



2016 Minerals Yearbook

CHROMIUM [ADVANCE RELEASE]

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U.S. chromium apparent consumption was estimated to be 452,000 metric tons (t) on a contained-chromium basis in 2016, a slight decrease from that in 2015 (table 1). Chromium apparent consumption in 2016 was about one-half that of the record high in 1965.

Domestic reported consumption of chromium materials decreased slightly in 2016 compared with that of 2015. Steelmaking was the leading end use for chromium materials and accounted for 96% of reported consumption in 2016 (table 2). Superalloys and other end uses made up the remaining 4%.

Chromium exports increased by 7% to 253,000 t in 2016 compared with those of 2015, based on estimated chromium content of the chromite ore and chromium chemicals, ferroalloys, and metal. Chromium imports increased slightly on a chromium content basis to 549,000 t compared with those of 2015, based on U.S. Census Bureau trade data for chromite ore and chromium chemicals, ferroalloys, and metal.

The annual average unit value (by gross weight) of imported chromite ore in 2016 decreased by 8% from that in 2015; the annual average unit value of imported ferrochromium, including ferrochromium silicon, decreased by 3% from that in 2015; and the annual average unit value of imported chromium metal decreased by 12% from that in 2015 (tables 1, 3).

World production of chromite ore in 2016 decreased by 3% to 30.4 million metric tons (Mt) compared with the revised quantity of 31.2 Mt in 2015. South Africa was the leading producer of chromite ore, accounting for about 48% of world production in 2016 (table 8). World production of ferrochromium increased by 6% to 10.9 Mt compared with the revised quantity of 10.3 Mt in 2015. South Africa was also the leading producer of ferrochromium, accounting for about 33% of world production in 2016 (table 9).

Legislation and Government Programs

Stockpile.—The Defense Logistics Agency Strategic Materials, U.S. Department of Defense, administered disposals of chromium materials from the National Defense Stockpile (NDS) under its fiscal year 2016 (October 1, 2015, through September 30, 2016) Annual Materials Plan (AMP). Maximum disposal limits were based on the 2016 AMP for chromium materials, which were set at 23,500 t of chromium ferroalloys and 200 t of chromium metal (Defense Logistics Agency Strategic Materials, 2015).

During 2016, the quantity of chromium ferroalloys and chromium metal held in the NDS decreased by 8% and decreased slightly, respectively, compared with stocks at the beginning of the year (table 2). As a result, the quantity of chromium materials in the NDS at yearend was equivalent to about 15% of U.S. chromium apparent consumption on a contained chromium basis in 2016.

AK Steel Corp. (AK Steel), Allegheny Technologies Inc. (ATI), North American Stainless Co. (NAS), and Outokumpu Stainless USA, a subsidiary of Outokumpu Oyj (Finland), requested antidumping and countervailing duty trade investigations on imports of stainless steel from China (U.S. International Trade Commission, 2016, p. 1–2). The U.S. Department of Commerce assessed preliminary antidumping (AD) and countervailing (CV) duties against stainless steel sheet and strip imports from China (U.S. International Trade Administration, 2016a, p. 12711; 2016b, p. 64136). If the U.S. International Trade Commission were to determine that material injury, threat of material injury, or material retardation does exist, the U.S. Department of Commerce would issue AD and CV duty orders. A final determination on antidumping and countervailing duties range was expected to conclude in 2017.

Other Programs.—Chromium is required for normal glucose, protein, and fat metabolism, and thus, is an essential trace element for human health. Hexavalent chromium, however, is acutely toxic, chronically toxic, and (or) carcinogenic. The U.S. Environmental Protection Agency (EPA) regulates total chromium emissions into the air under the Clean Air Act of 1990 and in drinking water under the National Primary Drinking Water Regulations. The Occupational Safety and Health Administration (OSHA) regulates workplace exposure to chromium.

Production

Domestic data for chromium materials were developed by the U.S. Geological Survey 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 (table 2). In 2016, no chromite ore or ferrochromium was produced in the United States.

The major marketplace chromium-containing materials are chromite ore and foundry sand; chromium chemicals, ferroalloys, and metal; and stainless steel (Roskill Information Services Ltd., 2016a). In 2016, the United States was a major world producer of chromium chemicals and stainless steel, with an annual capacity to produce 42,000 t of chromium chemicals and 476,000 t of stainless steel on a chromium content basis in 2016 (table 7). The United States was the second-ranked global producer of chromium chemicals and the fourth-ranked producer of stainless steel.

Chromium Chemicals.—Chemical-grade chromite ore, which contains greater than 45% chromium oxide (Cr_2O_3), is typically processed via conversion to sodium dichromate. Sodium dichromate can then be used in other applications as

an oxidizing agent or in the production of dyes and inorganic chemicals, such as leather tanning liquors, metal plating and finishing solutions, drilling muds, and wood preservatives. In the United States, Elementis Chromium Inc., 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 used to reduce stress corrosion susceptibility and improve toughness in aluminum-magnesium, aluminum-magnesium-silicon, and aluminum-magnesium-zinc alloys.

In 2016, the U.S. stainless steel industry produced more than 2.5 Mt of stainless steel and imported and exported stainless steel mill products and scrap, making it a leading consumer of chromium materials. The leading United States stainless steel producers, in descending order of stainless steel production in 2016, were NAS, Outokumpu Oyj, AK Steel, and ATI (Roskill Information Services Ltd., 2016a).

NAS [a subsidiary of Acerinox S.A. (Spain)] produced stainless steel in its Ghent, KY, facility. Stainless steel production in 2016 was 1.07 Mt, an 8% increase compared with that of 2015 (Acerinox S.A., 2017, p. 56). Acerinox also completed new construction and equipment installation of a bright annealing line and a cold-rolling mill at their Kentucky facility in 2016, which increased the range of products and total production capacity.

Outokumpu Stainless USA, LLC [a subsidiary of Outokumpu] produced stainless steel at its Calvert, AL, plant. A loss settlement for machinery breakdown in the Calvert plant that occurred in 2014 was cleared with insurers in March 2016 (Outokumpu Oyj, 2017a, p. 45). The plant obtained ISO 14001 certification in April 2016 (Outokumpu Oyj, 2016). The company's stainless steel deliveries in North America and South America, including the United States, were 690,000 t, an increase of 29.5% compared with 533,000 t in 2015 owing to strong commercial development (Outokumpu Oyj, 2017b, p. 4).

AK Steel produced stainless steel at manufacturing plants in Butler, PA, and Mansfield, OH. AK Steel reported shipments of 847,252 t of stainless and electrical steel in 2016 compared with 850,704 t in 2015 (AK Steel Corp., 2017, p. 18). Shipments of stainless steel and electrical steel products were predominantly to the automotive industry. Light vehicle production increased in 2016, improving sales and shipments of steel to the automotive market. AK Steel also saw higher demand for stainless steel from appliance manufacturers and manufacturers of heating and air conditioning equipment. Demand for electrical steels from power transmission and distribution transformer manufacturers increased modestly owing to an increase in housing starts.

ATI produced stainless steel at facilities located in Brackenridge and Latrobe, PA. Sales for flat-rolled stainless steel and grain-oriented electrical steel decreased by 31% compared with those of 2015, which led to the permanent idling of the Midland, PA, stainless-steel melt and sheet-finishing facility in October 2016 and the Bagdad, PA, finishing facility in April 2016 (Allegheny Technologies Inc., 2017, p. F-26). Shipments of flat rolled products were 307,807 t in 2016, which was an 18% decrease

compared with 376,975 t in 2015 (Allegheny Technologies Inc., 2017, p. F-27). ATI attributed decreased shipments to the closure of the Midland and Bagdad facilities.

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. Census Bureau for calendar year 2016, the value of foreign trade of these chromium materials excluding stainless steel mill products and scrap was \$25.6 million for exports (57% less than that of the previous year) and \$667 million for imports (10% less than that of the previous year). A significant amount of chromium exits and enters the U.S. economy via the stainless steel mill product and scrap trade. The value of foreign trade of chromium materials including stainless steel mill products and scrap was \$2,820 million for exports (17% less than that of the previous year) and \$3,920 million for imports (18% less than that of the previous year).

In November 2016, the European Commission reopened its investigation into antidumping duties on imports of cold-rolled stainless steel from Taiwan. The European Steel Association (Eurofer) requested the investigation owing to a decrease in export prices from Taiwan after imposition of duties in 2015 (European Commission, 2016).

World Review

Brazil.—Brazil produced an estimated 500,000 t of chromite ore (gross weight) in 2016, unchanged from that in 2015. Reported ferrochromium production was 212,521 t in 2016 compared with a revised quantity of 261,778 t in 2015 (tables 8, 9).

Companhia de Ferro Ligas da Bahia (Ferbasa) was the leading ferrochromium producer in Brazil and produced high-carbon ferrochromium, low-carbon ferrochromium, and ferrosilicon for the steel and stainless steel industries. Because of developments in the political-economic environment in Brazil during 2016 and low overall demand for ferroalloys, Ferbasa struggled financially in the first half of the year (Companhia de Ferro Ligas da Bahia, 2017, p. 2). Reductions in cost and improvements in organization and operational performance, along with recovery in ferrochromium prices, enabled Ferbasa to financially recover in the second half of the year, and to perform maintenance and refurbishment of furnaces in their ferrochromium and ferrosilicon plants (Companhia de Ferro Ligas da Bahia, 2017, p. 2–3).

China.—China produced an estimated 20,000 t of chromite ore (gross weight) in 2016 compared with 22,700 t in 2015 and 3.4 Mt of ferrochromium in 2016 compared with 3.0 Mt in 2015. As a result, China was the second-ranked producer of ferrochromium in 2016, following South Africa (tables 8, 9).

The main source of chromite ore in China is in Tibet, but production capacity is insufficient to meet the country's large demand. As a result, China has invested in chromite ore resources in South Africa and Kazakhstan. China also relies on imports from Turkey and India, which can then be processed in ferrochromium plants located along the coast, saving the cost of transporting chromite from Tibet (Lafitte, 2013, p. 103).

Outotec Oyj (Finland) reached an agreement with Mintal Group Co. Ltd. (China) on the design and delivery of their joint venture ferrochromium plant in Baotou, China (Outotec Oyj, 2016). The steel belt sintering plant will have a capacity of 700,000 metric tons per year (t/yr) of sintered pellets and two 75-megavoltampere smelting furnaces with preheating technology. The ferrochromium capacity was reported to be 300,000 t/yr. This was the second plant built for Mintal Group and the third plant established in China by Outotec.

Environmental inspections, which affected stainless steel production in certain Provinces, were performed by the Government of China in 2016. As a result, many stainless-steel-processing plants were shut down in Guangdong, Jiangsu, and Shandong Provinces (CRU Group, 2016b, c). Jiangsu Delong Nickel Ind. Co., Ltd. restarted stainless steel production after ceasing production for 2 months owing to environmental investigations (CRU Group, 2016a).

Finland.—Finland produced an estimated 1.07 Mt of chromite ore concentrate in 2016 compared with 946,180 t in 2015 and an estimated 480,000 t of ferrochromium in 2016 compared with 460,000 t in 2015 (tables 8, 9). Outokumpu's Kemi Mine was the only operating chromite mine in Finland and the European Union. Outokumpu produced ferrochromium at its ferrochromium production facility in Tornio, Finland, using chromite extracted from the Kemi Mine (Outokumpu Oyj, 2018). In September, Outokumpu acquired Hernandez Edelstahl GmbH, a stainless steel distributor in Germany (Outokumpu Oyj, 2017a, p. 7). In April 2016, Outokumpu sold Outokumpu Stainless International (Guangzhou) Ltd., which was a service center based in China (Outokumpu Oyj, 2017b, p. 7).

India.—India produced an estimated 3.20 Mt of chromite ore (gross weight) in 2016 compared with 2.66 Mt in 2015 and an estimated 943,000 t of ferrochromium in 2016 compared with 944,000 t in 2015 (tables 8, 9). In May 2016, the Government of India reimposed a 30% export duty on chromite ore. The 2016–17 budget had removed the export duty on chromite ore (Dash, 2016a).

The government of West Bengal established a mineral exploration corporation under the Mines and Mineral Development Regulation Act to simplify the process of auction and exploration of mines. The new body is a subsidiary of the State-run Odisha Mining Corporation and will offer mineral exploration and analysis services to other State agencies (Mishra and Mohanty, 2016).

The Sukinda Chromite Mine, owned by Tata Steel Ltd. (a subsidiary of Tata Group), became the first mine in India

to establish a pilot project on a sustainable development framework (SDF). The SDF was proposed by the Union Ministry of Mines in an effort to develop a culture of sustainable mining in the country. The aim was to integrate social, environmental, and economic aspects of mining companies in order to include mineral conservation and corporate social responsibility in decisions (Times of India, The, 2016).

In addition, the Chief Minister of Odisha inaugurated Tata Steel's 55,000-t/yr high-carbon ferrochromium smelter in Gopalpur, Odisha State. The plant was the first greenfield ferrochromium plant for Tata Steel, with state-of-the-art pollution control equipment and technology, such as an effluent treatment plant and sewage treatment plant. The plant was also the first of its kind in India to use chromite briquettes for ferrochromium production and the first of its kind with a semiclosed hybrid furnace (Tata Steel Ltd., 2016). This plant was slated to open in 2014 but experienced delays. The high-carbon ferrochromium plant had the potential to expand production to 245,000 t/yr (Roskill Information Services Ltd., 2016c).

VISA Steel Ltd. was ordered by the Odisha State Pollution Control Board to close its ferroalloy and direct-reduced iron plants at Kalinganagar in Jaipur district owing to its failure to meet air and water pollution standards. Inspectors found deficiencies in the company's environmental management system in September 2016, including heavy dust emissions from ferroalloy furnaces (Dash, 2016b).

South Africa.—South Africa was the world's leading producer of chromite ore and ferrochromium in 2016. South Africa produced 14.7 Mt (gross weight) of chromite ore in 2016 compared with 15.7 Mt in 2015 and an estimated 3.60 Mt of ferrochromium in 2016 compared with 3.68 Mt in 2015 (tables 8, 9).

Afarak Group Plc (Helsinki, Finland) transitioned a furnace at its Mogale Alloys processing plant from producing silicomanganese to ferrochromium owing to favorable ferrochromium market conditions. The Mogale plant now has two ferrochromium furnaces in operation and a third furnace still producing silicomanganese (Afarak Group Plc, 2016a).

Pollux Investments Holdings Pty Ltd. [a subsidiary of Jubilee Metals Group Plc (London, United Kingdom)] entered into an agreement with ASA Metals Pty Ltd. and Dilokong Chrome Mine Pty Ltd. to process 1.1 Mt of tailings for chromite and platinum-group-metal (PGM) recovery. The processing will take place at a newly constructed 30,000-metric-ton-per-month (t/mo) chromium-processing plant that was fully commissioned and operational in March 2016 (Jubilee Metals Group Plc, 2016b; Mining Review Africa, 2016). Jubilee Metals had also entered into an agreement with Heric Ferrochrome Pty Ltd. in December 2015 to process more than 1.7 Mt of PGM-bearing chromite tailings at a newly commissioned 660,000-t/yr processing plant in South Africa. At the end of 2016, 71% of the Heric Tailings Project was completed (Jubilee Metals Group Plc, 2016a, p. 2). Both plants will remove chromium concentrate as a first step in the refining process.

In January 2016, International Ferro Metals (SA) Pty Ltd. (IFMSA) and Rustenburg Platinum Mines Ltd. completed a chromite ore supply contract. Under the terms of the agreement, Rustenburg Platinum will supply IFMSA with 10,000 t/mo

of chromite ore from the Upper Group 2 Reef (UG2) of the Bushveld Igneous Complex in 2016. From January 2017 through November 2020, Rustenburg Platinum will supply 7,500 t/mo of ore to IFMSA (Blamey, 2016).

In May 2016, Samancor Chrome Limited (Samancor) acquired IFMSA, which included their smelter in Mooinooi, North West Province, with a capacity of 250,000 t/yr of charge chrome. Samancor restarted production in November after completion of the IFMSA furnace acquisitions (Roskill Information Services Ltd., 2016b).

Owing to adverse market conditions in the chromite ore economic sector, Bauba Platinum Ltd. put the Moeijelyk Mine on care-and-maintenance status in January 2016 until conditions improve (Baub Platinum Ltd., 2016a). However, Bauba obtained a 20-year mining permit at Moeijelijik from the Department of Mineral Resources in June 2016, which may allow them to develop underground mining operations in the near future depending on water use licensing and market conditions (Baub Platinum Ltd., 2016b).

Tata Steel Ltd. (Mumbai, India) sold its steel operation located at KwaZulu-Natal, Tata Steel KwaZulu-Natal Pty Ltd. (TSKZN), to Richards Bay Alloys Pty Ltd. [a subsidiary of Traxys Africa Pty Ltd. (Luxembourg)]. TSKZN produced 150,000 t/yr of high-carbon ferrochromium from locally supplied ores prior to operations being shut down in July 2015 (Mchunu, 2016).

ASA Metals Pty Ltd. and Dilokong Chrome Mine Pty Ltd. [subsidiaries of Sinosteel Corporation (Beijing, China)] entered business rescue in 2016 (ASA Metals Pty Ltd., 2016a, b). Tubatse Ferrochrome, a joint venture between Samancor Chrome and Sinosteel, agreed to buy ASA Metals (PR Newswire, 2016).

Assore Ltd. completed the acquisition of African Rainbow Minerals Ltd.'s 50% indirect stake in the Dwarsrivier Chrome Mine. The indirect interest will be held through Assmang Proprietary Ltd. (African Rainbow Minerals Ltd., 2016, p. 16; Assore Ltd., 2016).

Turkey.—Turkey produced an estimated 2.80 Mt of chromite ore (gross weight) in 2016 compared with 3.50 Mt in 2015 and 90,000 t of ferrochromium in 2016 compared with 82,600 t in 2015 (tables 8, 9).

Turk Maadin Şirketi A.S. (TMS) [a subsidiary of Afarak Group Plc] was granted the exploration mining license for the Eskisehir-Mihaliccik Karaagac “Eagle Field” chromite project. TMS operates in three Provinces in Turkey and processes run-of-mine chromite ore into high-grade concentrate and lumpy chromite ore, which is delivered to Elektrowerk Weisweiler GmbH in Germany for further processing. With the exploration license, TMS can now investigate bringing the Eagle Field Mine into production (Afarak Group Plc, 2016b).

Zimbabwe.—Zimbabwe produced an estimated 275,000 t of chromite ore (gross weight) in 2016 compared with a reported 208,328 t in 2015 and an estimated 149,000 t of ferrochromium in 2016 compared with a reported 115,586 t in 2015 (tables 8, 9).

Zimbabwe Mining and Smelting Co. Pvt. Ltd. (Zimasco), Zimbabwe's leading ferrochromium producer and owned by China's Sinosteel Corp. Ltd., and Zimbabwe Alloys (ZimAlloys) secured chromite export licenses after agreeing to cede 50%

of their chromite claims to Apple Bridge Investment, a special purpose organization created by the Zimbabwe Government to buy and export chromite ore from small-scale miners (CNBC Africa, 2016; Zvauya, 2016). Exports of Zimasco chromite ore concentrates began in early September 2016 with an initial stockpile of 30,000 t (Herald, The, 2016).

Zimasco's West Plant smelting facility was ordered to shut down by the Environmental Management Agency after the leasing company, South African-based Portnex International, failed to submit an environmental management plan. Portnex continued to operate the plant, however, which resulted in the Zimbabwe Electricity Supply Authority switching off power, bringing operations to a halt (Muronzi, 2016). This came after disputes regarding sources of ore to run the three leased furnaces at West Plant, a \$500 million lawsuit instigated by Portnex against Zimasco regarding environmental pollution, and undisclosed business rescue plans on the part of Zimasco at the time of the original lease agreement (Daily News, 2016; Muronzi, 2016; Smith, 2016).

Outlook

Domestic and global consumption of chromium was expected to follow closely the trend in stainless steel production. U.S. stainless steel production (gross weight) was estimated by the American Iron and Steel Institute to be 2.5 Mt in 2016, up 5.8% from that of 2015 (American Iron and Steel Institute, 2015, 2016). According to the International Stainless Steel Forum, world stainless and heat-resisting steel melt shop production (ingot or slab equivalent) in 2016 increased by 10.2% to 45.8 Mt compared with that in 2015 (International Stainless Steel Forum, 2017, p. 8).

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TABLE 1
SALIENT CHROMIUM STATISTICS¹

		2012	2013	2014	2015	2016
Components of U.S. supply, contained chromium:						
Domestic mines	metric tons	--	--	--	--	--
Secondary ²	do.	146,000	150,000	157,000	154,000 ^r	152,000
Imports:						
Chromite ore	do.	89,200	55,000	58,100	81,900 ^r	64,600
Chromium chemicals	do.	5,990	5,870	6,010 ^r	6,090	3,810
Chromium ferroalloys	do.	306,000	280,000	359,000	228,000	266,000
Chromium metal	do.	15,300	13,700	17,500	12,800	13,800
Stainless steel mill products and scrap ²	do.	220,000	203,000	242,000	208,000	201,000
Stocks, January 1:						
Government	do.	111,000	107,000	96,500	81,200	72,300
Industry ³	do.	7,770	7,580	7,750	8,320	8,060
Total	do.	901,000	821,000	944,000	781,000 ^r	781,000
Distribution of U.S. supply, contained chromium:						
Exports:						
Chromite ore ⁴	do.	6,930	2,700	2,090	4,510 ^r	1,340
Chromium chemicals	do.	17,300	16,800	15,700 ^r	3,600 ^r	48
Chromium ferroalloys and metal	do.	3,090	3,360	2,950	1,330	1,320
Stainless steel mill products and scrap	do.	216,000	217,000	236,000	228,000	251,000
Stocks, December 31:						
Government	do.	107,000	96,500	81,200	72,300	66,800
Industry ³	do.	7,580	7,750	8,320	8,060	8,060
Total	do.	358,000	344,000	346,000 ^r	318,000 ^r	328,000
Consumption:						
Apparent, contained chromium	do.	543,000	477,000	598,000 ^r	463,000 ^r	452,000
Reported:						
Chromite ore and concentrates, gross weight	do.	W	W	W	W	W
Chromium ferroalloys: ⁵						
Gross weight	do.	435,000	435,000	449,000	432,000	422,000
Contained chromium	do.	251,000	248,000	257,000	248,000	242,000
Chromium metal, gross weight	do.	4,470	4,270	4,190	4,170	4,220
Stocks, December 31, gross weight:						
Government:						
Chromium ferroalloys	do.	144,000	129,000	108,000	95,700	88,100
Chromium metal	do.	4,090	4,090	3,960	3,960	3,910
Industry, consumer:						
Chromium ferroalloys ⁶	do.	12,500	13,000	13,900	13,400	13,400
Chromium metal	do.	169	159	157	160	159
Other	do.	192	193	185	189	197
Prices, average annual:						
Chromite ore ⁷	dollars per metric ton	168	162	181 ^r	173	204
Ferrochromium, chromium content ⁸	dollars per pound	1.08	1.00	1.07	1.06	0.92
Aluminothermic chromium metal, gross weight ⁹	do.	5.87	4.57	4.49	4.38	3.75
Value of trade:						
Exports	thousands	\$159,000	\$152,000	\$153,000 ^r	\$58,900 ^r	\$25,600
Imports	do.	\$1,100,000	\$871,000	\$1,110,000 ^r	\$740,000 ^r	\$667,000
Net imports ¹⁰	do.	-\$941,000	-\$719,000	-\$958,000 ^r	-\$682,000 ^r	-\$641,000
Stainless steel:						
World production, contained chromium ¹¹	metric tons	6,110,000 ^r	6,550,000 ^r	7,090,000 ^r	7,060,000 ^r	7,780,000
U.S. production:						
Gross weight ¹²	do.	1,980,000	2,030,000	2,390,000	2,350,000	2,480,000
Contained chromium ¹³	do.	343,000	354,000	420,000	412,000	436,000
Average grade, dimensionless ¹⁴		0.1733	0.1744	0.1759	0.1758	0.1758
Shipments, gross weight ¹⁵	metric tons	1,900,000	2,220,000	2,270,000	2,230,000	2,360,000
Exports, gross weight	do.	650,000	633,000	838,000 ^r	828,000	821,000
Imports, gross weight	do.	1,140,000	965,000	1,100,000	1,030,000	917,000
Scrap, gross weight:						
Receipts	do.	858,000	882,000	921,000	907,000 ^r	891,000
Consumption	do.	1,300,000	1,300,000	1,320,000	1,330,000 ^r	1,340,000

See footnotes at end of table.

TABLE 1—Continued
SALIENT CHROMIUM STATISTICS¹

		2012	2013	2014	2015	2016
Stainless steel:—Continued						
Scrap, gross weight:—Continued						
Exports	metric tons	623,000 ^r	644,000	548,000	514,000	654,000
Imports	do.	156,000	226,000	329,000	192,000	263,000
Value of trade:						
Exports	thousands	\$2,570,000	\$2,500,000	\$3,020,000	\$2,710,000	\$2,350,000
Imports	do.	\$4,600,000	\$3,670,000	\$4,370,000	\$3,850,000	\$3,070,000
Scrap exports	do.	\$804,000	\$742,000	\$674,000	\$639,000	\$442,000
Scrap imports	do.	\$236,000	\$211,000	\$426,000	\$165,000	\$182,000
Net imports ^{10, 16}	do.	-\$1,460,000	-\$632,000	-\$1,100,000	-\$670,000 ^r	-\$453,000

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

¹Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Calculated assuming chromium content of stainless steel and stainless steel scrap to average 17% chromium.

³Includes consumer stocks of chromium ferroalloys and metal and other chromium-containing materials.

⁴Calculated based on the chromium content of imported chromite ore, typically between 46% and 63% Cr₂O₃.

⁵Chromium ferroalloys, chromite ore, and other chromium-containing materials excluding chromium metal.

⁶Consumer stocks of high- and low-carbon ferrochromium and ferrochromium-silicon.

⁷Time-weighted average price of South African chromite ore that contains 44% Cr₂O₃ free on board (f.o.b.) South Africa as reported in CRU Group.

⁸Time-weighted average U.S. price of imported high-carbon chromium that contains 47% to 55% chromium as reported in CRU Group.

⁹Time-weighted average U.S. price of imported aluminothermic chromium metal as reported by CRU Group.

¹⁰Negative data indicate that imports are greater than exports.

¹¹Production estimated from publicly available sources. Chromium content estimated at 17%.

¹²Source: American Iron and Steel Institute annual report of stainless and heat-resisting raw steel production and shipments.

¹³Estimated mass-weighted average of the mean chromium content of stainless steel production by grade.

¹⁴Ratio 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.

¹⁵Source: American Iron and Steel Institute annual report of stainless and heat-resisting raw steel shipments.

¹⁶Includes stainless steel and stainless steel scrap.

TABLE 2
U.S. REPORTED CONSUMPTION AND STOCKS OF CHROMIUM PRODUCTS¹

(Metric tons, unless otherwise specified)

	2015		2016		Change ²	
	Gross weight	Chromium content	Gross weight	Chromium content	Quantity	Percent
Consumption by end use:						
Steel:						
Carbon steel	4,620	2,990	4,900	3,140	276	6
High-strength low-alloy steel	2,000	1,310	1,870	1,230	-129	-6
Stainless and heat-resisting steel	378,000	216,000	366,000	208,000	-12,200	-3
Fully alloy steel	13,300	8,200	11,500	7,080	-1,830	-14
Unspecified steel ³	24,700	14,600	24,500	14,500	-205	-1
Superalloys	7,280	5,150	11,800	7,850	4,500	62
Other alloys and uses ⁴	5,440	3,830	5,280	3,780	-166	-3
Total	436,000	252,000	426,000	246,000	-9,770	-2
Consumption by material:						
Low-carbon ferrochromium	26,100	17,200	26,700	17,600	630	2
High-carbon ferrochromium	375,000	218,000	364,000	212,000	-10,800	-3
Ferrochromium silicon	(5)	(5)	(5)	(5)	(5)	(5)
Chromium metal	4,170	4,170	4,230	4,220	57	1
Chromium-aluminum alloy	427	387	477	344	50	12
Other chromium materials	30,200	11,900	30,500	12,100	250	1
Total	436,000	252,000	426,000	246,000	-9,770	-2
Consumer stocks:						
Low-carbon ferrochromium	1,740	1,150	1,840	1,220	97	6
High-carbon ferrochromium	10,900	6,330	10,700	6,210	-201	-2
Ferrochromium silicon	(5)	(5)	(5)	(5)	(5)	(5)
Chromium metal	160	160	159	159	-1	-1
Chromium-aluminum alloy	(5)	(5)	(5)	(5)	(5)	(5)
Other chromium materials	944	415	1,080	472	134	14
Total	13,700	8,060	13,800	8,060	30	(6)
National Defense Stockpile stocks:⁷						
Chromium ferroalloys:⁸						
High-carbon ferrochromium	63,000	45,000	57,400	41,000	-5,650	-9
Low-carbon ferrochromium	32,600	23,300	30,700	21,900	-1,910	-6
Chromium metal ⁹	3,960	3,960	3,910	3,910	-59	-1

¹Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Change based on gross weight unrounded data from current year compared with that of previous year.

³Includes electrical, tool, and unspecified steel end uses.

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

⁵Withheld to avoid disclosing company proprietary data; included in "Other chromium materials."

⁶Less than ½ unit.

⁷Data are based on the "Total Uncommitted Inventory" of stockpile material D-1 report by the Defense Logistics Agency Strategic Materials.

⁸Chromium content estimated using 71.4% chromium.

⁹Chromium content estimated using 100% chromium.

TABLE 3
VALUE OF IMPORTS AND U.S. PRICE QUOTATIONS FOR CHROMIUM MATERIALS¹

Material	2015		2016	
	Contained chromium	Gross weight	Contained chromium	Gross weight
Value: ²				
Chromite ore:				
Not more than 40% chromic oxide	dollars per metric ton	XX	XX	XX
More than 40% but less than 46% chromic oxide	do.	410 ^r	179	371
46% or more chromic oxide	do.	331 ^r	229 ^r	417
Average	do.	345 ^r	216 ^r	410
Ferrochromium:				
Not more than 0.5% carbon	do.	4,310	2,920	3,940
More than 0.5% but not more than 3% carbon	do.	3,630	2,440	3,250
More than 3% but not more than 4% carbon	do.	1,660	843	1,470
Average (not more than 4% carbon)	do.	4,160	2,790	3,470
More than 4% carbon	do.	1,880	1,020	1,460
Average (all grades)	do.	2,250	1,260	1,750
Chromium metal ³	do.	XX	11,200	XX
Price: ⁴				
Chromite ore:				
South Africa:				
38% to 40% Cr ₂ O ₃	do.	623 ^{r,5}	166	705
44% Cr ₂ O ₃	do.	574 ⁵	173	676
42% UG2	do.	522 ^{r,5}	150	617
High-carbon ferrochromium:				
47% to 55% chromium	cents per pound	106	XX	92
60% to 70% chromium	do.	108	XX	95
Low-carbon ferrochromium:				
0.05% carbon	do.	228	XX	220
0.10% carbon	do.	210	XX	184
0.15% carbon	do.	208	XX	181
Chromium metal, imported, aluminothermic	do.	XX	438	XX

¹Revised. do. Ditto. XX Not applicable.

²Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

³Mass-weighted average based on customs value and quantity of imported material, as reported by the U.S. Census Bureau.

⁴Average for all grades.

⁵Source: CRU Group.

⁵Based on average Cr₂O₃ content.

TABLE 4
U.S. EXPORTS OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2015		2016		Principal destinations in 2016 (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	7,210	\$5,680	2,760	\$1,650	Canada (1,950, \$903); Mexico (430, \$317); China (168, \$118); United Kingdom (48, \$44); Republic of Korea (45, \$33); Vietnam (44, \$75); Thailand (33, \$65); Philippines (30, \$62); Ecuador (8, \$21); Colombia (1, \$12).
Chromium metal, gross weight:						
8112.21.0000	Unwrought chromium powders	555	7,900	232	5,930	Japan (76, \$1,670); United Kingdom (35, \$614); Germany (30, \$1,370); Mexico (30, \$727); China (12, \$290); India (7, \$210); Canada (7, \$128); Italy (5, \$81); Switzerland (5, \$70); Colombia (5, \$51); Belgium (4, \$72); Singapore (3, \$188); Taiwan (3, \$125); Malaysia (3, \$90); Republic of Korea (2, \$57); France (1, \$52); Hong Kong (1, \$50); Peru (1, \$6).
8112.22.0000	Chromium metal waste and scrap	35	551	93	1,140	Japan (52, \$444); United Kingdom (34, \$567); Malaysia (3, \$57); Canada (2, \$34); Spain (1, \$22); Taiwan (1, \$14).
8112.29.0000	Chromium metal other than unwrought powders and waste and scrap	210	7,200	182	7,240	Taiwan (68, \$2,270); United Kingdom (23, \$494); Mexico (16, \$616); China (12, \$701); Japan (9, \$366); Brazil (8, \$368); Ireland (7, \$173); France (6, \$275); Canada (5, \$113); Republic of Korea (4, \$421); Chile (4, \$38); Italy (3, \$224); Malaysia (3, \$216); India (2, \$229); Singapore (2, \$145); Hong Kong (2, \$125); Hungary (2, \$68) Spain (2, \$51); United Arab Emirates (1, \$78); Germany (1, \$56); Israel (1, \$44); Colombia (1, \$32).
Total chromium metal		801	15,700	506	14,300	
Chromium ferroalloys:						
7202.41.0000	High-carbon ferrochromium: ³ Gross weight	723	1,020	675	1,030	Canada (407, \$600); Mexico (167, \$310); Peru (43, \$52); Poland (29, \$25); Luxembourg (15, \$13); Colombia (5, \$15); China (3, \$3); Czechia (3, \$3); Japan (3, \$3); Pakistan (1, \$3).
7202.49.0000	Chromium content Low-carbon ferrochromium: ⁴	354	XX	374	XX	
		279	717	800	1,310	Canada (295, \$489); Mexico (255, \$505); Afghanistan (156, \$184); Argentina (58, \$79); India (33, \$44); Egypt (2, \$3); Peru (1, \$7).
7202.50.0000	Chromium content Ferrochromium-silicon:	154	XX	421	XX	
	Gross weight	73	85	61	64	Canada (36, \$37); Mexico (20, \$22); India (4, \$5).
	Chromium content	26	XX	21	XX	
Total chromium ferroalloys:						
	Gross weight	1,080	1,820	1,540	2,400	
	Chromium content	533	XX	816	XX	
Chemicals, gross weight:						
2819.90.0000	Chromium oxides; other	5,260 ^r	26,900 ^r	--	--	Mexico (130, \$637); Taiwan (19, \$92); Malaysia (12, \$61); Poland (3, \$19); Hong Kong (1, \$3).
2833.29.4000	Chromium sulfates	244 ^r	1,210 ^r	165	815	

See footnotes at end of table.

TABLE 4—Continued
U.S. EXPORTS OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2015		2016		Principal destinations in 2016 (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	24	\$713	25	\$649	Mexico (15, \$203); China (4, \$32); South Africa (3, \$375); Trinidad and Tobago (2, \$18); Turkey (1, \$11).
2841.50.1000	Potassium dichromate	184 ^r	416 ^r	101	141	Guatemala (60, \$60); Taiwan (33, \$74); Mexico (3, \$3).
2841.50.9100	Other	204 ^r	1,640	212	1,890	Canada (102, \$477); South Africa (20, \$473); Mexico (19, \$123); Germany (19, \$108); Japan (12, \$230); Trinidad and Tobago (5, \$33); Taiwan (5, \$19); United Kingdom (4, \$68); El Salvador (3, \$20); Republic of Korea (2, \$94); France (2, \$33); India (1, \$18); Antigua and Barbuda (1, \$6); Colombia (1, \$6); Guatemala (1, \$6); Grenada (1, \$4).
	Total salts	411 ^r	2,770 ^r	338	2,680	
3206.20.0000	Pigments and preparations, gross weight	757 ^r	4,860 ^r	499	3,700	Canada (88, \$624); Mexico (77, \$831); Saudi Arabia (42, \$35); Colombia (21, \$476); Trinidad and Tobago (11, \$65); El Salvador (10, \$67); Antigua and Barbuda (10, \$35); Netherlands (8, \$60); China (7, \$172); Honduras (4, \$6); Republic of Korea (3, \$37); Venezuela (3, \$33); Germany (2, \$73); Guatemala (2, \$12); Belgium (1, \$30); Dominican Republic (1, \$26); Ecuador (1, \$17); Egypt (1, \$12); Suriname (1, \$11); Grenada (1, \$8); Ireland (1, \$8); Jamaica (1, \$6); Finland (1, \$4); Barbados (1, \$3); Hong Kong (1, \$3); Malaysia (1, \$3).

¹Revised. XX Not applicable. -- Zero.

²Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

³Harmonized Tariff Schedule of the United States.

⁴More than 4% carbon.

⁵Not more than 4% carbon.

Source: U.S. Census Bureau.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF FERROCHROMIUM, BY COUNTRY OR LOCALITY¹

Country or locality	Not more than 0.5% carbon (HTS ² code 7202.49.5090)			More than 0.5% carbon, but not more than 3% carbon (HTS ² code 7202.49.5010)			More than 3% carbon, but not more than 4% carbon (HTS ² code 7202.49.1000)			More than 4% carbon (HTS ² code 7202.41.0000)			Total all grades		
	Gross weight (metric tons)	Chromium content (metric tons)	Value (thousands)	Gross weight (metric tons)	Chromium content (metric tons)	Value (thousands)	Gross weight (metric tons)	Chromium content (metric tons)	Value (thousands)	Gross weight (metric tons)	Chromium content (metric tons)	Value (thousands)	Gross weight (metric tons)	Chromium content (metric tons)	Value (thousands)
2015:															
Albania	--	--	--	--	--	--	--	--	--	--	--	3,210	2,200	3,210	\$4,580
Belgium	220	153	\$715	--	--	--	--	--	--	--	--	220	153	220	715
Brazil	2,900	1,790	5,790	162	98	\$395	--	--	--	1,070	592	1,130	4,130	2,480	7,320
China	4,930	2,990	10,900	279	170	617	--	--	--	63	39	97	5,270	3,200	11,600
Finland	--	--	--	--	--	--	--	--	--	--	--	4,530	2,470	4,530	4,260
Germany	5,800	4,070	21,500	--	--	--	--	--	--	--	--	17,700	10,900	17,800	19,800
India	70	28	194	--	--	--	--	--	--	--	--	33,400	21,100	2,960	2,020
Japan	2,960	2,020	12,000	--	--	--	--	--	--	--	--	--	--	35,200	22,400
Kazakhstan	638	455	1,640	1,220	870	2,990	--	--	--	--	--	156	80	118	50,900
Mexico	39	24	194	--	--	--	--	--	--	80	55	156	3,000	1,610	349
Oman	--	--	--	--	--	--	--	--	--	--	--	3,000	1,610	3,000	2,740
Poland	--	--	--	120	73	237	--	--	--	--	--	--	120	73	237
Russia	29,300	20,300	84,300	1,620	1,140	4,360	--	--	--	24,000	16,100	35,300	54,900	37,500	124,000
South Africa	708	430	1,730	472	257	824	2,590	1,320	2,180	203,000	102,000	180,000	207,000	104,000	184,000
Sweden	--	--	--	--	--	--	--	--	--	--	--	349	234	349	509 ^r
Turkey	747	518	2,270	81	57	225	--	--	--	16,700	10,500	21,500	17,600	11,100	24,000
Zimbabwe	--	--	--	--	--	--	--	--	--	40,000	21,900	40,000	40,000	21,900	40,000
Total	48,300	32,800	141,000	3,960	2,660	9,650	2,590	1,320	2,180	348,000	189,000	356,000	402,000	226,000 ^r	509,000 ^r
2016:															
Albania	--	--	--	--	--	--	--	--	--	1,640	1,110	1,940	1,640	1,110	1,940
Austria	--	--	--	--	--	--	--	--	--	74	46	71	74	46	71
Brazil	4,620	2,800	8,940	4,750	2,920	9,200	--	--	--	1,260	667	826	10,600	6,390	19,000
China	2,930	1,840	6,160	1,100	708	2,290	12	6	6	--	--	--	4,050	2,550	8,450
Germany	5,080	3,540	19,800	--	--	--	--	--	--	--	--	--	5,080	3,540	19,800
Hong Kong	--	--	--	25	15	47	--	--	--	--	--	--	25	15	47
India	81	52	361	--	--	--	--	--	--	7,740	4,710	7,220	7,820	4,760	7,590
Japan	1,970	1,390	8,120	--	--	--	--	--	--	--	--	--	1,970	1,390	8,120
Kazakhstan	5,430	3,880	13,400	1,160	806	2,850	--	--	--	37,900	29,700	39,300	44,500	34,400	55,500
Mexico	136	89	883	--	--	--	--	--	--	--	--	--	136	89	883
Netherlands	1,510	999	3,640	--	--	--	--	--	--	--	--	--	1,510	999	3,640
Oman	--	--	--	--	--	--	--	--	--	2,900	1,730	2,660	2,900	1,730	2,660
Russia	14,800	10,200	36,600	--	--	--	450	242	241	3,930	2,600	5,370	19,200	13,100	42,200
South Africa	266	98	386	31	20	44	11,000	5,490	8,160	320,000	158,000	224,000	331,000	164,000	233,000
Sweden	--	--	--	--	--	--	--	--	--	2,550	1,710	3,460	2,550	1,710	3,460
Switzerland	--	--	--	--	--	--	--	--	--	41	25	30	41	25	30
Turkey	2,820	1,970	7,490	405	287	1,010	--	--	--	29,800	19,700	36,400	33,000	22,000	44,900
United Kingdom	1	1	2	--	--	--	--	--	--	--	--	--	1	1	2
Zimbabwe	--	--	--	--	--	--	--	--	--	6,120	3,460	5,920	6,120	3,460	5,920
Total	39,700	26,900	106,000	7,480	4,750	15,400	11,400	5,740	8,410	414,000	224,000	327,000	473,000	261,000	457,000

See footnotes at end of table.

TABLE 5—Continued
U.S. IMPORTS FOR CONSUMPTION OF FERROCHROMIUM, BY COUNTRY OR LOCALITY¹

¹Revised. -- Zero.

¹Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Harmonized Tariff Schedule of the United States.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2015		2016		Sources in 2016 (Quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	
	Chromite ore:					
2610.00.0040	More than 40%, but less than 46% Cr ₂ O ₃ :					
	Gross weight	34,600	\$6,210	22,700	\$3,810	South Africa (22,000, \$3,680); Brazil (641, \$128); Canada (29, \$4).
	Cr ₂ O ₃ content	15,100	XX	10,300	XX	
2610.00.0060	46% or more Cr ₂ O ₃ :					
	Gross weight	96,300 ^r	22,100 ^r	111,000	22,600	South Africa (111,000, \$22,600), Netherlands (19, \$11); Belgium (1, \$2).
	Cr ₂ O ₃ content	66,800 ^r	XX	54,300	XX	
	Total chromite ore:					
	Gross weight	131,000 ^r	28,300 ^r	133,000	26,400	
	Cr ₂ O ₃ content	81,900 ^r	XX	64,600	XX	
	Chromium ferroalloys:					
	Ferrochromium:					
7202.49.5090	Not more than 0.5% carbon:					
	Gross weight	48,300	141,000	39,700	106,000	Russia (14,800, \$36,600); Kazakhstan (5,430, \$13,400); Germany (5,080, \$19,800); Brazil (4,620, \$8,940); China (2,930, \$6,160); Turkey (2,820, \$7,490); Japan (1,970, \$8,120); Netherlands (1,510, \$3,640); South Africa (266, \$386); Mexico (136, \$883); India (81, \$361); United Kingdom (1, \$2).
	Chromium content	32,800	XX	26,900	XX	
7202.49.5010	More than 0.5%, but less than 3% carbon:					
	Gross weight	3,960	9,650	7,480	15,400	Brazil (4,750, \$9,200); Kazakhstan (1,160, \$2,850); China (1,100, \$2,290); Turkey (405, \$1,010); South Africa (31, \$44); Hong Kong (25, \$47).
	Chromium content	2,660	XX	4,750	XX	
7202.49.1000	More than 3%, but less than 4% carbon:					
	Gross weight	2,590	2,180	11,400	8,410	South Africa (11,000, \$8,160); Russia (450, \$241); China (12, \$6).
	Chromium content	1,320	XX	5,740	XX	
7202.41.0000	More than 4% carbon:					
	Gross weight	348,000	356,000	414,000	327,000	South Africa (320,000, \$224,000); Kazakhstan (37,900, \$39,300); Turkey (29,800, \$36,400); India (7,740, \$7,220); Zimbabwe (6,120, \$5,920); Russia (3,930, \$5,370); Oman (2,900, \$2,660); Sweden (2,550, \$3,460); Albania (1,640, \$1,940); Brazil (1,260, \$826); Austria (74, \$71); Switzerland (41, \$30).
	Chromium content	189,000	XX	224,000	XX	
7202.50.0000	Ferrochromium-silicon:					
	Gross weight	5,810	8,020	7,300	10,000	Kazakhstan (5,520, \$8,090); Brazil (1,780, \$1,960).
	Chromium content	2,240	XX	4,780	XX	
	Total chromium ferroalloys:					
	Gross weight	408,000	517,000	480,000	467,000	
	Chromium content	228,000	XX	266,000	XX	

See footnotes at end of table.

TABLE 6—Continued
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2015		2016		Sources in 2016 (Quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	
8112.21.0000	Chromium metal, gross weight: Unwrought chromium powders	4,820	\$53,600	5,430	\$55,500	United Kingdom (2,830, \$28,900); China (1,210, \$13,400); Russia (709, \$4,850); France (632, \$7,300); Japan (43, \$466); Germany (16, \$479); Taiwan (2, \$59).
8112.22.0000	Waste and scrap	153	1,430	215	1,470	Canada (110, \$230); United Kingdom (58, \$419); Japan (23, \$469); France (19, \$271); China (3, \$33); Russia (1, \$31); Germany (1, \$15).
8112.29.0000	Other than waste and scrap	7,870	89,300	8,190	80,400	Russia (3,950, \$26,900); France (2,550, \$26,300); Germany (601, \$3,880); China (394, \$3,280); Canada (233, \$16,500); United Kingdom (160, \$1,670); Spain (143, \$987); South Africa (134, \$86); Austria (11, \$52); Japan (7, \$308); Taiwan (7, \$127); New Zealand (2, \$61).
Total chromium metal		12,800	144,000	13,800	137,000	
Chemicals, gross weight:						
Chromium oxides and hydroxides:						
2819.10.0000	Chromium trioxides	8,490	24,900	2,850	8,630	Kazakhstan (1,440, \$3,430); China (985, \$3,950); South Africa (97, \$262); Mexico (93, \$227); Slovakia (51, \$143); Germany (36, \$126); Taiwan (36, \$86); Russia (34, \$77); Spain (32, \$161); Canada (19, \$52); India (18, \$47); Colombia (7, \$27); Japan (1, \$39).
2819.90.0000	Other	2,310	10,200	2,510	10,500	Germany (980, \$5,920); China (801, \$3,670); Canada (695, \$774); Colombia (10, \$77); France (8, \$39); Spain (8, \$36); United Kingdom (3, \$22).
Total oxides		10,800	35,100	5,360	19,200	Turkey (234, \$202); China (233, \$125); India (14, \$11); Canada (1, \$2).
2833.29.4000	Sulfates of chromium	500	452	482	340	
Salts of oxometallic or peroxometallic acids:						
2841.90.4500	Chromates of lead and zinc	128	2,220	220	539	China (198, \$466); Japan (22, \$73).
2841.30.0000	Sodium dichromate	39	62	134	204	Argentina (87, \$134); South Africa (19, \$36); China (18, \$20); United Kingdom (11, \$11).
Other chromates and dichromates, peroxochromates:						
2841.50.1000	Potassium dichromate	7	30	40	177	Austria (38, \$158); Colombia (3, \$13).
2841.50.9100	Other	832	2,820	1,580	5,340	Austria (1,240, \$4,140); France (278, \$1,020); Republic of Korea (36, \$112); Colombia (16, \$53); China (2, \$14).
Total salts		1,010	5,130	1,970	6,260	
2849.90.2000	Chromium carbide	109	2,550	100	1,940	United Kingdom (45, \$568); China (29, \$526); Canada (16, \$429); Germany (6, \$313); Hong Kong (3, \$52); Austria (1, \$47).
Total chromium chemicals		12,400	43,300	7,910	27,700	
Pigments and preparations based on chromium, gross weight:						
3206.20.0010	Chrome yellow	626	3,190 ^r	624	3,410	Canada (464, \$2,710); Colombia (135, \$431); Mexico (12, \$50); China (7, \$41); India (6, \$22).
3206.20.0020	Molybdenum orange	609	2,620 ^r	737	2,420	Canada (534, \$1,830); Colombia (103, \$388); India (95, \$172); China (4, \$27); Mexico (2, \$9).

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2015		2016		Sources in 2016 (Quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	
	Pigments and preparations based on chromium,					
	gross weight:—Continued					
3206.20.0030	Zinc yellow	40	\$137	82	\$259	China (69, \$225); Mexico (13, \$34).
3206.20.0050	Other	289	1,880 ^r	339	1,980	France (129, \$505); India (71, \$246); Germany (45, \$426); Netherlands (30, \$111); Japan (27, \$174); Poland (19, \$93); China (15, \$389); Canada (1, \$18); Mexico (1, \$9).
	Total pigments	1,560	7,830 ^r	1,780	8,070	

^rRevised. XX Not applicable.

¹Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Harmonized Tariff Schedule of the United States.

³Customs 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
ESTIMATED WORLD PRODUCTION CAPACITY (CHROMITE ORE, FERROCHROMIUM,
CHROMIUM METAL, CHROMIUM CHEMICALS, AND STAINLESS STEEL)
AND CONSUMPTION FOR SELECTED COUNTRIES OR LOCALITIES¹

(Thousand metric tons of contained chromium)

Country or locality	Production capacity in 2016					Chromium consumption ²		
	Ore	Ferro-chromium	Metal	Chemicals	Stainless steel	2014	2015	2016
Afghanistan	3	--	--	--	--	2	2	2
Albania	361	43	--	--	--	210 ^r	210 ^r	200
Argentina	--	--	--	16	--	24	17	17
Australia	--	--	--	--	--	5	7	6
Austria	--	--	--	--	12	25	19	25
Belgium	--	--	--	--	268	140 ^r	150 ^r	160
Brazil	361	177	--	--	75	230 ^r	170 ^r	138
Canada	--	--	--	--	--	15	17	16
China	136	4,810	15	113	4,050	4,100 ^r	4,700 ^r	1,600
Finland	542	302	--	--	242	170 ^r	140 ^r	190
France	--	--	12	--	55	55	51	48
Germany	--	17	1	1	256	85	91	79
India	1,810	684	--	30	581	690 ^r	650 ^r	690
Iran	226	14	--	2	--	-36	-17 ^r	-48
Italy	--	--	--	5	289	180 ^r	180 ^r	190
Japan	--	15	1	7	600	470 ^r	400 ^r	450
Kazakhstan	2,700	1,040	--	30	--	1,100 ^r	1,100 ^r	1,000
Korea, Republic of	--	--	--	--	380	270 ^r	300 ^r	330
Kosovo	6	--	--	--	--	4	2	2
Madagascar	135	--	--	--	--	30	61 ^r	62
Mexico	--	--	--	7	--	8	6	11
Oman	452	194	--	--	--	230	140 ^r	180
Pakistan	90	--	--	1	--	26	31	31
Papua New Guinea	44	--	--	--	--	30	12	12
Philippines	181	--	--	--	--	2	-4	-6
Poland	--	--	--	7	--	16	6	10
Russia	678	433	16	31	17	350 ^r	330 ^r	260
South Africa	9,780	2,760	--	18	104	130 ^r	-4 ^r	-590
Spain	--	--	--	2	171	110 ^r	110 ^r	130
Sudan	36	--	--	--	--	18	31 ^r	26
Sweden	--	103	--	--	107	17	6 ^r	--
Taiwan	--	--	--	--	210	140 ^r	140 ^r	200
Turkey	2,250	103	--	28	--	790 ^r	680	460
Ukraine	--	--	--	--	19	12	11	13
United Arab Emirates	16	--	--	--	--	6	5	6
United Kingdom	--	--	8	1	56	26	15	16
United States	--	--	--	42	476	420 ^r	270 ^r	-3,400
Vietnam	9	--	--	--	--	1	4	5
Zimbabwe	407	171	--	--	--	130 ^r	140 ^r	85
Total	20,200	10,900	53	341	7,970	XX	XX	XX

^rRevised. XX Not applicable. -- Zero.

¹Table includes data available through July 2, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Consumption is calculated as ore production plus imports minus exports. Negative consumption indicates exports are greater than production and imports. Ore production estimated based on U.S. Geological Survey consumer surveys and trade statistics reported by Global Trade Atlas for chromite ore, chromium metal, and ferrochromium in January 2017. Data calculated assuming that the average grade of chromite ore is 45% Cr₂O₃; ferrochromium, 57% Cr; and chromium metal, 100% Cr.

TABLE 8
CHROMITE: WORLD PRODUCTION BY COUNTRY OR LOCALITY^{1,2}

(Metric tons, gross weight)

Country or locality	2012	2013	2014	2015	2016
Afghanistan ³	6,000 ^{r,e}	3,309	6,370	6,400 ^e	6,400 ^e
Albania, concentrate, 18% to 42% Cr ₂ O ₃ ⁴	380,349	521,080 ^r	652,463 ^r	680,000 ^r	660,000 ^e
Brazil ⁵	425,159	429,745	555,959	500,000 ^e	500,000 ^e
China	123,000 ^e	105,000 ^e	24,000 ^e	22,700 ^r	20,000 ^e
Finland, concentrate ⁶	425,217	981,752	1,034,750	946,188 ^r	1,070,000
Greece ⁷	1,300 ^{r,e}	--	--	--	--
India ⁸	3,255,482 ^r	2,632,792 ^r	2,374,337 ^r	2,660,000 ^r	3,200,000 ^e
Iran, concentrate	411,566	344,169	359,332 ^r	320,000 ^{r,e}	300,000 ^e
Kazakhstan, other ⁹	5,233,100 ^r	5,255,100	5,410,700 ^r	5,382,800 ^r	5,543,000
Kosovo ¹⁰	7,780 ^{r,e}	11,600 ^{r,e}	14,600 ^{r,e}	8,000	8,000 ^e
Madagascar ⁴	111,500	88,000 ^r	97,250	197,750 ^r	200,000 ^e
Oman ¹¹	602,225 ^r	787,645	751,200	442,658 ^r	570,000 ^e
Pakistan	207,000 ^r	77,000 ^r	72,000 ^r	100,155 ^r	101,000 ^e
Papua New Guinea ⁷	8,250	92,000	97,000	40,000	40,000 ^e
Philippines ¹²	36,628	35,281 ^r	47,056	15,502 ^r	29,100
Russia	552,000	360,000 ^e	380,000 ^{r,e}	400,000 ^e	220,000 ^e
South Africa:					
44% to 48% Cr ₂ O ₃	1,073,000	1,608,000	2,043,000	2,128,000	1,935,394
Less than 44% Cr ₂ O ₃	10,244,000	12,082,000	11,995,000	13,528,000	12,769,786
Sudan	75,000 ^r	30,870	60,000	100,000 ^r	83,000 ^e
Turkey	3,295,398	4,140,655	4,100,000	3,500,000	2,800,000 ^e
United Arab Emirates ⁴	17,208	15,750	19,822	16,000 ^r	19,500
Vietnam ⁴	1,900	24,990	3,400	14,000 ^r	15,000 ^e
Zimbabwe ¹³	408,475	355,142	408,422	208,328 ^r	275,000 ^e
Total	26,900,000 ^r	30,000,000 ^r	30,500,000 ^r	31,200,000 ^r	30,400,000

^eEstimated. ^rRevised. -- Zero.

¹Table includes data available through November 20, 2017. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Figures for all countries represent marketable output.

³Reported in Cr₂O₃ content by the World Mining Congress in World Mining Data (2012) and converted to gross weight assuming 44% Cr₂O₃ ore grade.

Reported in gross weight by Afghanistan minerals questionnaire (2013–14).

⁴Reported by World Bureau of Metal Statistics in World Metal Statistics Yearbook.

⁵Reported as lump ore and chromite concentrates by Brazil in Sumário Mineral 2015 for 2012–2014.

⁶Reported by Geological Survey of Finland in Metals and Mineral Production.

⁷Reported in Cr₂O₃ content by the World Mining Congress in the World Mining Data and converted to gross weight assuming 44% Cr₂O₃ ore grade.

⁸Production is based on fiscal year, with a starting date of July 1.

⁹Reported by the British Geological Survey (2012) and by Kazakhstan in minerals questionnaire (2013–14).

¹⁰Reported by Kosovo in minerals questionnaire (2012) and by the British Geological Survey in World Mineral Production (2013–14).

¹¹Reported by Oman in minerals questionnaire (2012–13) and by the British Geological Survey in World Mineral Production (2014).

¹²Reported by the British Geological Survey in World Mineral Production (2012) and by Philippines in minerals questionnaire (2013–14).

¹³Reported by the British Geological Survey in World Mineral Production (2012, 2014) and by Zimbabwe in minerals questionnaire (2013).

TABLE 9
FERROCHROMIUM: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons, gross weight)

Country or locality ²	2012	2013	2014	2015	2016
Albania ³	24,018	24,692	34,897	38,000 ^e	38,900 ^e
Brazil ^{4,5}	165,532	189,088	285,340	261,778 ^r	212,521
China	2,709,000	3,041,900	3,928,700	3,000,000 ^e	3,400,000 ^e
Finland	228,744	433,677	441,292	460,000 ^r	480,000 ^e
Germany ^e	17,800	17,800	17,800	17,800 ^r	17,700
India	944,000 ^r	944,000	944,000	944,000	943,000 ^e
Japan	19,392	21,671	22,000	20,000	22,500 ^e
Kazakhstan	1,310,000	1,336,532	1,351,803 ^r	1,141,476	1,430,000
Oman	--	20,625	44,063	63,750 ^r	64,000 ^e
Russia	546,360 ^r	487,810 ^r	439,600 ^r	358,800 ^r	360,000 ^e
South Africa	3,063,257	3,219,162	3,719,010	3,684,598 ^r	3,600,000 ^e
Sweden ^e	39,900 ^r	49,000	67,000	90,500	79,100
Turkey ^e	69,600 ^r	133,000 ^r	86,000 ^r	82,600	90,000
Zimbabwe	137,543 ^r	150,060 ^r	214,110 ^r	115,586 ^r	149,000 ^e
Total	9,270,000 ^r	10,100,000 ^r	11,600,000 ^r	10,300,000 ^r	10,900,000

^eEstimated. ^rRevised. -- Zero.

¹Tables includes data available through November 22, 2017. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Chile and Iran are known to have produced ferrochromium, but information was inadequate to make reliable estimates of output levels.

³Reported by Albania in minerals questionnaire (2012–14).

⁴Includes high- and low-carbon ferrochromium.

⁵Reported by Brazil Sumário Mineral, various years.