



2012 Minerals Yearbook

MAGNESIUM COMPOUNDS [ADVANCE RELEASE]

MAGNESIUM COMPOUNDS

By E. Lee Bray

Domestic survey data and tables were prepared by Paula R. Neely, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Although domestic steel production increased by 2.5% in 2012 compared with that in 2011 (World Steel Association, 2013b) and domestic shipments of refractory (dead-burned) magnesia increased slightly, net imports for consumption and apparent consumption of refractory magnesia in the United States declined by more than 20% each, suggesting consumers used stocks previously imported. Domestic caustic-calcined magnesia shipments decreased slightly from those in 2011, imports for consumption were 3% higher, and apparent consumption was unchanged. China was the main source of dead-burned magnesia and caustic-calcined magnesia imports, accounting for 55% of the imports of each. About 69% of U.S. magnesium compounds production came from seawater and well and lake brines. The remainder was recovered from dolomite, magnesite, and olivine.

World production of magnesite decreased by 12% in 2012 to 23.1 million metric tons (Mt). China, with 69% of the total, was the world's leading magnesite producer.

Legislation and Government Programs

The U.S. Department of Commerce, International Trade Administration, was conducting an administrative review of its antidumping and countervailing duties, which were established in 2010, on imports of magnesia-carbon brick from China between September 1, 2011, and August 31, 2012. A preliminary determination was expected in June 2013 (U.S. Department of Commerce, International Trade Administration, 2012).

Production

Domestic shipments of caustic-calcined magnesia decreased slightly and magnesium sulfate shipments increased slightly (table 3). Magnesium hydroxide shipments were 11% lower, attributed to the closure of Premier Magnesia, LLC's plant at Port St. Joe, FL, which was permanently shut down in 2011 (O'Driscoll, 2012d).

Data for magnesium compounds were collected by the U.S. Geological Survey (USGS) from one voluntary survey of U.S. operations. Of the 11 operations canvassed, 8 responded, representing 98% 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.

Fused magnesia was produced by one company in the United States; UCM Magnesia Inc. [a subsidiary of UCM Group plc (Stafford, United Kingdom)] operated a plant in Cherokee, AL. Olivine Corp., the only company in the United States to produce olivine, operated a mine and processing plant in Washington.

Great Salt Lake Minerals Corp. [a subsidiary of Compass Minerals International, Inc. (Overland Park, KS)] completed the

initial phase of an expansion project, installing new technology to increase the efficiency of its solar evaporation ponds near the Great Salt Lake in Utah. Magnesium chloride brine production capacity increased to 750,000 metric tons per year (t/yr) from 550,000 t/yr, and further expansion was planned to increase its total magnesium chloride brine production capacity to 1 million metric tons per year (Mt/yr) by 2015. The company's production was marketed mainly for deicing applications (Compass Minerals International, Inc., 2011; 2013, p. 5, 9, 38).

Consumption

In 2012, environmental applications (water treatment and stack-gas scrubbing) remained the largest tonnage end use for domestic producer shipments of caustic-calcined magnesia, with 43% of the total. The other major end-use sectors for caustic-calcined magnesia (with the individual components in descending order of consumption in parentheses) were agriculture (animal feed and fertilizers), 32% and chemical intermediates, 23%. The remaining categories combined had 2% of the total use—manufacturing (rubber and electrical), construction (primarily oxychloride and oxysulfate cements), and medicines and cosmetics.

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

Foreign Trade

Dead-burned and fused magnesia exports in 2012 were 11% less than exports in 2011. South Africa (43%) and Canada (28%) were the principal destinations. Caustic-calcined magnesia exports were 6% less than those in 2011. Mexico (91%) was the main destination (table 4).

Imports of dead-burned and fused magnesia were 24% less than those in 2011, although data reported by the World Steel Association (2013b) indicated that U.S. steel production increased by 2.5% from 2011 to 2012 suggesting that stocks of dead-burned and fused magnesia refractory products were relied upon by steel producers. In 2011 imports of dead-burned and fused magnesia increased by 19% while steel production increased by only 7% from those in 2010, possibly indicating accumulation of inventories during 2011. Imports of dead-burned and fused magnesia from China were 55% of the total, followed by Brazil (17%), Ukraine (7%), and Russia (5%). Imports of caustic-calcined magnesia were 3% more than

those in 2011. China (55%), Canada (32%), and Australia (11%) remained the leading sources (table 6).

World Review

The largest capacity magnesite processing facilities in the world are in China and Russia. These countries accounted for about two-thirds of world magnesia from magnesite production capacity. Japan, the Netherlands, and the United States accounted for about 52% of the world's magnesia production capacity from seawater or brines. Fused magnesia was produced in Australia, Brazil, China, Iran, Israel, Japan, the Republic of Korea, Mexico, Norway, Russia, Turkey, the United Kingdom, and the United States. World production capacity for fused magnesia increased by about 175,000 t/yr during 2012. World production capacity for dead-burned magnesia was 8.5 Mt/yr.

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, Turkey, and the United States. Roberts (2008) estimated that total world production of olivine in 2008 was 8.4 Mt, although the total was likely smaller in 2012 with mine closures, particularly in Greenland and the United States, which resulted from the global economic downturn in 2008–09.

Australia.—In April, SCR Sibelco N.V. (Antwerp, Belgium) acquired Queensland Magnesia Pty. Ltd. (QMAG) (Toowong, Queensland) which had a 300,000-t/yr caustic-calcined magnesia plant in Parkhurst, Queensland, supplied by a 600,000-t/yr magnesite mine at Kunwarara, Queensland. QMAG continued work on converting a mothballed cement plant at Rockhampton, Queensland, purchased in 2011 from Cement Australia Pty. Ltd., to produce 100,000 t/yr of caustic-calcined magnesia. The plant was expected to come onstream by 2013 and would increase QMAG's total magnesia production capacity to 400,000 t/yr (O'Driscoll, 2011, 2012f; Queensland Magnesia Pty. Ltd., 2012).

Tasmania Magnesite NL [a subsidiary of Beacon Hill Resources plc (London, United Kingdom)] conducted a preliminary scoping study of the Arthur River magnesite project in Tasmania. A feasibility study was planned for a 292,000-t/yr magnesite mine and an adjacent 100,000-t/yr caustic calcined magnesia plant. The Arthur River magnesite deposit has an inferred resource estimate of 25 Mt grading 42.4% MgO (Beacon Hill Resources plc, 2012).

Archer Exploration Ltd. (Wayville, South Australia) was exploring a series of magnesite deposits near Leigh Creek, South Australia. If feasible, Archer could develop a 315,000-t/yr mine and processing facility to produce 150,000 t/yr of caustic calcined magnesia. Samples collected had an average grade of 41.3% MgO (Archer Exploration Ltd., 2012a, b).

Austria.—RHI AG (Vienna) was upgrading its magnesia-chrome refractory plant in Trieben. The project would increase capacity to 63,000 t/yr of magnesia refractories from 55,000 t/yr (Roberts, 2012).

Brazil.—In April, Magnesita Refratários S.A. (Contagem) commissioned a fourth 60,000-t/yr furnace in Brumado, increasing capacity of the plant to 240,000 t/yr of dead-burned magnesia production from magnesite (Magnesita Refratários S.A., 2012, p. 8, 11, 12).

Canada.—In July, Karnalyte Resources Inc. (Calgary, Alberta) released a prefeasibility study for a proposed magnesium chloride and potash solution mining project at Wynyard, Saskatchewan. Karnalyte planned to develop the carnallite-sylvite mineral deposit to produce 100,000 t/yr of magnesium chloride brine (32% MgCl₂), 104,000 t/yr of hydromagnesite, and 625,000 t/yr of potash. In September, Karnalyte signed a construction agreement for the processing facility and submitted its environmental impact statement for review by the Saskatchewan Ministry of Environment (Karnalyte Resources Inc., 2012a, b, c).

In March, Globex Mining Enterprises Inc. (Rouyn-Noranda, Quebec) announced results of a preliminary economic assessment of its Timmins talc-magnesite project in Deloro Township, Ontario. Globex proposed to develop a mine to produce approximately 260,000 t/yr of magnesite to be processed into 125,000 t/yr of magnesia, in addition to 125,000 t/yr of talc. A feasibility study was expected to be conducted in 2013 (Globex Mining Enterprises Inc., 2012).

China.—At the beginning of the year, China set its annual export quota for caustic-calcined and dead-burned magnesia at 1.23 Mt for 2012, the same as the 2011 quota (O'Driscoll and Roberts, 2012). However, export quotas for caustic-calcined and dead-burned magnesia for the second half of 2012 were cut owing to low exports during the first half of the year, and the revised total 2012 export quotas were 15.6% lower than those in 2011 (O'Driscoll, 2012b).

Iran.—Iran Refractories Procurement & Production Co. (IRRPCO) (Tehran) was building a fused magnesia plant in Sarbishe to supply customers in Iran's cement and steel industries. The plant would have a capacity of 5,000 t/yr of fused magnesia when completed in the first half of 2013. IRRPCO already had capacity to produce 45,000 t/yr of dead burned magnesia and 10,000 t/yr of caustic calcined magnesia at Sarbishe. Magnesite mined near Sarbishe was the raw material used by IRRPCO (O'Driscoll, 2012e).

Netherlands.—Nedmag Industries Mining and Manufacturing B.V. (Veendam) was drilling a new well to recover magnesium salts and increase dead-burned magnesia production capacity to 200,000 t/yr from 160,000 t/yr at its Veendam operation by 2013. The facility also had the capacity to produce 100,000 t/yr of magnesium chloride, 5,000 t/yr of caustic-calcined magnesia, and 5,000 t/yr of magnesium hydroxide (O'Driscoll, 2012g).

Norway.—In November, RHI opened a new 85,000-t/yr fused magnesia plant in Porsgrunn. The plant used magnesia recovered from sea water as its feedstock (RHI AG, 2012b).

Russia.—In February, Magnezit Group (Moscow) completed the first stage of a new complex near Razzdolinsk, Krasnoyarsk, to mine magnesite from the Kirgiteisk deposit. The first stage of the project included construction of the mine, a 50,000-t/yr caustic calcined magnesia plant, and a 50,000-t/yr fused magnesia plant. Additional capacity was expected to be completed in 2015 that would expand the plant to 200,000 t/yr of caustic-calcined magnesia and 150,000 t/yr of fused magnesia (Magnezit Group, 2012a; O'Driscoll, 2012a).

Magnezit was constructing a 100,000-t/yr multiple-hearth furnace to produce dead-burned magnesia in Satka,

Chelyabinsk. When completed, the plant's capacity for dead-burned magnesia would increase to 130,000 t/yr. An 80,000-t/yr high-temperature shaft kiln was also being constructed to process briquetted calcined magnesia. In addition, five electric fusion furnaces, each with a capacity of 10,000 t/yr of fused magnesia, were being installed at the Satka plant (Magnezit Group, 2012b, c).

Turkey.—In January, Kobin Madencilik İnşaat ve Ticaret A.Ş. acquired Kümaş Kütahya Manyezit İşletmeleri A.Ş. (Kütahya) for \$285.5 million. Kobin expanded the fused magnesia capacity at the Kütahya facility to 52,500 t/yr from 17,500 t/yr by yearend 2012. Kobin was also building a new 80,000-t/yr rotary kiln to expand caustic-calcined and dead-burned magnesia capacities at the facility, to 265,000 t/yr from 185,000 t/yr (O'Driscoll, 2012a, c, g).

Akdeniz Minerals Kaynakları A.Ş. [a subsidiary of Grecian Magnesite S.A. (Athens, Greece)] completed a new rotary furnace at its plant at Kumbet, in the Eskisehir area, doubling the caustic-calcined magnesia production capacity to 32,000 t/yr. Commercial production from the new furnace started in January (Watts and Feytis, 2012).

RHI completed a new 70,000-t/yr rotary kiln in Tutluca during the third quarter of the year, increasing dead-burned magnesia capacity to approximately 140,000 t/yr (RHI AG, 2012a).

Outlook

According to the World Steel Association (2013b), world crude steel production reached a record 1.55 billion metric tons in 2012, an increase of 1.2% compared with that of 2011. China continued to be the leading steel-producing nation, accounting for 46.3% of the global total in 2012. In the first 4 months of 2013, world steel production continued to increase slightly, with production 1.9% more than that in the comparable period of 2012 (World Steel Association, 2013a).

A sustained increase in steel production in China, which increased by 8.4% in the first 4 months of 2013, could lead to more internal consumption of magnesia-based refractories, increased or sustained barriers to export, and less magnesia available for the export market, although China has extensive magnesite deposits that could be developed. However, development of magnesite deposits in Australia and Canada and recent expansion of processing capacity in Australia, Brazil, Iran, the Netherlands, Norway, Russia, and Turkey may increase supplies of magnesium compounds outside of China. Previous expansions have been driven by the desire of refractory producers to have captive supplies of magnesium compounds to lessen dependence on supplies from China, a trend that is expected to continue.

Because caustic-calcined magnesia is used in a wide variety of applications, the economic downturn did not affect U.S. consumption as significantly as consumption of refractory magnesia, which was directly tied to the performance of the U.S. steel industry. Magnesium hydroxide continued to be used mainly in environmental applications, but interest in magnesium hydroxide flame retardants also was increasing. Substitution of magnesium hydroxide for halogenated flame retardants in some plastics, for which there is concern about corrosiveness and toxicity of smoke and other emission products, could increase

its use. The use of magnesium compounds in agricultural feed products was expected to increase, as the value of magnesium as a nutrient gains more attention.

Carbon sequestration is gaining world attention as a method to reduce greenhouse gas emissions into the atmosphere. Magnesium-based minerals, particularly brucite and olivine, were being investigated as minerals that are naturally capable of sequestering carbon dioxide, which is emitted by burning fossil fuels and other human activities, and transforming the gas into a geologically stable carbonate. If this technology were to be developed commercially, it could represent a new market for these minerals.

References Cited

- Archer Exploration Ltd., 2012a, Magnesite—Archer's exploration portfolio: Wayville, South Australia, Australia, Archer Exploration Ltd., September 19, 8 p. (Accessed June 10, 2013, at <http://www.archerexploration.com.au/assets/pdfs/AXEMagnesite120919.pdf>.)
- Archer Exploration Ltd., 2012b, Magnesite: Wayville, South Australia, Australia, Archer Exploration Ltd. (Accessed June 10, 2013, at <http://www.archerexploration.com.au/index.php?PID=109>.)
- Beacon Hill Resources plc, 2012, Positive preliminary scoping study results for Arthur River magnesite project: London, United Kingdom, Beacon Hill Resources plc press release, May 2. (Accessed May 2, 2012, at <http://hsprod.investis.com/ir/bhr/ir.jsp?page=news-item&item=971107138101894>.)
- Compass Minerals International, Inc., 2011, Compass Minerals to nearly double its magnesium chloride production capacity: Overland Park, KS, Compass Minerals International, Inc. news release, June 15. (Accessed March 7, 2012, at http://phx.corporate-ir.net/phoenix.zhtml?c=148615&p=irol-newsArticle_Print&ID=1573986&highlight=.)
- Compass Minerals International, Inc., 2013, 2012 annual report: Overland Park, KS, Compass Minerals International, Inc., February 21, 100 p. (Accessed May 22, 2013, at <http://phx.corporate-ir.net/phoenix.zhtml?c=148615&p=irol-reportsAnnual>.)
- Globex Mining Enterprises Inc., 2012, Globex releases positive PEA results for Timmins talc-magnesite project: Rouyn-Noranda, Quebec, Canada, Globex Mining Enterprises Inc. press release, March 2, 4 p. (Accessed March 30, 2012, at http://www.globexmining.com/staging/admin/news_pdfs/3-2-12_TTM_PEA_final.pdf.)
- Karnalyte Resources Inc., 2012a, Karnalyte Resources announces environmental impact study public review period for Wynyard carnallite project: Calgary, Alberta, Canada, Karnalyte Resources Inc. press release, December 12. (Accessed June 6, 2013, at <http://www.karnalyte.com/News/news-details/2012/Karnalyte-Resources-announces-Environmental-Impact-Study-public-review-period-for-Wynyard-Carnallite-Project1132295/default.aspx>.)
- Karnalyte Resources Inc., 2012b, Karnalyte Resources Inc. announces positive pre-feasibility study for the production of magnesium compounds: Calgary, Alberta, Canada, Karnalyte Resources Inc. press release, July 19. (Accessed June 6, 2013, at <http://www.karnalyte.com/News/news-details/2012/Karnalyte-Resources-Inc-Announces-Positive-Pre-Feasibility-Study-for-the-Production-of-Magnesium-Compounds1130232/default.aspx>.)
- Karnalyte Resources Inc., 2012c, Karnalyte Resources Inc. signs agreement for Wynyard carnallite project detailed engineering and site preparation: Calgary, Alberta, Canada, Karnalyte Resources Inc. press release, September 6. (Accessed June 6, 2013, at <http://www.karnalyte.com/News/news-details/2012/Karnalyte-Resources-Inc-Signs-Agreement-for-Wynyard-Carnallite-Project-Detailed-Engineering-and-Site-Preparation1130898/default.aspx>.)
- Magnesita Refratários S.A., 2012, Magnesita posts record new revenues of R\$637.6 million in the quarter: Contagem, Brazil, Magnesita Refratários S.A. news release, August 9, 17 p. (Accessed June 7, 2013, at http://www.mzweb.com.br/magnesita/web/arquivos/Magnesita_Release_2T12_ENG_VFinal.pdf.)
- Magnezit Group, 2012a, Magnezit Group commissions a new crushing complex with production capacity of more than 200 thousand tpa in Krasnoyarsk Territory: Moscow, Russia, Magnezit Group press release, February 16. (Accessed June 5, 2013, at <http://magnezit.ru/en/about/press/news/index.php?from4=2&id4=798>.)
- Magnezit Group, 2012b, Magnezit Group is conducting construction of multi-hearth furnace—An unique unit, not having analogues in Russia and

- CIS countries: Moscow, Russia, Magnezit Group press release, June 14. (Accessed June 5, 2013, at <http://magnezit.ru/en/about/press/news/index.php?from4=2&id4=816>.)
- Magnezit Group, 2012c, Magnezit Group to increase annual production of fused magnesia by 100 thousand tons: Moscow, Russia, Magnezit Group press release, August 23. (Accessed June 5, 2013, at <http://magnezit.ru/en/about/press/news/index.php?from4=2&id4=830>.)
- O'Driscoll, Mike, 2011, QMAG increases magnesia capacity with cement plant: Industrial Minerals, no. 528, September, p. 11.
- O'Driscoll, Mike, 2012a, At the core of fused magnesia: Industrial Minerals, no. 536, May, p. 35–42.
- O'Driscoll, Mike, 2012b, China cuts H2 magnesia export quotas: Industrial Minerals, August 22. (Accessed August 22, 2012, via <http://www.indmin.com/>.)
- O'Driscoll, Mike, 2012c, Kobin Mining poised to acquire Kumas: Industrial Minerals, no. 533, February, p. 27.
- O'Driscoll, Mike, 2012d, Magnesia price fixing allegation case dismissed: Industrial Minerals, September 13. (Accessed September 26, 2012, via <http://www.indmin.com/>.)
- O'Driscoll, Mike, 2012e, New fused magnesia plant for Iran in 2013: Industrial Minerals, August 21. (Accessed August 21, 2012, via <http://www.indmin.com/>.)
- O'Driscoll, Mike, 2012f, Sibelco acquires Queensland Magnesia: Industrial Minerals, no. 536, May, p. 8–9.
- O'Driscoll, Mike, 2012g, Turkish magnesia group Kumas for sale: Industrial Minerals, no. 532, January, p. 8–9.
- O'Driscoll, Mike, and Roberts, Jessica, 2012, China announces export quotas for 2012: Industrial Minerals, no. 532, January, p. 10.
- Queensland Magnesia Pty. Ltd., 2012, Sibelco acquires QMAG Limited: Toowong, Queensland, Australia, Queensland Magnesia Pty. Ltd. media release, April 2, 1 p. (Accessed June 5, 2013, at http://www.qmag.com.au/pdf/120402_Sibelco_QMAG_Australia_Media_Release.pdf.)
- RHI AG, 2012a, RHI increases earnings again in the third quarter of 2012: Vienna, Austria, RHI AG press release, November 6. (Accessed June 7, 2013, at http://www.rhi.at/internet_en/investor_relations_en/21632/06.11.2012_-_Q23.html.)
- RHI AG, 2012b, RHI opens largest raw material fusion plant: Vienna, Austria, RHI AG press release, November 8. (Accessed June 5, 2013, at http://www.rhi.at/internet_en/media_relations_en/corporate_news_en/21672/121107_Norwegen_en.html.)
- Roberts, Jessica, 2008, Olivine's future in flux: Industrial Minerals, no. 494, November, p. 40–49.
- Roberts, Jessica, 2012, RHI expands magnesia-chrome brick capacity at Trieben: Industrial Minerals, May 3. (Accessed May 3, 2012, via <http://www.indmin.com/>.)
- U.S. Department of Commerce, International Trade Administration, 2012, Certain magnesia carbon bricks from the People's Republic of China: Federal Register, May 10, v. 77, no. 91, p. 27428. (Accessed May 22, 2013, at <http://www.gpo.gov/fdsys/pkg/FR-2012-05-10/pdf/2012-11346.pdf>.)
- Watts, Mark, and Feytis, Alexandra, 2012, Grecian Magnesite completes Turkish rotary kiln: Industrial Minerals, no. 535, April, p. 21.
- World Steel Association, 2013a, Monthly crude steel production in the 63 countries included in the report, in thousands of tonnes: Brussels, Belgium, World Steel Association, May 21, 1 p. (Accessed June 7, 2013, at http://www.worldsteel.org/dms/internetDocumentList/press-release-downloads/2013/April-2013-Production-Figures/document/April_2013_Production_Figures.pdf.)
- World Steel Association, 2013b, World crude steel output increases by 1.2% in 2012: Brussels, Belgium, World Steel Association, January 22. (Accessed June 7, 2013, at <http://www.worldsteel.org/media-centre/press-releases/2012/12-2012-crude-steel.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

- Industrial Minerals, monthly.
- 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)

	2008	2009	2010	2011	2012
United States:					
Caustic-calcined and specified magnesia: ²					
Shipped by producers: ³					
Quantity	170	147	162	155	152
Value	52,700	42,200	47,000	48,800	46,000
Exports ⁴	1	1	(5)	(5)	(5)
Imports for consumption ⁴	167	126	127	111	114
Refractory magnesia:					
Shipped by producers:					
Quantity	W	W	W	W	W
Value	W	W	W	W	W
Exports	22	8	9	18	16
Imports for consumption	386	151	323	384	292
World, production of magnesite	21,200 ^r	18,400 ^r	21,300 ^r	26,100 ^r	23,100 ^e

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

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

²Excludes caustic-calcined magnesia used in the production of refractory magnesia.

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 2012¹

(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:			
Great Salt Lake Minerals Corp.	Ogden, UT	185,000	Magnesium chloride and magnesium chloride brines.
Intrepid Wendover-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		692,000	

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

TABLE 3
U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED¹

	2011		2012	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesia ²	155,000	\$48,800	152,000	\$46,000
Magnesium hydroxide [100% Mg(OH) ₂] ²	199,000	120,000	176,000	89,400
Magnesium sulfate, anhydrous and hydrous	50,600	22,500	51,900	24,300
Refractory 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 CRUDE AND PROCESSED MAGNESITE, BY COUNTRY¹

Material and country	2011		2012	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
China	91	\$47	--	--
India	25	16	--	--
Mexico	4	15	142	\$89
Peru	42	21	--	--
Other	4	13	14	37
Total	166	112	156	126
Dead-burned and fused magnesia:				
Brazil	277	241	132	138
Canada	4,110	2,780	4,500	1,850
China	63	77	122	163
Germany	822	927	719	648
Korea, Republic of	541	463	268	241
Mexico	166	376	574	442
Saudi Arabia	873	462	453	253
South Africa	9,170	5,550	6,810	4,140
Taiwan	48	54	30	23
Turkey	118	128	79	90
Venezuela	783	385	1,080	648
Other	960 ^r	1,210 ^r	1,140	1,550
Total	17,900	12,700	15,900	10,200
Other magnesia:				
Brazil	954	1,100	449	509
Canada	2,850	3,150	2,660	3,140
China	465	956	945	2,540
France	672	657	382	333
Germany	1,290	1,080	811	664
India	642	728	569	605
Korea, Republic of	429	393	464	515
Mexico	782	713	1,770	1,080
Netherlands	1,310	996	834	715
Spain	629	569	367	351
Taiwan	1,960	1,790	2,070	2,060
Venezuela	661	472	48	69
Other	3,080	4,800	3,350	4,580
Total	15,700	17,400	14,700	17,200
Crude magnesite:				
Argentina	835	109	--	--
Australia	879	161	32	12
Brazil	175	23	841	110
Canada	1,540	251	449	152
Egypt	307	40	--	--
Germany	208	27	309	40
Iceland	1,820	264	618	92
Mexico	208	27	861	113
Panama	1,270	167	536	70
Thailand	876	115	--	--
Trinidad and Tobago	783	103	296	39
United Kingdom	412	56	441	58
Venezuela	8,580	1,130	515	67
Other	509 ^r	73 ^r	315	46
Total	18,400	2,540	5,210	799

^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	2011		2012		Principal destinations in 2012
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
Magnesium chloride, anhydrous and other	10,100	\$6,520	10,300	\$6,880	Canada, 91%.
Magnesium hydroxide and peroxide	18,500	14,900	22,900	19,600	Canada, 48%; United Kingdom, 11%; Sweden, 10%.
Magnesium sulfate, natural kieserite and epsom salts	654	1,820	211	587	Mexico, 58%; Canada, 21%; Saudia Arabia, 15%.
Magnesium sulfate, other	13,300	5,030	12,100	4,720	Canada, 96%; Italy, 2%; Brazil, 2%.

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

Source: U.S. Census Bureau.

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

Material and country	2011		2012	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
Australia	13,200	\$3,930	12,100	\$2,720
Canada	39,900	17,700	36,100	16,300
China	56,500	17,900	62,900	15,200
Hong Kong	--	--	1,150	283
Israel	465	123	797	145
Turkey	473	316	611	372
United Kingdom	--	--	2	10
Other	485 ^r	359 ^r	580	411
Total	111,000	40,300	114,000	35,500
Dead-burned and fused magnesia:				
Australia	26,500	16,100	2,320	1,660
Austria	--	--	13,100	5,290
Brazil	27,700	15,100	50,400	23,600
China	220,000	136,000	160,000	96,600
Germany	8	48	34	121
Greece	4,700	2,540	2,600	1,340
Israel	3,370	11,200	3,330	11,900
Japan	2,280	9,630	1,640	4,230
Mexico	1,630	1,190	468	533
Netherlands	3,060	2,080	7,060	4,730
Russia	43,100	16,600	15,800	6,040
Spain	8,130	2,430	8,150	2,280
Turkey	4,530	2,270	7,340	5,470
Ukraine	38,100	17,000	19,100	13,100
Other	210	1,560	237	939
Total	384,000	234,000	292,000	178,000
Other magnesia:				
Australia	--	--	1,660	3,390
Brazil	1,220	7,130	3,670	1,520
Canada	227	76	232	100
China	5,020	924	3,710	1,710
Israel	1,190	3,160	1,700	4,800
Japan	982	3,040	1,020	2,540
Mexico	6,310	5,310	5,410	4,760
Russia	20	8	1,490	539
Slovakia	1,970	775	1,300	568
Spain	11,600	4,510	5,600	2,370
Other	237 ^r	822 ^r	156	671
Total	28,700	25,700	26,000	23,000
Crude magnesite:				
Brazil	360	416	350	401
China	187	235	6,380	1,040
France	60	73	60	124
Hong Kong	8,210	2,620	4,940	1,100
Israel	1,220	1,120	510	347
Japan	172	242	399	709
United Kingdom	990	882	931	1,240
Other	390	207	402	215
Total	11,600	5,790	14,000	5,180

^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

	2011		2012		Principal sources in 2012
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
Magnesium chloride, anhydrous and other	75,600	\$22,100	53,800	\$17,100	Israel, 70%; Netherlands, 16%.
Magnesium hydroxide and peroxide	6,110	17,800	5,070	13,700	Austria, 35%; Israel, 29%; Netherlands, 16%.
Magnesium sulfate, natural epsom salts	2,400	818 [†]	2,870	1,160	China, 99%.
Magnesium sulfate, natural kieserite	15,200	302	32,900	2,370	Germany, 100%.
Magnesium sulfate, other	20,100	11,900	24,300	14,800	Germany, 34%; China, 32%; Mexico, 19%.

[†]Revised.

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, 2012^{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	--	428
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	165	175
Norway	--	--	30	--	30
Poland	--	10	--	--	10
Russia	200	2,400	--	--	2,550
Saudi Arabia	39	32	--	--	71
Serbia	--	35	--	--	35
Slovakia	--	465	--	--	465
South Africa	12	--	--	--	12
Spain	150	70	--	--	220
Turkey	66	504	--	--	484
Ukraine	--	120	20	80	220
United States	140	--	191	195	526
Total	2,720	7,640	378	845	11,400

-- 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	2008	2009	2010	2011 ^e	2012 ^e
Australia	126,000	344,000	275,000	300,000	300,000
Austria, crude	837,476	544,716	757,063	867,912 ^{r,3}	870,000
Brazil, beneficiated	421,333	409,909	483,882	476,805 ^{r,3}	480,000
Canada ^{e,4}	140,000	140,000	150,000	150,000	140,000
China ^e	15,600,000	13,000,000	14,000,000	19,000,000 ^r	16,000,000
Colombia	38,000 ^e	--	--	--	--
Greece, crude	361,165	380,834 ^r	396,000 ^r	300,000	300,000
Guatemala	11,758	17,247	-- ^r	311 ^{r,3}	500
India ^e	350,000	340,000	345,000	350,000	355,000
Iran	115,987	130,575 ^r	126,702 ^r	130,000 ^r	125,000
Korea, North ^e	150,000	150,000	150,000	150,000	150,000
Pakistan	3,500	3,918 ^r	8,330 ^r	7,000 ^r	7,500
Poland, concentrate	60,000	47,000	63,000 ^r	60,000 ^r	60,000
Russia ^e	1,200,000	1,000,000	1,200,000	1,200,000	1,200,000
Slovakia, concentrate	807,000	800,000 ^r	800,000 ^r	600,000	600,000
South Africa	83,900	47,600	27,700 ^r	31,900 ^{r,3}	31,000
Spain, calcined	187,626 ^r	163,930 ^r	195,893 ^r	200,000 ^{r,3}	200,000
Turkey, run-of-mine	677,784	861,180	2,316,763 ^r	2,300,000 ^r	2,300,000
United States	W	W	W	W	W
Zimbabwe	2,549	449	-- ^{r,e}	-- ^r	--
Total	21,200,000 ^r	18,400,000 ^r	21,300,000 ^r	26,100,000 ^r	23,100,000

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

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. Table includes data available through August 30, 2013.

³Reported figure.

⁴Magnesitic dolomite and brucite.