

BAUXITE AND ALUMINA

By Patricia A. Plunkert

Domestic survey data and tables were prepared by Micheal George, statistical assistant, and the world production tables were prepared by Regina R. Coleman, international data coordinator.

Bauxite is a naturally occurring, heterogeneous material comprised primarily of one or more aluminum hydroxide minerals plus various mixtures of silica (SiO_2), iron oxide (Fe_2O_3), titania (TiO_2), aluminosilicates (clay, etc.), and other impurities in trace amounts. The principal aluminum hydroxide minerals found in varying proportions within bauxite are gibbsite [$\text{Al}(\text{OH})_3$] and the polymorphs, boehmite and diaspore [both $\text{AlO}(\text{OH})$].

Bauxite is typically classified according to its intended commercial application, such as abrasive, cement, chemical, metallurgical, and refractory. Of all bauxite mined, approximately 85% is converted to alumina (Al_2O_3) for the production of aluminum metal, an additional 10% goes to nonmetal uses as various forms of specialty alumina, and the remaining 5% is used for nonmetallurgical bauxite applications. The bulk of world bauxite production is, therefore, used as feed for the manufacture of alumina via a wet chemical caustic leach process known as the Bayer process. The majority of the alumina produced from this refining process is smelted using the Hall-Héroult process to produce aluminum metal by electrolytic reduction in a molten bath of natural or synthetic cryolite (NaAlF_6).

Specifications for the nonmetallurgical grades of bauxite are more stringent than those for bauxite used to produce metal and are based on the processing requirements and special properties required of their final commercial products. The natural chemical impurities that exist within these specialty-grade raw materials are not chemically removed by refining as is the case for metallurgical-grade bauxite. Nonmetallurgical ores in an essentially unrefined chemical form are used as direct feed for the production of their ultimate end products. Although figures on bauxite production and consumption within nonmetallurgical markets are not commonly available, the principal industrial end uses for nonmetallurgical-grade bauxite are considered to be in refractories and abrasives, followed by cement applications. In addition, the aluminum chemicals and steel industries also consume significant quantities of bauxite.

In 1999, 22 countries reported bauxite mine production, and total world production increased by 4% compared with that of 1998. Australia, Brazil, Guinea, and Jamaica accounted for about 70% of the total bauxite mined in 1999. The principal sources of nonmetallurgical-grade bauxite are limited to only a handful of countries; abrasive grade is produced in Australia, China, Guinea, and Guyana, and refractory grade, in Brazil, China, and Guyana (Sehnke, 1995, p. 40).

Total reported world reserves of bauxite are sufficient to meet cumulative world primary aluminum metal demand well into the 21st century. Although bauxite reserves are unevenly distributed throughout the world, with approximately 90% in about a dozen countries, the sheer magnitude of these reserves (25 billion metric tons) is sufficient to ensure a readily

accessible supply for the future (Plunkert, 2000).

U.S. production of alumina (calcined equivalent), derived almost exclusively from imported metallurgical-grade bauxite, decreased by 12% in 1999 compared with that of 1998. An estimated 94% of the alumina shipped by U.S. refineries went to domestic primary smelters for aluminum metal production. Consumption by the abrasives, chemicals, refractories, and specialties industries accounted for the remainder of U.S. alumina shipments.

World output of alumina increased slightly in 1999. The principal producing countries, in descending order of alumina output, were Australia, the United States, China, and Jamaica. These countries accounted for more than 55% of the world's production; Australia alone accounted for almost one-third of total world production.

Legislation and Government Programs

In October 1999, the Defense Logistics Agency (DLA) released its Annual Materials Plan (AMP) for the National Defense Stockpile (NDS) for fiscal year 2000. The 2000 AMP, including its subsequent revisions, provided for the sale of 3.56 million metric tons (Mt) (3.5 million long tons) of metallurgical-grade bauxite, of which 2.03 Mt (2 million long tons) was Jamaica type and 1.52 Mt (1.5 million long tons) was Suriname type. Also, as part of the plan, the DLA was authorized to dispose of 29,500 calcined tons (29,000 long calcined tons) of refractory-grade bauxite in fiscal year 2000. These were the maximum amounts recommended for disposal during the fiscal year, and the actual level of sales was to be dependent upon the prevailing market conditions (Defense Logistics Agency, 1999a).

During calendar year 1999, the DLA announced the following sales of bauxite from the NDS: 29,500 calcined tons (29,000 long calcined tons) of refractory-grade bauxite for an approximate value of \$3 million to Harbison-Walker Refractories Co. and National Refractory & Minerals Corp. (Defense Logistics Agency, 1999c); 61,000 metric tons (t) (60,000 long tons) of metallurgical-grade bauxite, Suriname type, for an approximate value of \$600,000 to River Resources Inc. (Defense Logistics Agency, 1999b); 432,000 t (425,000 long tons) of metallurgical-grade bauxite, Suriname type, for an estimated market value of \$630,000 plus an option for an additional 640,000 t (630,000 long tons) in fiscal year 2000 for a total provisional value of approximately \$1.6 million to Alcoa Inc. (Defense Logistics Agency, 1999d); 127,000 t (125,000 long tons) metallurgical-grade bauxite, Suriname type, for an estimated market value of \$1.1 million to Bulk Materials International (Defense Logistics Agency, 1999e); 234,000 t (230,000 long tons) of metallurgical-grade bauxite, Suriname type, for an estimated market value of \$186,000 plus an option

for an additional 102,000 t (100,000 long tons) in fiscal year 2001 for a total provisional value of approximately \$270,000 to Alcoa (Defense Logistics Agency, 1999f); and 2.7 Mt (2.66 million tons) of metallurgical-grade bauxite, Jamaica type, for an approximate value of \$19.4 million (Thomas Rasmussen, Defense Logistics Agency, oral commun., 2000). Option quantities are subject to AMP authority for each of the out years.

At yearend 1999, the NDS uncommitted inventory for metallurgical-grade bauxite was 5.96 Mt (5.87 million long tons) of Jamaica type and 769,000 t (757,000 long tons) of Suriname type. The NDS calcined refractory-grade bauxite inventory was 44,500 calcined tons (43,800 long calcined tons) (Defense Logistics Agency, 2000).

Industry Structure—Mergers

On August 19, 1999, Alcoa and Reynolds Metals Company announced that they had reached a definitive merger agreement under which Alcoa would acquire all outstanding shares of Reynolds in a stock-for-stock transaction. Alcoa, which was the world's leading producer of primary aluminum, fabricated aluminum, and alumina, had 215 operating locations in 31 countries. Revenues for all of 1999 were \$16.3 billion (Alcoa Inc., 2000b, p. 56). Reynolds, which was the third largest aluminum company in the world, employed approximately 18,000 people at more than 100 locations in 24 countries. Reynolds revenues in 1999 were \$4.8 billion (Reynolds Metals Company, 2000, p. 20). The merger was dependent upon the approval of Reynold's shareholders, the Antitrust Division of the U.S. Department of Justice (DOJ), and the European Union (EU) (Alcoa Inc., 1999a).

On May 3, 2000, Alcoa and Reynolds announced that the DOJ and the EU had approved their proposed merger and that the merger had been completed. Reynolds shareholders had approved the merger on February 11. Under the terms of the consent decree entered into with the DOJ and an undertaking agreement with the EU, Alcoa will sell a 25% interest in Reynolds' Longview, WA, smelter, as well as Reynolds' interests in three alumina refineries—Worsley, Australia (56%); Stade, Germany (50%); and Sherwin, TX (100%). As a result of the merger, each outstanding share of Reynolds common stock was converted into 1.06 shares of Alcoa common stock (Alcoa Inc., 2000a).

On August 11, 1999, Alcan Aluminium Limited, Pechiney, and algroup, which was the aluminum division of Alusuisse Lonza Group Inc., announced that they had reached agreement on the principal terms of a proposed merger of the three companies. The combined company, if approved, would be called A.P.A. and would employ approximately 91,000 people in 59 countries. In 1999, Alcan, algroup, and Pechiney had combined sales and operating revenues of \$18.9 billion (Alcan Aluminium Limited, 2000c, p. 66; algroup, 2000, p. 34; Pechiney, 2000, p. 161). On completion of the proposed merger, Alcan shareholders would hold 44% of the share capital of A.P.A.; Pechiney, 29%; and algroup, 27%. The merger was subject to approval by the companies' shareholders, the DOJ, and the EU (Alcan Aluminium Limited, 1999a, p. 1).

On April 13, 2000, the three companies announced their decision to withdraw the previously announced three-way merger plan and to terminate their Combination Agreement

insofar as Pechiney was concerned. The companies had been unable to receive regulatory approval from either the DOJ or the EU. According to the companies, the required divestments for approval would have threatened the economic viability of the proposed three-way merger. The Combination Agreement between Alcan and algroup, however, remained in effect with respect to their proposed two-way merger (Alcan Aluminium Limited, 2000d).

On April 21, Alcan reported that the applicable waiting period under U.S. antitrust regulations had expired and, consequently, that there was no U.S. antitrust barrier to proceeding with the Alcan-algroup merger (Alcan Aluminium Limited, 2000a). The EU gave its approval subject to commitments made by the companies to alleviate the EU's competition concerns in the aluminium trihydrate (ATH) market. Among its commitments, Alcan proposed selling algroup's ATH facility in Martinswerk, Germany, and the algroup lithography operations in Bridgenorth, United Kingdom (Platt's Metals Week, 2000).

On June 1, the companies announced that they had reached agreement on their revised merger plan. Pending shareholder approval, the merger will involve the combination of a cash payment and the exchange of 17.1 Alcan common shares for every algroup share. The combined sales and operating revenues of the two companies in 1999 was \$12.3 billion (Alcan Aluminium Limited, 2000c, p. 66; algroup, 2000, p. 34). Alcan, which was a leading producer of primary metal and rolled products, had operations in more than 30 countries with some 30,000 employees. Algroup, which was one of Switzerland's largest corporations, employed more than 23,000 people who were engaged in aluminum and packaging activities in 18 countries (Alcan Aluminum Limited, 2000b).

Production

Bauxite.—For many years, domestic mines have supplied less than 1% of the U.S. requirement for bauxite. Essentially all the domestic bauxite production is used in nonmetallurgical products, such as abrasives, chemicals, proppants, and refractories. Thus, the United States imports almost all the bauxite, especially the metallurgical grade, that it requires.

Alumina.—On July 5, Kaiser Aluminum & Chemical Corp.'s Gramercy, LA, alumina refinery was extensively damaged by an explosion in the digester area of the plant. As a result of the incident, alumina production at the 1.05-million-metric-ton-per-year (Mt/yr) facility was completely curtailed (Kaiser Aluminum & Chemical Corp., 2000a, p. 2). Kaiser is proceeding with a \$198 million project that includes rebuilding the damaged portion of the plant and upgrading other parts of the facility. The company expects the plant to be partially operational by the third quarter of 2000 and fully operational by the first quarter of 2001 (Kaiser Aluminum & Chemical Corp., 2000b).

Kaiser purchased LaRoche Industries Inc.'s 45% interest in Kaiser LaRoche Hydrate Partners (KLHP) for \$10 million. KLHP was a marketing partnership formed in 1993 by Kaiser and LaRoche to sell alumina hydrate produced by Kaiser at its Gramercy plant to manufacturers of flame retardants and other specialty chemicals (Kaiser Aluminum & Chemical Corp., 1999).

Ormet Corporation began a \$30 million modernization of its

600,000-metric-ton-per-year (t/yr) alumina refinery at Burnside, LA. The technology upgrade will enable the use of a wider range of bauxite grades, which in turn would offer advantages in raw material costs, provide improvements in refinery productivity, and increase capacity by 400,000 t/yr. Ormet expects to complete the first phase of its modernization program by the end of 2000. In addition to metallurgical grade alumina, the Burnside plant also produces some specialty aluminas for use in ceramics, abrasives, and flame retardants (Ormet Corporation, 1999).

UOP LLC, a supplier of process technology, catalysts, and adsorbents, purchased LaRoche's specialty alumina business. The purchase included the Baton Rouge, LA, manufacturing facility, the full alumina product line, including LaRoche's proprietary Versal™ aluminas, and LaRoche's 50% interest in the CRILAR joint venture with Criterion Catalyst Company LP (UOP LLC, 1999).

Consumption

Bauxite.—Total domestic consumption of bauxite decreased by approximately 10% compared with that of 1998. Most of the decrease in consumption was for alumina production. The cessation of production at the damaged Gramercy refinery accounted for the bulk of the decrease. In 1999, 95% of the bauxite consumed in the United States was refined to alumina (an estimated 2.2 t of dried bauxite was required to produce 1 t of alumina); the remaining 5% was consumed in nonmetallurgical applications (table 4). Domestic production and consumption data for bauxite and alumina were obtained by the U.S. Geological Survey from three separate, voluntary surveys of U.S. operations. Typical of these surveys is "Bauxite Consumption," sent to 49 operations, 37 of which responded, representing 91% of total bauxite consumption listed in table 4.

Global Technologies Inc., parent of Harbison-Walker, was acquired by RHI AG, an Austrian company. Harbison-Walker was a bauxite consumer and a producer of refractory materials. The new company name is RHI Refractories America (Robertson, 1999).

Alumina.—An estimated 94% of the alumina shipped by U.S. alumina plants went to domestic primary aluminum smelters for metal production. In 1999, 23 primary aluminum smelters consumed 7.34 Mt of alumina. Consumption in various forms by the abrasives, chemicals, refractories, and specialties industries accounted for the remainder of U.S. alumina use.

Prices

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

Industrial Minerals (1999b) quoted end-of-year prices for several types of imported refractory-grade bauxite from China and Guyana. The price quotes for Chinese refractory-grade bauxite, minimum 87% Al₂O₃ f.o.b. Chinese ports, were as follows: Shanxi, shaft, lump, \$70 to \$75 per ton, and rotary, lump, \$86 to \$95 per ton, and Guizhou, round, lump, \$70 to

\$75 per ton. The price ranges for Guyanese refractory-grade bauxite were as follows: \$155 to \$175 per ton, f.o.b. barge, U.S. Gulf Coast, and \$165 to \$175 per ton, c.i.f. Europe.

The 1999 annual average values of U.S. imports of metallurgical-grade bauxite are listed in table 8.

The market or spot prices for alumina trended upward during the year. According to Metal Bulletin, metallurgical-grade alumina spot prices on international markets began 1999 at \$145 to \$160 per ton. The price range narrowed slightly at the end of February to \$145 to \$155 per ton, then decreased to \$140 to \$150 per ton at the end of March before beginning a steady upward climb at the end of April that continued through the end of the year. By yearend, the price range had increased to \$375 to \$385 per ton. A limited supply of alumina was cited as the reason for the increase in both the spot and contract prices (Metal Bulletin, 1999a). Trade data released by the U.S. Census Bureau indicated that the average annual value of U.S. imports of calcined alumina was \$203 per ton, f.a.s. port of shipment, and \$217 per ton, c.i.f. U.S. ports.

Foreign Trade

In addition to the trade data listed in tables 9-11, various specialty aluminum compounds were also exported from and imported to the United States. The compounds exported included 6,670 t of aluminum sulfate, 16,000 t of aluminum chloride, 9,020 t of aluminum oxide abrasives, and 16,100 t of various fluoride-based compounds of aluminum, including synthetic cryolite and aluminum fluoride. The compounds imported included 31,600 t of aluminum sulfate, 282 t of aluminum chloride, 166,000 t of aluminum oxide abrasives, and 19,300 t of various fluoride-based aluminum compounds.

World Review

In 1999, world production of bauxite increased compared with that of 1998 (table 12). Mine production was reported in 22 countries, and total world production amounted to slightly more than 127 Mt. The largest producers of bauxite, in decreasing order of tonnage mined, continued to be Australia, Guinea, Brazil, and Jamaica, accounting for about 70% of total world production.

World output of alumina increased slightly in 1999 compared with that of 1998 (table 13). The four principal producing countries, in order of quantity of alumina produced, were Australia, the United States, China, and Jamaica. These countries accounted for more than 55% of the world's production; Australia alone accounted for almost one-third.

Australia.—In mid-1999, Alcoa completed a \$260 million expansion at its Wagerup alumina refinery. Capacity at the plant was increased by 440,000 t/yr to 2.2 Mt/yr (Alcoa Inc., 2000b, p. 17).

Brazil.—Vale do Rio Doce Alumínio S.A. (Aluvalle), a wholly owned subsidiary of Companhia Vale do Rio Doce (CVRD), and Hydro Aluminium A.S., a wholly owned subsidiary of Norsk Hydro ASA, signed a memorandum of understanding (MOU) with the intention of making Hydro a partner in Alumina do Norte do Brasil S.A. (Alunorte), an alumina refinery in the State of Pará. According to the MOU, Hydro would acquire a 25.3% interest in Alunorte with a guaranteed receipt of 378,000 t/yr of alumina. Hydro would

also participate in a planned expansion that would increase the capacity of the refinery from 1.5 Mt/yr to 2.3 Mt/yr by 2002 (Norsk Hydro ASA, 1999; Kepp, 1999).

China.—To meet the increased demand of aluminum metal producers, alumina refinery production increased an estimated 15% in 1999 compared with that of 1998 (table 13). Despite this increase, China continued to be dependent upon imports to meet its alumina supply shortages. Imports of alumina in 1999 were expected to remain at the 1998 level of about 1.6 Mt (American Metal Market, 1999).

Pingguo Aluminium Co. announced plans to increase capacity at its 350,000-t/yr alumina refinery in Guangxi to 950,000 t/yr. The company was in the process of increasing capacity by 300,000 t/yr through upgrades, which it hoped to complete by the end of 2000. An additional 300,000-t/yr increase was awaiting approval from the Government (Platt's Metals Week, 1999b).

Guizhou Aluminium Works and Pechiney have been working on an alumina digestion system that will increase capacity at Guizhou's 400,000-t/yr refinery. Upon completion at the end of 2000, capacity at the refinery was expected to increase to 500,000 t/yr (Metal Bulletin, 1999b).

Shandong Aluminium Plant announced plans to increase capacity at its 620,000-t/yr alumina refinery. The company has applied to the State for approval and loan packages, and expects to start construction by mid-2000. Upon completion, capacity would increase to 770,000 t/yr (Platt's Metals Week, 1999c).

Guyana.—The Government announced plans to privatize its two State-owned bauxite companies, Berbice Mining Enterprises Ltd. (Bermine) and Linden Mining Enterprise Ltd. (Linmine). The Government planned to offer a majority ownership (60%) in each of the two companies. The money paid by the private investors would be used by the new companies, which would be created to operate Bermine's and Linmine's existing facilities, to fund necessary capital improvements (Industrial Minerals, 1999a).

Hungary.—Bakony Bauxite Mines announced plans to open a new bauxite mine at Bakonyoszlop. Exploration, which was completed in 1997, indicated reserves of 4.4 Mt. The open pit mine was expected to produce at least 650,000 t/yr (Platt's Metals Week, 1999a).

India.—The Tata Group withdrew from the Utkal Aluminium International Ltd. (Uktal) alumina refinery project. Tata's 20% stake in the 1-Mt/yr alumina refinery was split between two of the other partners in the joint venture—Alcan and Norsk Hydro. Alcan's share increased to 35% from 20%, Norsk Hydro's share increased to 45% from 40%, and the Indian Aluminium Co. Ltd.'s (Indal) share remained at 20% (Raghuvanshi, 1999). Financing for the \$1 billion project was expected to be completed by the end of 2001. Following 4 years of construction work, production was scheduled to begin in 2005 (Metal Bulletin, 1999c).

Ireland.—Alcan sold its 1.4-Mt/yr Aughinish alumina refinery to Glencore AG. Terms of the transaction were not disclosed (Alcan Aluminium Limited, 1999b).

Jamaica.—Alumina Partners of Jamaica (Alpart) and Jamalco agreed to merge their mining operations. Alpart, a joint venture of Kaiser (65%) and Norsk Hydro (35%), operated a 3.6-Mt/yr bauxite mine on the Manchester Plateau. Jamalco, a 50-50 joint venture of Alcoa and the Jamaican Government,

operated a 2-Mt/yr mine in Clarendon Parish. The merger of the mining operations, which are in close proximity to each other, is designed to improve production efficiencies and to reduce costs (Mining Journal, 1999).

Russia.—Sevuralboksitruda and its main customer, Bogoslovsk aluminum works, spent an estimated \$740,000 (18.5 million rubles) during the first 10 months of 1999 on the construction of the new Novo-Kalinskaya deep bauxite mine. The first stage of production is expected to come on-stream in 2003, at which time production at existing deep mines will be scaled back. In 1999, Sevuralboksitruda also began open pit mining at Olkhovskoye, a new bauxite field. Sevuralboksitruda was Russia's largest bauxite producer and produced an estimated 70% of Russian bauxite (Interfax Mining & Metals Report, 1999).

Spain.—Alcoa announced a modernization plan for its 1.11-Mt/yr San Ciprian alumina refinery that would increase capacity by 220,000 t/yr. The expansion will use state-of-the-art technology developed at San Ciprian and other Alcoa plants. Basic engineering for the project has been completed, and the work was expected to be finished by March 2001 (Alcoa Inc., 2000b, p. 17).

Technology

Alcoa has applied for a patent for a new process that improves refinery productivity by reducing the amount of carbonate in the Bayer circuit liquor. Other benefits include improved lime efficiency and a decrease in the alkalinity of the mud residue. Alcoa has begun an engineering retrofit employing this new process at its Pinjarra refinery in Western Australia, which is expected to increase capacity at the plant by 165,000 t/yr upon completion in early 2001. Commercial trials are also being planned at Alcoa's Kwinana, Australia, and Point Comfort, TX, refineries (Alcoa Inc., 1999b).

Outlook

Identified world bauxite reserves are sufficient to meet cumulative world demand well into the 21st century. Considering the probability of discovering additional bauxite deposits plus the added possibility of employing lower grade bauxite occurrences and various alternative sources of alumina, world resources of aluminum remain adequate to satisfy demand for the foreseeable future.

Aluminum demand in the United States and the rest of the world should remain strong with the major growth area continuing to be the transportation industry, especially the automotive market. World metal production should keep pace with demand despite some short-term idling of smelter capacity in the United States owing to increases in domestic energy costs. Despite the loss of production from Kaiser's Gramercy facility, recent alumina refinery expansions in other areas of the world, coupled with announced smelter closures, indicate that world alumina supply should be more than sufficient to meet demand in the near future.

References Cited

Alcan Aluminium Limited, 1999a, Alcan, Pechiney, and Algroup announce proposed merger to form world's largest aluminium company and global leader in both flexible and specialty packaging: Montreal, Alcan Aluminium Limited

- press release, August 11, 22 p.
- 1999b, Alcan's sale of Auginish plant completed: Montreal, Alcan Aluminium Limited press release, February 25, 1 p.
- 2000a, Alcan Aluminium Limited advises that the applicable waiting period under U.S. antitrust regulations with respect to the proposed Alcan-algroup merger has expired: Montreal, Alcan Aluminium Limited press release, April 21, 1 p.
- 2000b, Alcan and algroup to merge: Montreal, Canada, and Zurich, Switzerland, Alcan Aluminium Limited press release, June 1, 2 p.
- 2000c, Annual report—1999: Montreal, Alcan Aluminium Limited, 69 p.
- 2000d, Proposed Alcan-Pechiney-algroup merger will not proceed; Alcan-algroup merger agreement remains in force: Montreal, Canada, Paris, France, and Zurich, Switzerland, Alcan Aluminium Limited press release, April 13, 2 p.
- Alcoa Inc., 1999a, Alcoa and Reynolds agree to merge: Pittsburgh, PA, and Richmond, VA, Alcoa Inc. press release, August 19, 2 p.
- 1999b, Alcoa World Alumina develops a productivity breakthrough in alumina refining: Pittsburgh, PA, Alcoa press release, May 12, 1 p.
- 2000a, Alcoa completes merger with Reynolds Metals: Pittsburgh, PA, and Richmond, VA, Alcoa Inc. press release, May 3, 1 p.
- 2000b, Annual report—1999: Pittsburgh, PA, Alcoa Inc., 67 p.
- algroup, 2000, Annual report—1999: Zurich, algroup, 72 p.
- American Metal Market, 1999, China's October alumina imports fall: American Metal Market, v. 107, no. 222, November 17, p. 5.
- Defense Logistics Agency, 1999a, Revised FY 2000 annual materials plan: Fort Belvoir, VA, Defense Logistic Agency news release, November 23, 3 p.
- 1999b, Stockpile accepts metallurgical grade, Surinam [sic] type bauxite offer: Fort Belvoir, VA, Defense Logistics Agency news release, April 1, 1 p.
- 1999c, Stockpile accepts refractory grade bauxite offers: Fort Belvoir, VA, Defense Logistics Agency news release, May 19, 1 p.
- 1999d, Stockpile accepts Surinam [sic] type bauxite offer: Fort Belvoir, VA, Defense Logistics Agency new release, June 4, 1 p.
- 1999e, Stockpile accepts Surinam [sic] type bauxite offer: Fort Belvoir, VA, Defense Logistics Agency news release, November 3, 1 p.
- 1999f, Stockpile accepts Surinam [sic] type bauxite offer: Fort Belvoir, VA, Defense Logistics Agency news release, December 1, 1 p.
- 2000, Inventory of stockpile material L-1: Defense Logistics Agency, January 14, 3 p.
- Industrial Minerals, 1999a, Bauxite industry new privatisation tender: Industrial Minerals, no. 376, January, p. 15.
- 1999b, Prices: Industrial Minerals, no. 387, December, p. 70.
- Interfax Mining & Metals Report, 1999, Russian bauxite producer to raise output: Interfax Mining & Metals Report, v. VIII, issue 47 (401), November 12-18, p. 10.
- Kaiser Aluminum & Chemical Corp., 1999, Kaiser Aluminum acquires full ownership of alumina hydrate joint venture: Houston, TX, Kaiser Aluminum & Chemical Corp. press release, February 26, 1 p.
- 2000a, Form 10-K—1999: Securities and Exchange Commission, 71 p.
- 2000b, Kaiser Aluminum reports results for second quarter of 2000: Houston, TX, Kaiser Aluminum & Chemical Corp. press release, July 26, 2 p.
- Kepp, Michael, 1999, Brazil's CVRD in aluminum suit: American Metal Market, v. 107, no. 197, October 13, p. 2.
- Metal Bulletin, 1999a, Alumina market still waiting for 2000 contracts: Metal Bulletin, no. 8439, December 13, p. 11.
- 1999b, Guizhou alumina output to rise with Pechiney tie-up: Metal Bulletin, no. 8414, October 4, p. 7.
- 1999c, Uktal alumina project faces delays: Metal Bulletin, no. 8423, November 4, p. 5.
- Mining Journal, 1999, Jamaican bauxite merger: Mining Journal, v. 332, no. 8535, June 11, p. 434.
- Norsk Hydro ASA, 1999, Aluvale and Hydro Aluminium signed today a memorandum: Oslo, Norway, Norsk Hydro press release, July 8, 1 p.
- Ormet Corporation, 1999, USWA Local 14465 ratifies contract extension at Ormet Primary Aluminum Corporation's Burnside alumina plant: Wheeling, WV, Ormet Corporation press release, April 16, 1 p.
- Pechiney, 2000, Form 20-F—1999: Securities and Exchange Commission, 167 p.
- Platt's Metals Week, 1999a, New bauxite mine for Hungary: Platt's Metals Week, v. 70, no. 18, May 3, p. 6.
- 1999b, Pingguo plans expansions: Platt's Metals Week, v. 70, no. 33, August 16, p. 16.
- 1999c, Shandong to hike alumina capacity: Platt's Metals Week, v. 70, no. 50, December 13, p. 13.
- 2000, EC forces rethink of Alcan-Pechiney merger plan: Platt's Metals Week, v. 71, no. 12, p. 1, 10-11.
- Plunkert, P.A., 2000, Bauxite and alumina: U.S. Geological Survey Mineral Commodity Summaries 2000, p. 32-33.
- Raghuvanshi, Vivek, 1999, Uktal names new chairman: American Metal Market, v. 107, no. 95, May 18, p. 7.
- Reynolds Metals Company, 2000, Form 10-K405—1999: Securities and Exchange Commission, 76 p.
- Robertson, Scott, 1999, Harbison-Walker well prepared for merger: American Metal Market, v. 107, no. 134, July 14, p. 4.
- Sehnke, E.D., 1995, Bauxite—A global review: Industrial Minerals, no. 335, August, p. 39-51.
- UOP LLC, 1999, UOP acquires aluminas business from LaRoche Industries: Des Plaines, IL, UOP LLC press release, June 3, 1 p.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

- Aluminum. Ch. in Mineral Commodity Summaries, annual.¹
- Aluminum. Mineral Industry Surveys, monthly.¹
- Aluminum and bauxite. Ch. in United States Mineral Resources, Professional Paper 820, 1973.
- Bauxite and alumina. Ch. in Mineral Commodity Summaries, annual.¹
- Primary Aluminum Plants Worldwide, 1998.¹
- U.S. Trade in Bauxite and Alumina. Mineral Industry Surveys, quarterly.¹
- World Bauxite Resources, Professional Paper 1076-B, 1986.
- World Nonbauxite Aluminum Resources—Alunite, Professional Paper 1076-A, 1978.
- World Nonbauxite Aluminum Resources Excluding Alunite, Professional Paper 1076-C, 1990.

Other

- Aluminum. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
- Alumina Plants Worldwide, U.S. Bureau of Mines, 1993.
- Bauxite Mines Worldwide, U.S. Bureau of Mines, 1994.
- CRU. Alumina Monitor (monthly).

¹Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
SALIENT BAUXITE STATISTICS 1/

(Thousand metric tons)

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|--|---------|------------|------------|---------|------------|
| <u>United States:</u> | | | | | |
| Production, crude ore (dry equivalent) | W | W | NA | NA | NA |
| Value | W | W | NA | NA | NA |
| <u>Exports (as shipped):</u> | | | | | |
| Crude and dried | 86 | 92 | 64 | 83 | 115 |
| Calcined | 22 | 40 | 21 | 16 | 34 |
| <u>Imports for consumption (as shipped):</u> | | | | | |
| Crude and dried | 10,100 | 10,200 | 10,700 | 11,000 | 9,890 |
| Calcined | 482 | 352 | 369 | 393 | 299 |
| Consumption (dry equivalent) | 10,900 | 11,000 | 11,500 | 12,700 | 11,700 |
| World, production | 112,000 | 117,000 r/ | 122,000 r/ | 122,000 | 127,000 e/ |

e/ Estimated. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.

1/ Data are rounded to no more than three significant digits.

TABLE 2
PRODUCTION AND SHIPMENTS OF ALUMINA IN THE UNITED STATES 1/

(Thousand metric tons)

| Year | Calcined alumina | Other alumina 2/ | Total | |
|-----------------------|------------------|------------------|---------------------------|---------------------|
| | | | As produced or shipped 3/ | Calcined equivalent |
| <u>Production: e/</u> | | | | |
| 1998 | 5,100 | 820 | 5,920 | 5,590 |
| 1999 | 4,620 | 780 | 5,400 | 4,930 |
| <u>Shipments: e/</u> | | | | |
| 1998 | 5,080 | 822 | 5,910 | 5,580 |
| 1999 | 4,600 | 780 | 5,380 | 4,910 |

e/ Estimated.

1/ Data are rounded to no more than three significant digits.

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

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

TABLE 3
CAPACITIES OF DOMESTIC ALUMINA PLANTS, DECEMBER 31 1/ 2/

(Thousand metric tons per year)

| Company and plant | 1998 | 1999 |
|---|-------|-------|
| <u>Alcoa Inc.:</u> | | |
| Point Comfort, TX | 2,300 | 2,300 |
| St. Croix, VI | 600 | 600 |
| Total | 2,900 | 2,900 |
| <u>Kaiser Aluminum & Chemical Corp., Gramercy, LA</u> | | |
| Ormet Corporation, Burnside, LA | 1,050 | (3/) |
| Reynolds Metals Company, Corpus Christi, TX | 600 | 600 |
| Grand total | 1,600 | 1,600 |
| | 6,150 | 5,100 |

1/ Capacity may vary depending on the bauxite used.

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

3/ Damaged in an explosion, under repair.

TABLE 4
U.S. CONSUMPTION OF BAUXITE, BY INDUSTRY 1/

(Thousand metric tons, dry equivalent)

| Industry | 1998 | 1999 |
|------------|--------|--------|
| Abrasive | 135 | 113 |
| Alumina | 12,000 | 11,100 |
| Chemical | W | W |
| Refractory | 332 | 251 |
| Other 2/ | 291 | 229 |
| Total | 12,700 | 11,700 |

W Withheld to avoid disclosing company proprietary data.

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

2/ Includes cement, chemical, municipal water works, oil, and steel and ferroalloys.

TABLE 5
PRODUCTION AND SHIPMENTS OF SELECTED ALUMINUM
SALTS IN THE UNITED STATES IN 1998 1/

| Item | Number of producing plants | Production (thousand metric tons) | Total shipments, including interplant transfers | |
|--|----------------------------------|---|--|----------------------|
| | | | Quantity (thousand metric tons) | Value (thousands) |
| Aluminum sulfate: | | | | |
| Commercial and municipal (17% Al ₂ O ₃) | 65 | 1,060 | 1,020 | \$114,000 |
| Iron-free (17% Al ₂ O ₃) | 15 | 122 | 119 | 17,200 |
| Aluminum chloride: | | | | |
| Liquid and crystal | 5 | 28 | W | W |
| Anhydrous (100% AlCl ₃) | 3 | 27 | 27 | 32,600 |
| Aluminum fluoride, technical | 3 | W | W | W |
| Aluminum hydroxide, trihydrate [100% Al(OH) ₃] | 12 | 979 | 984 | 279,000 |
| Aluminates | 16 | W | W | W |
| Other aluminum compounds 2/ | XX | XX | XX | 204,000 |

W Withheld to avoid disclosing company proprietary data. XX Not applicable.

1/ Data are rounded to no more than three significant digits.

2/ Includes light aluminum hydroxide, cryolite, etc.

Source: Data are based on U.S. Census Bureau 1998 Current Industrial Reports, Series MA-28A, "Inorganic Chemicals."

TABLE 6
STOCKS OF BAUXITE IN THE UNITED STATES, DECEMBER 31 1/ 2/

(Thousand metric tons, dry equivalent)

| Sector | 1998 | 1999 |
|----------------------------------|--------|-------|
| Producers, processors, consumers | 1,860 | 1,440 |
| Government | 11,000 | 6,800 |
| Total | 12,800 | 8,250 |

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

2/ Domestic and foreign bauxite; crude, dried, calcined, activated, all grades.

TABLE 7
STOCKS OF ALUMINA IN THE UNITED STATES, DECEMBER 31 1/ 2/

(Thousand metric tons, calcined equivalent)

| Sector | 1998 | 1999 |
|-------------------------|-------|-------|
| Producers | 335 | 349 |
| Primary aluminum plants | 997 | 939 |
| Total | 1,330 | 1,290 |

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

2/ Excludes consumers stocks other than those at primary aluminum plants.

TABLE 8
AVERAGE VALUE OF U.S. IMPORTS OF CRUDE AND DRIED BAUXITE 1/

(Per metric ton)

| Country | 1997 | | 1998 | | 1999 | |
|------------------|---------------------------|----------------------------------|---------------------------|----------------------------------|---------------------------|----------------------------------|
| | Port of shipment (f.a.s.) | Delivered to U.S. ports (c.i.f.) | Port of shipment (f.a.s.) | Delivered to U.S. ports (c.i.f.) | Port of shipment (f.a.s.) | Delivered to U.S. ports (c.i.f.) |
| Australia | \$9.45 | \$20.47 | \$13.27 | \$22.51 | \$12.11 | \$20.09 |
| Brazil | 27.85 | 34.45 | 26.05 | 33.49 | 24.32 | 31.15 |
| Guinea | 26.35 | 33.35 r/ | 25.09 | 31.87 | 22.37 | 28.81 |
| Guyana | 25.07 | 35.42 | 31.21 | 39.08 | 24.58 | 35.66 |
| Jamaica | 20.41 | 25.56 | 16.74 | 21.78 | 17.05 | 23.93 |
| Weighted average | 24.64 | 31.31 r/ | 22.69 | 29.12 | 21.56 | 28.67 |

r/ Revised

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

TABLE 9
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF BAUXITE, CRUDE AND DRIED,
BY COUNTRY 1/

(Thousand metric tons)

| Country | 1998 | 1999 |
|-------------|--------|-------|
| Imports: 2/ | | |
| Australia | 158 | 59 |
| Brazil | 1,730 | 1,520 |
| Guinea | 3,880 | 4,060 |
| Guyana | 977 | 1,010 |
| Jamaica 3/ | 4,020 | 2,800 |
| Other | 235 | 456 |
| Total | 11,000 | 9,890 |
| Exports: | | |
| Canada | 60 | 99 |
| Mexico | 2 | 11 |
| Other | 21 | 5 |
| Total | 83 | 115 |

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

2/ Includes bauxite imported to the U.S. Virgin Islands from foreign countries.

3/ Dry equivalent of shipments to the United States.

NOTE: Total U.S. imports of crude and dried bauxite (including the U.S. Virgin Islands) as reported by the U.S. Census Bureau were as follows: 1998--10,800,000 tons and 1999--8,900,000 tons.

Sources: U.S. Census Bureau and the Jamaica Bauxite Institute.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF CALCINED BAUXITE, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

| Country | 1998 | | | | 1999 | | | |
|-----------------|------------------|----------|-------------|----------|------------------|----------|-------------|----------|
| | Refractory grade | | Other grade | | Refractory grade | | Other grade | |
| | Quantity | Value 2/ | Quantity | Value 2/ | Quantity | Value 2/ | Quantity | Value 2/ |
| Imports: | | | | | | | | |
| Australia | -- | -- | 15 | 1,590 | -- | -- | 22 | 2,380 |
| Brazil | 72 | 7,600 | 2 | 118 | 33 | 5,110 | 1 | 117 |
| China | 92 | 6,530 | 99 | 7,090 | 75 | 5,810 | 94 | 7,110 |
| Guyana | 32 | 3,570 | 59 | 1,620 | 42 | 4,700 | 12 | 1,010 |
| Other | 22 | 1,170 | -- | -- | 17 | 1,550 | 2 | 162 |
| Total | 218 | 18,900 | 175 | 10,400 | 167 | 17,200 | 132 | 10,800 |
| Exports: | | | | | | | | |
| Canada | 1 | 206 | 10 | 892 | 2 | 514 | 5 | 434 |
| Japan | (3/) | 21 | -- | -- | 17 | 3,480 | -- | -- |
| Mexico | 3 | 726 | (3/) | 101 | 6 | 1,170 | (3/) | 96 |
| Other | (3/) | 101 | 1 | 379 | 1 | 307 | 1 | 570 |
| Total | 5 | 1,050 | 11 | 1,370 | 27 | 5,470 | 7 | 1,100 |

-- Zero.

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

2/ Value at foreign port of shipment as reported to U.S. Customs Service.

3/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF ALUMINA, BY COUNTRY 1/

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

| Country | 1998 | | 1999 | |
|---------------------|----------|----------|----------|----------|
| | Quantity | Value 2/ | Quantity | Value 2/ |
| Imports: | | | | |
| Australia | 2,640 | 508,000 | 2,380 | 430,000 |
| Brazil | 81 | 16,600 | 44 | 18,900 |
| Canada | 93 | 58,800 | 92 | 58,800 |
| France | 12 | 18,700 | 11 | 19,000 |
| Germany | 50 | 71,800 | 64 | 71,600 |
| India | 235 | 44,100 | 135 | 21,300 |
| Jamaica | 374 | 76,200 | 357 | 60,600 |
| Japan | 15 | 12,500 | 7 | 12,900 |
| Suriname | 463 | 86,600 | 580 | 95,300 |
| Trinidad and Tobago | -- | -- | 31 | 4,990 |
| Venezuela | 28 | 12,700 | 56 | 18,700 |
| Other | 54 | 26,900 | 48 | 32,700 |
| Total | 4,050 | 933,000 | 3,810 | 845,000 |
| Exports: | | | | |
| Brazil | 1 | 2,530 | 1 | 2,040 |
| Canada | 757 | 230,000 | 923 | 224,000 |
| China | 28 | 5,820 | 27 | 7,310 |
| Finland | (3/) | 232 | (3/) | 318 |
| Mexico | 159 | 47,700 | 189 | 46,400 |
| Netherlands | 9 | 7,840 | 5 | 5,140 |
| Norway | (3/) | 163 | (3/) | 218 |
| Russia | 179 | 34,200 | (3/) | 97 |
| Sweden | (3/) | 895 | (3/) | 897 |
| Other | 150 | 159,000 | 88 | 148,000 |
| Total | 1,280 | 488,000 | 1,230 | 435,000 |

-- Zero.

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

2/ Value at foreign port of shipment as reported to U.S. Customs Service.

3/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 12
BAUXITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

| Country | 1995 | 1996 | 1997 | 1998 | 1999 e/ |
|---------------------------|---------|------------|------------|-----------|-----------|
| Albania e/ | 1 | 1 | 1 | -- | -- |
| Australia | 42,655 | 43,063 | 44,465 | 44,553 | 48,416 3/ |
| Bosnia and Herzegovina e/ | 75 | 75 | 75 | 75 | 75 |
| Brazil | 10,214 | 10,998 | 11,671 | 11,961 r/ | 12,880 p/ |
| China e/ | 5,000 | 6,200 | 8,000 | 8,200 | 8,500 |
| Croatia e/ | 2 3/ | -- | -- | -- | -- |
| Ghana | 523 r/ | 473 r/ | 519 r/ | 443 r/ | 353 3/ |
| Greece | 2,200 | 2,452 | 1,877 | 1,823 r/ | 1,883 |
| Guinea e/ 4/ | 15,800 | 15,600 r/ | 16,400 r/ | 15,000 | 15,000 |
| Guyana 4/ | 2,028 | 2,475 r/ | 2,467 r/ | 2,600 e/ | 3,300 |
| Hungary | 1,015 | 1,044 | 743 | 908 r/ | 1,000 |
| India | 5,240 | 5,757 | 6,019 r/ | 6,102 r/ | 6,200 |
| Indonesia | 899 | 842 | 809 | 1,056 | 1,116 3/ |
| Iran e/ | 148 | 150 | 150 | 260 r/ | 260 |
| Italy e/ | 11 | -- | -- | -- | -- |
| Jamaica 4/ 5/ | 10,857 | 11,863 | 11,987 | 12,646 | 11,688 p/ |
| Kazakhstan | 3,071 | 3,140 e/ | 3,380 e/ | 3,437 r/ | 3,607 |
| Malaysia | 184 | 219 | 279 | 160 r/ | 223 3/ |
| Mozambique | 11 e/ | 11 | 8 | 6 | 6 |
| Pakistan | 3 | 4 | 5 | 5 | 11 3/ |
| Romania | 174 | 175 | 127 | 162 r/ | -- 3/ |
| Russia e/ | 3,100 | 3,300 | 3,350 | 3,450 | 3,750 |
| Serbia and Montenegro | 60 | 323 | 470 | 226 r/ | 500 3/ |
| Suriname | 3,530 | 3,695 | 3,877 | 4,000 e/ | 4,000 |
| Turkey 6/ | 232 | 545 | 369 | 458 | 160 |
| United States | W | W | NA | NA | NA |
| Venezuela | 5,022 | 4,834 r/ | 4,967 r/ | 4,826 r/ | 4,193 p/ |
| Total | 112,000 | 117,000 r/ | 122,000 r/ | 122,000 | 127,000 |

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; not included in "Total."

-- Zero.

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

2/ Table includes data available through July 28, 2000.

3/ Reported figure.

4/ Dry bauxite equivalent of crude ore.

5/ Bauxite processed for conversion to alumina in Jamaica plus kiln-dried ore prepared for export.

6/ Public-sector production only.

TABLE 13
ALUMINA: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/

(Thousand metric tons)

| Country | 1995 | 1996 | 1997 | 1998 | 1999 e/ |
|---------------------------|----------|----------|-----------|-----------|-----------|
| Australia | 13,147 | 13,348 | 13,385 | 13,853 | 14,532 4/ |
| Azerbaijan e/ | 27 4/ | 5 | 10 | (5/) r/ | 10 |
| Bosnia and Herzegovina e/ | 50 | 50 | 50 | 50 | 50 |
| Brazil | 2,141 | 2,752 | 3,088 r/ | 3,322 r/ | 3,506 p/ |
| Canada | 1,064 | 1,060 | 1,165 | 1,229 r/ | 1,233 4/ |
| China e/ | 2,200 | 2,550 | 2,940 | 3,330 | 3,840 |
| France | 425 | 440 | 454 | 450 e/ | 400 |
| Germany | 750 | 755 | 738 r/ | 750 e/ | 600 |
| Greece | 598 | 602 | 602 e/ | 600 e/ | 600 |
| Guinea | 616 | 640 e/ | 650 r/ | 480 r/ e/ | 500 |
| Hungary | 184 | 208 | 76 | 138 r/ | 150 |
| India e/ | 1,650 4/ | 1,780 r/ | 1,860 r/ | 1,890 r/ | 1,900 |
| Ireland | 1,186 | 1,234 | 1,273 | 1,200 e/ | 1,200 |
| Italy | 857 | 881 | 913 r/ | 930 r/ | 973 4/ |
| Jamaica | 3,030 | 3,200 | 3,394 | 3,440 | 3,570 4/ |
| Japan 6/ | 363 | 337 | 368 r/ | 359 r/ | 352 4/ |
| Kazakhstan | 1,022 | 1,083 | 1,095 e/ | 1,085 | 1,152 4/ |
| Romania | 323 | 261 | 282 | 250 r/ | 277 4/ |
| Russia | 2,300 e/ | 2,105 | 2,400 e/ | 2,465 | 2,657 4/ |
| Serbia and Montenegro | 35 | 186 | 160 e/ | 153 r/ | 156 4/ |
| Slovakia e/ | 100 | 100 | 100 | 100 | 100 |
| Slovenia | 14 | 88 | 85 | 70 r/ e/ | 70 |
| Spain 7/ | 1,070 | 1,095 | 1,110 | 1,100 e/ | 1,200 |
| Suriname | 1,589 | 1,600 | 1,600 e/ | 1,600 e/ | 1,600 |
| Turkey | 172 | 159 | 164 | 157 | 100 |
| Ukraine e/ | 1,100 | 1,000 | 1,080 | 1,291 4/ | 1,230 4/ |
| United Kingdom e/ | 108 | 99 4/ | 100 | 96 r/ 4/ | 100 |
| United States | 4,530 | 4,700 | 5,090 | 5,590 | 4,928 4/ |
| Venezuela | 1,661 r/ | 1,701 r/ | 1,730 r/ | 1,553 r/ | 1,335 4/ |
| Total | 42,300 | 44,000 | 46,000 r/ | 47,500 r/ | 48,300 |

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available.

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

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

3/ Table includes data available through July 28, 2000.

4/ Reported figure.

5/ Production sharply curtailed or ceased.

6/ Data presented are for alumina used principally for specialty applications. Information on aluminum hydrate for all uses is not adequate to formulate estimates of production levels.

7/ Hydrate.