



2016 Minerals Yearbook

BAUXITE AND ALUMINA [ADVANCE RELEASE]

BAUXITE AND ALUMINA

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In 2016, almost all of the 4.94 million metric tons (Mt) of bauxite consumed in the United States was imported. World production of bauxite was estimated to be 270 Mt (tables 1, 11); the leading producing countries were, in descending order of production, Australia, China, Brazil, Guinea, and India. U.S. production and shipments of alumina (calcined equivalent) were 2.36 Mt and 2.41 Mt, respectively. An estimated 79% of domestic shipments were used for metal production. World production of alumina (calcined equivalent) was estimated to be 121 Mt (tables 2, 12). The leading producing countries were China, Australia, Brazil, and India.

Production

Bauxite.—The United States is 100% net import reliant for metallurgical-grade bauxite. Small amounts of bauxite and bauxitic clays are produced in Alabama, Arkansas, and Georgia for nonmetallurgical uses, such as abrasives, cement, chemicals, proppants, and refractories. Domestic mines operated by five companies supplied less than 5% of the U.S. requirement for bauxite, and all of the bauxite that the United States required for alumina production was imported.

Alumina.—U.S. production of alumina (calcined equivalent), which was derived exclusively from imported metallurgical-grade bauxite, decreased by 48% in 2016 from that in 2015 (table 2).

In March, Alcoa Inc. (New York, NY) temporarily shut down the remaining 810,000 metric tons per year (t/yr) of operating capacity at the 2.3-million-metric-ton-per-year (Mt/yr) alumina refinery at Point Comfort, TX. In November 2015, Alcoa shut down 1.2 Mt/yr of capacity at the refinery, and 290,000 t/yr had been previously shut down. Alcoa cited the need to close unprofitable capacity in order to improve the cost position of its upstream portfolio in the face of lower aluminum prices (Alcoa Inc., 2016b; 2016c, p. 11).

In September, Sherwin Alumina Co. LLC (a subsidiary of Glencore International AG) permanently shut down its 1.65-Mt/yr refinery in Gregory, TX. Sherwin filed for bankruptcy protection in January citing a price dispute with its bauxite supplier, Noranda Aluminum Holding Corp. (Franklin, TN), and low prices for alumina. A lockout of 450 employees represented by the United Steelworkers Union that started on October 11, 2014, by Sherwin continued until the shutdown. Production at the refinery was continued by management employees and temporary workers. The unionized employees rejected a contract offer the day before the lockout started. Issues in the contract dispute included health care contributions, pay for unscheduled work, and wages (Laliberte, 2014; Lim, 2014; United Steelworkers, 2015; Matyi, 2016e; Sherwin Alumina Co. LLC, 2016).

Noranda filed for bankruptcy protection on February 8, citing low alumina prices as well as losses on sales of bauxite to Sherwin. Noranda's 263,000-t/yr aluminum smelter in New Madrid, MO, was temporarily shut down after a power

failure in January, also contributing to the bankruptcy filing. New Day Aluminum LLC, an affiliate of DADA Holdings LLC (Ft. Lauderdale, FL), purchased Noranda's 1.2-Mt/yr alumina refinery at Gramercy, LA, and its 5.4-Mt/yr bauxite mine at St. Ann, Jamaica. Both the alumina refinery and bauxite mine continued production during the bankruptcy proceedings. Noranda also completed a project in February to convert some metallurgical-grade alumina capacity to produce chemical-grade alumina (Matyi, 2016b; Noranda Aluminum Holding Corp., 2016a, b, c, d).

Consumption

Bauxite.—Domestic production and consumption data for bauxite and alumina were obtained by the U.S. Geological Survey from three separate voluntary surveys. The "Bauxite Consumption" survey was sent to 30 operations, 24 of which responded, representing approximately 89% of the bauxite consumed for uses other than cement listed in table 4.

Total domestic consumption of bauxite decreased by 49% compared with the revised amount in 2015. In 2016, 94% of the bauxite consumed in the United States was refined to alumina; the remaining 6% was consumed in nonmetallurgical applications (table 4). An estimated 1.97 metric tons (t) of dried bauxite was required to produce 1 t of alumina.

Alumina.—The "Alumina Production" survey was sent to all four domestic alumina refineries, two of which responded, and the other two reported alumina production in public reports. Alumina production was 2.36 Mt in 2016, 48% less than that in 2015 (table 2). Alumina consumption by domestic primary aluminum smelters was estimated from the responses to the "Aluminum" survey, which were received from three companies that operated eight primary aluminum smelters. An estimated 79% of domestic alumina consumption (net alumina imports and domestic alumina shipments by U.S. alumina refineries) was for metal production at primary aluminum smelters. In 2016, eight domestic primary aluminum smelters consumed 1.68 Mt of alumina, 47% less than the amount of alumina consumed in 2015. The remainder of U.S. consumption of various forms of alumina was by abrasives, chemicals, refractories, and other specialty industries.

Prices

Most metallurgical-grade bauxite was purchased under long-term contracts, and contract terms normally were not made public. Spot prices for metallurgical-grade alumina and specialty forms of bauxite and alumina for nonmetallurgical applications, however, were published in trade journals.

The annual average delivered value of U.S. imports of metallurgical-grade bauxite decreased by 6% in 2016 compared with that of 2015 (table 5). In 2016, the average value of U.S.

imports of calcined alumina, including cost, insurance, and freight at U.S. ports, was 10% lower at \$384 per metric ton (table 6). However, U.S. import prices for alumina are often based on long-term contracts or are for alumina produced by the same company as the smelter, so they are not necessarily reflective of the world market. Yearend price ranges, as quoted in *Industrial Minerals* (2016, 2017), for refractory-grade bauxite exported from China were significantly lower than those at yearend 2015 (table 7).

Foreign Trade

In 2016, as a result of shutdowns of alumina refineries and aluminum smelters, imports of bauxite and alumina as well as exports of alumina decreased compared with those in 2015. Imports of crude dry bauxite decreased by 53%. Imports of alumina decreased by 27%. Exports of alumina decreased by 39% and net exports of alumina decreased by 67% compared to the revised amounts in 2015 (tables 8, 10). Jamaica and Brazil remained the leading sources of crude dry bauxite imports, accounting for 69% and 27%, respectively. Brazil, Australia, and Jamaica were the leading sources of alumina imports, accounting for 35%, 33%, and 14%, respectively. Iceland and the United Arab Emirates were the leading destinations for alumina exports in 2016, receiving 29% and 21%, respectively.

World Industry Structure

Bauxite.—In 2016, world production of bauxite was 10% less than that of 2015, attributed mostly to a significant decrease of production in Malaysia that was partially offset by increased production in Guinea (table 11). Total mine production of 270 Mt was reported from 28 countries, not including production from the United States, which was withheld to avoid disclosing proprietary data. The leading producers of bauxite were, in decreasing order of tonnage mined, Australia, China, Brazil, Guinea, and India. These countries accounted for 86% of total world production; Australia and China together accounted for 53% of the world's production.

Alumina.—World output of alumina increased slightly in 2016 compared with that of 2015 (table 12). Increased production in China, Australia, Brazil, India, Saudi Arabia, and Indonesia was partially offset by decreased production in Suriname and the United States. Although 24 countries reported production, the 4 leading producing countries, in descending order of quantity of alumina produced—China, Australia, Brazil, and India—accounted for 81% of world production; China and Australia accounted for 50% and 17%, respectively.

Mergers, Acquisitions, and Divestitures.—In September 2015, Alcoa announced that it would split into two separate companies citing the desire to have the individual companies be able to focus on either value-added products or upstream commodities. During the past several years, Alcoa had been preparing for this restructuring by shutting down or selling high-cost upstream assets and investing in assets that produced value-added products. On November 1, the separation into two separate entities was completed. Alcoa Corp. (Pittsburgh, PA) will own the upstream aluminum commodity assets including bauxite mines, alumina refineries, primary aluminum smelters,

and powerplants. Arconic Inc. (Pittsburgh, PA) will own the downstream, value-added businesses including rolling mills and associated secondary aluminum capacity, as well as aerospace, automobile product, and specialty metal assets (Alcoa Inc., 2015, 2016a).

Noranda filed for Chapter 11 bankruptcy protection on February 8. In March, during the restructuring, the company shut down the one potline that was still producing at the aluminum smelter in New Madrid, MO. The two other potlines were previously shut down a month earlier after an electrical supply circuit failure on January 7. Noranda also sold most of its assets in the second half of the year. On October 28, ARG International AG (Switzerland) completed the purchase of the idled New Madrid primary aluminum smelter. Gränges AB (Sweden) acquired Noranda's rolling mills in Huntingdon, TN, Salisbury, NC, and Newport, AR. New Day Aluminum purchased the alumina refinery in Gramercy, LA, and the St. Ann Mine in Jamaica from Noranda (Dent, 2016; Gränges AB, 2016; Matyi, 2016a, c; Noranda Aluminum Holding Corp., 2016b, c).

World Review

Australia.—Bauxite production increased slightly (1.09 Mt) but alumina production increased by 4% (796,000 t) compared with that in 2015. Increased alumina production was partially attributed to an 11% (312,000-t) increase from Rio Tinto plc's (United Kingdom) 3.4-Mt/yr Yarwun refinery in Queensland, which completed rampup in 2015. Production from the 3.85-Mt/yr Queensland alumina refinery in Gladstone, Queensland, was 3% (101,000 t) more than that in 2015. Bauxite production from the Weipa Mine increased by 6% (1.76 Mt) compared with that in 2015 as Rio Tinto increased alumina production at the Yarwun refinery. Rio Tinto increased bauxite production at the 8-Mt/yr Gove Mine in the Northern Territory by 21% (1.59 Mt) compared with production in 2015. Bauxite from the Gove Mine was sold to third-party customers because the 3.8-Mt/yr Gove alumina refinery was temporarily shut down in May 2014 (Rio Tinto plc, 2014, p. 4; 2016, p. 3, 16–18; 2017, p. 219).

Australian Bauxite Ltd. was ramping up production at the Bald Hill Mine in Tasmania that started bauxite production in December 2015. Production at the 1.5-Mt/yr mine was less than planned and experienced temporary delays owing to difficulties in obtaining customers. Most of the bauxite produced was sold for use in cement and as a fertilizer additive instead of for metallurgical uses (Australian Bauxite Ltd., 2016, p. 3–4).

Rio Tinto started construction of a 22.8-Mt/yr bauxite mine in Queensland. Bauxite produced at the Amrun Mine would be shipped through the port of Cape York. Completion of the project was expected in the first half of 2019 (Rio Tinto plc, 2017, p. 23, 35).

Metro Mining Ltd. was developing the Bauxite Hills project in Queensland with construction scheduled to start in mid-2017. The bauxite deposit reserves were reported to be 48.2 Mt. Metro was also in the process of acquiring Gulf Alumina Ltd. and expected to complete the transaction in early 2017. Gulf Alumina was developing the Skardon River project adjacent to the Bauxite Hills project. The Skardon River deposit reserves were reported to be 48.3 Mt. Metro planned to consolidate the

projects into a single operation after acquiring Gulf Alumina. Bauxite mining was scheduled to start in 2018 at an initial rate of 2 Mt/yr, and increasing production to 4 Mt/yr was being considered (Lee, 2016b; Metro Mining Ltd., 2016).

Brazil.—The Juruti Mine capacity was being expanded to 5.7 Mt/yr from 4.7 Mt/yr. The expansion project would be completed in 2017. Some of the new capacity was ramped up, and production increased to 5.2 Mt compared with 4.7 Mt in 2015. The mine was a joint venture of Alcoa Corp. (60%) and Alumina Ltd. (40%) (Alumina Ltd., 2016, p. 8; 2017, p. 25).

Canada.—Orbite Technologies Inc. continued construction on a 1,100-t/yr refinery to produce high-purity (99.99%) alumina from high-alumina clay at Cap-Chat, Quebec. Trial production started in October. Construction issues were cited for delaying completion from yearend 2015 to mid-2016. In addition to high-purity alumina, Orbite's plant would produce gallium, iron oxide, rare-earth elements, and high-purity silica (Orbite Technologies Inc., 2014, 2016; Maltais, 2016).

China.—Alumina production was 60.9 Mt, a 3% increase compared with the amount in 2015, a smaller increase compared with those in prior years. In 2013, 2014, and 2015, alumina production increased by 25%, 9%, and 15%, respectively (table 12). Less new capacity was ramped up during 2016 than in the prior year, and several refineries continued shutdowns that started in the fourth quarter of 2015 until prices increased in the first half of 2016. It was estimated that between 8 and 10 Mt/yr of alumina capacity was temporarily shut down in late 2015 or early 2016 in response to low alumina prices. By the end of May, at least 7 Mt/yr of that capacity was restarted as spot alumina prices increased (Mok, 2016a, b, e, j). Bauxite production was estimated to be 60.8 Mt, 6% less than that in 2015. Bauxite imports were 51.8 Mt, 7% less than the 55.9 Mt imported in 2015. The leading sources of bauxite imports, in descending order, were Australia (41%), Guinea (23%), and Malaysia (14%). Although Malaysia supplied 43% of bauxite imports to China in 2015, it dropped from the leading supplier to the third-ranked supplier after Malaysia's Government temporarily banned bauxite mining starting in January. Increased imports from Australia, Brazil, and Guinea partially offset the decreased imports from Malaysia. Alumina imports in 2016 were 3.03 Mt, a decrease of 35% compared with those in 2015, and accounted for about 5% of China's consumption. The leading sources of alumina imports, in descending order, were Australia (58%), Indonesia (11%), and Vietnam (11%) (China Metal Market—Alumina and Aluminum, 2017b, c). Alumina capacity at yearend 2016 was estimated to be 74 Mt/yr, a 7% increase from 69 Mt/yr estimated at yearend 2015, and an additional 6 Mt/yr was expected to be completed in 2017 (Mok, 2016d).

Guizhou Province.—Aluminum Corp. of China Ltd. (Chinalco) started production at the 1.2-Mt/yr Maochang Mine in June. The underground mine, projected to produce for 36 years, was completed at yearend 2015 and would supply the Qingzhen refinery (China Metal Market—Alumina and Aluminum, 2016a, d).

In September, China Power Investment Corp. started production at the 1-Mt/yr Dazhuyuan Mine and the 1-Mt/yr Wachangping Mine, which were completed in 2015. Commissioning of the mines was delayed because of low alumina

prices. The mines were built to supply an 800,000-t/yr alumina refinery in Wuchuan County that was under construction with completion expected by yearend 2016 (China Metal Market—Alumina and Aluminum, 2015, 2016e).

Henan Province.—Chinalco was developing the Duancun-Leigou bauxite mine and planned to start production in early 2017. The mine's capacity would be 1.6 Mt/yr (Leung, 2016a). Luoyang Xiangjiang Wanji Aluminum Ltd. shut down its 1.2-Mt/yr alumina refinery for several weeks following a breach of its red mud impound on August 8. The refinery was producing at a rate of about 1 Mt/yr at the time of the incident (Mok, 2016f).

Shandong Province.—In June, KDNEU International Engineering Co., Ltd. started production at its 1-Mt/yr alumina refinery in Binzhou (Leung, 2016c). Weiqiao Aluminum & Power Co. Ltd. expanded its alumina refinery by about 2 Mt/yr (Mok, 2016c).

Shanxi Province.—In April, Chinalco and its partner Shenzhen CR Yuanta commissioned a 1-Mt/yr alumina refinery in Luliang (Lee, 2016a). Chinalco's 1.8-Mt/yr alumina refinery in Xingxian shut down in August owing to flooding. The shutdown lasted for more than a month (CRU Alumina Monitor, 2016b).

Shanxi Huaxing Aluminum Co. Ltd. completed an expansion of its alumina refinery in Xing County to 2 Mt/yr from 1 Mt/yr and started production in April. Construction started in July 2015, and the new capacity was designed to consume diasporic-rich bauxite instead of gibbsite-rich bauxite commonly consumed in refineries. The refinery temporarily shut down all capacity on August 15 citing water supply issues (China Metal Market—Alumina and Aluminum, 2016b, i).

East Hope Group Ltd. started production at its new 1-Mt/yr alumina refinery in Lingshi County. East Hope planned to expand the refinery to 2 Mt/yr and to construct a 300,000-t/yr smelter with the capacity to produce downstream aluminum products, but construction schedules were not available (China Metal Market—Alumina and Aluminum, 2016c).

Yunnan Province.—Yunnan Aluminium Co. Ltd. continued expanding its alumina refinery in Wenshan to 1.4 Mt/yr from 800,000 t/yr. The project started in June 2014 and completion was expected at yearend. The refinery consumed bauxite from an adjacent bauxite mine (Lee, 2015, 2016c; Mok, 2016c).

Fiji.—Bauxite production was 77% less than that in 2015 and 91% less than that in 2014. Aurum Exploration Fiji Ltd. had difficulty obtaining customers for its bauxite in part because of concerns about the impurity levels in its bauxite. Exports to customers in China resumed in August after a washing plant was installed to remove impurities from the bauxite (CRU Bauxite and Alumina Weekly, 2016a).

Guinea.—United Company RUSAL Plc (Russia) continued construction of the Dian-Dian Mine, which would have a capacity of 3 Mt/yr. The bauxite mine would be completed in 2017, and bauxite would be shipped by rail to a port for export. Further expansion to 9 Mt/yr was planned for completion in 2021. Additional expansions and construction of a 1.2-Mt/yr alumina refinery would also be studied (United Company RUSAL Plc, 2016).

Alufer Mining Ltd. [Guernsey (United Kingdom)] continued preparation work to construct the 5.5-Mt/yr Bel Air Mine. Construction was scheduled to start in January 2017,

and production would start in the third quarter of 2018 (Alufer Mining Ltd., 2017).

Guinea Alumina Corp., a subsidiary of Emirates Global Aluminum PJSC (United Arab Emirates), was developing a 12-Mt/yr bauxite mine in the Boke region that would be completed in 2018. A rail spur was constructed to link the mine with an existing rail line. A 55,000-t sample was shipped to China in December for testing. Construction of support facilities at the port in Kamsar was completed in August, and shipments started in September. The upgraded port was able to ship 30 Mt/yr of bauxite (China Metal Market—Alumina and Aluminum, 2016g; Emirates Global Aluminum PJSC, 2016c, d).

India.—Production of alumina increased by 9% but bauxite production decreased by 14% compared with production in 2015. Hindalco Industries Ltd. increased alumina production at the 1.5-Mt/yr Utkal alumina refinery in 2016 after emergency repairs interrupted production in March 2015. The refinery produced at full capacity throughout 2016. National Aluminium Co. Ltd. of India (Nalco) also increased alumina production with the rampup of the alumina refinery in Damanjodi, Odisha State. The capacity of the refinery was expanded to 2.28 Mt/yr from 2.1 Mt/yr in 2015. In 2015, Vedanta Resources plc (London) decreased alumina production at the 1.25-Mt/yr Lanjigarh alumina refinery to 800,000 t/yr to reduce costs while aluminum prices were low. As prices in the spot market for aluminum and alumina increased in 2016, Vedanta increased alumina production at Lanjigarh. Although Hindalco, Nalco, and Vedanta increased bauxite production as they increased alumina production, the increases were offset by decreased production of bauxite for exports to China, which declined by 42% compared with exports to China in 2015. Nalco was planning to expand its alumina refinery at Damanjodi to 3.1 Mt/yr from 2.1 Mt/yr and was awaiting an environmental permit. If all necessary permits were received, construction would start in early 2017 (Lim, 2015, 2016a, c; China Metal Market—Alumina and Aluminum, 2016f, 2017a; Hindalco Industries Ltd., 2016, p. 5; 2017, p. 6; Mok, 2016i; National Aluminium Co. Ltd., 2016, 2017; Vedanta Resources plc, 2016, p. 9; 2017, p. 8–9).

Anrak Aluminium Ltd. continued to delay the startup of its 1.5-Mt/yr alumina refinery in Rachapalle, Andhra Pradesh State. The refinery would consume bauxite from Andhra Pradesh Mineral Development Corporation Ltd.'s (APMDC) Jerella deposit in Andhra Pradesh State, but APMDC had not received the necessary permit to start production at the mine. Anrak received approval from the State government to start up the refinery that was completed in the fourth quarter of 2013 (CRU Alumina Monitor, 2016a).

Indonesia.—Bauxite production was 1.4 Mt compared with 472,000 t in 2015, 2.56 Mt in 2014, and 57 Mt in 2013, as mines that supplied two alumina refineries ramped up production. Alumina production was estimated to be 600,000 t in 2016, compared with 70,000 t in 2015. A ban on exporting bauxite and other unprocessed mineral ores took effect on January 12, 2014. The export ban was part of the 2009 Mining Law and was intended to increase economic development in the country through investment in mineral processing facilities (Yee, 2014). The Government proposed to change the bauxite export ban by establishing a system to issue 5-year bauxite export

permits to companies building alumina refineries in Indonesia (Jakarta Post, The, 2016).

Construction of a 1-Mt/yr alumina refinery in Ketapang, West Kalimantan Province, was completed in May, and rampup to full capacity was completed in July. The project was a joint venture of China-based companies Hongqiao Group Ltd. (60%) and Winning Investment Co. Ltd. (10%) and Indonesia-based companies Harita Group Ltd. (25%) and PT Danpac (5%) (Mok, 2016g, h; Winning International Group Ltd., 2016).

Antam planned to build a 1-Mt/yr alumina refinery in Mempawah, West Kalimantan Province, with PT Indonesia Asahan Aluminium Ltd. (Inalum). A construction schedule was not available. Expansion to 2 Mt/yr would begin after production of the first phase was ramped up. The refinery would supply Inalum's aluminum smelter in Asahan, North Sumatra Province, which Inalum planned to expand to 500,000 t/yr from 250,000 t/yr by 2020 (PT Aneka Tambang Tbk, 2016).

Shaanxi Nonferrous Metals Holdings Group Co. Ltd. (China) completed a feasibility study for an alumina refinery during the year. The 2-Mt/yr alumina refinery would be built on Singkep Island, Riau Islands Province. A construction schedule was not available (China Metal Market—Alumina and Aluminum, 2016h).

Jamaica.—The Government of Jamaica approved a plan for Noranda to transfer bauxite to ships with cargo capacities of 170,000 t from smaller ships in a location along the south coast of Jamaica. This plan would enable Noranda to export bauxite produced at the 5.4-Mt/yr St. Ann Mine to China and other locations more efficiently (Matyi, 2016d). Previously, exports were only sent to refineries in the United States, but Noranda was seeking markets elsewhere since the shutdown of the Sherwin refinery in Texas.

Laos.—Sino-Lao Aluminium Co. Ltd. was planning to build a 1-Mt/yr alumina refinery that would consume bauxite from a 3-Mt/yr mine at Champasak. Yunnan Aluminium Co. Ltd. (China) was a partner in the project. Construction was not expected to be completed until 2020 (Leung, 2015, 2016b; CRU Bauxite and Alumina Weekly, 2016b; Lee, 2016c).

Malaysia.—Bauxite production decreased to 1 Mt in 2016 from 35 Mt in 2015 and 3.67 Mt in 2014. In January, the Government temporarily banned bauxite mining in response to illegal mining and pollution at ports from bauxite stockpiles. The initial mining ban was for 3 months but was extended until at least March 2017. Exportation of bauxite was still allowed in order to remove uncovered stockpiles at ports. When mines increased production in 2015, storage facilities and other infrastructure were inadequate for handling and storing bauxite, leading to water pollution. Production in Malaysia increased in 2015 to supply alumina refineries in China after Indonesia implemented a ban on exporting bauxite and other mineral ores in 2014 (Radford, 2016).

Altech Chemicals Ltd. (Australia) completed a bankable feasibility study for a refinery to be built in Johor Bahru to produce high-purity (99.99%) alumina. Feedstock would be sourced from a high-alumina clay deposit in Western Australia. Altech planned to sell the high-purity alumina for use in electronics and other high-tech products. A completion schedule of the 4,500-t/yr refinery was not announced (Altech Chemicals Ltd., 2017).

Romania.—Alumina production increased by 15% compared with the revised amount in 2015. Vimetco N.V. (Netherlands) completed a modernization project in the first quarter of 2014 at the 600,000-t/yr alumina refinery in Tulcea and continued to ramp up production in 2016 (Vimetco N.V., 2015, p. 15; 2016, p. 14; 2017).

Saudi Arabia.—Alcoa and Saudi Arabian Mining Co. (Ma'aden) continued ramping up their joint-venture alumina refinery at Ras Al-Khair that started production in December 2014. The refinery was producing at about 97% of its 1.8-Mt/yr capacity at yearend. The refinery consumed bauxite from the 4-Mt/yr Al Ba'itha Mine that was also completed in 2014 and supplied an adjacent 740,000-t/yr smelter that was completed in 2013. Ma'aden owned 74.9% of the joint venture, and Alcoa owned 25.1% (Alcoa Inc., 2014; Lim, 2016b).

Ukraine.—RUSAL was increasing the capacity of the Nikolaev alumina refinery to 1.7 Mt/yr from 1.6 Mt/yr. The first phase of the project was completed in the fourth quarter and added 29,000 t/yr of capacity. Completion of the project and rampup of the new capacity was expected to be completed by yearend 2017 (United Company RUSAL Plc, 2017a; 2017b, p. 23).

United Arab Emirates.—Emirates Global Aluminum continued construction of a 2-Mt/yr alumina refinery adjacent to its Al Taweelah aluminum smelter. The refinery, to be completed in 2018, would use bauxite from Emirates Global Aluminum's mine in Guinea (Emirates Global Aluminum PJSC, 2016a, b).

Vietnam.—Vietnam National Coal and Mineral Industries Group (Vinacomin) started production in December at the 650,000-t/yr Nhan Co alumina refinery in Dak Nong Province. Only about one-half of the capacity was planned to be ramped up in 2017, and production at full capacity was not expected until 2018. In January, the Government imposed a 2% export tax on alumina; Vinacomin was appealing the tax on the grounds that other alumina exporting countries did not have a similar tax (Lim, 2016d, e).

Outlook

Consumption of bauxite and alumina is expected to closely follow the trend of aluminum production. Aluminum prices generally continued to increase in 2017 as they had throughout 2016. World demand for aluminum was expected to increase as the global economy continues to expand and aluminum products become more accessible to consumers in developing economies. World consumption of alumina for nonmetallurgical uses is expected to increase slightly, attributable to continued growth in consumption of aluminum-hydroxide-based fire retardant materials and other alumina-based chemicals. Demand for high-purity alumina for devices such as smartphones, laptops, and tablets is expected to continue to increase, although the effect on total consumption of bauxite and alumina would be nominal because of the limited volume of this market relative to aluminum smelting. Also, new entrants to the high-purity alumina market are expected to consume high-alumina clay instead of bauxite as the raw material for their processes, as higher purity levels can be obtained using high-alumina clay.

Malaysia is expected to continue its ban on bauxite mining owing to concerns about environmental impacts. Indonesia's restriction on exports of unprocessed mineral products is expected to be modified for companies constructing new

alumina refineries making more bauxite available to alumina refineries in China in the short term. Some alumina refineries in China are expected to shut down because the Government was eliminating older capacity to reduce emissions. New alumina capacity in Indonesia and Vietnam is expected to offset some of the refinery shutdowns in China. Chinese refineries are expected to continue to source more bauxite from Australia and countries in West Africa. Access barriers to bauxite deposits in India, which currently restrain the startup of new alumina capacity, are expected to be resolved in the long run, but the history of slow mine permitting is expected to deter expansion projects in India. Shutdowns of capacity in the United States announced for 2016 are expected to last until aluminum prices are significantly higher for a sustained period of time.

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TABLE 1
SALIENT BAUXITE STATISTICS¹

(Thousand metric tons)

| | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------------------------------------|----------------------|----------------------|----------------------|--------------------|---------|
| United States: | | | | | |
| Production | W | W | W | W | W |
| Exports, as shipped: | | | | | |
| Crude and dried | 11 | 4 | 3 | 4 | 5 |
| Calcined | 18 | 10 | 7 | 10 ^r | 20 |
| Imports for consumption, as shipped: | | | | | |
| Crude and dried | 10,300 | 9,830 | 10,800 | 10,700 | 5,010 |
| Calcined | 406 | 582 | 601 | 526 | 574 |
| Consumption, dry equivalent | 9,560 | 10,200 | 9,840 | 9,660 ^r | 4,940 |
| World, production | 255,000 ^r | 295,000 ^r | 258,000 ^r | 299,000 | 270,000 |

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

¹Table includes data available through March 23, 2018. Data are rounded to no more than three significant digits.

TABLE 2
SALIENT ALUMINA STATISTICS¹

(Thousand metric tons)

| | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------------------------------------|---------------------|----------------------|----------------------|----------------------|---------|
| United States: | | | | | |
| Production: | | | | | |
| Calcined alumina | 3,960 | 4,250 | 4,200 | 4,130 | 2,000 |
| Other alumina ² | 645 | 582 | 635 | 615 | 568 |
| Total: | | | | | |
| As produced or shipped ³ | 4,610 | 4,830 | 4,830 | 4,750 | 2,570 |
| Calcined equivalent | 4,370 | 4,320 | 4,460 | 4,550 | 2,360 |
| Shipments: | | | | | |
| Calcined alumina | 3,990 | 4,260 | 4,150 | 4,070 | 2,050 |
| Other alumina ² | 641 | 580 | 637 | 614 | 564 |
| Total: | | | | | |
| As produced or shipped ³ | 4,630 | 4,840 | 4,790 | 4,690 | 2,610 |
| Calcined equivalent | 4,400 | 4,330 | 4,410 | 4,490 | 2,410 |
| Stocks, yearend ^{4,5} | 363 | 280 | 276 | 274 | 245 |
| Imports for consumption ⁵ | 1,900 | 2,050 | 1,630 | 1,570 | 1,140 |
| Exports ⁵ | 1,720 | 2,250 | 2,130 | 2,240 ^r | 1,370 |
| Consumption, apparent ^{5,6} | 5,140 | 4,210 | 3,970 | 3,880 ^r | 2,170 |
| World, production ⁵ | 97,100 ^r | 106,000 ^r | 111,000 ^r | 119,000 ^r | 121,000 |

^rRevised.

¹Table includes data available through March 23, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Trihydrate, activated, tabular, and other aluminas. Excludes calcium and sodium aluminates.

³Includes only the end product if one type of alumina was produced and used to make another type of alumina.

⁴Excludes consumers stocks other than those at primary aluminum plants.

⁵Calcined equivalent.

⁶Defined as domestic production plus imports minus exports plus adjustments for industry stock changes.

TABLE 3
CAPACITIES OF DOMESTIC ALUMINA PLANTS, DECEMBER 31^{1,2}

(Thousand metric tons per year)

| Company and plant | 2015 | 2016 |
|--|-------|--------------------|
| Alcoa Corp., ³ Point Comfort, TX | 2,300 | 2,300 ⁴ |
| Noranda Alumina LLC, ⁵ Gramercy, LA | 1,200 | 1,200 |
| Almatis Inc., Burnside, LA | 500 | 500 |
| Sherwin Alumina Co. LLC, Corpus Christi, TX ⁶ | 1,650 | -- |
| Total | 5,650 | 4,000 |

-- Zero.

¹Table includes data available through March 23, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Capacity may vary depending on the bauxite used.

³Name changed from Alcoa Inc. to Alcoa Corp. on November 1, 2016.

⁴Temporarily idle at yearend.

⁵Name was changed from Noranda Aluminum Holding Corp. to Noranda Alumina LLC on October 28, 2016.

⁶Owned by Glencore International AG. Refinery was permanently shut down in September 2016.

TABLE 4
U.S. CONSUMPTION OF BAUXITE, BY INDUSTRY¹

(Thousand metric tons, dry equivalent)

| Industry | 2015 | 2016 |
|--------------------|--------------------|-------|
| Alumina | 9,340 ^r | 4,650 |
| Other ² | 325 ^r | 284 |
| Total | 9,660 ^r | 4,940 |

^rRevised.

¹Table includes data available through March 23, 2018.

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

²Includes abrasive, chemical, and refractory uses.

TABLE 5
AVERAGE VALUE OF U.S. IMPORTS OF CRUDE AND DRIED BAUXITE¹

(Dollars per metric ton)

| Country or locality | 2015 | | 2016 | |
|-------------------------------|---|--|---|--|
| | Port of shipment f.a.s. ² | Delivered to U.S. ports c.i.f. ³ | Port of shipment f.a.s. ² | Delivered to U.S. ports c.i.f. ³ |
| Brazil | 34.27 | 43.28 | 41.74 | 45.98 |
| Guinea | 30.07 | 41.21 | 25.27 | 33.94 |
| Jamaica ⁴ | 21.57 | 28.66 | 23.40 | 30.17 |
| Weighted average ⁵ | 27.62 | 36.28 | 28.10 | 34.27 |

¹Computed from quantity and value data reported to U.S. Customs and Border Protection and compiled by the U.S. Census Bureau. Not adjusted for moisture content of bauxite or differences in methods used by importers to determine value of individual shipments.

²Free alongside ship valuation.

³Cost, insurance, and freight valuation.

⁴Based on quantity reported by the Jamaica Bauxite Institute.

⁵Weighted average of major suppliers.

TABLE 6
AVERAGE VALUE OF
U.S. IMPORTS OF ALUMINA¹

(Dollars per metric ton)

| | 2015 | 2016 |
|-------------------------------|------------------|------|
| January | 423 | 354 |
| February | 402 | 399 |
| March | 470 | 322 |
| April | 429 | 367 |
| May | 563 | 365 |
| June | 440 | 439 |
| July | 407 | 297 |
| August | 423 | 480 |
| September | 417 | 396 |
| October | 431 | 493 |
| November | 387 | 356 |
| December | 398 | 689 |
| Weighted average ² | 426 ^r | 384 |

^rRevised.

¹Metallurgical grade; cost, insurance, and freight valuation. Computed from quantity and value data reported to U.S. Customs and Border Protection and compiled by the U.S. Census Bureau.

²Weighted average of major suppliers.

TABLE 7
REFRACTORY GRADE BAUXITE PRICES¹

(Dollars per metric ton)

| Material | 2015 | 2016 |
|---|---------|---------|
| China: | | |
| Xingang, rotary kiln, lump 86% Al ₂ O ₃ | 380–390 | 280–300 |
| Xingang, round kiln, lump 87% Al ₂ O ₃ | 375–385 | 300–325 |

¹Port of shipment, free-on-board ship valuation, yearend.

Source: Industrial Minerals.

TABLE 8
U.S. EXPORTS AND IMPORTS FOR CONSUMPTION
OF BAUXITE, CRUDE AND DRIED, BY COUNTRY OR LOCALITY¹

(Thousand metric tons)

| Country or locality | 2015 | 2016 |
|----------------------|---------------|--------------|
| Exports: | | |
| Canada | 3 | 4 |
| Other | 1 | 1 |
| Total | 4 | 5 |
| Imports: | | |
| Brazil | 3,480 | 1,340 |
| Guinea | 2,480 | 101 |
| Jamaica ² | 4,560 | 3,460 |
| Other | 156 | 118 |
| Total | 10,700 | 5,010 |

¹Table includes data available through March 23, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Data from the Jamaica Bauxite Institute.

Note: Total U.S. imports of crude and dried bauxite as reported by the U.S. Census Bureau were as follows: 2015—7.97 million metric tons (Mt) (revised) and 2016—2.45 Mt.

Source: U.S. Census Bureau.

TABLE 9
U.S. EXPORTS AND IMPORTS FOR CONSUMPTION OF CALCINED BAUXITE, BY COUNTRY OR LOCALITY¹

(Thousand metric tons and thousand dollars)

| Country or locality | 2015 | | | | 2016 | | | |
|---------------------|------------------|--------------------------|-------------|---------------------------|------------------|--------------------|-------------|--------------------|
| | Refractory grade | | Other grade | | Refractory grade | | Other grade | |
| | Quantity | Value ² | Quantity | Value ² | Quantity | Value ² | Quantity | Value ² |
| Exports: | | | | | | | | |
| Canada | 6 | 517 | -- | -- | 3 | 574 | -- | -- |
| Mexico | (3) ³ | 75 ^r | 1 | 232 ^r | 3 | 1,040 | (3) | 46 |
| Other | 3 | 603 ^r | (3) | 52 ^r | 14 | 4,510 | (3) | 57 |
| Total | 9 | 1,200^r | 1 | 284^r | 20 | 6,120 | (3) | 103 |
| Imports: | | | | | | | | |
| Australia | -- | -- | 117 | 4,480 ^r | -- | -- | 170 | 6,090 |
| Brazil | (3) ^r | 20 ^r | -- | -- | 1 | 41 | -- | -- |
| China | 56 | 21,200 | 15 | 5,840 | 53 | 14,000 | 13 | 4,230 |
| Greece | -- | -- | 26 | 870 | -- | -- | -- | -- |
| Guyana | 35 | 13,700 | 260 | 10,100 | 29 | 10,300 | 242 | 13,500 |
| Turkey | 16 | 620 | -- | -- | -- | -- | 25 | 694 |
| Other | (3) ^r | 21 ^r | 1 | 543 | 4 | 1,730 | 37 | 668 |
| Total | 107 | 35,500 | 419 | 21,900^r | 87 | 26,000 | 487 | 25,200 |

^rRevised. -- Zero.

¹Table includes data available through March 23, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Value at foreign port of shipment as reported to U.S. Customs and Border Protection.

³Less than ½ unit.

Source: U.S. Census Bureau; data adjusted by U.S. Geological Survey.

TABLE 10
 U.S. EXPORTS AND IMPORTS FOR CONSUMPTION OF ALUMINA,
 BY COUNTRY OR LOCALITY¹

(Thousand metric tons, calcined equivalent, and thousand dollars)

| Country or locality | 2015 | | 2016 | |
|----------------------|--------------------------|----------------------------|--------------|--------------------|
| | Quantity | Value ² | Quantity | Value ² |
| Exports: | | | | |
| Bahrain | 152 | 45,000 | 32 | 6,440 |
| Canada | 791 ^r | 254,000 ^r | 86 | 46,700 |
| Egypt | 422 | 129,000 | 60 | 16,300 |
| Iceland | 121 | 38,200 ^r | 395 | 88,700 |
| Mexico | 87 | 55,300 | 77 | 47,100 |
| Netherlands | 98 | 57,400 | 120 | 56,600 |
| Norway | 367 | 89,400 | (3) | 281 |
| Russia | 1 ^r | 3,690 ^r | 63 | 16,300 |
| Sweden | 1 | 2,230 | 32 | 8,910 |
| United Arab Emirates | 1 | 1,850 | 282 | 64,000 |
| Other | 201 ^r | 236,000 ^r | 220 | 218,000 |
| Total | 2,240^r | 912,000^r | 1,370 | 570,000 |
| Imports: | | | | |
| Australia | 672 | 209,000 | 373 | 87,900 |
| Brazil | 401 | 137,000 | 400 | 128,000 |
| Canada | 58 | 43,500 | 67 | 45,300 |
| France | 16 | 33,600 | 18 | 36,400 |
| Germany | 31 | 89,400 | 26 | 71,200 |
| Jamaica ⁴ | 38 | 2,700 | 164 | 34,200 |
| Suriname | 244 | 75,900 | 35 | 8,400 |
| Other | 112 | 113,000 | 60 | 95,400 |
| Total | 1,570 | 705,000 | 1,140 | 507,000 |

^rRevised.

¹Table includes data available through March 23, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Value at foreign port of shipment as reported to U.S. Customs and Border Protection.

³Less than ½ unit.

⁴Data from the Jamaica Bauxite Institute.

Source: U.S. Census Bureau.

TABLE 11
BAUXITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Thousand metric tons)

| Country or locality | 2012 | 2013 | 2014 | 2015 | 2016 |
|-------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|
| Australia | 76,281 ^r | 81,119 ^r | 78,632 ^r | 80,910 | 82,000 ^e |
| Bosnia and Herzegovina | 800 | 657 | 605 | 787 | 800 ^e |
| Brazil | 34,988 | 33,896 | 36,308 | 37,057 | 34,400 ^e |
| China | 47,000 | 50,400 | 59,200 | 65,000 | 60,800 ^e |
| Dominican Republic | 11 | 770 | 1,446 | 1,724 | 282 |
| Fiji | 500 ^r | 600 ^r | 640 ^{r,e} | 250 | 58 |
| Ghana | 753 ^{r,2} | 909 ^r | 798 ^r | 1,314 ^r | 1,600 |
| Greece ³ | 1,816 | 1,844 | 1,873 | 1,832 | 1,800 ^e |
| Guinea ³ | 16,041 | 16,887 | 17,257 ^r | 16,303 | 31,500 |
| Guyana ³ | 2,210 | 1,649 | 1,602 ^r | 1,500 | 1,700 ^e |
| Hungary | 144 | 94 | 14 | 8 | 10 ^e |
| India | 13,463 ^r | 20,664 ^r | 22,636 ^r | 27,757 ^r | 23,886 |
| Indonesia | 31,443 | 57,024 | 2,555 | 472 ^r | 1,400 ^e |
| Iran ³ | 892 | 789 | 540 ^r | 520 ^r | 500 ^e |
| Jamaica | 9,339 | 9,435 | 9,677 | 9,629 | 8,540 |
| Kazakhstan | 5,170 | 5,192 | 4,516 | 4,683 | 5,000 ^e |
| Malaysia | 122 | 209 | 3,665 | 35,000 | 1,000 ^e |
| Mexico | 96 | -- | -- | -- | -- |
| Montenegro | -- | 61 | 155 | 50 | 400 |
| Mozambique ^e | 8 | 7 | 3 | 5 | 5 |
| Pakistan | 30 | 27 | 30 | 31 | 30 ^e |
| Russia | 5,700 | 6,028 | 6,293 | 5,900 | 5,431 |
| Saudi Arabia | -- ^r | -- ^r | 879 ^r | 1,600 ^r | 3,843 |
| Sierra Leone | 776 | 616 | 1,161 | 1,334 | 1,369 |
| Solomon Islands | -- | -- | -- | 270 | 238 |
| Suriname | 2,873 | 2,706 | 2,708 | 1,600 | -- |
| Tanzania ^e | 59 | 34 ^r | 26 | 26 | 25 |
| Turkey | 1,989 ^r | 914 ^r | 1,285 ^r | 1,340 ^r | 1,300 ^e |
| United States | W | W | W | W | W |
| Venezuela | 2,286 | 2,341 | 2,346 | 992 | 1,200 ^e |
| Vietnam ^e | 100 | 482 | 1,090 | 1,150 | 1,200 |
| Total | 255,000 ^r | 295,000 ^r | 258,000 ^r | 299,000 | 270,000 |

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

¹Table includes data available through May 1, 2017. All data are reported unless otherwise noted. Totals and estimated data are rounded to three significant digits; may not add to totals shown.

²Estimate based on Ghana's bauxite exports to the world in 2012 and on the release of the "Half-Year Performance of the Mining Industry" report by the Chamber of Mines, which indicated an 82% increase in bauxite production.

³Dry bauxite equivalent of crude ore.

TABLE 12
ALUMINA: WORLD PRODUCTION, BY COUNTRY OR LOCALITY^{1,2}

(Thousand metric tons)

| Country or locality | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------|---------------------|----------------------|----------------------|----------------------|---------------------|
| Australia | 20,915 ^r | 21,528 | 20,474 ^r | 20,097 | 20,893 |
| Azerbaijan | 102 | -- | -- | -- | -- ^e |
| Bosnia and Herzegovina | 202 | 176 | 171 | 251 | 250 ^e |
| Brazil | 10,320 ^r | 9,942 | 10,404 | 10,452 ^r | 10,900 ^e |
| Canada | 1,499 ^r | 1,555 ^r | 1,563 ^r | 1,561 ^r | 1,567 |
| China | 37,700 | 47,000 ^r | 51,300 ^r | 58,978 | 60,907 |
| France ^e | 430 | 315 | 300 | 300 | 300 |
| Germany | 1,854 ^r | 2,244 ^r | 1,910 ^r | 1,910 ^r | 1,900 ^e |
| Greece | 784 | 812 | 814 ^r | 807 | 821 |
| Guinea | 150 | -- | -- | -- | -- |
| Hungary | 110 | 81 | 61 | -- ^r | -- |
| India | 4,347 | 4,040 | 5,060 | 5,512 | 6,028 |
| Indonesia | -- | -- | -- | 70 | 600 ^e |
| Iran | 227 | 249 ^r | 251 ^r | 241 ^r | 250 ^e |
| Ireland | 1,926 | 1,935 | 1,951 | 1,983 | 1,967 |
| Jamaica | 1,758 | 1,855 | 1,851 | 1,865 | 1,865 |
| Japan ³ | 250 ^e | 250 ^e | 100 ^e | 15 | 80 ^e |
| Kazakhstan | 1,760 | 1,590 | 1,419 | 1,448 | 1,500 ^e |
| Romania | 414 | 391 | 363 | 405 | 467 |
| Russia | 2,719 | 2,659 | 2,572 | 2,593 | 2,680 |
| Saudi Arabia | -- | -- | 23 | 846 | 1,429 |
| Spain | 1,500 ^e | 1,573 | 1,517 | 1,633 | 1,579 |
| Suriname | 1,203 | 1,149 ^r | 1,149 ^r | 748 | -- |
| Turkey ^e | 280 ^r | 280 ^r | 280 ^r | 290 ^r | 280 |
| Ukraine | 1,429 | 1,494 | 1,457 ^r | 1,481 | 1,510 |
| United States | 4,370 | 4,320 | 4,460 | 4,550 | 2,360 |
| Venezuela | 808 | 580 | 660 | 465 | 500 ^e |
| Vietnam | -- | 214 | 485 | 484 | 600 |
| Total | 97,100 ^r | 106,000 ^r | 111,000 ^r | 119,000 ^r | 121,000 |

^eEstimated. ^rRevised. -- Zero.

¹Table includes data available through May 1, 2017. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

²Figures represent calcined alumina or the total of calcined alumina plus the calcined equivalent of hydrate when available; exceptions, if known, are noted.

³Data are for alumina used principally for specialty applications. Information on aluminum hydroxide for all uses is not adequate to make estimates of production levels.