MAGNESIUM COMPOUNDS

By Deborah A. Kramer

In 1997, domestic production of caustic-calcined magnesia increased slightly, and dead-burned magnesia production increased by 5% from 1996 levels. Environmental applications (water treatment and stack-gas scrubbing) were the largest end uses for caustic-calcined magnesia, surpassing chemical applications for the first time. Refractory magnesia production increased mostly as a result of declining imports from China, traditionally the United States' largest import source. Seawater and brines accounted for about 75% of total U.S. magnesium compounds production; the rest of the U.S. production was sourced from magnesite, brucite, dolomite, and olivine.

Production

U.S. production of caustic-calcined magnesia increased slightly and production of dead-burned magnesia increased by 5% in 1997. An increase in demand for water treatment applications was principally responsible for the rise in caustic-calcined magnesia production. Dead-burned magnesia production increased partially to replace the loss of imported material from China.

In September, Martin Marietta Magnesia Specialties Inc. completed a new 31,800-ton-per-year magnesium hydroxide powder plant at its Manistee, MI, magnesia complex. Output from the new plant principally will target the plastics flame retardant market, but the new plant also will supply chemicals, water treatment, and other applications. The magnesium hydroxide powder typically will be marketed at 98.5% purity, with a particle size of 0.5 to 1 micrometer (Industrial Minerals, 1997j). The capacity addition brings Martin Marietta's total U.S. magnesium hydroxide production capacity to 157,000 tons per year at its plants in Michigan, Pennsylvania, and Tennessee. *(See tables 1 and 2.)*

RMc Industries Inc. announced that after a number of trial mining efforts, the company plans to bring a brucite [natural $Mg(OH)_2$] deposit in Arizona into commercial operation. The deposit, which is near Kingman, AZ, contains about 450,000 tons of reserves grading at least 90% brucite. When the operation starts in early 1998, RMc Industries plans to crush and screen the brucite before shipping it to processors in the United States who will produce a range of specialty grades whose primary application will be as a fire retardant and smoke suppressant in plastic and rubber polymer systems. Eventually the company hopes to export some of the material and is negotiating with a potential European partner (Industrial Minerals, 1997d).

Harbison-Walker Refractories Co. commissioned a sixth shaft kiln at its refractories operation in Ludington, MI. The new kiln is dedicated to producing magnesia-aluminate spinels rather than refractory magnesia, the company's principal product. The spinels are becoming increasingly more popular as refractory materials in the cement industry and in steel ladle applications. Because of environmental concerns, the spinels, which have high resistance to thermal stress and good resistance to basic slags, are replacing magnesia-chrome refractories in these applications (North American Minerals News, 1997a).

In December, IMC Global Inc. announced that it would acquire the Harris Chemical Group Inc., which is the parent company of Great Salt Lake Minerals Corp., a producer of magnesium chloride brines. Under terms of the agreement, IMC Global will purchase Harris' equity for $450 million and assume $950 million of debt. IMC Global hopes to achieve cost savings in distribution logistics, procurement, and operations; the estimated savings is projected to be $50 million by 2000 (North American Minerals News, 1998).

Data for magnesium compounds were collected from one voluntary survey of U.S. operations. Of the 19 operations canvassed, 68% responded, representing 62% of the magnesium compounds shipped and used shown in table 3. Data for the six nonrespondents were estimated based on prior-year consumption levels and other factors. *(See table 3.)*

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.

The largest magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for 64% of the world magnesite production capacity. Japan and the United States account for 58% 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, the world's principal producer of olivine, supplied its domestic needs and was a major world supplier of olivine. Countries with smaller output included Australia, Italy, Japan, Mexico, Pakistan, Spain, and the United States.

Consumption

In 1997, environmental applications (water treatment and stack gas scrubbing, in declining order) were the dominant use for caustic-calcined magnesia, accounting for 30% of U.S. shipments. This was the first year that these applications have been the largest end-use sectors for magnesia. The following categories, with the individual components in parentheses in declining order, were the other end-use sectors for caustic-calcined magnesia: chemical, 27%; agriculture (animal feed and fertilizers), 25%; construction (oxychloride and oxysulfate cements and general construction) and refractories, 10%; manufacturing (rubber,

fluxes, pulp and paper, and fuel additives), 7%; pharmaceuticals and nutrition (sugar, cosmetics, medicine and pharmaceutical, and candies and other food items), 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, in animal feed, and in pharmaceuticals.

Magnesium chloride was used mainly as a chemical intermediate. Magnesium chloride brines were used principally for refractories and for road dust and ice control.

Foundry uses remained the largest application for olivine in the United States, accounting for 80% of consumption of domestically produced material. Refractory applications accounted for 13% of U.S. demand, sandblasting and other abrasive uses accounted for 5%, and soil conditioners accounted for 2%.

Prices

Yearend 1997 prices for dead-burned and synthetic magnesia and magnesium sulfate increased from those at yearend 1996, but the rest of the magnesium compound prices quoted in Chemical Market Reporter remained the same. The dead-burned magnesia price increased by $20 per short ton, the synthetic magnesia price increased by $19 per short ton, and the magnesium sulfate price increased by 1.5 to 2.5 cents per pound. U.S. olivine prices, quoted in Industrial Minerals, were $62 to $109 per ton for foundry grade and $50 to $78 per ton for aggregate material, the same as price quotes at yearend 1996. All prices were quoted f.o.b. mine or plant. *(See table 4.)*

Foreign Trade

Imports of all forms of magnesite and magnesia increase compared with those of 1996. Although imports of dead-burned magnesia from China appeared to decrease in 1997, there was a significant increase in magnesia imports from Hong Kong that nearly equaled the decrease in imports from China. With the transfer of Hong Kong to Chinese rule in 1997, this material is most likely of Chinese origin. *(See tables 5, 6, 7, and 8.)*

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 1997, the United States exported 867 tons of olivine, with Chile (57%) as the principal destination. Olivine imports totaled 109,000 tons, all from Norway.

World Review

Australia.—Minerals Holdings Australia Pty. Ltd. (MHA) announced that it would develop a magnesite deposit near Burnie in Tasmania. Reserves at the deposit are estimated to be between 500 million and 1 billion tons of ore grading 40% to 45% MgO. According to the company, drilling and testing programs underway indicate that the ore has low or acceptable levels of trace elements, such as nickel and lead, and that the ore has excellent refractory characteristics, generating only about 2% fines when calcined. Within a 2-year timeframe, MHA plans to extract the ore and sell it as crude magnesite throughout the world. Long-term plans for the deposit include the possibility of constructing a magnesium metal plant, and MHA is negotiating with parties to take a stake in the project (Industrial Minerals, 1997h). MHA is also looking for joint-venture partners to develop a dolomite-dolomitic limestone deposit, also in Tasmania. Although the company does not plan to carry out large-scale exploration, it plans to prove sufficient reserves to supply a silicothermic magnesium metal plant. Ore reserves are estimated to be 2 billion tons (Industrial Minerals, 1997a).

China.—A new refractories plant came on-stream early in 1997. The plant is a joint venture between Veitsch-Radex of Austria (55% ownership) and Liaoning Metallurgical Import/Export Co. (45% ownership). The plant is designed to produce 60,000 tons of magnesia-carbon bricks and 50,000 tons of unshaped products annually. The companies plan to export at least 50% of the plant's output (Industrial Minerals, 1997l).

The UK firm, R. Hostcombe Ltd., signed a joint-venture sales agreement with China's Haicheng Xiyang Refractories Materials Co. for exclusive rights to market the company's magnesite production. Haicheng Xiyang operates about 20 plants in the Liaoning Province with the capacity to produce 510,000 tons of various grades of dead-burned magnesia, 150,000 tons of caustic-calcined magnesia, and 10,000 tons of fused magnesia annually. Haicheng Xiyang also possesses an independent export license for more than 30 countries in Asia, Europe, and North America (Industrial Minerals, 1997f).

India.—Birla Periclase commissioned its new seawater magnesia plant in December with production projected to be 70% of its rated capacity of 50,000 tons per year in the first year of operation. Production is scheduled to increase to full capacity by the second year of operation. This is India's first seawater magnesia operation, and initial production is expected to be sold domestically, replacing some of the country's imported magnesia (Industrial Minerals, 1997b).

Jordan.—After 3 years of operating a pilot plant for magnesia production and securing financing, Jordan Magnesia Co. plans to begin construction of a new magnesia plant at Safi at the beginning of 1999. The $100 million plant is scheduled to produce 50,000 tons of dead-burned magnesia and 10,000 tons of caustic-calcined magnesia per year when operation begins in the first quarter of 2000. Magnesia-rich brines from the Dead Sea are the raw material, and detailed engineering and contractor approval for the project are expected to begin in early 1998 (Industrial Minerals, 1997k).

Mexico.—Qímica del Rey, one of Mexico's two magnesia producers, completed a new plant in Laguna del Rey, Coahuila, to produce magnesium sulfate heptahydrate. Startup of the plant will begin when brine in the newly constructed evaporation ponds reaches the required concentration. The company will use solar evaporation followed by evaporative crystallization and drying to produce the magnesium sulfate product. Initial capacity of the plant is 30,000 tons per year, and the main products will be agricultural and technical grades. Most of the product is destined

for Mexican and Latin American markets, which have been importing their magnesium sulfate requirements from the United States (North American Minerals News, 1997b).

Pakistan.—Construction of a new refractories plant at Haripur began late in 1997. The $50 million plant, established by Magnesite Refractories Ltd., is expected to have a capacity of 30,000 tons of refractories per year when fully operational in 2000. The specific plant location was selected because of its proximity to chromite mines and the magnesite mine in Kumhar. The plant's capacity is estimated to be sufficient to meet local needs for the steel, glass, and cement industries (Industrial Minerals, 1997i).

Russia.—Magnesite Combine Co. in the Chelyabinsk area is the largest producer and consumer of magnesite in Russia. Annual ore output at the open pit averaged about 3.5 million tons per year for the last few years; however, magnesite reserves in January 1997 were estimated to be 26 million tons, perhaps enough to last for the next 10 years. Because of the low quantity of reserves, the company is constructing an underground mine with a planned annual output of 2.4 million tons. With the conversion to underground mining, the quality of the magnesite is expected to deteriorate, and the combine is planning to construct a new concentration plant using flotation rather than heavy-media separation, which is currently in use. Concentration plant construction is estimated to cost $50 million, and the firm is actively seeking investors for project financing (Troitsky, 1997).

Turkey.—Kümaş Kütahya Manyezit İşletmeleri A.Ş. installed 19 new screening units to increase processing efficiency at its magnesite mine and processing operations in Kütahya. Since the company was privatized in 1995, Kümaş Kütahya has invested in ore separation technology at its open pit to prolong the life of the mine by preventing profitable material being lost to the waste area. Current production capacity is 144,000 tons per year of dead-burned magnesia (Industrial Minerals, 1997g).

Comag Continental Madencilik Sanayii Tic. A.Ş. (Comag) completed a 120,000-ton-per-year magnesite upgrading plant in Eskişehir at a cost of $3 million. The plant will upgrade crude magnesite, primarily from the company's Kümbet-Eskişehir Mine, to feed the calcining plants. Comag expects that a centralized preparation unit will be more economical, and that the new production technology will be more efficient (Industrial Minerals, 1997e).

United Kingdom.—At the end of May, Redland Aggregates Ltd. announced that it was selling its magnesia operation in Hartlepool to KHSL Industries Ltd. of Calcutta, India. The plant will be renamed Britmag Ltd. after one of its product lines. Current plant capacity is 150,000 tons per year of caustic-calcined and dead-burned magnesias (Industrial Minerals, 1997c). *(See tables 9 and 10.)*

Outlook

Imports of refractory magnesia from China into the United States are expected to decline in 1998. China's export quota for 1998 has been reduced to 1 million tons from the 1997 level of 2 million tons (Industrial Minerals, 1998). As a result, U.S. dead-burned magnesia production is expected to increase to replace some of the shortfall. In the United States, overall refractories production is expected to decrease as steel producers are reducing refractories consumption rate per ton of steel produced by using higher quality refractories in their operations. One analyst projects that by 2000 the refractories production will decline by an average of 4% per year from the 1995 production level (Semler, 1997).

Significant growth in caustic-calcined magnesia is expected to be solely in two applications—water treatment and flame retardants. Although magnesium hydroxide is the principal product used in these applications, caustic-calcined magnesia is often the feedstock. The principal reasons to use magnesia or magnesium hydroxide for water treatment rather than caustic soda or lime include buffering ability, reduced quantities of sludge, heavy metal removal, and safety. The principal drawbacks are the higher cost and slower reaction time. Because of its enhanced properties, magnesia is expected to increase its share of the water treatment market, albeit at a slower pace than was originally forecast.

Magnesium hydroxide has a small percentage of the total flame retardant market compared with alumina trihydrate, its principal competitor (10,000 to 15,000 tons per year vs. 300,000 to 475,000 tons per year). Potential growth in this market hinges on magnesium hydroxide's superior flame retardancy and smoke suppression properties. Market penetration has been limited by its cost and high loading level requirements for polymers. Flame retardants represent a significant market for magnesium hydroxide but serious obstacles will have to be overcome before there is a shift from the traditional materials (Sims, 1997).

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TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS 1/

(Thousand metric tons, unless otherwise specified)

		1993	1994	1995	1996	1997
United States:						
Caustic-calcined and specified magnesias: 2/						
Shipped by producers: 3/						
Quantity		131	135	141	158	160
Value	thousands	$39,500	$39,300	$37,900	$47,600	$52,600
Exports 4/		4	3	2	20	5
Imports for consumption 4/		141	125	139	114	133
Refractory magnesia:						
Shipped by producers: 3/						
Quantity		268	243	234	269	283
Value	thousands	$77,700	$67,800	$83,800	$96,800	$97,500
Exports		60	60	75	73	66
Imports for consumption		279	342	393	271	279
Dead-burned dolomite:						
Sold and used by producers:						
Quantity		315	300	308	271	NA
Value	thousands	$26,200	$25,000	$28,100	$24,100	NA
World production (magnesite)		8,280	8,720	10,700 r/	10,700 r/	10,500 e/

e/ Estimated. r/ Revised. NA Not available.

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 1997

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:			
Great Salt Lake Minerals 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	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 and dead-burned magnesia.
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-ton-per-year plant.

3/ In addition to its Michigan plant, Martin Marietta owns a 30,000-ton-per-year magnesium hydroxide plant in Pittsburgh, PA, and a 15,000-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/

	1996		1997	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined 2/ and specified (USP and technical) magnesias	158,000	$47,600	160,000	$52,600
Magnesium hydroxide [100% Mg (OH)2] 2/	338,000	112,000	307,000	111,000
Magnesium sulfate (anhydrous and hydrous)	45,600	19,500	46,100	21,500
Precipitated magnesium carbonate 2/	2,960	726	2,470	5,290
Refractory magnesia	269,000	96,800	283,000	97,500

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 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.	.175- .185

Source: Chemical Market Reporter.

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

Material and country	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Caustic-calcined magnesia:				
Chile	--	--	1,810	$558
France	1,480	$1,070	546	349
Germany	14,300	4,360	693	399
Mexico	1,220	340	206	104
Netherlands	690	379	1,350	760
Spain	1,700	510	--	--
Other	208	113	103	57
Total	19,600	6,770	4,700	2,230
Dead-burned and fused magnesia:				
Canada	42,500	15,600	34,200	15,000
Germany	8,890	2,750	3,010	933
Netherlands	7,190	2,300	11,300	3,570
Switzerland	5,520	1,660	--	--
Taiwan	71	35	2,820	1,020
Thailand	17	26	3,900	1,220
Venezuela	2,910	945	3,650	1,130
Other	5,470 r/	4,200 r/	7,420	7,450
Total	72,600	27,500	66,200	30,300
Other magnesia:				
Canada	5,450	2,640	5,010	2,290
China	1,320	480	108	133
Colombia	1,450	539	2,640	666
Mexico	2,680	1,770	4,150	2,090
Spain	1,050	1,320	1,480	1,810
United Kingdom	1,470	1,870	526	707
Venezuela	--	--	3,470	1,040
Other	3,130	3,910	4,280	5,210
Total	16,600	12,500	21,700	13,900
Crude magnesite:				
Belgium	--	--	7,400	1,090
Brazil	5,220	558	5,670	614
France	4,390	623	1,120	124
Germany	1,580	342	8,990	1,820
Korea, Republic of	5,340	621	5,650	706
Mexico	5,000	586	4,400	472
Venezuela	5,170	587	6,210	706
Other	6,310 r/	927 r/	12,100	1,540
Total	33,000	4,240	51,500	7,070

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	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Magnesium chloride, anhydrous and other	3,630	$2,750	5,320	$3,300
Magnesium hydroxide and peroxide	12,200	6,560	10,600	6,100
Magnesium sulfate, natural kieserite and epsom salts	6,750	877	564	628
Magnesium sulfate, other	5,030	1,810	6,760	2,530

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	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Caustic-calcined magnesia:				
Canada	37,300	$7,810	33,500	$6,980
China	63,700	6,870	89,400	8,620
Greece	10,500	2,580	7,460	1,900
Other	2,700	1,940	2,570	2,320
Total	114,000	19,200	133,000	19,800
Dead-burned and fused magnesia:				
Australia	12,100	3,620	13,100	3,440
Austria	21,000	9,530	24,600	10,700
Brazil	10,000	1,190	20,000	2,230
China	193,000	30,100	170,000	19,900
Greece	5,710	911	6,270	997
Hong Kong	3,410	445	20,400	2,330
Israel	3,480	3,010	6,900	5,450
Slovakia	9,010	1,020	--	--
Other	13,700 r/	7,840 r/	17,800	6,850
Total	271,000	57,600	279,000	51,900
Other magnesia:				
China	2,520	944	1,300	576
Israel	2,790	3,450	3,370	4,290
Japan	973	1,810	1,390	2,700
Mexico	4,100	1,570	8,210	3,350
Other	1,470	1,270	3,390	2,530
Total	11,900	9,040	17,700	13,500
Crude magnesite:				
China	5,290	441	5,280	570
Netherlands	3,610	1,370	4,900	1,760
Other	282 r/	83 r/	711	243
Total	9,190	1,900	10,900	2,580

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/

	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Magnesium chloride, anhydrous and other	21,500	$5,600	12,800	$3,890
Magnesium hydroxide and peroxide	4,310	7,590	5,930	10,300
Magnesium sulfate, natural epsom salts	24	23	86	55
Magnesium sulfate, natural kieserite	18,700	1,120	13,500	870
Magnesium sulfate, other	20,200	4,260	20,400	4,040

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, 1997

(Thousand metric tons, MgO equivalent)

Country	Raw material				Total
	Magnesite		Seawater or brines		
	Caustic-calcined	Dead-burned	Caustic-calcined	Dead-burned	
North America:					
Canada	100	--	--	--	100
Mexico	--	--	15	95	110
United States	NA	NA	NA	NA	1,020 3/
Total	100	NA	15	95	1,230
South America: Brazil	58	291	--	--	349
Europe:					
Austria	80	485	--	--	565
France	--	--	30	--	30
Greece	120	80	--	--	200
Ireland	--	--	--	90	90
Italy	25	--	5	130	160
Netherlands	--	--	--	130	130
Norway	--	--	25	--	25
Poland	--	10	--	--	10
Russia	--	2,220	--	--	2,220
Serbia and Montenegro	40	200	--	--	240
Slovakia	30	275	--	--	305
Spain	140	65	--	--	205
Turkey	50	279	--	--	329
Ukraine	--	120	20	80	220
United Kingdom	--	--	70	80	150
Total	485	3,740	150	510	4,880
Africa:					
Kenya	NA	NA	--	--	170
South Africa	7	--	--	--	7
Total	7	NA	--	--	177
Asia:					
China	200	1,770	--	10	1,980
India	25	246	--	--	271
Iran	--	30	--	--	30
Israel	--	--	10	60	70
Japan	--	--	65	265	330
Korea, North	NA	NA	--	--	500
Korea, Republic of	--	--	--	50	50
Total	225	2,040	75	385	3,230
Oceania: Australia	40	107	--	--	147
Grand total	915	6,180	240	990	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 magnesia.

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

(Metric tons)

Country	1993	1994	1995	1996	1997 e/
Australia	261,000 e/	285,610	263,249	237,707 r/	245,024 3/
Austria	648,864	681,000	784,000	624,000 r/	650,000
Brazil 4/ (beneficiated)	232,683 r/	279,489 r/	315,978 r/	300,446 r/	301,000
Canada e/ 5/	180,000	180,000	180,000	180,000	180,000
China e/	1,230,000	990,000	2,050,000 r/	2,100,000 r/	2,000,000
Colombia	8,816	10,747	10,000 e/	10,000 e/	10,000
Greece	479,999	575,472	565,720 r/	682,346 r/	650,000
India	408,971	336,735	335,189 r/	373,306 r/	375,000
Iran e/ 6/	49,424 3/	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/	1,530 3/	1,500	1,200	1,300	1,300
Pakistan	4,157	4,464	16,891	3,202 r/	4,000
Philippines e/	700	700	700	700	700
Poland	13,000	16,400	21,500	19,300 r/	20,000
Russia e/	800,000	700,000	700,000	600,000	600,000
Serbia and Montenegro	55,000	68,000	75,000	89,000 r/ e/	95,000
Slovakia e/	1,200,000	1,200,000	1,200,000	1,000,000	1,000,000
South Africa	67,403	71,726	84,639 r/	71,358 r/	76,000
Spain e/	400,000	400,000	491,397 r/ 3/	490,000 r/	450,000
Turkey (run of mine)	628,782	1,279,614	1,928,064 r/	2,273,418 r/	2,200,000
United States	W	W	W	W	W
Zimbabwe	6,276	1,588	5,597 r/	10,659 r/	11,000
Total	8,280,000	8,720,000	10,700,000 r/	10,700,000 r/	10,500,000

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

1/ World totals and estimated data are 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 formulation of reliable estimates of output levels. Table includes data available through May 20, 1998.

3/ Reported figure.

4/ Series reflects output of marketable concentrates. Production of crude ore was as follows, in tons: 1993--974,161; 1994--1,026,991 (revised); 1995--1,210,617 (revised); 1996--1,268,265 (revised); and 1997--1,300,000 (estimated).

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

6/ Year beginning March 21 of that stated.