



# 2017 Minerals Yearbook

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## CHROMIUM [ADVANCE RELEASE]

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U.S. chromium apparent consumption was estimated to be 542,000 metric tons (t) on a contained-chromium basis in 2017, a 20% increase from that in 2016 (table 1). The increase in apparent industry demand was primarily in response to a greater demand for stainless steel in 2017 relative to demand in 2016; this resulted in an increase in overall ferrochromium imports in 2017 compared with those in 2016 as well as an increase in secondary production. Chromium apparent consumption in 2017 was 61% of the recorded high of 893,000 t in 1965.

Domestic reported consumption of chromium materials increased by 5% in 2017 compared with that of 2016. Steelmaking was the leading end use for chromium materials and accounted for 96% of consumption in 2017 (table 2). Superalloys and other end uses made up the remaining 4%.

Chromium exports were essentially unchanged in 2017 compared with those in 2016, based on U.S. Census Bureau trade data for chromite ore and chromium chemicals, chromium metal, ferroalloys, and stainless-steel mill products and scrap. Chromium imports increased by 16% on a contained-chromium basis to 633,000 t compared with those in 2016 (table 1).

The import unit value of chromite ore (gross weight) in 2017 increased by 31% from that in 2016, the import unit value of ferrochromium (gross weight) increased by 44% from that in 2016, and the import unit value of chromium metal decreased 3% from that in 2016. Prices and unit values of specific grades of chromite ore, chromium metal, and ferrochromium are reported in tables 1 and (or) 3.

World production of chromite ore in 2017 increased by 4% to 35.7 million metric tons (Mt) compared with the revised amount of 34.4 Mt in 2016. South Africa was the leading producer of chromite ore (table 8). World production of ferrochromium was essentially unchanged in 2017 compared with the amount in 2016. China was the leading producer of ferrochromium (table 9).

## Legislation and Government Programs

**Stockpile.**—The Defense Logistics Agency Strategic Materials, U.S. Department of Defense, disposed of chromium materials under its fiscal year 2017 (October 1, 2016, through September 30, 2017) Annual Materials Plan (AMP). Maximum disposal limits were based on the 2017 AMP for chromium materials, which were set at 21,319 t of chromium ferroalloys and 181 t of chromium metal (Defense Logistics Agency Strategic Materials, 2016).

During 2017, the quantity of chromium ferroalloys and chromium metal held in the National Defense Stockpile (NDS) decreased by 13% and decreased slightly, respectively, compared with stocks at yearend 2016 (table 2). As a result, the quantity of chromium materials in the NDS at yearend was equivalent to about 11% of U.S. chromium apparent consumption on a contained-chromium basis in 2017.

In October 2017, the U.S. International Trade Commission (USITC) announced its final determination of its 5-year “sunset” review of outstanding orders on stainless-steel sheet and strip in coils from Japan, the Republic of Korea, and Taiwan. The USITC found that the revocation of the countervailing duty (CVD) order on imports from the Republic of Korea and the antidumping duties on imports from Japan, the Republic of Korea, and Taiwan would likely lead to the continuation or recurrence of material injury to an industry in the United States. As a result, existing antidumping orders on stainless-steel sheet and strip imports from Japan, the Republic of Korea, and Taiwan and CVD orders on imports of stainless-steel sheet and strip from the Republic of Korea would remain effective for an additional 5 years (U.S. International Trade Commission, 2017).

**Other Programs.**—Chromium (III) is required for normal glucose, protein, and fat metabolism, and is thus an essential trace element for human health. Hexavalent chromium [Cr (VI)], however, is acutely toxic, chronically toxic, and (or) carcinogenic. The Occupational Safety and Health Administration regulates workplace exposure to Cr (VI). Currently, the 8-hour time-weighted average exposure limit for Cr (VI) is 5 micrograms per cubic meter of air (U.S. Department of Labor, undated). The U.S. Environmental Protection Agency regulates total chromium emissions into the air under Section 112 of the Clean Air Act of 1990 and in drinking water under the National Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 2002, undated).

## Consumption and Production

Domestic data for chromium materials were developed by the U.S. Geological Survey (USGS) by means of monthly “Chromite Ores and Chromium Products” and “Consolidated Consumers” consumer surveys. Based on the results of these surveys, stainless and heat-resisting steel producers are the leading chromium consumers, and high-carbon ferrochromium is the leading chromium-containing material consumed.

The major marketplace chromium-containing materials are chromite ore and foundry sand; chromium chemicals, ferroalloys, and metal; and stainless steel. In 2017, the United States produced chromium chemicals and stainless steel.

**Chromium Chemicals.**—Chemical-grade chromite ore, which has a high chromium content with greater than 45% chromium oxide (Cr<sub>2</sub>O<sub>3</sub>), is typically processed by conversion to sodium dichromate. Sodium dichromate can then be used in other applications as oxidizing agents or in the production of dyes and inorganic chemicals for use in leather, drilling muds, metal plating and finishing solutions, tanning liquors, and wood preservatives. In the United States, Elementis Chromium, a subsidiary of Elementis plc (United Kingdom), produced sodium dichromate from chromite ore at Castle Hayne, NC.

**Stainless Steel.**—Chromium is essential to stainless-steel production by virtue of its oxide forming properties and to some grades of alloy steel as well as nickel-, iron-, and cobalt-base superalloys because of its alloying properties. Among a variety of uses, chromium is also used to reduce stress corrosion susceptibility and improve toughness in aluminum-magnesium, aluminum-magnesium-silicon, and aluminum-magnesium-zinc alloys.

In 2017, the U.S. stainless steel industry produced more than 3.0 Mt of stainless steel and imported and exported stainless-steel mill products and scrap, making it a leading consumer of chromium materials (American Iron and Steel Institute, 2017). North American Stainless Co. (NAS), AK Steel Corp. (AK), Allegheny Technologies Inc. (ATI), and Outokumpu Stainless USA, LLC were the leading U.S. stainless-steel producers, listed in descending order of reported production.

NAS, a subsidiary of Acerinox, S.A. (Spain), produced stainless steel at its Ghent, KY, facility. In October 2017, a new bright annealing line was inaugurated at the Ghent facility creating 36 additional full-time jobs (Acerinox S.A., 2017). Stainless-steel production at the NAS facility was 1.1 Mt in 2017, making it the leading producer in the United States and for the Acerinox Group (Acerinox S.A., 2018, p. 10).

AK Steel produced stainless steel at manufacturing plants in Butler, PA, and Mansfield, OH. AK Steel reported a 6% decrease in shipments of stainless and electrical steel in 2017, from 890,460 t in 2016 to 839,430 t in 2017 (AK Steel Corp., 2018a, p. 22). The decrease was primarily attributed to a decline in shipments to the automotive market owing to a reduction in North American light vehicle production. Electrical and stainless-steel products were sold primarily in North America and Europe (AK Steel Corp., 2018a, p. 3). A decline in shipments to international markets was attributed to global overcapacity and trade actions by European countries and China (AK Steel Corp., 2018a, p. 32).

In April, AK Steel opened its Research and Innovation Center in Middletown, OH. The facility was 135,000 square feet and cost \$36 million to build (AK Steel Corp., 2018b). In May, AK Steel received an award from the U.S. Department of Energy (DOE) to develop next-generation nonoriented electrical steel for automotive and industrial motors under the Advanced Manufacturing Office's Next Generation Electric Machines program. This project would last 3 years and would be conducted in collaboration with DOE, Oak Ridge National Laboratory's Power Electronics and Electric Machinery Research Center, and Regal Beloit Corporation (AK Steel Corp., 2018a, p. 5).

Allegheny Technologies Incorporated (ATI) (Pittsburgh, PA) produced stainless steel at facilities located in Brackenridge and Latrobe, PA. Sales for flat-rolled products increased by 21% compared with sales in 2016 owing to higher prices and shipment volumes (Allegheny Technologies Incorporated, 2018, p. F-26). Stainless steel shipments were 202,548 t in 2017, a 16% increase compared with 174,638 t in 2016 (Allegheny Technologies Incorporated, 2018, p. F-27). In 2017, ATI sold approximately 65% of its stainless-steel-sheet products to independent service centers for additional processing or directly to end-use customers (Allegheny Technologies Incorporated, 2018, p. F-6).

In November, ATI partnered with the Tsingshan Holding Group Co. Ltd. (China) in a 50–50 joint venture called Allegheny & Tsingshan Stainless pending regulatory approvals (Allegheny Technologies Incorporated, 2017). Tsingshan agreed to ship stainless-steel slabs from a newly acquired stainless-steel mill in Indonesia to ATI's hot-rolled processing facility in Brackenridge, PA (Roskill Information Services Ltd., 2017e). The hot-rolled coil would be cold rolled at ATI's finishing line located in Midland, PA, which was idled in early 2016.

Outokumpu Stainless USA, LLC, a subsidiary of Outokumpu Oyj, produced stainless steel at its Calvert, AL, and Richburg, SC, plants. In January 2017, Outokumpu sold its quarto plate mill in New Castle, IN, to D'Orazio Capital Partners, which had been managing the plant (Outokumpu Oyj, 2017b). In April 2017, Outokumpu announced new capabilities at its mill in South Carolina, including a coil-to-bar line and full reinforcement bar capabilities (Outokumpu Oyj, 2017c). In April 2017, Outokumpu divested its stainless-steel-pipe plant in Wildwood, FL, to Ta Chen International Inc., which distributed stainless steel in the United States. Ta Chen International was part of Ta Chen Stainless Pipe, Ltd. and based in Taiwan. This divestment allowed Outokumpu to focus on stainless-steel production at its plants in Alabama and South Carolina (Outokumpu Oyj, 2017a).

## Prices

Chromium materials are not openly traded. Purchase contracts are confidential between buyer and seller; however, trade journals report composite prices based on interviews with buyers and sellers, and the U.S. Department of Commerce reports the declared value of U.S. imports and exports. Thus, industry publications and U.S. trade statistics are sources of chromium material prices and values, respectively (table 3).

## Foreign Trade

Chromium-containing material exports from and imports to the United States included chromite ore; chromium chemicals, ferroalloys, metal, and pigments; and stainless steel (tables 4, 6). Based on foreign trade statistics reported by the U.S. Department of Commerce for calendar year 2017, the value of foreign trade of these chromium materials excluding stainless-steel mill products and scrap, was \$33.3 million for exports (30% more than that of the previous year) and \$1,250 million for imports (58% more than that of the previous year). A significant amount of chromium exits and enters the U.S. economy through stainless-steel mill product and scrap trade. The value of foreign trade of chromium materials, including stainless-steel mill products and scrap, was \$3,320 million for exports (18% more than that of the previous year) and \$5,230 million for imports (30% more than that of the previous year).

## World Review

**Argentina.**—There was no chromite ore or ferrochromium production in Argentina in 2017. Lanxess Aktiengesellschaft, a specialty chemical company based in Germany, discontinued

its chrome chemical production at its Zárate facility. The Zárate site was the only sodium dichromate and chrome tanning salt production facility in Argentina. This change was part of Lanxess's effort to centralize its chrome value chain in South Africa as well as increase its focus on organic leather production (Lanxess Aktiengesellschaft, 2017).

**Brazil.**—Brazil produced an estimated 700,000 t of chromite ore in 2017, unchanged from that in 2016. Ferrochromium production was 171,531 t in 2017 compared with a revised amount of 150,240 t in 2016, an increase of 14% (tables 8, 9).

The European Commission approved the merger of RHI AG (Austria) and Magnesita Refrátarios S.A. (Brazil). The merger was subject to the divestment of RHI's dolomite production sites concentrated in Marone, Italy, and Lugones, Spain, and the production and sale of magnesia-carbon bricks in Oberhausen, Germany. The new company would be named RHI Magnesita N.V. and listed on the London Stock Exchange with headquarters in Vienna, Austria. Magnesita Refrátarios would continue to operate in Brazil as a subsidiary of RHI Magnesita N.V. (RHI Magnesita N.V., 2017).

**China.**—China produced an estimated 30,000 t of chromite ore in 2017 compared with 25,444 t (revised) in 2016 (an increase of around 18%) and an estimated 4,500,000 t of ferrochromium, unchanged from 2016. China was the leading producer of ferrochromium in 2017 (tables 8, 9).

Mintal Group Co. Ltd. (Inner Mongolia Autonomous Region), a major producer of ferrochromium in Baotou, China, commissioned the first of two new 75-megavoltampere furnaces in August. The new furnaces increased Mintal's high-grade ferrochromium production capacity to 600,000 metric tons per year (t/yr) (CRU Group, 2017b, c).

Tharisa plc (Cyprus) signed a 5-year supply agreement for a minimum of 240,000 t/yr of chromite concentrate from its mine located in Marikana, South Africa, to Shanxi Taigang Wanbang Furnace Charge Co. Ltd. (Roskill Information Services Ltd., 2017b). Shanxi Taigang Wanbang Furnace Charge was a joint-venture company established by Taiyuan Iron and Steel Group Co., Ltd. (TISCO), a Chinese steel manufacturer based in Taiyuan, Shanxi Province. The supply agreement represented about 25% of Tharisa's current capacity of 1.1 million metric tons per year (Mt/yr) of metallurgical-grade chromium concentrates (Roskill Information Services Ltd., 2017b).

Ningbo Haoyang New Materials Technology Co., Ltd. obtained Government approval in December to increase its stainless-steel production capacity. The approval included the installation of a 70-t electric arc furnace that would add 400,000 t/yr to its stainless-steel capacity (CRU Group, 2017a).

The Government of China also announced in December that it would lower the tariff on stainless-steel plate exports to 5% from 10% beginning January 1, 2018 (Global Times, 2017). The net exports of stainless-steel plates from China in 2017 were \$3.8 billion, an increase of 11% from \$3.4 billion in 2016, using import and export data from Global Trade Atlas.

**Finland.**—Finland produced 972,028 t of chromite ore in 2017 compared with 1,070,281 t in 2016, a decrease of 9%, and 416,285 t of ferrochromium in 2017 compared with 469,141 t in 2016, a decrease of 11% (tables 8, 9).

Outokumpu Oyj owned and operated the Kemi chromite mine, the only chromite mine in Finland. Outokumpu also produced ferrochromium at its Tornio ferrochromium production facility using chrome extracted from its Kemi chrome mine. The Tornio facility was the only ferrochromium plant in Finland. Even though the overall global demand for stainless steel increased in 2017, Outokumpu cited furnace maintenance and technical issues as causes for the 11% decrease in ferrochromium production (Outokumpu Oyj, 2018, p. FS2).

Outokumpu obtained European patents for high-chromium-grade stainless-steel products in March. The products were developed in Outokumpu's Research and Development Center in Tornio, Finland, and included the ferritic Core 4622 and austenitic Supra 316plus (Outokumpu Oyj, 2018, p. 5). Core 4622 is a nickel-free, ferritic stainless steel with 21% chromium; Supra 316plus is an austenitic chromium-nickel-molybdenum stainless steel, also with 21% chromium (Outokumpu Oyj, undated a, b). In addition, Outokumpu announced that it was expanding the Kemi Mine to a depth of 1 kilometer to ensure that mining operations would continue well into the future, with expected completion in 2020 (Outokumpu Oyj, 2018, p. 5; Salmi, 2018).

**India.**—India produced an estimated 3,500,000 t of chromite ore in 2017 compared with a revised amount of 3,727,777 t in 2016, a decrease of around 6%, and 944,000 t of ferrochromium in 2017, unchanged from 2016 (tables 8, 9).

The Ferro Alloys and Minerals Division at Tata Steel produced 1,320,000 t of ferrochromium in 2017 compared with 740,000 t in 2016. The 78% increase in production was the result of a sudden increase in global demand for stainless steel owing to global economic growth (Tata Steel, 2017, p. 92–93). In order to meet demand, Tata Steel increased ferrochromium production at new ferroalloy-processing centers, including its first greenfield ferrochromium plant in Gopalpur, which began producing ferrochromium in February 2017 (Economic Times of India, 2017b; Tata Steel, 2017, p. 93; Times of India, The, 2017).

The government of Odisha in eastern India approved Jindal Stainless (Hisar) Ltd.'s proposal to construct a downstream stainless-steel industrial park at Kalinganagar. The park would have approximately 71 small- and medium-sized industrial processing plants, which would cater to sectors such as auto manufacturing, kitchenware, light engineering, pipes and tubes, and the service industry (Economic Times of India, 2017a). Jindal Stainless also signed a technology transfer agreement with the Defense Research and Development Organization to manufacture high-nitrogen stainless steel for lightweight armored vehicles [Jindal Stainless (Hisar) Ltd., 2017; Saluja, 2017].

On August 21, Visa Steel Ltd. suspended operations at its facilities in Kalinganagar owing to a disruption in raw material supply of iron and chromite ore. The suspended facilities included its blast furnace, ferrochrome facilities, rolling mill, sponge iron, and steel-melting shop. Transportation to Visa Steel of iron and chromite ore from the Daitari and Kaliapani Mines, operated by the State-owned Odisha Mining Corporation Limited, were also suspended (Dash, 2017). In May, the Odisha

State Pollution Control Board (OSPCB) found serious lapses in environmental control mechanisms, such as damaged filter bags and an inoperable dry fog system, at the facilities. On August 18, the OSPCB issued a formal closure notice to Visa Steel for air and water pollution violations if the company did not reply within 21 days of receipt (Pioneer, The, 2017).

Illegal mining of bauxite, chromite, coal, iron ore, sand, and stone between 2013 and 2017 was reported by the Ministry of Environment, Forests and Climate Change to the Parliament of India in response to a query on the environmental impact of illegal mining. During this time, more than 400,000 illegal mining cases were recorded, with more than a third located in the State of Maharashtra (Chatterjee, 2018).

**Kazakhstan.**—Kazakhstan produced 4,579,300 t of chromite ore in 2017 compared with 5,542,900 t (revised) in 2016, a decrease of 17%, and an estimated 1,400,000 t of ferrochromium in 2017 compared with 1,525,221 t (revised) in 2016, a decrease of about 8% (tables 8, 9). Kazakhstan was the third-leading producer of both chromite ore and ferrochromium.

Eurasian Resources Group S.à r.l. (ERG), with headquarters in Luxembourg, began mining chromite ore at the Pervomayskoye deposit, a mine in the Khromtau District in the western part of Kazakhstan. The Donskoy Ore Mining and Processing Plant, owned by JSC TNC Kazchrome (a subsidiary of ERG), had already extracted the first 3,500 t of ore. Production at the mine was estimated to be 300,000 t/yr of ore. Movable reserves at the deposit were expected to exceed 3 Mt of ore (Eurasian Resources Group S.à r.l., 2017a).

JSC TNC Kazchrome planned to construct a new slag-processing plant at its Aksu Ferroalloys Plant. The new plant would produce about 130,000 t/yr of metal concentrate and would be able to process materials not treatable at Aksu's existing slag-processing plants. The existing slag would be processed at existing production slag-processing shops at the same time as the new slag to prevent overlaps between the two operations. A closed-loop water system and internal sludge filtration system have been included in the plant design to help prevent environmental pollution (Eurasian Resources Group S.à r.l., 2017b).

**Russia.**—Russia produced an estimated 450,000 t of chromite ore in 2017, unchanged from the 2016 estimate (table 8). Ferrochromium production was estimated to be 270,000 t in 2017, essentially unchanged compared with a reported 268,439 t in 2016 (table 9). Polymetcore Trading S.A., a subsidiary of Yildirim Group, signed a 7-year offtake agreement with MidUral Group's Kluchevsky Ferroalloy Plant, a chromium metal producer in the Sverdlovsk region. Under the agreement, Polymetcore Trading would market and sell Kluchevsky's low- and ultra-low-carbon ferrochrome and chrome metal outside of Russia; Kluchevsky would continue to market its products within Russia. This move was part of Yildirim's effort to establish itself as a global producer and trader of critical minerals for aerospace, aviation, electric vehicles, and high-tech industries. An option existed for a 7-year extension after the first 7-year period expired (MidUral Group, 2017).

**South Africa.**—South Africa was the world's leading producer of chromite ore and the second-ranked country in ferrochromium production in 2017. South Africa produced

16.5 Mt of chromite ore in 2017 compared with 14.7 Mt in 2016, an increase of 12%, and an estimated 3,600,000 t of ferrochromium in 2017, essentially unchanged compared with 3,596,000 t (revised) in 2016 (tables 8, 9).

Afarak Group Plc, through its South African subsidiary Afarak Mining Limited, agreed to acquire a 70% stake in the Zeerust Chrome Mine (ZCM) from Afrika Mineral Trading & Investment Trust (Afarak Group Oyj, 2017; Afarak Group Plc, 2018, p. 15). The acquisition would include the Mogale Alloys processing plant, which was capable of producing high-carbon ferrochromium. The rest of the ZCM shares would be distributed to workers, the local community, and other black economic empowerment partners. In addition, Afarak converted a furnace from processing silicomanganese to ferrochrome at its Mogale plant in South Africa, increasing its ferrochrome production by 27,600 t/yr (Roskill Information Services Ltd., 2017a).

In March, Jubilee Metals Group Plc commissioned an integrated chromite and platinum-group-metals (PGM) recovery plant at its Hemic Ferrochrome (Pty) Ltd. facility. At full production, the plant could process 55,000 metric tons per month of PGM-rich chromite tailings to produce separate chromite and PGM concentrates (Jubilee Metals Group Plc, 2017). In September 2017, Hemic was placed under voluntary business rescue. The company had been financially distressed after difficult market conditions and unable to meet credit requirements [Hemic Ferrochrome (Pty) Ltd., 2017]. In December 2017, Jubilee confirmed media speculation about a tailings spill at the Hemic chrome and platinum recovery plant. Output at the PGM processing facility was reduced by approximately 30% while Hemic fully restored the affected tailings dam (Jubilee Metals Group Plc, 2018; Solomons, 2018).

Richards Bay Alloys, a subsidiary of Traxys S.A. (Luxembourg), suspended ferrochrome operations in South Africa for 3 months owing to low international ferrochrome prices. The smelter had two furnaces and the capacity to produce approximately 130,000 t/yr of ferrochromium (Roskill Information Services Ltd., 2017c).

**Zimbabwe.**—Zimbabwe produced an estimated 319,000 t of chromite ore in 2017 compared with 225,000 t (revised) in 2016, an increase of around 42%, and 142,800 t of ferrochromium in 2017 compared with 78,200 t (revised) in 2016, an increase of 83% (tables 8, 9).

Zimbabwe Alloys (ZimAlloys), a ferrochrome producer based in Gweru and under judicial management by Grant Thornton International, approved a \$100 million investment deal with Balasore Alloys Group, an Indian ferroalloys producer (Roskill Information Services Ltd., 2017d). Part of Balasore's investment would help settle ZimAlloy's debts, and the remainder would go towards refurbishing and restarting the smelter (Kachembere, 2017; Musiiwa, 2017). ZimAlloys was put under judicial management in 2014 owing to high debt levels and had only been processing tailings since 2005.

The Zimbabwe Government began redistributing idle chromite mines previously owned by the Zimbabwe Iron and Smelting Company (Zimasco) in response to inquiries from the Parliament regarding possible illegal mining activity. The Ministry of Mines agreed to investigate the illegal mining activity and reallocated 211.7 square kilometers (km<sup>2</sup>) of land to

curb further illegal activity. The Zimbabwe Geological Survey was granted 57.46 km<sup>2</sup>. The remaining land would be distributed to medium-scale beneficiation plants and new smelters as well as small-scale miners, with special attention given to marginalized groups (Majaka, 2017).

After legal disputes in 2016, Portnex International (Pty) Ltd. and Zimasco resolved their differences. As a result, the two companies worked to improve operations at Zimasco's ferrochromium facilities in Kwekwe. Under judicial management by Sinosteel Corporation (China), Zimasco was able to export an average of 10,000 t/yr of high-grade chromite ore concentrates and, with Portnex operating the formerly idled furnaces, ran the ferrochromium operations at 80% capacity (Makichi, 2017).

Apple Bridge Investment, a special purpose organization established in 2016 by the Zimbabwe Government to buy and export chromite ore from small-scale miners, was directed to buy all chromite supplied by small-scale chromite miners so that private smelters could not undervalue the ore. Apple Bridge Investment had previously required a minimum of 250 t of ore per delivery. Many small-scale miners were unable to meet this tonnage requirement and instead had to sell to local private smelters, which were reportedly paying well below market value for the ore (Chingwere, 2017).

## Outlook

Domestic and global consumption of chromium was expected to closely follow the trend in stainless-steel production. U.S. stainless-steel production was estimated by the American Iron and Steel Institute to be 3.0 Mt (gross weight of stainless steel) in 2017, up 11% from that of 2016 (American Iron and Steel Institute, 2016, 2017). According to the International Stainless Steel Forum, world stainless and heat-resisting steel melt shop production (ingot/slab equivalent) in 2017, compared with that in 2016, increased by 5% to 48.1 Mt (International Stainless Steel Forum, 2018).

Domestic reported consumption of chromium ferroalloy and metal in 2017 increased by 5% compared with that of 2016, suggesting that chromium ferroalloy and metal consumption will increase in 2018. The global trend of production from 2013 through 2017 suggests the chromite ore production in 2018 will be about 34 Mt and ferrochromium production will be about 12 Mt.

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TABLE 1  
SALIENT CHROMIUM STATISTICS<sup>1</sup>

		2013	2014	2015	2016	2017
Components of U.S. supply, chromium content:						
Secondary <sup>2</sup>	metric tons	150,000	157,000	154,000	152,000	158,000
Imports:						
Chromite ore	do.	80,400 <sup>r</sup>	84,900 <sup>r</sup>	81,900	64,600	61,300
Chromium chemicals	do.	5,870	6,010	6,180 <sup>r</sup>	3,280 <sup>r</sup>	3,760
Chromium ferroalloys	do.	280,000	359,000	228,000	266,000 <sup>r</sup>	319,000
Chromium metal	do.	13,700	17,500	12,800	13,800 <sup>r</sup>	14,500
Stainless-steel mill products and scrap <sup>2</sup>	do.	201,000 <sup>r</sup>	240,000 <sup>r</sup>	206,000 <sup>r</sup>	199,000 <sup>r</sup>	234,000
Stocks, January 1:						
Government	do.	107,000	96,500	81,200	72,300	66,800
Industry <sup>3</sup>	do.	7,580	7,750	8,320	8,060	7,720
Total	do.	845,000 <sup>r</sup>	969,000 <sup>r</sup>	779,000 <sup>r</sup>	779,000 <sup>r</sup>	865,000
Distribution of U.S. supply, chromium content:						
Exports:						
Chromite ore <sup>4</sup>	do.	3,950 <sup>r</sup>	3,050 <sup>r</sup>	4,510	1,340	5,240
Chromium chemicals	do.	16,900 <sup>r</sup>	15,800 <sup>r</sup>	3,670 <sup>r</sup>	48	631
Chromium ferroalloys and metal	do.	3,360	2,950	1,330	1,320	1,580
Stainless-steel mill products and scrap <sup>2</sup>	do.	217,000	236,000 <sup>r</sup>	228,000 <sup>r</sup>	251,000 <sup>r</sup>	249,000
Stocks, December 31:						
Government	do.	96,500	81,200	72,300	66,800	58,700
Industry <sup>3</sup>	do.	7,750	8,320	8,060	7,720 <sup>r</sup>	7,900
Total	do.	345,000 <sup>r</sup>	347,000 <sup>r</sup>	318,000 <sup>r</sup>	328,000	323,000
Consumption						
Apparent, chromium content <sup>5</sup>	do.	500,000 <sup>r</sup>	622,000 <sup>r</sup>	461,000 <sup>r</sup>	451,000 <sup>r</sup>	542,000
Reported:						
Chromite ore and concentrates, gross weight	do.	W	W	W	W	W
Chromium ferroalloys: <sup>6</sup>						
Gross weight	do.	435,000	449,000	432,000	416,000 <sup>r</sup>	436,000
Chromium content	do.	248,000	257,000	248,000	238,000 <sup>r</sup>	250,000
Chromium metal, gross weight	do.	4,190 <sup>r</sup>	4,190	4,170	3,230 <sup>r</sup>	4,290
Stocks, December 31, gross weight:						
Government:						
Chromium ferroalloys	do.	129,000	108,000	95,700	88,100	76,800
Chromium metal	do.	4,090	3,960	3,960	3,900	3,860
Industry, consumer:						
Chromium ferroalloys <sup>7</sup>	do.	13,000	13,900	13,400	12,900 <sup>r</sup>	13,100
Chromium metal	do.	159	157	160	128 <sup>r</sup>	192
Other	do.	193	185	189	197	186
Price, average annual:						
Chromite ore, gross weight <sup>8</sup>	dollars per metric ton	162	181	173	204	280
Ferrochromium, chromium content <sup>9</sup>	dollars per pound	1.00	1.07	1.06	0.92	1.34
Aluminothermic chromium metal, gross weight <sup>10</sup>	do.	4.57	4.49	4.38	3.75	3.94
Value of trade:						
Exports	thousands	\$153,000 <sup>r</sup>	\$155,000 <sup>r</sup>	\$58,900	\$25,600 <sup>r</sup>	\$33,300
Imports	do.	\$863,000 <sup>r</sup>	\$1,210,000 <sup>r</sup>	\$820,000 <sup>r</sup>	\$792,000 <sup>r</sup>	\$1,250,000
Net imports <sup>11</sup>	do.	-\$710,000 <sup>r</sup>	-\$1,050,000 <sup>r</sup>	-\$761,000 <sup>r</sup>	-\$766,000 <sup>r</sup>	-\$1,210,000
Stainless steel:						
World production, chromium content <sup>12</sup>	metric tons	6,550,000	7,090,000	7,060,000	7,780,000	8,170,000
U.S. production:						
Gross weight <sup>13</sup>	do.	2,030,000	2,390,000	2,350,000	2,480,000	274,000
Chromium content <sup>14</sup>	do.	354,000	42,100 <sup>r</sup>	412,000	436,000	468,000
Average grade, dimensionless <sup>15</sup>		0.1744	0.1759	0.1758	0.1758	0.1700
Shipments, gross weight <sup>16</sup>	metric tons	2,220,000	2,270,000	2,230,000	2,360,000	2,500,000
Exports, gross weight	do.	633,000	838,000	828,000 <sup>r</sup>	821,000 <sup>r</sup>	974,000
Imports, gross weight	do.	957,000 <sup>r</sup>	1,080,000 <sup>r</sup>	1,020,000 <sup>r</sup>	910,000 <sup>r</sup>	1,090,000
Scrap, gross weight:						
Receipts	do.	882,000	921,000	907,000	891,000	927,000
Consumption	do.	1,300,000	1,320,000	1,330,000	1,340,000	2,220,000
Exports	do.	644,000	548,000	514,000 <sup>r</sup>	654,000	488,000
Imports	do.	226,000	329,000	192,000	263,000	282,000

See footnotes at end of table.

TABLE 1—Continued  
SALIENT CHROMIUM STATISTICS<sup>1</sup>

		2013	2014	2015	2016	2017
Stainless steel:—Continued						
Value of trade:						
Exports	thousands	\$2,500,000	\$3,020,000	\$2,710,000 <sup>r</sup>	\$2,350,000 <sup>r</sup>	\$2,860,000
Imports	do.	\$3,640,000 <sup>r</sup>	\$4,330,000 <sup>r</sup>	\$3,830,000 <sup>r</sup>	\$3,050,000 <sup>r</sup>	\$3,710,000
Scrap exports	do.	\$742,000	\$674,000	\$639,000	\$442,000	\$425,000
Scrap imports	do.	\$211,000	\$426,000	\$165,000	\$182,000	\$280,000
Net imports	do.	-\$608,000 <sup>r</sup>	-\$1,060,000 <sup>r</sup>	-\$644,000 <sup>r</sup>	-\$436,000 <sup>r</sup>	-\$702,000

<sup>r</sup>Revised. do. Ditto. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Table includes data available through June 21, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Calculated assuming chromium content of stainless steel and stainless-steel scrap to average 17% chromium.

<sup>3</sup>Includes consumer stocks of chromium ferroalloys and metal and other chromium-containing materials.

<sup>4</sup>Calculated based on the chromium content of imported chromite ore, typically between 46% and 63% Cr<sub>2</sub>O<sub>3</sub>.

<sup>5</sup>Apparent consumption calculated as total U.S. distribution minus total U.S. supply.

<sup>6</sup>Chromium ferroalloys, chromite ore, and other chromium-containing materials excluding chromium metal.

<sup>7</sup>Consumer stocks of high- and low-carbon ferrochromium and ferrosilicon-chromium.

<sup>8</sup>Time-weighted average price of South African chromite ore that contains 44% Cr<sub>2</sub>O<sub>3</sub> free on board (f.o.b.) South Africa as reported in CRU Group.

<sup>9</sup>Time-weighted average U.S. price of imported high-carbon chromium that contains 47% to 55% chromium as reported in CRU Group.

<sup>10</sup>Time-weighted average U.S. price of imported aluminothermic chromium metal as reported by CRU Group.

<sup>11</sup>Negative data indicate that imports are greater than exports.

<sup>12</sup>Production estimated from publicly available sources. Chromium content estimated at 17%.

<sup>13</sup>Source: American Iron and Steel Institute annual report of stainless and heat-resisting raw steel production and shipments.

<sup>14</sup>Estimated mass-weighted average of the mean chromium content of stainless-steel production by grade.

<sup>15</sup>Ratio of estimated mass-weighted average chromium content of stainless-steel production by grade to production. Uncertainty is approximately ± 0.01, owing to the range of chromium chemical specification limits by stainless-steel grade.

<sup>16</sup>Source: American Iron and Steel Institute annual report of stainless and heat-resisting raw steel shipments.

<sup>17</sup>Includes stainless steel and stainless-steel scrap.

TABLE 2  
U.S. REPORTED CONSUMPTION AND STOCKS OF CHROMIUM PRODUCTS<sup>1</sup>

(Metric tons)

	2016		2017		Change <sup>2</sup>	
	Gross weight	Chromium content	Gross weight	Chromium content	Quantity	Percent
<b>Consumption by end use:</b>						
<b>Steel:</b>						
Carbon steel	4,900	3,140	4,950	3,210	56	1
High-strength low-alloy steel	1,500 <sup>r</sup>	971 <sup>r</sup>	2,030	1,330	530	35
Stainless and heat-resisting steel	366,000 <sup>r</sup>	208,000 <sup>r</sup>	382,000	218,000	16,100	4
Fully alloy steel	11,500	7,080	11,400	7,000	-67	-1
Unspecified steel <sup>3</sup>	22,200 <sup>r</sup>	12,900 <sup>r</sup>	24,500	14,500	2,290	10
Superalloys	7,850 <sup>r</sup>	5,090 <sup>r</sup>	9,710	6,810	1,860	24
Other alloys and uses <sup>4</sup>	5,280	3,790 <sup>r</sup>	5,310	3,740	38	1
<b>Total</b>	<b>419,000<sup>r</sup></b>	<b>241,000<sup>r</sup></b>	<b>440,000</b>	<b>254,000</b>	<b>20,900</b>	<b>5</b>
<b>Consumption by material:</b>						
Low-carbon ferrochromium	21,600 <sup>r</sup>	14,200 <sup>r</sup>	26,800	17,700	5,210	24
High-carbon ferrochromium	364,000	212,000	377,000	219,000	12,700	3
Ferrochromium silicon	W	W	W	W	W	W
Chromium metal	3,230 <sup>r</sup>	3,230 <sup>r</sup>	4,290	4,290	1,060	33
Chromium-aluminum alloy	477	344	475	342	-2	(5)
Other chromium materials	29,700 <sup>r</sup>	11,800 <sup>r</sup>	31,500	12,800	1,880	6
<b>Total</b>	<b>419,000<sup>r</sup></b>	<b>241,000<sup>r</sup></b>	<b>440,000</b>	<b>254,000</b>	<b>20,900</b>	<b>5</b>
<b>Consumer stocks:</b>						
Low-carbon ferrochromium	1,480 <sup>r</sup>	969 <sup>r</sup>	1,840	1,220	365	25
High-carbon ferrochromium	10,700	6,210	10,300	5,990	-381	-4
Ferrochromium silicon	W	W	W	W	W	W
Chromium metal	128 <sup>r</sup>	128 <sup>r</sup>	192	191	64	50
Chromium-aluminum alloy	W	W	W	W	W	W
Other chromium materials	942 <sup>r</sup>	417 <sup>r</sup>	1,130	492	187	20
<b>Total</b>	<b>13,200<sup>r</sup></b>	<b>7,720<sup>r</sup></b>	<b>13,500</b>	<b>7,900</b>	<b>234</b>	<b>2</b>
<b>National Defense Stockpile stocks:<sup>6</sup></b>						
<b>Chromium ferroalloys:<sup>7</sup></b>						
High-carbon ferrochromium	57,400	41,000	48,300	34,500	-9,010	-16
Low-carbon ferrochromium	30,700	21,900	28,500	20,300	-2,270	-7
Chromium metal <sup>8</sup>	3,900	3,900	3,860	3,860	-45	-1

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Table includes data available through June 21, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Change based on gross weight of unrounded data of current year compared with that of previous year.

<sup>3</sup>Includes electrical, tool, and unspecified steel end uses.

<sup>4</sup>Includes cast irons, welding and alloy hard-facing rods and materials, wear- and corrosion-resistant alloys, and aluminum, copper, magnetic, nickel, and other alloys.

<sup>5</sup>Less than ½ unit.

<sup>6</sup>Data are based on the "Total Uncommitted Inventory" of stockpile material D-1 report by the Defense Logistics Agency Strategic Materials.

<sup>7</sup>Chromium content estimated using 71.4% chromium.

<sup>8</sup>Chromium content estimated using 100% chromium.

TABLE 3  
VALUE OF IMPORTS AND U.S. PRICE QUOTATIONS FOR CHROMIUM MATERIALS<sup>1</sup>

Material	2016		2017		
	Chromium content	Gross weight	Chromium content	Gross weight	
Value: <sup>2</sup>					
Chromite ore:					
Not more than 40% chromic oxide	dollars per metric ton	XX	XX	639	157
More than 40% but less than 46% chromic oxide	do.	371 <sup>r</sup>	168	556	249
46% or more chromic oxide	do.	417 <sup>r</sup>	205	547	260
Average	do.	410 <sup>r</sup>	198	548	259
Ferrochromium:					
Not more than 0.5% carbon	do.	4,060 <sup>r</sup>	2,750 <sup>r</sup>	3,890	2,560
More than 0.5% but not more than 3% carbon	do.	3,450	2,190 <sup>r</sup>	3,700	2,390
More than 3% but not more than 4% carbon	do.	1,470	736	2,120	1,060
Average (not more than 4% carbon)	do.	3,970 <sup>r</sup>	2,660	3,880	2,550
More than 4% carbon	do.	2,000	1,080	3,140	1,690
Average (all grades)	do.	2,230	1,230 <sup>r</sup>	3,210	1,760
Chromium metal <sup>3</sup>	do.	XX	9,830 <sup>r</sup>	XX	9,680
Price: <sup>4</sup>					
Chromite ore, South Africa:					
38% to 40% Cr <sub>2</sub> O <sub>3</sub>	do.	705	188	940	251
44% Cr <sub>2</sub> O <sub>3</sub>	do.	676	204	931	280
42% UG2	do.	617	177	850	244
High-carbon ferrochromium:					
47% to 55% chromium	cents per pound	92	XX	134	XX
60% to 70% chromium	do.	95	XX	145	XX
Low-carbon ferrochromium:					
0.05% carbon	do.	220	XX	217	XX
0.10% carbon	do.	184	XX	206	XX
0.15% carbon	do.	181	XX	197	XX
Chromium metal, imported, aluminothermic	do.	XX	375	XX	394

<sup>r</sup>Revised. do. Ditto. XX Not applicable.

<sup>1</sup>Table includes data available through June 21, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Mass-weighted average based on customs value and quantity of imported material, as reported by the U.S. Census Bureau.

<sup>3</sup>Average for all grades.

<sup>4</sup>Source: CRU Group.

TABLE 4  
U.S. EXPORTS OF CHROMIUM MATERIALS, BY TYPE<sup>1</sup>

HTS <sup>2</sup> code	Type	2016		2017		Principal destinations in 2017 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
2610.00.0000	Chromite ore and concentrates, gross weight	2,760	\$1,650	11,100	\$4,760	China (8,540, \$3,080); Canada (1,780, \$1,020); Mexico (\$87, \$452); United Kingdom (170, \$165); Philippines (15, \$30); Ireland (11, \$6); Belgium (1, \$4).
8112.21.0000	Chromium metal, gross weight: Unwrought chromium powders	232	5,930	299	6,500	Japan (83, \$2,020); United Kingdom (68, \$939); Switzerland (23, \$309); Brazil (21, \$188); Germany (20, \$650); Mexico (19, \$548); Canada (14, \$246); China (12, \$289); Malaysia (7, \$192).
8112.22.0000	Chromium metal waste and scrap	93	1,140	118	988	Brazil (65, \$501); Japan (36, \$304); Canada (13, \$128); United Kingdom (2, \$46).
8112.29.0000	Chromium metal other than unwrought powders and waste and scrap	182	7,240	205	6,950	Mexico (43, \$1,010); Brazil (29, \$406); United Kingdom (22, \$426); Taiwan (21, \$566); China (18, \$849); Japan (13, \$515); Ireland (12, \$245); Canada (11, \$233); Republic of Korea (4, \$540); France (4, \$334).
Total chromium metal		506	14,300	622	14,400	
Chromium ferroalloys:						
7202.41.0000	High-carbon ferrochromium: <sup>3</sup> Gross weight	675	1,020 <sup>r</sup>	1,240	1,400	Canada (557, \$658); Mexico (463, \$457); India (102, \$109); Peru (39, \$64); Ireland (31, \$27); Spain (18, \$42); Germany (7, \$13); Republic of Korea (6, \$6); Czechia (4, \$4); China (4, \$3).
7202.49.0000	Chromium content Low-carbon ferrochromium: <sup>4</sup> Gross weight	374	XX	510	XX	
7202.50.0000	Chromium content Ferrochromium-silicon: Gross weight	800	1,310	854	1,840	Canada (413, \$775); Mexico (241, \$736); India (108, \$195); Argentina (44, \$59); China (31, \$42); Germany (8, \$11); Austria (6, \$7); Japan (4, \$14).
	Chromium content	421	XX	441	XX	
	Total chromium ferroalloys:					
	Gross weight	61	64	15	31	Ireland (12, \$13); Mexico (2, \$11).
	Chromium content	21	XX	5	XX	
2833.29.4000	Chromium sulfates	165	815	7	49	Republic of Korea (3, \$13); United Kingdom (2, \$10); Belgium (1, \$4); Taiwan (1, \$3).

See footnotes at end of table.

TABLE 4—Continued  
U.S. EXPORTS OF CHROMIUM MATERIALS, BY TYPE<sup>1</sup>

HTS <sup>2</sup> code	Type	2016		2017		Principal destinations in 2017 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
	Chemicals, gross weight:—Continued					
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Zinc and lead chromate	25	\$644 <sup>r</sup>	39	\$847	Jamaica (24, \$75); Mexico (7, \$131); South Africa (5, \$588); Netherlands (2, \$33).
2841.50.1000	Potassium dichromate	96 <sup>r</sup>	137 <sup>r</sup>	2,140	2,530	Honduras (1,400, \$1,190); Guatemala (437, \$332); Mexico (78, \$238); Peru (43, \$43); Taiwan (37, \$85); Saudi Arabia (32, \$249); Brazil (29, \$27); Republic of Korea (26, \$127); Jamaica (19, \$150); Greece (18, \$16).
2841.50.9100	Other	199 <sup>r</sup>	1,760 <sup>r</sup>	229	2,450	Canada (130, \$461); South Africa (49, \$1,160); Mexico (8, \$141); Germany (8, \$89); United Kingdom (7, \$107); Australia (7, \$71); Republic of Korea (5, \$258); Colombia (5, \$35); Japan (5, \$32); Taiwan (2, \$11).
	Total salts	484 <sup>r</sup>	2,540 <sup>r</sup>	2,420	5,830	
3206.20.0000	Pigments and preparations, gross weight	299 <sup>r</sup>	2,720 <sup>r</sup>	296	3,830	Canada (86, \$498); Mexico (83, \$918); Antigua and Barbuda (22, \$74); Colombia (21, \$1,460); El Salvador (16, \$85); Saudi Arabia (13, \$76); Jamaica (12, \$92); Peru (7, \$12); Trinidad and Tobago (6, \$34); Barbados (5, \$21).

<sup>r</sup>Revised. XX Not applicable.

<sup>1</sup>Table includes data available through June 21, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Harmonized Tariff Schedule of the United States.

<sup>3</sup>More than 4% carbon.

<sup>4</sup>Not more than 4% carbon.

Source: U.S. Census Bureau.

TABLE 5  
U.S. IMPORTS FOR CONSUMPTION OF FERROCHROMIUM, BY COUNTRY OR LOCALITY<sup>1</sup>

Country or locality	Not more than 0.5% carbon (HTS <sup>2</sup> code 7202.49.5090)			More than 0.5% carbon, but not more than 3% carbon (HTS <sup>2</sup> code 7202.49.5010)			More than 3% carbon, but not more than 4% carbon (HTS <sup>2</sup> code 7202.49.1000)			More than 4% carbon (HTS <sup>2</sup> code 7202.41.0000)			Total all grades		
	Chromium		Value (thousands)	Chromium		Value (thousands)	Chromium		Value (thousands)	Chromium		Value (thousands)	Chromium		Value (thousands)
	weight (metric tons)	content (metric tons)		weight (metric tons)	content (metric tons)		weight (metric tons)	content (metric tons)		weight (metric tons)	content (metric tons)		weight (metric tons)	content (metric tons)	
2016:															
Albania	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Austria	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brazil	4,620	2,800	\$8,940	4,750	2,920	\$9,200	--	--	74	46	71	74	46	71	\$1,940
China	2,930	1,840	6,160	1,100	708	2,290	12	6	\$6	--	--	--	--	--	19,000
Germany	5,080	3,540	19,800	--	--	--	--	--	--	--	--	--	--	--	8,450
Hong Kong	--	--	--	25	15	47	--	--	--	--	--	--	--	--	19,800
India	81	52	361	--	--	--	--	--	--	--	--	7,740	4,710	7,220	15
Japan	1,970	1,390	8,120	--	--	--	--	--	--	--	--	--	--	--	47
Kazakhstan	5,430	3,880	13,400	1,160	806	2,850	--	--	--	--	--	37,900	29,700	39,300	7,580
Mexico	136	89	883	--	--	--	--	--	--	--	--	44,500	34,300	55,600	8,120
Netherlands	1,510	999	3,640	--	--	--	--	--	--	--	--	--	--	--	34,300 <sup>r</sup>
Oman	--	--	--	--	--	--	--	--	--	--	--	136	89	883	7,580
Russia	14,800	10,200	36,600	--	--	--	--	--	--	--	--	--	--	--	4,760
South Africa	266	98	386	31	20	44	11,000	5,490	8,160	241	242	320,000	158,000	224,000	1,390
Sweden	--	--	--	--	--	--	--	--	--	--	--	2,550	1,710	3,460	8,120
Switzerland	--	--	--	--	--	--	--	--	--	--	--	41	25	30	34,300 <sup>r</sup>
Turkey	2,820	1,970	7,490	405	287	1,010	--	--	--	--	--	29,800	19,700	36,400	89
United Kingdom	1	1	2	--	--	--	--	--	--	--	--	--	--	--	89
Zimbabwe	--	--	--	--	--	--	--	--	--	--	--	6,120	3,460	5,920	883
Total	39,700	26,900	106,000	7,480	4,750	15,400	11,400	5,740	8,410	414,000	224,000	473,000	261,000	457,000	55,600 <sup>r</sup>
2017:															
Albania	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brazil	1,110	660	2,590	1,590	978	3,730	--	--	172	7,630	5,080	13,100	5,220	13,300	2,660
Canada	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2,660
China	407	247	1,100	27	18	84	--	--	--	204	122	214	204	214	2,660
Germany	6,120	4,260	20,900	--	--	--	225	121	120	--	--	--	--	--	13,100
India	129	87	557	--	--	--	--	--	--	--	--	--	--	--	42,200
Japan	3,040	2,150	12,000	--	--	--	--	--	--	20,800	12,500	27,500	20,900	28,100	233,000
Kazakhstan	9,770	6,890	27,900	1,030	729	2,720	--	--	--	42,900	30,000	81,300	53,700	112,000	3,460
Oman	--	--	--	--	--	--	--	--	--	189	114	242	189	242	1,710
Russia	21,500	14,400	53,300	--	--	--	237	128	127	28,400	19,500	49,900	50,200	103,000	3,460
Singapore	--	--	--	--	--	--	--	--	--	108	66	149	108	149	2,660
South Africa	6,060	2,790	7,030	172	92	282	6,000	2,970	6,710	357,000	175,000	396,000	369,000	410,000	1,390
Sweden	--	--	--	--	--	--	--	--	--	513	341	920	513	341	8,120
Turkey	3,440	2,410	9,810	--	--	--	--	--	--	26,000	17,100	46,500	29,400	56,300	34,300 <sup>r</sup>
United Kingdom	3	2	21	--	--	--	11	8	8	--	--	--	--	--	8,120
Zimbabwe	--	--	--	--	--	--	--	--	--	23,000	12,400	28,200	23,000	28,200	8,120
Total	51,600	33,900	135,000	2,820	1,820	6,820	6,740	3,370	7,140	507,000	272,000	644,000	568,000	793,000	55,600 <sup>r</sup>

See footnotes at end of table.

TABLE 5—Continued  
U.S. IMPORTS FOR CONSUMPTION OF FERROCHROMIUM, BY COUNTRY OR LOCALITY<sup>1</sup>

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<sup>1</sup>Revised. -- Zero.

<sup>2</sup>Table includes data available through June 21, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>3</sup>Harmonized Tariff Schedule of the United States.

Source: U.S. Census Bureau.



TABLE 6  
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE<sup>1</sup>

HTS <sup>2</sup> code	Type	2016		2017		Sources in 2017 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value <sup>3</sup> (thousands)	Quantity (metric tons)	Value <sup>3</sup> (thousands)	
	Chromite ore:					
2610.00.0020	Not more than 40% Cr <sub>2</sub> O <sub>3</sub> :					
	Gross weight	--	--	676	\$106	South Africa (657, \$90); Brazil (19, \$16).
	Cr <sub>2</sub> O <sub>3</sub> content	--	XX	166	XX	
2610.00.0040	More than 40%, but less than 46% Cr <sub>2</sub> O <sub>3</sub> :					
	Gross weight	22,700	\$3,810	13,700	3,420	South Africa (13,600, \$3,400); Netherlands (44, \$7); Brazil (28, \$16).
	Cr <sub>2</sub> O <sub>3</sub> content	10,300	XX	6,150	XX	
2610.00.0060	46% or more Cr <sub>2</sub> O <sub>3</sub> :					
	Gross weight	111,000	22,600	116,000	30,100	South Africa (111,000, \$28,900); Canada (3,830, \$652); Netherlands (401, \$201); Brazil (107, \$99); China (40, \$214).
	Cr <sub>2</sub> O <sub>3</sub> content	54,300	XX	55,000	XX	
	Total chromite ore:					
	Gross weight	133,000	26,400	130,000	33,600	
	Cr <sub>2</sub> O <sub>3</sub> content	64,600	XX	61,300	XX	
	Chromium ferroalloys:					
	Ferrosilicon:					
7202.49.5090	Not more than 0.5% carbon:					
	Gross weight	39,700	106,000	51,600	135,000	Russia (21,500, \$53,300); Kazakhstan (9,770, \$27,900); Germany (6,120, \$20,900); South Africa (6,060, \$7,030); Turkey (3,440, \$9,810); Japan (3,040, \$12,000); Brazil (1,110, \$2,590); China (407, \$1,100); India (129, \$557); United Kingdom (3, \$21).
	Chromium content	26,900	XX	33,900	XX	
7202.49.5010	More than 0.5%, but less than 3% carbon:					
	Gross weight	7,480	15,400	2,820	6,820	Brazil (1,590, \$3,730); Kazakhstan (1,030, \$2,720); South Africa (172, \$282); China (27, \$84).
	Chromium content	4,750	XX	1,820	XX	
7202.49.1000	More than 3%, but less than 4% carbon:					
	Gross weight	11,400	8,410	6,740	7,140	South Africa (6,000, \$6,710); Albania (268, \$172); Russia (237, \$127); Germany (225, \$120); United Kingdom (11, \$8).
	Chromium content	5,740	XX	3,370	XX	
7202.41.0000	More than 4% carbon:					
	Gross weight	414,000	328,000 <sup>r</sup>	507,000	644,000	South Africa (357,000, \$396,000); Kazakhstan (42,900, \$81,300); Russia (28,400, \$49,900); Turkey (26,000, \$46,500); Zimbabwe (23,000, \$28,200); India (20,800, \$27,500); Albania (7,640, \$13,100); Sweden (513, \$920); Canada (204, \$214); Oman (189, \$242); Singapore (108, \$149).
	Chromium content	224,000	XX	272,000	XX	
7202.50.0000	Ferrosilicon-chromium:					
	Gross weight	7,300	10,000	21,500	32,000	Kazakhstan (all).
	Chromium content	4,780	XX	7,760	XX	
	Total chromium ferroalloys:					
	Gross weight	480,000	467,000	590,000	826,000	
	Chromium content	266,000	XX	319,000	XX	

See footnotes at end of table.

TABLE 6—Continued  
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE<sup>1</sup>

HTS <sup>2</sup> code	Type	2016		2017		Sources in 2017 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value <sup>3</sup> (thousands)	Quantity (metric tons)	Value <sup>3</sup> (thousands)	
8112.21.0000	Chromium metal, gross weight: Unwrought chromium powders	5,430	\$55,500	6,140	\$63,300	United Kingdom (2,930, \$31,500); China (1,350, \$15,500); Russia (1,350, \$9,900); France (328, \$4,510); Germany (99, \$1,170); Switzerland (39, \$290); India (38, \$349); Japan (3, \$64); Taiwan (2, \$59); Canada (136, \$741); United Kingdom (126, \$766); Japan (22, \$300); Taiwan (6, \$111); Chile (5, \$24); Brazil (3, \$8).
8112.22.0000	Waste and scrap	196 <sup>r</sup>	1,460 <sup>r</sup>	298	1,960	
8112.29.0000	Other than waste and scrap	8,190	80,400	8,090	75,300	Russia (3,740, \$28,900); France (3,190, \$33,200); China (505, \$4,970); Germany (449, \$3,210); United Kingdom (108, \$1,340); Spain (44, \$263); Canada (41, \$2,790); Japan (4, \$210); New Zealand (2, \$93); Taiwan (1, \$17).
	Total chromium metal	13,800	137,000	14,500	140,000	
	Chemicals, gross weight:					
	Chromium oxides and hydroxides:					
2819.10.0000	Chromium trioxides	2,850	8,630	3,630	11,800	Kazakhstan (1,890, \$4,520); China (1,240, \$5,540); France (135, \$667); South Africa (130, \$322); Mexico (54, \$114); India (51, \$142); Germany (36, \$83); Spain (35, \$219); Canada (18, \$41); Slovakia (17, \$45); Hong Kong (8, \$49); Colombia (8, \$43).
2819.90.0000	Other	2,510	10,500	2,490	12,300	China (1,020, \$5,570); Germany (983, \$5,950); Canada (447, \$506); Mexico (13, \$37); Colombia (7, \$44); Spain (6, \$34); Turkey (6, \$30); India (5, \$7); United Kingdom (3, \$17); Kazakhstan (3, \$12); France (1, \$40); Switzerland (1, \$16).
2833.29.4000	Total oxides Sulfates of chromium	5,360 482	19,200 340	6,120 436	24,100 414	Turkey (401, \$361); Germany (19, \$36); Canada (8, \$5); China (4, \$6); United Kingdom (3, \$5).
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Chromates of lead and zinc	220	539	236	664	China (220, \$565); Italy (10, \$85); Germany (7, \$15); South Africa (all).
2841.30.0000	Sodium dichromate Other chromates and dichromates; peroxochromates:	134	204	91	110	
2841.50.1000	Potassium dichromate	40	177	30	122	Austria (29, \$116); Colombia (1, \$4).
2841.50.9100	Other	1,580	5,340	1,650	5,440	Austria (1,380, \$4,460); France (204, \$786); Germany (26, \$53); China (22, \$65); Colombia (21, \$77).
2849.90.2000	Total salts Chromium carbide	1,970 100	6,270 <sup>r</sup> 1,940	2,010 194	6,330 4,460	China (145, \$3,190); Canada (22, \$615); United Kingdom (19, \$259); Germany (6, \$350); Austria (1, \$38).
	Total chromium chemicals	7,910	27,700	8,750	35,300	

See footnotes at end of table.

TABLE 6—Continued  
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE<sup>1</sup>

HTS <sup>2</sup> code	Type	2016		2017		Sources in 2017 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value <sup>3</sup> (thousands)	Quantity (metric tons)	Value <sup>3</sup> (thousands)	
Pigments and preparations based on chromium, gross weight:						
3206.20.0010	Chrome yellow	624	\$3,260 <sup>r</sup>	556	\$2,810	Canada (479, \$2,480); Colombia (39, \$149); China (30, \$128); Mexico (7, \$40); India (1, \$12),
3206.20.0020	Molybdenum orange	737	2,420	840	3,370	India (455, \$1,201); Canada (264, \$1,646); Colombia (115, \$481); China (6, \$46).
3206.20.0030	Zinc yellow	82	259	47	149	China (36, \$118); Mexico (9, \$23); Colombia (2, \$8).
3206.20.0050	Other	339	1,980	439	2,200	India (135, \$414); France (100, \$369); Germany (48, \$445); Poland (38, \$196); Japan (35, \$195); Netherlands (32, \$118); China (25, \$294); Canada (20, \$74); Mexico (2, \$29); Philippines (2, \$5); Thailand (1, \$57).
Total pigments		1,780	7,920 <sup>r</sup>	1,880	8,530	

<sup>r</sup>Revised. XX Not applicable. -- Zero.

<sup>1</sup>Table includes data available through June 21, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Harmonized Tariff Schedule of the United States.

<sup>3</sup>Customs import value generally represents a value in the foreign country, and therefore, excludes U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise into the United States.

Source: U.S. Census Bureau.

TABLE 7  
 WORLD PRODUCTION CAPACITY (CHROMITE ORE, FERROCHROMIUM, CHROMIUM METAL,  
 CHROMIUM CHEMICALS, AND STAINLESS STEEL) AND CONSUMPTION FOR SELECTED COUNTRIES OR LOCALITIES<sup>1</sup>

(Thousand metric tons of contained chromium)

Country or locality	Production capacity in 2017					Chromium consumption <sup>2</sup>		
	Ore <sup>3</sup>	Ferro-chromium <sup>3</sup>	Metal	Chemicals	Stainless steel <sup>4</sup>	2015	2016	2017
Afghanistan	7	--	--	--	--	2	1 <sup>r</sup>	1
Albania	1,000	75	--	--	--	11 <sup>r</sup>	25 <sup>r</sup>	150
Argentina	--	--	--	12	--	18 <sup>r</sup>	17	7
Australia	--	--	--	--	--	7	6	7
Austria	--	--	--	--	13	25 <sup>r</sup>	25	31
Belgium	--	--	--	--	270	140 <sup>r</sup>	160	160
Brazil	800	300	--	--	76	220 <sup>r</sup>	200 <sup>r</sup>	200
Canada	--	--	--	--	--	21 <sup>r</sup>	16	28
China	110	8,000	16	113	4,370	4,700	4,800 <sup>r</sup>	5,800
Finland	2,000	530	--	--	242	140	190	200
France	--	--	12	--	55	57 <sup>r</sup>	47 <sup>r</sup>	41
Germany	--	30	1	1	256	86 <sup>r</sup>	69 <sup>r</sup>	78
India	4,000	1,200	--	30	599	740 <sup>r</sup>	850 <sup>r</sup>	660
Iran	500	25	--	2	--	-30 <sup>r</sup>	-27 <sup>r</sup>	-5
Italy	--	--	--	5	289	190 <sup>r</sup>	180 <sup>r</sup>	2
Japan	--	26	1	3	540	430 <sup>r</sup>	450 <sup>r</sup>	450
Kazakhstan	6,000	1,800	--	38	--	1,100 <sup>r</sup>	1,000 <sup>r</sup>	610
Korea, Republic of	--	--	--	--	398	320 <sup>r</sup>	330	340
Kosovo	15	--	--	--	--	-- <sup>r</sup>	-- <sup>r</sup>	--
Madagascar	300	--	--	--	--	-30 <sup>r</sup>	1 <sup>r</sup>	31
Mexico	--	--	--	--	--	7 <sup>r</sup>	11	13
Oman	1,000	340	--	--	--	-5 <sup>r</sup>	56 <sup>r</sup>	-2
Pakistan	200	--	--	1	--	-63 <sup>r</sup>	-100 <sup>r</sup>	-100
Papua New Guinea	120	--	--	--	--	31 <sup>r</sup>	31 <sup>r</sup>	31
Philippines	400	--	--	--	--	-4	-7 <sup>r</sup>	-12
Poland	--	--	--	7	--	7 <sup>r</sup>	8 <sup>r</sup>	14
Russia	1,500	760	19	31	17	270 <sup>r</sup>	250 <sup>r</sup>	240
South Africa	22,000	4,800	--	18	104	-37 <sup>r</sup>	-590	-520
Spain	--	--	--	2	172	110	130	120
Sudan	81	--	--	--	--	13 <sup>r</sup>	5 <sup>r</sup>	7
Sweden	--	120	--	--	110	8 <sup>r</sup>	-1 <sup>r</sup>	-3
Taiwan	--	--	--	--	227	150 <sup>r</sup>	200	180
Turkey	12,000	180	--	28	--	2,200 <sup>r</sup>	1,500 <sup>r</sup>	1,600
Ukraine	--	--	--	--	17	12 <sup>r</sup>	13	16
United Arab Emirates	35	--	--	--	--	-3 <sup>r</sup>	4 <sup>r</sup>	5
United Kingdom	--	--	8	1	52	19 <sup>r</sup>	16	24
United States	--	--	--	42	505	300 <sup>r</sup>	-3,400	440
Vietnam	30	--	--	--	--	-2 <sup>r</sup>	1 <sup>r</sup>	--
Zimbabwe	900	300	--	--	--	-40 <sup>r</sup>	-80 <sup>r</sup>	98
Total	53,000	18,500	57	334	8,310	XX	XX	XX

<sup>1</sup>Revised. XX Not applicable. -- Zero.

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

<sup>3</sup>Estimated based on U.S. Geological Survey reported chromite ore production and trade statistics for chromite ore, chromium metal, and ferrochromium as reported by Global Trade Atlas and U.N. Comtrade in August 2018. Chromium content calculated assuming that the average grade of chromite ore is 45% Cr<sub>2</sub>O<sub>3</sub>; ferrochromium, 57% chromium; and chromium metal, 100% chromium.

<sup>4</sup>Reported in gross weight.

<sup>5</sup>Chromium content of stainless steel was calculated assuming the average grade is 17% chromium.

TABLE 8  
CHROMITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY<sup>1,2</sup>

(Metric tons, gross weight)

Country or locality	2013	2014	2015	2016	2017
Afghanistan	3,309	6,369 <sup>r</sup>	5,682 <sup>r</sup>	4,545 <sup>r</sup>	4,500 <sup>e</sup>
Albania, marketable	529,592 <sup>r</sup>	678,803 <sup>r</sup>	646,139 <sup>r</sup>	726,671 <sup>r</sup>	950,181
Brazil, ore and concentrate <sup>3</sup>	485,951 <sup>r</sup>	716,674 <sup>r</sup>	700,000 <sup>r,e</sup>	700,000 <sup>r,e</sup>	700,000 <sup>e</sup>
China	105,000	24,000	22,700	25,444 <sup>r</sup>	30,000 <sup>e</sup>
Finland, concentrate <sup>4</sup>	981,752	1,034,750	946,188	1,070,281 <sup>r</sup>	972,028
India <sup>5</sup>	2,878,320 <sup>r</sup>	2,164,163 <sup>r</sup>	2,915,584 <sup>r</sup>	3,727,777 <sup>r</sup>	3,500,000 <sup>e</sup>
Iran, concentrate	344,169	359,332	276,570 <sup>r</sup>	368,409 <sup>r</sup>	350,000 <sup>e</sup>
Kazakhstan <sup>6</sup>	5,255,100	5,410,700	5,382,800	5,542,900 <sup>r</sup>	4,579,300
Kosovo <sup>7</sup>	11,600	14,600	-- <sup>r</sup>	-- <sup>r</sup>	--
Madagascar	88,000	97,250	196,750 <sup>r</sup>	79,345 <sup>r</sup>	80,000 <sup>e</sup>
Oman <sup>8</sup>	787,645	751,200	442,600 <sup>r</sup>	450,800 <sup>r</sup>	450,000 <sup>e</sup>
Pakistan	77,100 <sup>r,e</sup>	71,861 <sup>r</sup>	100,155	81,250 <sup>r</sup>	100,000 <sup>e</sup>
Papua New Guinea <sup>9</sup>	92,045 <sup>r</sup>	96,750 <sup>r</sup>	102,273 <sup>r</sup>	100,000 <sup>r,e</sup>	100,000 <sup>e</sup>
Philippines	35,281	47,056	15,502	25,745 <sup>r</sup>	20,849
Russia	327,000 <sup>r</sup>	476,000 <sup>r</sup>	471,000 <sup>r</sup>	450,000 <sup>r</sup>	450,000 <sup>e</sup>
South Africa:					
44% to 48% Cr <sub>2</sub> O <sub>3</sub>	1,608,033 <sup>r</sup>	2,042,842 <sup>r</sup>	2,127,466 <sup>r</sup>	1,935,394	2,009,644
Less than 44% Cr <sub>2</sub> O <sub>3</sub>	12,081,627 <sup>r</sup>	11,994,880 <sup>r</sup>	13,528,195 <sup>r</sup>	12,769,786	14,534,007
Total	13,689,660	14,037,722	15,655,661	14,705,180	16,543,651
Sudan	30,870	61,334 <sup>r</sup>	60,000 <sup>r</sup>	15,000 <sup>r</sup>	34,314
Turkey, 34% to 43% Cr <sub>2</sub> O <sub>3</sub>	11,131,311 <sup>r</sup>	10,241,477 <sup>r</sup>	8,301,218 <sup>r</sup>	6,066,022 <sup>r</sup>	6,500,000 <sup>e</sup>
United Arab Emirates	15,750	19,822	3,869 <sup>r</sup>	17,863 <sup>r</sup>	17,000 <sup>e</sup>
Vietnam <sup>10</sup>	24,990	3,400	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>e</sup>
Zimbabwe	355,142	408,422	208,328	225,000 <sup>r</sup>	319,000 <sup>e</sup>
Grand total	37,300,000 <sup>r</sup>	36,700,000 <sup>r</sup>	36,500,000 <sup>r</sup>	34,400,000 <sup>r</sup>	35,700,000

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through August 6, 2018. All data are reported unless otherwise noted. Grand totals and estimated data are rounded to three significant digits; may not add to totals shown.

<sup>2</sup>Figures for all countries represent marketable output.

<sup>3</sup>Reported as lump ore and chromite concentrates by Brazil in Sumario Mineral 2015 for 2013–2014.

<sup>4</sup>Reported in gross weight by Geological Survey of Finland.

<sup>5</sup>Production is based on fiscal year, with a starting date of July 1 of the year shown.

<sup>6</sup>Reported in gross weight by the Statistical Committee of the Ministry of National Economy of the Republic of Kazakhstan.

<sup>7</sup>Reported in gross weight by the Republic of Kosovo Independent Commission for Mines and Minerals.

<sup>8</sup>Reported in gross weight by the Central Bank of Oman since 2014.

<sup>9</sup>Reported in Cr<sub>2</sub>O<sub>3</sub> content by the World Mining Congress in World Mining Data and converted to gross weight assuming 44% Cr<sub>2</sub>O<sub>3</sub> ore grade since 2015.

<sup>10</sup>Reported in gross weight by the World Bureau of Metal Statistics in World Metal Statistics Yearbook.

TABLE 9  
FERROCHROMIUM: WORLD PRODUCTION, BY COUNTRY OR LOCALITY<sup>1</sup>

(Metric tons, gross weight)

Country or locality <sup>2</sup>	2013	2014	2015	2016	2017
Albania	24,692	34,897	43,669 <sup>r</sup>	44,551 <sup>r</sup>	49,000
Brazil <sup>3</sup>	189,088	285,340	173,467 <sup>r</sup>	150,240 <sup>r</sup>	171,531
China	3,928,700 <sup>r</sup>	4,300,000 <sup>r,c</sup>	4,500,000 <sup>r,c</sup>	4,500,000 <sup>r,c</sup>	4,500,000 <sup>c</sup>
Finland	433,677	441,292	457,063 <sup>r</sup>	469,141 <sup>r</sup>	416,285
Germany <sup>c</sup>	17,500 <sup>r</sup>	17,000 <sup>r</sup>	17,000 <sup>r</sup>	17,000 <sup>r</sup>	17,000
India <sup>4</sup>	944,000	944,000	944,000	944,000 <sup>r</sup>	944,000 <sup>c</sup>
Japan	21,671	16,000 <sup>r,c</sup>	15,000 <sup>r,c</sup>	15,000 <sup>r,c</sup>	16,000 <sup>c</sup>
Kazakhstan	1,336,532	1,351,803	1,414,476 <sup>r</sup>	1,525,221 <sup>r</sup>	1,400,000 <sup>c</sup>
Oman <sup>5</sup>	20,625	44,063	63,750	90,063 <sup>r</sup>	79,563
Russia	487,810	439,600	363,286 <sup>r</sup>	268,439 <sup>r</sup>	270,000 <sup>c</sup>
South Africa <sup>6</sup>	3,219,162	3,719,010	3,684,598	3,596,000 <sup>r</sup>	3,600,000 <sup>c</sup>
Sweden <sup>5</sup>	49,000	67,000	90,480 <sup>r</sup>	81,900 <sup>r</sup>	92,390
Turkey <sup>5</sup>	132,603 <sup>r</sup>	86,025 <sup>r</sup>	82,650 <sup>r</sup>	72,966 <sup>r</sup>	83,894
Zimbabwe	150,063 <sup>r</sup>	235,256 <sup>r</sup>	115,586	78,200 <sup>r</sup>	142,800
Total	11,000,000 <sup>r</sup>	12,000,000 <sup>r</sup>	12,000,000 <sup>r</sup>	11,900,000 <sup>r</sup>	11,800,000

<sup>c</sup>Estimated. <sup>r</sup>Revised.

<sup>1</sup>Table includes data available through August 6, 2018. All data are reported unless otherwise noted. Totals and estimated data are rounded to three significant digits; may not add to totals shown.

<sup>2</sup>In addition to the countries and (or) localities listed, Iran may have produced ferrochromium, but available information was inadequate to make reliable estimates of output.

<sup>3</sup>Includes high- and low-carbon ferrochromium.

<sup>4</sup>Includes charge chrome. Production is based on the fiscal year, with a starting date of April 1 of the year shown.

<sup>5</sup>Reported by CRU Group in Chrome Monitor.

<sup>6</sup>Includes high- and low-carbon ferrochromium and ferrosilicon-chromium.