers, etc.	$2,771	72.3%
Resales	$187	4.9%
Fuels	$53	1.4%
Purchased electricity	$44	1.1%
Contract work	$8	0.2%

Source: U.S. Department of Commerce, Bureau of the Census. 1999. *1997 Economic Census: Manufacturing Industry Series—Asphalt Shingle and Coating Materials Manufacturing*. EC97M-3241C. Washington, DC: Government Printing Office. <http://www.census.gov/prod/ec97/97m3241c.pdf>.

there are no apparent economies of size for this industry. As Table 2-3 shows, the value added per production worker hour peaks at $97.50 for those facilities with 5 to 9 employees, and it generally drops for the following categories. The 1 to 4 employees category has the lowest value added, which is $55 per production worker hour. For the 250 to 499 employees and 500 to 999 employees categories, the information is withheld to avoid disclosing data on individual companies.

Table 2-2. Historical Costs of Production for NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing: 1990-1998

	Total Cost of Production (10^6)		Payroll Expenses (10^6)		Capital Expenditures (10^6)		Cost of Materials (10^6)		Value of Shipments (10^6)		Cost of Production as a Percentage of Value of Shipments
Year	Current $	1999 $	Current $	1999 $	Current $	1999 $	Current $	1999 $	Current $	1999 $	
1990	$2,759	$3,078	$381	$425	$66	$74	$2,312	$2,579	$3,585	$4,000	77%
1991	$2,642	$2,887	$382	$417	$63	$69	$2,197	$2,401	$3,438	$3,757	77%
1992	$2,840	$3,066	$413	$445	$69	$75	$2,359	$2,546	$3,913	$4,224	73%
1993	$3,054	$3,257	$441	$470	$74	$78	$2,539	$2,708	$4,173	$4,451	73%
1994	$3,095	$3,280	$434	$460	$97	$103	$2,564	$2,717	$4,043	$4,285	77%
1995	$3,274	$3,404	$446	$463	$102	$106	$2,726	$2,835	$4,272	$4,443	77%
1996	$3,533	$3,579	$471	$477	$128	$130	$2,934	$2,971	$4,488	$4,546	79%
1997	$3,722	$3,755	$499	$504	$150	$151	$3,072	$3,100	$5,095	$5,141	73%
1998	$3,887	$3,956	$523	$532	$149	$151	$3,216	$3,272	$5,350	$5,444	73%

Sources: U.S. Department of Commerce, Bureau of the Census. 1995b. *1992 Census of Manufactures, Industry Series—Petroleum and Coal Products*. MC92-I-29A. Washington, DC: Government Printing Office.
U.S. Department of Commerce, Bureau of the Census. 2000. *1998 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*. M98(AS)-1. Washington, DC: Government Printing Office.
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U.S. Department of Commerce, Bureau of the Census. 1996. *1994 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*. M94(AS)-1. Washington, DC: Government Printing Office.
U.S. Department of Commerce, Bureau of the Census. 1995c. *1993 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*. M93(AS)-1. Washington, DC: Government Printing Office.
U.S. Bureau of Labor Statistics. 2000a. "Producer Price Index Revision—Commodities: WPUSOP3000, Finished Goods: 1990-1999." <http://146.142.4.24/cgi-bin/surveymost>.

Table 2-3. Efficiency of Plant Size for Facilities in NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing

Employees	Value Added by Manufacturer (10^6)	Number of Production Worker Hours (10^6)	Value Added/Production Worker Hour
1 to 4 employees	$11	$0.2	$55.00
5 to 9 employees	$19.5	$0.2	$97.50
10 to 19 employees	$71.3	$0.8	$89.13
20 to 49 employees	$225.8	$2.4	$94.08
50 to 99 employees	$477.9	$5.7	$83.84
100 to 249 employees	$869.3	$10.2	$85.23
250 to 499 employees	NA	NA	NA
500 to 999 employees	NA	NA	NA

NA = Not available.

Source: U.S. Department of Commerce, Bureau of the Census. 1999. *1997 Economic Census: Manufacturing Industry Series—Asphalt Shingle and Coating Materials Manufacturing*. EC97M-3241C. Washington, DC: Government Printing Office. <http://www.census.gov/prod/ec97/97m3241c.pdf>.

SECTION 3

THE DEMAND SIDE

The primary consumers of asphalt roofing products are those in the construction industry. This industry selects asphalt-based products for roofing applications for a number of reasons, especially due to their excellent waterproofing capabilities. Despite the fact that asphalt roofing products are popular, the construction industry also relies on a number of substitute roofing products. The characteristics, uses, and consumers of asphalt roofing products, as well as the substitutes for these products, are the focus of this section.

3.1 Product Characteristics

Asphalt roofing products are popular among consumers because of their excellent waterproofing capabilities, and the specific type of asphalt product desired by an end user varies depending on a number of factors. These factors include the end-user's budget, the ease of installation, the type of surface area to which the product is being applied, and the climate and weather patterns of the location where the roofing products are installed.

Consumers desiring an inexpensive substitute that is simpler to install than asphalt shingles may use roll roofing as the product of choice. This product comes in rolls instead of cutouts, but it is surfaced similar to shingles.

If climate or weather patterns are of concern to the end user, the type of asphalt shingle desired depends on the climatic conditions. Compared to organic-based asphalt shingles, fiberglass-based shingles are generally better suited for warmer climates because they can stiffen in cold climates. In warmer climates fiberglass-based shingles are preferred because they are more weather resistant and have the highest ASTM fire-resistance rating. This is because fiberglass-based shingles contain more coating asphalt, which provides greater resistence to warping, rotting, blistering, and curling (Hillstrom and Ruby, 1994).

The desired shape of asphalt shingles also varies depending on the geographic area of application. The most common shape is the three-tab shingle, which has two slots cut in its front edge. These slots serve to provide stress relief as the shingle expands and contracts with the weather. In areas often characterized by strong winds, the T-lock shingle may be

the shingle of choice. This is a highly wind-resistant slotted T-shape shingle that locks to the shingle both above and below it (Kroschwitz and Howe-Grant, 1991).

Consumers may select modified bitumen membranes if they desire a product that is versatile and able to suit a wide variety of project needs. These membranes are suitable for both steep and low-slope applications and have the durability and flexibility necessary for free span buildings, such as aircraft hangars and warehouses. In addition, modified bitumen membranes are effective in both cold and warm weather climates (Kroschwitz and Howe-Grant, 1991).

3.2 Uses and Consumers

Asphalt roofing products are initially consumed by the construction industry, with only a small percentage going to nonbuilding use. It is worth noting that asphalt products are also intermediate goods that are inputs into final products, such as housing and other buildings, produced by the construction industry. In addition, asphalt roofing products may be sold to consumers for home improvement. The uses of these products and the demand for asphalt roofing products by the construction industry sector are discussed below.

3.2.1 Uses of Asphalt Roofing Products

Table 3-1 provides a list of the primary types of asphalt roofing products. As a percentage of value of shipments, asphalt strip shingles make up the majority of products in this industry (52.1 percent). Roll roofing and cap sheets account for 9.7 percent of the total, while roofing asphalt accounts for 6.4 percent. The "other" asphalt roofing products category includes asphalt roofing cements and pitches, modified bitumen membranes, and asphalt- and tar-saturated felts for nonbuilding uses.

3.2.2 Primary Consumers of Asphalt Roofing Products

About 81 percent of all asphalt roofing products are used in residential construction, while the remaining 19 percent are used in the commercial construction market (Kroschwitz and Howe-Grant, 1991). For the residential market, reroofing jobs consume 79 percent of all asphalt roofing products and the remaining 21 percent are used in new construction applications (Burns and Paulson, 1997).

Table 3-1. Major Uses of Products in NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing

Product	Value of Product Shipments (10^6)	Percentage of Total
Total	$4,576.8	100.0%
Roofing asphalt	$292.1	6.4%
Asphaltic roofing coatings	$170.7	3.7%
Asphalt roll roofing and cap sheets	$442.8	9.7%
Asphalt strip shingles	$2,382.6	52.1%
Other	$1,288.6	28.2%

Source: U.S. Department of Commerce, Bureau of the Census. 1999. *1997 Economic Census: Manufacturing Industry Series—Asphalt Shingle and Coating Materials Manufacturing.* EC97M-3241C. Washington, DC: Government Printing Office. <http://www.census.gov/prod/ec97/97m3241c.pdf>.

Table 3-2 provides a breakdown of the specific industries purchasing asphalt roofing products. The majority of these products are used in nonfarm residential structure maintenance (24.4 percent). Two sectors—maintenance of nonfarm buildings not elsewhere classified (n.e.c.) and nonfarm residential one-unit structures—also consume a large portion of asphalt roofing products (22 percent and 13.4 percent, respectively). Other sectors that rely on asphalt roofing products are office buildings (7.1 percent), nonfarm residential additions/alterations (4.7 percent), construction of educational buildings (3.1 percent), and industrial buildings (3.1 percent).

3.3 Substitution Possibilities in Consumption

Several substitution possibilities exist for asphalt roofing products. Some of the more common substitutes for the products discussed below are listed in Table 3-3. A number of roofing materials can be used in place of asphalt shingles and roll roofing. Popular substitutes for these products include elastomeric roofing (used in single-ply roofing) and metal roofing. Wood shingles, tile, clay, metal, and plastic are other materials that can be used in place of asphalt shingles and roll roofing.

Table 3-2. Consumers of Products in NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing

Industry or Sector Purchasing Outputs	Percentage of Total Asphalt Roofing Products
Nonfarm residential structure maintenance	24.4%
Maintenance of nonfarm buildings n.e.c.	22.0%
Residential 1-unit structures, nonfarm	13.4%
Office buildings	7.1%
Residential additions/alterations, nonfarm	4.7%
Construction of educational buildings	3.1%
Industrial buildings	3.1%
Residential garden apartments	2.9%
Construction of hospitals	2.5%
Construction of stores and restaurants	2.1%
Farm service facilities	1.5%
Electric utility facility construction	1.3%
Residential 2-4 unit structures, nonfarm	1.3%
Other	9.9%

Source: Darnay, Arsen J. 1989. *Manufacturing USA: Industry Analyses, Statistics, and Leading Companies.* Fifth Edition, Volume 1. Detroit, MI: Gale Research.

Asphalt-saturated felts and modified bitumen membranes have few substitution possibilities. Coal tar bitumen is the only known suitable replacement for asphalt-saturated felt. Synthetic rubbers can be used in place of modified bitumen membranes in BUR applications. However, synthetic rubbers are less adaptable to repair and maintenance work than synthetic rubbers (Kroschwitz and Howe-Grant, 1991).

Table 3-3. Substitutes for Products in NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing

Asphalt-Base Roofing Product	Substitutes
Asphalt shingles and roll roofing	Wood shingles
	Cementious roofing tile
	Clay roofing tile
	Metal roofing
	Slate roofing
	Elastomeric roofing
	Plastic roofing
Coatings	Alkyd-base colored aluminum coatings
	Refined coal tar coatings
	Flexible ceramic coatings
Mopping asphalt	Torch application
	Cold adhesives
Asphalt-saturated felt	Coal tar bitumen

SECTION 4

INDUSTRY ORGANIZATION

This section identifies the characteristics of the asphalt roofing industry in the United States. The issues affecting the asphalt roofing industry's organization are addressed at both the company and the facility levels.

4.1 Market Structure

Market structure is of interest because it determines the behavior of producers and consumers in the industry. If an industry is perfectly competitive, then individual producers are not able to influence the price of the outputs they sell or the inputs they purchase. This condition is most likely to hold if the industry has a large number of firms, the products sold are undifferentiated, and entry and exit of firms are unrestricted. Product differentiation can occur both from differences in product attributes and quality, and from brand name recognition of products. Entry and exit of firms are unrestricted for most industries except, for example, in cases when government regulates who is able to produce, when one firm holds a patent on a product, when one firm owns the entire stock of a critical input, or when a single firm is able to supply the entire market.

When compared across industries, firms in industries with fewer firms, more product differentiation, and restricted entry are more likely to be able to influence the price they receive for a product by reducing output below perfectly competitive levels. This ability to influence price is referred to as exerting market power. At the extreme, a single monopolistic firm may supply the entire market and hence set the price of the output.

To assess the competitiveness of a market, economists often estimate four-firm concentration ratios (CR4), eight-firm concentration ratios (CR8), and Herfindahl-Hirschman Indexes (HHI) for the subject market or industry. The CR4 and CR8 ratios measure the percentage of sales accounted for by the top four and eight firms in the industry, respectively. The HHI is the sum of the squared market shares of firms in the industry. Unfortunately, there is no objective criterion for determining market structure based on the values of concentration ratios alone. However, there are criteria for determining market structure

based on the HHIs as provided in the 1997 Department of Justice's revised Horizontal Merger Guidelines (U.S. Department of Justice and the Federal Trade Commission, 1997). According to these criteria, industries with HHIs below 1,000 are considered unconcentrated (i.e., more competitive), those with HHIs between 1,000 and 1,800 are considered moderately concentrated (i.e., moderately competitive), and those with HHIs above 1,800 are considered highly concentrated (i.e., less competitive). Firms in less-concentrated industries are more likely to be price takers, while firms in more-concentrated industries are more likely to be able to influence market prices.

Table 4-1 presents the various measures of market concentration for the asphalt felts and coatings industry. The HHI for NAICS 324122 is 778, which is less than the Department of Justice's threshold value of 1,000 for considering market power potential. The unconcentrated nature of the asphalt roofing industry implies that individual producers in this industry are less likely to be able to set the market price of asphalt roofing products.

Table 4-1. Market Concentration Measures for NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing

Category	Value
Herfindahl-Hirschman Index (HHI)	778
Four-firm concentration ratio (CR4)	47
Eight-firm concentration ratio (CR8)	65
Number of companies	149
Number of facilities	248
Value of shipments (10^6)	4,932

Sources: U.S. Department of Justice and the Federal Trade Commission. Horizontal Merger Guidelines. <http://www.usdoj.gov/atr/public/guidelines/horiz_book/hmg1.html> April 8, 1997.
U.S. Department of Commerce, Bureau of the Census. 1992. *Concentration Ratios in Manufacturing.* Washington, DC: Government Printing Office.
U.S. Department of Commerce, Bureau of the Census. 1999. *1997 Economic Census: Manufacturing Industry Series—Asphalt Shingle and Coating Materials Manufacturing.* EC97M-3241C. Washington, DC: Government Printing Office. <http://www.census.gov/prod/ec97/97m3241c.pdf>.

4.2 Manufacturing Plants

Table 4-2 lists all of the asphalt roofing manufacturing facilities in the 50 states and the District of Columbia as of 1999 and provides company name, facility location, product type, and sales and employment ranges. Data on plant locations and product types were obtained from the Asphalt Roofing Manufacturing Association (ARMA) and Dun & Bradstreet and complemented with information from American Business Information.

As reported in Table 4-2, in 1999 34 companies owned and operated 123 facilities that produce asphalt roofing materials. Figure 4-1 presents the distribution of the 76 facilities for which sales data were available by sales ranges. The range with the largest number of facilities (25) is $20 to $50 million, followed by the number of facilities (24) with sales between $50 to 100 million dollars. Four facilities have sales volumes less than $5 million, five between $5 to $10 million, nine between $10 to $20 million, and nine with more than $100 million. Sales data were not available for 47 facilities.

Employment information was not available for 45 of the 123 facilities. Figure 4-2 illustrates the distribution of facility employment for 78 facilities for which employment information is available. Although facilities with between 100 and 249 employees are the most numerous (38 establishments), those employing fewer than 100 employees (36 establishments) make up the second largest segment. Only four facilities employ more than 249 workers.

Besides asphalt roofing manufacturing facilities, Table 4-2 also reports the refineries that process asphalt. In 1999, five companies owned and operated eight refineries that produce blown asphalt as their only asphalt product. Likewise Figures 4-1 and 4-2 incorporate sales and employment data for the identified refineries that have larger sales volumes and employ more workers when compared to asphalt roofing manufacturing facilities. However, sales information was lacking for three refineries, and employment information was lacking for two refineries. Two refineries have sales volumes less than $100 million while the other three have sales volumes of more than $100 million. Four out of six refineries employ more than 249 workers and the rest employ fewer than 249.

Table 4-2. Facility-Level Product, Sales, and Employment for Asphalt Roofing Manufacturers

Facility Location	Products						Sales Range)	Employment Range
	Blown Asphalt	Fiberglass Shingle	Organic Shingle	Built-up Roofing	Modified Bitumen	Saturated Felt		
								100
								138
								170
								160
								207
								90
								45
								750
								NA
								NA
								120
								NA
								NA
								NA
								NA
								NA
								NA
								164
								250
								NA
								NA
								NA
								113
								NA
								NA
								NA
								NA

Table 4-2. Facility-Level Product, Sales, and Employment for Asphalt Roofing Manufacturers (continued)

Facility Location	Products						Sales Range)	Employment Range
	Blown Asphalt	Fiberglass Shingle	Organic Shingle	Built-up Roofing	Modified Bitumen	Saturated Felt		
								250
								NA
								100
								158
								NA
								NA
								NA
								165
								NA
								100–249
								140
								NA
								NA
								NA
								NA
								NA
				125				101
								160
								NA
								NA
								NA
								NA
								200
								NA
								100–249
								79

Table 4-2. Facility-Level Product, Sales, and Employment for Asphalt Roofing Manufacturers (continued)

Facility Location	Products						Sales Range)	Employment Range
	Blown Asphalt	Fiberglass Shingle	Organic Shingle	Built-up Roofing	Modified Bitumen	Saturated Felt		
							50–100, 100–500	120 120, 30
								100
								NA
	Products							NA
								90
								100
								50
								5
								70
								30
								50
								120
							20–50, 50–100	NA 90, 85
								28
								NA
Mineral Fiber Manufacturing Corp.								NA
								NA 100–249
								75
								110
								100
								110

Table 4-2. Facility-Level Product, Sales, and Employment for Asphalt Roofing Manufacturers (continued)

Facility Location	Products						Sales Range)	Employment Range
	Blown Asphalt	Fiberglass Shingle	Organic Shingle	Built-up Roofing	Modified Bitumen	Saturated Felt		
								80
								NA
								NA
								5
								115
								90
								98
								100
								160
								105
								NA
								77
								18
								NA
								92
								NA
								NA
								150
								125
								60
								40
								5
								150
								140
								45
								150

Table 4-2. Facility-Level Product, Sales, and Employment for Asphalt Roofing Manufacturers (continued)

Facility Location	Products						Sales Range)	Employment Range
	Blown Asphalt	Fiberglass Shingle	Organic Shingle	Built-up Roofing	Modified Bitumen	Saturated Felt		
Green Cove Springs, FL								150 200 NA
								300 81 NA 271 100–249
								50 5 30 100 200, 120
								15 7 65 6,300
Refineries								
								43 NA 250-499 20-49

Table 4-2. Facility-Level Product, Sales, and Employment for Asphalt Roofing Manufacturers (continued)

Facility Location	Blown Asphalt	Fiberglass Shingle	Organic Shingle	Built-up Roofing	Modified Bitumen	Saturated Felt	Sales Range	Employment Range
Refineries (continued)								
Marathon Ashland Petroleum LLC								85
Marathon Ashland Petroleum LLC								250-499
Marathon Ashland Petroleum LLC								NA
	Products						over 1 billion	250-499
								413

NA = Not available.

September 24.

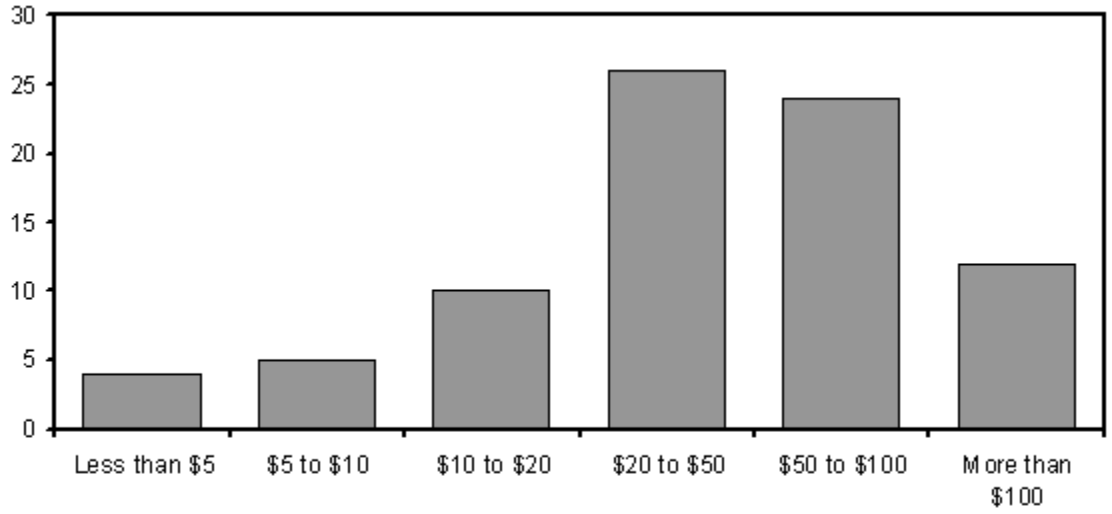

Figure 4-1. Distribution of Facilities by Sales

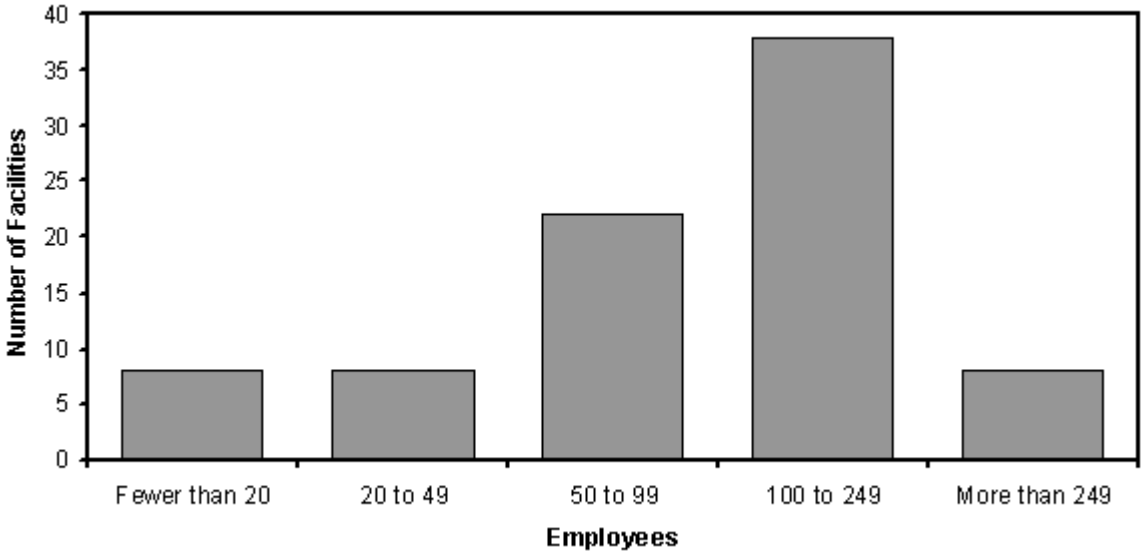

Figure 4-2. Distribution of Facilities by Employment

4.2.1 Geographic Distribution

Table 4-3 is based on data presented in Table 4-2 and lists the number of asphalt roofing manufacturing facilities and refineries by state. Overall, California is the state with the largest number of facilities (18), followed by Texas (13), Ohio (11), Alabama (8), and Georgia (7). These five states are home to approximately 44 percent of the total number of asphalt roofing facilities in the country.

Product information is available for the 123 facilities and eight refineries identified in Table 4-2. In 25 states, 66 asphalt roofing factories produce fiberglass shingles as one of their outputs. California and Texas have the most factories (by state) producing fiberglass shingles (seven and eight respectively). Other states with a large number of fiberglass shingle facilities are Georgia and Ohio (five each).

Thirty-seven of the 123 facilities for which product information is available (30.1 percent) produce modified bitumen roofing (MBR) as one of their outputs. Twenty states have factories producing MBR. With five facilities, California has the most factories producing MBR, followed by Ohio, which has four. Arkansas and Texas each have three facilities producing MBR.

Of the 123 facilities for which product data are available, 34 produce built-up roofing. Of the 20 states with facilities producing built-up roofing, California has the most factories (five), followed by Alabama (four) and Texas (three). (Built up roofing is manufactured at the building site with alternating layers of mopping asphalt and roofing felt.)

Twenty-five facilities in the group produce saturated felt. Of the 19 states with saturated felt factories, California (five), Alabama (two), and Arkansas (two) are the only states that have more than one facility.

Seven facilities produce organic shingles. Minnesota (two) is the only state that has more than one asphalt roofing facility with organic shingles as a product. Six states have organic shingles factories.

Besides eight refineries, blown asphalt is also produced in six facilities, representing nearly 5 percent of the 123 asphalt roofing manufacturing facilities for which data are available. The 14 factories are located in Alabama, California (two refineries), Colorado,

Table 4-3. Location of Asphalt Roofing Manufacturing Facilities and Refineries by State

State	Number
Alabama	8
Arizona	1
Arkansas	4
California	18
Colorado	2
Connecticut	1
Delaware	1
Florida	3
Georgia	7
Illinois	4
Indiana	5
Kansas	2
Kentucky	1
Louisiana	1
Maryland	3
Massachusetts	2
Michigan	2
Minnesota	5
Mississippi	2
Missouri	2
Nevada	1
New Hampshire	1
New Jersey	2
New Mexico	1
New York	1
North Carolina	3
Ohio	11
Oklahoma	6
Oregon	5
Pennsylvania	6
South Carolina	1
Tennessee	3
Texas	14
Utah	1
Washington	2

Source: Asphalt Roofing Manufacturing Association. 1997. "Manufacturing Plants." Facsimile on member company plant listing. Calverton, MD. September 24.

Kentucky, Michigan, Minnesota, North Carolina, Ohio, Oklahoma (one refinery and one asphalt roofing manufacturing facility), Oregon, Tennessee, and Utah.

4.2.2 Current Trends

The U.S. asphalt roofing products industry expanded in the mid-1990s because of new purchases, additions, and plants. Both GAF Corp. and Firestone Building Products increased capacity at their plants in Tampa, FL, and Beech Grove, IN, respectively. According to 1996 data, by the end of 1997, Firestone's multimillion dollar investment in a new built-up roofing production line in Beech Grove, IN, was to have been completed, with full operations commencing in early 1998 (Rubber World, 1996). Elk Corporation's new $30 million facility in Shafter, CA, began producing laminated asphalt shingles in 1995 (Straub, 1995).

4.3 Firm Characteristics

Facilities comprise a site of land with a plant and equipment that combine inputs to produce output (blown asphalt, fiberglass shingles, organic shingles, built-up roofing, modified bitumen roofing, saturated felt, and glass mat). Companies owning these facilities are legal business entities that have the capacity to conduct transactions and make business decisions that affect that facility. The terms establishment, facility, and plant are synonymous in this study and refer to the physical location where products are manufactured. Likewise, the terms company and firm are synonymous and refer to the legal business entity that owns one or more facilities. This section presents information on the parent companies that own the asphalt roofing manufacturing plants and refineries identified in the previous section.

4.3.1 Ownership

As discussed in Section 4.2, currently 34 companies operate 123 facilities that produce various asphalt roofing products for commercial, industrial, and residential use while five companies run eight refineries that produce blown asphalt. Table 4-4 lists companies determined to own and/or operate the previously identified facilities and refineries. With 21 facilities, Owens-Corning operates more factories that produce asphalt roofing products than any other domestic manufacturer. GAF Corp. (20 facilities), Johns Manville Corp. (8), Tamko Roofing Products Inc. (8), and Atlas Roofing Corp. (6) complete the list of top five firms with the most facilities producing asphalt roofing products. Together, these five companies account for more than half of the asphalt roofing facilities in the United States. As for refineries, Marathon Ashland Petroleum L.L.C., a joint venture between USX-

Table 4-4. Parent Companies

Company	Organization Type	Sales (10^6)	Employees
Atlas Roofing Corp.	Private	124.5	1,100
Bitec	Private	12	45
Carlisle Companies Inc.[a]	Public	1,611.3	10,430
Certainteed Corp.[b]	Subsidiary	28.6	400
Conglass, Inc.	NA	NA	NA
Elcor Corp.[c]	Public	317.9	1,145
Firestone Building Products	NA	NA	NA
GAF Corp.[d]	Private	852.0	5,000
GAP Roofing, Inc.	Private	1.2	79
Gardland Co.	Private	85.0	300
Globe Building Materials, Inc.	Private	100.0	429
Goldis Holdings Inc.[e]	Private	33.60	194
Honeywell International Inc.[f]	Private	23,735.0	70,400
Johns Manville Corp.	Public	2,161.8	9,740
Malarkey Herbert Roofing Co.	Private	38.0	100
MB Technology	NA	NA	NA
Mineral Fiber Manufacturing Corp.	NA	20–50	100–249
Northern Elastomeric Inc.	Private	13.30	75
Owens-Corning	Public	5,048.0	21,000
Pacific Coast Building Products[g]	Private	360.0	2,500
Performance Roof System, Inc.	Private	20.0	60
Polyglass USA Inc.	Private	23.0	68
Ridglass Shingle Manufacturing Co.	Private	14.0	150
RPM Inc.[h]	Public	1,712.2	7,537
Siplast Inc.	Private	19.9	140
Soprema Inc.	Private	21.0	45
Southwestern Petroleum Corp.	Private	24.4	150

(continued)

Table 4-4. Parent Companies (continued)

Company	Organization Type	Sales (10^6)	Employees
Tamko Roofing Products Inc.	Private	225.0	1,300
Tarco Inc.	Private	20.0	110
Thermo Manufacturing Systems, L.L.C.	Private	5.2	20
United Roofing Manufacturing Co.	Private	20.8	65
United States Single Ply Co.	Private	2.5–5	7
W. R. Grace & Co.–Connecticut	Public	1,528.6	6,300
Warrior Roofing Manufacturing Co.	Private	20–50	43
Refineries			
Gary-Williams Energy Corporation	Private	NA	NA
Hunt Consolidated Inc.	Private	750.0	2,600
Huntway Refining Company	Private	193.0	90
Marathon Ashland Petroleum L.L.C.	Private	20,293.0	NA
Paramount Petroleum Corp.	Private	239.7	413
Silver Eagle Refining Inc.[i]	Private	40.6	85

NA = Not available.

[a] Owns Carlisle Syntec Systems
[b] Owned by Compagnie de Saint-Gobain
[c] Owns Elk Corp.
[d] Owns GAF Materials Corp.
[e] Owns IKO Production, Inc.
[f] Owns Honeywell Inc.
[g] Owns Pabco Roofing Products
[h] Owns Tremco Inc.
[i] Owns Inland Refining Inc.

Sources: Asphalt Roofing Manufacturing Association. 1997. *Manufacturing Plants*. Facsimile on member company plant listing. Calverton, MD. September 24.
Dun & Bradstreet. 2000a. 2000 Dun & Bradstreet Million Dollar Directory Series. America's Leading Public and Private Companies.
Dun & Bradstreet. 2000b. Electronic database.
American Business Information (ABI). 2000. Electronic database. Omaha, NE.

Marathon Group and Ashland Inc., operates three refineries producing blown asphalt out of its seven refinery operations in the United States (Hoover's, 2001).

4.3.2 Size Distribution

Figure 4-3 presents the distribution of companies by sales ranges and is limited to companies for which data were available. Sales and employment information for four companies is currently unavailable. Twenty-four companies have sales lower than $299 million a year, four have sales between $300 million and $1 billion, and eight have sales greater than $1 billion.

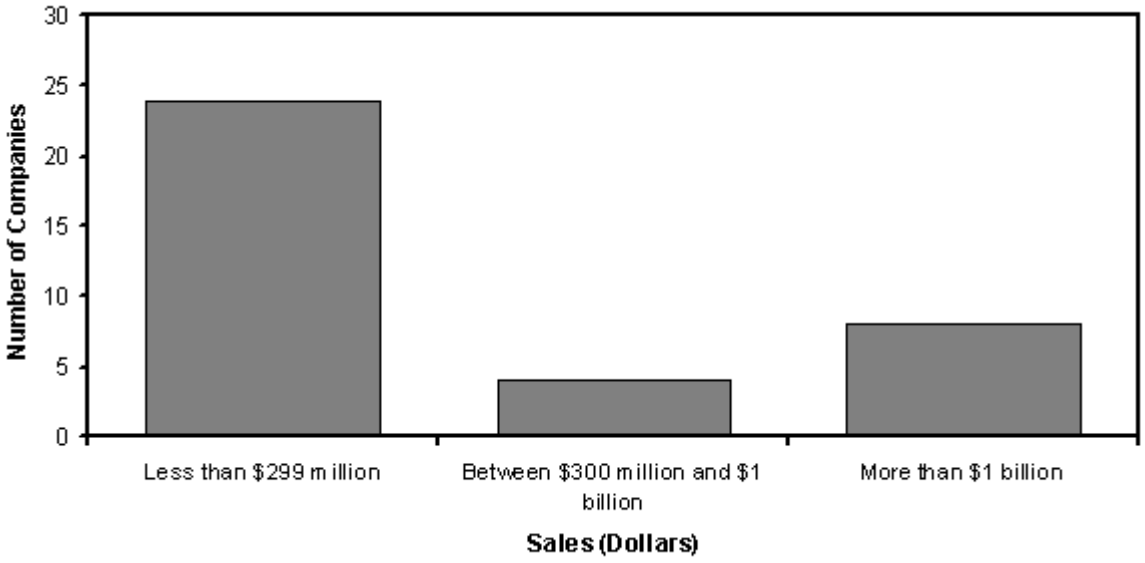

Figure 4-3. Distribution of Companies by Sales

Figure 4-4 presents the distribution of the same companies by employment range. Twenty-two companies employ 749 or fewer people, three employ between 750 and 1,499, and ten companies employ 1,500 or more.

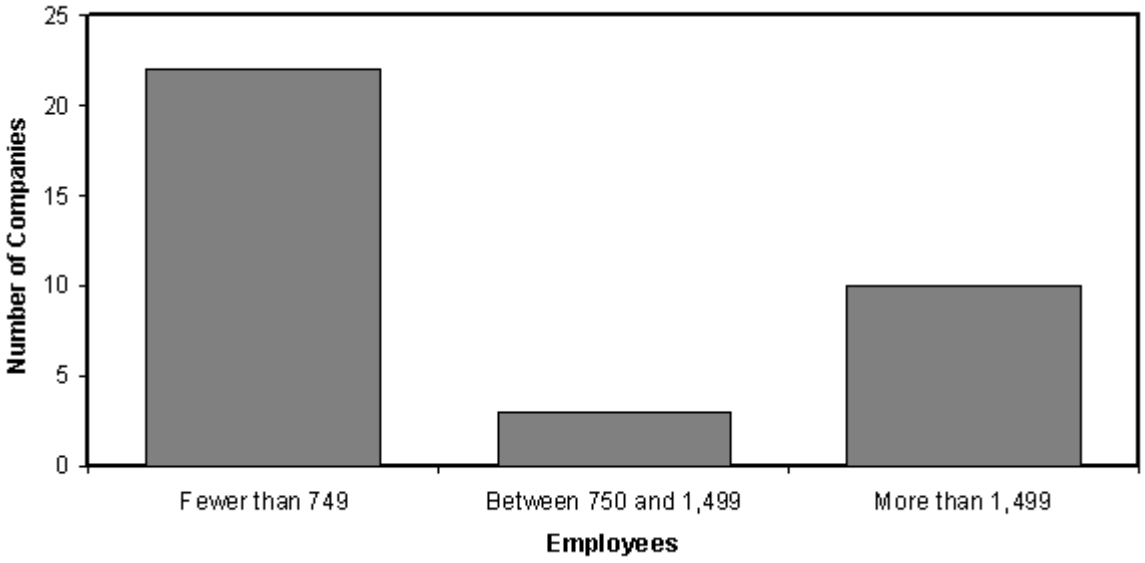

Figure 4-4. Distribution of Companies by Employment

4.3.3 Horizontal and Vertical Integration

Whether a firm in this industry is vertically or horizontally integrated depends on the primary business activity of the parent company. Vertically integrated firms may produce the inputs used in their production process or use the product as an input into other production processes. These firms may own several plants and/or operate many subsidiaries, each of which handles a different stage of production or directly or indirectly produces an input or product. For example, Firestone/Bridgestone Corporation (rubber products) and Koch Industries (petroleum refining and products) use asphalt by-products from their production of rubber and petroleum products to produce asphalt roofing products. Owens-Corning produces fiberglass fibers for numerous markets, including residential and industrial insulation and asphalt shingles. These companies take cast-offs from one process and use them in another. Nearly all of companies having more than 750 employees (not considered small businesses in this industry) are vertically integrated.

However, vertical and horizontal integration are not mutually exclusive, meaning that a corporation is usually not either in a pure form, but a mixture of both. Perceiving a firm as horizontally or vertically integrated depends on vantage point. The above companies can be

seen as vertically integrated because one subsidiary feeds an input into another. However, the products each subsidiary produces may be as varied as tires and asphalt shingles, an aspect of horizontal integration. The smaller companies involved in manufacturing asphalt roofing products are, for the most part, horizontally integrated; they produce a sole product without having forward or backward corporate linkages. These companies purchase inputs from outside suppliers, not of their corporate tree. Then they manufacture the product and sell it either directly to consumers or through wholesalers. In its pure form, horizontal integration is the situation in which one company produces various, unrelated products rather than specializing in one particular product.

4.4 Small Business Impacts

To determine the possible impacts on small businesses, businesses producing asphalt roofing products are categorized as small or large using the Small Business Administration's (SBA's) general size standards definitions. For NAICS 324122, these guidelines indicate a small business employs 750 or fewer workers (U.S. Small Business Administration, 2000), but employing no more than 1,500 workers is the criterion for refineries that process asphalt as well as petroleum.

Table 4-5 lists the employment, sales, and organization information for the 24 businesses that potentially are small businesses. This list also includes four companies assumed to be small for which data are not available. Based on the 24 companies, the majority are either private companies or private subsidiaries. Combined, the 24 firms employ about 3,243 workers and have estimated annual sales of $1 billion.

Table 4-5. Small Companies: 1999

Company	Organization Type	Sales (10^6)	Employees
Bitec	Private	12	45
Certainteed Corp.[a]	Subsidiary	28.6	400
Conglass, Inc.	NA	NA	NA
Firestone Building Products	NA	NA	NA
GAP Roofing, Inc.	Private	1.2	79
Gardland Co.	Private	85.0	300
Globe Building Materials, Inc.	Private	100.0	429
Goldis Holdings Inc.[b]	Private	33.60	194
Malarkey Herbert Roofing Co.	Private	38.0	100
MB Technology	NA	NA	NA
Mineral Fiber Manufacturing Corp.	NA	20–50	100–249
Northern Elastomeric Inc.	Private	13.30	75
Performance Roof System, Inc.	Private	20.0	60
Polyglass USA Inc.	Private	23.0	68
Ridglass Shingle Manufacturing Co.	Private	14.0	150
Siplast Inc.	Private	19.9	140
Soprema Inc.	Private	21.0	45
Southwestern Petroleum Corp.	Private	24.4	150
Tarco Inc.	Private	20.0	110
Thermo Manufacturing Systems, L.L.C.	Private	5.2	20
United Roofing Manufacturing Co.	Private	20.8	65
United States Single Ply Co.	Private	2.5–5	7
Warrior Roofing Manufacturing Co.	Private	20-50	43
Refineries			
Huntway Refining Co.	Private	193.0	90
Paramount Petroleum Corp.	Private	239.7	413
Gary-Williams Energy Corp.	Private	NA	NA
Silver Eagle Refining Inc.[c]	Private	40.6	85

NA = Not available.

[a] Owned by Compagnie de Saint-Gobain
[b] Owns IKO Production, Inc.
[c] Owns Inland Refining Inc.

Sources: Asphalt Roofing Manufacturing Association. 1997. "Manufacturing Plants." Facsimile on member company plant listing. Calverton, MD. September 24.
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SECTION 5

MARKETS

This section examines the historical market statistics and future trends and projections for the asphalt roofing industry. Historical data for this industry are provided for the value of shipments, prices, foreign trade, and consumption of asphalt roofing products. The future trends section focuses on projected demand and employment for the asphalt roofing industry.

5.1 Historical Market Data

Data on the value of shipments from 1990 through 1998 for the asphalt roofing industry are available from the Census Bureau. However, historical data on prices and domestic production volumes of asphalt roofing products are not available. Prices were estimated in 1999 constant dollars for asphalt roofing products by using the producer price index (PPI) for asphalt roofing products, which is obtained from the U.S. Department of Labor, Bureau of Labor Statistics. Foreign trade data for individual asphalt roofing products are not reported because of the aggregate nature of the available data. Industry-level import and export data were obtained from the U.S. Department of Commerce and are reported for the years 1990 through 1999.

5.1.1 Value of Shipments Data

Table 5-1 provides the value of shipments for the asphalt roofing industry. As the table shows, the value of shipments, in constant 1999 dollars, is highest for the year 1998, at $5.3 billion. After dropping to its lowest value at $3.5 billion in 1991, the value of shipments began to rise. However, the value of shipments was relatively flat over the years 1992 through 1996.

5.1.2 Prices

A time series of estimated prices in current dollars for asphalt roofing products is presented in Table 5-2. The products for which prices are provided are smooth and surfaced roll roofing, strip shingles, and individual organic or inorganic shingles. The 1992 price for

Table 5-1. Value of Shipments for NAICS 324122, Asphalt Shingle and Coating Materials Manufacturing: 1990-1998 (10^9)

	Value of Shipments	
	Current $	1999 $
1990	$3.6	$3.8
1991	$3.4	$3.5
1992	$3.9	$4.1
1993	$4.2	$4.3
1994	$4.0	$4.3
1995	$4.3	$4.3
1996	$4.5	$4.5
1997	$5.1	$5.1
1998	$5.4	$5.3

Sources: U.S. Department of Commerce, Bureau of the Census. 2000. *1998 Annual Survey of Manufactures: Statistics for Industry Groups and Industries.*" M98(AS)-1. Washington, DC: Government Printing Office.
U.S. Department of Commerce, Bureau of the Census. 1998. *1996 Annual Survey of Manufactures: Statistics for Industry Groups and Industries.* M96(AS)-1. Washington, DC: Government Printing Office.
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U.S. Department of Commerce, Bureau of the Census. 1995a. *1991 Annual Survey of Manufactures: Statistics for Industry Groups and Industries.* M91(AS)-1. Washington, DC: Government Printing Office.
U.S. Bureau of Labor Statistics. 2000b. "Producer Price Index Revision—Current Series: PCU2952#, Asphalt Felts and Coatings: 1990-1999." <http://146.142.4.24/servlet/SurveyOutputServlet?jrunsessionid=9772358862760607>.

each product was estimated by dividing the 1992 value of shipments by the 1992 volume of shipments for that product. The 1992 price was then multiplied by the PPI for asphalt felts and coatings for the years 1990 through 1999 to obtain prices for other years.

Table 5-2. Historical Prices of Asphalt Roofing Products: 1990-1999[a]

Year	Roll Roofing (current dollars/square)	Strip Shingles (current dollars/square)	Individual Shingles, Organic or Inorganic, All Styles (current dollars/square)
1990	$6.48	$10.71	$10.06
1991	$6.59	$10.91	$10.24
1992	$6.47	$10.70	$10.05
1993	$6.51	$10.77	$10.11
1994	$6.42	$10.62	$9.98
1995	$6.70	$11.08	$10.41
1996	$6.77	$11.20	$10.52
1997	$6.80	$11.25	$10.57
1998	$6.79	$11.23	$10.55
1999	$6.78	$11.21	$10.53

[a] Prices were calculated by dividing 1992 value of shipments by quantities and then multiplying by the PPI for the relevant year for asphalt felts and coatings divided by 100.

Source: U.S. Department of Commerce, Bureau of the Census. 1995b. *1992 Census of Manufactures, Industry Series—Petroleum and Coal Products*. MC92-I-29A. Washington, DC: Government Printing Office.

As Table 5-2 shows, the estimated prices for asphalt roofing products are characterized by increases and subsequent declines over the 1990 through 1999 time period. Prices were at their peak in 1997 and at their lowest in 1994. Estimated 1999 prices for asphalt roofing products range from $6.78 to $11.21 per square.

5.1.3 Foreign Trade

U.S. exports and imports of asphalt roofing products make up only a small portion of the total asphalt roofing product market. In 1998, the domestic value of shipments of this industry was $5 billion. By comparison, only $75 million worth of asphalt roofing products were exported, and $46 million worth were imported in 1998. Tables 5-3 and 5-4 provide the volume and value of U.S. imports for consumption and total exports for the years 1990 through 1999, as reported by the U.S. Department of Commerce, the U.S. Treasury, and U.S.

Table 5-3. U.S. Total Exports and Value of Exports of Asphalt Roofing Products: 1990-1999

	Exports (10^3 Kg)	Value of Exports ($10^3)		Value of Exports per Kilogram ($10^3)	
		Current $	1999 $	Current $	1999 $
1990	69,609	$38,675	$40,475	$0.56	$0.58
1991	87,659	$43,642	$44,857	$0.50	$0.51
1992	119,812	$59,690	$62,532	$0.50	$0.52
1993	142,905	$70,171	$73,068	$0.49	$0.51
1994	193,879	$77,769	$82,054	$0.40	$0.42
1995	150,674	$67,771	$68,567	$0.45	$0.46
1996	165,930	$77,474	$77,549	$0.47	$0.47
1997	241,109	$96,215	$95,844	$0.40	$0.40
1998	184,177	$74,755	$74,610	$0.41	$0.41
1999	269,884	$109,309	$109,309	$0.41	$0.41

Sources: U.S. International Trade Commission. Trade Database. <http://dataweb.usitc.gov/scripts/>.
U.S. Bureau of Labor Statistics. 2000b. "Producer Price Index Revision—Current Series: PCU2952#, Asphalt Felts and Coatings: 1990-1999." <http://146.142.4.24/servlet/SurveyOutputServlet?jrunsessionid=9772358862760607>.

International Trade Commission. For this time period, exports in terms of 1999 dollars were generally higher than imports, although the volume of imports seemed greater than the volume of exports. In 1990, the volume of exports from the United States was only 24 percent of the volume of imports (69.6 million kilograms versus 289.9 million kilograms). By 1997, this number had increased to 63 percent (241.1 million kilograms versus 381.9 million kilograms). However, imports dropped dramatically to 160.8 million kilograms in 1998, and 176.1 million kilograms in 1999. The average annual growth of the volume of exports from 1990 through 1999 was 19.3 percent, while the average annual growth of the value of exports was only 13.8 percent for the same time period. Imports to the United States decreased annually by an average of 2.1 percent over this time period, and the value of imports increased at a rate of 1.7 percent. The annual growth in the value of imports dropped 47 percent, and the annual growth in the volume of imports decreased by 58 percent in 1998.

Table 5-4. U.S. Imports for Consumption and Value of Imports of Asphalt Roofing Products: 1990-1999

	Imports (10^3 Kg)	Value of Imports ($10^3)		Value of Imports per Kilogram ($10^3)	
		Current $	1999 $	Current $	1999 $
1990	289,883	$50,815	$53,180	$0.18	$0.18
1991	298,911	$53,791	$55,289	$0.18	$0.18
1992	308,763	$58,396	$61,177	$0.19	$0.20
1993	319,863	$64,289	$66,944	$0.20	$0.21
1994	346,690	$69,946	$73,800	$0.20	$0.21
1995	341,505	$71,119	$71,954	$0.21	$0.21
1996	402,615	$86,056	$86,140	$0.21	$0.21
1997	381,856	$86,560	$86,226	$0.23	$0.23
1998	160,834	$45,892	$45,803	$0.29	$0.28
1999	176,080	$50,465	$50,465	$0.29	$0.29

Sources: U.S. International Trade Commission. Trade Database. <http://dataweb.usitc.gov/scripts/>.
U.S. Bureau of Labor Statistics. 2000b. "Producer Price Index Revision—Current Series: PCU2952#, Asphalt Felts and Coatings: 1990-1999." <http://146.142.4.24/servlet/SurveyOutputServlet?jrunsessionid=9772358862760607>.

Although the total value of imports to the United States over the 1989 through 1996 time period was higher than the total value of exports, the value of exports was higher on a per-kilogram basis. As Tables 5-3 and 5-4 illustrate, the price range of the value of exports in 1999 dollars was $0.40 to $0.58, while the price range for the value of imports was only $0.18 to $0.29. Therefore, asphalt roofing products exported from the United States have a higher value than U.S. imports of these products.

A small number of countries make up the majority of U.S. import sources and export destinations for U.S. asphalt roofing products. Table 5-5 provides the value of both U.S. imports and exports for selected countries. Canada's exports of asphalt roofing products to the United States, which were valued at $27 million in 1999, make up over approximately 55 percent of the total U.S. imports of these products. Other countries from which the

Table 5-5. Value of Imports for Consumption and Exports of Asphalt Roofing Products by Country: 1999

	Value (10^3)	Share
Imports from:		
Canada	$27,660	54.8%
France	$838	1.7%
Italy	$708	1.4%
Mexico	$13,385	26.5%
Spain	$1,120	2.2%
Venezuela	$4,438	8.8%
All others	$2,316	4.6%
Total	$50,465	
Exports to:		
Bahamas	$3,046	2.8%
Canada	$52,596	48.1%
China	$1,148	1.1%
Korea	$14,201	13.0%
Mexico	$6,725	6.2%
Portland	$2,385	2.2%
All others	$29,208	26.7%
Total	$109,309	

Source: U.S. International Trade Commission. Trade Database. <http://dataweb.usitc.gov/scripts/>.

United States imports asphalt roofing products are Mexico (26.5 percent) and Venezuela (8.8 percent). Among the primary importers of U.S. asphalt roofing products are Canada, Korea, and Mexico. Exports to Canada make up 48.1 percent of all U.S. exports of these products, while exports to Korea and Mexico make up much smaller shares of the total value of U.S. exports of asphalt roofing products (13 percent and 6.2 percent, respectively).

5.1.4 Consumption

Apparent U.S. consumption of asphalt roofing products is measured by computing U.S. shipments minus U.S. exports plus U.S. imports. Table 5-6 provides apparent U.S.

consumption for the years 1990 through 1998. The value of apparent U.S. consumption, in 1999 dollars, was $3.7 billion in 1990 and $5.3 billion in 1998, an increase of 5 percent over this time period. However, several decreases in apparent U.S. consumption occurred between 1990 and 1998. Consumption levels dropped in 1991 (0.6 percent decrease), and 1994 (2 percent decrease), which is most likely a result of declines in housing starts for these years. Apparent U.S. consumption of asphalt roofing products was at its highest in 1998 at $5.3 billion.

Table 5-6 also provides the import concentration for asphalt roofing products, which indicates the percentage of total U.S. consumption that comprises imports. As the table shows, imports made up only a small percentage of apparent U.S. consumption of asphalt roofing products. The import concentrations ranged from only 0.86 percent to 1.91 percent over the 1990 through 1998 time period.

5.2 Trends and Projections

Limited information is available on future trends and projections for the asphalt roofing industry. Based on the forecasts of the Freedonia Group (1997) and Gale Research (1995), the industry is expected to see a moderate increase in the demand for its products, while employment in the industry is projected to decline. Demand for asphalt roofing is expected to increase slightly into the next century as the market for building materials improves. However, competition from new synthetic roofing materials is expected to keep the rise in demand for asphalt roofing products at a minimum. Employment in the asphalt roofing industry is expected to decline into the 21st century as a result of productivity improvements from increased automation and layoffs by manufacturers. According to the U.S. Bureau of Labor Statistics, positions in the asphalt roofing industry are expected to decrease by 10 to 20 percent between 1990 and 2005.

Table 5-6. Apparent U.S. Consumption and Import Concentration of Asphalt Roofing Products: 1990-1998 (10^3)

Year	U.S. Shipments ($1999)	U.S. Exports ($1999)	U.S. Imports ($1999)	Apparent U.S. Consumption ($1999)[a]	Import Concentration (%)[b]
1990	$3,751,808	$40,475	$53,180	$3,764,513	1.41%
1991	$3,533,895	$44,857	$55,289	$3,544,327	1.56%
1992	$4,099,333	$62,532	$61,177	$4,097,978	1.49%
1993	$4,345,299	$73,068	$66,944	$4,339,175	1.54%
1994	$4,265,672	$82,054	$73,800	$4,257,418	1.73%
1995	$4,322,565	$68,567	$71,954	$4,325,953	1.66%
1996	$4,492,044	$77,549	$86,140	$4,500,635	1.91%
1997	$5,074,949	$95,844	$86,226	$5,065,331	1.70%
1998	$5,339,711	$74,610	$45,803	$5,310,903	0.86%

[a] Apparent consumption = U.S. shipments – U.S. exports + U.S. imports.
[b] Import concentration was calculated as the ratio of imports to apparent U.S. consumption.

Sources: U.S. Department of Commerce, Bureau of the Census. 2000. *1998 Annual Survey of Manufactures: Statistics for Industry Groups and Industries.*" M98(AS)-1. Washington, DC: Government Printing Office.
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