LIME

By M. Michael Miller

Domestic survey data and tables were prepared by Lisa D. Miller, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Lime is an important chemical with numerous chemical, industrial, and environmental uses in the United States. Some evidence of its use as a lime mortar has been found at a site in what is now eastern Turkey dating between 7,000 and 14,000 years ago. More definite evidence of its use in mortars in the Near East and in the former Yugoslavia dates from 8,000 years ago. In Tibet, it was used to stabilize clays in the construction of the pyramids of Shersi 5,000 years ago. The ancient Egyptians used lime as an ingredient in mortar and plaster. The Chinese, Greek, Roman, and other ancient civilizations used lime for construction, agriculture, bleaching, and tanning (Oates, 1998, p. 3-4). Its uses began expanding with the advent of the industrial revolution, but it remained primarily a construction commodity until the rapid growth of the chemical process industries at the beginning of the 20th century. At the turn of the 20th century, more than 80% of the lime consumed in the United States was used in construction, but currently more than 90% is used in chemical and industrial applications.

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 ($CaO \cdot MgO$), dolomitic hydrate type N [$Ca(OH)_2 \cdot MgO$] and dolomitic hydrate type S [$Ca(OH)_2 \cdot Mg(OH)_2$], and refractory dead-burned dolomite. 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

Lime is a basic chemical that was produced as quicklime at 101 plants in 33 States and Puerto Rico (table 2). Hydrated lime was produced at 12 separate hydrating facilities (including 1 plant where the kiln has been shut down but hydrate was manufactured from quicklime produced offsite). In four States with no quicklime production, hydrating plants used quicklime shipped in from other States. There were also a small number of slurry plants, where lime was converted to liquid form prior to sale. Principal producing States were, in descending order of production, Missouri, Kentucky, Alabama, Ohio, Texas, and Pennsylvania.

Domestic production data for lime are derived by the U.S. Geological Survey (USGS) from a voluntary survey of U.S. operations. The survey is sent to primary producers of quicklime and hydrate but not to independent hydrators that purchase quicklime for hydration so as to avoid double counting. Quantity data are collected for 28 specific and general end uses, and value data are collected by type of lime, such as high calcium or dolomitic. Because value data are not collected by end use, value data shown in table 4 are determined by calculating the average value per metric ton of quicklime sold or used for each respondent and then multiplying it by the quantity of quicklime that the respondent reported sold or used for each end use. The table 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. The same methodology is used to calculate the value of hydrate sold and used in table 5.

The USGS maintains a list of operations classified as producing or idle; in 2000, there were 112 operations listed. One of these operations is not surveyed at the producer's

Lime in the 20th Century

In 1900, U.S. lime production was about 1.8 million metric tons. Historically, lime has always been a very versatile chemical, but when the first survey of lime usage was performed in 1906, nearly 83% of lime was used in building trades for mortar, plaster, and sand-lime brick. The remaining was used in agriculture (9%) and for various chemical and industrial uses (8%). Pennsylvania and Ohio accounted for more than 30% of production. There were more than 1,000 lime burners operating nationwide at the time, and most used vertical shaft kilns producing a few hundred to a few thousand tons per year. The largest lime plants only produced about 20,000 tons per year.

In 2000, the United States produced nearly 19.6 million metric tons of lime. Changes in technologies, new environmental laws, and entirely new uses have resulted in great changes in how lime is consumed. More than 83% of lime was used in descending order, for steelmaking, flue gas desulfurization, water treatment (acid mine drainage, drinking water, and waste water), nonferrous metallurgy, soil stabilization, precipitated calcium carbonate production, sugar refining, and pulp and paper manufacturing. Only about 2% of lime was consumed in traditional building trades. The two leading producing States were Missouri and Kentucky, which accounted for 21% of production. The basic lime manufacturing process had not changed; it still involved heating limestone to dissociate calcium oxide and carbon dioxide. In the past 100 years, kilns have become much larger and use computer monitoring and control systems to operate at high efficiencies. In 2000, more than 10 times as much lime was produced as in 1900, but it was produced at only 107 plants, some of which had production capacities of more than 1 million tons per year.

request, and estimates are made by using reported prior-year production figures or other industry data. Five of the listed operations were idle in 2000. Of the 108 operations to which the 2000 annual survey request was sent, 107 were in operation all or part of the year and 96 responded to the survey, representing 98% of the total sold or used by producers. Production data for the 12 nonrespondents were estimated based on prior-year production figures and other commodity data.

Total lime sold or used by domestic producers in 2000 decreased by about 100,000 metric tons (t) (110,000 short tons) to 19.6 million metric tons (Mt) (21.6 million short tons) from the revised 1999 total of 19.7 Mt (21.7 million short tons) (table 1). Production included the commercial sale or captive consumption of quicklime, hydrated lime, and dead-burned refractory dolomite. These products were valued at $1.19 billion. Commercial sales increased by 165,000 t (182,000 short tons) to 17.5 Mt (19.3 million short tons), while captive consumption decreased by 282,000 t (311,000 short tons) to 2.04 Mt (2.25 million short tons).

The most significant factor affecting the lime industry in 2000 was the impact of high natural gas prices on lime kiln operations. Because of the large increase in natural gas prices, some of the kilns burning these fuels were shut down. Fuel price increases affected mainly plants with vertical shaft and Calcimatic kilns. The commercial lime industry operates a relatively small number of these kilns, but production costs at those plants that do would have risen dramatically. Commercial plants or individual kilns in Missouri, Pennsylvania, South Carolina, Tennessee, Texas, and Virginia were shut down. Kilns in Arizona and Ohio also may have been affected. Since the peak demand season for natural gas is the winter, gas prices were expected to decrease in the spring of 2001, although industry experts still expected prices to be significantly higher than the average price in 1998 and 1999.

The largest commercial lime company in North America, Carmeuse North America, underwent an internal reorganization into central, northern, and southern regions. Plants in Illinois, Indiana, Kentucky, and Pennsylvania were allocated to the central region, plants in eastern Canada, Michigan, and Ohio to the northern region, and plants in Alabama, Louisiana, and Texas to the southern region (William S. Brown, Executive Vice President Marketing and Development, Carmeuse North America, written commun., January 19, 2001).

Graymont Ltd., the Canadian parent company of Continental Lime Inc. and others, reorganized and renamed its lime subsidiaries into the following: Graymont Western US Inc., Graymont Western Canada Inc., Graymont Dolime (OH) Inc., Graymont (PA) Inc., Graymont (QC) Inc., and Graymont (NB) Inc. Graymont produces lime in six U.S. States and five Canadian Provinces (Graymont Ltd., 2000, Related companies, accessed July 11, 2000, at URL http://www.graymont.com/related.htm).

United States Lime & Minerals, Inc. (U.S. Lime & Minerals) started up its new preheater rotary kiln on October 22 at its Arkansas Lime Co. subsidiary in Batesville, AR. The new kiln successfully achieved design volumes in excess of 540 metric tons per day (t/d) (600 short tons per day). U.S. Lime & Minerals is proceeding with financing plans for the construction of phase II of the Arkansas Lime project. The requisite permits for the installation of the phase II kiln have already been obtained, and the company expected to commence construction of phase II in midyear 2001, subject to market demand, the ability to secure competitive bids, and the availability of financing (United States Lime & Minerals, Inc., October 21, 2000, United States Lime & Minerals, Inc. announces results for the third quarter 2000, the start-up of its new kiln in Arkansas, and proposed financings, accessed April 19, 2001, via URL http://www.uslm.com/news.htm).

Chemical Lime Co. and Martin Marietta Materials, Inc., signed an agreement whereby Martin Marietta would process aggregate materials and provide certain operating services at Chemical Lime's lime plant in New Braunfels, TX. Under the agreement, Martin Marietta will build an aggregates plant to process what is currently unusable limestone for the lime plant. The plant is expected to be operational the second half of 2001 and will have an initial capacity of about 1.3 to 1.8 million metric tons per year (1.5 to 2.0 million short tons per year). Martin Marietta will also assume responsibility for all pit operations, including supplying kiln feed to the lime plant (Martin Marietta Materials, Inc., July 17, 2000, Martin Marietta Materials, Inc. announces agreement with Chemical Lime Co. in Texas, accessed September 25, 2000, at URL http://www.martinmarietta.com/corpsite/news/press_releases/00_07_17.asp). Chemical Lime's Ten Mile plant located near Bancroft, ID, shut down in late 1999 and was idle all of 2000. The facility was used as a terminal in 2000 for sales of lime produced at other Chemical Lime plants in the region.

Baker Refractories and Wülfrath Refractories GmbH, the refractories arm of the Lhoist Group of Belgium, signed an agreement to merge pending approval by antitrust authorities in Europe and the United States. The new unit will operate under a unifying name and will be headquartered in Hilden, Germany. Baker Refractories manufactures dead-burned refractory-dolomite products in York, PA, and also has manufacturing facilities in the United Kingdom and joint-venture operations in Mexico and Taiwan (Industrial Minerals, 2000).

In the captive lime sector, three plants closed permanently. The Dow Chemical Co.'s lime plant at Ludington, MI, closed in late 1999, when Dow switched to purchasing lime on the open market. Holly Sugar Co.'s sugar beet plants and their respective lime kilns located at Tracy and Woodlands, CA, closed in late 2000.

Of the 43 companies manufacturing quicklime at the end of 2000, 26 were primarily commercial producers, 13 were predominantly captive producers, and 4 combined commercial sales with captive production. During 2000, the 26 commercial producers operated 63 lime plants producing quicklime and 7 separate hydrating plants (including 1 lime plant that was idle but operated its hydrator). The 13 captive producers operated 34 plants producing quicklime primarily for internal company use. At yearend, the top 10 companies were, in descending order of production, (1) Carmeuse North America, (2) Chemical Lime, (3) Graymont Ltd., (4) Mississippi Lime Co., (5) Global Stone Corp., (6) Martin Marietta Magnesia Specialties, Inc., (7) U.S. Lime & Minerals, (8) Vulcan Materials Co., (9) LTV Steel Co., Inc., and (10) Austin White Lime Co. These companies operated 45 lime plants and 6 separate hydrating plants and accounted for 86% of the combined commercial sales of quicklime and hydrated lime and 79% of total lime production.

Domestic lime plant capacity is based on 365 days minus the average number of days for maintenance multiplied by the average 24-hour capacity of quicklime production, including quicklime converted to hydrated lime. In 2000, based on capacity data from 48 commercial plants, the U.S. lime industry operated at about 79% of capacity compared with 76% in 1999. The calculations do not include combined commercial and captive producers, hydrating plants, and Puerto Rico.

Environment

The most common fuel used to produce lime in the United States is coal. Emissions generated in the combustion of coal and other fuels make the lime industry subject to regulation under the Clean Air Act. Of immediate concern to the lime industry are the costs and obligations expected for additional monitoring, reporting, and control of particulate matter and hazardous air pollutants such as hydrogen chloride. Of longterm concern, with a potentially greater impact, is the international debate on the reduction of greenhouse gas emissions, particularly carbon dioxide. Lime production generates carbon dioxide from the combustion of fuels and from the calcination process, which dissociates calcium carbonate into calcium oxide and carbon dioxide. Any program to regulate carbon dioxide emissions would affect lime producers.

Consumption

The breakdown of consumption by major end uses (table 4) was as follows: 38% for metallurgical uses, 26% for environmental uses, 24% for chemical and industrial uses, 11% for construction uses, and 1% for refractory dolomite. Captive lime accounted for about 10% of consumption and was used mainly in the production of steel in basic oxygen furnaces, sugar refining, and magnesia and magnesium production. Almost all data on captive lime consumption, excluding the sugar industry, are withheld to protect company proprietary information. As a result, table 4 lists the total quantity and value of lime by end use. End uses with captive consumption are listed in footnote 4 of the table. Values assigned to specific end uses in table 4 should not be construed as being price specific to that market. The USGS does not collect value data by end use, and the values shown in tables 4 and 5 are derived, in general, from average lime values. The market values shown are simply designed to show the relative value of the market.

In steel refining, quicklime is used as a flux to remove such impurities as phosphorus, silica, and sulfur. Dolomitic lime is often substituted for a fraction of the high-calcium lime to extend refractory life. Dolomitic quicklime is also used as a flux in the manufacture of glass. The steel industry accounted for about 31% of all lime consumed in the United States. Lime consumption by the iron and steel industry was 6.15 Mt (6.78 million short tons), a 2.9% increase compared with that of 1999. This increase is in part explained by the lower usage rate of lime in electric arc furnaces. The trend toward using magnesia to replace some dolomitic lime in the steel furnace appears to have leveled off after making inroads into dolomitic lime sales.

The U.S. steel industry reported strong production during the first and second quarters of 2000, but a slowing economy and increased imports resulted in a decrease in production of more than 10% in the third and fourth quarters. For the year, raw steel production was up by 4.2% (3.1%, basic oxygen process and 5.5%, electric arc process) compared with that in 1999.

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 agitated 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 4 under the category “Other nonferrous metallurgy.”

Lime usage in nonferrous metallurgy (mainly concentration of copper and gold ores, aluminum and bauxite processing, and magnesium production) decreased by 17% in 2000. Previously announced cutbacks and closures by copper producers (including the Continental Mine in Montana) were made more acute by power disruptions and high energy costs. Decreases in copper output and magnesium production were primary causes of the decrease in lime consumption. Recoverable mine production of copper decreased by about 8% (Edelstein, 2001). Magnesium production decreased by 23%; the power and energy problems of the Pacific northwest caused production problems for magnesium producer Northwest Alloys, Inc., and for its aluminum customers (Kramer, 2001).

The tailings that result from the recovery of precious metals may contain elevated levels of cyanides. Lime is used to recover cyanides in such treatment processes as Cyanisorb, alkaline chlorination, and sulfur dioxide/air.

In the environmental sector, lime is used in the softening and clarification of municipal potable water and to neutralize acid-mine and industrial discharges. In sewage treatment, lime’s traditional role is to control pH in the sludge digester, which removes dissolved and suspended solids that contain phosphates and nitrogen compounds. Lime also aids clarification and in destroying harmful bacteria. More recently, the largest use in sewage treatment has been to stabilize the resulting sewage sludges. 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 increased by 29% compared with that in 1999. The sewage sludge market increased by 53%, but the industrial and hazardous waste market decreased by 8%.

In flue gas desulfurization (FGD) systems serving electric utility and industrial plants and incinerators, lime is used to react with sulfur oxides in the flue gas and is used to stabilize the resulting sludge before disposal. In 2000, the FGD market grew by 13%, recouping the 10% decrease in sales reported in 1999. The utility industry increased operating and maintenance budgets, which improved plant reliability and helped eliminate much of the unscheduled downtime experienced by some powerplants in 1999. Probably just as important, after mild temperatures in 1999, temperatures returned to more normal ranges, thus increasing the demand for electricity. In addition, the price of nitrogen oxide (NO_x) emission allowances dropped. One of the large midwestern powerplants was forced to reduce its power generation to limit NO_x emissions in 1999 but resumed normal operations in 2000.

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 and sodium sulfide and sodium carbonate are recovered. 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.

The pulp and paper market was adversely affected by the slowdown of the economy and by the trend toward increased recycling of byproduct calcium carbonate into lime by pulp and paper producers. These factors resulted in a 17% decrease in lime consumption.

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 is bubbled through milk-of-lime, a suspension of hydrated lime in water, to form a precipitate of calcium carbonate and water. The reaction conditions determine the size and shape of the resulting PCC crystals. Lime use for PCC production was unchanged compared with that of 1999.

Lime is used, generally in conjunction with soda ash, for softening plant process water. This precipitation process removes bivalent soluble calcium and magnesium cations (and, to a lesser extent, ferrous iron, manganese, strontium, and zinc), which contribute to the hardness of water. This process also reduces carbonate alkalinity and dissolved solids content.

The chemical industry uses lime in the manufacture of alkalies. 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 carbon dioxide to precipitate calcium carbonate. The carbon dioxide is obtained as a byproduct of lime production.

In construction, hydrated lime and quicklime are used in subgrade stabilization 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 roads, airfields, building foundations, earthen dams, and parking areas. Highway projects, airport runway expansions, and commercial projects kept the large Texas stabilization market at about the same level as in 1999, but nationwide lime sales for stabilization decreased by 7% compared with the revised 1999 figures.

Although the overall quantities of lime used for soil stabilization are believed to be accurate, the data reported in table 5 may not accurately reflect how much hydrated lime is actually used in soil stabilization. Much of the lime used in soil stabilization is consumed as slurry, which may be manufactured by the lime company at a slurry plant or by the user onsite.

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 using conventional paving equipment, which produces a smooth base course for the new asphalt surface. In 2000, sales of lime for use in asphalt decreased by nearly 7% compared with the revised 1999 figures.

In the traditional building sector, quicklime is used to make calcium silicate building products, such as sand-lime brick and autoclaved aerated concrete (AAC). AAC offers the advantage of producing building materials that can be cut, drilled, and nailed like wood but with the advantages of a concrete product.

Hydrated lime is used in the traditional building sector where it still is used in plaster, stucco, and mortars to improve durability. The recent growth in this traditional lime market is the result of strong growth in nonresidential building construction (industrial buildings, offices, shopping centers, etc.) where architects have specified the use of the traditional lime building materials. According to preliminary data released by the U.S. Census Bureau, there was a 6.8% increase in the value of nonresidential building construction in 2000; the use of hydrated lime in traditional building uses increased by more than 4%. The use of hydrated lime in traditional building uses has increased by 33% since 1997.

A small amount of hydrated lime (estimated to be less than 2% of total building uses) also is used on the renovation of old structures built with lime-based mortars, which were standard before the development of portland cement-based mortars. Modern portland cement-based mortars are incompatible with old lime mortars.

Dead-burned dolomite, also called refractory lime, is used as a component in tar-bonded refractory brick used in basic oxygen furnaces. Hydrated lime is used to produce silica refractory brick used to line industrial furnaces.

Prices

The average values per ton of lime, rounded to three significant figures, are listed in table 8. The values are reported in dollars per metric ton with accompanying conversions into dollars per short ton. For accuracy, the conversions were made from the unrounded metric value and, as a result, may not be an exact conversion of the rounded values. 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 ton of lime sold.

In 2000, the average value for all types of lime sold and used was essentially unchanged from the previous year. Although there was some upward movement in commercial lime prices on an free on board plant basis (less than 2%), because much of the quicklime is sold through long-term contracts to such large customers as steel mills and utilities, significant price increases cannot be enacted until current contracts expire. In some cases, however, lime companies passed along increased fuel and energy costs in the form of surcharges.

The average value per ton of high-calcium quicklime and high-calcium hydrate sold increased only slightly, but dolomitic quicklime and dolomitic hydrate values per ton of lime sold increased by 7% and 17%, respectively. The increase in price for dolomitic quicklime was partly the result of an increase in the steel producer price index in 2000. Steelmaking is the largest market for dolomitic quicklime, and lime supply contracts are sometimes tied to the steel index. In addition, there is increased use of dolomitic quicklime in higher value specialty products manufactured for the steel markets.

Overall, despite idled capacity, strong competition continued to keep prices down. Figures 1 and 2 show the average sales value per ton of quicklime and hydrate over the past 10 years in actual and constant dollars.

Foreign Trade

The United States exported and imported quicklime, hydrated lime (slaked lime), hydraulic lime, and calcined dolomite (dolomitic lime). Combined exports of lime (table 6) were 73,200 t (80,700 short tons) valued at $9.96 million, with 69% exported to Canada, 17% exported to Mexico, 9% exported to Argentina, and the remaining 5% going to various other countries. Combined imports of lime (table 7) were 113,000 t (125,000 short tons) value at $13.5 million, with 85% coming from Canada and 14% coming from Mexico.

Data on imports and exports of hydraulic lime may be questionable. There is only one known producer of hydraulic lime in the United States, and with exports averaging about 10,000 to 11,000 metric tons per year (t/yr) in 1999 and 2000, it is likely that what is being classified as hydraulic lime is in fact portland cement (or some other hydraulic cement product). Chemically, hydraulic lime and portland cement are quite similar.

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

World Review

With the exception of industrialized nations with good data collection, accurate lime data for many countries are frequently difficult to acquire. The variations in quality, types of lime, production technologies, and industries manufacturing lime and the frequent confusion with limestone data make accurate reporting of world lime data (table 9) extremely difficult and certainly incomplete. The following is a brief discussion of acquisitions or new construction in specific countries.

Italy.—Calcestruzzi Calò A has purchased a 200-t/d Cim-Reversy oil-fired kiln from Cimprogetti S.p.A. (World Cement, 2001).

Jamaica.—Rugby Jamaica Lime and Minerals Ltd. successfully commissioned its new 400-t/d lime plant near Clarendon. The plant includes a Cimprogetti Twin-D 85 twin shaft regenerative kiln and will supply lime to the local alumina industry (World Cement, 2001).

Mexico.—Mexico's Grupo Calider S.A. de C.V., a joint-venture partner of the Belgian Lhoist Group, acquired Mexican lime producer Caleras Fernandez S.A. de C.V. Caleras Fernandez, which operates in southwestern Mexico, has a 300,000-t/yr plant near Guadalajara and a 35,000-t/yr hydrating plant near Cimarron (Lhoist Group, July 2000, Acquisition of Mexican Caleras Fernandez, accessed January 5, 2001, at URL http://www.lhoist.com/about/news/intro.html).

Peru.—Cia. De Minas de Buenaventura S.A. de C.V. successfully commissioned its new oil-fired Cimprogetti Cim-Reversy twin shaft regenerative kiln. The 130-t/d kiln is located at the Yanococha Gold Mine (World Cement, 2001).

Poland.—In November 2000, Lhoist Bukowa Sp. zo. o. started up its new 600-t/d Maerz kiln. The new kiln increases the plant's capacity to 1,760 t/d and makes it the most modern lime plant in the Kielce region. Additional work on a new hydrating plant and pebble lime storage facilities are expected to be completed by June 2001 (Lhoist Group, November 2000, New kiln at Lhoist Bukowa, accessed April 30, 2001, at URL http://www.lhoist.com/about/news/intro.html).

Spain.—Caleras De San Cucao has placed an order for a Cimprogetti gas-fired Twin-D 70 kiln. The kiln is designed to alternate between producing high-calcium lime and dolomitic lime (World Cement, 2001). A Maerz lime kiln was installed at Ciarues S.A.'s Aragon plant. The new kiln has a capacity of 200 t/d and is natural-gas/coal-dust fired (World Cement, 2001).

United Kingdom.—On December 14, the Lhoist Group of Belgium acquired the United Kingdom lime business of RMC Group plc. The acquisition includes two Maerz kilns with an annual capacity of 200,000 t/yr near Hindlow, Derbyshire, and a hydrating plant near Hartley, Cumbria. The new entity will operate under the name Lhoist UK Ltd. (Lhoist Group, December 2000, Lhoist purchases RMC lime in the UK, accessed January 5, 2001, at URL http://www.lhoist.com/about/news/intro.html).

Outlook

Lime has dozens of end uses in the chemical, industrial, and construction industries, but sales are dominated, in descending order by tonnage, by the iron and steel markets, FGD, pulp and paper including the related PCC market, construction, and nonferrous metallurgy. These market groups accounted for 75% of total lime consumption in 2000.

In the short term, the slowdown of the economy and the energy crisis in the western United States will have a negative impact on lime sales. The domestic steel industry is plagued by high levels of imports, large inventories, and bankruptcies; the slowing economy will only exacerbate the industry's problems. These factors are expected to cause a decrease in U.S. steel production in 2001, and lime sales for steel could be decline by 5% to 10% in 2001.

In 2000, the FGD market recovered from the problems experienced in 1999, and the future for the lime-based FGD remains promising. Phase II of the Clean Air Act Amendments (CAAA), which went into effect January 1, 2000, remains the driving force behind the growth in this market. The costs of lime-based scrubbers have decreased to about $330 per ton of sulfur dioxide removed (from $440 to $1,000 per ton), and lime scrubbers display favorable economics and efficiencies for the smaller units regulated under phase II. Regulations covering emissions from small municipal incinerators and waste-to-energy incinerators also favor the use of lime scrubbers. When phase II went into effect, it was thought that the real boost to lime sales for FGD would be slow in coming because of an excess of emission allowances accumulated during phase I of the CAAA and the low prices for emissions allowances. It was thought that it would likely take until 2005 for the scrubber market to really start seeing the demand increase from the phase II regulation. There has been a steep rise in the price of emissions allowances from about $130 per ton to more than $200 per ton between the fall of 2000 and the spring of 2001. If allowance prices continue to rise or stay at current levels, the economics of installing scrubbers may become more attractive earlier than the previously forecasted 2005 time period.

Analysis of the energy crisis of 2000 and the potential for energy shortages in the future has indicated that the quickest way to expand generating capacity is to maximize the use of existing powerplants and to add capacity at current facilities. There continues to be strong public support for environmental cleanup of emissions, so greater use of FGD controls is likely in the future. The higher prices of natural gas, which has been the preferred fuel for new powerplants, also has made coal a more acceptable option for future power plant construction.

In a recent forecast of air pollution control markets, The McIlvaine Co. predicted that U.S. utilities will spend $25 billion over the next 9 years on flue gas desulfurization. The majority of these systems will use lime or limestone and produce byproduct gypsum. About 60% will be for existing powerplants and 40% for new coal-fired powerplants (The McIlvaine Co., November 2000, Huge U.S. power plant scrubber market now developing, accessed April 30, 2001, at URL http://www.mcilvainecompany.com/news%20releases/NR600.htm).

Increased funding for highway and airport construction as authorized by the Transportation Equity Act for the 21st Century (TEA-21) and the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21) should benefit the soil stabilization and asphalt markets over the next several years. The following are two examples of projects that potentially could benefit from the acts. AIR-21 will help fund runway expansion projects that have been announced for Corpus Christi International Airport, Dallas-Fort Worth International Airport, and McAllen-Miller International Airport (located west of Brownsville, TX). In addition, TEA-21 designated the “Ports to Plains” corridor linking Denver, CO, with the Texas-Mexico border as 1 of 43 high-priority corridors. Several transportation studies have been conducted on this corridor in the past, but a major feasibility study is underway that will examine preferred highway alignments and the feasibility of highway improvements. The goal would be to develop a four-lane divided highway linking the two points (Wilbur Smith Associates, January 2001, Ports to plains feasibility study process, accessed May 1, 2001, at URL http://www.wilbursmith.com/portstoplains). If this corridor gets built, it would provide a large potential market for lime stabilization that could last for years.

The traditional building markets (masonry and finishing lime) have shown unexpected growth in recent years and the trend should continue, but with the economy lagging in 2001 the growth rate of nonresidential construction is likely to slow.

Sales to the traditional pulp and paper market have decreased in recent years mainly because of increased recycling of byproduct calcium carbonate. This market will also be adversely affected by the announced closure of three International Paper Co. mills at Mobile, AL, Camden, AR, and Lock Haven, PA, and reduced operations at Courtland, AL (Tappi, October 20, 2000, PACE addresses mill closures, downsizing at IP, accessed November 15, 2000, via URL http://www.tappi.org). These closures will also adversely affect the PCC market because Minerals Technologies, Inc., operates satellite PCC mills at Lock Haven and Mobile, although PCC production at Courtland will be unaffected. On the positive side, Minerals Technologies opened a new merchant PCC mill at Brookhaven, MS, which will manufacture PCC for such nonpaper uses as vinyl siding and automotive and construction sealants (North American Minerals News, 2000b). In addition, Minerals Technologies signed an agreement to construct a satellite PCC mill at a paper mill in Millinocket, ME, owned by Great Northern Paper, Inc. The plant is expected to be in operation in the third quarter of 2001 (North American Minerals News, 2001). Despite the closures by International Paper, which will slow the growth of PCC in 2001, the PCC market should exhibit solid growth in the long term. Its penetration of the groundwood paperboard markets is considered a driver of future PCC demand. Kline & Co., a consultancy based in Fairfield, NJ, expects PCC use in paper and paperboard to grow on average by 6% per year through 2004 (North American Minerals News, 2000a).

The increase in natural gas prices already has had a dramatic effect on lime plant operations. With gas prices expected to remain high and coal prices rising because of increased demand as gas users try to switch fuels, lime plant operating costs will increase. Higher prices for transportation fuels (mainly diesel) will also increase operating costs. If these fuel prices continue at elevated levels, as current long-term contracts expire, lime producers will certainly attempt to raise prices. In the long term, coal prices are expected to come down as coal mine output catches up with demand. Considering the strong competition between lime companies and excess production capacity, the biggest impact of the current energy problems on the lime industry likely will not be big price increases but rather more production from coal-fired kilns. Companies will, where possible, convert gas-fired kilns to coal firing, but it is not known if this is feasible for all types of kilns.

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TABLE 1
SALIENT LIME STATISTICS 1/

(Thousand metric tons, unless otherwise specified) 2/

	1996	1997	1998	1999	2000
United States: 3/					
Number of plants	108	106	107	108	107
Sold or used by producers:					
High-calcium quicklime	NA	14,300	14,800	14,100	14,800
Dolomitic quicklime	NA	2,900	2,740	3,000 r/	2,570
Total	16,800	17,300	17,500	17,100	17,300
High-calcium hydrated lime	NA	1,820	1,950	2,010 r/	1,550
Dolomitic hydrated lime	NA	352	383	298	421
Total	2,190	2,170	2,330 r/	2,310 r/	1,970
Dead-burned dolomite 4/	300	300	300	300	200
Grand total	19,200	19,700	20,100	19,700 r/	19,600
Value 5/ thousands	$1,150,000 r/	$1,200,000	$1,250,000 r/	$1,190,000 r/	$1,190,000
Average value per ton	$61.50	$61.00	$60.40	$60.40 r/	$60.60
Lime sold	16,800	17,300	17,800	17,400 r/	17,500
Lime used	2,440 r/	2,420	2,320 r/	2,320 r/	2,040
Exports: 6/					
Quantity	68 7/	80	56	59	73
Value thousands	$8,810 7/	$9,550	$9,110	$8,270 r/	$9,960
Imports for consumption: 6/					
Quantity	298 7/	276 r/	231	140 r/	113
Value thousands	$27,500 7/	$26,500	$22,700	$15,700 r/	$13,500
Consumption, apparent 8/	19,400	19,900	20,300	19,800 r/	19,600
World, production	114,000 r/	116,000 r/	116,000 r/	116,000 r/	116,000 e/

e/ Estimated. r/ Revised. NA Not available.
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 1.10231.
3/ Excludes regenerated lime.
4/ Data rounded to no more than one significant digit to protect company proprietary data.
5/ Selling value, f.o.b. plant, excluding cost of containers.
6/ U.S. Census Bureau.
7/ The 1996 data were revised to correlate with the data for following years.
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	1999					2000				
	Plants	Hydrated (thousand metric tons)	Quicklime 3/ (thousand metric tons)	Total (thousand metric tons)	Value (thousands)	Plants	Hydrated (thousand metric tons)	Quicklime 3/ (thousand metric tons)	Total (thousand metric tons)	Value (thousands)
Alabama	5	102	1,830	1,930	$114,000	5	111	1,840	1,950	$121,000
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	20	271	2,320 r/	2,590 r/	151,000 r/	20	273	2,480	2,750	161,000
California, Oregon, Washington	10	64	505	569	47,000	10	54	490	544	38,800
Illinois, Indiana, Missouri	9	329	3,770	4,100	234,000 r/	9	316	3,570	3,890	224,000
Iowa, Nebraska, South Dakota	4	W	W	260	17,500	4	W	W	254	16,600
Kentucky, Tennessee, West Virginia	5	132	2,170	2,300	124,000	5	117	2,400	2,510	139,000
Michigan	8	1	781	781	43,900	7	W	W	530	31,300
Ohio	8	W	W	1,820	105,000	8	121	1,730	1,850	106,000
Pennsylvania	7	176	1,170	1,340	94,300	7	W	W	1,350	93,900
Texas	7	585 r/	1,080	1,670 r/	111,000 r/	7	316	1,280	1,600	105,000
Virginia	5	135	672	807	48,400	5	121	601	722	44,800
Wisconsin	4	149	469	618	37,000	4	150	469	619	37,000
Other 4/	16	173 r/	722 r/	895 r/	58,000 r/	16	164	828	992	68,100
Total	108	2,310 r/	17,400	19,700 r/	1,190,000 r/	107	1,970	17,600	19,600	1,190,000

r/ Revised. 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 dead-burned dolomite.

4/ Includes Arkansas, Georgia, Louisiana, Massachusetts, Minnesota, North Dakota, Oklahoma, Puerto Rico, South Carolina, and data indicated by the symbol W.

TABLE 3
LIME SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY RANGE OF PRODUCTION 1/ 2/

Range of production	1999 Plants	1999 Quantity r/ (thousand metric tons)	1999 Percent of total	2000 Plants	2000 Quantity (thousand metric tons)	2000 Percent of total
Less than 25,000 tons	25 r/	404	2	22	351	2
25,000 to 100,000 tons	25 r/	1,350	7	28	1,480	8
100,000 to 200,000 tons	24 r/	3,510	18 r/	24	3,370	17
200,000 to 300,000 tons	15 r/	3,580	18 r/	14	3,390	17
300,000 to 400,000 tons	7 r/	2,330	12 r/	6	2,040	10
400,000 to 600,000 tons	5 r/	2,550	13 r/	7	3,530	18
More than 600,000 tons	7 r/	5,950	30 r/	6	5,400	28
Total	108	19,700	100	107	19,600	100

r/ Revised.
1/ Excludes regenerated lime. Includes Puerto Rico.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 4
LIME SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE 1/ 2/

(Thousand metric tons and thousand dollars) 3/

Use	1999 Quantity 4/	1999 Value	2000 Quantity 4/	2000 Value
Chemical and industrial:				
Fertilizer (aglime and fertilizer)	23	1,900	48	3,540
Glass	98	5,650	84	5,060
Paper and pulp	971	57,800 r/	802	48,400
Precipitated calcium carbonate	1,200	71,100	1,200	72,900
Sugar refining	792 r/	46,400 r/	867	53,000
Other chemical and industrial	1,920	122,000 r/	1,670	110,000
Total	5,010 r/	305,000 r/	4,670	293,000
Metallurgical:				
Steel and iron:				
Basic oxygen furnaces	3,860 r/	219,000 r/	4,000	229,000
Electric arc furnaces	1,870 r/	111,000 r/	1,840	111,000
Other steel and iron	239	14,700	300	17,900
Total	5,970	344,000 r/	6,150	358,000
Nonferrous metals:				
Aluminum and bauxite	242 r/	14,600 r/	W	W
Other nonferrous metallurgy 5/	1,330 r/	76,400 r/	W	W
Total nonferrous metals	1,570	91,000	1,310	66,300
Total metallurgical	7,550	435,000 r/	7,450	424,000
Construction:				
Asphalt	370 r/	27,100 r/	345	27,300
Building uses	396	40,400	437	43,900
Soil stabilization	1,370 r/	89,200 r/	1,270	80,500
Other construction	31 r/	2,130 r/	14	1,350
Total	2,170 r/	159,000 r/	2,070	153,000
Environmental:				
Flue gas sulfur removal:				
Utility powerplants	2,650 r/	135,000 r/	2,990	158,000
Incinerator	140 r/	8,910 r/	139	9,020
Other	34	2,110 r/	31	2,120
Total	2,820 r/	146,000 r/	3,160	169,000
Sludge treatment:				
Sewage	147	9,890 r/	225	14,100
Other (industrial, hazardous, etc.)	98	6,720 r/	90	5,690
Total	245	16,600 r/	316	19,800
Water treatment:				
Acid mine drainage	91 r/	5,940 r/	103	6,650
Drinking water	904	56,000	958	59,600
Waste water	433 r/	28,100 r/	424	28,300
Total	1,430 r/	90,000 r/	1,480	94,600

See footnotes at end of table.

TABLE 4--Continued
LIME SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE 1/ 2/

(Thousand metric tons and thousand dollars) 3/

Use	1999 Quantity 4/	1999 Value	2000 Quantity 4/	2000 Value
Environmental--Continued:				
Other environmental	178 r/	11,700 r/	155	10,700
Total environmental	4,690	265,000	5,120	294,000
Refractories (dead-burned dolomite)	300 6/	21,800 r/ 7/	200 6/	21,900 7/
Grand total	19,700 r/	1,190,000 r/	19,600	1,190,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."
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 1.10231.
4/ Quantity includes lime sold and used, where "used" denotes lime produced for internal company use for copper ore concentration, magnesia, paper and pulp, precipitated calcium carbonate, basic oxygen furnaces, mason's lime, and refractories.
5/ Includes ore concentration (copper, gold, etc.), magnesium, and other.
6/ Data rounded to one significant digit to protect company proprietary data.
7/ Values are estimated based on average value per ton for 1999 and 2000.

TABLE 5
HYDRATED LIME SOLD OR USED IN THE UNITED STATES, BY END USE 1/ 2/

(Thousand metric tons and thousand dollars) 3/

Use	1999 Quantity 4/	1999 Value	2000 Quantity 4/	2000 Value
Chemical and industrial	477 r/	38,000 r/	431	37,000
Construction:				
Asphalt paving	356 r/	26,500 r/	325	26,200
Building uses	394	40,200	411	42,300
Soil stabilization	528 r/	39,400 r/	237	17,600
Other construction	16	1,080	10	1,140
Total	1,290 r/	107,000 r/	983	87,200
Environmental:				
Flue gas treatment (FGT):				
Incinerators	19 r/	1,380 r/	25	1,860
Industrial boilers and other FGT	19 r/	1,280 r/	37	2,730
Utility powerplants	42 r/	2,790 r/	47	3,490
Total	80 r/	5,460 r/	109	8,080
Sludge treatment:				
Sewage	17 r/	1,420 r/	28	2,280
Other sludge treatment	21 r/	1,760 r/	17	1,470
Total	38 r/	3,180 r/	45	3,750
Water treatment:				
Acid mine drainage	55 r/	3,620 r/	54	3,620
Drinking water	199	15,200	143	11,900
Wastewater	114 r/	8,240 r/	150	11,300
Total	368 r/	27,000 r/	347	26,800
Other environmental	31 r/	2,670 r/	33	2,580
Metallurgy	22	1,560 r/	19	1,650
Grand total	2,310 r/	185,000 r/	1,970	167,000

r/ Revised.
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 1.10231.
4/ Quantity includes hydrated lime sold or used, where "used" denotes lime produced for internal company use in building, chemical and industrial, and metallurgical sectors.

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

Type	1999 Quantity (metric tons) 2/	1999 Value 3/	2000 Quantity (metric tons) 2/	2000 Value 3/
Calcined dolomite:				
Brazil	--	--	217	$95,800
Canada	2,050 r/	$483,000 r/	2,490	553,000
Israel	24 r/	31,900 r/	103	25,500
Japan	1,470 r/	358,000 r/	90	27,800
Mexico	320 r/	86,600 r/	197	36,800
Netherlands	25	33,400	149	40,000
Taiwan	809 r/	188,000 r/	772	162,000
Vietnam	--	--	368	108,000
Other 4/	36	17,900	265	88,300
Total	4,730 r/	1,200,000 r/	4,650	1,140,000
Hydraulic lime:				
Canada	10,600	1,280,000	9,680	1,170,000
New Zealand	269	99,800	206	72,900
Other 5/	211 r/	62,600 r/	130	91,400
Total	11,100	1,440,000	10,000	1,330,000
Quicklime:				
Argentina	150	36,400	6,590	1,280,000
Canada	28,300	3,140,000	31,000	3,280,000
Costa Rica	739	124,000	428	63,800
Mexico	7,540	1,240,000	12,400	1,390,000
Russia	--	--	200	19,100
Other 6/	58	20,000 r/	132	202,000
Total	36,800 r/	4,560,000 r/	50,700	6,230,000
Slaked lime (hydrate):				
Bahamas, The	287	47,600	551	89,300
Canada	5,820	840,000	7,040	1,070,000
France	117	39,400	--	--
Philippines	372	81,800	151	17,300
Other 7/	163 r/	66,600 r/	91	81,700
Total	6,760	1,080,000	7,830	1,260,000
Grand total	59,300 r/	8,270,000 r/	73,200	9,960,000

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 1.10231.

3/ Declared " Free alongside ship" (f.a.s.) valuation.

4/ Includes Egypt, New Zealand, South Africa, and Uruguay.

5/ Includes The Bahamas, Chile, Germany, Haiti, India, the Republic of Korea, Mexico, Spain, the United Kingdom, and Venezuela.

6/ Includes The Bahamas, Barbados, Guatemala, Kuwait, Panama, Slovenia, and the United Arab Emirates.

7/ Includes Antigua, Ireland, Mexico, Taiwan, Trinidad and Tobago, and the United Kingdom.

Source: U.S. Census Bureau.

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

Type	1999 Quantity (metric tons) 2/	1999 Value 3/	2000 Quantity (metric tons) 2/	2000 Value 3/
Calcined dolomite:				
Canada	29,500 r/	$4,510,000 r/	15,700	$2,750,000
Other 4/	8 r/	8,320 r/	404	310,000
Total	29,500 r/	4,520,000 r/	16,200	3,060,000
Hydraulic lime:				
Canada	26 r/	2,750	1	3,460
Mexico	2,870 r/	189,000	--	--
Total	2,900 r/	192,000	1	3,460
Quicklime:				
Canada	79,100 r/	$7,570,000	68,200	$6,770,000
Mexico	--	--	701	81,400
Other 5/	89 r/	138,000	246	272,000
Total	79,200 r/	7,700,000	69,200	7,120,000
Slaked lime (hydrate):				
Canada	16,900 r/	1,590,000	12,400	1,210,000
Mexico	11,800 r/	1,490,000	15,400	1,880,000
Other 6/	88 r/	198,000	119	196,000
Total	28,800 r/	3,270,000	27,900	3,290,000
Grand total	140,000 r/	15,700,000 r/	113,000	13,500,000

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 1.10231.
3/ Declared "Cost, insurance, and freight" (c.i.f.) valuation.
4/ Includes China, Spain, and Switzerland.
5/ Includes Australia, Belgium, China, Finland, Japan, Thailand, and the United Kingdom.
6/ Includes Ecuador, Germany, Japan, Montserrat, Taiwan, Thailand, and the United Kingdom.

Source: U.S. Census Bureau.

TABLE 8
LIME PRICES 1/

Type	1999 Dollars per metric ton	1999 Dollars per short ton	2000 Dollars per metric ton	2000 Dollars per short ton
Sold and used:				
Quicklime	57.30	52.00	57.50	52.10
Hydrate	80.20	72.70	85.00	77.10
Dead-burned dolomite	85.40	77.40	88.90	80.60
Average all types	60.40 r/	54.80	60.60	55.00
Sold:				
High-calcium quicklime	56.90	51.70	57.40	52.10
Dolomitic quicklime	55.00	49.90	59.00	53.50
Average quicklime	56.60	51.40	57.60	52.30
High-calcium hydrate	79.10	71.80	80.20	72.70
Dolomitic hydrate	87.90	79.70	103.00 r/	93.30
Average hydrate	80.30	72.80	85.10	77.20
Dead-burned dolomite	82.40	74.80	89.70	81.40
Average all types	59.90	54.40	60.90	55.20

r/ Revised.
1/ Average value per ton, on an f.o.b. plant basis, including cost of containers.

TABLE 9

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

(Thousand metric tons)

Country 3/	1996	1997	1998	1999	2000 e/
Australia e/	1,500	1,500	1,500	1,500	1,500
Austria e/	1,990 4/	1,900	2,000	2,000	2,000
Belgium e/	1,800	1,750	1,750	1,750	1,750
Brazil e/	5,700	5,700	5,700	5,700	5,700
Bulgaria e/	1,000	1,200	1,100	1,100	1,100
Canada	2,402	2,477	2,514	2,585	2,600
Chile e/	1,050	1,000	1,000	1,000	1,000
China e/	20,000	20,500	21,000	21,500	21,500
Colombia e/	1,300	1,300	1,300	1,300	1,300
Czech Republic	1,176	1,217	1,151	1,200 e/	1,200
France e/	2,714 4/	2,360	2,400	2,400	2,400
Germany e/	7,570 4/	7,600	7,600	7,600	7,600
Iran	2,000 e/	2,500 e/	2,737	2,138	2,200
Italy e/ 5/	3,500	3,500	3,500	3,500	3,500
Japan (quicklime only)	7,744	8,104	7,646	7,594 r/	7,650
Mexico e/	6,600 4/	6,500 r/	6,500 r/	6,500 r/	6,500
Poland	2,461	2,516	2,406	2,500 e/	2,500
Romania	1,712	1,750	1,700	1,700 e/	1,700
Russia 6/	7,822	7,626	7,000	7,000 e/	8,000
South Africa (sales)	1,650	1,585	1,523	1,920 r/	1,345 4/
Spain e/	1,000	1,000	1,000	1,000	1,000
Turkey 7/	1,023	1,170	1,066	1,100 e/	1,100
United Kingdom e/	2,500	2,500	2,500	2,500	2,500
United States (sold or used by producers) 8/	19,200	19,700	20,100	19,700 r/	19,600 4/
Other e/	8,590 r/	9,050 r/	9,310 r/	9,210 r/	8,760
Total	114,000 r/	116,000 r/	116,000 r/	116,000 r/	116,000

e/ Estimated. 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 6, 2001.

3/ Lime is produced in many other countries besides those included in the total. Argentina, Iraq, Pakistan, and Syria are among the more important countries for which official data are not available.

4/ Reported figure.

5/ Includes hydraulic lime.

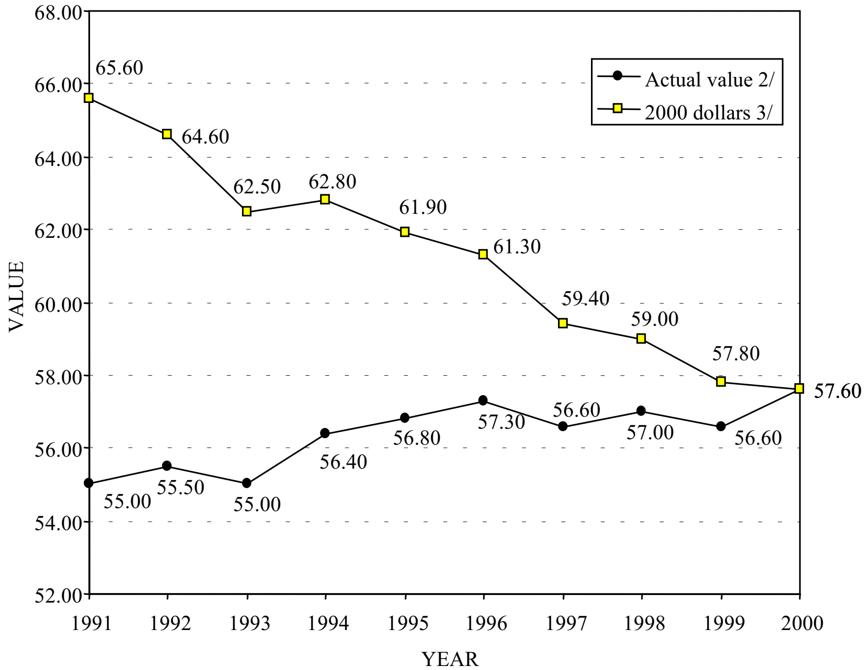
6/ Total industrial and construction production as reported by Russia.

7/ Lime produced for steel production; does not include the widespread artisanal production of lime for whitewash and sanitation purposes.

8/ Includes Puerto Rico.

FIGURE 1
TIME-VALUE RELATIONS FOR QUICKLIME SOLD

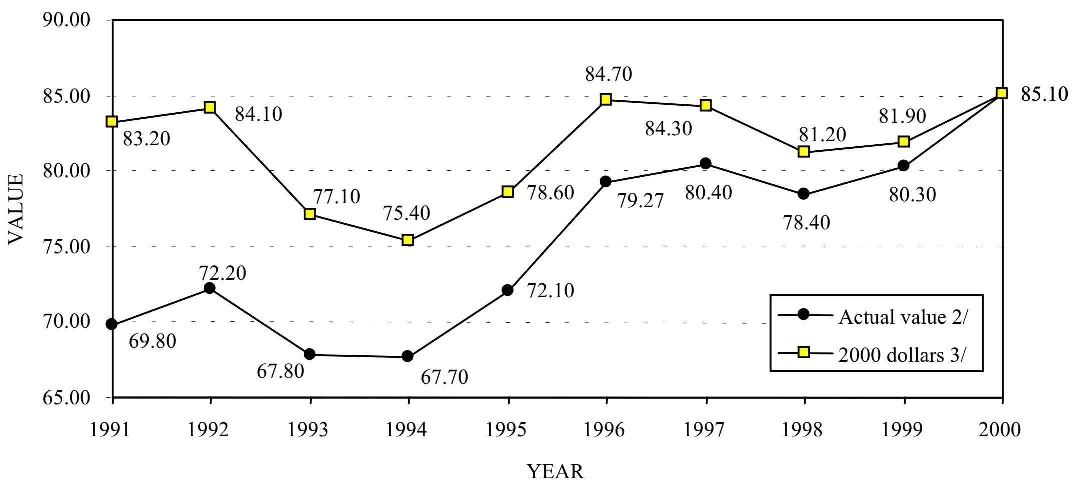
(Dollars per metric ton) 1/



1/ To convert dollars per metric ton to dollars per short ton, divide value by 1.10231.
2/ Based on implicit price deflator for gross domestic product; base year 2000.
3/ Value of quicklime sold as prepared for shipment, f.o.b. plant.

FIGURE 2
TIME-VALUE RELATIONS FOR HYDRATED LIME SOLD

(Dollars per metric ton) 1/



1/ To convert dollars per metric ton to dollars per short ton, divide value by 1.10231.
2/ Based on implicit price deflator for gross domestic product; base year is 2000.
3/ Value of hydrated lime sold as prepared for shipment, f.o.b. plant.