MAGNESIUM COMPOUNDS

By Deborah A. Kramer

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In 1998, domestic production of caustic-calcined magnesia increased, with environmental applications accounting for one-third of the total end-use applications. Production of dead-burned magnesia declined by 21% from that of 1997. Much of the U.S. production was replaced by lower cost material imported from China. Seawater and brines accounted for about 71% of total U.S. magnesium compounds production; the rest came from magnesite, brucite, dolomite, and olivine. About 57% of the total magnesium compounds consumed in the United States was used in refractory applications, and 43% was used in environmental, chemical, and other applications.

Production

Domestic production of caustic-calcined magnesia increased by 6% from that of 1997. This increase was mainly the result of increased use for water treatment. U.S. production of dead-burned magnesia and magnesium hydroxide declined by 21% and 14%, respectively. Consumers used imports of cheaper material from China instead of the U.S.-produced dead-burned magnesia in some applications, leading to reduced production. The decrease in dead-burned magnesia production was primarily responsible for the decline in magnesium hydroxide production; much of the U.S.-produced magnesium hydroxide is used to feed dead-burned magnesia production. The large increase in magnesium sulfate production resulted from the inclusion of two plants that have not been canvassed by the U.S. Geological Survey (USGS) in the past. (See tables 1-3.)

Data for magnesium compounds were collected by the USGS from one voluntary survey of U.S. operations. Of the 21 operations canvassed, 62% responded, representing 53% of the magnesium compounds shipped and used (table 3). Data for the eight nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

IMC Global Inc. completed its purchase of the Harris Chemical Group Inc. for $1.4 billion ($450 million in cash and $950 million in debt) in the first quarter of 1998. As part of the Harris Chemical Group, Great Salt Lake Minerals Corp. was included in the sale. Although IMC has announced that it would divest itself of several operations that it had acquired in the sale including boron and soda ash businesses, the company planned to continue operating the Utah magnesium chloride production facility (IMC Global, April 1, 1998, IMC Global completes acquisition of Harris Chemical Group, Inc., accessed March 15, 1999, at URL http://www.imcglobal.com/pressrel/harris2.htm).

Applied Chemical Magnesias Corp. (ACM) was founded in 1998 as a spinoff from RMc Industries Inc. RMc opened a brucite mine in Arizona in 1998, and ACM plans to open a $2 million milling facility in Bullhead City, AZ, by June 1999 to process the brucite produced at the mine. The mill capacity will be 30,000 metric tons per year (t/yr) of various magnesia and magnesium hydroxide products, primarily geared toward the acid neutralization market (Applied Chemical Magnesias Corp., Company profile, accessed May 10, 1999, at URL http://www.magnesias.com/profile.html).

With the closure of The Dow Chemical Co.'s magnesium metal plant in November, the company will discontinue selling magnesium chloride at its Freeport, TX, facility. The magnesium chloride was produced as a coproduct of Dow's metal production operation (The Dow Chemical Co., November 20, 1998, Dow to exit magnesium business, accessed November 20, 1998, at URL http://www.dow.com/pr_business/mag.html).

English China Clays International (ECC) purchased the U.S. fused magnesia producer Minco Inc. in October for about $28 million. In addition to fused magnesia, Minco produces fused silica; both products are marketed toward the investment casting, refractory, and electrical heating element markets. The acquisition will complement ECC's ceramic division, which supplies the same markets (Industrial Minerals, 1998b).

Global Industrial Technologies Inc., the parent company of Harbison-Walker Refractories Co., purchased A.P. Green Industries Inc. in July for about $195 million. A.P. Green has 22 plants in 6 countries that manufacture refractory products and/or lime. With the acquisition, Harbison-Walker will operate 32 refractory plants in 8 countries, making it one of the largest refractory manufacturers in the world (PR Newswire, March 4, 1998, Global Industrial Technologies to acquire A.P. Green, accessed March 29, 1999, at URL http://prnewswire.com/cgi-bin/stories.pl?ACCT=105&STORY=/www/story3-4-98/ 427668). After the acquisition was completed, Harbison-Walker announced that it would close or consolidate five refractory plants throughout the United States by the end of October (PR Newswire, July 24, 1998, Harbison-Walker to close five plants in its consolidation strategy, accessed March 29, 1999, at URL http://prnewswire.com/cgi-bin/stories.pl?ACCT=105&STORY=/www/story/07-27-1998/0000719337).

Two companies in the United States produced olivine—Unimin Corp. and Olivine Corp. Unimin operated two mines, one in North Carolina and one in Washington, and processing plants in Indiana, North Carolina, and Washington; Olivine operated one mine and one processing plant in Washington. Fused magnesia is produced by two companies in the United States—ECC with a plant in Midway, TN, and Universal Ceramic Materials PLC of the United Kingdom,

which operates a plant in Cherokee, AL, through its Muscle Shoals Minerals Co. subsidiary and a plant in Greeneville, TN.

The largest magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for 59% of the world magnesite production capacity. Japan and the United States account for 56% of the world's magnesium compounds production capacity from seawater or brines. Fused magnesia is produced in Australia, Brazil, Canada, China, France, Israel, Japan, the Republic of Korea, Mexico, the United Kingdom, and the United States.

Norway is the world's principal producer and supplier of olivine. Other producers include Australia, Italy, Japan, Mexico, Pakistan, Spain, and the United States.

Consumption

In 1998, environmental applications (water treatment and stack gas scrubbing, in declining order) were the dominant use for caustic-calcined magnesia, accounting for 33% of U.S. shipments; this was the second year in a row that this surpassed chemicals as the largest end use for caustic-calcined magnesia. The following categories, with the individual components in parentheses in declining order of consumption, were the other end-use sectors for caustic-calcined magnesia—chemical, 26%; agriculture (animal feed and fertilizers), 23%; construction (oxychloride and oxysulfate cements) and refractories, 14%; manufacturing (rubber, fluxes, pulp and paper, fuel additives, and electrical), 7%; pharmaceuticals and nutrition (cosmetics, sugar, and medicine and pharmaceuticals), less than 1%; and unspecified uses, 1%.

Magnesium carbonate was used principally as a chemical intermediate, in rubber processing, in cosmetics, and in medicines and pharmaceuticals. Magnesium hydroxide was used mainly in the chemical industries and for water treatment. Magnesium sulfate was used mostly in the pulp and paper industry, animal feed, and pharmaceuticals. Magnesium chloride was used mainly as a chemical intermediate and in pharmaceuticals. Magnesium chloride brines were used principally for road dust and ice control and as a chemical intermediate. A detailed review of end uses for magnesium compounds was presented by Kramer (1998).

Foundry uses remained the largest application for olivine in the United States, accounting for 83% of consumption of domestically produced material. Refractory applications accounted for 12% of U.S. consumption, sandblasting and other abrasive uses accounted for 3%, and soil conditioners accounted for 2%.

Prices

Yearend 1998 prices for magnesium compounds quoted in Chemical Market Reporter remained the same as those for 1997 (table 4). U.S. olivine prices, quoted in Industrial Minerals, were $62 to $109 per metric ton for foundry grade and $50 to $78 per ton for aggregate material at yearend 1998; these were unchanged from those at yearend 1997. All prices were quoted f.o.b. mine or plant.

Foreign Trade

Imports continued to supply a significant share of U.S. consumption of caustic-calcined and dead-burned magnesias (table 7). China was the dominant supplier of dead-burned magnesia and increased the quantity of material imported from that in 1997. This increase in exports to the United States was in spite of a decrease in the total quantity of magnesia that could be legally exported though the export licensing system in China [a maximum of 2 million metric tons (Mt) in 1997 compared with 1 Mt in 1998] (Industrial Minerals, 1998e).

Trade data for olivine is not available separately from the Bureau of the Census. The Journal of Commerce Port Import/Export Reporting Service provides data on material that travels by ship. In 1998, the United States exported 330 metric tons (t) of olivine; Chile (38%) and Guatemala (24%) were the principal destinations. U.S. olivine imports totaled 174,000 t, all from Norway.

World Review

World capacity and production are shown in tables 9 and 10.

Australia.—Pima Mining NL announced that it would develop a magnesite property near Leigh Creek, South Australia. Pima's subsidiary SAMAG Ltd. will assume management and funding responsibilities for the proposed magnesite mine. Studies done at the deposits indicated that reserves were about 47 Mt of magnesite. SAMAG eventually plans to construct a magnesium metal plant at Port Augusta; magnesite from the mine would be used as feedstock. Capital costs for the proposed magnesium plant are estimated to be $547 million for a plant producing 52,000 t/yr of metal and alloys. Within the next year, Pima plans to complete resource definition, raw material leach testing, and process design (Industrial Minerals, 1998f).

China.—In the bidding round for the export licenses for magnesite held in early January, the license fee was set at $40 per ton for 1998, a $10 increase from the 1997 fee. In addition, the quota for exports was set at 1 Mt, one-half of the 1997 quota (Industrial Minerals, 1998e).

In December, the European Commission (EC) announced that it would review the antidumping measures that it instituted on Chinese magnesite in 1993, which were scheduled to expire in 1999. In September, Eurometaux, a consortium representing more than 80% of the dead-burned magnesia producers in the European Union (EU), had requested that the measures be reviewed. According to the EC, Chinese exporters are alleged to be offering magnesia at purities of greater than 92% MgO at prices normally paid for material that is less than 92% MgO; this was essentially equivalent to a price discount. In addition, Chinese export prices in the United States, which has no antidumping duties, were less than the minimum price established for the EU. The review was scheduled to begin in January 1999 (Industrial Minerals, 1999).

Jordan.—After prequalifying eight companies to construct its magnesia plant, Jordan Magnesia Co. planned to award a contract by the end of 1998. If a contract is awarded, then construction on the 60,000-t/yr facility is scheduled to begin in

early 1999, with completion in mid-2000. The proposed facility will have the capacity to produce 50,000 t of refractory magnesia and 10,000 t of magnesium hydroxide and caustic-calcined magnesia for the chemical and plastics industries using Dead Sea brines as a feedstock. Jordan Magnesia has secured $48 million of the expected $90 million cost of the plant from the Islamic Development Bank and Jordanian banks (Fertilizer International, 1998).

Netherlands.—The Japanese firm Kyowa Chemical Industry Co. Ltd. plans to construct an 8,000-t/yr magnesium hydroxide flame-retardant plant near Veendam. This plant location was selected because the plant's raw material supplies will be magnesium chloride brines from Nedmag Industries Mining & Manufacturing BV's nearby operation. Construction was scheduled to begin in February 1998, and the plant was scheduled to start up in June 1999. Flame retardants produced at the new plant are expected to be targeted to the European market (Industrial Minerals, 1998d).

Turkey.—With only one bid received for Konya Krom Magnezit Tuðla Sanayii A.Þ., the Turkish Government canceled the auction for the company. The $20 million bid was considered to be too low for the company, which has the capacity to produce about 35,000 t/yr of dead-burned magnesia. The Government tried unsuccessfully to privatize the firm twice (Industrial Minerals, 1998a).

Current Research and Technology

A material that was originally developed for the U.S. Department of Energy for containing radioactive and hazardous wastes may find a new use as a patching material for potholes. The material, called Ceramicrete, is a combination of phosphate salts and magnesium oxide that is harder and denser than concrete, binds to itself, and does not require firing. A Chicago-based firm, Bindan Corp., licensed the technology and plans to make the Ceramicrete into a pour-on patch. Because the material binds well to cement, gravel, and rocks and cures even in freezing weather, a road can be put back into service within 2 hours of repair. The material has been tested by the Tennessee and the Illinois Departments of Transportation; results are pending (Phair, 1998).

Harbison-Walker introduced a new line of magnesia-alumina spinel refractories. These refractories are designed to be chromium-free alternatives for cement and steelmaking furnaces. Because the material is chromium-free, waste products do not have to be treated as hazardous materials (Industrial Minerals, 1998c).

Outlook

Water treatment applications continue to be the principal growth area for caustic-calcined magnesia, much of which is hydrated to magnesium hydroxide. For the second year in a row, this end use was the largest for caustic-calcined magnesia. If growth is to continue in this application, then producers need to convince potential consumers of the benefits of magnesia compared with such traditional materials as caustic soda, otherwise cost becomes the determining factor in material selection. With cost as the principal selection criterion, demand for magnesia and magnesium hydroxide for water treatment is not expected to increase.

The largest influence on the demand for dead-burned magnesia in the United States was the steel industry. This market was estimated to consume about one-half of all the refractories produced in the United States. Because of the Asian financial crisis that began in 1997 and continued through 1998, steel producers from that region found themselves without a domestic market for their product. In an attempt to make money, the Asian producers exported inexpensive steel to the United States. Unable to compete with these Asian exports, U.S. steel producers cut back production. With this production decline, the demand for refractories also decreased, so demand for dead-burned magnesia decreased as well. In addition, U.S. dead-burned magnesia producers had to compete with low-valued exports of Chinese dead-burned magnesia, which were at their highest level since 1995. If the strong U.S. economy continues, then steel production is expected to increase, but not until the second half of 1999 (Bolger, 1999). Even with increased steel production, U.S. magnesia producers will need to continue competing with imports of magnesia from China.

Magnesium sulfate manufacturers cite the principal growth area for magnesium sulfate as pulp and paper processing. Increasing strictness of regulations on the release of chlorine-containing effluents have caused many paper mills to switch from chlorine-based processing to oxygen delignification. According to SRI Consulting, Menlo Park, CA, the pulp and paper industry's consumption of magnesium sulfate should grow at a average annual rate of 3% through 2001 because of this change in the manufacturing process. Other analysts felt that most of the mills that were going to convert to oxygen have already done so, and this market for magnesium sulfate has leveled off (Johnson, 1998).

Water-treatment and flame-retardant applications have been singled out as areas for the largest potential for growth in magnesium hydroxide consumption. Business Communications Co. estimated that the U.S. flame retardant market for magnesium hydroxide will grow at an average rate of 5% per year through 2003. Magnesium hydroxide accounts for an estimated 1% of total flame retardants and was forecast to grow at the same overall rate as the total flame-retardant market (Chemical Market Reporter, 1998). For the past several years, analysts have cited potential U.S. regulation of halogenated flame retardants as affecting magnesium hydroxide replacement and increasing the projected growth rate. No specific legislation, however, has been enacted, so this potential for growth has not yet been realized. Growth in acid neutralization applications, however, is expected to continue to fuel the growth of magnesium hydroxide.

Because the uses for magnesium carbonate, with the exception of flame retardants, are essentially in mature markets, significant growth in U.S. consumption is not expected. In flame retardants, magnesium carbonate competes with magnesium hydroxide; most of the growth in flame retardants is expected in magnesium hydroxide.

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[1]Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS 1/

(Thousand metric tons, unless otherwise specified)

		1994	1995	1996	1997	1998
United States:						
Caustic-calcined and specified magnesias: 2/						
Shipped by producers: 3/						
Quantity		135	141	158	160	170
Value	thousands	$39,300	$37,900	$47,600	$52,600	$75,100
Exports 4/		3	2	20	5	5
Imports for consumption 4/		125	139	114	133	127
Refractory magnesia:						
Shipped by producers: 3/						
Quantity		243	234	269	283	223
Value	thousands	$67,800	$83,800	$96,800	$97,500	$76,800
Exports		60	75	73	66	63
Imports for consumption		342	393	271	279	427
World production (magnesite)		9,020 r/	11,000 r/	11,200 r/	10,600 r/	10,800 e/

e/ Estimated. r/ Revised.
1/ Data are rounded to three significant digits.
2/ Excludes caustic-calcined magnesia used in the production of refractory magnesia.
3/ Includes magnesia used by producers.
4/ Caustic-calcined magnesia only.

TABLE 2
U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL
SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 1998

Raw material source and producing company	Location	Capacity (metric tons of MgO equivalent) 1/	Products
Magnesite: Premier Services Inc.	Gabbs, NV	100,000	Caustic-calcined and dead-burned magnesia.
Lake brines:			
IMC Kalium Ogden Corp.	Ogden, UT	106,000	Magnesium chloride and magnesium chloride brines.
Reilly Industries Inc.	Wendover, UT	45,000	Magnesium chloride brines.
Well brines:			
The Dow Chemical Co. 2/	Ludington, MI	214,000	Magnesium hydroxide.
Martin Marietta Magnesia Specialties Inc. 3/	Manistee, MI	297,000	Caustic-calcined and dead-burned magnesia.
Morton International, Inc.	do.	10,000	Magnesium carbonate, magnesium hydroxide, and caustic-calcined magnesia.
Seawater:			
Barcroft Co.	Lewes, DE	5,000	Magnesium hydroxide.
The Dow Chemical Co.	Freeport, TX	20,000	Magnesium chloride.
National Refractories & Minerals Corp.	Moss Landing, CA	165,000	Magnesium hydroxide and caustic-calcined and dead-burned magnesia.
Premier Services Inc.	Port St. Joe, FL	50,000	Caustic-calcined magnesia and magnesium hydroxide.
Western Salt Co.	Chula Vista, CA	3,000	Magnesium chloride brines.
Total		1,010,000	

1/ Data are rounded to three significant digits; may not add to total shown.
2/ Most of Dow's production is shipped to Harbison-Walker Refractories Co. in Ludington, MI, where it is converted to dead-burned magnesia at a 200,000-metric-ton-per-year plant.
3/ In addition to its Michigan plant, Martin Marietta owns a 30,000-metric-ton-per-year magnesium hydroxide plant in Pittsburgh, PA, and a 15,000-metric-ton-per-year magnesium hydroxide plant in Lenoir City, TN, which use imported magnesite as a raw material.

TABLE 3
U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED 1/

	1997		1998	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias 2/	160,000	$52,600	170,000	$75,100
Magnesium hydroxide [100% Mg (OH)2] 2/	307,000	111,000	259,000	48,100
Magnesium sulfate (anhydrous and hydrous)	46,100	21,500	57,500	24,100
Precipitated magnesium carbonate 2/	2,470	5,290	2,170	4,710
Refractory magnesia	283,000	97,500	223,000	76,800

1/ Data are rounded to three significant digits.
2/ Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

TABLE 4
YEAREND 1998 MAGNESIUM COMPOUND PRICES

Material		Price
Magnesia, natural, technical, heavy, 85%, f.o.b. Nevada	per short ton	$232-$265
Magnesia, natural, technical, heavy, 90%, f.o.b. Nevada	do.	265
Magnesia, dead-burned	do.	350
Magnesia, synthetic, technical	do.	385
Magnesium chloride, hydrous, 99%, flake	do.	290
Magnesium carbonate, light, technical, freight equalized	per pound	.73-.78
Magnesium sulfate, technical, epsom salts	do.	.18

Source: Chemical Market Reporter.

TABLE 5
U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY 1/

Material and country	1997 Quantity (metric tons)	1997 Value (thousands)	1998 Quantity (metric tons)	1998 Value (thousands)
Caustic-calcined magnesia:				
Chile	1,810	$558	--	--
Colombia	45	21	1,270	$238
France	546	349	794	515
Germany	693	399	972	555
Mexico	206	104	925	356
Netherlands	1,350	760	752	472
Other	58 r/	37 r/	717	278
Total	4,700	2,230	5,430	2,410
Dead-burned and fused magnesia:				
Canada	34,200	15,000	45,500	14,700
Germany	3,010	933	381	152
Mexico	1,870	1,110	3,760	1,370
Netherlands	11,300	3,570	3,230	1,010
Taiwan	2,820	1,020	68	36
Thailand	3,900	1,220	38	43
Venezuela	3,650	1,130	4,020	1,210
Other	5,550 r/	6,340 r/	6,220	5,260
Total	66,200	30,300	63,200	23,700
Other magnesia:				
Canada	5,010	2,290	4,660	1,750
Colombia	2,640	666	299	343
Hong Kong	1,410	1,780	1,370	1,690
Mexico	4,150	2,090	2,720	2,800
Spain	1,480	1,810	1,180	1,410
Venezuela	3,470	1,040	44	44
Other	3,500 r/	4,270 r/	3,020	3,610
Total	21,700	13,900	13,300	11,600
Crude magnesite:				
Belgium	7,400	1,090	--	--
Brazil	5,670	614	1,090	117
Germany	8,990	1,820	31,700	3,500
Korea, Republic of	5,650	706	5,870	646
Mexico	4,400	472	4,960	579
Venezuela	6,210	706	3,040	324
Other	13,200 r/	1,660 r/	6,640	865
Total	51,500	7,070	53,300	6,030

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

Source: Bureau of the Census.

TABLE 6
U.S. EXPORTS OF MAGNESIUM COMPOUNDS 1/

Material	1997 Quantity (metric tons)	1997 Value (thousands)	1998 Quantity (metric tons)	1998 Value (thousands)
Magnesium chloride, anhydrous and other	5,320	$3,300	4,130	$3,690
Magnesium hydroxide and peroxide	10,600	6,100	17,700	8,770
Magnesium sulfate, natural kieserite and epsom salts	564	628	69	101
Magnesium sulfate, other	6,760	2,530	5,910	2,190

1/ Data are rounded to three significant digits.

Source: Bureau of the Census.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY 1/

Material and country	1997 Quantity (metric tons)	1997 Value (thousands)	1998 Quantity (metric tons)	1998 Value (thousands)
Caustic-calcined magnesia:				
Canada	33,500	$6,980	35,700	$6,700
China	89,400	8,620	78,500	7,710
Greece	7,460	1,900	9,100	2,320
Other	2,570	2,320	3,300	2,580
Total	133,000	19,800	127,000	19,300
Dead-burned and fused magnesia:				
Australia	13,100	3,440	53,200	13,100
Austria	24,600	10,700	21,200	10,400
Brazil	20,000	2,230	10,000	1,190
China	170,000	19,900	292,000	31,900
Greece	6,270	997	9,620	1,620
Hong Kong	20,400	2,330	10,700	1,130
Israel	6,900	5,450	13,000	8,800
Other	17,800	6,890 r/	17,300	8,200
Total	279,000	51,900	427,000	76,300
Other magnesia:				
Canada	1,310	737	4,400	1,180
China	1,300	576	805	392
Israel	3,370	4,290	3,710	5,610
Japan	1,390	2,700	1,500	2,590
Mexico	8,210	3,350	3,740	2,110
Other	2,080 r/	1,800 r/	2,890	2,430
Total	17,700	13,500	17,000	14,300
Crude magnesite:				
Austria	131	66	1,010	466
China	5,280	570	582	375
Netherlands	4,900	1,760	2,580	831
Other	580 r/	177 r/	415	168
Total	10,900	2,580	4,590	1,840

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

Source: Bureau of the Census.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS 1/

	1997		1998	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Magnesium chloride, anhydrous and other	12,800	$3,890	12,000	$3,720
Magnesium hydroxide and peroxide	5,930	10,300	6,140	10,100
Magnesium sulfate, natural epsom salts	86	55	288	103
Magnesium sulfate, natural kieserite	13,500	870	26,000	1,870
Magnesium sulfate, other	20,400	4,040	21,900	4,330

1/ Data are rounded to three significant digits.

Source: Bureau of the Census.

TABLE 9
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY 1/ 2/
DECEMBER 31, 1998

(Thousand metric tons, MgO equivalent)

	Raw material				
	Magnesite		Seawater or brines		
Country	Caustic-calcined	Dead-burned	Caustic-calcined	Dead-burned	Total
North America:					
Canada	100	--	--	--	100
Mexico	--	--	15	95	110
United States	NA	NA	NA	NA	1,010 3/
Total	100	NA	15	95	1,220
South America: Brazil	88	291	--	--	379
Europe:					
Austria	90	486	--	--	576
France	--	--	30	--	30
Greece	120	80	--	--	200
Ireland	--	--	--	100	100
Italy	25	--	15	130	170
Netherlands	--	--	--	130	130
Norway	--	--	25	--	25
Poland	--	10	--	--	10
Russia	--	2,020	--	--	2,020
Serbia and Montenegro	40	200	--	--	240
Slovakia	30	275	--	--	305
Spain	140	65	--	--	205
Turkey	50	359	--	--	409
Ukraine	--	120	20	80	220
United Kingdom	--	--	70	80	150
Total	495	3,620	160	520	4,790
Africa:					
Kenya	NA	NA	--	--	170
South Africa	7	--	--	--	7
Total	7	NA	--	--	177
Asia:					
China	200	1,770	--	10	1,980
India	25	292	--	50	367
Iran	--	30	--	--	30
Israel	--	--	10	60	70
Japan	--	--	65	265	330
Korea, North	--	500	--	--	500
Korea, Republic of	--	--	--	50	50
Total	225	2,590	75	435	3,320
Oceania: Australia	50	107	--	--	157
Grand total	965	6,600	250	1,050	10,000

NA Not available.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes capacity at operating plants, as well as at plants on standby basis.
3/ Includes capacity for production of magnesium chloride, magnesium chloride brines, magnesium carbonate, magnesium hydroxide, and caustic-calcined and dead-burned magnesias.

TABLE 10
MAGNESITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1994	1995	1996	1997 e/	1998 e/
Australia	285,610	263,249	237,707	245,127 r/ 3/	359,208 3/
Austria	681,000	784,000	624,000	650,000	650,000
Brazil 4/ (beneficiated)	279,489	315,978	305,737 r/	294,629 r/ 3/	300,000
Canada e/ 5/	180,000	180,000	180,000	180,000	180,000
China e/	990,000	2,050,000	2,100,000	2,400,000 r/	2,400,000
Colombia e/	10,747 3/	10,500 r/	10,500 r/	10,500 r/	10,500
Greece	575,472	565,720	682,346	650,000	650,000
India	336,735	335,189	373,306	375,000	372,000
Iran e/	40,000	40,000	40,000	40,000	40,000
Korea, North e/	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000
Mexico e/	1,120 r/	250 r/	200 r/	231 r/	250
Pakistan	4,464	16,891	3,202	4,000	4,500
Philippines e/	700	700	700	700	700
Poland	16,400	21,500	19,300	20,000	20,000
Russia e/	1,000,000 r/	1,000,000 r/	1,000,000 r/	1,040,000 r/	851,845 3/
Serbia and Montenegro	68,000	75,000	89,000 e/	95,000	100,000
Slovakia e/	1,200,000	1,200,000	1,000,000	1,000,000	1,000,000
South Africa	71,726	84,639	71,358	76,669 r/ 3/	80,000
Spain e/	400,000	491,397 3/	490,000	450,000	500,000
Turkey (run of mine)	1,279,614	1,928,064	2,339,138 r/	1,409,768 r/ 3/	1,600,000
United States	W	W	W	W	W
Zimbabwe	1,588	5,597	10,659	11,000	10,000
Total	9,020,000 r/	11,000,000 r/	11,200,000 r/	10,600,000 r/	10,800,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

1/ World totals, U.S. data, and estimated data have been rounded to three significant digits; may not add to totals shown.

2/ Figures represent crude salable magnesite. In addition to the countries listed, Bulgaria produced magnesite, but output is not reported quantitatively, and available information is inadequate for the formulation of reliable estimates of output levels. Table includes data available through May 20, 1999.

3/ Reported figure.

4/ Series reflect output of marketable concentrates. Production of crude ore was as follows, in tons: 1994--1,026,991; 1995--1,210,617; 1996--1,268,265; 1997--1,030,171 (revised); and 1998--1,050,000 (estimated).

5/ Magnesitic dolomite and brucite. Figures are estimated on the basis of reported tonnage dollar value.