ASBESTOS

By Robert L. Virta

Asbestos is a generic name given to six fibrous minerals that have been used widely in commercial products. The six types of asbestos are chrysotile, crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos. The most widely used variety is chrysotile. The properties that make asbestos so versatile and cost effective are high tensile strength, chemical and thermal stability, high flexibility, low electrical conductivity, and large surface area.

Legislation and Government Programs

The Occupational Safety and Health Administration (OSHA) issued several notices amending its asbestos standard covering general industry, construction, and the shipyard industry. Two notices dealt with extensions for the starting date for compliance with various sections of the asbestos standard.[1] OSHA issued other notices that provided corrections, clarifications, and amendments concerning definitions, handling and disposal of asbestos-containing materials, medical surveillance, removal methods, use of respirators, worker training, etc.[2]

The Environmental Protection Agency (EPA) removed the asbestos processing area source category from its list of sources of hazardous air pollutants (HAP) under the Clean Air Act. The EPA "believes that no source in the category emits asbestos in quantities that pose an individual risk greater than one in one million..." The category was originally listed in 1992 as a source of HAP because asbestos emissions previously were thought to exceed the limits set under the Clean Air Act.[3] The EPA also issued two clarifications of its National Emission Standards for Hazardous Air Pollutants (NESHAP) for asbestos. The first notice clarifies the "residential building exemption" under NESHAP.[4] The second addresses the analysis of friable asbestos material composed of several layers.[5]

A variety of asbestos-containing civilian products also have military applications. Examples include friction materials (brakes and clutches), electrical and thermal insulations, packings and gaskets, asbestos-reinforced plastics, etc., for use on military vehicles, ships, rockets, missiles, and in military construction. Consumption of asbestos, however, has decreased considerably in recent years because of the controversy surrounding exposures to asbestos dust. Because of the trend toward lower asbestos consumption, the Department of Defense authorized the disposal of 9,767 metric tons of chrysotile; 30,850 tons of amosite; and 33 tons of crocidolite from the National Defense Stockpile.

Production

Asbestos was mined in the United States by one company, KCAC Inc., San Benito County, CA. Domestic production was limited to chrysotile. KCAC operated a mine in a highly sheared serpentinite composed of matted, short fiber chrysotile and unfractured serpentinite (also called a mass fiber deposit). The ore was stripped and wet processing was used to beneficiate the fiber. Vermont Asbestos Group Inc., which stopped mining and milling asbestos in 1994, closed in 1995.

Domestic production data for asbestos were collected by means of a voluntary survey of one mining operation, representing 100% of the sales data shown in table 1. Domestic production (sales) declined in 1995. *(See table 1.)*

Consumption

U.S. consumption of asbestos decreased from 26,800 tons in 1994 to 22,000 tons in 1995. The largest declines were in the friction and roofing products categories, which accounted for 32% and 48% of the asbestos market, respectively.

More than 99% of the asbestos consumed domestically was chrysotile. The remainder was crocidolite. Ninety-four percent of the chrysotile consumed in the United States was grade 7, followed by grades 5, 6, 4, and 3. *(See table 2.)* Markets for crocidolite were very limited and consumption was estimated to be less than 5 tons.

Manufacturers gradually have been replacing asbestos with substitute materials, redesigning old products to eliminate the need for asbestos, or designing new products that require neither asbestos nor asbestos substitutes. Economic, manufacturing, performance, and/or technical difficulties were considered before asbestos was replaced by a substitute material or product.

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

Prices

The average unit value of domestically produced asbestos decreased from that of 1994. The decrease was attributed to the closure of Vermont Asbestos Group, which sold higher value fiber than the California operation.

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Unit values for all varieties of imported asbestos ranged from $161 per ton to $2,826 per ton and averaged $219 per ton. Unit values for all varieties of exported asbestos ranged from $176 per ton to $8,633 per ton and averaged $411 per ton.

The customs unit value for imported chrysotile ranged from $161 per ton to $2,826 per ton. The average unit value for imported crude chrysotile was $1,806 per ton. The average unit value for spinning grade chrysotile and other chrysotile types increased to $461 per ton and $201 per ton, respectively. The average unit value for imported crocidolite was reported to be $196 per ton. This is considerably lower than in previous years. Based on the lack of any significant markets in the United States and the low unit value, most of the imports reported as crocidolite probably were chrysotile. *(See tables 3 and 6.)*

Approximate equivalents, in dollars per metric ton, of price ranges quoted in Industrial Minerals (London), December 1995, for Canadian chrysotile, f.o.b. mine, ranged between $190 per ton and $1,500 per ton, depending on the grade. Chrysotile from South Africa ranged from $200 per ton to $440 per ton. Crocidolite from South Africa ranged from $640 per ton to $920 per ton. Quoted prices should be used only as a guideline because actual prices depend on the terms of the contract between seller and buyer.

Foreign Trade

The value of asbestos fibers and asbestos products exported and reexported increased slightly in 1995. Japan was the largest importer of unmanufactured asbestos fiber. Canada was the largest importer of unmanufactured fibers and manufactured products from the United States, followed by Mexico and Venezuela. *(See table 4.)* The largest increases in export value were observed for the panel, sheet, tile, and tube category; the paper and millboard category; and the miscellaneous category. *(See table 5.)* Exports and reexports of brake linings and disk pads accounted for 82% of the value of all manufactured asbestos products.

The Bureau of the Census reported that 14,600 tons of asbestos were exported in 1995. This category includes asbestos crudes, fiber, stucco, sand, and refuse. It is likely that some manufactured asbestos products, nonasbestos fiber, and/or nonasbestos mineral exports also were included in the export total. Exports of asbestos fiber were estimated to be less than 10,000 tons in 1995.

Canada supplied nearly all of the asbestos imported by the United States. Most of this asbestos fiber was chrysotile. *(See table 6.)* According to the Bureau of the Census, 192 tons of asbestos imports were reported as crocidolite in 1995. Although Canada was listed as the source of the crocidolite imports, the crocidolite was mined in South Africa and transshipped through Canada.

World Review

World production of asbestos was estimated to be 2.40 million tons. Russia continued to be the largest producer of asbestos, followed by Canada, Kazakstan, China, and Brazil. These countries accounted for 83% of the world production. *(See table 7.)* LAB Chrysotile halted operations at its BC/Beaver chrysotile mine in Canada because of poor markets and low ore grades.[6]

Current Research and Technology

Research continued on the production of magnesium from asbestos wastes. Noranda indicated that it will build a 200-ton-per-year demonstration plant in Montreal. The plant will use leaching, dehydration, and electrolysis to extract magnesium from asbestos wastes.[7] EA Technology Ltd., the University of Manchester Institute of Science and Technology, and private industry tested a new magnesium smelting method that allows the use of up to 40 weight percent asbestos cement waste in the furnace feed. Magnesium is produced using high temperature silicothermic reduction at atmospheric pressure. The operating costs are reported 20% to 30% less than when using the conventional commercial processes.[8]

Outlook

For the first time since the late 1980's, world production of asbestos appears to be leveling off. Despite this slackening in the rate of decline, there still is considerable opposition to the use of asbestos in consumer and building products. It is anticipated that this opposition will continue to affect markets and world production and demand will continue to decrease. Rather than the double-digit declines observed in the late 1980's and early 1990's, future declines should be at considerably lower rates.

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[6]Industrial Minerals (London). LAB Halts Asbestos Output at BC/Beaver. No. 330, Mar. 1995, p. 10.

[7]Gibbens, R. Noranda to Produce Magnesium from Asbestos Waste. Financial Times, Mar. 9, 1995.

[8]Chemical Engineering. How to Make Magnesium from Asbestos Waste. V. 102, No. 10, Oct. 1995, p. 27.

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TABLE 1
SALIENT ASBESTOS STATISTICS 1/

(Metric tons unless otherwise specified)

		1991	1992	1993	1994	1995
United States:						
Production (sales):						
Quantity		20,100	15,600	13,700	10,100	W
Value 2/	thousands	$7,690	$6,140	$5,960	$5,120	W
Exports and reexports 3/ (unmanufactured):						
Value	thousands	$7,420	$6,720	$8,440	$6,550	$6,010
Exports and reexports of asbestos products:						
Value	thousands	$116,000	$134,000	$141,000	$177,000	$180,000
Imports for consumption 4/ (unmanufactured):						
Quantity		34,800	31,600	30,800	25,800	21,900
Value	thousands	$8,900	$7,210	$6,960	$5,390	$4,810
Consumption, apparent 5/		34,800	32,800	31,600	26,800	22,000
World: Production		3,530,000 r/	3,120,000 r/	2,830,000 r/	2,460,000 r/	2,410,000 e/

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.
1/ Data are rounded to three significant digits.
2/ F.o.b. mine.
3/ F.A.S. value, includes exports of crudes, fibers, stucco, sand, and refuse. May also include nonasbestos materials.
4/ U.S. Customs declared value.
5/ Production, plus imports, minus producer exports of asbestos fiber, plus adjustments in Government and industry stocks.

TABLE 2
U.S. ASBESTOS CONSUMPTION BY END USE, GRADE, AND TYPE 1/ 2/

(Metric tons)

	Chrysotile							
End use	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Total	Crocidolite	Total asbestos
1994	324	615	864	364	24,700	26,800	(3/)	26,840
1995:								
Coatings and compounds	--	--	--	--	295	295	--	295
Friction products	--	3	295	263	6,460	7,020	--	7,023
Packing	--	6	180	101	2,360	2,650	--	2,651
Paper	--	--	--	--	453	453	--	453
Plastics	40	--	--	--	--	40	--	40
Roofing products	--	6	--	--	10,600	10,600	--	10,588
Other	31	279	67	--	214	591	192	783
Total	71	294	542	364	20,400	21,600	192 4/	21,994 5/

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Estimated distribution based upon data provided by the Asbestos Institute, Montreal, Canada, and the U.S. Geological Survey asbestos producer survey.
3/ May include imports of chrysotile. Estimated consumption of crocidolite was less than 1 ton.
4/ May include imports of chrysotile. Estimated consumption of crocidolite was less than 5 tons.
5/ Includes 162 tons for which the end use breakout is unknown.

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TABLE 3
CUSTOMS UNIT VALUES OF IMPORTED ASBESTOS

(Dollars per metric ton)

	1994	1995
Canada:		
Chrysotile:		
Crude	741	1,806
Spinning	410	461
Other	198	201
South Africa: Crocidolite 1/	369	196

1/ May include imports of chrysotile.

Source: Bureau of the Census.

TABLE 4
U.S. EXPORTS AND REEXPORTS OF ASBESTOS FIBERS AND PRODUCTS 1/ 2/

(Thousand dollars)

	1994			1995		
Country	Unmanufactured fiber 3/	Manufactured products 4/	Total	Unmanufactured fiber 3/	Manufactured products 4/	Total
Australia	24	1,250	1,270	23	1,300	1,320
Brazil	658	1,880	2,540	229	463	692
Canada	282	105,000	106,000	152	98,100	98,200
Germany	16	4,200	4,210	--	3,190	3,190
Japan	2,940	9,790	12,700	3,370	4,820	8,200
Korea, Republic of	135	2,050	2,190	212	4,050	4,260
Kuwait	--	115	115	--	78	78
Mexico	543	12,800	13,300	750	17,300	18,000
Saudi Arabia	142	506	648	--	1,370	1,370
Thailand	363	420	783	22	193	215
Turkey	--	140	140	--	257	257
United Kingdom	--	3,310	3,310	9	2,830	2,840
Venezuela	--	363	363	--	5,700	5,700
Other	1,450	35,200	36,600	1,240	40,100	41,400
Total	6,550	177,000	184,000	6,010	180,000	186,000

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ F.A.S. value.
3/ Includes exports of crudes, fibers, stucco, sand, and refuse. May also include nonasbestos materials.
4/ Also includes products manufactured using asbestos substitutes.

Source: Bureau of the Census.

TABLE 5
U.S. EXPORTS AND REEXPORTS OF ASBESTOS AND ASBESTOS PRODUCTS 1/

	1994		1995	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
Unmanufactured:				
Asbestos 3/	17,500	$6,550	14,600	$6,010
Manufactured:				
Asbestos fibers	NA	746	NA	744
Brake linings and disk brake pads 4/	NA	149,000	NA	147,000
Clutch facings and linings 5/	NA	9,270	NA	8,450
Clothing, cord, fabric, and yarn	NA	2,670	NA	1,520
Gaskets, packing and seals	NA	3,130	NA	3,870
Panel, sheet, tile, and tube 6/	NA	5,150	NA	7,330
Paper and millboard	NA	873	NA	3,140
Other articles 7/	NA	6,030	NA	7,910
Total	XX	177,000	XX	180,000

NA Not available. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ F.A.S. value.
3/ Includes crudes, fibers, stucco, sand, and refuse. May also include nonasbestos materials.
4/ Includes asbestos and cellulose fiber brakes and similar materials.
5/ Includes clutches and other friction materials, excluding brakes and brake pads.
6/ Includes asbestos cement and cellulose fiber cement products.
7/ Includes asbestos and cellulose fiber products.

Source: Bureau of the Census.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF ASBESTOS FIBERS, BY TYPE, ORIGIN, AND VALUE 1/ 2/

	Canada		Other		Total	
Type	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1994:						
Chrysotile:						
Crude	101	$73	28	$22	129	$96
Spinning fibers	752	228	35	94	787	323
All other	22,200	4,280	8	15	22,200	4,290
Crocidolite (blue) 3/	242	89	--	--	242	89
Other (unspecified asbestos type)	2,430	575	14	8	2,440	583
Total	25,700	5,250	85	140	25,800	5,390
1995:						
Chrysotile:						
Crude	20	5	75	167	95	172
Spinning fibers	430	101	41	116	471	217
All other	19,100	3,770	46	84	19,200	3,850
Crocidolite (blue) 3/	192	38	--	--	192	38
Other (unspecified asbestos type)	2,010	530	--	--	2,010	530
Total	21,800	4,440	162	367	21,900	4,810

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ U.S. Customs declared value.
3/ Reported by the Bureau of the Census. Its source and low value suggest the imports labeled as crocidolite were primarily chrysotile.

Source: Bureau of the Census.

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TABLE 7
ASBESTOS: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1991	1992	1993	1994	1995 e/
Argentina	270 e/	215	309	350 e/	300
Bosnia and Herzegovina e/ 4/	XX	500	500	300	--
Brazil	237,000	170,000	185,000 r/	192,000 r/	190,000
Bulgaria	400	500	500 r/ e/	500 r/ e/	500
Canada	639,000	591,000	523,000 r/	531,000 r/	511,000 5/
China e/	200,000	240,000	240,000	240,000	240,000
Colombia	7,830	7,900	-- r/	-- r/	--
Egypt	450	373	436	400 e/	400
Greece	4,730	30,000 r/ e/	50,000 r/	50,000 r/	75,000
India	24,100	43,700	44,100 r/	28,900 r/	30,000
Iran e/	3,000	4,300	4,500	4,500	4,500
Italy	15,000 e/	--	--	--	--
Japan e/	25,000	29,500	24,900	21,000 r/	20,000
Kazakstan e/	XX	400,000	325,000	300,000	250,000
Korea, Republic of	1,500 e/	2,310	2,200	2,000 e/	1,800
Russia e/	XX	1,500,000	1,000,000	800,000	800,000
Serbia and Montenegro 4/	XX	1,180	314 r/	498 r/	300
South Africa	149,000	133,000	104,000	92,100 r/	95,000
Swaziland	13,900	32,300	33,900	35,000 e/	35,000
U.S.S.R. e/ 6/	2,000,000	XX	XX	XX	XX
United States (sold or used by producers)	20,100	15,600	13,700	10,100	W
Yugoslavia 4/ 7/	6,170	XX	XX	XX	XX
Zimbabwe	142,000	150,000	157,000	152,000 r/	150,000
Total	3,490,000	3,350,000 r/	2,710,000 r/	2,460,000 r/	2,400,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; excluded from "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Marketable fiber production. Table includes data available through May 13, 1996.

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

4/ All production from Yugoslavia in 1991 came from Bosnia and Herzegovina and Serbia and Montenegro.

5/ Reported figure.

6/ Dissolved in Dec. 1991.

7/ Dissolved in Apr. 1992.

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