ASBESTOS

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The first stage of a regulation enacted by the Environmental Protection Agency (EPA) that phases out the use of asbestos went into effect on August 27, 1990. Health and liability issues continued to be a major factor in determining the economic stability of several former producers of asbestos products. The number of firms that produce asbestos-containing products continued to decline in response to these issues. Domestic asbestos production increased slightly from that of 1989, but consumption decreased 25%, from 55,306 to 41,348 tons. Asbestos was consumed domestically for roofing products, 37%; friction products, 26%; asbestos-cement pipe, 15%; packing and gaskets, 8%; and other, 14%.

DOMESTIC DATA COVERAGE

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

ANNUAL REVIEW

Legislation and Government Programs

The first stage of the EPA rule banning the manufacture, importation, processing, and distribution of most asbestos-containing products was implemented on August 27, 1990. The first stage banned the production of asbestos-containing flooring and roofing felt, pipeline wrap, asbestos-cement corrugated and flat sheet, vinyl asbestos floor tile, and asbestos clothing. Sales of these materials are banned after August 25, 1992.[1] The validity of the regulation was contested in legal briefs filed on behalf of the Asbestos Information Association of North America, Asbestos-Cement Pipe Producers Association, the Asbestos Institute, and several other organizations and trade associations.[2]

The EPA issued revisions to the national emission standards for hazardous air pollutants under the Clean Air Act for asbestos. The revisions require daily monitoring of visible emissions

TABLE 1

SALIENT ASBESTOS STATISTICS

		1986	1987	1988	1989	1990
United States:						
Production (sales):						
Quantity	metric tons	51,437	50,600	18,233	17,427	W
Value[1]	thousands	$17,367	$17,198	W	W	W
Exports and reexports (unmanufactured):						
Quantity	metric tons	47,281	60,084	31,544	27,004	27,965
Value	thousands	$14,520	$16,149	$8,468	$7,690	$7,964
Exports and reexports of asbestos products:						
Value	do.	$163,896	$180,602	$194,858	$153,081	$120,328
Imports for consumption (unmanufactured):						
Quantity	metric tons	108,352	93,763	85,326	55,306	41,348
Value	thousands	$26,537	$22,022	$21,528	$14,031	$10,773
Consumption, apparent[2]	metric tons	119,627	84,279	71,354	55,306	41,348
World: Production	do.	r4,029,364	r4,235,458	r4,316,443	r4,242,973	[3] e3,979,500

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data.

[1] F.o.b. mine.

[2] Production plus imports minus exports plus adjustments in Government and industry stocks.

[3] Does not include U.S. production.

Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 1 of 7
Published by AsbestosClaims.Law
asbestosclaims.law/library/11027/1

for milling, manufacturing, and fabricating operations; weekly inspection of air cleaning devices; and recordkeeping. Notification requirements for demolitions and renovations are revised, and recordkeeping is required for asbestos waste disposal.[3]

The EPA published a summary of information submitted by manufacturers and processors of certain asbestos products in accordance with the Asbestos Information Act of 1988. The summary provided the names and addresses of the manufacturer, the type of materials produced, the years in which the materials were manufactured, and identifying characteristics of these materials.[4]

The Mine Safety and Health Administration (MSHA) issued a proposed rule to establish a hazard communication standard. The standard would require mine operators to assess the hazards of chemicals they produce or use and provide information to their employees concerning chemical hazards, including asbestos. Employers also would have to establish a hazard communication program, label containers, provide access to material safety data sheets, and provide employee training. Mixtures containing more than 0.1% of a carcinogen would be assumed to present a carcinogenic hazard.[5]

The MSHA 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 centimeters.[6]

The Occupational Safety and Health Administration (OSHA) conducted public hearings on the regulation governing exposure to the nonasbestiform varieties of actinolite, anthophyllite, and tremolite. An administrative stay was extended through August 31, 1991, on the regulation while it continued to review submissions to the docket.[7] OSHA revised that section of the rule covering asbestos to reduce the short-term exposure limit to 1 fiber per cubic centimeter, to expand its ban on smoking in the workplace, and to increase worker risk awareness training.[8] OSHA proposed to reduce the personal exposure limit from 0.2 fiber cubic centimeters to 0.1 fiber cubic centimeters, to require modified work practices to reduce exposures in certain occupations, to require additional warning of asbestos risks to owners and occupants of buildings prior to asbestos abatement operations, and to require oversight of all abatement work.[9]

The National Institute for Occupational Safety and Health (NIOSH) issued a request for information on synthetic and natural mineral fibers, including asbestos, nonasbestiform amphiboles, glass fibers, mineral wool, and refractory and aluminosilicate ceramic fibers. The type of information that NIOSH requested covered the types of operations that mine, produce, or process these fibers; the number of workers in these occupations; and exposure data to these fibers. Other information requested included the results of medical and epidemiological studies of persons exposed to these fibers, the results of experimental animal studies in which these fibers were used, and criteria for defining fibers.[10]

The EPA continued to review proposed changes in the national primary and secondary drinking water regulations. The proposal covers 30 organic chemicals and 8 inorganic chemicals, including asbestos. The proposed maximum contaminant level goal for asbestos is 7 million fibers (longer than 10 micrometers) per liter.[11]

Strategic Considerations

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, and asbestos-reinforced plastics for use on military vehicles, ships, rockets, missiles, and in military construction. During World War II and the Korean War, strict controls were placed on the export of asbestos because the United States was dependent on foreign sources for about 90% of its requirements of all grades of asbestos. The United States was totally dependent on foreign sources for low-iron, spinning-grade chrysotile. Since that time, equipment components have been redesigned, new products have been introduced, and substitutes for asbestos are being used more frequently. Many of the asbestos-containing civilian products that are used by the military will be eliminated because of the EPA-mandated phaseout of asbestos. Because of the trend toward lower asbestos consumption, the Department of Defense has authorized the disposal of 6,155 tons of chrysotile, 33,844 tons of amosite, and 33 tons of crocidolite from the National Defense Stockpile.

Issues

Environmental and liability issues continued to affect the asbestos industry. The first stage of the EPA regulation that phases out the use of asbestos went into effect in August 1990. The second and third phases become effective in 1993 and 1996, respectively. Most uses of asbestos will be banned after 1997. The EPA phaseout of asbestos is based on the assumption that there is no threshold level of exposure beyond which there is no reasonable risk. Industry representatives and many health scientists maintain that available data do not support this assumption and have challenged the legality of the regulation in court. A decision by the courts is expected in late 1991.

Production

Asbestos was produced in the United States by two companies, KCAC Inc., San Benito County, CA, and Vermont Asbestos Group Inc. (VAG), Orleans County, VT. 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. VAG operated an open pit mine in a serpentinite containing cross-fiber veins of chrysotile. Dry milling was used to process the fiber. While the California company produced only short fiber chrysotile, the Vermont company produced a wide range of chrysotile grades.

Domestic production increased slightly from that of 1989. While domestic markets for asbestos continued to weaken, foreign markets remained strong.

Consumption and Uses

Asbestos was used in a wide variety of products because of its high tensile strength, chemical and thermal stability, high flexibility, low electrical conductivity, and large surface area. Products made from asbestos were more heat resistant (and often incombustible), more resistant to chemical attack (particularly for alkalis), stronger (as-

Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 2 of 7
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bestos acted as a physical reinforcer), and less conductive (asbestos had a low dielectric constant). Products were also more viscose (asbestos stiffened compounds and coatings), faster setting (asbestos hastened water drainage in asbestos-cement pipe production), and more cost efficient than many nonasbestos products.

Asbestos cement is composed of 10% to 15% asbestos in a portland cement matrix. This mixture is widely used in the construction industry to produce corrugated and flat sheet, slates, and low- and high-pressure pipe. The main advantage of asbestos-cement products is that they are inexpensive, incombustible, corrosion resistant, and can be produced locally. Markets in North America and Western Europe have declined owing to maturing markets and environmental concerns. However, markets grew in South America, Southeast Asia, the Middle East, and Eastern Europe because of the demands of infrastructure development.[12]

U.S. consumption of asbestos decreased 25% in 1990. Approximately 83% of the asbestos consumed domestically was chrysotile, 2% was crocidolite, and 15% was an unspecified fiber type, most likely chrysotile. Approximately 76% of the chrysotile consumed in the United States was grade 7, followed by grades 4, 6, 5, and 3.

The construction industry is the major consumer of asbestos fiber in the form of asbestos-cement pipe and asbestos-cement sheet, coatings, compounds, packings, and roofing products. These end uses accounted for 70% of the asbestos consumed in the United States.

Apparent consumption has declined dramatically from 800,962 tons in 1973 to 41,348 tons in 1990 in response to environmental and liability issues. There is a continuing interest among manufacturers of both organic and inorganic fibers in acquiring portions of the asbestos market. Product 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, calcium silicate, carbon fiber, cellulose fiber, ceramic fiber, fibrous glass, graphite flake and fiber, 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; polyvinyl-chloride pipe; prestressed and reinforced concrete pipe; and semimetallic brakes.

Markets and Prices

The average unit value of domestically produced asbestos increased slightly from that of 1989. Unit values for imported asbestos ranged from $130 per ton to $1,629 per ton and averaged $261 per ton. Unit values for exported asbes-

TABLE 2

U.S. ASBESTOS CONSUMPTION, BY END USE, GRADE, AND TYPE

(Thousand metric tons)

End use	Chrysotile[1]							Amosite	Crocidolite	Other[3]	Total asbestos[4]
	Grades 1 and 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Total[2]				
1989	0.1	0.1	5.7	3.8	3.4	38.3	51.5	(5)	0.6	3.2	52.1
1990:											
Asbestos-cement pipe	—	—	3.2	.5	.9	—	4.6	—	.8	—	5.4
Asbestos-cement sheet	—	—	—	—	.9	.9	1.8	—	—	—	1.8
Coatings and compounds	—	—	—	—	—	1.7	1.7	—	—	—	1.7
Flooring products	—	—	—	—	—	—	—	—	—	—	—
Friction products	—	—	—	1.0	.5	7.9	9.3	—	—	—	9.3
Insulation:											
Electrical	—	—	—	—	—	—	—	—	—	—	—
Thermal	—	—	—	—	—	—	—	—	—	—	—
Packing and gaskets	—	—	(5)	.7	.1	1.8	2.7	—	—	—	2.7
Paper	—	—	—	—	—	.2	.2	—	—	—	.2
Plastics	—	—	—	—	—	.3	.3	—	—	—	.3
Roofing products	—	—	—	—	—	12.9	12.9	—	—	—	12.9
Textiles	—	—	—	—	—	—	—	—	—	—	—
Other	—	.1	.4	(5)	—	.4	.9	—	—	—	.9
Total[2]	—	.1	3.6	2.1	2.4	26.0	34.3	—	.8	6.2	35.1

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

Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 3 of 7
Published by AsbestosClaims.Law
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tos ranged from $128 per ton to $2,158 per ton and averaged $285 per ton. Customs unit values of imported crude chrysotile increased significantly because high-valued crude chrysotile from Canada and Zimbabwe was imported under this import category in 1990. The unit value of imported spinning chrysotile decreased 25% because lower valued chrysotile fiber was included under the "chrysotile, spinning" category. Approximate equivalents, in dollars per metric ton, of price ranges quoted in Industrial Minerals (London), December 31, 1990, for Canadian chrysotile, f.o.b. mine, were $1,320 to $2,125 for Group 3, $918 to $1,275 for Group 4, $604 to $714 for Group 5, $442 for Group 6, and $136 to $264 for Group 7.

TABLE 3

CUSTOMS UNIT VALUES OF IMPORTED ASBESTOS

(Dollars per metric ton)

	1986	1987	1988	1989	1990
Canada:					
Chrysotile:					
Crude	547	610	635	167	782
Spinning	507	598	756	387	291
Other	229	218	227	227	259
South Africa, Republic of:					
Amosite	—	—	—	3,728	—
Crocidolite	582	572	609	631	651

Source: Bureau of the Census.

Foreign Trade

The total value of asbestos fibers and asbestos products exported and reexported from the United States was $128,292,000. This is a 20% decrease from that of 1989. Exports and reexports of brake linings and disk pads accounted for 77% of the value of all manufactured asbestos products. Canada remained the largest importer of unmanufactured fibers and manufactured products, followed by Japan, the United Kingdom, Mexico, and the Federal Republic of Germany.

Canada provided approximately 98% of the asbestos imported into the United States, and the Republic of South Africa provided 2%. Zimbabwe supplied the remaining amount. Approximately 98% of the asbestos fiber imports was chrysotile.

World Review

Canada continued to be the largest market economy producer of asbestos, followed by Brazil, Zimbabwe, and the Republic of South Africa. The U.S.S.R. was the world's largest producer of asbestos. Canada and the U.S.S.R. accounted for 77% of the world production. Canada continued to be the largest exporter of asbestos.

Australia.—Woodsreef Mines continued to await governmental approval to rehabilitate its mine site. The site, consisting of an open pit mine and dry

TABLE 4

COUNTRIES IMPORTING U.S. ASBESTOS FIBERS AND PRODUCTS

(Thousand dollars)

Country	1989			1990		
	Unmanufactured fiber	Manufactured products	Total[1]	Unmanufactured fiber	Manufactured products	Total[1]
Australia	18	1,734	1,752	12	1,851	1,863
Brazil	785	4,203	4,988	534	4,171	4,705
Canada	884	98,974	99,859	472	58,458	58,930
Germany, Federal Republic of	93	3,801	3,894	63	5,479	5,542
Japan	3,314	7,211	10,526	4,119	10,938	15,057
Korea, Republic of	145	953	1,097	107	1,477	1,584
Kuwait	—	574	574	—	189	189
Mexico	370	5,797	6,166	529	5,822	6,350
Saudia Arabia	105	1,394	1,499	14	1,047	1,061
Thailand	10	167	177	81	280	360
Turkey	—	304	304	—	92	92
United Kingdom	75	4,841	4,916	134	6,517	6,650
Venezuela	50	709	759	13	712	725
Other	1,841	22,417	24,259	1,888	23,295	25,185
Total[1]	7,690	153,081	160,771	7,964	120,328	128,292

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

Source: Bureau of the Census.

Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 4 of 7
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TABLE 5

U.S. EXPORTS AND REEXPORTS OF ASBESTOS AND ASBESTOS PRODUCTS

		Quantity	Value (thousands)
1989:			
Unmanufactured:			
Asbestos[1]	metric tons	27,004	$7,690
Manufactured:			
Asbestos fibers	do.	r104	382
Brake linings and disk brake pads[2]		NA	127,182
Clutch facings and linings[3]	metric tons	NA	3,868
Clothing, cord, fabric, and yarn		NA	1,363
Gaskets, packing and seals	metric tons	NA	6,206
Panel, sheet, title, and tube[4]	do.	NA	4,773
Paper and millboard		NA	1,188
Other articles[5]		NA	8,119
Total		XX	153,081
1990:			
Unmanufactured:			
Asbestos[1]	metric tons	27,965	7,964
Manufactured:			
Asbestos fibers	do.	81	684
Brake linings and disk brake pads[2]		NA	93,125
Clutch facings and linings[3]	metric tons	NA	7,242
Clothing, cord, fabric, and yarn		NA	1,376
Gaskets, packing and seals	metric tons	NA	4,565
Panel, sheet, title, and tube[4]	do.	NA	4,109
Paper and millboard		NA	885
Other articles[5]		NA	8,341
Total[6]		XX	120,328

r Revised. NA Not available. XX Not applicable.
[1] Includes crudes, fibers, stucco, sand, refuse.
[2] Includes asbestos and cellulose fiber brakes and similar materials.
[3] Includes clutches and other friction materials, excluding brakes and brake pads.
[4] Includes asbestos-cement and cellulose fiber cement products.
[5] Includes asbestos and cellulose fiber products.
[6] Data may not add to totals shown because of independent rounding.

processing facility, closed in 1983. Woodsreef Mine and ICI Australia constructed a prototype wet milling facility in 1982 to demonstrate its ability to improve fiber recovery. The prototype mill achieved a recovery of 90% compared to 67% recovery with dry processing.[13]

Canada.—Baie Verte Mines completed construction and began operation of its wet-process plant in Newfoundland. The operation initially will process tailings from its dry mill plant. Later, it will be used to process stockpiled tailings. Fiber recovery is expected to approach 95%. The process permitted the company to manufacture a pelletized open fiber product that was easier to handle, generated less dust during handling, and was of higher and more consistent quality.[14]

Italy.—Amiantifera di Balangero SpA closed its asbestos mine at San Vittore. The company produced asbestos for use in cement, gaskets, brakes, paint, and insulation products.[15]

Current Research

A new application under study is the use of preimpregnated asbestos-containing products. An asbestos textile would be impregnated with a resin and heated sufficiently to partially polymerize the resin. At a later time, the impregnated fabric would be placed in a mold and heated to completely polymerize the resin and form the shaped part. Preimpregnation would reduce dust during handling by encapsulating the fiber, provide excellent resin-to-fiber bonding, provide a faster molding cycle, and permit a wide variation of performance characteristics by using different resins and resin-to-fiber ratios. Examples of potential applications include rocket blast pipe, electrical and thermal insulating panels, rocket fins, and clutch disks.[16]

OUTLOOK

Domestic markets will decline as each stage of the EPA phaseout of asbestos becomes effective and consumer demand for asbestos substitutes continues. Foreign markets for asbestos fiber should remain strong for several years because of the high demand in developing countries for proven, low-cost construction materials. The prospects for the domestic asbestos manufacturing industry are poor because of the EPA-mandated phaseout of asbestos.

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Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 5 of 7
Published by AsbestosClaims.Law
asbestosclaims.law/library/11027/5

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[13] Phelps, S. Asbestos—After the Dust Has Settled. Australian Min., v. 82, No. 6, June 1990, pp. 18–20.

[14] Stewart, P., G. French, and D. Anthony. Baie Verte Wet Process Plant. Ind. Miner., No. 273, June 1990, pp. 51–55.

[15] Industrial Minerals (London). Asbestos Mine in Bankruptcy. No. 276, Sept. 1990, p. 15.

[16] Asbestos. A Novelty: Preimpregnated Asbestos-Containing Materials. V. 4, No. 3, Dec. 1989, p. 3.

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TABLE 6

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)
1988	79,690	$18,336	4,288	$2,516	1,348	$676	85,326	$21,528
1989:								
Amosite	—	—	—	—	2	7	2	7
Chrysotile:								
Crude	205	34	—	—	—	—	205	34
Spinning fibers	5,214	1,877	39	46	130	161	5,383	2,084
All other	45,816	10,378	—	—	110	56	45,926	10,433
Crocidolite (blue)	19	16	574	359	—	—	593	374
Other (unspecified asbestos type)	2,318	656	427	224	452	218	3,197	1,098
Total[1]	53,572	12,961	1,040	628	694	442	55,306	14,031
1990:								
Chrysotile:								
Crude	188	137	—	—	17	23	205	160
Spinning fibers	840	185	—	—	58	77	898	261
All other	33,164	8,542	—	—	58	77	33,222	8,619
Crocidolite (blue)	—	—	835	544	—	—	835	544
Other (unspecified asbestos type)	6,188	1,188	—	—	—	—	6,188	1,188
Total[1]	40,380	10,052	835	544	133	177	41,348	10,773

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

Source: Bureau of the Census.

Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 6 of 7
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TABLE 7

ASBESTOS: WORLD PRODUCTION, BY COUNTRY[1]

(Metric tons)

Country[2]	1986	1987	1988	1989	1990[e]
Argentina	1,697	332	2,328	r225	300
Brazil[3]	204,460	212,807	227,653	r206,195	210,000
Bulgaria	300	400	e400	e400	400
Canada (shipments)	662,381	664,546	r710,357	r701,227	682,200
China	150,712	144,673	157,478	e160,000	160,000
Colombia[e 4]	6,500	6,600	7,600	r7,900	8,000
Cyprus	13,011	18,070	14,585	—	—
Egypt	476	209	166	r312	300
Greece	51,355	r60,134	r e71,000	r e72,500	72,500
India	25,236	29,110	r31,123	r36,502	37,000
Iran (concentrate)[e]	3,000	3,300	r3,400	r3,500	3,500
Italy	115,208	r118,352	94,549	r54,500	20,000
Japan	3,593	3,143	e3,000	e3,000	3,500
Korea, Republic of	2,983	2,518	2,428	r2,361	2,300
South Africa, Republic of	138,862	135,074	145,678	r155,462	147,500
Swaziland	r24,475	25,925	22,804	r27,291	35,000
Turkey	1,098	r806	r e50	([5])	—
U.S.S.R.[e]	2,400,000	[6]2,554,600	2,600,000	2,600,000	2,400,000
United States (sold or used by producers)	51,437	50,600	18,233	17,427	W
Yugoslavia	8,596	10,964	17,030	r7,105	7,000
Zimbabwe	163,984	r193,295	186,581	r187,066	190,000
Total	r4,029,364	r4,235,458	r4,316,443	r4,242,973	3,979,500

[e] Estimated. r Revised. W Withheld to avoid disclosing company proprietary data; excluded from "Total."

[1] Marketable fiber production. Table includes data available through Apr. 15, 1991.

[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] Excludes direct sales of run-of-mine material of 2,060 metric tons in 1986, zero in 1987-88, and estimated zero in 1989-90.

[4] Estimated fiber production based on reported crude production, in metric tons, of: 1986—129,155; 1987—132,723; 1988—152,896; 1989—158,149; and 1990—160,000 (estimated).

[5] Revised to zero.

[6] Reported figure.

Minerals Yearbook: Asbestos Chapters, 1990
ACL Doc 11027 · Page 7 of 7
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