2007 Minerals Yearbook

LIME [ADVANCE RELEASE]

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LIME

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In 2007, U.S. production of lime decreased by about 4% to 20.2 million metric tons (Mt) (about 22.3 million short tons) compared with that of 2006 (table 1). Although lime production decreased, the value of production increased by $59 million to $1.76 billion as a result of overall price increases of about 7% in 2007. The decrease in lime production was spread out fairly evenly across the country, with most States exhibiting a decrease compared with that of 2006. A few States—Arkansas, Massachusetts, Utah, West Virginia, and Wisconsin—recorded significant production increases ranging from 4% to 12%.

The term lime as used throughout this chapter refers primarily to six chemicals produced by the calcination of high-purity calcitic or dolomitic limestone followed by hydration where necessary. There are two high-calcium forms—high-calcium quicklime (calcium oxide, CaO) and high-calcium hydrated lime [calcium hydroxide, $Ca(OH)_2$]. There are four dolomitic forms—dolomitic quicklime (CaO•MgO), dolomitic hydrate type N [$Ca(OH)_2$•MgO], dolomitic hydrate type S [$Ca(OH)_2$•$Mg(OH)_2$], and refractory dead-burned dolomite (CaO•MgO). Lime also can be produced from a variety of calcareous materials, such as aragonite, chalk, coral, marble, and shell. It also is regenerated (produced as a byproduct) by paper mills, carbide plants, and water-treatment plants. Regenerated lime, however, is beyond the scope of this report.

Production

Domestic production data for lime were derived by the U.S. Geological Survey (USGS) from a voluntary survey of U.S. operations. The survey was sent to primary producers of quicklime and hydrate, but, in order to avoid double counting, it was not sent to independent hydrators that purchase quicklime for hydration. Quantity data were collected for 28 specific and general end uses, and value data were collected by type of lime, such as high-calcium or dolomitic. Because value data were not collected by end use, value data listed in table 3 were determined by calculating the average value per metric ton of lime sold or used for each respondent and then multiplying it by the quantity of lime that the respondent reported sold or used for each end use. Table 3 lists the total quantity sold or used for an end use and the total value of the quicklime and hydrate sold or used for that end use calculated as described above. A similar methodology using average hydrate values was used to calculate the value of hydrate sold and used listed in table 4.

In 2007, of the 90 operations to which an annual survey form was sent, responses were received from 77 plants, representing 97% of the total sold or used by producers. Production data for the 13 nonrespondents were estimated based on prior-year production figures and other information.

Lime is a basic chemical that was produced as quicklime or hydrate in 36 States and Puerto Rico (table 2). During 2007, quicklime was produced at 81 lime plants operating kilns, which included 34 plants with collocated hydrating plants. Hydrated lime also was produced at 13 standalone hydrating facilities, which included 3 plants where the kilns had been shut down and hydrate was manufactured from quicklime produced offsite. These numbers do not necessarily agree with the number of plants reported in tables 1 and 2 because for data collection purposes some company operations (owing to their physical proximity to one another) have been combined at the respondent's request. In a few States with no quicklime production, hydrating plants used quicklime shipped from other States. There were also a small number of slurry plants where lime was converted to liquid form by the addition of water prior to sale; this is sometimes called milk-of-lime. States with production exceeding 2 Mt were, in descending order, Missouri, Alabama, and Kentucky; States with production between 1 and 2 Mt were, in descending order, Ohio, Texas, Nevada, and Pennsylvania.

Total lime sold or used by domestic producers in 2007 was 20.2 Mt, a 4% decrease compared with the total in 2006. Production included the commercial sale or captive consumption of quicklime, hydrated lime, and dead-burned refractory dolomite. The production of high-calcium quicklime decreased by about 2% and production of high-calcium hydrate decreased by about 6%. Production of dolomitic quicklime and dolomitic hydrate decreased by 8% and 14%, respectively. Commercial sales decreased by 697,000 metric tons (t) (768,000 short tons) to about 18.7 Mt (20.6 million short tons), and captive consumption decreased by 89,000 t (98,000 short tons) to 1.53 Mt (1.69 million short tons).

Western Lime Corp. (West Bend, WI) commissioned a new lime plant in Port Inland, MI. The plant has a preheater rotary kiln with the capacity to produce more than 230,000 metric tons per year (t/yr) of high-calcium lime from limestone that is quarried on site. Quarry operations will cease in the winter, so the plant has the capacity to stockpile about 200,000 t of limestone, which allows the plant to operate year round (Ferenco, 2007). Western Lime has two other plants in Wisconsin at Eden and Green Bay.

Projects underway in 2007, but not concluded by the yearend, included a new lime plant under construction in Kentucky by Gallatin Materials LLC (Verona, KY) and a new hydrating facility in West Virginia by Mississippi Lime Co. (St. Louis, MO). These two operations were expected to start up in early 2008.

Graymont Ltd. (Richmond, British Columbia, Canada) acquired a controlling interest in Cutler Magner Corp. (Duluth, MN) that included the CLM Corp. lime plant in Superior, WI. The lime plant will operate under the Graymont subsidiary Graymont Western U.S. Inc. The acquisition was made while CLM was in the final stages of installing a new kiln that would add 180,000 t/yr of new capacity to the plant (Graymont Ltd., 2007).

Jomico, LLC (St. Louis, MO) acquired the small Missouri lime producer Vessell Mineral Products Co. (Bonne Terre, MO). Jomico (a supplier of carbon, coal, and coke to the steel industry) acquired the kiln and associated packaging plant and reportedly planned on investing heavily in the plant to improve reliability, expand capacity, and introduce additional products. Renamed Missouri Lime, LLC, the plant produced dolomitic quicklime for the steel industry (Desloge, 2007).

A major acquisition was in progress—Oglebay Norton Co. (Cleveland, OH) by Carmeuse Lime (Pittsburgh, PA)—but the deal had not received final approval from the U.S. Federal Trade Commission (FTC) by yearend. Oglebay Norton through its O-N Minerals Group operated lime and limestone facilities in Georgia, Indiana, Michigan, Ohio, Pennsylvania, Tennessee, and Virginia. One of O-N Minerals' important limestone markets is flue gas desulfurization (FGD), which is expected to complement Carmeuse's expertise in lime-based FGD products (Moores, 2007). FTC approval for the purchase was given in February 2008 and the deal was finalized on February 13 (Carmeuse Lime & Stone, 2008). Carmeuse also announced plans to expand capacity at its Millersville, OH, lime plant. The Millersville plant, which produces dolomitic quicklime for metallurgical markets, will add a kiln with a capacity of about 127,000 t/yr (Pallotta, 2007).

Through years of acquisitions, Carmeuse retained several legal identities. For marketing purposes, including continuity in brand recognition in the marketplace, the company used Carmeuse Lime. With the acquisition of the Oglebay-Norton limestone operations, Carmeuse chose to use Carmeuse Lime & Stone to maintain brand identity in the marketplace but also to reflect the additional products now offered (Anthony Pallotta, Marketing Communication Specialist, Carmeuse Lime & Stone, written commun., February 13, 2008).

Pete Lien & Sons, Inc. (Rapid City, SD) was in the planning and permitting stage for the construction of a new limestone quarry, lime plant, and hydrating plant on a tract of land about 9 miles north of Laramie, WY. The cost of the project was estimated to be $50 million to $80 million, and construction was forecast to begin in 2009 (LeClair, 2007).

Chemical Lime Co.'s (Fort Worth, TX) plans to add production capacity at its New Braunfels, TX, plant and to construct a hydrating plant in the Louisville, KY, area were delayed. Project completion dates were uncertain but were likely to be in the 2009 to 2010 timeframe.

After restarting its Tenmile plant in Idaho in 2006, Chemical Lime idled the plant once again in 2007 in response to decreased demand in Western markets.

At yearend, the top 10 companies were, in descending order of U.S. lime production, Carmeuse Lime, Chemical Lime, Graymont, Mississippi Lime, United States Lime & Minerals, Inc., Martin Marietta Magnesia Specialties LLC, O-N Minerals, Western Lime, Southern Lime Co., and Mittal Steel U.S.A. These companies operated 45 lime plants and 10 separate hydrating plants and accounted for nearly 91% of the combined commercial sales of quicklime and hydrated lime and 87% of total lime production.

Consumption

The breakdown of consumption by general end-use sectors was as follows: 36% for metallurgical uses, 29% for environmental uses, 22% for chemical and industrial uses, 12% for construction uses, and 1% for refractory dolomite (table 3). Consumption decreased in all general sectors except for refractory dolomite, which was essentially unchanged compared with that of 2006. The construction sector recorded a decrease in consumption of more than 8%, environmental and metallurgical sectors each decreased by about 4%, and the chemical and industrial sector decreased by 1% compared with 2006 totals.

Commercial sales accounted for about 92% of total lime consumption. Captive lime accounted for about 8% of consumption and was used mainly in the production of steel in basic oxygen furnaces (BOF), sugar refining, magnesia production, and refractories. Almost all data on captive lime consumption, excluding the sugar industry, are withheld to avoid disclosing company proprietary information. As a result, table 3 lists the total quantity and value of lime by end use. End uses with captive consumption are listed in footnote 4 of the table.

In steel refining, quicklime is used as a flux to remove impurities, such as phosphorus, silica, and sulfur. The steel industry accounted for 29% of all lime consumed in the United States. In 2007, raw steel production in the United States was essentially unchanged compared with that of 2006. There was, however, a dramatic production shift from BOF to electric arc furnaces (EAF). In 2006, about 57% of steel was produced in BOF and 43% in EAF, but this shifted to 41% BOF and 59% EAF in 2007. This shift may explain the 5% decrease in lime consumption for steel production, because mills that use EAF technology tend to use iron and steel scrap instead of pig iron as their primary iron source. Scrap contains fewer impurities than pig iron and, on average, requires less than one-half of the lime per ton of steel produced.

In nonferrous metallurgy, lime is used in the beneficiation of copper ores to neutralize the acidic effects of pyrite and other iron sulfides and to maintain the proper pH in the flotation process. Lime is used to process alumina and magnesia, to extract uranium from gold slimes, to recover nickel by precipitation, and to control the pH of the sodium cyanide solution used to leach gold and silver from the ore. Such leaching processes are called dump leaching when large pieces of ore are involved, heap leaching when small pieces of ore are involved, and carbon-in-pulp cyanidation when the ore is leached in agitation tanks. Dump and heap leaching involve crushing the ore, mixing it with lime for pH control and agglomeration, and stacking the ore in heaps for treatment with cyanide solution. Lime is used to maintain the pH of the cyanide solution at a level between 10 and 11 to maximize the recovery of precious metals and to prevent the creation of hydrogen cyanide. Lime consumed for these various uses is included in table 3 under the category "Nonferrous metallurgy." Lime usage in nonferrous metallurgy (aluminum and bauxite processing, concentration of copper and gold ores, and unspecified nonferrous uses) increased by 4% in 2007. Although specific data are not collected on lime consumption for copper recovery or for gold recovery, consumption for copper is thought to have increased as a result of a 24% increase in copper smelter production compared with that of 2006 (D.L. Edelstein, U.S. Geological Survey, written commun., May 13, 2008).

Environmental remediation uses of lime in mining include treatment of the tailings that result from the recovery of precious metals, such as gold and silver. These tailings may contain elevated levels of cyanides, and lime is used to recover cyanides in such treatment processes as alkaline chlorination, Caro's acid (H_2SO_5), Cyanisorb™, and sulfur dioxide/air.

Lime is used, generally in conjunction with soda ash, for softening municipal and plant process water. This precipitation process removes bivalent soluble calcium and magnesium cations (and, to a lesser extent, ferrous iron, manganese, strontium, and zinc) that contribute to the hardness of water. This process also reduces carbonate alkalinity and total dissolved solids. Lime consumption for drinking water treatment decreased by about 5% compared with that of 2006.

In sewage treatment, the traditional role of lime is to control pH in the sludge digester, which removes dissolved and suspended solids that contain phosphates and nitrogen compounds. Lime also aids in clarification and in destroying harmful bacteria. The leading use in sewage treatment is to stabilize the resulting sewage sludge. Sewage sludge stabilization, also called biosolids stabilization, reduces odors, pathogens, and putrescibility of the solids. Lime stabilization involves mixing quicklime with the sludge to raise the temperature and pH of the sludge to minimum levels for a specified period of time. Lime consumption for all sludge treatment decreased by about 9% compared with that of 2006.

In flue gas desulfurization (FGD) systems serving coal-fired powerplants, incinerators (most are waste-to-energy powerplants), and industrial plants, lime is injected into the flue gas to remove acidic gases, particularly sulfur dioxide (SO_2) and hydrochloric acid (HCl). It also may be used to stabilize the resulting sludge before disposal. Many FGD systems at utility powerplants are now designed to produce byproduct gypsum from the SO_2 emissions suitable for use in manufacturing gypsum wallboard, cement production, and agriculture. Hydrated lime may be used in another FGD-related market—to control sulfur trioxide (SO_3) emissions from selective catalytic reduction (SCR) systems installed at powerplants to control emissions of nitrogen oxides (NO_x). The utility powerplant category dominates the FGD market, and regularly accounts for more than 90% of the total FGD market. In 2007, consumption decreased by 3% in the utility powerplant market, increased by more than 8% in the incinerator market, and was unchanged in the industrial boiler and other FGD markets. Eighty-seven waste-to-energy powerplants operated in the United States in 2007, and nearly all were subject to acid-gas controls as required by the Clean Air Act Amendments of 1990. There are a number of different acid-gas control systems and several use dry lime or lime slurry as the sorbent to neutralize acid gases, such as hydrochloric acid (Michaels, 2007, p. 1).

Lime is used by the pulp and paper industry in the basic Kraft pulping process where wood chips and an aqueous solution (called liquor) of sodium hydroxide and sodium sulfide are heated in a digester. The cooked wood chips (pulp) are discharged under pressure along with the spent liquor. The pulp is screened, washed, and sent directly to the paper machine or for bleaching. Lime is sometimes used to produce calcium hypochlorite bleach for bleaching the paper pulp. The spent liquor is processed through a recovery furnace where dissolved organics are burned to recover waste heat, sodium sulfide, and sodium carbonate. The recovered sodium sulfide and sodium carbonate are diluted with water and then treated with slaked lime to recausticize the sodium carbonate into sodium hydroxide (caustic soda) for reuse. The byproduct calcium carbonate is recalcined in a lime kiln to recover lime for reuse. The paper industry also uses lime as a coagulant aid in the clarification of plant process water. Lime consumption for pulp and paper production was essentially unchanged in 2007.

Lime is used to make precipitated calcium carbonate (PCC), a specialty filler used in premium-quality coated and uncoated papers, paint, and plastics. The most common PCC production process used in the United States is the carbonation process. Carbon dioxide (CO_2) is bubbled through milk-of-lime to form a precipitate of calcium carbonate and water. The reaction conditions determine the size and shape of the resulting PCC crystals. Lime used for PCC production increased by about 2% compared with that of 2006.

The chemical industry uses lime in the manufacture of alkalis. Quicklime is combined with coke to produce calcium carbide, which is used to make acetylene and calcium cyanide. Lime is used to make calcium hypochlorite, citric acid, petrochemicals, and other chemicals.

In sugar refining, milk-of-lime is used to raise the pH of the product stream, precipitating colloidal impurities. The lime itself is then removed by reaction with CO_2 to precipitate calcium carbonate.

In road paving, hydrated lime is used in hot mix asphalt to act as an antistripping agent. Stripping is generally defined as a loss of adhesion between the aggregate surface and the asphalt cement binder in the presence of moisture. Lime also is used in cold in-place recycling for the rehabilitation of distressed asphalt pavements. Existing asphalt pavement is pulverized by using a milling machine, and a hot lime slurry is added along with asphalt emulsion. The cold recycled mix is placed and compacted by conventional paving equipment, which produces a smooth base course for the new asphalt surface. In 2007, sales of lime for use in asphalt decreased by 18% compared with those for 2006.

In construction, hydrated lime and quicklime are used to stabilize fine-grained soils in place of materials that are employed as subbases, such as hydraulic clay fills or otherwise poor-quality clay and silty materials obtained from cuts or borrow pits. Lime also is used in base stabilization, which includes upgrading the strength and consistency properties of aggregates that may be judged unusable or marginal without stabilization. Common applications for lime stabilization included the construction of airfields, building foundations, earthen dams, parking areas, and roads. Lime sales for soil stabilization decreased by nearly 7% compared with those for 2006. Limes sales for soil stabilization tend to be cyclical, especially in large market areas like Texas. There is competition between lime, cement, fly ash, cement kiln dust, and other additives (liquid enzymes, for example). Choices made by consumers can depend on availability, price, contract specifications, soil chemistry, and State and Federal funding in the case of highway construction projects. In 2007, the soil stabilization market was adversely affected by troubles in the real estate markets, which was reflected by the statistic that building permits issued for privately owned housing units decreased by 24% in 2007 compared with those for 2006 (U.S. Census Bureau, 2008b). The decrease in housing construction would have affected lime used to stabilize streets, driveways, foundations, and so forth, associated with new home construction projects.

Hydrated lime is used in the traditional building sector in mortars, plaster, and stucco. Standard cement mortars that include lime exhibit superior workability balanced with appropriate compressive strength, as well as low water permeability and superior bond strength. Lime is a major constituent in exterior and interior stuccos and plasters, enhancing the strength, durability, and workability of these finishes. A small amount of hydrated lime also is used in the renovation of old structures built with lime mortars, which was standard before the development of portland cement mortars. Modern portland cement mortars are incompatible with old lime mortars. Hydrated lime also is used to make synthetic hydraulic lime, which is produced by blending powdered hydrated lime with pulverized pozzolanic or hydraulic materials.

Owing to the diverse building markets that might consume lime, a direct correlation to a specific construction index or measurement is problematic. The U.S. Census Bureau collects data on construction spending for residential construction and 16 categories of nonresidential construction. Total construction spending decreased by about 3% but the annual value of residential construction decreased by nearly 18% compared with that of 2006 (U.S. Census Bureau, 2008a). Sales of hydrated lime for traditional building uses decreased by nearly 10%. The bulk (nearly 80%) of lime sold for building uses is produced at five plants located in Nevada, Ohio, Utah, and Wisconsin.

Dead-burned dolomite, also called refractory lime, is used as a component in tar-bonded refractory brick or monolithics manufactured for use in BOF. Refractory brick also is used in the lining of many treatment and casting ladles, in argon oxygen decarburization and vacuum oxygen decarburization converters, in EAF, and in continuous steel casting. Although the actual numbers are rounded to one significant figure to avoid disclosing company proprietary data, the production of dead-burned dolomite sold and used was essentially unchanged compared with that of 2006. LWB Refractories Co., York, PA, and Carmeuse Lime, Millersville, OH, were the only significant producers. Hydrated lime is used to produce silica refractory brick used to line industrial furnaces.

Prices

The average values per ton for the various types of lime are listed in table 5. The values are reported in dollars per metric ton and dollars per short ton. All value data for lime are reported by type of lime produced—high-calcium quicklime, high-calcium hydrate, dolomitic quicklime, dolomitic hydrate, and dead-burned dolomite. Emphasis is placed on the average value per metric ton of lime sold.

There was significant upward movement in lime prices, and the average for all types of lime sold increased to $85.90 per metric ton ($78.00 per short ton), about a 7% increase compared with the average for 2006. The average value for high-calcium quicklime sold increased by 7% to $81.80 per metric ton ($74.20 per short ton), and the average for dolomitic quicklime sold increased by 10% to $90.80 per metric ton ($82.40 per short ton). This was the second year in a row in which dolomitic quicklime prices increased by 10%. The average values of dolomitic hydrate and high-calcium hydrate increased by 11% and 3%, respectively.

Foreign Trade

The United States exported and imported quicklime, hydrated lime (slaked lime), hydraulic lime, and calcined dolomite (dolomitic lime). Combined exports of lime were 144,000 t (159,000 short tons) valued at $24.8 million. About 89% of exports went to Canada, with the remaining going to Jamaica, 3%; Russia, 3%; and other countries, 5% (table 6).

Combined imports of lime were 375,000 t (413,000 short tons) valued at $46.1 million, with 87% from Canada, 12% from Mexico, and 1% from other countries (table 7). Canada was the primary source of quicklime (high-calcium and dolomitic) imports and accounted for 93% of the total. Mexico was the leading exporter of hydrated lime to the United States and accounted for 62% of U.S. imports.

There is likely some misclassification of what is being reported as imports and exports of hydraulic lime. Natural hydraulic lime is produced from siliceous or argillaceous limestones that contain varying amounts of silica, alumina, and iron. There is no production of natural hydraulic lime in the United States. Synthetic hydraulic lime is produced by mixing hydrated lime with pozzolanic or hydraulic materials like portland cement. Exports could be synthetic hydraulic lime or, because the chemistry is quite similar, portland cement (or some other hydraulic cement product).

No tariffs are placed on imports of hydraulic lime, quicklime, and slaked lime from countries with normal trade relations (NTR) with the United States. A 3% ad valorem tariff is placed on imports of calcined dolomite from NTR countries.

World Review

With the exception of some industrialized nations, accurate lime production data for individual countries are difficult to obtain. The variations in quality and types of lime, production technologies, and industries manufacturing lime and the frequent confusion with limestone data make accurate reporting extremely difficult and certainly incomplete (table 8). In addition to routine revisions made to individual country data, beginning in 2006, major revisions were made to the estimates for China based on new information.

Outlook

In 2008, lime consumption is expected to decrease in the construction sector owing to the decline in the housing market. Other sectors may be affected as was the case in 2007. Consumption by the steel industry may increase, because domestic steel producers are benefitting from the low value of the U.S. dollar compared with major foreign currencies and have increased exports. In addition, owing to high ocean freight rates, steel buyers may shift from foreign steel suppliers to domestic suppliers. Longer term growth is still expected in the FGD and related markets, which are expected to display significant growth as a result of the Clean Air Interstate Rule (CAIR). CAIR will permanently cap emissions of SO_2 and NO_x in 28 Eastern States and the District of Columbia and will reduce these emissions through a cap-and-trade system. The phase I cap for NO_x emissions is scheduled to be implemented 2009, and the phase I cap for SO_2 emissions is scheduled for 2010. FGD systems that use limestone already dominate the utility powerplant market, and lime price increases in recent years have effectively taken lime out of consideration for use in new FGD systems at powerplants. However, opportunities exist for dry lime FGD systems on small utility and industrial boiler units and for the use of hydrated lime to treat SO_3 wastes from SCR systems that control NO_x emissions. [Update: On July 11, 2008, the U.S. Court of Appeals for the District of Columbia Circuit vacated the rule and remanded it to the U.S. Environmental Protection Agency. Characterizing the program as "fundamentally flawed," the Court specifically instructed the Agency to redo its analysis from the ground up (Beveridge & Diamond, P.C., 2008)].

Upward pressures on lime prices will continue primarily in the form of high fuel prices (kiln fuels and diesel), although production costs are also being pushed upward by increased costs of electricity, freight, health care, and environmental compliance. The largest effect on lime prices has been from rising coal prices, which have followed the lead of oil and have increased dramatically in the first 5 months of 2008. Since the beginning of the year, the prices for high-British thermal unit coals have nearly doubled—Appalachian coals increased from $55 per short ton to $105 per short ton, Illinois Basin coal from about $35 per short ton to $65 per short ton, and Uinta Basin coal from about $24 per short ton to $44 per short ton (U.S. Energy Information Administration, 2008).

Lime prices have increased by about 8% per year for each of the past 3 years, and one of the top five lime producers announced price increases of 5% to 11% effective January 1, 2008. Pressures from rapidly increasing fuel prices are pushing up production costs at an even higher rate. When possible, costs are being passed on to the customer in the form of higher prices and fuel surcharges, but the rate at which costs are increasing has made operating difficult for the lime companies. Normally, a decrease in demand puts downward pressure on prices owing to increased competition, but with costs rising rapidly, any downward pressure from competition would likely be minor or short term.

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TABLE 1
SALIENT LIME STATISTICS[1, 2]

		2003	2004	2005	2006	2007
United States[3]						
Number of plants[4]		96	91	94	91	89
Sold or used by producers:						
Quicklime:						
High-calcium	thousand metric tons	13,900	14,200	14,100	15,000	14,700
Dolomitic	do.	2,460	3,020	2,990	2,950	2,700
Total	do.	16,400	17,200	17,100	18,000	17,400
Hydrated lime:						
High-calcium	do.	2,140	2,140	2,220	2,370	2,240
Dolomitic	do.	464	421	474	409	352
Total	do.	2,610	2,570	2,700	2,780	2,590
Dead-burned dolomite[5]	do.	200	200	200	200	200
Grand total:						
Quantity	do.	19,200	20,000	20,000	21,000	20,200
Value[6]	thousand dollars	1,240,000	1,370,000	1,500,000	1,700,000	1,760,000
Average value	dollars per metric ton	64.80	68.90	75.00	81.20	87.10
Lime sold	thousand metric tons	17,700	18,400	18,600	19,400	18,700
Lime used	do.	1,470	1,520	1,490	1,620	1,530
Exports:[7]						
Quantity	do.	98	100	133	116	144
Value	thousand dollars	13,700	14,300	17,500	19,200	24,800
Imports for consumption:[7]						
Quantity	thousand metric tons	202	232	310	298	375
Value	thousand dollars	22,500	25,900	33,100	36,300	46,100
Consumption, apparent[8]	thousand metric tons	19,300	20,100	20,200	21,200	20,400
World, production	do.	238,000 r	251,000 r	260,000 r	273,000 r	283,000 e

[e]Estimated. [r]Revised.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]To convert metric tons to short tons, multiply metric tons by 1.102.
[3]Excludes regenerated lime; includes Puerto Rico.
[4]Includes producer-owned hydrating plants not located at lime plants.
[5]Data are rounded to no more than one significant digit to protect company proprietary data.
[6]Selling value, free on board plant.
[7]Source: U.S. Census Bureau.
[8]Defined as sold or used plus imports minus exports.

TABLE 2

LIME SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE[1, 2]

State	Plants[3]	Hydrated (thousand metric tons)[4]	Quicklime[5] (thousand metric tons)[4]	Total (thousand metric tons)[4]	Value (thousands)
2006:					
Alabama	5	164	2,290	2,450	$224,000
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	20	357	2,910	3,260	237,000
California, Oregon, Washington	6	70	253	323	39,000
Illinois, Indiana, Missouri	7	549	3,450	4,000	322,000
Iowa, Nebraska, South Dakota	3	W	W	352	26,900
Kentucky, Tennessee, West Virginia	5	133	2,730	2,860	209,000
Ohio	7	140	1,710	1,850	150,000
Pennsylvania	6	177	984	1,160	115,000
Texas	5	654	995	1,650	130,000
Wisconsin	4	196	726	922	70,700
Other[6]	23	340	2,170	2,510	181,000
Total	91	2,780	18,200	21,000	1,700,000
2007:					
Alabama	5	152	2,330	2,480	234,000
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	20	295	2,790	3,090	264,000
California, Oregon, Washington	6	58	163	222	30,700
Illinois, Indiana, Missouri	6	457	3,470	3,920	317,000
Iowa, Nebraska, South Dakota	3	W	W	338	29,400
Kentucky, Tennessee, West Virginia	5	128	2,520	2,640	205,000
Ohio	6	125	1,570	1,690	159,000
Pennsylvania	4	143	954	1,100	112,000
Texas	4	697	923	1,620	132,000
Wisconsin	5	175	784	959	78,000
Other[6]	24	362	2,120	2,140	197,000
Total	89	2,590	17,600	20,200	1,760,000

W Withheld to avoid disclosing company proprietary data; included with "Other."

[1]Excludes regenerated lime.

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

[3]Includes producer-owned hydrating plants not located at lime plants.

[4]To convert metric tons to short tons, multiply metric tons by 1.102.

[5]Includes dead-burned dolomite.

[6]Includes Arkansas, Florida, Georgia, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, North Dakota, Oklahoma, Puerto Rico, Virginia, and data indicated by the symbol W.

TABLE 3
LIME SOLD AND USED BY PRODUCERS IN THE UNITED STATES, BY USE[1, 2]

(Thousand metric tons[3] and thousand dollars)

Use	2006 Quantity[4]	2006 Value[5]	2007 Quantity[4]	2007 Value[5]
Chemical and industrial:				
Fertilizer, aglime and fertilizer	32	3,260	32	3,490
Glass	196	16,100	187	16,100
Paper and pulp	855	69,800	859	73,500
Precipitated calcium carbonate	1,230	111,000	1,260	122,000
Sugar refining	783	58,300	703	69,700
Other chemical and industrial[6]	1,410	121,000	1,420	136,000
Total	4,510	380,000	4,460	421,000
Metallurgical:				
Steel and iron:				
Basic oxygen furnaces	2,750	233,000	2,590	223,000
Electric arc furnaces	3,100	266,000	2,960	270,000
Other steel and iron	393	30,100	358	29,800
Total	6,250	529,000	5,910	523,000
Nonferrous metallurgy[7]	1,320	90,600	1,370	100,000
Total	7,570	620,000	7,280	631,000
Construction:				
Asphalt	432	38,200	353	35,000
Building uses	481	54,600	435	50,100
Soil stabilization	1,650	126,000	1,540	123,000
Other construction	67	5,590	80	6,730
Total	2,630	224,000	2,410	215,000
Environmental:				
Flue gas desulfurization (FGD):				
Utility powerplants	3,530	238,000	3,410	248,000
Incinerators	226	21,100	245	23,200
Industrial boilers and other FGD	72	6,940	71	7,410
Total	3,830	266,000	3,730	279,000
Sludge treatment:				
Sewage	141	12,100	127	11,600
Other, industrial, hazardous, etc.	123	9,800	112	9,760
Total	263	21,900	239	21,400
Water treatment:				
Acid-mine drainage	113	10,500	104	10,000
Drinking water	992	80,200	946	81,600
Wastewater	644	57,200	625	60,000
Total	1,750	148,000	1,680	152,000
Other environmental:	200	17,800	175	16,300
Total	6,040	454,000	5,820	468,000
Refractories (dead-burned dolomite)	200 [8]	26,800 [9]	200 [8]	24,500 [9]
Grand total	21,000	1,700,000	20,200	1,760,000

[1]Excludes regenerated lime. Includes Puerto Rico.

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

[3]To convert metric tons to short tons, multiply metric tons by 1.102.

[4]Quantity includes lime sold and used, where "used" denotes lime produced for internal company use for basic oxygen furnaces, magnesia, paper and pulp, precipitated calcium carbonate, refractories, and sugar refining.

[5]The U.S. Geological Survey does not collect value data by end use; the values shown are mainly derived from average lime values.

[6]May include alkalis, calcium carbide and cyanamide, calcium hypochlorite, citric acid, food (animal or human), oil and grease, oil well drilling, petrochemicals, tanning, and other uses. Magnesia is included here to avoid disclosing proprietary data.

[7]Includes aluminum and bauxite, magnesium, ore concentration (copper, gold, etc.) and other.

TABLE 3—Continued

LIME SOLD AND USED BY PRODUCERS IN THE UNITED STATES, BY USE[1, 2]

[8]Data are rounded to one significant digit to protect company proprietary data.

[9]Values are estimated based on average value per metric ton of dead-burned dolomite for each year.

TABLE 4

HYDRATED LIME SOLD OR USED IN THE UNITED STATES, BY END USE[1, 2]

(Thousand metric tons[3] and thousand dollars)

Use	2006		2007	
	Quantity[4]	Value[5]	Quantity[4]	Value[5]
Chemical and industrial	542	61,200	549	63,000
Construction:				
Asphalt	381	34,400	316	32,100
Building uses	470	53,600	426	49,200
Soil stabilization	466	37,600	504	40,500
Other construction	16	1,770	18	1,750
Total	1,330	127,000	1,260	123,000
Environmental:				
Flue gas desulfurization (FGD):				
Utility powerplants	165	11,000	120	8,120
Incinerators	40	3,860	35	3,320
Industrial boilers and other FGD	34	3,820	35	4,050
Total	239	18,700	190	15,500
Sludge treatment:				
Sewage	30	3,170	23	2,710
Other sludge treatment	51	4,910	42	4,680
Total	80	8,080	65	7,380
Water treatment:				
Acid-mine drainage	58	5,770	69	7,150
Drinking water	167	16,400	151	15,900
Wastewater	238	23,800	191	20,400
Total	463	46,000	411	43,500
Other environmental	66	6,270	63	7,070
Metallurgy	57	5,590	49	5,370
Grand total	2,780	273,000	2,590	265,000

[1]Excludes regenerated lime. Includes Puerto Rico.

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

[3]To convert metric tons to short tons, multiply metric tons by 1.102.

[4]Quantity includes hydrated lime sold and used, where "used" denotes lime produced for internal company use in building, chemical and industrial, and metallurgical sectors.

[5]The U.S. Geological Survey does not collect value data by end use; the values shown are mainly derived from average lime values.

TABLE 5

LIME PRICES[1]

Type	2006		2007	
	Dollars per metric ton	Dollars per short ton[2]	Dollars per metric ton	Dollars per short ton[2]
Sold and used:				
Quicklime	78.10	70.80	84.60	76.70
Hydrate	98.30	89.20	102.40	92.90
Dead-burned dolomite	115.10	104.40	106.80	96.90
Average all types	81.20	73.70	87.10	79.00
Sold:				
High-calcium quicklime	76.20	69.10	81.80	74.20
Dolomitic quicklime	82.60	75.00	90.80	82.40
Average quicklime	77.20	70.00	83.10	75.40
High-calcium hydrate	94.50	85.70	97.50	88.40
Dolomitic hydrate	120.50	109.30	133.70	121.20
Average hydrate	98.30	89.20	102.40	92.90
Dead-burned dolomite	135.20	122.60	112.60	102.10
Average all types	80.50	73.00	85.90	78.00

[1]Average value per ton, on a free-on-board-plant basis, including cost of containers.

[2]Unit values in metric and short tons were rounded independently.

TABLE 6
U.S. EXPORTS OF LIME, BY TYPE[1]

Type	2006 Quantity (metric tons)[2]	2006 Value[3]	2007 Quantity (metric tons)[2]	2007 Value[3]
Calcined dolomite:				
Canada	38,400	$7,050,000	60,700	$9,220,000
Germany	264	56,200	364	60,400
Taiwan	560	115,000	365	94,200
Other	592	253,000	1,120	474,000
Total	39,800	7,480,000	62,600	9,850,000
Hydraulic lime:				
Bahamas, The	327	53,900	326	54,900
Canada	3,260	532,000	3,710	635,000
Jamaica	--	--	4,640	714,000
Taiwan	154	27,800	--	--
Other	402	118,000	248	247,000
Total	4,140	732,000	8,930	1,650,000
Quicklime:				
Bahamas, The	627	171,000	554	155,000
Canada	58,400	7,520,000	52,500	6,970,000
Costa Rica	138	41,100	583	177,000
Mexico	1,380	163,000	315	208,000
Netherlands	44	90,000	427	1,010,000
Other	19 r	34,400 r	91	133,000
Total	60,600	8,020,000	54,500	8,650,000
Slaked lime, hydrate:				
Angola	--	--	537	233,000
Canada	10,400	2,820,000	11,900	2,300,000
Chile	--	--	325	57,200
Mexico	283	43,400	210	32,200
Nigeria	--	--	695	147,000
Philippines	431	62,000	442	67,700
Russia	--	--	4,140	1,490,000
Other	213	86,500	114	346,000
Total	11,300	3,010,000	18,300	4,670,000
Grand total	116,000	19,200,000	144,000	24,800,000

[r]Revised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]To convert metric tons to short tons, multiply metric tons by 1.102.
[3]Declared free alongside ship valuation.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF LIME, BY TYPE[1]

Type	2006 Quantity (metric tons)[2]	2006 Value[3]	2007 Quantity (metric tons)[2]	2007 Value[3]
Calcined dolomite:				
Canada	46,000	$4,740,000	34,600	$3,540,000
Mexico	90	16,700	336	93,300
Other	238	124,000	120	46,900
Total	46,300	4,880,000	35,000	3,680,000
Hydraulic lime:				
Canada	(4) r	8,750	59	9,620
Mexico	1,980	222,000	449	48,400
Other	232	231,000	1,430	1,040,000
Total	2,210	462,000	1,940	1,100,000
Quicklime:				
Canada	189,000	24,400,000	278,000	34,300,000
Mexico	27,000	1,570,000	20,500	1,120,000
Other	623	592,000	1,170	517,000
Total	217,000	26,600,000	299,000	36,000,000
Slaked lime, hydrate:				
Canada	12,100	1,380,000	12,300	1,390,000
Mexico	19,700	2,210,000	23,900	2,760,000
Other	1,540	760,000	2,230	1,200,000
Total	33,400	4,340,000	38,400	5,340,000
Grand total	298,000	36,300,000	375,000	46,100,000

[r]Revised.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]To convert metric tons to short tons, multiply metric tons by 1.102.
[3]Declared cost, insurance, and freight valuation.
[4]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8

QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country[3]	2003	2004	2005	2006	2007
Australia[e]	1,500	1,500	1,500	1,600	1,600
Austria[e]	2,000	2,000	2,000	2,000	2,000
Belgium[e, 4]	2,000	2,400	2,300	2,400	2,200
Brazil[e]	6,600	6,900	6,900	6,900	7,000
Canada	2,221	2,386 r	2,289 r	2,185 r	2,200 e
Chile	40 r	525 r	575 r	620 r	600
China[e]	130,000	140,000	150,000	160,000	170,000
Colombia[e]	1,300	1,300	1,300	1,300	1,300
Czech Republic	1,250	1,264	1,211	1,218 r	1,250 e
Egypt[e]	800	800	800	800	800
France[e, 4]	3,500	3,600	3,300 r	4,000 r	4,000
Germany	6,876	6,947	6,823	7,119 r	7,120 e
Hungary[e]	500	500	500	500	500
India[e]	900	900	920	910	900
Iran[e]	2,300	2,500	2,500	2,600 r	2,600
Italy[e, 5]	5,600 r, 6	6,100 r	6,300 r	5,900 r	6,000
Jamaica	276	269	270	304	300 e
Japan, quicklime only	7,953	8,507	8,879	9,014 r	9,150 e
Korea, Republic of	3,579	3,574	3,600	3,600 e	3,600 e
Mexico[e, 4]	6,500 r	6,500 r	6,500 r	6,500 r	6,500
New Zealand[e]	2,000	2,000	2,000	2,000	2,000
Peru	195	205	215	216	215 e
Poland[e]	1,955 6	1,950	2,000	2,000	2,000
Romania[e]	2,025 6	1,500 r	1,000 r	1,000 r	1,000
Russia[e]	8,000	8,200	8,200	8,200	8,200
Slovakia	847	961 r	946 r	1,104 r	1,100 e
Slovenia[e]	1,500 6	1,500	1,500	1,500	1,500
South Africa, burnt lime sales	1,518	1,738	1,417	1,583 r	1,599 p
Spain[e, 4]	1,800	1,800	1,818 6	2,000 r	2,000
Sweden[e]	590	590	600	600	600
Taiwan	520	494	444	450	470 e
Tunisia	446	476	424	401	400 e
Turkey[e, 4]	3,300	3,400	3,400 r	3,500 r	3,600
United Kingdom[e]	2,000	2,000	2,000	2,000	2,000
United States, including Puerto Rico	19,200	20,000	20,000	21,000	20,200
Vietnam	1,384	1,464	1,737 r	1,929 r	2,120
Other[e]	4,380 r	3,990 r	4,190 r	4,270 r	4,260
Total	238,000 r	251,000 r	260,000 r	273,000 r	283,000

[e]Estimated. [p]Preliminary. [r]Revised.

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

[2]Table includes data available through April 28, 2008.

[3]In addition to the countries listed, Argentina, Chad, Iraq, Nigeria, Pakistan, Syria, and several other nations produce lime, but output data are not reported; available general information is inadequate to formulate reliable estimates of output levels.

[4]Production estimate based on sales only; data may be incomplete.

[5]Includes hydraulic lime.

[6]Reported figure.