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.

Domestic production data for asbestos were collected by means of a voluntary survey of two mining operations. Both operations responded, representing 100% of the total sales data shown in table 1.

Legislation and Government Programs

The Mine Safety and Health Administration continued reviewing its proposed revisions to existing standards for air quality and chemical substances, including the lowering of permissible exposure levels to asbestos from 2.0 fibers per cubic centimeter to 0.2 fibers per cubic centimeter.[1]

The Environmental Protection Agency (EPA) proposed to amend its Worker Protection Rule for asbestos abatement projects. The proposed change would incorporate asbestos workplace standards developed by the Occupational Safety and Health Administration (OSHA) and extend coverage to include State and local workers not covered by EPA or OSHA asbestos abatement plans. The proposed rule also would amend the Asbestos Hazard Emergency Response Act.[2]

EPA issued a ruling that specifies the types of roof removal operations that are covered by the National Emission Standards for Hazardous Air Pollutants (NESHAP) and roof removal work practices that are in compliance with the NESHAP.[3]

OSHA amended its standards for occupational exposure to asbestos in general industry and the construction industry. The time-weighted-average permissible exposure limit for asbestos was reduced from 0.2 fiber per cubic centimeter to 0.1 fiber per cubic centimeter in all industries. The rule includes a new job classification scheme for construction and shipyard work, an asbestos identification requirement for asbestos containing building materials, notification requirements for abatement work, and control methods for brake and clutch repairs.[4]

A wide variety of asbestos-containing civilian products also have military applications. Examples include friction materials (brakes and clutches), electrical and thermal insulations, packings and gaskets, asbestos-reinforced plastics, etc., for use on military vehicles, ships, rockets, missiles, and in military construction. 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 9,770 tons of chrysotile, 30,900 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, one of six commercial varieties of asbestos. KCAC operated a mine in a highly sheared serpentinite composed of matted, short fiber chrysotile and unfractured serpentinite (also referred to as a mass fiber deposit). The ore was stripped, and wet processing was used to beneficiate the fiber. Vermont Asbestos Group Inc., Orleans County, VT, sold asbestos fiber from inventory. While the California company produced only short fiber chrysotile, the Vermont company produced a wide range of chrysotile grades.

Domestic production (sales) declined from 13.7 thousand tons in 1993 to 10.1 thousand tons in 1994. *(See table 1.)*

Consumption

U.S. consumption of asbestos decreased from 31.6 thousand tons in 1993 to 26.8 thousand tons in 1994. Reported consumption declined in most industry segments. The two largest consumers of asbestos were the roofing products and friction products industries with 47% and 35% of the market, respectively.

More than 99% of the asbestos consumed domestically was chrysotile. The remainder was crocidolite. Ninety-two percent of the chrysotile consumed in the United States was grade 7, followed by grades 5, 4, 6, and 3. *(See table 2.)*

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 increased from $435 per ton in 1993 to $506 per ton in 1994. The increase was attributed to increased sales of higher value fiber in 1994 compared to 1993. Unit values for all varieties of imported asbestos ranged from $177 per ton to $3,401 per ton and averaged $209 per ton. Unit values for all varieties of exported asbestos ranged from $192 per ton to $5,380 per ton and averaged $375 per ton.

The customs unit value for imported chrysotile ranged from $177 per ton to $3,401 per ton. The customs unit value for imported crude chrysotile was $741 per ton. This is comparable to the unit values of the early 1990's. The high unit value in 1993 was the result of a single shipment of a high-value fiber. The unit value for spinning grade chrysotile increased in 1993 and the unit value for other chrysotile types declined. The customs unit value for imported crocidolite was reported to be $369 per ton. This is considerably lower than in previous years. Based on the lack of any significant markets in the United States, the source of the asbestos listed under the crocidolite category (Canada), and the low unit value, imports reported as crocidolite probably should have been reported as chrysotile. *(See*

tables 3 and 6.)

Approximate equivalents, in dollars per metric ton, of price ranges quoted in Industrial Minerals (London), December 1994, for Canadian chrysotile, f.o.b. mine, ranged between $210 per ton and $1,750 per ton, depending on the grade. Crocidolite from the Republic of South Africa ranged from $640 per ton to $920 per ton, depending on the grade. 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 total value of asbestos fibers and asbestos products exported and reexported increased in 1994. Canada was the largest importer of unmanufactured fibers and manufactured products from the United States, followed by Mexico and Japan. *(See table 4.)* The largest increase in export value was observed under the brake and clutch lining categories. *(See table 5.)* It is likely that nonasbestos products (products based on cellulose, magnesium carbonate, or other minerals) included under the asbestos export codes contributed to this increase in export values based on the slight decrease in domestic asbestos consumption for these products in 1994. Exports and reexports of brake linings and disk pads accounted for 84% of the value of all manufactured asbestos products.

The Bureau of the Census reported that 17,500 tons of asbestos were exported in 1994. This category includes asbestos crudes, stucco, sand, and refuse as well as asbestos fiber. 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 reported to be slightly less than 10,000 tons by domestic producers in 1994.

Canada supplied nearly all of the asbestos imported into the United States and most of the asbestos fiber imported into the United States was chrysotile. *(See table 6.)* According to the Bureau of the Census, 242 tons of asbestos imports were reported as crocidolite in 1994. Markets for crocidolite, however, are very limited and consumption was estimated to be less than one ton. Asbestos imports reported as crocidolite probably were chrysotile based on the source (Canada) and the unit value of the shipments ($369 per ton). Asbestos under the "Other" category in table 6 was imported from Canada and assumed to be chrysotile.

World Review

World production of asbestos was estimated by the U.S. Bureau of Mines (USBM) to be 2.41 million tons. The Department of Natural Resources Canada (DNR), however, estimated world production to be 2.74 million tons. The difference between the two numbers occurred because the USBM estimated production for the Commonwealth of Independent States (CIS) to be 1.1 million tons and DNR estimated production to be 1.4 million tons. Despite the difference in the estimates for the CIS, Russia continued to be the largest producer of asbestos, followed by Canada, Kazakhastan, and China. Canada, Kazakhastan, and Russia accounted for approximately 67% of the world production. *(See table 7.)*

Outlook

World production has declined to approximately 50% of that of the late 1970's. The decline was largely in response to the opposition to the use of asbestos in consumer and building products. Opposition to the use of asbestos will continue to affect world demand although its impact will not be as great as in previous years. World production probably will decline but at a much lower rate than was observed between 1989 and 1994.

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[1]Federal Register. Mine Safety and Health Administration. Air Quality, Chemical Substances, and Respiratory Protection Standards. V. 56, No. 39, Feb. 27, 1991, pp. 8168-8171.

[2]———. Environmental Protection Agency. Asbestos Worker Protection; Asbestos-Containing Materials in Schools; Proposed Amendment. V. 59, No. 210, Nov. 1, 1994, pp. 54746-54779.

[3]———. Environmental Protection Agency. Interpretive Rule for Roof Removal Operations Under the Asbestos NESHAP. V. 59, No. 116, June 17, 1994, pp. 31157-31161.

[4]———. Occupational Safety and Health Administration. Occupational Exposure to Asbestos. V. 59, No. 153, Aug. 10, 1994, pp. 40964-41162.

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TABLE 1
SALIENT ASBESTOS STATISTICS 1/
(Metric tons unless otherwise specified)

		1990	1991	1992	1993	1994
United States:						
Production (sales):						
Quantity		W	20,100	15,600	13,700	10,100
Value 2/	thousands	W	$7,690	$6,140	$5,960	$5,120
Exports and reexports 3/ (unmanufactured):						
Value	thousands	$7,960	$7,420	$6,720	$8,440	$6,550
Exports and reexports of asbestos products:						
Value	thousands	$120,000	$116,000	$134,000	$141,000	$177,000
Imports for consumption 4/ (unmanufactured):						
Quantity		41,300	34,800	31,600	30,800	25,800
Value	thousands	$10,800	$8,900	$7,210	$6,960	$5,390
Consumption, apparent 5/		41,300	34,800	32,800	31,600	26,800
World: Production		4,010,000 r/ 6/	3,490,000 r/	3,320,000 r/	2,650,000 r/	2,410,000 e/

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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.
6/ Does not include U.S. production.

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

End use	Chrysotile							Total
	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Total	Crocidolite	Asbestos
1993 total	158	1,080	1,680	460	28,200	31,600	18	31,600
1994:								
Coatings and compounds	--	--	--	--	290	290	--	290
Friction products	8	--	521	268	8,660	9,460	--	9,460
Packing	1	25	284	96	2,350	2,750	--	2,750
Paper	--	--	--	--	270	270	--	270
Plastics	39	--	--	--	52	91	--	91
Roofing products	--	8	--	--	12,600	12,600	--	12,600
Other	276	582	59	--	457	1,370	--	1,370
Total	324	615	864	364	24,700	26,800	(3/)	26,800

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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. Bureau of Mines asbestos producer survey.
3/ May include imports of chrysotile. Estimated consumption of crocidolite was less than one ton.

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TABLE 3
CUSTOMS UNIT VALUES OF IMPORTED ASBESTOS
(Dollars per metric ton)

	1993	1994
Canada:		
Chrysotile:		
Crude	1,519	741
Spinning	350	410
Other	224	198
South Africa, Republic of:		
Amosite	--	--
Crocidolite	--	369 1/

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)

Country	1993			1994		
	Unmanufactured fiber 3/	Manufactured products 4/	Total	Unmanufactured fiber 3/	Manufactured products 4/	Total
Australia	21	865	887	24	1,250	1,270
Brazil	600	515	1,120	658	1,880	2,540
Canada	289	84,700	85,000	282	105,000	106,000
Germany	--	4,560	4,560	16	4,200	4,210
Japan	3,350	11,100	14,400	2,940	9,790	12,700
Korea, Republic of	313	2,140	2,460	135	2,050	2,190
Kuwait	91	69	160	--	115	115
Mexico	605	9,630	10,200	543	12,800	13,300
Saudi Arabia	142	1,010	1,150	142	506	648
Thailand	255	637	892	363	420	783
Turkey	--	529	529	--	140	140
United Kingdom	--	2,340	2,340	--	3,310	3,310
Venezuela	--	489	489	--	363	363
Other	2,770	22,500	25,200	1,450	35,200	36,600
Total	8,440	141,000	150,000	6,550	177,000	184,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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/

	1993		1994	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
Unmanufactured:				
Asbestos 3/	27,600	$8,440	17,500	$6,550
Manufactured:				
Asbestos fibers	NA	723	NA	746
Brake linings and disk brake pads 4/	NA	114,000	NA	149,000
Clutch facings and linings 5/	NA	7,190	NA	9,270
Clothing, cord, fabric, and yarn	NA	1,410	NA	2,670
Gaskets, packing and seals	NA	4,660	NA	3,130
Panel, sheet, tile, and tube 6/	NA	6,430	NA	5,150
Paper and millboard	NA	947	NA	873
Other articles 7/	NA	6,130	NA	6,030
Total	XX	141,000	XX	177,000

NA Not available. XX Not applicable.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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		South Africa, Republic of		Other		Total	
Type	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1993:								
Chrysotile:								
Crude	16	24	--	--	--	--	16	24
Spinning fibers	935	267	--	--	43	75	978	342
All other	26,600	5,830	--	--	88	152	26,700	5,980
Crocidolite (blue) 3/	18	4	--	--	--	--	18	4
Other (unspecified asbestos type)	3,100	604	--	--	--	--	3,100	604
Total	30,700	6,730	--	--	131	227	30,800	6,960
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

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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/	1990	1991	1992	1993	1994 e/
Argentina	275	270	215 r/	309 r/	350
Bosnia and Herzegovina e/ 4/	XX	XX	500	500	300
Brazil	205,000	237,000 e/	170,000 r/	175,000 r/	175,000
Bulgaria	500	400	500 r/ e/	400	400
Canada	725,000 r/	639,000	591,000	517,000 r/	518,000
China e/	221,000	200,000	240,000	240,000	240,000
Colombia	8,000 e/	7,830 r/	7,900	8,000	7,500
Egypt	369	450	373	436 r/	400
Greece	66,000 r/	4,730	--	--	--
India	26,100 r/	24,100 r/	43,700 r/	43,600 r/	44,000
Iran e/	2,800	3,000	4,300	4,500	4,500
Italy	3,860	15,000 e/	--	--	--
Japan e/	5,000	25,000	29,500	24,900 r/	25,000
Kazakhstan e/	XX	XX	400,000 r/	325,000 r/	300,000
Korea, Republic of	1,530	1,500 e/	2,310 r/	2,200	2,000
Russia e/	XX	XX	1,500,000	1,000,000	800,000
Serbia and Montenegro 4/	XX	XX	1,180	1,100 e/	1,100
South Africa, Republic of	146,000 r/	149,000 r/	133,000	104,000 r/	94,800 5/
Swaziland	35,900	13,900 r/	32,300	33,900 r/	35,000
U.S.S.R. e/ 6/	2,400,000	2,000,000	XX	XX	XX
United States (sold or used by producers)	W	20,100 r/	15,600 r/	13,700	10,100 5/
Yugoslavia 4/ 7/	6,580 r/	6,170 r/	XX	XX	XX
Zimbabwe	161,000 r/	142,000 r/	150,000	157,000 r/	150,000
Total	4,010,000	3,490,000 r/	3,320,000 r/	2,650,000 r/	2,410,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; excluded from "Total." XX Not applicable.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Marketable fiber production. Table includes data available through Apr. 18, 1995.
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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