



2017 Minerals Yearbook

ZINC [ADVANCE RELEASE]

ZINC

By Christine L. Thomas

Domestic survey data and tables were prepared by Hodan A. Fatah, statistical assistant.

In 2017, U.S. mine production of recoverable zinc was 748,000 metric tons (t), a 4% decrease from that of 2016 (table 1). The value of domestic mine production was approximately \$2.3 billion. Alaska continued to be the dominant zinc-producing State. Other producing States included Idaho, Missouri, Tennessee, and Washington (table 3). The United States exported 91% of its zinc mine production (682,000 t of zinc in concentrate) to foreign smelters for processing. Leading destinations for domestic exports of zinc contained in concentrates were Canada (33%), Australia (14%), the Republic of Korea (12%), and Spain (11%) (table 6). Regionally, 34% of exports were sent to North America, 33% to Europe, 20% to Asia, and 13% to Australia and Oceania. Imports for consumption of zinc contained in concentrates were significantly less than exports as the only domestic primary zinc smelter mostly consumed domestically produced zinc concentrates (table 1).

Estimated total U.S. refined zinc production in 2017 increased by 5% to 132,000 t owing to a higher proportion of feed being sourced from the East Tennessee mines at the Clarksville, TN, primary zinc refinery (table 1) (Nyrstar NV, 2017; 2018, p. 8). Imports for consumption of refined zinc in 2017 increased slightly to 729,000 t (table 1) and were sourced primarily from Canada (54%), Australia (14%), Mexico (12%), and Peru (7%). Domestic exports of refined zinc decreased by 31%, or by 14,700 t, to 32,200 t in 2017 (table 1). Apparent consumption of refined zinc increased by 5% from that of the prior year to 829,000 t (table 1). Most reported refined zinc consumption was for galvanizing, and other major end uses were brass and bronze and zinc-base alloys (table 5).

Global zinc mine production decreased slightly to 12.5 million metric tons (Mt) of contained zinc, and zinc metal production was essentially unchanged at 13.8 Mt (tables 9, 10). According to data from the International Lead and Zinc Study Group (ILZSG), global zinc metal consumption increased by 3% to 14.2 Mt in 2016 (International Lead and Zinc Study Group, 2018c, p. 47).

Legislative and Government Programs

A U.S. Government stockpile of refined zinc has been maintained since 1967 for national defense purposes. Public Law 102-484, signed in 1992, authorized the disposal of the entire inventory of zinc from the National Defense Stockpile (NDS). Sales of zinc from the NDS, however, were suspended in August 2008 owing to concerns regarding domestic availability and access to various raw materials. The Defense Logistics Agency Strategic Materials, U.S. Department of Defense, relisted zinc for disposal on the Annual Materials Plan (AMP) for fiscal year 2016 (October 1, 2015, through September 30, 2016). The AMP ceiling disposal quantity for zinc in fiscal year 2018 was 7,250 t, which represented the

maximum quantity of zinc that could be sold from the NDS during the fiscal year. At yearend 2017, the reported inventory of zinc remained at 7,250 t (Defense Logistics Agency Strategic Materials, 2017).

U.S. imports for consumption of zinc-coated (hot-dipped and electrogalvanized) steel from Vietnam increased notably beginning in December 2015 after the U.S. Department of Commerce (DOC) announced in November 2015 that it had preliminarily determined that countervailable subsidies were provided to producers and exporters of corrosion-resistant steel in China. In November 2016, the DOC initiated an anticircumvention inquiry on imports of cold-rolled and corrosion-resistant steel from Vietnam in response to requests from United States-based steel producers, AK Steel Corp., ArcelorMittal USA LLC, California Steel Industries, Nucor Corp., Steel Dynamics Inc., and United States Steel Corp. The United States producers asserted that steel mills in Vietnam toll-processed hot-rolled steel from China into cold-rolled and corrosion-resistant steel for export to the United States in order to avoid the antidumping and countervailing duties imposed on imports of these steel products from China. The United States companies claimed that although Vietnam does not have the capacity to produce hot-rolled steel, the cost of manufacturing value-added steel (cold-rolled and corrosion-resistant) products in Vietnam is small compared with the total export value. (Cowden, 2016; Schier, 2016; U.S. Department of Commerce, International Trade Administration, 2016). In December 2017, the DOC made a preliminary affirmative determination that imports of certain corrosion-resistant steel products made in Vietnam from China's substrate were circumventing antidumping and countervailing duty orders. The DOC instructed the U.S. Customs and Border Protection to begin collecting cash deposits on these imports based on the antidumping and countervailing rates previously established for China. The DOC planned to announce its final determination in February 2018 (Cowden, 2017; U.S. Department of Commerce, 2018).

In April, the President of the United States signed a memorandum instructing the Secretary of Commerce to conduct an investigation on the impact of steel imports on the national security. The investigation was conducted under the authority of Section 232 of the Trade Expansion Act of 1962. If the investigation found that steel was being imported in quantities or under circumstances as to threaten to impair the national security, the Secretary of Commerce would recommend actions and steps in his report to the President that would be taken to adjust steel imports so that they would not threaten to impair the national security. The findings would be reported to the President within 270 days of the initiation of the investigation and were expected in early 2018 (U.S. Department of Commerce, 2017; White House, The, 2017).

Production

Mine.—In 2017, zinc was produced in five States: Alaska, Idaho, Missouri, Tennessee, and Washington (table 3). Domestic mine production of recoverable zinc in 2016 was 748,000 t, 4% less from that of 2016 (table 1).

Alaska.—Teck Alaska Inc. (a subsidiary of Teck Resources Ltd., Canada) operated the open pit Red Dog zinc-lead mine in the Northern Region, the leading zinc-producing mine in the United States (table 3). The Red Dog property consists of several sedimentary-exhalative lead-zinc sulfide ore bodies and was leased and operated under an agreement with NANA Regional Corp. Inc. (Kotzebue, AK), an Alaska Native-owned corporation. Teck reported that zinc in concentrate production at Red Dog decreased by 7% to 542,000 t in 2017 from 583,000 t in 2016 owing primarily to poor mill performance in the first half of the year and lower zinc grades. Approximately 30% of the zinc concentrates produced at Red Dog were refined at Teck's metallurgical complex at Trail, British Columbia, Canada. The remaining concentrates were exported to Asia and Europe. Most of Red Dog's concentrates were sold through long-term contracts, with the balance sold on the spot market. Reported reserves at yearend 2017 contained 6.31 Mt of recoverable zinc metal, and mine life was expected to extend to 2031. Teck projected that zinc production at Red Dog would decrease during the next few years, ranging from 525,000 to 545,000 t in 2018 and from 475,000 to 525,000 metric tons per year (t/yr) in 2019 through 2021 (Teck Resources Ltd., 2018a, p. 40–43, 51; 2018b, p. 23).

Hecla Mining Co.'s (Coeur d'Alene, ID) underground Greens Creek Mine recovered metals from a polymetallic (gold-lead-silver-zinc) massive sulfide deposit on Admiralty Island in the Tongass National Forest near Juneau. The mine produced bulk zinc-lead, lead, and zinc concentrates and a gravity concentrate that was upgraded into gold and silver dore by a third-party processor. Hecla reported that zinc in concentrate production decreased by 9% from that of 2016 to 47,700 t. Reported yearend reserves at Greens Creek contained 558,000 t of zinc, and mine life was expected to extend to 2026 (Hecla Mining Co., 2018, p. 30–34).

Idaho.—Hecla operated the Lucky Friday Mine, an underground silver-lead-zinc mine in the Coeur d'Alene mining district in northern Idaho, which produced silver-lead concentrate and zinc concentrate. In 2017, reported zinc production decreased significantly from that of 2016 to 2,320 t. The decrease in production was a result of a strike of unionized employees. The strike started in mid-March 2017 and was ongoing at yearend 2017. All concentrates were sent to Teck's metallurgical facility in Trail for processing. Reported reserves at yearend contained 205,000 t of zinc, and mine life was expected to extend for 22 years (Hecla Mining Co., 2018, p. 35–39).

Missouri.—Doe Run Resources Corp. (St. Louis, MO) operated a series of production shafts that ran along the Viburnum Trend within the Mississippi Valley-type (MVT) lead-zinc-copper ore bodies in southeast Missouri. In 2017, Doe Run processed ore from the Brushy Creek, Fletcher, Sweetwater, and Viburnum (#29 and #35) Mines at four mills to produce primarily lead concentrates and, to a lesser extent, zinc and copper concentrates.

New York.—In December 2016, Star Mountain Resources (Tempe, AZ) sold Balmat Holding Corp., including the operating subsidiary, St. Lawrence Zinc Company LLC, and its mining operations in the Balmat zinc mining district in St. Lawrence County, to Titan Mining Corp. (Canada). Titan Mining changed the name of the Balmat Mine to the Empire State Mine (Dent, 2017a; OTC Markets, 2017; Augusta Group, undated). In November 2017, Titan Mining Corp. announced plans to reopen the Empire State Mine in 2018. A technical report produced by Titan in mid-September 2017 indicated that the mine could produce 276,000 t of processed ore in its first year and 639,000 t in its second year (Dent, 2017a).

Tennessee.—Nyrstar NV (Belgium) owned and operated the East Tennessee and Middle Tennessee zinc mine complexes that recovered ore from MVT zinc deposits. The two mine complexes produced zinc concentrates, of which the Middle Tennessee concentrates contained a recoverable amount of gallium and germanium. In December 2015, Nyrstar placed the Middle Tennessee mines on care-and-maintenance status to reduce costs in its mining segment as zinc prices in the fourth quarter fell below the operating costs of the mines. In 2017, the Middle Tennessee mines restarted mill production ahead of schedule and mill processing of zinc in concentrate commenced in May (Nyrstar NV, 2017, 2018, p. 10). In 2017, the Middle Tennessee mine complex (the Cumberland Mine, Elmwood Mine, and Gordonsville Mine and mill) produced 22,000 t of zinc in concentrate. Zinc in concentrate production at the East Tennessee mine complex (the Coy Mine, Immel Mine, and Young Mine and mill) increased by 6% from that of 2016 to 66,000 t. Increased production at The East Tennessee complex was due to increased development work, which provided access to more mining areas and improved underground equipment availability. Concentrates were sent to Nyrstar's Clarksville, TN, zinc refinery for processing (Nyrstar NV, 2018, p. 10).

Washington.—Teck operated the underground Pend Oreille zinc mine near Metaline Falls in northeastern Washington State. Pend Oreille is a carbonate-hosted zinc-lead ore body. Zinc concentrates from the mine are shipped to Teck's nearby metallurgical facility in Trail for processing. Zinc in concentrate production at Pend Oreille was 33,100 t in 2017, a 3% decrease compared with 34,100 t in 2016. Teck projected that zinc production would increase to approximately 35,000 t in 2018. Reported reserves at yearend 2017 contained 40,000 t of recoverable zinc. Production rates beyond 2018 were uncertain. Current mine planning efforts focused on sustaining the operation and the potential exists to extend the mine life at similar production rates for several more years (Teck Resources Ltd., 2018a, p. 43–44, 51; 2018b, p. 24).

Smelter.—In 2017, refined zinc was mainly produced in Tennessee (Nyrstar's Clarksville zinc refinery). A smaller quantity of zinc metal was produced by U.S. Zinc Corp.'s (owned by Votorantim Metais, Brazil) zinc recycling operation in Houston, TX. Refined zinc production in 2017 increased by 5% from that of 2016 to 132,000 t owing to an increase in primary production (table 1).

Nyrstar's Clarksville electrolytic zinc refinery was the only primary zinc smelter in the United States. Clarksville mostly treated zinc concentrate from Nyrstar's East Tennessee

and Middle Tennessee mines, but also treated imported zinc concentrates and domestically sourced secondary crude zinc oxide. Refined zinc production at Clarksville in 2017 increased by 5% from that of 2016 to 117,000 t owing to a higher proportion of feed being sourced from the East Tennessee mines (Nyrstar NV, 2018, p. 8). Clarksville produced Special High Grade (SHG) and Continuous Galvanizing Grade (CGG) zinc. Byproducts included cadmium metal, copper cementate, copper sulfate, germanium leach product, synthetic gypsum, and sulfuric acid (Nyrstar NV, 2016, p. 9–10, 18).

Horsehead Holding Corp.'s (Pittsburgh, PA) solvent extraction–electrowinning (SX–EW) zinc refinery in Mooresboro, NC, began operating in May 2014 and was idled in January 2016. The plant produced SHG and CGG zinc in addition to Prime Western-grade (PW) zinc from secondary materials, sourced mostly from the company's four electric arc furnace (EAF) dust recycling operations in Barnwell, SC; Calumet, IL; Palmerton, PA; and Rockwood, TN. In February 2016, Horsehead Holding Corp. filed for Chapter 11 bankruptcy protection and exited bankruptcy protection as a private company in September 2016 (Business Wire, 2016). In May 2017, Horsehead Holding Corp. changed its name to American Zinc Recycling Corp. (Maltais, 2017). In June 2017, the company announced that its Mooresboro, NC, secondary zinc refinery was not expected to restart operations before 2018, and an engineering evaluation to determine the feasibility and cost to reopen was ongoing (Dent, 2017b). In December 2017, the company announced that a subsidiary of Glencore plc (Switzerland) purchased a 10% stake in American Zinc Recycling. Under the terms of the investment, Glencore would provide engineering services to American Zinc Recycling to advance the restart of the Mooresboro refinery. Glencore operated the Portovesme zinc smelter in Italy, which used a similar process technology to the one used at Mooresboro (Diaz and others, 2014). The two companies also entered into a 10-year offtake agreement, in which Glencore would purchase full metal output from the refinery once fully operational (American Zinc Recycling Corp., 2017).

U.S. Zinc Corp. produced PW zinc and zinc dust at its zinc recycling facility in Houston, TX. Feed materials were mainly top dross from continuous galvanizers and bottom dross and skimmings from general galvanizers. U.S. Zinc also produced zinc oxide at two recycling facilities in Tennessee (U.S. Zinc Corp., 2017).

Consumption

Changes in zinc consumption generally follow trends in industrial production or, more generally, economic growth. Domestic apparent consumption of refined zinc in 2017 was 829,000 t, a 5% increase from apparent consumption in 2016 (table 1).

According to reported data, most of the zinc consumed domestically in 2017 was for the production of galvanized (zinc-coated) steel (table 5). Galvanized steel is used extensively in the automotive and construction industries. Most of the zinc consumed domestically for galvanizing was at continuous galvanizing plants. There were an estimated 48 continuous galvanizing plants operated by 20 companies in the United States, and leading producers of galvanized sheet

included AK Steel Corp. (West Chester, OH), ArcelorMittal USA LLC (East Chicago, IN), Nucor Corp. (Charlotte, NC), Steel Dynamics (Fort Wayne, IN), and U.S. Steel (Pittsburgh, PA). The balance of zinc consumed for galvanizing was at general galvanizing plants that treat fabricated steel shapes (for example, structural beams or fasteners). There were about 170 general galvanizing plants operated by 80 companies in the United States in 2017, of which the leading included AZZ Inc. (Fort Worth, TX), Valmont Industries Inc. (Omaha, NE), and Voigt & Schweitzer LLC (Columbus, OH).

In March 2017, Big River Steel LLC (Osceola, AR) opened a new 1.5-million-metric-ton-per-year (Mt/yr) steel plant in Osceola, AR. The mill's hot-dip continuous galvanizing line started in the second quarter of 2017 (Lavigne, 2017; Metal Bulletin, 2017, p. 53).

In May 2017, Nucor Corp. (Charlotte, NC) announced plans to build a new galvanizing and pickling line at its Gallatin sheet mill near Ghent, KY. The 450,000-t/yr plant would serve the automotive market and would help increase the company's share of the coated steel market in the Midwest (Dent, 2017d).

Other major end uses of zinc included brass and bronze, chemicals, semimanufactures, and zinc-based alloys. Leading zinc chemicals, by production volume, included zinc oxide, which is used extensively in the tire manufacturing industry as an activator in the vulcanization process, and zinc sulfate, which is used as a micronutrient additive in animal feed and fertilizers. Leading zinc oxide producers included U.S. Zinc Corp. and Zinc Oxide LLC (Dickson, TN). U.S. Zinc consumed zinc dross and skimmings to produce up to 78,000 t/yr of zinc oxide at its two plants in Clarksville, TN, and Millington, TN (U.S. Zinc Corp., 2017). Zinc Oxide consumed zinc metal and secondary zinc materials at its 40,000-t/yr zinc oxide plant in Dickson, TN (Zinc Oxide LLC, undated). In September, Zinc Oxide acquired Zochem (Brampton, Ontario, Canada), a subsidiary of American Zinc Recycling LLC. The combined companies were approved suppliers at 88% of the total North American zinc oxide market volume (Zinc Oxide LLC, 2017).

Zinc semimanufactures included mainly zinc sheet, also known as rolled zinc, which is used in architectural applications and for the production of the U.S. 1-cent coin. Zinc-based alloys were mainly produced by about 15 companies and predominantly used to make die-cast parts for such applications as automotive parts, builders and household hardware, electronics, home appliances, medical instruments, office equipment, power tools, and zippers.

Stocks

Reported producer and consumer stocks of zinc in the United States were 120,000 t in 2017. Global London Metal Exchange Ltd. (LME) warehouses held 180,975 t of zinc at the end of 2017, a 58% decrease from the yearend 2016 stock level, and the Shanghai Futures Exchange (SHFE) held 69,000 t of zinc, a 55% decrease from that of 2016. In the United States, LME stocks of zinc were held in warehouses in New Orleans, LA. At yearend 2017, LME warehouses in New Orleans, LA, held 179,225 t of zinc, or 99% of global LME stocks, a 53% decrease from 380,125 t held at yearend 2016 (International Lead and Zinc Study Group, 2018c, p. 55).

Aside from the United States, China was the only other country known to hold a Government stockpile of zinc. China's State Reserve Bureau (SRB) manages its stockpile, which contained 254,000 t of zinc at yearend 2017, unchanged from the stock level at yearend 2016 (International Lead and Zinc Study Group, 2018c, p. 55).

Prices

The annual average LME cash price for SHG zinc in 2017 increased by 38% from that of 2016 to \$2,893.52 per metric ton (131.25 cents per pound) (table 1). Prices generally increased throughout the year. Prices averaged \$2,712.68 per metric ton (123.05 cents per pound) in January and rose to \$3,129.04 per metric ton (144.79 cents per pound) in December. The increase in price was coincident with increased investment interest and a growing refined zinc production-to-consumption deficit. The annual average Platts North American price for SHG zinc in 2017, which was based on the LME cash price plus a regional North American premium, was 139.28 cents per pound, 37% more than that in 2016 (table 1). The monthly average North American SHG premium began the year at about 6 cents per pound in January, increased through May to 8.5 cents per pound, and remained relatively stable through November before decreasing slightly in December to 8 cents per pound. Increasing premiums are generally indicative of a decreasing supply of zinc in a regional market.

World Review

Mine Production.—Global zinc mine production in 2017 decreased slightly from that of the prior year to 12.5 Mt. China (35% share of global production), Peru (12%), Australia (7%), and India (7%) were the four leading producers of zinc in concentrate in 2017. The United States was the fifth leading producer, accounting for 6% of global zinc mine production. Zinc mine production decreased significantly in China (400,000-t decrease), Australia (41,800-t decrease), and Thailand (34,500-t decrease). Partially offsetting these decreases were production increases in India (175,000-t increase), Peru (136,000-t increase), and Eritrea (49,100-t increase) (table 9).

In response to rising zinc prices, several zinc mines opened during the year. About 537,000 t of capacity was added in 2017, and ramp up of commercial production was expected in 2018. Most notably, the opening of the following mines accounted for about 77% of the added capacity: Minerals and Metals Group Ltd.'s (Australia) 170,000-t/yr Dugald River Mine in Australia, Guojiagou Lead and Zinc Mining's (China) 120,000-t/yr Guojiagou Mine in China, Empresa Minera Del Caribe S.A.'s (Cuba) 50,000-t/yr Castellanos Mine in Cuba, Minera Shouxin Perú S.A.'s (Peru) 30,000-t/yr Marcona Mine in Peru, Eldorado Gold Corp.'s (Canada) 21,000-t/yr Olympias Mine in Greece, and Auctus Mineral's (Australia) 20,000-t/yr Mungana Mine in Australia (International Lead and Zinc Study Group, 2018b, p. 36–38).

Metal Production.—Global zinc metal production was essentially unchanged in 2017 from that of the prior year at 13.8 Mt. China (45% share of global production), the Republic of Korea (7%), India (6%), Canada (4%), and Japan (4%) were

the leading producers of refined zinc metal in 2017. Production decreased most significantly in China (126,000-t decrease), Thailand (52,800-t decrease), and the Republic of Korea (42,300-t decrease); offsetting these decreases were notable production increases in India (190,000-t increase), Kazakhstan (27,800-t increase), and Spain (15,000-t increase) (table 10). Global zinc smelter production capacity increased in 2017 owing to the opening of two 100,000-t/yr electrolytic zinc refineries in China. This capacity increase was partially offset by the closure of Padaeng Industry's (Thailand) 105,000-t/yr Tak electrolytic zinc refinery in Thailand (International Lead and Zinc Study Group, 2018b, p. 42–43).

Metal Consumption.—According to the International Lead and Zinc Study Group (2018), global zinc metal consumption increased by 3% from that of 2016 to 14.2 Mt. Notable increases in Australia, Canada, China, and Taiwan offset reported decreases in Argentina, Germany, Italy, and Thailand. The leading consumer of zinc was China, accounting for 49% of global consumption. Other significant consumers included, in decreasing order of consumption, the United States, India, the Republic of Korea, Japan, Germany, and Belgium. Collectively, these countries accounted for 24% of global consumption. ILZSG's data indicated that zinc metal consumption exceeded production by 496,000 t in 2017, compared with 122,000 t in 2016 (International Lead and Zinc Study Group, 2018c, p. 46–47, 52).

Australia.—Zinc mine production in Australia decreased by 5% in 2017 compared with that of 2016 mainly as a result of several mine closures in 2016 (table 9). Three mines opened in Australia in 2017, and increased production from those mines was expected in 2018. During the second quarter of 2017, Auctus Minerals Pty. Ltd. restarted the 20,000-t/yr Mungana zinc mine in northern Queensland. In September 2017, Red River Resources Ltd. restarted production at the 21,000-t/yr Thalanga zinc-copper-lead mine in Queensland (Burton, 2016; International Lead and Zinc Study Group, 2018b). The mine was placed on care-and-maintenance status in 2012 and reopened after the processing plant was refurbished (Red River Resources Ltd., 2017, p. 3). In November 2017, Minerals and Metals Group opened the 170,000-t/yr Dugald River zinc mine in northwestern Queensland, and commercial production was expected to commence in 2018 (Minerals and Metals Group Ltd., 2017).

Canada.—Zinc mine production in Canada was 344,000 t in 2017, 7% more than that in 2016 (table 9). Production increased in 2017 owing mostly to an increase in zinc production at Trevali Mining Corp.'s Caribou Mine (Trevali Mining Corp., 2018). In October 2017, Coeur Mining, Inc. (Chicago, IL) acquired the Silvertip silver-zinc-lead mine in British Columbia, and production was expected to commence in the first quarter of 2018 (Coeur Mining, Inc., 2018, p. 37; International Lead and Zinc Study Group, 2018b, p. 36).

Zinc smelter production in Canada was 608,000 t in 2017, 12% less than that in 2016 (table 10). Smelter production decreased mainly as a result of the 9-month strike at Noranda Income Fund's zinc refinery in Salaberry-de-Valleyfield, Quebec. The strike was initiated by unionized workers on February 12 and ended after unionized workers voted in favor of

a new collective bargaining agreement on November 25. During the strike, the facility operated at a partial production level, although the reduced rate was not disclosed (Dent, 2017c, e; Jennemann, 2017).

China.—Zinc mine production in China decreased by 8% in 2017 from that of 2016 to 4.4 Mt (table 9). According to Beijing Antaika Information Development Co. Ltd. (Antaika), decreased production was attributed to the closure of mines owing to increased environmental protection measures, lower than expected production from new mines, and a decrease in ore grades (Beijing Antaika Information Development Co. Ltd., 2018a, p. 3, 9–10). As a result of the decrease in mine production, China's net imports of zinc in concentrate increased by 22% in 2017 to about 2.4 Mt. About 60% of China's zinc concentrate imports (gross weight) were sourced from Australia, Peru, and Russia (Beijing Antaika Information Development Co. Ltd., 2018b, p. 8; Global Trade Information Services Inc., 2018).

Zinc metal production in China decreased slightly in 2017 from that of 2016 to 6.14 Mt (table 10). Despite the slight production decrease, two 100,000-t/yr smelters opened in China: Hualian Zinc and Indium Co.'s Hulian zinc smelter in Yunnan Province, and Huili Lead and Zinc Co.'s Huili zinc smelter in Sichuan Province (International Lead and Zinc Study Group, 2018b, p. 42). Antaika attributed the decrease in zinc smelter production to refinery maintenance, a shortage of zinc concentrates, and stricter environmental regulations (Beijing Antaika Information Development Co. Ltd., 2018a, p. 11).

China's net imports of refined zinc increased by 67% in 2017 to about 0.66 Mt. Increased imports were attributed to the tight domestic supply. About 66% of China's refined zinc imports were sourced from Australia, Kazakhstan, and Spain (Beijing Antaika Information Development Co. Ltd., 2018b, p. 8–9; Global Trade Information Services Inc., 2018).

China's zinc consumption increased in 2017 from that of 2016. ILZSG reported a 4% increase in zinc consumption in 2017 compared with a 9% increase in 2016 (Beijing Antaika Information Development Co. Ltd., 2018b, p. 9–11; International Lead and Zinc Study Group, 2018c, p. 47).

Cuba.—In 2017, construction was completed on the Castellanos lead and zinc mine near Santa Lucia, Pinar del Rio. This was the first new mining project in Cuba in more than 20 years. The mine, operated by Empresa Minera del Caribe [a joint venture between Trafigura Group Pte. Ltd. (49%) and state-owned Geominera S.A. (51%)], was expected to commence commercial production during the first half of 2018. Trafigura reported that the mine was expected to ramp up throughout the year and produce 100,000 t of zinc concentrate when it reached full capacity (Trafigura Group Pte. Ltd., 2018, p. 21, 24, 30).

India.—Zinc mine production in India increased by 27% in 2017 from that in 2016 to 833,000 t (table 9). Increased production was primarily owing to Hindustan Zinc Ltd.'s (HZL's) (a joint venture between predominantly Vedanta Ltd. and the Government of India) ramp-up of underground production at the Rampura Agucha Mine. With depleting reserves at the mine's open pit operation, ore production from the underground operation ramped up at an accelerated rate. HZL planned to operate the open pit operation of the mine

until the first quarter of 2018. Ore production capacity for Rampura Agucha was 6.15 Mt/yr (Hindustan Zinc Ltd., 2017a, p. 19, 21, 34; 2017b).

Peru.—Zinc mine production in Peru increased by 10% in 2017 from that of 2016 (table 9) as a result of increased production at the Antamina copper-zinc mine [a joint venture among BHP Billiton plc (33.75%), Glencore plc (33.75%), Teck (22.5%), and Mitsubishi Corp. (10%)] and the opening of two mines. Zinc production nearly doubled at Antamina in 2017 to 372,100 t primarily as a result of increased processing of copper-zinc ores and significantly higher zinc grades and recoveries. Copper and zinc production at Antamina can vary significantly from year to year owing to the geology of the deposit and the proportion of copper to copper-zinc ore produced (Ministry of Energy and Mines of Peru, 2018; Teck Resources Ltd., 2018a, p. 30–33; 2018b, p. 18–19).

In 2017, a new mine and a capacity expansion opened in Peru. In January, Compañía de Minas Buenaventura S.A.A. commissioned the 10,000-t/yr Tambomayo Mine near Chilcaymarca, Arequipa (Compañía de Minas Buenaventura S.A.A., 2018). In May 2017, Shougang Group Co. Ltd. (China) added 30,000 t/yr of capacity by reprocessing the tailings at the Marcona Mine near San Juan de Marcona. The company also planned to produce copper and iron (International Lead and Zinc Study Group, 2018b).

Thailand.—Zinc mine production ceased in Thailand in 2017 after the closure of Padaeng Industry Public Co. Ltd.'s Mae Sod Mine in 2016. The mine closed owing to the depletion of reserves and ceased operations by the end of 2017. In 2017, zinc metal production decreased by 73% from that of 2016. Padaeng Industry's smelter in Tak Province processed the remaining zinc concentrate from Mae Sod in 2017, and operations at the plant ceased in the second quarter of 2017. The refinery had a production capacity of 105,000 t/yr (International Lead and Zinc Study Group, 2018b; Padaeng Industry Public Co. Ltd., 2018, p. 3, 34).

Outlook

ILZSG forecasted global zinc consumption in 2018 to increase by 2.0% from that in 2017 to 14 Mt primarily owing to continued demand in China, India, and the Republic of Korea. In both Europe and the United States, consumption was projected to rise by 2.1%. On the supply side, ILZSG forecasted global zinc mine production to increase by approximately 5% as a result of increased output in China and Peru. Metal production is forecasted to increase by approximately 4% in 2018 owing to an increase in China and a recovery of production in Canada. Overall, zinc metal consumption is expected to exceed production by 263,000 t in 2018 (International Lead and Zinc Study Group, 2018a).

References Cited

American Zinc Recycling Corp., 2017, American Zinc Recycling announces strategic investment by Glencore: Pittsburgh, PA, American Zinc Recycling Corp. news release, December 8, 1 p. (Accessed April 16, 2018, at <http://azr.com/news/view/american-zinc-recycling-announces-strategic-investment-by-glencore>.)

- Augusta Group, [undated], List of companies—Titan Mining Corporation: Vancouver, British Columbia, Canada, Augusta Group. (Accessed September 27, 2017, at <http://www.augustacorp.com/companies/>)
- Beijing Antaika Information Development Co. Ltd., 2018a, Lead and zinc monthly: Beijing Antaika Information Development Co. Ltd., no. 252, January, 22 p.
- Beijing Antaika Information Development Co. Ltd., 2018b, Lead and zinc monthly: Beijing Antaika Information Development Co. Ltd., no. 253, February, 19 p.
- Burton, Melanie, 2016, Auctus Minerals readies for zinc mine output in 2H 2017: Reuters, October 26. (Accessed May 14, 2018, at <https://af.reuters.com/article/africaTech/idAFL8N1CW970>.)
- Business Wire, 2016, Horsehead Holding Corp. and certain of its subsidiaries commence voluntary restructuring: Business Wire, February 2. (Accessed September 27, 2017, at <http://www.businesswire.com/news/home/20160202005804/en/Horsehead-Holding-Corp.-Subsidiaries-Commence-Voluntary-Restructuring>.)
- Coeur Mining, Inc., 2018, 2017 annual report: Chicago, IL, Coeur Mining, Inc., 128 p. (Accessed May 14, 2018, at https://www.coeur.com/_resources/financials/2017_Annual_Report.pdf.)
- Compañía de Minas Buenaventura S.A.A., 2018, Operations Tambomayo: Lima, Peru, Compañía de Minas Buenaventura. (Accessed May 15, 2018, at <http://www.buenaventura.com/es/operaciones/detalle/1>.)
- Cowden, Michael, 2016, Circumvention probes initiated vs. Vietnam: American Metal Market, November 7. (Accessed November 7, 2016, via <http://www.amm.com/>.)
- Cowden, Michael, 2017, US slaps Vietnam sheet with triple-digit duties: American Metal Market, December 5. (Accessed May 15, 2018, via <http://www.amm.com/>.)
- Defense Logistics Agency Strategic Materials, 2017, Annual Materials Plan for FY 2017: Fort Belvoir, VA, Defense Logistics Agency Strategic Materials news release, October 1, 1 p. (Accessed April 2, 2018, at <http://www.dla.mil/Portals/104/Documents/StrategicMaterials/Announcements/3117%20FY17%20AMP.pdf>.)
- Dent, Millicent, 2017a, Former Balmat zinc mine to reopen in January: American Metal Market, November 8. (Accessed November 13, 2017, via <http://www.amm.com/>.)
- Dent, Millicent, 2017b, Mooresboro zinc plant won't reopen before 2018: American Metal Market, June 26. (Accessed June 26, 2017, via <http://www.amm.com/>.)
- Dent, Millicent, 2017c, NIF, union reach deal; 9-month strike ends: American Metal Market, November 27. (Accessed February 6, 2018, via <http://www.amm.com/>.)
- Dent, Millicent, 2017d, Overcapacity concerns grow in galv. market: American Metal Market, July 3. (Accessed July 10, 2017, via <http://www.amm.com/>.)
- Dent, Millicent, 2017e, USW workers strike at NIF zinc facility: American Metal Market, February 13. (Accessed March 15, 2017, via <http://www.amm.com/>.)
- Díaz, G., Mejías, A.B., Martín, D., and Cubeddu, F., 2014, ZincexTM technology—Recent industrial operations: Proceedings of Hydrometallurgy, 37 p. (Accessed February 6, 2019, at <https://ddtp.tecnicasreunidas.es/wp-content/uploads/2016/11/Solutions-for-secondary-zinc-materials-WOX-PORTOVESME-HORSEHEAD.pdf>.)
- Global Trade Information Services Inc., 2018, Global trade atlas: Global Trade Information Services Inc. (Accessed May 15, 2018, via <https://www.gtis.com/gta>.)
- Hecla Mining Co., 2018, Form 10-K—2017: U.S. Securities and Exchange Commission, 220 p. (Accessed March 8, 2018, at <http://ir.hecla-mining.com/Doc/Index?did=43570536>.)
- Hindustan Zinc Ltd., 2017a, Annual report 2016–17: Udaipur, India, Hindustan Zinc Ltd., 160 p. (Accessed May 15, 2018, at http://www.hzllindia.com/wp-content/uploads/HZL_Final_Annual_Report_16-17-2.pdf.)
- Hindustan Zinc Ltd., 2017b, Production release for the fourth quarter and full year ended 31 March 2017: Udaipur, India, Hindustan Zinc Ltd. news release, 6 p. (Accessed May 15, 2018, at http://www.hzllindia.com/wp-content/uploads/Results_Q4FY17-new1.pdf.)
- International Lead and Zinc Study Group, 2018a, ILZSG session/forecasts: Lisbon, Portugal, International Lead and Zinc Study Group press release, April 26, 4 p. (Accessed May 15, 2018, via <http://www.ilzsg.org/>.)
- International Lead and Zinc Study Group, 2018b, Lead and zinc new mine and smelter projects: Lisbon, Portugal, International Lead and Zinc Study Group, 70 p.
- International Lead and Zinc Study Group, 2018c, Lead and zinc statistics—Monthly bulletin of the International Lead and Zinc Study Group: Lisbon, Portugal, International Lead and Zinc Study Group, March, v. 58, no. 3, 77 p. (Accessed April 9, 2018, via <http://www.ilzsg.org/>.)
- Jennemann, Tom, 2017, NIF resumes partial zinc production: American Metal Market, March 1. (Accessed March 16, 2017, via <http://www.amm.com/>.)
- Lavigne, Grace, 2017, Big River continues to diversify, ramp up: American Metal Market, May 10. (Accessed May 16, 2018, via <http://www.amm.com/>.)
- Maltais, Kirk, 2017, Horsehead now American Zinc Recycling: American Metal Market, May 1. (Accessed May 11, 2017, via <http://www.amm.com/>.)
- Metal Bulletin, 2017, High-tech at Big River Steel: Metal Bulletin Magazine, June, p. 53 (Accessed May 16, 2018, via <http://www.metalbulletin.com/>.)
- Minerals and Metals Group Ltd., 2017, First production from Dugald River, mine officially opened: Melbourne, Victoria, Australia, Minerals and Metals Group Ltd. news release, November 8, 2 p. (Accessed May 14, 2018, at http://www.mmg.com/en/Investors-and-Media/News/2017/11/08/171108_Dugald-River-opening.aspx?pn=2&backitem=BA5603A202CE4D1E848FA BA9D1339247.)
- Ministry of Energy and Mines of Peru, 2018, Mining production 2011–2017: Lima, Peru, Ministry of Energy and Mines of Peru. (Accessed May 15, 2018, via http://www.minem.gob.pe/_estadistica.php?idSector=1&idEstadistica=12501.)
- Nyrstar NV, 2016, 2015 full year results: Balen, Belgium, Nyrstar NV news release, February 4, 24 p. (Accessed September 20, 2017, at <http://www.nyrstar.com/~media/Files/N/Nyrstar/results-reports-and-presentations/english/2016/nyrstar-2015-release-en.pdf>.)
- Nyrstar NV, 2017, First half 2017 results: Balen, Belgium, Nyrstar NV news release, August 2, 13 p. (Accessed August 15, 2017, at <http://hugin.info/138416/R/2124892/810912.pdf>.)
- Nyrstar NV, 2018, 2017 full year results: Balen, Belgium, Nyrstar NV news release, February 22, 16 p. (Accessed March 8, 2018, at <https://www.nyrstar.com/~media/Files/N/Nyrstar/results-reports-and-presentations/english/2018/2017-full-year-results-release.pdf>.)
- OTC Markets, 2017, Star Mountain Resources, Inc. completes sale of Balmat Holding Corporation to Titan Mining (US) Corporation: OTC Markets, January 6. (Accessed April 11, 2017, at <http://www.otcmrkt.com/stock/SMRS/news/Star-Mountain-Resources--Inc--Completes-sale-of-Balmat-Holding-Corporation-to-Titan-Mining--US--Corporation?id=148158&b=y>.)
- Padaeng Industry Public Co. Ltd., 2018, Annual report and sustainability report 2017: Bangkok, Thailand, Padaeng Industry Public Co. Ltd., 176 p. (Accessed February 6, 2019, at <http://www.padaeng.com/wp-content/uploads/2018/09/annual-report-2017.pdf>.)
- Red River Resources Ltd., 2017, Annual financial report—30 June 2017: Melbourne, Victoria, Australia, Red River Resources Ltd., 79 p. (Accessed May 14, 2018, at http://www.redriverresources.com.au/images/RVR001_20170928_AFR_30Jun17_FINAL.pdf.)
- Schier, Thorsten, 2016, China said skirting US sheet duties via Vietnam: American Metal Market, September 22. (Accessed September 22, 2016, via <http://www.amm.com/>.)
- Teck Resources Ltd., 2018a, 2016 annual information form: Vancouver, British Columbia, Canada, Teck Resources Ltd., 124 p. (Accessed April 9, 2018, at <https://www.teck.com/media/2017-Annual-Information-Form.pdf>.)
- Teck Resources Ltd., 2018b, 2017 annual report: Vancouver, British Columbia, Canada, Teck Resources Ltd., 130 p. (Accessed April 9, 2017, at [https://www.teck.com/media/2017-Teck-Annual-Report\(0\).pdf](https://www.teck.com/media/2017-Teck-Annual-Report(0).pdf).)
- Trafigura Group Pte. Ltd., 2018, 2017 annual report: Singapore, Trafigura Group Pte. Ltd., 92 p. (Accessed May 15, 2018, at <https://www.trafigura.com/media/364892/trafigura-2017-annual-report.pdf>.)
- Trevali Mining Corp., 2018, Trevali reports 2017 annual financial results: Vancouver, British Columbia, Canada, Trevali Mining Corp. news release, March 13, 10 p. (Accessed May 14, 2018, at https://s22.q4cdn.com/617180940/files/doc_news/archive/2018-03-13-nr-tv.pdf.)
- U.S. Department of Commerce, 2017, Section 232 investigations—The effect of imports on the national security: U.S. Department of Commerce website. (Accessed May 16, 2018, at <https://www.bis.doc.gov/232>.)
- U.S. Department of Commerce, 2018, U.S. Department of Commerce issues affirmative final circumvention rulings on steel from Vietnam: U.S. Department of Commerce news release, May 21. (Accessed February 6, 2019, at <https://www.commerce.gov/news/press-releases/2018/05/us-department-commerce-issues-affirmative-final-circumvention-rulings>.)

U.S. Department of Commerce, International Trade Administration, 2016, Certain corrosion-resistant steel products from the People's Republic of China—Initiation of anti-circumvention inquiries on the antidumping duty and countervailing duty orders: Federal Register, v. 81, no. 219, November 14, p. 79454–79458.

U.S. Zinc Corp., 2017, Zinc oxide: Houston, TX, U.S. Zinc Corp. (Accessed April 16, 2018, at <http://www.uszinc.com/products/zinc-oxide/>.)

White House, The, 2017, Presidential memorandum for the Secretary of Commerce: The White House, Office of the Press Secretary press release, April 27. (Accessed May 13, 2017, at <https://www.whitehouse.gov/presidential-actions/presidential-memorandum-secretary-commerce/>.)

Zinc Oxide LLC, 2017, Zinc Oxide LLC acquires Zochem...becomes a leading North American producer: Dickson, TN, Zinc Oxide LLC press release, September 19. (Accessed July 26, 2018, at <https://www.zochem.com/zinc-oxide-llc-acquires-zochembecomes-largest-zinc-oxide-producer-north-america-95000-mt-capacity/>.)

Zinc Oxide LLC, [undated], Company profile: Dickson, TN, Zinc Oxide LLC. (Accessed November 4, 2016, at <https://www.zochem.com/company/company-profile/>.)

Zinc. Ch. in Mineral Commodity Summaries, annual.

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

Zinc. Mineral Industry Surveys, monthly.

Zinc (Zn). Ch. in Metal Prices in the United States Through 2010, Scientific Investigations Report 2012–5188, 2013.

Other

Defense Logistics Agency Strategic Materials.

Economics of Zinc. Roskill Information Services, Ltd.

International Lead and Zinc Study Group.

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

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

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

TABLE 1
SALIENT ZINC STATISTICS¹

(Metric tons, unless otherwise specified)

	2013	2014	2015	2016	2017
United States:					
Production:					
Domestic ores and concentrates:					
Contained zinc	784,000	831,000	825,000	805,000	774,000
Recoverable zinc:					
Quantity	758,000	803,000	797,000 ^r	778,000	748,000
Value	\$1,600,000	\$1,900,000	\$1,680,000	\$1,740,000	\$2,300,000
thousands					
Refined zinc:					
At primary smelters	106,000	110,000	124,000	111,000	117,000
At secondary smelters ^c	127,000	70,000	48,300	15,000	15,000
Total	233,000	180,000	172,000	126,000	132,000
Exports:					
Ores and concentrates, zinc content	669,000	644,000	708,000	597,000	682,000
Refined zinc	11,500	19,800	12,700	46,900	32,200
Imports for consumption:					
Ores and concentrates, zinc content	2,370	2	22	50 ^r	6,780
Refined zinc	713,000	805,000	771,000	713,000	729,000
Reported stocks of refined zinc, December 31:					
Producer and consumer	73,600	88,000	86,700	79,500 ^r	120,000
Government stockpile	7,250	7,250	7,250	7,250	7,250
Consumption, refined zinc:					
Reported	414,000	403,000	433,000	462,000	536,000
Apparent ²	935,000	965,000	931,000	792,000	829,000
Price: ³					
North American	95.57	107.12	95.54	101.37	139.28
cents per pound					
London Metal Exchange, cash	86.64	98.05	87.64	94.82	131.25
do.					
World production:					
Mine	13,800 ^r	13,700 ^r	13,500	12,700 ^r	12,500
Smelter	13,200 ^r	13,500 ^r	13,700 ^r	13,800	13,800
do.					

^rEstimated. ^rRevised. do. Ditto.

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits, except prices; may not add to totals shown.

²Smelter production plus imports for consumption minus domestic imports.

³Special High Grade. Source: Platts Metals Week.

TABLE 2
MINE PRODUCTION OF RECOVERABLE ZINC
IN THE UNITED STATES, BY STATE¹

(Metric tons)

State	2016	2017
Alaska	658,000	611,000
Other ²	120,000	138,000
Total	778,000	748,000

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes production from Idaho, Missouri, Tennessee, and Washington.

TABLE 3
LEADING ZINC-PRODUCING MINES IN THE UNITED STATES IN 2017, IN ORDER OF OUTPUT¹

Rank	Mine	County and State ²	Operator	Source of zinc
1	Red Dog	Northern Region, AK	Teck Alaska Inc.	Zinc-lead ore.
2	East Tennessee Zinc Complex ³	Jefferson and Knox, TN	Nyrstar Tennessee Mines - Strawberry Plains LLC	Zinc ore.
3	Greens Creek	Southeastern Region, AK	Hecla Mining Co.	Silver-zinc ore.
4	Pend Oreille	Pend Oreille, WA	Teck American Inc.	Zinc-lead ore.
5	Middle Tennessee Zinc Complex ⁴	Smith, TN	Nyrstar Tennessee Mines - Strawberry Plains LLC	Zinc ore.
6	Brushy Creek	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
7	Viburnum (#29 and #35)	Washington and Iron, MO	do.	Do.
8	Lucky Friday	Shoshone, ID	Hecla Mining Co.	Silver ore.
9	Fletcher	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
10	Sweetwater	do.	do.	Do.

Do., do. Ditto.

¹The mines on this list accounted for 100% of recoverable U.S. zinc mine production in 2017.

²For Alaska, mines are located by geographic region, as delineated by the Alaska Division of Geological & Geophysical Surveys in its Special Report 73, Alaska's mineral industry 2017—Exploration activity.

³Includes the Coy, Immel, and Young Mines.

⁴Includes the Cumberland, Elmwood, and Gordonsville Mines.

TABLE 4
ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF SCRAP¹

(Metric tons)

Type of scrap	2016	2017
New scrap:		
Zinc-base	52,800 ^r	52,800 ^e
Copper-base	82,200	81,800
Magnesium-base	373	465
Total	135,000	135,000
Old scrap:		
Zinc-base	22,900	22,900 ^e
Copper-base	5,900 ^r	6,140 ^e
Aluminum-base	403	923
Magnesium-base	9	72
Total	29,300	30,100
Grand total	165,000 ^r	165,000

^eEstimated. ^rRevised.

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 5
U.S. REPORTED CONSUMPTION OF ZINC IN 2017, BY INDUSTRY USE AND GRADE¹

(Metric tons)

Industry use	Special High Grade	High Grade	Continuous Galvanizing Grade	Controlled Lead Grade	Prime Western	Remelt and other grades	Total
Galvanizing	132,000	79,100	238,000	--	20,100	319	469,000
Zinc-base alloys	28,900	82	--	--	--	--	29,000
Brass and bronze	23,800	9,970	--	--	98	9	33,900
Other	4,540	--	--	--	--	--	4,540
Total	189,000	89,200	238,000	--	20,200	328	536,000

-- Zero.

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 6
U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY OR LOCALITY¹

Country or locality	2016		2017	
	Quantity (metric tons, zinc content)	Value (thousands)	Quantity (metric tons, zinc content)	Value (thousands)
Australia	47,800	\$78,100	93,000	\$169,000
Belgium	26,800	40,600	41,900	87,900
Belize	--	--	2	3
Canada	209,000	347,000	227,000	531,000
China	6,440	11,000	9,880	14,900
Dominican Republic	2	8	--	--
El Salvador	48	141	54	195
Finland	30,700	43,500	29,600	56,100
Germany	30,600	45,700	26,200	57,300
Hong Kong	--	--	40	26
India	--	--	69	72
Italy	16,500	23,500	29,500	57,400
Japan	38,100	59,400	43,600	95,200
Korea, Republic of	102,000	159,000	79,600	167,000
Mexico	75	81	4,610	6,970
Netherlands	--	--	7,050	10,500
Nigeria	--	--	184	193
Panama	6	23	5	20
Poland	--	--	5,770	11,000
Singapore	--	--	500	241
Spain	88,800	130,000	78,300	154,000
St. Lucia	--	--	1	4
Switzerland	--	--	4,570	9,090
Trinidad and Tobago	1	3	--	--
Tunisia	--	--	500	241
United Arab Emirates	--	--	365	241
Total	597,000	938,000	682,000	1,430,000

-- Zero.

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 7
U.S. EXPORTS OF ZINC COMPOUNDS¹

	2016		2017	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Chromates of zinc or of lead	25	\$644	39	\$847
Lithopone	1,260	7,160	762	4,630
Zinc chloride	856	1,130	288	498
Zinc oxide	55,300	56,300	66,100	90,100
Zinc sulfate	588	850	776	871
Zinc sulfide	1,040	14,500	636	16,200

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF ZINC COMPOUNDS¹

	2016		2017	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Chromates of zinc or of lead	220	\$539	236	\$664
Lithopone	2,670	6,310	1,940	1,860
Zinc chloride	137	1,290	204	1,770
Zinc oxide	123,000	239,000	114,000	294,000
Zinc sulfate	79,900	60,400	91,100	85,400
Zinc sulfide	579	1,600	2,140	6,490

¹Table includes data available through February 19, 2019. Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 9
ZINC: WORLD MINE PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons, zinc content of concentrate and direct shipping ore unless otherwise specified)

Country or locality	2013	2014	2015	2016	2017
Argentina	39,424	28,038	30,498	22,792 ^r	30,000 ^e
Armenia ²	9,054 ^r	8,459 ^r	6,790 ^r	4,740 ^r	5,300 ^e
Australia	1,481,135 ^r	1,505,986 ^r	1,610,004 ^r	883,747 ^r	841,989
Bolivia	407,332	474,988 ^r	442,154	486,955 ^r	473,000 ^e
Bosnia and Herzegovina ^c	9,100 ^r	8,100 ^r	8,800 ^r	10,000 ^r	10,000
Brazil	152,147	169,766	185,000 ^r	195,000 ^r	200,000 ^e
Bulgaria	11,992	11,900 ^r	16,300 ^r	19,200 ^r	17,600 ^e
Burkina Faso	32,215	65,000	62,000	65,000 ^e	64,469
Burma ^e	4,800	6,100	4,800 ^r	6,500 ^r	7,000
Canada	426,545	352,125	276,519	321,757	344,294
Chile	29,759	45,094	48,071	42,870 ^r	43,000 ^e
China	5,187,700 ^r	5,118,400 ^r	4,748,900 ^r	4,800,000	4,400,000 ^e
Congo (Kinshasa)	12,114	12,737	12,675	12,587 ^r	12,500 ^e
Dominican Republic	--	--	4,655	3,636	4,000 ^e
Eritrea	--	--	--	40,900 ^e	90,000 ^e
Finland	40,956	43,000 ^e	25,332 ^r	45,852	66,284
Greece ²	22,262	22,658	14,936	18,886 ^r	14,600
Guatemala	1,221	13,394	14,810	15,000	6,100
Honduras	25,223	29,509	22,992	14,579	19,986
India	793,000	706,000	821,617 ^r	658,000 ^{r,e}	833,000 ^e
Iran ^e	134,000 ^r	139,000 ^r	124,000 ^r	125,000 ^r	140,000
Ireland	326,700	282,600	236,300	147,800 ^r	130,580
Kazakhstan	361,500	345,200	342,500	324,800 ^r	330,000 ^e
Korea, North ^e	36,000	32,000	26,000	30,000	25,000
Korea, Republic of ²	1,750	1,918	2,070	2,257 ^r	2,665
Kosovo	4,983	5,500	3,986	4,814 ^r	4,410 ^e
Laos	1,500 ²	--	--	--	--
Macedonia ²	30,907 ^r	31,570 ^r	29,150 ^r	24,817 ^r	24,208
Mexico	642,542	659,878	694,544 ^r	661,188 ^r	674,318
Mongolia ²	52,100	46,600	44,800	50,100	58,000
Montenegro	9,200 ^e	14,400 ^e	14,136	16,226 ^r	22,600 ^e
Morocco	47,600 ²	45,000 ²	53,260 ²	50,000 ^e	55,000 ^e
Namibia	184,109 ²	172,783	123,672	129,856	140,000 ^e
Nigeria	7,000	7,000 ^e	14,200 ^e	13,400 ^{r,e}	14,000 ^e
Pakistan	5,000 ^e	--	--	8,317 ^r	21,013
Peru	1,350,874	1,315,215	1,421,218	1,337,081 ^r	1,473,037
Philippines	16,730	--	--	--	--
Poland	58,200	70,000	65,000	61,000 ^r	65,000 ^e
Portugal	53,382	67,378	66,871 ^r	69,526 ^r	71,356
Russia ³	384,400 ^r	352,500 ^r	388,800 ^r	390,000 ^{r,e}	280,000
Saudi Arabia	18,332 ^r	17,350 ^r	18,757 ^r	2,550 ^r	15,219
Serbia ^e	5,800 ^r	6,200 ^r	4,000 ^r	6,300 ^r	12,000
South Africa	30,145	26,141	29,040	26,695	30,000 ^e
Spain	30,428	26,756	49,216 ^r	64,000 ^e	67,000 ^e
Sweden	176,578	221,882	246,983 ^r	258,264 ^r	250,960
Tajikistan ^c	24,000 ^r	48,000 ^r	50,000 ^r	72,000 ^r	77,000
Thailand	30,000	39,140	34,738	34,500	--
Turkey ^e	200,000 ⁴	211,500 ⁴	173,600 ⁴	202,000 ^r	220,000
United States	784,000	831,000	825,000	805,000	774,000
Uzbekistan ^c	40,000	50,000	50,000	55,000 ^r	60,000
Vietnam ^e	20,000	17,000	15,000 ^r	12,000 ^r	10,000
Total	13,800,000 ^r	13,700,000 ^r	13,500,000	12,700,000 ^r	12,500,000

See footnotes at end of table

TABLE 9—Continued
ZINC: WORLD MINE PRODUCTION, BY COUNTRY OR LOCALITY¹

⁰Estimated. ¹Revised. -- Zero.

¹Table includes data available through May 21, 2018. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Data derived from reported production of zinc concentrates.

³May not include production from some small-scale mining operations.

⁴Data derived from reported exports of zinc ores and concentrates.

Sources: British Geological Survey; Bulgarian Association of the Metallurgical Industry; Chamber of Mines (Namibia); Chilean Copper Commission; China Nonferrous Metals Industry Association; company reports; Department of Industry and Science (Australia); Department of Mineral Resources (South Africa); Department of Statistics of Kazakhstan; Geological Survey of Finland; International Lead and Zinc Study Group; Istanbul Minerals & Metals Exporters' Association; Korea Institute of Geoscience and Minerals Resources; Lao Department of Mines; Mineral Resources Authority of Mongolia; Mines and Geosciences Bureau (Philippines); Ministry of Energy and Mines (Peru); Ministry of Energy, Mines, Water, and the Environment (Morocco); Ministry of Industry, Energy, and Tourism (Spain); Ministry of Mines (Democratic Republic of the Congo); Ministry of Natural Resources and Ecology (Russia); National Department of Mineral Production (Brazil); National Institute of Statistics and Census (Argentina); National Institute of Statistics and Geography (Mexico); National Statistical Service of the Republic of Armenia; Natural Resources Canada; Polish Geological Institute; U.S. Geological Survey.

TABLE 10
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY OR LOCALITY^{1,2}

(Metric tons, zinc content)

Country or locality	2013	2014	2015	2016	2017
Algeria, primary ^c	6,980	6,980 ^r	7,090	5,000	4,000
Argentina, primary	36,712	29,122	30,000 ^e	-- ^e	-- ^e
Australia, primary	498,291	481,573	489,030	464,176	459,144
Belgium, primary	252,000	262,000	260,000	236,000	249,000
Brazil, primary	245,417	246,120	270,715 ^r	284,457 ^r	290,000 ^e
Bulgaria, primary	75,830	76,293	75,095 ^r	75,811 ^r	74,000 ^e
Canada, primary	651,638	649,217	683,118	691,389	608,398
China:					
Primary	5,160,000	5,610,000	5,680,000 ^r	5,980,000 ^r	5,960,000
Secondary	150,000	170,000	206,000 ^r	290,000 ^{r,e}	184,000
Total	5,310,000	5,780,000	5,886,000 ^r	6,270,000 ^r	6,144,000
Finland, primary	311,686	302,024	305,717	290,599	284,992
France, primary	152,000	171,000	169,000	149,000	166,000
Germany:					
Primary	140,000 ^r	140,000	143,000 ^r	138,000 ^r	145,000
Secondary	26,000 ^r	28,000 ^r	30,000 ^r	30,000 ^r	30,000
Total	166,000 ^r	168,000	173,000 ^r	168,000 ^r	175,000
India:					
Primary	768,834	705,707	821,617	611,814	799,844
Secondary	19,166	18,293	16,383	16,816 ^r	19,123
Total	788,000	724,000	838,000	629,000 ^r	818,967
Iran, primary and secondary	140,000	145,000	138,000	115,000 ^r	140,000 ^e
Italy, primary and secondary	267,624 ^r	154,982 ^r	158,214 ^r	186,028 ^r	190,000 ^e
Japan:					
Primary	470,573	458,481	457,786	438,650	435,440
Secondary	116,718	124,540	108,833	95,129	89,479
Total	587,291	583,021	566,619	533,779	524,919
Kazakhstan, primary and secondary	320,150	324,946	323,848	301,335 ^r	329,178
Korea, North, primary and secondary ^c	35,000	30,000	20,000	20,000	15,000
Korea, Republic of, primary	885,804	900,943	934,949	1,012,763	970,455
Mexico, primary	322,781	320,924	326,642	321,159	327,003
Namibia, primary	124,924	118,665 ^r	71,818 ^r	88,650 ^r	83,768
Netherlands, primary	275,000	290,000	291,000	283,000	248,000
Norway, primary	143,444	165,600	162,878	170,541	172,086
Peru, primary	346,362	336,454	335,422	341,518	321,339
Poland, primary	146,300	154,000	161,000	123,800 ^r	140,000 ^e
Russia, primary and secondary	216,260	223,311	229,602	254,709 ^r	264,989
Spain, primary	490,488	491,331	493,765	495,016 ^r	510,000 ^e
Thailand, primary	78,000	70,100	74,100 ^r	72,813	20,000 ^e
United States:					
Primary	106,000	110,000	124,000	111,000	117,000
Secondary	127,000	70,000	48,300 ^r	15,000	15,000
Total	233,000	180,000	172,000	126,000	132,000
Uzbekistan, primary ^c	54,000	66,000	73,000	85,000	93,000
Vietnam, primary ^c	12,000	12,000	10,000	10,000	10,000
Grand total	13,200,000 ^r	13,500,000 ^r	13,700,000 ^r	13,800,000	13,800,000
Of which:					
Primary	12,000,000 ^r	12,300,000 ^r	12,600,000	12,700,000 ^r	12,700,000
Secondary	439,000 ^r	411,000 ^r	409,000 ^r	447,000 ^r	338,000
Undifferentiated	711,000 ^r	723,000 ^r	711,000 ^r	691,000 ^r	749,000

See footnotes at end of table

TABLE 10—Continued
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY OR LOCALITY^{1,2}

^cEstimated. ¹Revised. -- Zero.

¹Table includes data available through June 6, 2018. All data are reported unless otherwise noted. Grand totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

²Wherever possible, detailed information on raw material source of output (primary—directly from ores, and secondary—from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undifferentiated (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output.

Sources: Bulgarian Association of the Metallurgical Industry; Chamber of Mines of Namibia; China Nonferrous Metals Industry Association; company reports; Department of Statistics (Kazakhstan); Federal Institute for Geosciences and Natural Resources (Germany); Indian Bureau of Mines; International Lead and Zinc Study Group; Ministry of Economy, Trade, and Industry (Japan); Ministry of Energy and Mines (Namibia); Ministry of Energy and Mines (Peru); Ministry of Natural Resources and Ecology (Russia); National Department of Mineral Production (Brazil); National Institute of Statistics and Census (Argentina); Natural Resources Canada; Office of the Chief Economist (Australia); Polish Geological Institute; U.S. Geological Survey.