



2015 Minerals Yearbook

MAGNESIUM COMPOUNDS [ADVANCE RELEASE]

MAGNESIUM COMPOUNDS

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The leading magnesium compounds were, in descending order of U.S. apparent consumption, magnesia (MgO) and magnesium hydroxide [Mg(OH)₂]. There are three forms of magnesia: caustic-calcined magnesia, dead-burned magnesia, and fused magnesia. The leading commercial magnesium compound was caustic-calcined magnesia, which was used, in descending order by volume, in the chemical industry, agricultural supplements, and environmental applications. Domestic apparent consumption of caustic-calcined magnesia increased by 11%; shipments in 2015 increased slightly from those in 2014, and imports for consumption increased by 21% (table 1). The second-leading commercial magnesium compound was dead-burned magnesia, which was used for refractory products, in descending order of volume, by the steel, cement, and glass industries. U.S. apparent consumption of dead-burned magnesia in 2015 decreased by 10%; production decreased by 19% from that in 2014, shipments decreased by 11%, imports for consumption increased by 8%, and exports increased by 19%. The decreased production of dead-burned magnesia was attributed to increased imports of magnesia from China and to decreased demand for refractory products. The third-leading commercial magnesium compound was magnesium hydroxide, which was used for, in descending order of volume, environmental applications, chemicals, and flame retardants. Apparent consumption of magnesium hydroxide in 2015 was essentially unchanged from that in 2014; domestic shipments decreased slightly from those in 2014, exports decreased by 9%, and imports decreased by 4% (tables 3, 5, 7). Magnesium sulfate (MgSO₄) shipments decreased by 10% (table 3). About 71% of magnesium compounds produced domestically came from seawater and well and lake brines. The remainder was recovered from the minerals dolomite, magnesite, and olivine. Imports made up for the shortfall relative to consumption of domestic production of magnesium compounds with China as the main supplier, accounting for 55% of imports of caustic-calcined magnesia and 50% of imports of dead-burned magnesia and fused magnesia (table 6).

Legislation and Government Programs

The U.S. Department of Commerce, International Trade Administration (ITA), conducted an administrative review of countervailing duties on magnesia-carbon bricks imported from China between September 1, 2012, and August 31, 2013. In April 2015, the ITA published its final determinations and established dumping margins of 236% ad valorem for magnesia-carbon bricks shipped from China by 155 companies during the period of review (U.S. Department of Commerce, International Trade Administration, 2015b).

In May 2015, the ITA rescinded an administrative review of its antidumping duty order on imports of certain magnesia-

carbon bricks from China between September 1, 2013, and August 31, 2014, because the two U.S. companies that requested the review in October 2014 withdrew their requests (U.S. Department of Commerce, International Trade Administration, 2015e).

In July 2015, the ITA implemented determinations regarding antidumping duty investigations on certain magnesia-carbon bricks from China. Dumping margins were established for magnesia-carbon bricks shipped by 14 companies in China of 128.1% ad valorem and 236% ad valorem for other magnesia-carbon brick producers in China effective July 20, 2015 (U.S. Department of Commerce, International Trade Administration, 2015f).

In August, the ITA rescinded an administrative review of its antidumping duty order on imports of certain magnesia-carbon bricks from China between January 1, 2013, and December 31, 2013, because the ITC determined that the five companies under review had not shipped magnesia-carbon bricks to the United States during the review period (U.S. Department of Commerce, International Trade Administration, 2015d).

In December, the ITA completed a sunset review of countervailing duties on certain magnesia-carbon bricks from China and maintained the duties. In September 2010, the ITA established a countervailing duty of 253.87% on one producer of certain magnesia-carbon bricks and 24.24% on all other producers of certain magnesia-carbon bricks in China. In December, the ITA completed a sunset review of antidumping duties on certain magnesia-carbon bricks from China and Mexico. Antidumping duties of 236% and 57.9% on magnesia-carbon bricks from China and Mexico, respectively, were maintained (U.S. Department of Commerce, International Trade Administration, 2015a, c).

Production

In 2015, 156,000 metric tons (t) of caustic-calcined magnesia and 183,000 t of magnesium hydroxide were shipped by domestic producers in the United States (tables 1, 3). Production and shipments data for dead-burned magnesia were withheld to avoid disclosing company proprietary data. Fused magnesia production stopped in June 2013 in the United States. Olivine Corp. processed olivine for use as foundry sand at a plant in Bellingham, WA, using stockpiled material mined in the previous year. No other company mined or processed olivine in the United States in 2015. Data for magnesium compounds were collected by the U.S. Geological Survey (USGS) from an annual voluntary survey of U.S. operations. Of the nine operations canvassed, six responded, representing approximately 99% of the magnesium compounds shipped and used, including data for some compounds that were not reportable in table 3. Data

for the three nonrespondents were estimated on the basis of prior-year production levels.

Compass Minerals International, Inc. (Overland Park, KS) planned to build new solar evaporation ponds on the west side of the Great Salt Lake in Utah. Compass produced magnesium chloride (MgCl_2), potassium sulfate, and salt from the Great Salt Lake. The project would increase production capacity of Compass's main product, potassium sulfate, by 35%, and magnesium chloride capacity could be increased if market conditions warranted. No construction progress was made during the year as a project schedule was still pending regulatory approval since submission in 2013. Compass sold magnesium chloride, mainly for deicing and dust control applications but also for agricultural purposes; potassium sulfate for agricultural uses; and salt for deicing and chemicals (Compass Minerals International, Inc., 2016, p. 14, 26).

Consumption

In 2015, the domestic end uses by tonnage for caustic-calcined magnesia were chemical intermediates, accounting for 38% of the total use; agriculture (animal feed and fertilizers), 31%; environmental applications (water treatment), 18%; and other uses, 13%. Dead-burned magnesia and fused magnesia were used for refractory products, with the steel industry being the leading domestic end use. Domestic consumption of magnesia refractories decreased in 2015 as a result of reduced domestic steel production attributed to increased imports of steel from China. The cement and glass industries also used refractory products made from dead-burned and fused magnesia.

Magnesium hydroxide was used, in descending order of quantity, for water treatment, as a chemical intermediate, and in medicines and pharmaceuticals. Magnesium sulfate was used, in descending order of quantity, for chemicals, fertilizer, rubber, pulp and paper, pharmaceuticals, and water treatment. Magnesium chloride was used mainly for deicing, and magnesium chloride brines were used for deicing and to control road dust.

Foreign Trade

Net imports of caustic-calcined magnesia in 2015 were 19% more than those in 2014. Net imports of dead-burned and fused magnesia in 2015 were 6% more than those in 2014. The leading sources of caustic-calcined magnesia imports remained China (55%), Canada (20%), and Australia (13%). China, Ukraine, and Brazil supplied 50%, 20%, and 18%, respectively, of imports of dead-burned and fused magnesia. Imports of dead-burned and fused magnesia from China decreased by 20% compared with those in 2014. Ukraine had not supplied imports of dead-burned and fused magnesia since 2012 (tables 4, 6).

Prices

In 2015, import prices of caustic-calcined magnesia decreased by 7% to \$296 per metric ton from \$317 per metric ton. Export prices of caustic-calcined magnesia increased by 4% to \$670 per metric ton in 2015 from \$643 per metric ton in 2014. In 2015, prices for dead-burned and fused magnesia imports decreased by 13% to \$535 per metric ton from \$614 per metric ton in

2014. Prices for exports of dead-burned and fused magnesia decreased by 7% to \$673 per metric ton in 2015 from \$720 per metric ton in 2014. In 2015, prices for magnesite imports decreased by 35% to \$134 per metric ton from \$206 per metric ton in 2014. Prices for exports of magnesite increased by 14% to \$1,470 per metric ton in 2015 from \$1,290 per metric ton in 2014 (tables 4, 6). In 2015, prices for magnesium hydroxide imports decreased by 25% to \$1,770 per metric ton from \$2,370 per metric ton in 2014. Prices for exports of magnesium hydroxide decreased by 3% to \$760 per metric ton in 2015 from \$785 per metric ton in 2014 (tables 5, 7).

World Review

World production of crude salable magnesite (MgCO_3) decreased by 6% to 27.7 million metric tons (Mt) in 2015 compared with revised 29.4 Mt in 2014 (table 9). In descending order of capacity, China, Russia, and Turkey had the largest magnesite processing capacity and combined accounted for 84% of world production of magnesia from magnesite in 2015, with China accounting for 69% of the total (tables 8, 9). Japan, the Netherlands, and the United States together accounted for about 57% of the world's magnesia production capacity from seawater or brines (table 8). Fused magnesia was produced in Australia, Brazil, China, Iran, Israel, Japan, North Korea, the Republic of Korea, Mexico, Norway, Russia, Turkey, and the United Kingdom. At yearend 2015, world production capacity for caustic-calcined magnesia was about 3.32 million metric tons per year (Mt/yr) and capacity for dead-burned magnesia was about 8.62 Mt/yr (table 8).

Norway has been the world's principal producer and supplier of olivine. Other producers include Australia, Austria, Brazil, China, Greece, Italy, Japan, the Republic of Korea, Mexico, Spain, Taiwan, and Turkey. Production data were not available for many of these countries, and some producers may not have mined olivine in 2015 but supplied stockpiled olivine to customers. Olivine was not mined in the United States in 2015, but stockpiled olivine was processed and supplied to foundries and other consumers from a plant in Washington.

Canada.—In 2015, Karnalyte Resources Inc. (Calgary, Alberta) obtained additional financing to develop and mine a carnallite-sylvite mineral deposit near Wynyard, Saskatchewan, although limited construction activities took place on the project. A schedule for further construction was not available. In 2013, the Saskatchewan Ministry of Environment approved Karnalyte's Environmental Impact Statement and notified Karnalyte that it could proceed with the construction permitting process. Karnalyte planned to produce 100,000 metric tons per year (t/yr) of magnesium chloride brine (32% MgCl_2), 104,000 t/yr of hydromagnesite [$\text{Mg}_4(\text{OH})_2(\text{CO}_3)_3 \cdot 3\text{H}_2\text{O}$], and 625,000 t/yr of potash (Karnalyte Resources Inc., 2013a, b; 2016, p. 12–17).

China.—The Ministry of Industry and Information Technology announced regulations for refractory product producers in order to reduce pollution and conserve energy. Consolidation of the refractories industry was also encouraged in order to close excess capacity and limit production. Steel production in China decreased by 2.3% in 2015 compared with that of 2014, resulting in more

magnesia available for export (Industrial Minerals, 2016; World Steel Association, 2015; 2016b, c).

Greece.—Terna Mag S.A. was constructing a multiple hearth furnace to produce dead-burned magnesia at its Mantoudi plant. Completion was expected by the end of 2016 and would increase dead-burned magnesia capacity at the plant to 90,000 t/yr from 60,000 t/yr. The plant also had 30,000 t/yr of caustic-calcined magnesia capacity (Syrett and Li, 2015).

Norway.—RHI AG (Vienna, Austria) reduced production from the 80,000-t/yr fused magnesia from seawater plant in Porsgrunn to about 30,000 t/yr in the second half of 2015. Low prices for fused magnesia were cited for the reduced production at the plant (Gyekye and Syrett, 2015; RHI AG, 2016, p. 41, 94, 127).

Russia.—Magnezit Group was developing a magnesite mine at the Talsky deposit in eastern Siberia. The mine was expected to be completed by mid-2016. A plant to produce 200,000 t/yr of caustic-calcined magnesia and 100,000 t/yr of fused magnesia was planned for completion by 2019 (Vorotnikov, 2015).

In July, Nikochem LLC commissioned a 25,000-t/yr magnesium hydroxide plant and a 30,000-t/yr synthetic magnesia plant in Volgograd. Nikochem recovered bischofite ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$) from deposits near Volgograd as its feedstock (Nikochem LLC, 2015).

Outlook

According to the World Steel Association (2016a, c), world crude steel production, the leading end use for magnesia, was 1.6 billion metric tons in 2015, a decrease of 2.8% compared with that of 2014. China continued to be the leading steel-producing nation, accounting for 49.5% of global production in 2015. Demand for dead-burned and fused magnesia is expected to decline if steel production declines in 2016 compared with that in 2015.

The global supply of magnesia and magnesium compounds is expected to be sufficient to meet global demand for many years. Magnesia exports from China are expected to increase in 2016 as China's magnesia production exceeds the consumption by the steel and other pyrogenic industries that require refractory products. Magnesia producers in China were reported to have delayed or slowed restarting production following China's New Year holiday in early 2016 owing to weak demand and low prices, especially for fused magnesia (Li and Syrett, 2016). In addition, by 2018, the steel industry in China set a goal to reduce unit consumption of dead-burned magnesia to 15 kilograms per metric ton (kg/t) of steel produced from the current 23 kg/t of steel produced (Moore, 2014). If this target is achieved, less demand for magnesia refractory products is expected, even if steel production in China recovers to previous levels. Production of cement, glass, magnesia, and steel could decrease in China if the Government of China enforces policies to close older, less efficient capacity in order to reduce emissions. Magnesia consumption in Europe is expected to remain at levels significantly lower than peak consumption in 2007 and may decrease if Europe's economy contracts. Development of magnesite deposits in Australia and Canada and recent expansion of processing capacity in Australia, Brazil, Iran, the Netherlands, Norway, Russia, and Turkey are expected to increase supplies of magnesium compounds outside of China.

Consumption of caustic-calcined magnesia as a feed supplement and fertilizer additive is expected to increase as the nutrient value of magnesium continues to gain attention. By 2020, global consumption of caustic-calcined magnesia in animal feed is expected to increase to 600,000 t/yr from 470,000 t/yr in 2014, a 28% increase. Consumption of magnesium hydroxide for water treatment is expected to increase and remain the leading end use of magnesium hydroxide. Use of magnesium hydroxide for flame retardants is expected to increase owing to concern about the corrosiveness and toxicity of smoke and other emission products from plastics containing halogenated flame retardants (Industrial Minerals, 2014).

References Cited

- Compass Minerals International, Inc., 2016, 2015 annual report: Overland Park, KS, Compass Minerals International, Inc., 68 p. (Accessed June 29, 2016, at <http://phx.corporate-ir.net/phoenix.zhtml?c=148615&p=irol-reportsAnnual>.)
- Gyekye, Liz, and Syrett, Laura, 2015, RHI post stable Q1 2015 results despite dip in FM demand: Industrial Minerals, no. 573, June, p. 22.
- Industrial Minerals, 2014, Magnesia products under the radar: Industrial Minerals, no. 561, June, p. 57–58.
- Industrial Minerals, 2016, Magnesia—Year in review 2015: Industrial Minerals, no. 579, January, p. 43.
- Karnalyte Resources Inc., 2013a, Karnalyte Resources Inc. authorized to proceed to construction permitting process for Wynyard carnallite project: Calgary, Alberta, Canada, Karnalyte Resources Inc. press release, September 19. (Accessed June 19, 2014, at http://www.karnalyte.com/investors/press_releases/2013/index.php?&content_id=83.)
- Karnalyte Resources Inc., 2013b, Karnalyte Resources receives environmental impact statement approval for Wynyard carnallite project: Calgary, Alberta, Canada, Karnalyte Resources Inc. press release, February 11. (Accessed June 19, 2014, at http://www.karnalyte.com/investors/press_releases/2013/index.php?&content_id=56.)
- Karnalyte Resources Inc., 2016, Annual information form for the year ended December 31, 2015: Calgary, Alberta, Canada, Karnalyte Resources Inc., 61 p. (Accessed June 30, 2016, at http://www.karnalyte.com/investors/financial_reports/.)
- Li, Albert, and Syrett, Laura, 2016, Magnesia—A Sino-Soviet split?: Industrial Minerals, no. 582, April, p. 26.
- Moore, Simon, 2014, Chinese steel consumption rates to dictate global refractory future: Industrial Minerals, no. 556, January, p. 20.
- Nikochem LLC, 2015, New production start-up at JSC Kaustik site: Volgograd, Russia, Nikochem LLC news release, July 7. (Accessed June 30, 2016, at <http://www.nikochem.com/en/news/item/2163>.)
- RHI AG, 2016, Annual report 2015: Vienna, Austria, RHI AG, 168 p. (Accessed July 1, 2016, at http://ogb.rhi-ag.com/RHI_GB_2015_E/#168.)
- Syrett, Laura, and Li, Albert, 2015, MagMin 2015—Chinese completion squeezes Europe's CCM producers: Industrial Minerals, no. 573, June, p. 9.
- U.S. Department of Commerce, International Trade Administration, 2015a, Certain magnesia carbon bricks from Mexico and the People's Republic of China—Final results of expedited sunset review of the antidumping duty order: Federal Register, v. 80, no. 236, December 9, p. 76447–76448.
- U.S. Department of Commerce, International Trade Administration, 2015b, Certain magnesia carbon bricks from the People's Republic of China—Final results and final partial rescission of the antidumping duty administrative review: 2012–2013: Federal Register, v. 80, no. 71, April 14, p. 19961–19964.
- U.S. Department of Commerce, International Trade Administration, 2015c, Certain magnesia carbon bricks from the People's Republic of China—Final results of expedited first sunset review of the countervailing duty order: Federal Register, v. 80, no. 234, December 7, p. 75971–75972.
- U.S. Department of Commerce, International Trade Administration, 2015d, Certain magnesia carbon bricks from the People's Republic of China—Notice of rescission of the countervailing duty administrative review: Federal Register, v. 80, no. 164, August 25, p. 51536–51538.
- U.S. Department of Commerce, International Trade Administration, 2015e, Certain magnesia carbon bricks from the People's Republic of China—Rescission of the antidumping duty administrative review: Federal Register, v. 80, no. 91, May 12, p. 27146–27147.

U.S. Department of Commerce, International Trade Administration, 2015f, Implementation of determinations under Section 129 of the Uruguay Round Agreements Act: Federal Register, v. 80, no. 145, July 29, p. 45184–45192.

Vorotnikov, Vladislav, 2015, New projects set to boost Russian magnesia production: Industrial Minerals, no. 572, May, p. 38–40.

World Steel Association, 2015, Monthly crude steel production 2014: Brussels, Belgium, World Steel Association, January 22, 1 p. (Accessed June 24, 2015, at <http://www.worldsteel.org/statistics/statistics-archive/steel-archive.html>.)

World Steel Association, 2016a, May 2016 crude steel production: Brussels, Belgium, World Steel Association, June 21. (Accessed July 1, 2016, at <http://www.worldsteel.org/media-centre/press-releases/2016/May-2016-crude-steel-production.html>.)

World Steel Association, 2016b, Monthly crude steel production 2015: Brussels, Belgium, World Steel Association, January 25, 1 p. (Accessed July 1, 2016, at <http://www.worldsteel.org/statistics/statistics-archive/steel-archive.html>.)

World Steel Association, 2016c, World crude steel output decreases by -2.8% in 2015: Brussels, Belgium, World Steel Association, January 25. (Accessed July 1, 2016, at <http://www.worldsteel.org/media-centre/press-releases/2016/--World-crude-steel-output-decreases-by--2.8--in-2015.html>.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.

Magnesian Refractories. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Magnesium, its Alloys and Compounds. Open-File Report 01–341, 2001.

Magnesium Compounds. Ch. in Mineral Commodity Summaries, annual.

Mapping the Mineral Resource Base for Mineral Carbon-Dioxide Sequestration in the Conterminous United States. Data Series 414, 2009.

Other

Magnesium Minerals and Compounds. Ch. in Industrial Minerals and Rocks (7th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 2006.

Magnesium. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Magnesium and Magnesite in the CIS in 1996. Roskill Information Services Ltd., 1996.

Magnesium Compounds and Chemicals (11th ed.). Roskill Information Services Ltd., 2010.

TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS¹

(Thousand metric tons and thousand dollars)

	2011	2012	2013	2014	2015
United States:					
Caustic-calcined and specified magnesias: ²					
Shipped by producers: ³					
Quantity	155	152	155	152	156
Value	48,800	46,000	47,700	57,700	59,300
Exports ⁴	(5)	(5)	1	3	6
Imports for consumption ⁴	111	114	133	151	183
Dead-burned magnesia:					
Shipped by producers:					
Quantity	W	W	W	W	W
Value	W	W	W	W	W
Exports	18	16	19	21	25
Imports for consumption	384	292	215	241	259
World, production of magnesite	27,700 ^r	24,200	25,400 ^r	29,400 ^{r,e}	27,700 ^e

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

¹Data are rounded to no more than three significant digits.

²Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

³Includes magnesia used by producers.

⁴Caustic-calcined magnesia only.

⁵Less than ½ unit.

TABLE 2
U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 2015¹

(Metric tons, MgO equivalent)

Raw material source and producing company	Location	Capacity	Products
Magnesite, Premier Magnesia, LLC	Gabbs, NV	140,000	Caustic-calcined magnesia.
Lake brines:			
Compass Minerals International, Inc.	Ogden, UT	250,000	Magnesium chloride and magnesium chloride brines.
Intrepid Potash, LLC	Wendover, UT	45,000	Magnesium chloride brines.
Well brines, Martin Marietta Magnesia Specialties, LLC	Manistee, MI	314,000	Caustic-calcined magnesia, dead-burned magnesia, and magnesium hydroxide.
Seawater:			
South Bay Salt Works	Chula Vista, CA	3,000	Magnesium chloride brines.
SPI Pharma, Inc.	Lewes, DE	5,000	Magnesium hydroxide.
Total		757,000	

¹Data are rounded to no more than three significant digits; may not add to total shown.

TABLE 3
U.S. MAGNESIUM COMPOUNDS SHIPPED BY PRODUCERS¹

	2014		2015	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias ²	152,000	\$57,700	156,000	\$59,300
Magnesium hydroxide [100% Mg(OH) ₂] ²	187,000	88,900	183,000	86,500
Magnesium sulfate, anhydrous and hydrous	49,600	23,800	44,600	21,100
Dead-burned magnesia	W	W	W	W

W Withheld to avoid disclosing company proprietary data.

¹Data are rounded to no more than three significant digits.

²Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

TABLE 4
U.S. EXPORTS OF MAGNESIA AND CRUDE MAGNESITE, BY COUNTRY¹

Material and country	2014		2015	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
Canada	1,790	\$911	114	\$58
China	64	57	670	447
Germany	113	62	359	307
India	32	33	206	209
Korea, Republic of	171	158	19	18
Netherlands	263	164	1,470	882
Poland	120	120	139	140
Russia	--	--	1,410	720
Spain	116	121	312	310
Taiwan	299	207	348	259
Other	161 ^r	176 ^r	635	456
Total	3,130	2,010	5,680	3,810
Dead-burned and fused magnesia:				
Belgium	9	23	405	435
Canada	2,930	2,280	3,100	2,480
China	232	331	114	159
Germany	907	837	83	75
Mexico	2,040	1,040	2,810	1,260
South Africa	11,600	6,890	15,600	9,290
Taiwan	1,750	1,660	1,830	1,760
Turkey	100	114	69	93
United Arab Emirates	528	784	436	603
Other	742 ^r	1,030 ^r	347	518
Total	20,800	15,000	24,800	16,700
Other magnesia:				
Brazil	312	394	108	222
Canada	2,990	2,580	4,880	4,060
China	941	1,090	226	366
France	1,170	865	607	474
Germany	1,380	1,800	575	515
India	242	302	359	361
Italy	397	783	370	698
Korea, Republic of	650	686	642	845
Mexico	513	1,020	709	1,090
Netherlands	1,160	910	364	298
Norway	328	278	641	403
Taiwan	336	332	22	17
United Kingdom	2,090	1,820	1,540	1,400
Other	2,040 ^r	3,180 ^r	2,100	2,720
Total	14,500	16,000	13,100	13,500
Crude magnesite:				
Brazil	42	80	37	58
Canada	174	128	43	30
Germany	17	79	17	97
Iceland	184	210	--	--
Mexico	19	39	215	214
Panama	37	77	69	155
Spain	137	148	--	--
Trinidad and Tobago	25	32	23	30
United Kingdom	67	71	--	--
Venezuela	16	39	32	46
Other	52	92	84	134
Total	770	995	520	764

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 5
U.S. EXPORTS OF MAGNESIUM COMPOUNDS¹

Material	2014		2015		Principal destinations in 2015
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
Magnesium chloride, anhydrous and other	10,300	\$6,810	16,300	\$10,400	Canada, 93%.
Magnesium hydroxide and peroxide	26,900	21,100	24,500	18,600	Canada, 50%; Sweden, 20%; Mexico, 7%.
Magnesium sulfate, natural kieserite and epsom salts	176	298	924	735	Canada, 87%.
Magnesium sulfate, other	8,770	4,110	10,300	5,360	Canada, 72%; Mexico, 8%.

¹Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIA AND CRUDE MAGNESITE, BY COUNTRY¹

Material and country	2014		2015	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
Australia	18,100	\$5,830	23,000	\$5,170
Brazil	11,300	2,960	14,800	3,790
Canada	40,900	18,500	35,900	16,200
China	78,400	17,800	101,000	23,000
Hong Kong	--	--	307	76
Israel	1,280	234	2,060	375
Japan	1,150	2,540	2,290	4,670
Russia	--	--	3,040	777
Slovakia	127	70	--	--
Other	162	102	132	72
Total	151,000	48,100	183,000	54,100
Dead-burned and fused magnesia:				
Australia	--	--	4,520	2,990
Austria	18	37	3	2
Brazil	60,900	27,700	47,800	29,600
China	160,000	99,200	128,000	71,500
France	201	1,570	181	1,460
Germany	42	93	76	179
Greece	978	560	2,480	1,140
Israel	2,060	6,690	2,130	7,110
Japan	1,450	3,730	1,230	3,680
Mexico	1,020	1,100	1,490	1,430
Netherlands	110	111	703	522
Russia	57	60	1,500	626
Spain	5,170	1,720	4,040	1,460
Turkey	7,700	3,550	12,600	7,540
Ukraine	--	--	50,600	7,870
United Kingdom	859	1,480	680	1,180
Other	625	260	670	309
Total	241,000	148,000	259,000	139,000
Other magnesia:				
Australia	761	374	7,080	4,350
Brazil	13,000	3,610	11,400	3,500
Canada	96	53	2,840	1,440
China	11,700	4,560	8,290	2,810
France	149	505	247	854
Israel	1,940	5,200	1,880	5,310
Japan	1,130	2,690	905	2,070
Mexico	4,340	4,530	3,760	4,180
Russia	--	--	12,800	3,540
Slovakia	1,710	645	654	287
United Kingdom	379	691	508	884
Other	392 ^r	318 ^r	665	566
Total	35,600	23,200	51,000	29,800
Crude magnesite:				
Brazil	340	516	367	583
China	17,300	2,010	76,900	8,630
Israel	114	359	--	--
Italy	119	32	188	50
Japan	236	707	310	916
United Kingdom	--	--	29	84
Other	230	169	169	155
Total	18,400	3,790	77,900	10,400

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS¹

Material	2014		2015		Principal sources in 2015
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
Magnesium chloride, anhydrous and other	118,000	\$31,100	92,500	\$29,400	Israel, 60%; Netherlands, 26%.
Magnesium hydroxide and peroxide	6,800	16,100	6,530	11,600	Mexico, 45%; Israel, 15%; Austria, 15%.
Magnesium sulfate, natural epsom salts	3,040	1,050	5,170	1,510	China, 100%.
Magnesium sulfate, natural kieserite	45,700	1,920	39,600	3,970	China, 61; Germany, 38%.
Magnesium sulfate, other	30,300	15,300	32,800	13,600	China, 46%; Germany, 24%; Canada, 13%.

¹Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 8
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY,
DECEMBER 31, 2015^{1,2}

(Thousand metric tons, MgO equivalent)

Country	Raw material				Total
	Magnesite		Seawater or brines		
	Caustic- calcined	Dead- burned	Caustic- calcined	Dead- burned	
Australia	218	110	--	--	328
Austria	76	325	--	--	401
Brazil	96	380	12	--	488
Canada	100	--	--	--	100
China	1,440	2,740	--	--	4,180
France	--	--	30	--	30
Greece	90	110	--	--	200
India	20	202	--	--	222
Iran	25	40	--	--	65
Ireland	--	--	--	90	90
Israel	--	--	10	60	70
Italy	25	--	--	--	25
Japan	--	--	50	70	120
Jordan	--	--	10	50	60
Korea, North	25	100	--	--	125
Korea, Republic of	--	--	--	40	40
Mexico	--	--	15	95	110
Netherlands	--	--	10	205	215
Norway	--	--	30	--	30
Poland	--	10	--	--	10
Russia	380	2,500	--	--	2,880
Saudi Arabia	39	32	--	--	71
Serbia	--	35	--	--	35
Slovakia	--	465	--	--	465
South Africa	12	--	--	--	12
Spain	150	70	--	--	220
Turkey	106	544	--	--	650
Ukraine	--	170	20	80	270
United States	140	--	191	195	526
Total	2,940	7,730	378	885	12,000

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes capacity at operating plants as well as at plants on standby basis.

TABLE 9
MAGNESITE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country	2011	2012	2013	2014 ^c	2015 ^c
Australia ^c	640,000	587,000	450,000	500,000	420,000
Austria	867,912	778,810	714,422	750,000	760,000
Brazil	476,805	479,304 ^r	557,431 ^r	600,000	550,000
Canada ^{c,4}	150,000	150,000	150,000	150,000	150,000
China ^c	19,000,000	16,000,000	17,000,000 ^r	20,500,000	19,000,000
Greece	541,813	281,000	337,600	360,000	398,854 ³
Guatemala	311	27,132	17,196	20,000	20,000
India ^c	236,000	224,000	213,000	225,000	230,000
Iran ⁵	172,697 ³	170,000 ^r	170,000 ^r	170,000 ^r	170,000
Korea, North ^c	254,000	178,000	250,000	250,000	250,000
Mexico	45,598	44,700	45,281	46,942 ³	43,944 ³
Pakistan ⁴	4,908	5,444 ^r	6,705 ^r	5,000	5,000
Poland ⁵	129,166 ³	129,641 ³	165,000 ^r	165,000 ^r	150,000
Russia ^c	1,200,000	1,300,000	1,370,000	1,500,000	1,300,000
Saudi Arabia ⁵	41,000 ^{r,3}	39,000 ³	62,000	75,000 ^r	77,000 ³
Serbia	24,000	24,000 ^e	24,000 ^e	24,000	20,000
Slovakia ^c	751,700 ^{r,3}	618,400 ^{r,3}	620,000 ^r	700,000	650,000
South Africa ^c	31,900	31,000	31,000	30,000	30,000
Spain ⁵	500,000	649,937 ³	643,827 ³	650,000	640,000
Turkey	2,588,276	2,475,828 ^r	2,597,000	2,700,000	2,800,000
United States	W	W	W	W	W
Total	27,700,000 ^r	24,200,000	25,400,000 ^r	29,400,000 ^r	27,700,000

^cEstimated. ^rRevised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Figures 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 formation of reliable estimates of output levels. Includes data available through July 11, 2016.

³Reported figure.

⁴Magnesite, dolomite, and brucite.

⁵Magnesite-consumption estimate based on reported production of caustic-calcined or dead-burned magnesite, unless denoted as reported. Consumption may have been from stockpiled magnesite.