Asbestos

By Timothy C. May [1]

PRODUCTION of asbestos in the United States increased 25 percent in 1963 over 1962 due chiefly to greater output from California mines. Despite this increase, the United States produced only 9 percent of its requirements, while consuming 23 percent of the world production. Canada continued to be the world's leading supplier with 40 percent of the total. The United States ranked sixth among world producers.

LEGISLATION AND GOVERNMENT PROGRAMS

The Office of Minerals Exploration (OME) offered financial assistance up to 50 percent of approved costs in approved exploratory programs for strategic grades of asbestos. No contract was made for asbestos in 1963.

Under the Agricultural Trade Development and Assistance Act of 1954 (Public Law 480, 83d Cong.) the Department of Agriculture through the Commodity Credit Corporation (CCC) bartered surplus agricultural commodities for amosite, chrysotile, and crocidolite asbestos. A total of 16,467 tons was acquired under the program in 1963, consisting of 8,003 tons of amosite, 513 tons of chrysotile, and 7,951 tons of crocidolite.

TABLE 1.—Salient asbestos statistics

	1954–58 (average)	1959	1960	1961	1962	1963
United States:						
Production (sales)—short tons	44,227	45,459	45,223	52,814	53,190	66,606
Value—thousands	$4,794	$4,391	$4,231	$4,347	$4,677	$5,425
Imports for consumption (unmanufactured)—short tons	687,157	713,047	669,496	616,529	[1] 675,953	667,860
Value—thousands	$59,434	$65,006	$63,345	$58,942	[1] $64,112	$61,739
Exports (unmanufactured) short tons	2,710	4,461	5,525	3,799	2,949	10,044
Value—thousands	$342	$793	$857	$759	$598	$1,304
Exports of asbestos products (value)[2] thousands	$13,396	$12,921	$13,703	$13,825	$14,274	$16,315
Consumption, apparent [3]—short tons	728,674	754,045	709,194	665,544	[1] 726,194	724,422
World: Production—do	1,949,000	2,260,000	2,440,000	2,770,000	3,055,000	3,200,000

[1] Revised figure.
[2] Includes reexports.
[3] Measured by quantity produced, plus imports, minus exports.

[1] Commodity specialist, Division of Minerals.

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DOMESTIC PRODUCTION

Asbestos production in the United States in 1963 showed a substantial increase over 1962. Production increased 25 percent in quantity and 16 percent in value compared with 1962. Most of the rise in quantity came from the California mines.

The largest producer of asbestos in the United States continued to be the Vermont Asbestos Mines Division of Ruberoid Co. which operates at Belvidere Mountain near Hyde Park, Vt. Second largest producer was Jefferson Lake Asbestos Corp., Calaveras County, Calif.

Production and shipments were reported by the following California companies: Jefferson Lake Asbestos Corp., Calaveras County; Atlas Mineral Corp. (new producer), and Coalinga Asbestos Co., Inc., Fresno County; Asbestos Bonding Co., Napa County; and Union Carbide Corp. (Nuclear Division), San Benito County.

Four companies reported shipments from mines in Gila County, Ariz.; Asbestos Manufacturing Co. (new producer), Jaquays Mining Corp., Metate Asbestos Corp., and Phillips Asbestos Mines. Pan American Fiber Corp. discontinued mining operations.

Amphibole asbestos was produced at the Burnsville mine of the Powhatan Mining Co., in Yancey County, N.C.

No asbestos was produced in Oregon in 1963.

Union Carbide Corp. commenced operation of its experimental pilot plant for processing asbestos fiber near King City, Calif.[2]

Western States Minerals Company announced discovery of an asbestos deposit in the Big Blue Hills area of western Fresno County. The company leased 720 acres of land in the area.

CONSUMPTION AND USES

Total consumption of asbestos was 724,000 tons in 1963 compared with 726,000 tons in 1962. The consumption of chrysotile represented 96 percent of the total U.S. consumption of asbestos. Domestic mines supplied 11 percent of short fiber chrysotile consumed. Amosite consumption, represented by imports, was 22,000 tons compared with 20,000 tons in 1962, and crocidolite consumption decreased to 11,000 tons from 17,000 tons in 1962.

STOCKS

Strategic stockpile inventories on December 31, 1963, were as follows: Amosite, 11,705 tons; chrysotile, 6,224 tons; crocidolite (soft), 1,567 tons. Supplemental and CCC stockpiles consisted of the following: Amosite, 28,600 tons; chrysotile, 2,852 tons; crocidolite, 27,437 tons. Also, 2,348 tons of non-stockpile-grade chrysotile was held in the Defense Production Act stockpile and 3,193 tons in the supplemental stockpile. Maximum objectives remained at 45,000 tons for amosite and 11,000 tons for chrysotile. No objective was set for crocidolite. The total acquisition cost for stockpile-grade amosite was $9,724,100 and for chrysotile, $5,215,500.

[2] Mining World. Union Carbide Building Pilot Plant for Asbestos Production. V. 25, No. 3, March 1963, pp. 38–39.

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PRICES

Market quotations for Canadian (Quebec and British Columbia) chrysotile, f.o.b. mine, and United States (Vermont) chrysotile f.o.b. Hyde Park or Morrisville, remained unchanged from prices listed for 1962. Arizona chrysotile quotations remained the same in 1963 as in 1962 except for Group No. 5, which increased from a range of $225 to $375 in 1962 to $250 to $400 in 1963.

Market quotations were not available for African, Australian, and South American asbestos because sales were negotiated separately. U.S. Department of Commerce reports show the following figures for imports in 1962 and 1963, per short ton:

	Per short ton	
	1962	*1963*
Imports:		
Amosite: South Africa	$164	$158
Crocidolite:		
Australia	201	190
South Africa, Republic of	221	212

FOREIGN TRADE

Total imports of asbestos were 1 percent less than in 1962. Imports of amosite increased 5 percent, crocidolite decreased 35 percent, and chrysotile decreased 1 percent compared with 1962.

Imports of low-iron spinning-length chrysotile from British Columbia, Canada decreased from 5,077 tons in 1962 to 4,698 tons and imports of all grades of fiber increased from 12,930 tons to 14,088 in 1963. Ninety-seven percent of the total chrysotile imported was fiber of less than spinning length.

Imports from Australia consisted of crocidolite. The Republic of South Africa was the only source of amosite, and it supplied both crocidolite and chrysotile. Only chrysotile was imported from other countries.

Exports of unmanufactured asbestos rose to 10,000 short tons compared with 3,000 tons in 1962.

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TABLE 2.—U.S. imports for consumption of asbestos (unmanufactured), by classes and countries

Year and country	Crude (including blue fiber)		Textile fiber [1]		All other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1962:								
North America: Canada	[2] 238	$55,411	14,816	$5,875,484	608,757	$49,003,906	[2] 623,811	$54,934,801
South America: Bolivia [3]	1	300					1	300
Europe:								
Finland					440	18,150	440	18,150
Italy [1]	9	10,585			28	5,123	37	15,708
Portugal [1]					23	2,374	23	2,374
Yugoslavia	3,444	119,614			11	542	3,455	120,156
Africa:								
Rhodesia and Nyasaland, Federation of [1 4]	[2] 4,091	[2] 821,144			1,908	366,056	[2] 5,999	[2] 1,187,200
South Africa, Republic of [1]	30,250	5,514,426			4,412	803,274	34,662	6,317,700
Oceania: Australia	7,525	1,515,323					7,525	1,515,323
Total	[2] 45,558	[2] 8,036,803	14,816	5,875,484	615,579	50,199,425	[2] 675,953	[2] 64,111,712
1963:								
North America: Canada	470	89,017	13,852	5,216,206	604,420	48,706,010	618,742	54,011,233
Europe:								
Finland	55	2,000			398	22,246	453	24,246
Italy [1]	6	7,525					6	7,525
Portugal [1]					29	3,193	29	3,193
Yugoslavia	6,331	215,955			1,177	45,224	7,508	261,179
Africa:								
Portuguese Western Africa, n.e.c.					20	2,601	20	2,601
Rhodesia and Nyasaland, Federation of [1 4]	2,328	449,231	330	143,117	1,480	303,897	4,138	896,245
South Africa, Republic of [1]	33,172	5,830,022	136	27,845	3,646	673,044	36,954	6,530,911
Oceania: Australia	10	1,896					10	1,896
Total	42,372	6,595,646	14,318	5,387,168	611,170	49,756,215	667,860	61,739,029

[1] Data reported by the Bureau of the Census have been adjusted by the Bureau of Mines.
[2] Revised figure.
[3] Reported by the Bureau of the Census as Chile.
[4] All believed to be from Southern Rhodesia.

Source: Bureau of the Census.

TABLE 3.—U.S. imports for consumption of asbestos, from specified countries, by grades

(Short tons)

Grade	1962			1963		
	Canada	Southern Rhodesia [1]	Republic of South Africa [2]	Canada	Southern Rhodesia [1]	Republic of South Africa [2]
Chrysotile:						
Crudes	[3] 238	[3] 4,091	413	470	2,188	452
Spinning or textile	14,816			13,852	330	136
All other	608,757	1,908	4,412	604,420	1,480	3,646
Crocidolite (blue)			9,602		140	10,776
Amosite	(4)		20,235			21,944
Total	[3] 623,811	[3] 5,999	34,662	618,742	4,138	36,954

[1] Reported by the Bureau of the Census as Federation of Rhodesia and Nyasaland. Believed to be from Southern Rhodesia. Excludes data adjusted by the Bureau of Mines.
[2] Includes data adjusted by the Bureau of Mines.
[3] Revised figure.
[4] Excludes data adjusted by the Bureau of Mines.

Source: Bureau of the Census.

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TABLE 4.—U.S. exports[1] and reexports[2] of asbestos and asbestos products

Product	1962		1963	
	Quantity	Value	Quantity	Value
Exports:				
Unmanufactured:				
Crude and spinning fibers---short tons	655	$162,130	847	$228,666
Nonspinning fibers---do	968	204,797	3,169	506,725
Waste and refuse---do	1,201	211,456	5,962	553,272
Total unmanufactured---do	2,824	578,383	9,978	1,288,663
Products:				
Brake lining and blocks-molded, semimolded, and woven	(3)	4,645,844	(3)	4,888,141
Clutch facing and lining---number	2,277,461	1,561,659	2,519,467	1,760,767
Construction materials, n.e.c---short tons	9,064	2,343,404	13,469	3,355,256
Pipe covering and cement---do	2,890	1,242,752	4,100	1,607,754
Textiles, yarn, and packing---do	1,453	3,311,355	1,496	3,499,384
Manufactures, n.e.c	(4)	1,164,908	(4)	1,183,752
Total products		14,269,922		16,295,054
Reexports:				
Unmanufactured:				
Crude and spinning fibers---short tons	95	14,193	66	14,651
Waste and refuse---do	30	5,437		
Total unmanufactured---do	125	19,630	66	14,651
Products:				
Brake lining and blocks-molded, semimolded, and woven	(3)	1,905		
Construction materials, n.e.c---short tons	7	1,756	28	10,637
Pipe covering and cement---do			(5)	5,670
Manufactures, n.e.c			(4)	3,800
Total products		3,661		20,107

[1] Materials of domestic origin, or foreign material that has been milled, blended, or otherwise processed in the United States.
[2] Material that has been imported and later exported without change.
[3] Values have been summarized; quantities not shown.
[4] Quantity not recorded.
[5] Less than 1 ton.

Source: Bureau of the Census.

WORLD REVIEW[3]

NORTH AMERICA

Canada.—Canada has maintained its position as the major supplier of asbestos to the world market. For the fifth successive year, the industry set a production record. During 1963 1.27 million tons was shipped, an increase of 5 percent over 1962. Almost all of the Canadian production is expected and in 1963, over 50 percent was shipped to the United States.

Golden Age Mines granted a working option to Falconbridge Nickel Mines, Ltd., to explore the property of its subsidiary, Kingsbury Asbestos Mines, Ltd. The ground consists of 2,000 acres in Melbourne Township, about 8 miles from the Johns-Manville Corp. operation at Asbestos, Quebec. It is reported that some 15 million tons have been indicated grading $7 per ton, with values predominantly in Group 5 fiber.[4]

[3] Values in this section are U.S. dollars based on the average rate of exchange by the Federal Reserve Board unless otherwise specified.
[4] Northern Miner (Toronto). Golden Age Deals With Falconbridge on Asbestos Group. No. 19, Aug. 1, 1963, p. 3.

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TABLE 5.—World production of asbestos by countries [1] [2]
(Short tons)

Country [1]	1954–58 (average)	1959	1960	1961	1962	1963
North America:						
Canada (sales)	994,716	1,050,429	1,118,456	1,173,695	1,215,814	1,272,024
United States (sold or used by producers)	44,227	45,459	45,223	52,814	53,190	66,606
Total	1,038,942	1,095,888	1,163,679	1,226,509	1,269,004	1,338,630
South America:						
Argentina	477	320				
Bolivia (exports)	43	168	66	57	56	10
Brazil	3,230	[3] [4] 3,700	[3] [4] 3,900	[3] [4] 3,400	[3] [4] 4,900	[5] 1,440
Venezuela	5,016	5,095	4,333	650		
Total	8,766	9,283	8,299	[3] 4,100	[3] 5,000	1,450
Europe:						
Austria			215	564	503	638
Bulgaria	1,168	1,100	1,200	1,200	[3] 1,100	[3] 1,100
Finland [6]	8,759	9,579	10,534	10,339	10,869	10,201
France	15,505	23,360	28,662	30,746	28,000	26,455
Italy	36,872	52,538	60,532	62,816	61,233	63,418
Portugal	56	40	144	21		
Spain	35	19	4	11		
U.S.S.R. [3]	475,000	600,000	660,000	880,000	1,100,000	1,200,000
Yugoslavia	4,829	4,748	5,970	6,709	7,401	9,074
Total [3]	540,000	690,000	770,000	990,000	1,210,000	1,310,000
Asia:						
China [3]	33,000	90,000	90,000	100,000	100,000	110,000
Cyprus	15,502	14,424	23,316	16,207	22,391	[3] 22,000
India	1,321	1,464	1,886	1,618	1,705	2,989
Japan	629	13,633	17,042	18,799	15,407	18,210
Korea, Republic of	95	88	740	341	1,333	2,037
Philippines		56	36	83	1,037	[3] 1,100
Taiwan	200	150	485	44	525	604
Turkey	375	411	238	496	709	408
Total [3]	60,000	120,000	135,000	138,000	143,000	157,000
Africa:						
Bechuanaland	1,528	1,410	1,282	1,924	2,375	2,368
Kenya	155	43	117	151	212	78
Morocco	348					
Mozambique	209	37	22	162	370	[3] 370
Rhodesia and Nyasaland, Federation of: Southern Rhodesia	112,691	119,699	133,963	161,610	142,196	142,254
South Africa, Republic of	139,697	182,405	175,867	194,834	221,302	205,744
Swaziland	29,724	24,806	32,027	30,792	32,830	33,350
United Arab Republic (Egypt)	101	502	496	254	606	192
Total	284,453	328,902	343,774	389,726	399,890	384,356
Oceania:						
Australia	10,245	17,875	15,613	16,746	18,392	[3] 15,000
New Zealand	245	640	319	373	457	439
Total	10,490	18,515	15,932	17,119	18,849	[3] 15,440
World total (estimate) [1] [2]	1,940,000	2,260,000	2,440,000	2,770,000	3,055,000	3,200,000

[1] Asbestos also is produced in Czechoslovakia, Eritrea, North Korea, and Rumania. No estimates for these countries are included in the total, as production is believed to be negligible.
[2] This table incorporates some revisions. Data do not add to totals shown because of rounding where estimated figures are included in the detail.
[3] Estimate.
[4] Revised data represents fiber.
[5] Bahia only.
[6] Includes asbestos flour.

Most of Quebec's chrysotile asbestos production was derived from 12 mining and milling operations in the eastern area of the Province; 8 of the mines are open pits, 2 are almost entirely underground, and 2

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combine underground and open pit mining. The Jeffrey mine at Asbestos is the largest, handling 30,000 tons per day of ore.[5]

A comprehensive report on industrial engineering at the Jeffrey mine was presented in three parts: Part I.—Department responsibilities and techniques; part II.—An outline of wage incentives; and part III.—Maintenance control plan.[6]

TABLE 6.—Canada: Sales of asbestos by grades

Grades	1962			1963		
	Short tons	Value		Short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
Crude No. 1, 2, and other	205	$159	$776			
Milled group:						
3	30,374	11,268	371			
4	355,121	59,030	176	[1] 1,272,024	$124,806	$98
5	161,952	18,233	113			
6	209,572	15,626	75			
7	451,521	16,089	36			
8	7,069	146	21			
Total, all grades	1,215,814	120,551	99	[1] 1,272,024	124,806	98

[1] Breakdown by grades not available.

Source: Dominion Bureau of Statistics.

Hedman Mines Ltd. continued to operate its pilot plant at Matheson, northern Ontario, to conduct further research on its process and to produce test shipments of its asbestos fiber for use in experimental work by potential consumers. The pilot plant includes complete laboratory facilities, capable of carrying out all normal asbestos testing. A production-scale plant has been designed and a plant site has been acquired adjacent to Matheson. The initial stage of the plant is designed for a product capacity of 100 tons per day.[7]

Canadian Johns-Manville Co., Ltd., announced plans to develop an asbestos deposit in Reeves Township, 40 miles southwest of Timmins. A development shaft is planned to open two underground levels to provide bulk samples for pilot plant processing. The deposit was acquired by the company several years ago and is expected to provide a source of fiber to supplement the output of Munro mine, east of Matheson in northern Ontario.[8]

The Asbestos Hill deposit in the Ungava district, 30 miles south of Deception Bay on Hudson Straits, discovered by the Murray Mining Corp., was held under option by the Asbestos Corporation, Ltd. Under the option agreement, $1 million has been spent in exploring the deposit and the Asbestos Corporation planned to spend an additional $500,000 up to April 1, 1964 on further exploration

[5] Gartshore, J. L. Quebec Asbestos Mining and Milling. Canadian Min. and Met. Bull. (Montreal), v. 55, No. 602, June 1962, pp. 400–402.

[6] Fletcher, J. M., R. H. McDougall, and A. R. Dennis. Industrial Engineering at the Jeffrey Mine. Canadian Min. and Met. Bull. (Montreal), v. 56, No. 616, August 1963, pp. 645–656.

[7] Northern Miner (Toronto). Hedman Pilot Plant Producing Asbestos for Test Purposes. No. 18, July 25, 1963, pp. 13, 18.

[8] Woodrooffe, H. M. Asbestos. Canadian Min. J., v. 85, No. 2, Feb. 1, 1964, pp. 125–126.

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and feasibility studies. The ore reserve was estimated at 23.8 million tons with additional reserves indicated.[9]

Advocate Mines Ltd., near Baie Verte, Newfoundland, Canada's newest asbestos producer, reached capacity of 5,000 tons per day of asbestos ore. At this rate Advocate expects to produce 60,000 tons per year of asbestos fiber. The $25 million project has been financed by Johns-Manville (49.62 percent), The Patino Mining Corp. of Canada (17.3 percent), and Amvet Corp. and Financière Belge De L'Abeste-Ciment (16.54 percent each). Proven ore reserves total about 41.3 million tons, averaging 3.5 percent Group 4 fiber. Recovery of fiber as low as Group 6 is seen, with "short" Group 7 fiber discarded as waste. Advocate's concession covers about 750 square miles, of which only a small portion has been tested.[10]

Production capacity at Cassiar Asbestos Corp., Ltd., increased in 1963 with opening of several new mines producing principally asbestos-cement-grade fiber. During the year the mine produced 756,574 tons of ore of which 597,202 tons was treated in the rock rejection circuit to eliminate 219,825 tons of rock. Stripping operations removed from the pit and peak 2,824,197 tons of waste rock. Ore and concentrate milled totaled 588,733 tons. Production of asbestos fiber amounted to 62,214 tons, an increase of 8 percent over 1962 production.[11]

With a view to improving its market position, Cassiar will introduce two new asbestos-cement grades. Cassiar AD will be a premium-grade asbestos-cement fiber which will replace in part production of AC and other grades now produced, but will not increase total fiber output. In addition, the mill will be expanded to recover a new cement grade, tentatively named Cassiar AY. The new grade will be of shorter length than now produced at Cassiar and will sell at a price below the AX grade. Production of the AY grade will be principally from material now discarded and will represent additional recovery from the ore treated. During the year a magnetometer survey was carried out at the Clinton Creek asbestos property, west of Dawson, Yukon Territory. Limited followup drilling has indicated an extension of the ore body where approximately 7 million tons of ore was developed previously.[12]

Mexico.—Exploration was underway on a large asbestos deposit in the state of Tamaulipas, northeast of Mexico City. National Financira, a Government lending institution, is sponsoring the project. The deposit has been known to exist for many years but it was never measured. A pilot plant designed to determine the different types of fiber is under construction at the site.[13]

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[9] Bank of Nova Scotia (Toronto). Resource and Industrial Development in Canada, Annual Summary. Sept. 18, 1963.
Northern Miner (Toronto). Asbestos Corp. Taking Long Look at Murray Mining. No. 2, Apr. 4, 1963, p. 24.

[10] Engineering and Mining Journal. Advocate To Treat 5,000 tpd of Asbestos Ore. V. 164, No. 10, October 1963, p. 114.

[11] Cassiar Asbestos Corporation, Limited (Toronto). Twelfth Annual Report, Dec. 31, 1963, p. 4.

[12] Northern Miner (Toronto). Cassiar Asbestos Holds Profits. No. 39, Dec. 19, 1963, pp. 1–2.

[13] Engineering and Mining Journal. V. 164, No. 5, May 1963, p. 152.

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EUROPE

Greece.—A new company, Greek Asbestos Manufacturing Co., Ltd., has been formed to build and operate an asbestos plant expected to be completed by mid-1964.[14]

Ireland.—Canadian Johns-Manville will search for abestos in cooperation with Northern Canada Mines, Ltd., which already holds prospecting rights to an area of about 11 square miles in Counties Sligo and Leitrim. Exploratory work has been carried on and chrysotile fiber has been found. The program will continue on a basis of 49 percent Northern Canada and 51 percent Canadian Johns-Manville.[15]

Portugal.—The Portuguese company CIMIANTO (Sociedade Tecnica de Hidráulica), manufacturers of fibro-cement products and users of Canadian asbestos, is setting up a new factory near Valencia, Spain.[16]

ASIA

Cyprus.—Exports of asbestos in 1962 totaled 15,544 short tons valued at $2,247,000 compared with 17,702 tons with a value of $2,596,000 in 1961.[17] Approximately 50 percent of the ore mined is treated in the mills and recovery is more than 0.7 to 0.8 ton of asbestos per 100 tons mined or 1.4 to 1.6 percent of the ore milled.[18]

India.—During 1962 imports of asbestos amounted to 24,660 short tons valued at $4,889,000 compared with 21,679 tons valued at $4,927,000 in 1961.

AFRICA

Nigeria.—A new asbestos-cement factory near Enugu, capital of Eastern Nigeria, began production of roofing sheets. Manufacture of cement pipe was to commence later. The factory was operated by Turner Asbestos Cement Products (Nigeria) Ltd., and was a joint enterprise of Turner & Newall Ltd., group and the Eastern Nigerian Government.[19]

Rhodesia and Nyasaland, Federation of.—Production of chrysotile asbestos was 142,254 short tons compared with 142,196 short tons in 1962. Exports of crude asbestos in 1962 totaled 145,414 tons valued at $21,377,000. The United Kingdom, the traditional market, took more than half of the total exported; the remainder was shipped to 40 other countries.[20]

The new $4.2 million Pangani Asbestos mine at Filabusi, Southern Rhodesia was officially opened on August 9. It will be developed in three stages. In the first, 10,000 tons of fiber per year will be produced. In the last two stages production will be boosted to 30,000 tons per year. Mining will be mainly open pit, which requires re-

[14] Mining Journal (London). Greek Asbestos Venture. V. 260, No. 6667, May 31, 1963, p. 546.
[15] Engineering and Mining Journal. Canadian Firms Hunt Asbestos in Ireland. V. 164, No. 10, October 1963, p. 154.
[16] Foreign Trade (Ottawa). Fibro-Cement. V. 118, No. 4, Aug. 25, 1962, p. 25.
[17] Republic of Cyprus (Nicosia). Statistics of Imports and Exports for Year Ending 31 December 1962. Department of Statistics and Research, Ministry of Finance, October 1963, p. 47.
[18] Mining World. V. 25, No. 5, Apr. 25, 1963, p. 107.
[19] Rock Products. Asbestos. V. 66, No. 11, November 1963, p. 127.
[20] Bureau of Mines. Mineral Trade Notes. V. 57, No. 3, September 1963, p. 8.

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moval of 4.5 million tons of overburden before recovery can begin. Asbestos Investments (Pty.) Ltd., is the parent company of Pangani Asbestos Mine Ltd.[21]

TABLE 7.—Southern Rhodesia: Asbestos production

Year	Short tons	Value (thousands)	Year	Short tons	Value (thousands)
1959	119,699	$20,735	1962	142,196	$20,467
1960	133,963	20,888	1963	142,254	16,791
1961	161,610	24,453			

South Africa, Republic of.—Exports of the various varieties of asbestos by countries for 1961 and 1962 were published. The United Kingdom and the United States were the principal markets for amosite in 1962; the United States and Italy were the leading purchasers of crocidolite; Spain and Australia took the major portion of chrysotile exports.[22]

Cape Asbestos S.A. (Pty.), Ltd. announced steps were taken to increase underground drilling capacity at the Penge mine where 90 percent of the world's output of amosite is obtained. Increased power for underground drilling has been obtained as a result of the installation of the first automatic remotely controlled air compressor.[23]

TABLE 8.—Republic of South Africa: Asbestos production, by varieties and sources

(Short tons)

Variety and source	1959	1960	1961	1962	1963
Amosite (Transvaal)	71,720	68,630	69,234	74,883	77,618
Chrysotile (Transvaal)	29,326	29,471	31,726	29,993	28,928
Blue (Transvaal)	13,113	11,185	11,176	14,296	11,205
Blue (Cape)	68,024	66,567	82,624	102,034	87,965
Tremolite (Transvaal)	222	14	74	96	28
Total	182,405	175,867	194,834	221,302	205,744

TABLE 9.—Republic of South Africa: Production and exports of asbestos

Year	Production (short tons)			Exports	
	Transvaal	Cape Province	Total	Short tons	Value (thousands)
1959	114,381	68,024	182,405	151,515	$25,971
1960	109,300	66,567	175,867	174,810	28,965
1961	112,210	82,624	194,834	180,684	29,830
1962	119,268	102,034	221,302	184,170	30,787
1963	117,779	87,965	205,744	183,861	29,908

Turners Asbestos Products, Ltd., announced the production of asbestos roofing sheets at its new factory at Mobeni, near Durban. The plant will manufacture about 2,000 sheets per day.[24]

[21] E&MJ Metal and Mineral Markets. Southern Rhodesia Asbestos Mine Opened. V. 34, No. 33, Aug. 19, 1963, p. 7.
[22] Bureau of Mines. Mineral Trade Notes. V. 57, No. 6, December 1963, pp. 7–10.
[23] South Africa Mining & Engineering Journal (Johannesburg). Penge Steps Up Amosite Production. V. 74, No. 3670, June 7, 1963, pp. 17–18.
[24] South African Mining & Engineering Journal (Johannesburg). Asbetsos Roofing Plant Begins Production. V. 74, No. 3650, Jan. 18, 1963, p. 143.

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Swaziland.—The Havelock mine, controlled by Turner-Newall, Ltd., has modernized its mill and a 1,200-foot vertical shaft neared completion. Havelock owns 100 claims on mineral concession No. 41 and has undertaken a detailed survey and exploration program on the concession.[25]

OCEANIA

Australia.—Production in 1962 consisted of 901 short tons of chrysotile and 17,491 tons of crocidolite.

A new company was installing an asbestos treatment plant at Marble Bar, Western Australia. The asbestos deposits cover a 90-mile radius of Marble Bar.[26]

TECHNOLOGY

A report by the Geological Survey describes the geology and mineral resources of the upper Missisquoi Valley and vicinity, Vermont, an area in which 80 percent of the asbestos produced in the United States has been mined. The history and development of the asbestos deposits are described; a geologic map and structure sections of the area are included.[27]

The Fiber Testing Committee of the Asbestos Textile Institute issued its initial publication on test procedures and techniques for the evaluation of asbestos fiber characteristics and properties. Nineteen test procedures are included.[28]

The asbestos fiber laboratory recently completed at Trafford Park, Manchester, England, by Turner and Newall, Ltd., is devoted to fundamental research on asbestos fibers. Serving a group of companies which mine asbestos and manufacture it into different forms, effort is concentrated on problems basic to the material so that the research staffs of the unit companies can concentrate on product development such as classification equipment. A classifier developed by the company sorts milled asbestos into given fiber lengths. The fiber sample is dispersed in water and then passes downwards through a series of vessels containing progressively smaller mesh screens. By the rapid migration of shorter elements into the lower vessels, fibers are classified by length to give the precise breakdown important to the producers and users of fibers. The elutriator which classifies fibers according to diameter, thus making possible an estimate of the degree of subdivision of any sample, consists of two vessels in each of which fibers of small diameter are carried upwards by a current of water, larger diameters remaining behind. Progressive separation is obtained by the smaller flow velocity in the second vessel.[29]

[25] South African Mining & Engineering Journal (Johannesburg). Swaziland Mineral Prospects Must Be Regarded as Bright. V. 74, No. 3653, Feb. 8, 1963, p. 307.
[26] Engineering and Mining Journal. V. 164, No. 8, August 1963, p. 182.
[27] Cady, W. M., A. L. Albee, and A. H. Chidester. Bedrock Geology and Asbestos Deposits of the Upper Missisquoi Valley and Vicinity, Vermont. Geol. Survey Bull. 1122–B, 1963, 78 pp.
[28] Asbestos. V. 44, No. 8, February 1963, p. 4.
[29] Mining Journal (London). V. 260, No. 6656, Mar. 15, 1963, pp. 253, 255.

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Past, present, and probable future methods of testing and classifying various grades of commercial asbestos produced by the Quebec asbestos industry were reviewed.[30]

Use of asbestos-reinforced plastics in nose cones and solid motor chambers of rockets was mentioned. Research at the Taylor Corporation, Valley Forge, Pa., indicates other types of asbestos reinforcing may out-perform the long fiber material in many applications.[31]

A study was made of reactions of chrysotile at temperatures and pressures higher than those used in making asbestos-cement products.[32]

Amosite mining at Penge mine in Eastern Transvaal, Republic of South Africa was reviewed. Amosite seams occur in banked ironstones of dolomite series of Transvaal system and the ore is produced from semishrinkage stopes operated on "herring-bone" system.[33]

Investigations were made into the possibilities of making paper from chrysotile, amosite, and crocidolite.[34]

Investigations were made into basic properties and nature of asbestiform materials. Studies include cleavability of asbestos and crystal structure of chrysotile; particle-size analysis and selective physiochemical methods of separating chemically similar particles; and tensile strength and elasticity of different varieties of asbestos.[35]

Deposits of chrysotile asbestos that have been developed or extensively explored in California since 1959 were discussed. Names of companies that filed claims in the Copperopolis and Napa areas are mentioned. Included is a map of California showing principal asbestos deposits and an index map to asbestos deposits and mills in the vicinity of Coalinga, Fresno County.[36]

Sheet packing for gaskets to be used in contact with steam, water, petroleum oils, and refinery gas has been developed from asbestos fibers bonded under pressure with styrene-butadiene rubber compounds.[37]

Research indicates that chemical resistance of asbestos-cement pipe is determined by the chemical resistance of the cement paste. Data also provide support for the adoption of the uncombined calcium hydroxide test and limits on the calcium hydroxide content in the specifications for asbestos-cement pipe to ensure that the product has maximum chemical stability and will resist satisfactorily the chemical action normally encountered in field service.[38]

Development of four asbestos-resin materials were announced: (1) Asbestos-resin felts to meet weight requirements for missiles and aerospace vehicles. They are composed of long, spinning-grade asbestos fibers and resins. The basic advantages claimed for these products

[30] Wiser, J. P. Asbestos Industry Testing and Quality Control. Canadian Min. and Met. Bull. (Montreal), v. 55, No. 602, June 1962, pp. 403–405.
[31] Douglas, B. F. Research Uncovers Asbestos Potential. Missiles and Rockets, v. 12, No. 3, Jan. 21, 1963, pp. 31–32.
[32] Ball, M. C., and H. F. W. Taylor. X-ray Study of Some Reactions of Chrysotile. J. Appl. Chem., v. 13, No. 4, April 1963, pp. 145–150.
[33] Mine and Quarry Engineering. Asbestos Mining at Penge. V. 29, No. 3, March 1963, pp. 126–129.
[34] Mining Journal (London). Asbestos Ores for Paper Making. V. 260, No. 6648, Jan. 18, 1963, p. 61.
[35] South African Mining & Engineering Journal (Johannesburg). Growing Uses of Asbestos Coupled With New Research Organization. V. 74, No. 3661, Apr. 5, 1963, pp. 765–766.
[36] Rice, Salem J. California Asbestos Industry. California Division of Mines and Geol., Min. Inf. Serv., v. 16, No. 9, September 1963, 11 pp.
[37] Materials in Design Engineering. V. 58, No. 6, November 1963, p. 155.
[38] Materials Research and Standards. V. 3, No. 9, November 1963, pp. 918–922.

are resistance to heat, flames, chemicals and water; high elasticity and strength modulus at room or elevated temperatures; and dimensional stability; (2) wet asbestos-phenolic compound recommended for molding techniques; (3) an asbestos reinforced plastic for insulating areas of aerospace vehicles where rapid changes in temperature occur; and (4) a combination plastic-elastomeric tube is claimed to be resistant to most corrosive chemicals to 160° F.[39]

Sprayed asbestos provides protection against fire for road tankers which carry ethylene oxide or propylene oxide, both at ambient temperature. The asbestos fiber and cement mixture is applied in a spray with jets of atomized water and then lightly pressed back with a float to the required density and thickness. The range of thickness is from ¼ inch to 6 inches.[40]

A new application of molded asbestos cement was found in the construction of high cooling tower fan stacks.[41]

A method is presented for the microscopic examination of asbestos-cement products. The use of petrographic thin sections and polished sections in determining composition, texture, grain size, and cement-silica reaction is described. The preparation of thin sections and polished sections, using epoxy resin as an impregnant is outlined.[42]

Considerable information was presented in the Canadian Institute of Mining Transactions on the application of asbestos fibers in the major product groups of the construction industry in North America. Principal categories considered include flooring materials, asbestos-cement pipes and building products, high temperature insulation, textiles, saturated asbestos felts, and asphalt compounds. The use of short-fiber asbestos grades for extending the life of asphalt pavement was described.[43]

New Hampshire specified that all asphalt curbing must contain 2.5 percent asbestos. According to Johns-Manville engineers, incorporation of asbestos fiber in curbing mixes eliminates such problems as excessive slumping, tearing, and slow rate of replacement. The addition of 2.5 percent asbestos fiber has allowed an increase in asphalt contents from 6.5 percent to as much as 8 percent and placing temperatures from 250° to 340° F. At these levels curbing has been placed at rates of more than 4 feet per minute without tearing or slumping, and with no waste. Costs in New Hampshire are reported to be $1 per foot, or less.[44]

Three new grades of asbestos-rubber gasketing materials have been introduced for us in oil and water hydraulic systems. Three levels of compressibility (under 5,000 psi) are offered by the materials: Duroid 3390 has 40 percent, Duroid 3380 has 30 percent, and Duroid 3370, 25 percent.[45]

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[39] Industrial and Engineering Chemistry. Raybestos-Manhattan, Inc. Reinforced Plastics Dept. V. 55, No. 9, September 1963, p. 132.

[40] Chemical Age (London). New I.C.I. Tankers Have Asbestos Fire Protection. V. 90, No. 2306, September 1963, p. 399.

[41] Steel and Coal (London). New Application of Asbestos Cement at Steel Works. V. 186, No. 4939, March 1963, p. 52.

[42] Bailey, Donald. Microscopy of Steam-Cured Portland Cement Products. J. Am. Ceram. Soc., v. 46, No. 7, July 1963, pp. 348–351.

[43] Montpetit, L. D. Asbestos in the Construction Industry. Canadian Min. and Met. Bull. (Montreal), v. 56, No. 617, September 1963, pp. 737–742.

[44] Engineering News Record. Asphalt-Asbestos Curbs Gain. V. 171, No. 3, July 18, 1963, p. 56.

[45] Materials in Design Engineering. What's New in Materials. V. 57, No. 2, February 1963, p. 162.

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A sulfur-free gasket material has been developed from neoprene filled with long chrysotile asbestos fibers. When used with flanges of copper, magnesium, aluminum, or steel, the material is said to be completely corrosion resistant. The gasketing material has good flexibility; it can be bent around four times its own thickness without cracking. In addition, the material withstands synthetic and petroleum oils and fuels.[46]

A new plywood product called Fyretech 100, has been developed by a Jamaica, N.Y., firm. Layers of light asbestos foam separate natural wood veneer; the panels are three-fourths of an inch thick and easy to shape and nail.[47]

Investigations into the possibilities of making paper from inorganic fibers have recently been undertaken by the Departmet of Engineering, University of Florida, Gainesville, Fla., and among the materials studied for use in this field have been the various asbestos ores such as chrysotile, amosite, and crocidolite. Paper made from inorganic fibers is used extensively as an electrical insulator where high ambient temperatures are encountered. Prior to World War II high-grade chrysotile asbestos fibers by themselves had been used for these special-purpose papers.[48]

Low density asbestos-phenolic molding mat has been developed for lightweight thermal shielding. The material, designated 383, is composed of unbonded felt containing 100 percent ASTM grade AAAA long, randomly dispersed chrysotile asbestos fiber, and lightweight fillers saturated with phenolic resin conforming to MIL–R–9299. A laboratory test run on the material shows that it offers the same thermal protection at 310° F mean temperature as asbestos-phenolic resins nine times heavier and three times thicker.[49]

The application of asbestos fibers in the major product groups of the construction industry in North America was surveyed. Principal categories considered include flooring materials, asbestos-cement pipes and building products, high-temperature insulation, textiles, saturated asbestos felts, and asphalt compounds.[50]

A process was patented for asbestos paper manufacture. An ultra-high-molecular-weight anionic polymer is added to the aqueous slurry of asbestos fiber and causes the water to drain with increased speed during the sheeting operation.[51]

An improved pneumatic apparatus for opening and cleaning asbestos fiber was patented.[52]

A method was patented for the use of asbestos fiber in the preparation of asbestos paper containing minor amounts of vinyl alkyl ether-maleic anhydride copolymer as a binder.[53]

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[46] Materials in Design Engineering. Asbestos-Neoprene for Corrosion-Free Gaskets. V. 57, No. 5, May 1963, pp. 222, 224.
[47] Rock Products. V. 66, No. 4, April 1963, p. 12.
[48] Mining Journal (London). Asbestos Ores for Paper Making. V. 260, No. 6648, Jan. 18, 1963, p. 61.
[49] Materials in Design Engineering. Asbestos-Phenolic for High-Temperature Protection. V. 57, No. 5, May 1963, pp. 147–148.
[50] Montpetit, L. O. Asbestos in the Construction Industry. Canadian Min. and Met. Bull. (Montreal), v. 56, No. 617, September 1963, pp. 737–742.
[51] Reynolds Jr., W. F., and N. T. Woodberry (assigned to American Cyanamid Co.). Asbestos Paper Manufacture. U.S. Pat. 3.076.740, Feb. 5, 1963.
[52] Novotny, E. H. (assigned to Johns-Manville Corp.). Fiber Opener and Cleaner. U.S. Pat. 3,111,719, Nov. 26, 1963.
[53] Cukier, S. T. (assigned to General Aniline and Film Corp.). Asbestos Paper Containing Vinyl Alkyl Ether-Maleic Anhydride Copolymer and Method of Forming Same. U.S. Pat. 3,113,064, Dec. 3, 1963.

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A patent was issued on the use of crocidolite fiber impregnated with polytetrafluoroethylene in the manufacture of sheet materials.[54]

Several processes for making materials with asbestos as an ingredient were patented: An acoustical insulating tile,[55] a filter aid material,[56] gaskets, friction elements, etc.[57] and a dry-type joint cement composition.[58]

Several patents were issued for processes and apparatus used in the manufacture of asbestos-cement products.[59]

In the removal of organic substances in the treatment of raw asbestos fiber, the fiber or fiber-containing product is treated with an aqueous solution of an alkali metal phosphate, and then washed.[60]

A design was patented for an improved pneumatic apparatus for separating grit from milled asbestos fiber. Feed material is rotated in a chamber, and fiber is drawn by suction through a restricted passage.[61]

A method and apparatus for pressure packing of milled asbestos fiber was patented. The fiber is first compressed into a relatively firm block, and the block is then wrapped to form a firm, easily handled package.[62]

An improved apparatus for removing dust particles from asbestos fiber was patented. The fiber is moved by screw conveyor through a plenum chamber in which jets of air blow out the dust and fine fibers.[63]

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[54] Holly, R. B. (assigned to Armstrong Cork Co.). Polytetrafluoroethylene Saturated Crocidolite Fiber Product. U.S. Pat. 3,097,990, July 16, 1963.

[55] Becker, N. V. (assigned to Johns-Manville Perlite Corp.). Insulating Material and the Like. U.S. Pat. 3,095,347, June 26, 1963.

[56] Kruger, J. S. Filter Construction. U.S. Pat. 3,083,157, Mar. 26, 1963.

[57] Painter, J. B. (assigned to Johns-Manville Corp.). Dry Cold Molding Composition Containing Thermosetting Resin Binder and Hydrated Mineral Absorbent. U.S. Pat. 3,084,130, Apr. 2, 1963.

[58] Sirota, J., and B. D. Jubilee (assigned to National Starch & Chemical Corp.). U.S. Pat. 3,084,133, Apr. 2, 1963.

[59] Barchioli, G. and G. Gemigni. British Pat. 922,668.
Dubecky, P. (assigned to Johns-Manville Corp.). Punch for Forming Perforations in Coated Asbestos-Cement Sheets. U.S. Pat. 3,078,574, Feb. 26, 1963.
Sfiscko, N. M., R. Nebel, and Wil. Van Derbeck (assigned to Johns-Manville Corp.). U.S. Pat. 3,095,346, June 26, 1963.

[60] Burger, W., and H. Lubbe (assigned to Flammer Seifenwerke K. G.). Canadian Pat. 659,058, Mar. 12, 1963.

[61] Bourne, R. F., and D. G. Cheyne. Canadian Pat. 656,174, Jan. 22, 1963.

[62] Roberts, J. W., H Daum, and W. T. Donahue (assigned to Johns-Manville Corp.). Canadian Pat. 654,604, Dec. 25, 1962.

[63] Donovan, R. A. British Pat. 938,513, Oct. 2, 1963.

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