Asbestos

By Robert L. Virta[1]

U.S. apparent consumption of asbestos declined in 1987. Shipments from domestic mines decreased slightly, and imports for consumption decreased 13% from those of 1986. Adverse publicity on asbestos-related health risks and a proposed Environmental Protection Agency (EPA) ban of certain asbestos products contributed to the poor market conditions in the United States.

Domestic Data Coverage.—Domestic production data for asbestos are developed by the Bureau of Mines by means of a voluntary industry survey. Of the three canvassed operations to which a survey request was sent, all responded, representing 100% of the total production data shown in table 1.

Table 1.—Salient asbestos statistics

	1983	1984	1985	1986	1987
United States:					
Production (sales):					
Quantity, metric tons	69,906	57,422	57,457	51,437	50,600
Value[1], thousands	$27,866	$24,238	$20,485	$17,367	$17,198
Exports and reexports (unmanufactured):					
Quantity, metric tons	54,634	39,919	45,656	47,281	60,084
Value, thousands	$19,683	$18,346	$16,489	$14,520	$16,149
Exports and reexports of asbestos products:					
Value, do.	$129,582	$163,347	$193,765	$163,896	$180,602
Imports for consumption (unmanufactured):					
Quantity, metric tons	196,387	209,963	142,431	108,352	93,763
Value, thousands	$57,956	$64,749	$44,093	$26,537	$22,022
Consumption, apparent[2], metric tons	217,000	226,000	162,000	119,627	84,279
World: Production, do.	r4,428,867	r4,309,179	4,272,327	p4,050,261	e4,054,088

eEstimated. pPreliminary. rRevised.
[1]F.o.b. mine.
[2]Production, plus imports, minus exports, plus adjustments in Government and industry stocks.

Legislation and Government Programs.—The EPA continued a regulatory impact analysis of its proposed ban and/or phaseout of asbestos and asbestos-containing products. The proposed ruling would immediately ban the manufacture, importation, and processing of certain asbestos construction materials. In addition, the mining of asbestos and the importation of asbestos and asbestos products not immediately banned would be placed under a permit system and would be phased out within 10 years.

On February 25, 1987, the EPA modified its 1986 regulation covering State and local government employees on asbestos abatement projects. The permissible exposure limit was reduced from 2 fibers per cubic centimeter to 0.2 fiber per cubic centimeter, and new requirements for engineering and work practice controls and worker training were instituted.[2]

On October 30, 1987, the EPA issued a final ruling that requires local educational districts to identify asbestos-containing materials in public and private school buildings, and to submit a management plan that describes the appropriate action to take regarding the materials to the State Governor by October 12, 1988. The ruling

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requires the local education districts to begin implementing the management plan by July 9, 1989.[3]

The National Bureau of Standards established an accreditation program, effective October 1, 1988, for laboratories that determine the asbestos content of insulation and building materials using polarized light microscopy and that determine airborne asbestos concentrations following asbestos abatement programs using transmission electron microscopy.[4] An interim EPA quality assurance program, established September 3, 1987, for the analysis of asbestos-containing materials using polarized light microscopy remains in effect until October 1, 1988.[5]

The Occupational Safety and Health Administration (OSHA) extended through July 21, 1988, an administrative stay on its 1986 regulation governing worker exposure to the nonasbestiform varieties of tremolite, actinolite, and anthophyllite. During the stay, OSHA continued to analyze the impact of using the asbestos standard to regulate the nonasbestiform varieties of the minerals.[6]

Stockpile goals for asbestos were unchanged from those of 1986.

Table 2.—Stockpile goals and Government inventories for asbestos as of December 31

(Metric tons)

	Stockpile goals	Total inventories		
		1985	1986	1987
Amosite	15,422	30,855	30,853	30,849
Chrysotile	2,722	9,772	9,711	9,709
Crocidolite	--	33	33	33
Total	18,144	40,660	40,597	40,591

Source: General Services Administration, Federal Property Service.

DOMESTIC PRODUCTION

The producers of asbestos were Calaveras Asbestos Ltd., Calaveras County, CA; KCAC Inc., San Benito County, CA; and Vermont Asbestos Group Inc., Orleans County, VT. Calaveras Asbestos permanently closed its mine in Copperopolis, CA, on December 31, 1987. The company, which was the largest of the three domestic asbestos producers, cited depleted ore reserves and decreased market demand as the reason for closing. Plans were made to open the mine in 1988 as a disposal site for asbestos-containing materials under a new company name, Cal-Safe.[7]

CONSUMPTION AND USES

Total U.S. asbestos consumption decreased 30%. Approximately 94% of the asbestos consumed was chrysotile, 1% was crocidolite, and 5% was an unspecified fiber type. Chrysotile grade 7 was most commonly used, followed by grades 4, 6, and 5. Spinning grades 1, 2, and 3 represented approximately 1% of the total consumption.

Table 3.—U.S. asbestos consumption, by end use, grade, and type

(Thousand metric tons)

End use	Chrysotile[1]							Amosite	Crocidolite	Other[2]	Total asbestos[3]
	Grades 1 and 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Total				
1986 total	--	1.1	14.2	9.3	10.3	78.6	113.7	--	2.0	3.9	115.7
1987:											
Asbestos-cement pipe	--	--	6.8	1.1	2.3	--	10.2	--	1.1	--	11.3
Asbestos-cement sheet	--	--	--	--	2.2	1.7	3.9	--	--	--	3.9
Coatings and compounds	--	--	(4)	--	(4)	2.6	2.7	--	--	--	2.7
Friction products	--	(4)	.2	2.7	2.8	15.6	21.3	--	--	--	21.3
Insulation: Electrical	--	--	(4)	.1	(4)	--	.1	--	--	--	.1
Packing and gaskets	--	.1	.5	2.5	.1	6.9	10.2	--	--	--	10.2
Paper	--	--	--	--	--	4.8	4.8	--	--	--	4.8

See footnotes at end of table.

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Table 3.—U.S. asbestos consumption, by end use, grade, and type —Continued

(Thousand metric tons)

End use	Chrysotile[1]							Amosite	Crocidolite	Other[2]	Total asbestos[3]
	Grades 1 and 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Total				
1987 —Continued											
Plastics	--	--	--	--	--	1.3	1.3	--	--	--	1.3
Roofing products	--	--	(4)	(4)	(4)	22.6	22.6	--	--	--	22.6
Textiles	--	0.5	--	--	--	--	.5	--	--	--	.5
Other	--	.3	0.2	0.1	--	1.2	1.8	--	--	--	1.8
Total[5]	--	1.0	7.8	6.5	7.3	56.8	79.3	--	1.1	3.8	80.4

[1]Estimated distribution based upon data provided by the Asbestos Institute, Montreal, Canada, and the Bureau of Mines asbestos producer survey.
[2]Bureau of the Census.
[3]Does not include "Other" category in total. "Other" contains unspecified fiber type and end use.
[4]Less than 1/10 unit.
[5]Data may not add to totals shown because of independent rounding.

PRICES

The average unit value of domestically produced asbestos in 1987 was $340 per metric ton. The average unit value of exported asbestos was $269 per ton.

Table 4.—Customs unit values of imported asbestos

(Dollars per metric ton)

	1983	1984	1985	1986	1987
Canada:					
Chrysotile:					
Cement	257	284	--	--	--
Crude	199	1,084	576	547	610
Spinning	932	699	731	507	598
Other	384	431	283	229	218
South Africa, Republic of:					
Amosite	840	869	830	--	--
Crocidolite	629	705	569	582	572

Source: Bureau of the Census.

FOREIGN TRADE

There was a 10% increase in the total value of asbestos fibers and asbestos products exported from the United States. The asbestos fiber portion was 8% of total value. Exports and reexports of brake linings and disc pads accounted for 74% of the value of all asbestos products exported. Canada remained the largest importer of U.S. asbestos fibers and products, followed by Mexico, Japan, Brazil, and Thailand.

Canada provided 96% of the asbestos imported into the United States, and the Republic of South Africa provided 3%. Several other countries provided minor amounts. Approximately 95% of asbestos fiber imports were chrysotile.

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Table 5.—Countries importing U.S. asbestos fibers and products

(Thousand dollars)

Country	1986			1987		
	Unmanufactured fibers	Manufactured products	Total[1]	Unmanufactured fibers	Manufactured products	Total[1]
Australia	17	1,341	1,358	24	1,513	1,537
Brazil	467	2,555	3,022	401	4,642	5,043
Canada	605	123,819	124,424	673	136,828	137,501
Germany, Federal Republic of	300	2,746	3,047	673	1,975	2,648
Japan	2,981	7,867	10,848	3,604	5,931	9,535
Korea, Republic of	624	825	1,449	1,579	991	2,569
Kuwait	--	221	221	--	132	132
Mexico	2,667	5,593	8,260	2,893	6,720	9,613
Saudi Arabia	--	1,062	1,062	--	1,329	1,329
Thailand	2,490	354	2,844	3,028	397	3,425
Turkey	--	361	361	--	279	279
United Kingdom	166	1,313	1,479	359	1,949	2,307
Venezuela	218	2,688	2,906	257	2,314	2,571
Other	3,864	12,108	15,972	2,659	15,602	18,261
Total[1]	14,401	162,851	177,252	16,149	180,602	196,751

[1]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 6.—U.S. exports and reexports of asbestos and asbestos products

Products		1985		1986		1987	
		Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
EXPORTS							
Unmanufactured:							
Crudes, fibers, stucco	metric tons	29,382	$12,705	30,252	$9,728	39,720	$11,151
Sand and refuse	do	15,693	3,661	16,645	4,673	19,416	4,666
Total[1]	do	45,075	16,366	46,897	14,401	59,136	15,818
Manufactured:							
Asbestos fibers	do	607	3,793	723	3,902	1,078	4,761
Brake linings and disk brake pads	do	NA	144,262	NA	123,515	NA	133,733
Clutch facings and linings	number	NA	20,718	NA	16,187	NA	19,982
Gaskets	metric tons	78	900	266	1,285	471	1,857
Insulation	do	NA	4,566	NA	1,889	NA	3,700
Packing and seals	do	1,192	6,716	820	6,373	659	5,710
Shingles and clapboard	do	984	893	880	805	1,225	605
Other articles of asbestos	do	1,521	2,437	1,614	1,553	1,632	2,132
Other articles, n.s.p.f	do	NA	9,191	NA	7,342	NA	6,473
Total		XX	193,476	XX	162,851	XX	178,953
REEXPORTS							
Unmanufactured:							
Crudes and fibers	metric tons	369	71	329	98	904	316
Sand and refuse	do	212	52	54	20	44	15
Total[1]	do	581	123	384	119	948	331
Manufactured:							
Asbestos fibers	do	(2)	3	--	--	27	65
Brake linings and disk brake pads	do	NA	103	NA	222	NA	333
Clutch facings and linings	number	NA	73	NA	604	NA	845
Gaskets	metric tons	1	18	6	65	--	--
Insulation	do	NA	2	NA	23	--	--
Packing and seals	do	4	63	(2)	50	(2)	3
Other articles of asbestos	do	NA	20	NA	3	3	143
Other articles, n.s.p.f	do	NA	1	NA	78	NA	260
Total		XX	283	XX	1,045	XX	1,649

NA Not available. XX Not applicable.
[1]Data may not add to totals shown because of independent rounding.
[2]Less than 1/2 unit.

Source: Bureau of the Census.

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Table 7.—U.S. imports for consumption of asbestos fibers, by type, origin, and value

Type	Canada		South Africa, Republic of		Other		Total[1]	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1985	131,119	$38,547	10,985	$5,224	327	$322	142,431	$44,093
1986:								
Chrysotile:								
Crude	20	12	192	104	--	--	212	116
Spinning fibers	598	304	--	--	--	--	598	304
All other	101,273	23,065	227	139	107	94	101,607	23,291
Crocidolite (blue)	--	--	1,968	1,154	20	4	1,988	1,158
Other (unspecified asbestos type)	1,626	434	2,068	1,109	253	119	3,947	1,662
Total[1]	103,517	23,814	4,455	2,506	380	217	108,352	26,537
1987:								
Chrysotile:								
Crude	19	12	10	11	15	17	44	40
Spinning fibers	589	352	--	--	15	45	604	397
All other	88,107	19,207	44	57	22	5	88,173	19,269
Crocidolite (blue)	--	--	1,113	637	--	--	1,113	637
Other (unspecified asbestos type)	1,509	526	2,079	1,083	241	70	3,829	1,679
Total[1]	90,224	20,096	3,246	1,788	293	137	93,763	22,022

[1]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Imports of asbestos-containing pipes, tubes, and fittings increased from 960 tons in 1986 to 2,150 tons in 1987 according to the Bureau of the Census. Imports of spinnable asbestos fiber decreased from 750 tons in 1986 to 520 tons in 1987, and imports of other asbestos-containing products decreased from 7,530 tons in 1986 to 4,580 tons in 1987.

WORLD REVIEW

Canada.—The labor ministers for the Quebec Provincial and Federal Governments agreed to endorse the International Labor Organization convention on the controlled use of asbestos if approval is obtained from the respective Cabinets.[8]

The Canadian and Quebec Governments initiated an $8.8 million research and development program to investigate ways of improving asbestos mining techniques and reducing production costs. The Federal and Provincial Governments will provide $3.2 million each, the asbestos industry will provide $1.6 million, and the Asbestos Institute will provide $800,000 for the program.[9]

Hydrogen Energy Corp. and its subsidiary, Ulhycarb Chemicals of Canada Inc., initiated a technical and economic study of a process to produce hydrogen gas and byproducts from asbestos mine tailings. The study was supported by the Quebec government and the Hydrogen Industry Council and will focus on utilizing asbestos mine tailings from Thetford, Quebec.[10]

South Africa, Republic of.—The South African Department of Manpower issued regulations reducing worker exposure to asbestos. The new regulation limited occupational exposure to asbestos to 1 fiber per milliliter. When concentrations exceed this limit, workers are required to wear protective devices. In addition, the spray application of asbestos-containing materials was prohibited, and guidelines for labeling asbestos-containing materials, for disposal of asbestos-containing materials, and for demolition of buildings containing asbestos were established.[11]

U.S.S.R.—Production of asbestos-cement was predicted to increase 15% and 17% in 1989 and 1990, respectively. The U.S.S.R. produced over 40 asbestos-cement products including corrugated sheet, flat sheet, and pressure pipe. An extrusion process was introduced for manufacturing asbestos-cement products. The U.S.S.R. continued to upgrade equipment to reduce fuel costs and increase productivity.[12]

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Table 8.—Asbestos: World production, by country[1]

(Metric tons)

Country[2]	1983	1984	1985	1986[p]	1987[e]
Argentina	1,240	1,093	1,244	[e]1,100	1,000
Australia	3,909	--	--	--	--
Brazil (fiber)	158,885	134,788	165,446	204,460	210,000
Bulgaria	700	500	400	[e]500	500
Canada (shipments)	858,000	837,000	750,000	662,000	660,000
China[e]	160,000	135,000	150,000	150,000	150,000
Colombia	[e]5,400	9,982	12,435	[e]13,000	13,000
Cyprus	17,288	7,429	16,360	13,011	13,000
Egypt	245	389	229	476	450
Greece	31,811	45,376	46,811	[e]48,000	48,000
India	24,873	25,450	30,183	25,236	23,000
Indonesia[e]	25,000	25,000	25,000	25,000	25,000
Italy	139,054	147,272	136,006	115,208	120,000
Japan[e]	4,000	4,000	4,000	4,000	4,000
Korea, Republic of	12,506	8,062	4,703	2,983	3,000
Mozambique	[e]600	[e]400	55	--	--
South Africa, Republic of	221,111	167,389	164,247	138,862	[3]135,074
Swaziland	26,287	25,832	25,130	20,908	21,000
Taiwan	2,819	1,355	625	--	--
Turkey	1,510	1,499	[e]1,500	[e]1,500	1,500
U.S.S.R.[e]	[r]2,500,000	[r]2,500,000	[r]2,500,000	[r]2,400,000	2,400,000
United States (sold or used by producers)	69,906	57,422	57,457	51,437	[3]50,600
Yugoslavia	10,502	8,556	6,916	8,596	[3]10,964
Zimbabwe	153,221	165,385	173,580	163,984	164,000
Total	[r]4,428,867	[r]4,309,179	4,272,327	4,050,261	4,054,088

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Apr. 29, 1988.

[2]In addition to the countries listed, Afghanistan, Czechoslovakia, 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.

[3]Reported figure.

TECHNOLOGY

Contact filtration of chrysotile and amphibole asbestos suspensions was studied using magnesium oxide, sand, magnesium carbonate, acidic and basic alumina, calcite, diatomaceous earth, microcrystalline cellulose, and activated carbon as the filter media. Approximately 99% of the amphibole asbestos was removed using magnesium oxide and acidic alumina. Magnesium oxide and basic alumina were most effective for removing chrysotile from suspension by contact filtration.[13]

A study on the use of asbestos-reinforced plastics in fire and high heat environments concluded that asbestos-reinforced plastics may solve many of the problems created by burning and smoldering plastics in buildings and mass transit vehicles. Several factors considered were the dependence of flame retardancy and heat resistance on the asbestos content of the plastic, the increased use of competing reinforcement and filler materials, and the rapid change in plastic compositions as technological developments were made.[14]

In studies of asbestos, regression analysis commonly is used to correlate the number of particles in a specific size category with the incidence of cancer. An evaluation of the regression technique suggested that the strength of the correlation between particle size and carcinogenicity may not be as strong as originally theorized.[15]

Air-monitoring samples collected in occupational and mining environments were examined using the phase contrast microscope (PCM) and the scanning transmission electron microscope. The study concluded that by applying a multiplication factor to routine PCM counts, the regulatory assessment of the particle content on personal air-monitoring filters would be more accurate.[16]

The Société Nationale de l'Amiante continued investigating the use of phosphorus-rich coatings to reduce the harmful effects of asbestos. For a surface modification to be effective, the coating must penetrate the fiber bundle and coat individual fibrils, the coating must be durable enough to undergo processing and remain intact through the product life, the coating could not alter the fiber grade or processing characteristics, and the cost must be low enough to ensure that modified chrysotile would be cost com-

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petitive with asbestos substitutes.[17]

A process was developed to convert asbestos-containing waste into a harmless glass. The asbestos-containing waste was fed into a modified glassmaking furnace, where it was incorporated into the molten glass at a temperature of 1,400° C. The glass was reported to be nontoxic and safe even if broken or melted. Disposal using this technique was cost competitive with landfill disposal.[18] A second method for rendering asbestos harmless was developed at the Risoe Research Center in Copenhagen, Denmark. Ammonium sulfate at 260° C was used to decompose the asbestos.[19]

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