



2018 Minerals Yearbook

LIME [ADVANCE RELEASE]

LIME

By Lori E. Apodaca

Domestic survey data and tables were prepared by Joshua A. Braunstein, statistical assistant.

In 2018, lime production in the United States (including Puerto Rico) was 18.1 million metric tons (Mt) and had a value of \$2.40 billion (table 1). These were increases of 422,000 metric tons (t) and \$103 million from those of 2017. Lime consumption decreased in three major market sectors: construction, flue gas treatment, and water treatment. Increases were recorded for sales in chemical, industrial, metallurgy, sludge treatment, and refractory sectors (table 3). On average, prices for lime sold or used were higher in 2018 than in 2017 (table 5).

Lime plants and facilities require nearby proximity to markets and access to suitable transportation networks to allow for cost-effective production and distribution. The U.S. lime industry is dominated by a few large-scale producers with nationwide supply and distribution networks. Because there is a scarcity of high-quality limestone deposits for which required zoning and mining permits can be obtained, production capacity increases are usually met by replacing older kilns at existing plants and thus using existing air quality permits for new, more efficient, and higher capacity kilns that have reduced emissions.

Lime, as quicklime, is a basic chemical produced in 28 States and Puerto Rico. The U.S. lime industry consisted of 31 companies in 2018. Of these, 16 companies produced lime products for sale, 10 produced lime that was used entirely for internal company purposes, and 5 did both. Owing to its chemical reactivity and short shelf life, lime is not stockpiled in large amounts. Consequently, data on stocks are not collected. Thus, on an annual basis, lime “sold or used” is considered to be equivalent to both production and consumption. In 2018, Alabama and Missouri were the only two States that had production in excess of 2 Mt. Three States (Kentucky, Ohio, and Texas) had production of between 1 and 2 Mt.

The term “lime” as used throughout this report refers primarily to six chemicals produced by the calcination of high-purity limestone (calcium carbonate, CaCO_3) or dolomite [$\text{CaMg}(\text{CO}_3)_2$], followed by hydration where necessary. There are two high-calcium forms of lime: high-calcium quicklime (calcium oxide, CaO) and high-calcium hydrated lime [calcium hydroxide, $\text{Ca}(\text{OH})_2$]. There are four calcium-magnesium (dolomitic) forms: dolomitic quicklime ($\text{CaO}\cdot\text{MgO}$), dolomitic hydrate type N [$\text{Ca}(\text{OH})_2\cdot\text{MgO}$], dolomitic hydrate type S [$\text{Ca}(\text{OH})_2\cdot\text{Mg}(\text{OH})_2$], and refractory dead-burned dolomite ($\text{CaO}\cdot\text{MgO}$). The terms “type N” and “type S” refer to “Normal hydrated lime” and “Special hydrated lime” that are differentiated primarily by the compounds’ plasticity (ability to retain water) and oxide content. There are also air-entrained versions of these hydrates designated as “type NA” and “type SA.”

At present, all commercially produced lime in the United States is manufactured from limestone or dolomite. Lime can also be produced from a variety of similar carbonate materials, such as aragonite, chalk, coral, marble, and seashells, if they are of high chemical purity. Lime also is regenerated and produced as a byproduct by carbide plants, paper mills, sugar mills, and water-

treatment plants. Regenerated lime, however, is not covered in this report.

In the United States, most lime (about 84%) is produced as quicklime (table 1). Hydrated lime (also called slaked lime) is a dry calcium hydroxide powder made from reacting quicklime with a controlled amount of water in a hydrator. Slaked lime also includes dispersions (suspensions) of calcium hydroxide particles in water, either in the form of milk of lime or lime putty. Milks of lime contain up to 40% by weight of solids, and lime putties contain 55% to 70%. Slaked lime is widely used in aqueous systems as a low-cost alkali to neutralize or balance acidity (Oates, 1998, p. 1, 229).

Production

Domestic production data for lime were derived by the U.S. Geological Survey (USGS) from a voluntary canvass of U.S. operations. The canvass was sent to primary producers of quicklime and hydrate. To avoid double counting, the canvass 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. Of the 93 operations that were canvassed in 2018, 85 operations responded, 4 of which were idle during the entire year. Data received represented 93% of the total lime sold or used by producers listed in tables 1 through 5. Production data for the nonrespondents were estimated on the basis of prior-year production data and other information.

In 2018, quicklime was produced at 74 lime plants, including 29 plants with colocated hydrating plants. Hydrated lime also was produced at 18 stand-alone hydrating facilities, including 5 plants where the kilns had been shut down but hydrate was manufactured from quicklime produced offsite. These numbers do not necessarily agree with the number of plants reported in table 1 because, for data collection purposes, some company operations have been combined at the respondent’s request. In some States with no quicklime production, hydrating plants used quicklime sourced from other States. There were also stationary lime slurry plants in some States where hydrated lime was converted (slaked) to form lime slurry (milk of lime) by the addition of water prior to sale. Mobile hot lime slurry production systems also were used to slake quicklime or to make hydrated lime slurry to the percentage of solids (milks of lime or lime putties) required for specific jobs.

Data on lime sold or used in the United States are reported by U.S. Census Bureau region (table 2). In 2018, production, or the total amount of lime sold or used by domestic producers, including Puerto Rico, was 18.1 Mt, a slight increase compared with that of 2017 (table 1). The Midwest and East South Central regions combined accounted for 63% of the production (table 2).

The total included the commercial sale or captive consumption by producers (described by the term “used”) of quicklime, hydrated lime, and dead-burned refractory dolomite. Data on the production of hydrated lime were incomplete because some producers do not report data on downstream hydrating plants.

Most U.S. lime production sold or used is in the form of high-calcium quicklime. In 2018, production of high-calcium quicklime increased slightly to 12.4 Mt, and dolomitic quicklime increased by 6% to 2.8 Mt from that of 2017 (table 1). The production of high-calcium hydrate increased by 3% from that of 2017, and dolomitic hydrate production decreased by 4% from that of 2017. Commercial sales of quicklime and hydrate increased slightly to 16.9 Mt, and lime produced for captive consumption increased slightly to 1.22 Mt, compared to 2017.

At yearend, the top 10 lime companies were, in descending order of U.S. lime production, Lhoist North America; Carmeuse Lime and Stone; Graymont Ltd.; Mississippi Lime Co.; Martin Marietta Magnesia Specialties LLC; United States Lime & Minerals, Inc.; Unimin Corp. (doing business as Southern Lime Co.); Pete Lien & Sons, Inc.; Cheney Lime & Cement Co.; and Greer Lime Co. These companies reported production from 45 lime plants and 10 stand-alone hydrating plants and accounted for 95% of the combined commercial lime sales and 90% of total lime production.

On March 12, Mississippi Lime announced that it would add capability to produce high-reactivity hydrated (HRH) lime at its Weirton, WV, facility. HRH lime is used to control acidic gases at coal-fired boilers and in other industrial processes that generate byproduct acidic gases (Mississippi Lime Co., 2018b). In addition, Mississippi Lime announced on December 1 that it would significantly increase its enhanced hydrated lime capacities at its Weirton, WV, and Verona, KY, facilities (Mississippi Lime Co., 2018a).

Panamint Valley Limestone Inc. (PVL) announced in May that it planned to open a new \$45 million lime plant in Trona, CA. The plant would process limestone rock into quicklime and hydrated lime products used in cement, soil conditioning, water treatment, and industrial processes. The planned capacity at the PVL plant would be 360 metric tons per day. Production at the plant was expected to begin in early 2021 (PR Newswire, 2018).

Consumption

In 2018, reported U.S. lime consumption increased in most major market sectors (table 3). The percentage distribution of lime consumption by general end-use sector was little changed from that of 2017 and was 35% for metallurgical uses, 29% for environmental uses, 21% for chemical and industrial uses, 10% for construction uses, 3% for miscellaneous uses, and 1% for refractories. These end-use data were based on lime sold or used by domestic producers and do not include lime imports.

Commercial sales (lime sold by producers) accounted for 94% of total U.S. lime consumption (table 1). Captive lime (lime that is used by companies for internal purposes) accounted for the remainder of consumption and was used in the production of steel in basic oxygen furnaces (BOFs), magnesia production, precipitated calcium carbonate production, sugar refining, and refractories (dead-burned dolomite). As a result, table 3 lists

only the total quantity (commercial plus captive) by end use. Additional end uses with captive consumption are listed in footnote 5 of table 3.

In steel production, quicklime is used as a flux and slagging agent in BOFs and electric arc furnaces (EAFs) to remove impurities, such as phosphorus, silica, and sulfur, from the hot metal. The steel industry accounted for 29% of lime sold or used by domestic lime producers. According to the World Steel Association (2019), U.S. steel production in 2018 increased by 6.1% from that of 2017; lime sold for total steel and iron uses in 2018 was 6% more than that of 2017 (table 3).

In nonferrous metallurgy, lime is used in the beneficiation of copper and zinc ores to neutralize the acidic effects of pyrite and other sulfides and to maintain the proper pH in the flotation circuits. It is also used as a so-called depressant to prevent pyrite from entering the copper or zinc concentrate. Lime is used to process alumina and magnesia, extract uranium from gold slimes, and recover nickel by precipitation.

Gold and silver are recovered using heap leaching and by conventional milling and subsequent leaching of the slurry. Heap leaching involves crushing ore, mixing with lime or portland cement for pH control and sometimes agglomeration, then stacking the ore in heaps on specially prepared pads for treatment with cyanide solution. Lime is used to maintain the pH of the cyanide or thiourea solution at a level between 10 and 11 to maximize the recovery of precious metals and to prevent the creation of hydrogen cyanide gas.

Lime consumption data for nonferrous metallurgical uses [alumina and bauxite processing, flotation processing of sulfide ores (principally copper and gold ores), and unspecified nonferrous uses] are combined to avoid disclosing company proprietary data and are reported in table 3 under “Metallurgical: Nonferrous metallurgy.” In 2018, lime consumption in nonferrous metallurgy increased slightly to 1.12 Mt (table 3) but was lower than the peak of 1.33 Mt in 2015.

Lime is used in numerous processes to treat discharges to the environment in active or abandoned mines. These processes include the treatment of acid-mine drainage from operating and abandoned mines, specialized treatment processes such as catalyzed cementation of arsenic and other heavy metals, and treatment of precious metals mine tailings to recover cyanides.

Lime is used, generally in conjunction with soda ash (Na_2CO_3), for softening municipal and plant process water. This precipitation process removes soluble calcium and magnesium cations, and to a lesser extent, ferrous iron, manganese, strontium, and zinc cations 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 6% in 2018 compared with that of 2017 (table 3).

In sewage treatment, the traditional role of lime is to control pH in the sludge digester, where it removes dissolved and suspended solids that contain phosphates and nitrogen compounds. Lime aids in clarifying wastewater and in destroying harmful bacteria and is used to stabilize the resulting sewage sludge for beneficial use or disposal. 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, depending on the biosolids classification. The National Lime Association (undated) has a concise description of lime's use in biosolids stabilization. In 2018, lime consumption for all sludge treatment increased by 8% compared with that of 2017 (table 3).

In flue gas treatment (FGT) systems serving coal-fired powerplants, incinerators (most are waste-to-energy powerplants), and other industrial plants, lime is injected into the flue gas to remove gaseous pollutants, particularly sulfur dioxide (SO_2) and hydrochloric acid (HCl). Many FGT systems at utility powerplants are now designed to produce byproduct synthetic gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) from the captured SO_2 . In 2018, 29.7 Mt of synthetic gypsum was produced (American Coal Ash Association, 2019). This gypsum is suitable for use in manufacturing wallboard, as an additive in portland cement, and as a soil amendment in agriculture. Hydrated lime may be used in another FGT-related market—to control sulfur trioxide (SO_3) emissions from selective catalytic reduction systems installed at powerplants to control emissions of nitrogen oxides (NO_x). Utility powerplants were by far the leading consumers of lime for FGT and accounted for 89% of the total FGT lime market in 2018 (table 3). Incinerators, industrial boilers, and other FGT uses accounted for the remainder. In 2018, lime consumption decreased slightly in the utility powerplant market, decreased by 13% in the incinerators market, and increased by 9% in the industrial boilers and other FGT markets (table 3). The use of hydrated lime in FGT in 2018 increased by 11% to 539,000 t (table 4). This increase was attributed to increased consumption by the utility powerplant and industrial boilers and other FGT sectors.

Slaked lime is used by the pulp and paper industry in the basic kraft pulping process for converting wood chips into wood pulp. Slaked lime is sometimes used to produce calcium hypochlorite bleach for bleaching the paper pulp. The paper industry also uses lime as a coagulant aid in the clarification of plant process water. In 2018, consumption for pulp and paper production decreased by 5% from that in 2017 (table 3).

Lime is used in the manufacture of a wide range of chemicals. Lime is used to make precipitated calcium carbonate (PCC) for use as a specialty filler in premium-quality coated and uncoated papers, paints, and plastics. The most common method of making PCC in the United States is the carbonation process. Carbon dioxide (CO_2) is bubbled through calcium hydroxide (as 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 3% compared with that of 2017 (table 3).

The chemical industry also uses lime in the manufacture of alkalis. Other chemical uses include the production of calcium carbide, which is formed when quicklime is combined with coke; calcium carbide, in turn, is used to make acetylene and calcium cyanamide. Lime is also used to make calcium hypochlorite bleaches, citric acid, petrochemicals, and many other chemicals.

In sugar refining, milk of lime is used to raise the pH of the product stream, precipitating out colloidal impurities. The

lime itself is then removed by reaction with CO_2 to precipitate calcium carbonate.

Hydrated lime is used in oil and gas drilling as a source of alkalinity and calcium in both oil- and water-base drilling fluids. Drilling fluid applications include increasing the pH, providing excess lime as an alkalinity buffer, flocculating bentonite drilling muds, removing soluble carbonate (CO_3^{2-}) ions, controlling corrosion, and activating fatty-acid oil-base mud additives (M-I SWACO, 2011).

In the construction sector, hydrated lime is used in hot mix asphaltic concrete as an antistripping agent. Stripping is generally defined as a loss of adhesion between the aggregate surface and the asphalt binder in the presence of water. Lime also is used in cold, in-place recycling for the rehabilitation of distressed asphaltic concrete pavements. Existing asphaltic concrete pavement is pulverized 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 asphaltic concrete surface. In 2018, sales of lime for use in asphaltic concrete decreased by 5% compared with those in 2017 (table 3).

Hydrated lime and quicklime also are used to stabilize fine-grained soils, such as hydraulic clay fills or otherwise poor-quality clay and silty materials obtained from cuts or borrow pits, in place of materials that are employed as subbases. 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 include the construction of airfields, building foundations, earthen dams, parking areas, and roads.

Lime sales for soil stabilization tend to be cyclical, especially in major market areas such as Texas. In the soil stabilization market, lime competes with portland cement, cement kiln dust, fly ash, and other additives (liquid enzymes, for example). The choice of material for soil stabilization depends on availability, price, contract specifications, soil chemistry, and State and Federal funding in the case of highway construction projects. The amount of lime consumed for soil stabilization in 2018 decreased by 4% compared with that of 2017 (table 3). According to the U.S. Census Bureau (2019, table 2), public spending on highway and street construction was \$92.6 billion in 2018, an increase of 4% from the \$88.9 billion spent in 2017.

Hydrated lime is used in the building sector for some mortars, plasters, and stuccos. Standard masonry 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 some exterior and interior plasters and stuccos, enhancing the durability, strength, 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 were commonplace before the development of portland cement mortars. Modern portland cement-base 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.

Almost all lime sold or used in 2018 for building use was in the form of hydrate [251,000 t (table 4) out of 254,000 t of total lime (table 3)]. In 2018, the total amount of lime consumed in building uses, such as in aerated concrete, mortar, plaster, and whitewash, decreased by 12% compared with that of 2017 (table 3). Most of the lime sold or used for construction purposes was produced at a few plants primarily in Missouri, Nevada, South Dakota, Texas, 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 BOFs. Refractory brick also is used in the lining of many treatment and casting ladles, in cement clinker kilns, in argon-oxygen decarburization and vacuum-oxygen decarburization converters, in EAFs, and in continuous steel casting. The data on dead-burned dolomite reported in table 3 were rounded to one significant digit to avoid disclosing company proprietary data; unrounded data show that the consumption of dead-burned dolomite in 2018 was slightly more than that in 2017. Magnesita Refractories Co. at its York, PA, plant and Carmeuse at its Millersville, OH, plant were the only significant domestic producers of dead-burned dolomite. Although dead-burned dolomite is the primary form of lime used in refractories, hydrated lime may be used to produce silica refractory brick used to line industrial furnaces.

Prices

The USGS calculates unit values of lime products from the quantity and value data reported for lime sold or used by the lime producers on a free-on-board plant basis, including the cost of containers. These provide average values that eliminate variables such as potentially significant differences between list prices and individual supply contracts. There are no published lime prices in trade publications, so historically the data listed in table 5 have been used as representative of U.S. lime prices. To avoid disclosing company proprietary data, value data for dead-burned dolomite have not been reported separately but are included within the weighted average of all types of lime. The total weighted average price per metric ton of all quicklime and hydrate sold or used in 2018 increased slightly. Annual average prices for high-calcium quicklime sold and high-calcium hydrate sold increased slightly and by 3%, respectively, in 2018 compared with those for 2017, by \$2.70 and \$4.80 per metric ton, respectively. Annual average prices for dolomitic quicklime and dolomitic hydrate sold increased by \$0.10 and \$2.60 per metric ton, respectively. During the past 10 years, the total annual weighted average price for all types increased by \$40.60 per metric ton.

Foreign Trade

The United States exported and imported calcined dolomite (dolomitic lime), hydrated lime (slaked lime), hydraulic lime, and quicklime. Total exports and imports of lime were very small—each about 2%—compared with the total amount produced domestically in 2018. Total exports of lime in 2018 were 422,000 t valued at \$83.6 million (table 6). About 90% of exports went to Canada; most of the remaining exports went to Chile (6%) and

Mexico (1%). Total imports of lime were 370,000 t valued at \$66.7 million, with about 91% from Canada, 7% from Mexico, and 2% from other countries (table 7). Canada provided nearly all high-calcium quicklime and dolomitic (calcined dolomite) lime and 58% of slaked lime imports.

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

In 2018, global lime production was 420 Mt, 3% higher than that from 2017 but an average of 12% higher than global production in 2014–16 (table 8). The leading lime-producing countries in 2018 were China (71%), the United States (4%), India (4%), Russia (3%), and Brazil (2%). Lime is mostly traded on a regional basis because it is a low-value, bulk, and reactive product that cannot be shipped long distances and competes with lime produced locally. Most countries have limestone or dolomite deposits, which allows for at least basic forms of local production and consumption. There may also be some trade between countries on a regional basis where distances are not great, such as within the European Union, or to supply lime products of a quality not locally available.

With the exception of some industrialized nations, accurate lime production data for individual countries are difficult to obtain and are commonly incomplete. In addition to production by large commercial lime companies, lime is produced by small-scale manufacturers operating simple kilns to supply local consumers and by industries producing lime for internal consumption. Also, there is common misreporting of crushed limestone production data as lime data. In some cases, lime sales data have been used as a proxy for country production figures.

Outlook

Lime sales in markets such as chemical and industrial, construction, and steel are expected to follow the trend in gross domestic product in the overall economy. The outlook for FGT (lime's second-leading market) is easier to predict. With the recent boom in natural gas exploration, large increases in natural gas reserves, and low natural gas prices, U.S. electric utilities have increasingly shifted their fuel use from coal to natural gas either by conversion of the coal-fired powerplants or by shutting down coal-fired powerplants. Natural gas has the advantage of producing lower levels of emissions than coal and, as a result, does not usually require SO₂ scrubbing leading to decreased FGT lime consumption, which will likely continue. The U.S. Energy Information Administration (2019, p. 24) forecast the breakout of total domestic utility-scale electricity generation in 2019 to be 37% from natural gas and 25% from coal. In 2018, natural gas supplied 34% and coal supplied 29% of total U.S. electricity generation. In 2020, natural gas and coal are forecast to generate 39% and 22% of electricity, respectively. The amount of electricity produced by coal in 2018 was the lowest since 1979 (U.S. Energy Information Administration, 2018).

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TABLE 1
SALIENT LIME STATISTICS¹

	2014	2015	2016	2017	2018
United States: ²					
Number of plants ³	86	86	85	86 ^r	85
Lime sold or used by producers:					
Quantity:					
Quicklime:					
High-calcium thousand metric tons	14,100	13,100	12,000 ^r	12,200	12,400
Dolomitic do.	2,740	2,550	2,420 ^r	2,650 ^r	2,820
Total do.	16,800	15,600	14,500	14,800	15,200
Hydrated lime:					
High-calcium do.	2,190	2,150	2,350	2,360	2,430
Dolomitic do.	279	279	280	276	265
Total do.	2,470	2,430	2,630	2,640	2,690
Dead-burned dolomite ⁴ do.	200	200	200	200	200
Total do.	19,500	18,300	17,300	17,600	18,100
Value ⁵ thousand dollars	2,390,000	2,290,000	2,160,000 ^r	2,300,000	2,400,000
Average value dollars per metric ton	122.40	125.30	125.10	130.40 ^r	133.10
Lime sold by producers (commercial sales):					
Quantity:					
Quicklime ⁶ thousand metric tons	15,700	14,500	13,400	13,800	14,200
Hydrated lime do.	2,470	2,430	2,630	2,630 ^r	2,690
Total do.	18,100	17,000	16,100	16,400	16,900
Value ⁵ thousand dollars	2,210,000	2,110,000	2,000,000 ^r	2,130,000 ^r	2,230,000
Lime used by producers (captive consumption):					
Quantity thousand metric tons	1,400	1,280	1,230 ^r	1,200	1,220
Value ⁵ thousand dollars	180,000	176,000	168,000 ^r	168,000 ^r	175,000
Exports: ⁷					
Quantity thousand metric tons	320	346	329	391	422
Value ⁸ thousand dollars	57,600	62,600	64,500	74,200	83,600
Imports for consumption: ⁷					
Quantity thousand metric tons	414	391	376	367	370
Value ⁹ thousand dollars	67,700	66,900	61,500	62,300	66,700
Consumption, apparent ¹⁰ thousand metric tons	19,600	18,300	17,300 ^r	17,600	18,000
World production do.	350,000	370,000	410,000	410,000	420,000

^rRevised. do. Ditto.

¹Table includes data available through June 18, 2020. Data are rounded to no more than three significant digits; may not add to totals shown. Excludes regenerated lime.

²Includes Puerto Rico.

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

⁴Data are rounded to no more than one significant digit to avoid disclosing company proprietary data.

⁵Selling value, free on board plant.

⁶Includes dead-burned dolomite.

⁷Source: U.S. Census Bureau.

⁸Free alongside ship value.

⁹Cost, insurance, and freight value.

¹⁰Defined as sold or used plus imports minus exports.

TABLE 2
LIME SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY U.S. CENSUS BUREAU REGION¹

Region or division and year	Quantity				Value	
	Hydrated (thousand metric tons)	Quicklime ² (thousand metric tons)	Total (thousand metric tons)	Percent of total	Total (thousand dollars)	Percent of total
2017:						
Northeast ³	142 ^r	763	905	5	186,000	8
Midwest ⁴	890 ^r	5,920	6,810	39 ^r	878,000 ^r	38 ^r
South:						
South Atlantic ⁵	220	717	937	5	115,000	5
East South Central ⁶	285	3,930	4,220	24 ^r	496,000	22 ^r
West South Central ⁷	800	1,110	1,910	11	222,000	10
West ⁸	302	2,560	2,860	16	404,000	17
Total	2,640	15,000	17,600	100	2,300,000	100
2018:						
Northeast ³	142	812	954	5	192,000	8
Midwest ⁴	947	6,200	7,150	40	933,000	39
South:						
South Atlantic ⁵	201	763	964	5	120,000	5
East South Central ⁶	316	3,960	4,280	24	534,000	22
West South Central ⁷	797	1,150	1,950	11	233,000	10
West ⁸	288	2,490	2,780	15	392,000	16
Total	2,690	15,400	18,100	100	2,400,000	100

^rRevised.

¹Table includes data available through June 18, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes dead-burned dolomite.

³Production in Massachusetts and Pennsylvania.

⁴Production in Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

⁵Production in Florida, Georgia, Puerto Rico, Virginia, and West Virginia.

⁶Production in Alabama, Kentucky, and Tennessee.

⁷Production in Arkansas, Louisiana, Oklahoma, and Texas.

⁸Production in Arizona, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

TABLE 3
LIME SOLD OR USED BY PRODUCERS IN THE
UNITED STATES, BY USE^{1,2}

(Thousand metric tons)

Use	2017	2018
Chemical and industrial:		
Fertilizer, including aglime	79	86
Glass	W	W
Paper and pulp ³	919	877
Precipitated calcium carbonate ³	659	680
Sugar refining ³	629 ^r	631
Other chemical and industrial ⁴	1,350	1,550
Total	3,640 ^r	3,830
Metallurgical:		
Steel and iron:		
Basic oxygen furnaces ³	1,900 ^r	2,300
Electric arc furnaces	2,760	2,650
Other steel and iron	218	237
Total	4,880 ^r	5,190
Nonferrous metallurgy ⁵	1,100	1,120
Total metallurgical	5,980 ^r	6,310
Construction:		
Asphalt	261	247
Building uses	289	254
Soil stabilization	1,350	1,290
Other construction	32	57
Total	1,930	1,850
Environmental:		
Flue gas treatment:		
Utility powerplants	3,440	3,400
Incinerators	178	155
Industrial boilers and other flue gas treatment	254	277
Total	3,870	3,830
Sludge treatment:		
Sewage	123	133
Other, industrial and hazardous	W	W
Total	123	133
Water treatment:		
Acid-mine drainage	W	W
Drinking water	787	738
Wastewater	364	349
Total	1,150	1,090
Other environmental	221	218
Total environmental	5,370 ^r	5,270
Refractories (dead-burned dolomite) ^{3,6}	200	200
Miscellaneous and unspecified	538	613
Grand total	17,600	18,100

^rRevised. W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous and unspecified."

¹Table includes data available through June 18, 2020. Data are rounded to no more than three significant digits; may not add to totals shown. Excludes lime kiln dust and regenerated lime.

²Includes Puerto Rico.

³Includes lime sold and used, where "used" denotes lime produced for internal company use.

⁴May 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.

⁵Includes alumina and bauxite, magnesium, metals concentration (copper and gold), and other nonferrous uses.

⁶Data are rounded to no more than one significant digit to avoid disclosing company proprietary data.

TABLE 4
HYDRATED LIME SOLD OR USED IN THE
UNITED STATES, BY END USE^{1, 2, 3}

(Thousand metric tons)

Use	2017	2018
Chemical and industrial	519	541
Construction:		
Asphalt	237	218
Building uses	263	251
Soil stabilization	W	W
Other construction	574	541
Total	1,070	1,010
Environmental:		
Flue gas treatment:		
Utility powerplants	359	411
Incinerators	27	25
Industrial boilers and other flue gas treatment	99	103
Total	485	539
Sludge treatment:		
Sewage	33	42
Other sludge treatment	99	90
Total	132	132
Water treatment:		
Acid-mine drainage	35	56
Drinking water	120	111
Wastewater	120	125
Total	275	292
Other environmental	82	88
Metallurgy	74	87
Grand total	2,640	2,690

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

¹Table includes data available through June 18, 2020. Data are rounded to no more than three significant digits; may not add to totals shown. Excludes regenerated lime.

²Includes Puerto Rico.

³Includes hydrated lime sold and used, where "used" denotes lime produced for internal company use in the building, chemical and industrial, and metallurgical sectors.

TABLE 5
LIME PRICES IN THE UNITED STATES, BY TYPE^{1, 2, 3}

Type	2017		2018	
	Dollars per metric ton	Dollars per short ton	Dollars per metric ton	Dollars per short ton
Sold or used:				
Quicklime ⁴	122.10 ^r	110.80 ^r	124.60	113.00
Hydrated lime	147.10 ^r	133.40 ^r	151.50	137.50
Weighted average all types	130.40 ^r	118.30 ^r	133.10	120.70
Sold:				
Quicklime:				
High-calcium	118.30	107.30	121.00	109.80
Dolomitic	133.00 ^r	120.60 ^r	133.10	120.80
Average quicklime ⁴	120.80 ^r	109.60 ^r	123.20	111.70
Hydrated lime:				
High-calcium	143.30 ^r	130.00 ^r	148.10	134.40
Dolomitic	180.00 ^r	163.30 ^r	182.60	165.60
Average hydrated lime	147.10 ^r	133.50 ^r	151.50	137.50
Weighted average all types	129.70	117.70	132.30	120.00

^rRevised.

¹Table includes data available through June 18, 2020.

²Average value per ton, free on board plant, including cost of containers.

³Unit values in metric tons and short tons were rounded independently.

⁴Includes dead-burned dolomite.

TABLE 6
U.S. EXPORTS OF LIME, BY TYPE¹

(Metric tons and dollars)

Type and country or locality	2017		2018	
	Quantity	Value ²	Quantity	Value ²
Calcined dolomite:				
Argentina	472	160,000	474	138,000
Brazil	301	71,000	664	319,000
Canada	62,900	15,200,000	74,100	18,000,000
Dominican Republic	--	--	61	75,800
France	--	--	988	232,000
Germany	--	--	49	18,100
Kazakhstan	1	2,980	196	49,100
Mexico	430	116,000	432	113,000
South Africa	118	121,000	134	123,000
United Arab Emirates	445	392,000	80	71,900
Other [7 countries and (or) localities]	6,450 ^r	1,390,000 ^r	57	37,700
Total	71,200	17,400,000	77,200	19,100,000
Hydraulic lime:				
Afghanistan	4	5,420	--	--
Canada	4,040	797,000	4,140	1,200,000
Finland	3	3,900	34	36,700
France	5	7,130	10	13,300
Germany	42	54,300	109	141,000
Liberia	15	6,010	38	14,900
Mexico	5	5,960	38	29,500
Peru	--	--	(3)	2,950
Trinidad and Tobago	--	--	56	72,500
United Kingdom	15	19,800	6	8,070
Other [4 countries and (or) localities]	19 ^r	24,800 ^r	--	--
Total	4,150	924,000	4,430	1,520,000
Quicklime:				
Canada	280,000	44,000,000	288,000	45,800,000
China	27	20,100	96	80,500
Costa Rica	491	197,000	402	159,000
France	11	10,600	18	9,200
Ireland	318	428,000	131	213,000
Mexico	5,630	1,040,000	3,070	614,000
Netherlands	239	266,000	59	68,200
Russia	--	--	4	2,600
Singapore	4,420	2,180,000	3,060	1,200,000
United Kingdom	--	--	29	27,100
Other [11 countries and (or) localities]	215 ^r	162,000 ^r	6	21,200
Total	291,000	48,300,000	295,000	48,200,000
Slaked lime, hydrate:				
Bahamas, The	24	7,020	144	53,600
Canada	19,000	5,270,000	18,900	5,310,000
Chile	3,890	1,220,000	24,300	8,000,000
Costa Rica	192	83,700	101	54,800
Ecuador	16	9,050	200	101,000
Germany	577	287,000	516	184,000
Guyana	--	--	64	13,700
Mexico	108	61,500	1,020	592,000
Panama	37	9,870	229	59,600
Trinidad and Tobago	41	30,000	93	11,100
Other [14 countries and (or) localities]	986 ^r	599,000 ^r	204	345,000
Total	24,900	7,580,000	45,800	14,700,000
Grand total	391,000	74,200,000	422,000	83,600,000

^rRevised. -- Zero.

¹Table includes data available through June 18, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Free alongside ship value.

³Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF LIME, BY TYPE¹

(Metric tons and dollars)

Type and country or locality	2017 ²		2018	
	Quantity	Value ³	Quantity	Value ³
Calcined dolomite:				
Canada	43,300	7,120,000	52,400	8,910,000
Germany	75	14,700	31	29,600
Italy	2	4,770	8	16,000
Total	43,300	7,140,000	52,400	8,960,000
Hydraulic lime:				
Belgium	(4)	7,110	1	17,000
Canada	508	146,000	--	--
Dominican Republic	122	47,500	23	6,340
France	290	201,000	980	769,000
Germany	67	39,700	141	59,200
Italy	29	28,200	--	--
Mexico	21	2,280	--	--
Total	1,040	471,000	1,150	852,000
Quicklime:				
Austria	28	34,800	94	112,000
Canada	261,000	38,500,000	255,000	39,500,000
China	142	136,000	146	121,000
Dominican Republic	1	13,700	--	--
Italy	16	48,100	22	46,900
Japan	9	15,300	1	39,800
Mexico	8,950	1,620,000	8,700	1,800,000
Spain	--	--	24	8,510
Thailand	15	46,200	24	67,000
United Kingdom	306	257,000	1,390	1,160,000
Other [2 countries and (or) localities]	17 ^r	14,300 ^r	--	--
Total	271,000	40,700,000	265,000	42,800,000
Slaked lime, hydrate:				
Belgium	196	107,000	149	71,000
Canada	30,800	7,270,000	29,900	7,320,000
China	60	32,200	81	58,600
Dominican Republic	2,690	693,000	4,080	1,250,000
Germany	92	687,000	249	334,000
Honduras	65	41,400	130	42,200
Mexico	17,000	4,080,000	15,900	4,000,000
Netherlands	230	154,000	422	273,000
Spain	--	--	96	33,300
United Kingdom	111	335,000	95	281,000
Other [11 countries and (or) localities]	762 ^r	580,000 ^r	210	361,000
Total	52,000	14,000,000	51,300	14,000,000
Grand total	367,000	62,300,000	370,000	66,700,000

^rRevised. -- Zero.

¹Table includes data available through June 18, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²May include revisions to previously published data.

³Cost, insurance, and freight value.

⁴Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8
QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Thousand metric tons, gross weight)

Country or locality ²	2014	2015	2016	2017	2018
Angola ^e	880	900	880 ^r	840	830
Australia, sales ^e	2,000	2,000	2,000	2,000	2,000
Austria ^e	830	820	830 ^r	830	800
Belarus	769	626	474	452	476
Belgium ³	1,481	1,468	1,400 ^{r, c}	1,324 ^r	1,300 ^e
Bosnia and Herzegovina	428	423	458	503 ^r	579
Brazil ^e	8,300	8,300	8,100	8,300	8,300
Bulgaria, industrial	1,482	1,474 ^r	1,518	1,503 ^r	1,500 ^e
Canada, shipments	1,995	1,852	1,807	1,842 ^r	1,805
Chile ^e	900	910	920	930	930
China ^e	230,000	250,000	290,000	290,000	300,000
Croatia	205	186	165	202 ^r	200 ^e
Czechia	1,011	1,006	1,066	935 ^r	1,038
Egypt ^e	750	720	700	770	800
Finland ^e	460	470	470	470	470
France	2,864	2,504	2,500 ^e	2,600 ^e	2,600 ^e
Germany	6,747	6,847	6,973	6,991 ^r	7,000 ^e
Hungary ^e	270	310	300	340	340
India ^e	16,000	16,000	16,000	16,000	16,000
Iran ^e	2,800	2,800	2,900	3,100	3,300
Ireland ^e	270	260	250 ^r	300	300
Israel	250	554	573	385 ^r	390 ^e
Italy ^{e, 3}	3,600	3,500	3,500 ^r	3,600	3,600
Japan, quicklime only	7,911	7,336	7,341	7,431 ^r	7,575
Kazakhstan	923	871	928	1,048 ^r	1,100 ^e
Korea, Republic of ^e	5,100	5,100	5,100	5,200	5,200
Libya ^e	380	190	270	240	220
Malaysia, sales ^e	1,400	1,500	1,600	1,600	1,600
Peru ^e	240	240	250	250	250
Poland	1,817	1,942	1,869	1,904 ^r	2,684
Romania	1,723	1,907	1,951	2,126	2,213
Russia, industrial and construction	11,583	11,221	10,870 ^r	11,100 ^r	11,000 ^e
Serbia	235	316	322	350 ^e	390 ^e
Slovakia	827	778	801	774	791
Slovenia	919	1,103	1,046	1,100 ^e	1,100 ^e
South Africa, burnt lime sales	1,260 ^r	1,119 ^r	1,131 ^r	1,221 ^r	1,200 ^e
Spain, sales ^e	1,800	1,800	1,800	1,800	1,800
Sweden	650 ^r	640 ^r	650 ^{r, c}	676 ^r	680 ^e
Taiwan	259 ^r	209 ^r	214	247	263
Thailand, sales ^e	800	780	780	820	810
Tunisia	253	308	206	189 ^r	149
Turkey, sales ^e	4,300	4,400	4,500	4,700	4,700
Ukraine	3,134	2,717	2,542	2,151 ^r	2,100 ^e
United Arab Emirates ^e	430	460	470	480	470
United Kingdom ^e	1,600	1,600	1,400 ^r	1,500	1,400
United States, including Puerto Rico	19,500	18,300	17,300	17,600	18,100
Venezuela ^e	360	350	290	290	230
Vietnam ^e	850	840	840	840	840
Zambia ^e	280	280	300	310	320
Other ^{e, 4}	1,500 ^r	1,600 ^r	1,900 ^r	1,800 ^r	1,900
Total	350,000	370,000	410,000	410,000	420,000

^eEstimated. ^rRevised.

¹Table includes data available through September 11, 2019. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than two significant digits, and U.S. data are rounded to no more than three significant digits; may not add to totals shown.

²In addition to the countries and (or) localities listed, Argentina, Chad, Iraq, Lebanon, Mexico, Nigeria, North Korea, Pakistan, Saudi Arabia, Syria, and several other nations may have produced lime, but available information was inadequate to make reliable estimates of output.

³Includes hydraulic lime.

⁴Includes Afghanistan, Albania, Algeria (hydraulic only), Armenia, Azerbaijan (construction only), Cameroon, Cuba, Cyprus (hydrated only), Denmark (sales), Eritrea, Estonia, Ethiopia, Guatemala (hydrated only), Jamaica, Kenya, Kyrgyzstan, Macedonia, Malawi, Moldova, Mongolia, New Zealand, Nicaragua, Norway, Panama, Paraguay, Philippines, Qatar, Senegal, Switzerland, Tanzania, Turkmenistan, and Uganda.