



# 2013 Minerals Yearbook

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## CHROMIUM [ADVANCE RELEASE]

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# CHROMIUM

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In 2013, the U.S. chromium supply (measured in contained chromium) was 150,000 metric tons (t) from recycled stainless steel scrap, 475,000 t from imports, and 114,000 t from Government and industry stocks. Supply distribution was 235,000 t to exports, 104,000 t to Government and industry stocks, and 400,000 t to apparent consumption. Chromium apparent consumption decreased by 15% compared with that of 2012. Historically, chromium ferroalloys have replaced chromite ore as the leading source of chromium to the U.S. economy. Stainless steel mill products have been accounting for an increasing share of chromium supply to the domestic economy, now rivaling that of ferrochromium. Because stainless steel mill products contribute a significant amount of chromium to the domestic economy, trade in these products has been incorporated into chromium trade statistics, and their contribution has been accounted for in chromium apparent consumption.

Chromium has a wide range of uses in chemicals, metals, and refractory materials. It is used to enhance hardenability or resistance to corrosion and oxidation in iron, nonferrous alloys, and steel. Production of stainless steel and nonferrous alloys are two of its more critical applications. Other applications are in alloy steel, catalysts, leather processing, pigments, plating of metals, refractories, and surface treatments.

Chromium is an essential trace element for human health. Some chromium compounds, however, are acutely toxic, chronically toxic, and (or) carcinogenic. The U.S. Environmental Protection Agency regulates chromium releases into the environment. The Occupational Safety and Health Administration regulates workplace exposure.

Because the United States only has small chromite ore reserves, domestic supply has been a concern during every national military emergency since World War I. World chromite ore resources, mining capacity, and ferrochromium production capacity are concentrated in the Eastern Hemisphere. In recognition of the vulnerability of long supply routes during a military emergency, chromium (in various forms, including chromite ore, chromium ferroalloys, and chromium metal) has been held in the National Defense Stockpile (NDS) since before World War II. Since 1991, as a result of changed national security considerations, stockpile goals have been reduced, and inventory has been sold. Material for recycling was the leading domestic chromium supply source in 2013. Chromite foundry sand was also domestically produced.

## Legislation and Government Programs

The Defense Logistics Agency Strategic Materials, U.S. Department of Defense, disposed of chromium materials from the NDS under its fiscal year 2013 (October 1, 2012, through September 30, 2013) Annual Materials Plan (AMP) and set

maximum disposal goals for chromium materials at 88,048 t of chromium ferroalloys and 454 t of chromium metal in its fiscal year 2014 AMP (Defense Logistics Agency Strategic Materials, 2013).

## Production

Domestic data for chromium materials were developed by the U.S. Geological Survey (USGS) by means of the monthly “Chromite Ores and Chromium Products” and “Consolidated Consumers” consumer 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 2013, the United States mined chromite ore and produced chromium chemicals and stainless steel. The United States was a major world producer of chromium chemicals and stainless steel.

In 2013, Oregon Resources Corp. Ltd.’s (ORC) 70,000-metric-ton-per-year (t/yr) Coos Bay ore processing facility was operational only in December. ORC, owned by IDM International Ltd. (Australia), had put the plant on care-and-maintenance status at yearend 2012 (IDM International Ltd., 2013a, b). Elementis Chromium, a subsidiary of Elementis plc (United Kingdom), produced sodium dichromate from chromite ore at Castle Hayne, NC (Elementis plc, undated).

## Consumption

The U.S. stainless steel industry produced about 2.03 million metric tons (Mt) of stainless steel and imported and exported stainless steel mill products and scrap in 2013, making it the leading consumer of chromium materials. AK Steel Corp. (AK), Allegheny Technologies Inc. (ATI), and North American Steel Co. (NAS) were the leading U.S. stainless steel producers.

AK produced stainless steel at Butler, PA, and Mansfield, OH. AK reported shipments of 746,000 t of stainless and electrical steel in 2013 compared with 770,000 t in 2012 (AK Steel Corp., 2014, p. 11, 17). ATI produced stainless steel in Pennsylvania at Brackenridge, Midland, and Latrobe (Allegheny Technologies Inc., 2014, p. F-15).

NAS [a subsidiary of Acerinox, S.A. (Spain)] produced stainless steel in Ghent, KY. NAS did not report melt shop production for 2013; however, NAS produced more than 1 Mt in 2012. Acerinox considered the Ghent plant its most efficient stainless steel plant worldwide; its production in 2013 was comparable to historical production levels of about 1 million metric tons per year (Mt/yr) (Acerinox S.A., 2014, p. 172).

Outokumpu Oyj (Finland) purchased ThyssenKrupp Stainless USA [a subsidiary of ThyssenKrupp AG (Germany)] on December 28, 2012, at which time the Calvert, AL, plant became part of Outokumpu's Stainless Americas business. Stainless Americas delivered 465,000 t of stainless steel in 2013, compared with 400,000 t in 2012, a 16.3% year-on-year increase that was mainly driven by production at the Calvert mill (Outokumpu Oyj, 2013, p. 17; 2014a, p. 19).

The most ubiquitous uses of stainless steel are in flatware and razors. Chromium forms the chromic oxide ( $\text{Cr}_2\text{O}_3$ ) layer on stainless steel that makes it shiny and hygienic. It also makes cutlery flavorless, permitting the user to experience the unaltered taste and texture of food (Miodownik, 2014, p. 17–20).

## Prices

Chromium materials were not openly traded. Purchase contracts were 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 were 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. Based on foreign trade statistics reported by the U.S. Department of Commerce for calendar year 2013, the value of foreign trade of these chromium materials excluding stainless steel mill products and scrap was \$152 million for exports and \$839 million for imports (tables 4, 6). A significant amount of chromium exits and enters the U.S. economy via stainless steel mill products and scrap trade. The value of foreign trade of chromium materials including stainless steel mill products and scrap was \$3.26 billion for exports and \$3.23 billion for imports.

## World Industry Structure

The chromium industry consisted of chromite ore, refractory material, and foundry sand; chromium chemical and metal; ferrochromium; and stainless steel producers. Several long-term trends have simultaneously transpired in the chromium industry. The chromium chemical industry eliminated excess production capacity, concentrating on production growth in remaining plants. From 2001 through 2012 (the most recent time period for which data were available), chromite metallurgical use more than doubled from about 11 Mt/yr to 23 Mt/yr; refractory use remained at about 160,000 t/yr; chemical use nearly halved from about 1 Mt/yr to about 550,000 t/yr; and foundry use nearly doubled from about 350,000 t/yr to 650,000 t/yr (International Chromium Development Association, 2013, p. 1). The fraction of chromite ore being supplied by independent producers has been declining, while that being supplied by vertically integrated producers is increasing. In other words, chromite ore mines now tend to be owned and operated by chromite refractory, chromium chemical, or ferrochromium producers.

The emergence of China as a significant ferrochromium and leading stainless steel producer interrupted the migration of ferrochromium production capacity from stainless-steel-producing countries to the leading chromite-ore-producing countries. While ferrochromium production capacity was closed in historically producing countries, which usually have been stainless-steel-producing countries, new furnaces or plants were constructed in the leading chromite-ore-producing areas. China applied its ferroalloy production capacity to ferrochromium production as demand for ferrochromium grew with the emergence of China's stainless-steel-producing industry. However, environmental concerns and electrical power costs may limit ferrochromium production in China. The electrical power and submerged arc furnace production capacities used to produce ferrochromium have been increasing. Furnaces built recently have an electrical capacity in the tens of megavoltamperes (MVA), whereas when ferrochromium plants were first built, furnaces rated in the low-kilovoltampere range were common.

Production process improvements, such as agglomeration of chromite ore, preheating and prereluction of furnace feed, and closed-furnace technology, have been retrofitted at the plants of major producers and are being incorporated in newly constructed plants. Since the introduction of post-melting refining processes in the steel industry after 1960, there has been a shift in production to high-carbon ferrochromium from low-carbon ferrochromium. After years of ferrochromium production, slag stockpiles have grown. Recently developed processes have efficiently recovered ferrochromium from that slag, and those processes have been or are being installed at existing plant sites. In South Africa, the world's leading chromite-ore- and ferrochromium-producing country, three trends have been emerging—ferrochromium plants have been developed in the western belt of the Bushveld Complex, ferrochromium plants have been built at chromite ore mines, and ferrochromium production processes have been developed to accommodate chromite ore byproduct recovered from platinum operations.

The geographic distribution of mineral ore production has increased over the past 150 years (Kooroshy and others, 2010, p. 42, 89–93). Europe and the United States accounted for nearly all ore production in the mid-19th century, but together now account for less than one-fifth of world production. The world share of mineral production from the United States and Europe has decreased while the share from Australia, Canada, China, the Commonwealth of Independent States, and a collection of developing countries has been increasing. While minerals and metals are not being mined to extinction, mineral scarcity will likely become an issue in coming decades. The displacement of Western countries by developing countries as the leading mineral producers has major geopolitical implications because Europe has become dependent on foreign supplies to satisfy its industrial demand. It was of concern that scarce-minerals markets could be transformed from equal access, competitive bidding markets (that is, open markets) to markets with long-term supply agreements between major corporations with substantial Government involvement, resulting in a politicized mineral supply (that is, politically controlled closed markets).

**Capacity.**—Rated capacity (table 7) is defined as the maximum quantity of product that can be produced in a period of time at a normally sustainable long-term operating rate, based on the physical equipment of the plant and given acceptable routine operating procedures involving labor, energy, materials, and maintenance. Capacity includes both operating plants and plants temporarily closed that could be brought into production within a short period of time at minimum capital expenditure. Because not all countries and producers provide information about production capacity, historical chromium trade data have been used to estimate some national production capacities. Reported production capacity changes from year to year were the result of both facility changes and (or) increased knowledge about facilities. Production capacities have been estimated for the chromite ore, chromium chemical, chromium metal, ferrochromium, and stainless steel industries.

**Production.**—In 2013, world chromite ore production was 28.8 Mt, a 13% increase compared with that of 2012 (table 8); ferrochromium production was 9.57 Mt, a 3% increase compared with that of 2012 (table 9); stainless steel production was 38 Mt, a 12% increase compared with that of 2012 (as estimated by the author).

**Chromite Ore.**—South Africa, with 47% of world chromite ore production, was the leading chromite-ore-producing country (table 8). Other major chromite-ore-producing countries (and their percentage of world production) (in descending order of percentage of world production) were Kazakhstan (13%), Turkey (11%), and India (10%).

**Chromium Chemicals.**—Major chromium chemical producers included China, Kazakhstan, Russia, South Africa, Turkey, and the United States. Leading chromium-chemical-producing countries where large sodium dichromate plants (production capacities in excess of 100,000 t/yr) operated included Kazakhstan, Russia, and the United States. Moderate-sized production facilities were located in Argentina, China, India, Japan, South Africa, and Turkey. Small-scale local producers operated in China, India, Iran, Pakistan, and Poland. World chromium chemical (sodium dichromate equivalent) production in 2012 was estimated to have been 704,000 t (Roskill Information Services Ltd., 2014, p. 61).

**Chromium Metal.**—Major chromium metal producers included Russia (by the electrolytic process), Japan (by the silicothermic process), and China, France, Germany, Kazakhstan, Russia, and the United Kingdom (by the aluminothermic process).

**Ferrochromium.**—In 2013, China, Kazakhstan, and South Africa were the leading ferrochromium producers (table 9). Ferrochromium is the leading end use of chromite ore. CRU International Ltd. reported 2013 high-carbon ferrochromium production was 10.3 Mt compared with 8.98 Mt in 2012 (CRU Chrome Monitor, 2014a, b).

**Stainless Steel.**—Stainless steel is the leading end use of ferrochromium. The International Stainless Steel Forum reported 2013 world crude stainless steel production to have been about 38.506 Mt compared with about 35.917 Mt in 2012 (International Stainless Steel Forum, 2015).

**Stainless Steel Scrap.**—Stainless steel scrap is an important source of chromium to the stainless steel industry. Stainless steel scrap is produced in proportion to stainless steel mill product

production. Stainless steel scrap consumption is proportional to raw stainless steel production. The proportion of scrap generated and (or) consumed varies among producers and consumers.

## World Review

**Albania.**—Albania produced chromite ore and ferrochromium. Albania produced 32,000 t of high-carbon ferrochromium in 2013 compared with 26,000 t in 2012 and consumed 12,000 t in 2013 and 2012 (CRU Chrome Monitor, 2014a, b). Columbus Copper Corp. (Vancouver, British Columbia, Canada) applied to convert its chromite exploration licenses in the Bulqiza chromite mining district near the town of Bulqiza to chromite exploitation licenses (Columbus Copper Corp., 2014).

**Australia.**—The Government of Western Australia reported chromite ore sales by calendar year in contained  $\text{Cr}_2\text{O}_3$  of about 138,000 t in 2013 and of about 202,000 t in 2012 (Government of Western Australia, 2014, p. 22).

Consolidated Minerals Ltd. (2013) ceased mining activity at its Coobina chromite mine, southwest of Newman in Western Australia, effective July 22, 2013. Processing operations were expected to continue until stockpiled ore had been processed, which was expected to conclude around the end of 2013.

**Austria.**—Austria produced 65,000 t of stainless steel in 2013 compared with 66,000 t in 2012 and consumed 26,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**Belgium.**—Belgium produced about 1.25 Mt of stainless steel in 2013 compared with about 1.24 Mt in 2012 and consumed 247,000 t of high-carbon ferrochromium in 2013 compared with 228,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

**Brazil.**—Brazil produced chromite ore, ferrochromium, and stainless steel. Brazil reported production of 430,000 t of stainless steel in 2013 compared with 401,000 t in 2012. Brazil reported production of 153,000 t of high-carbon ferrochromium in 2013 compared with 161,000 t in 2012 and reported consumption of 150,000 t in 2013 compared with 136,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

Brazil reported 2012 chromite ore preliminary production of 472,501 t (187,070 t  $\text{Cr}_2\text{O}_3$  content), exports of 38,783 t, and imports of 25,115 t. Brazil produced from a chromite ore reserve of 3.58 Mt of contained  $\text{Cr}_2\text{O}_3$  mostly in Bahia State. In 2013, Brazil reported 2012 production of 165,532 t of chromium ferroalloys, exports of 8,184 t, and imports of 10,971 t. Chromite ore was mined in the States of Amapa and Bahia (Ramos, 2013).

**Canada.**—Canada consumed 19,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b). Several companies explored development of chromite ore.

In July, Cliffs Natural Resources Inc. (Cleveland, OH) (2013) reported that it had suspended environmental assessment of its chromite ore properties, Black Thor and Black Label (each 100% owned) and Big Daddy (72% owned), in Ontario. As a result, Cliffs indefinitely suspended development of these properties in November owing to an uncertain development timeline and associated risks with necessary infrastructure development.



Azimut Exploration Inc. explored for chromite in the James Bay region of Quebec at its Eastmain West property (Azimut Exploration Inc., 2013, p. 20).

KWG Resources Inc. (2013a, p. 1, 31), which owned about 30% of Big Daddy, reported chromite ore inferred resources of 46.5 Mt at an average grade of 38.8% Cr<sub>2</sub>O<sub>3</sub> to a cutoff grade of 20% Cr<sub>2</sub>O<sub>3</sub> for its Koper Lake project in northwestern Ontario. KWG sought a patent for the production of a new gas chromite reduction method that would produce 80% metalized ferrochromium by using an accelerator that promotes the reaction of chromite ore with carbon. KWG expected natural gas to be abundantly available and stably priced in North America at some time in the future (KWG Resources Inc., 2013b).

Noront Resources Ltd. (2013, p. 4, 6) planned to develop the Blackbird chromite deposit after production at its Eagle's Nest Mine began. Ressources Minières Pro-Or Inc. explored for chromite at its Menarik property in northwestern Quebec and researched technology to increase the chromium-to-iron ratio of chromite ore produced (Ressources Minières Pro-Or Inc., 2013).

**China.**—China produced chromite ore, ferrochromium, chromium chemicals and metal, and stainless steel. China was the leading producer of stainless steel, which also made it the leading consumer market for ferrochromium. China produced a small amount of chromite ore; a large amount of ferrochromium, mostly from imported chromite ore; and stainless steel. China produced about 19.5 Mt of stainless steel in 2013 compared with about 16.1 Mt in 2012. China produced about 4.02 Mt of high-carbon ferrochromium in 2013 compared with about 3.1 Mt in 2012 and consumed about 5.7 Mt of high-carbon ferrochromium in 2013 compared with about 4.68 Mt in 2012 (CRU Chrome Monitor, 2014a, b).

The difference between China's ferrochromium production and its consumption continued to increase. Many of the recent Chinese ferrochromium producers converted ferrosilicon furnaces to ferrochromium furnaces (Hobbs, 2013). More than a dozen ferrochromium production projects (mostly capacity expansions and some new producers) were reported to have been completed or in progress with completion dates in 2013; production capacities were estimated to have been 17 to 18 Mt/yr of stainless steel and 6 Mt/yr of high-carbon ferrochromium. High-carbon ferrochromium production was estimated to have been 3.3 Mt (Junhua, 2013). Mintal Group Co., Ltd. started an upgrade and expansion project that would bring its high-carbon ferrochromium production capacity to more than 1 Mt/yr after 2015 (Qiu, 2013).

Daijian (2013) reported that of world sodium dichromate production capacity of about 1 Mt/yr, China accounted for 40%. The sodium dichromate production capacity of Chongqing Minfeng Chemical Co., Ltd. was 50,000 t/yr.

**Finland.**—Finland produced chromite ore (Kemi Mine), ferrochromium (Tornio Works), and stainless steel (Tornio Works). Finland produced about 1.11 Mt of stainless steel in 2013 compared with about 1.08 Mt in 2012, 434,000 t of high-carbon ferrochromium in 2013 compared with 230,000 t in 2012 and consumed 175,000 t of high-carbon ferrochromium in 2013 compared with 171,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

As a result of new drilling, Outokumpu increased Kemi Mines' chromite ore proved reserves to 50.1 Mt in

January 2014, from the previous amount of 33 Mt. Outokumpu opened their new ferrochromium smelter in Tornio, in June 2013. By yearend, production reached their target of 434,000 t compared with 230,000 t in 2012. Outokumpu planned to increase ferrochromium production capacity to 530,000 t by 2015. Outokumpu produced stainless steel at Tornio Works, closed the stainless steel melt shop at Krefeld (Germany), and acquired the stainless plant at Calvert City, AL. Outokumpu produced stainless steel using 85%-recycled stainless steel compared to the industry average of 60% (Outokumpu Oyj, 2014a, p. 6, 17, 29, and 122; 2014b, p. 1, 18, and 26).

Afarak Group Plc consisted of chromite ore mining (Mecklenberg Mine, Stellite Mine, Turk Maadin Sirketi A.S.) and ferrochromium production facilities [through subsidiaries Mogale Alloys (Pty) Ltd and Elektrowerk Weisweiler GmbH (EWW)]. Mecklenberg Mine (South Africa) commenced operation in 2013. Afarak planned to start production of granular medium-carbon ferrochromium at Mogale at some time in the future (Afarak Group Plc, 2014, p. 1, 5).

**France.**—France produced chromium metal and stainless steel. France produced 294,000 t of stainless steel in 2013 compared with 285,000 t in 2012 and consumed 84,000 t of high-carbon ferrochromium in 2013 compared with 77,000 t in 2012 (CRU Chrome Monitor, 2014a, b). Delachaux Group's Metals Operations produced chromium metal by aluminothermic reduction of chromic oxide.

**Germany.**—Germany produced chromium metal, ferrochromium, and stainless steel. Germany produced about 1.13 Mt of stainless steel in both 2013 and 2012 and consumed 273,000 t of high-carbon ferrochromium in 2013 compared with 340,000 t in 2012 (CRU Chrome Monitor, 2014a, b). Elektrowerk Weisweiler GmbH (a subsidiary of Afarak Group Plc) produced ferrochromium at their Eschweiler-Weisweiler plant (Elektrowerk Weisweiler GmbH, undated).

**Greece.**—Greece consumed 1,000 t of high-carbon ferrochromium in 2013 compared with 1,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

**India.**—India produced chromite ore, chromium chemicals, ferrochromium, and stainless steel. India exported lumpy and friable chromite ore and chromite ore concentrates. India produced about 2.7 Mt of stainless steel in 2013 compared with about 2.47 Mt in 2012, produced 981,000 t of high-carbon ferrochromium in 2013 compared with about 1 Mt in 2012, and consumed 449,000 t of high-carbon ferrochromium in 2013 compared with 418,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

India reported that 25 mines collectively produced about 2.95 Mt of chromite ore in fiscal year 2012–13 (April 1, 2012, through March 31, 2013) compared with about 2.92 Mt from 22 mines in fiscal year 2011–12. India's provisional chromite ore reserves were estimated at about 54 Mt as of January 4, 2010. India reported chromite ore exports of 196,435 t and imports of 216,736 t in fiscal year 2012–13 compared with exports of 225,084 t and imports of 136,204 t in fiscal year 2011–12. Chromite ore was mined in Karnataka and Odisha States. The leading chromite ore mining companies, all in Odisha, were Balashore Alloys Ltd., Ferro Alloys Corporation Ltd., Indian Metal & Ferro Alloys Ltd., JSL Ltd., Orissa Mining

Corporation Ltd., and Tata Steel Ltd. Krebs & Cei (India) Pvt. Ltd., Tamil Nadu Chromates and Chemicals Ltd., and Vishnu Chemicals Ltd. produced chromium chemicals. India produced 0.1 t of chromium metal in 2012–13 compared with 3.115 t in 2011–12 (Indian Bureau of Mines, 2015).

From an installed production capacity of 1.69 Mt/yr, India produced 944,000 t of ferrochromium in fiscal year 2012–13 compared with 943,000 t in fiscal year 2011–12. India exported about 518,000 t and imported about 53,200 t of ferrochromium in fiscal year 2012–13 compared with about 568,000 t exported and about 66,800 t imported in fiscal year 2011–12. Chromium ferroalloys were produced at plants in Andhra Pradesh, Chhattisgarh, Gujarat, Odisha, and West Bengal States. India's leading ferrochromium producers were Balasore Alloys Ltd., FACOR Alloys Ltd., GMR Technologies & Ind. Ltd., IDCOL Ferro Chrome Plant, Indian Metals & Ferro Alloys Ltd., Jindal Stainless Ltd., Jindal Steel & Power Ltd., Nava Bharat Ferro Alloys Ltd., Sri Vasavi Ind. Ltd., Rawat Ferro Alloys, Rohit Ferro Tech. P. Ltd., SAL Steel, Standard Chrome Ltd., Tata Steel Ltd., and Utkal Manufacturing Services Ltd. (Indian Bureau of Mines, 2014).

The Indian Bureau of Mines (2013) published a monograph on a variety of aspects of Indian chromite ore including geology, mineralogy, deposits, prospecting and exploration, mining, beneficiation, ore specifications, production, consumption, trade, and environment.

**Iran.**—Iran produced chromite ore and ferrochromium. Iran produced 16,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**Italy.**—Italy produced about 1.48 Mt of stainless steel in 2013 compared with about 1.70 Mt in 2012 and consumed 381,000 t of high-carbon ferrochromium in 2013 compared with 392,000 t in 2012 (CRU Chrome Monitor, 2014a, b). Cogne Acciai Speciali and ThyssenKrupp Accai Speciali produced stainless steel.

**Japan.**—Japan was a major stainless-steel-producing country. Japan produced about 3.13 Mt of stainless steel in 2013 compared with about 3.18 Mt in 2012 and consumed 696,000 t of high-carbon ferrochromium in 2013 compared with 691,000 t in 2012 (CRU Chrome Monitor, 2014a, b). JFE Materials produced 21,671 t of low-carbon ferrochromium in 2013 compared with 19,390 t in 2012 (TEX Report, Co., Ltd., The, 2014, p. 11).

**Kazakhstan.**—Kazakhstan produced chromite ore and ferrochromium. Kazakhstan produced 1.035 Mt of high-carbon ferrochromium in 2013 compared with 1.005 Mt in 2012 and consumed 99,000 t in 2013 compared 92,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

Eurasian Resources Group Sarl (ERG) (Luxembourg) acquired Eurasian Natural Resources Corporation PLC (ENRC) (United Kingdom) in December and subsequently delisted ENRC from the London Stock Exchange. With a 40% stake in ERG, the Government of Kazakhstan is a main shareholder. TNK Kazchrome JSC, a subsidiary of ENRC, produced chromite ore in Kazakhstan and ferrochromium in Kazakhstan and Russia.

Voskhod Mine and Plant, a Yildirim Group company (Turkey), produced chromite ore (Yildirim Group, undated).

**Korea, Republic of.**—Korea produced about 2.1 Mt of stainless steel in 2013 compared with about 2.13 Mt in 2012 and consumed 526,000 t of high-carbon ferrochromium in 2013 compared with 499,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

**Mexico.**—Mexico consumed 16,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**Norway.**—Norway consumed 1,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**Oman.**—Oman produced chromite ore and ferrochromium. Oman produced 30,000 t of high-carbon ferrochromium in 2013 (CRU Chrome Monitor, 2014a, b).

Al Tamman Trading Establishment LLC (a wholly owned subsidiary of Muscat Overseas Group) produced chromite ore at Al Ram and Wadi Rajmi chromite projects (Al Tamman Trading Establishment LLC, undated). Gulf Mining Group mined and beneficiated chromite ore (Gulf Mining Group, undated).

Al Tamman produced ferrochromium at a new plant in Sohar free zone, Oman. The plant was a joint venture between Al Tamman, a chromite ore producer, and Indsil Group (Indsil Energy & Electrochemicals Ltd. and Indsil Hydro Power & Manganese Ltd.). The \$35 million plant consisted of two 25-MVA furnaces, with a combined ferrochromium production capacity of 75,000 t/yr, which produced two grades of high-carbon ferrochromium: 54–57% and 57–60% chromium (Indsil Group, 2013). The plant commenced full-scale operation in April 2014 (Indsil Group, 2014, p. 15).

Metkore Alloys and Industries Ltd. planned to build a 165,000-t/yr ferrochromium smelter in the Sohar free zone (Business Standard, 2013). The Gulf Mining Group also planned to construct a ferrochromium smelter in the Sohar free zone (Breadbulk, 2015).

**Poland.**—Poland consumed 8,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**Romania.**—Romania consumed 5,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**Russia.**—Russia produced 105,000 t of stainless steel in 2013 compared with 102,000 t in 2012. Russia produced 230,000 t of high-carbon ferrochromium in 2013 compared with 260,000 t in 2012 and consumed 90,000 t of high-carbon ferrochromium in 2013 compared with 91,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

In December, Mechel OAO sold Voskhod Mine and Plant (Kazakhstan), including the license for the chromite ore, and Tikhvin Ferroalloy Plant (Russia) to the Yildirim Group (Turkey) for \$475 million (Mechel OAO, 2014, p. 114). Tikhvin Ferroalloy Plant, a Yildirim Group (Turkey) company, produced high-carbon ferrochromium (Yildirim Group, undated).

**Slovenia.**—Slovenia produced 127,000 t of stainless steel in 2013 compared with 121,000 t in 2012 and consumed 26,000 t of high-carbon ferrochromium in both 2013 and 2012 (CRU Chrome Monitor, 2014a, b).

**South Africa.**—South Africa produced chromite ore, chromium chemicals, ferrochromium, and stainless steel.

In 2013, South Africa was the leading producer of chromite ore and ferrochromium. South Africa produced 523,000 t of stainless steel in 2013 compared with 505,000 t in 2012. South Africa produced about 3.11 Mt of high-carbon ferrochromium in 2013 compared with about 2.89 Mt in 2012 and consumed 146,000 t in 2013 compared with 140,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

South Africa reported chromite ore production of about 11.3 Mt in 2012 compared with about 10.8 Mt in 2011, about 10.9 Mt in 2010, and about 6.87 Mt in 2009. South Africa produced about 3.06 Mt of ferrochromium in 2012 compared with about 3.42 Mt in 2011, about 3.61 Mt in 2010 and about 2.35 Mt in 2009 (Ntshobane, 2014, p. 132–138). South Africa reported about 40 chromite ore mines and (or) processing plants (Ntshobane, 2013a, p. 1–22). Controlling mining companies were African Mining and Trust Co. Ltd., African Rainbow Mineral Platinum, ASA Metals Pty. Ltd., Assmang Ltd., Assore Ltd., Chrometco Ltd., Chromex Mining Co. Pty. Ltd., Chronmin Pty. Ltd., Corridor Mining Resources Pty. Ltd., Cronimet Chrome Mining SA Pty. Ltd., Glencore/Merafe Resources Joint Venture, Hernic Ferrochrome Pty. Ltd., Impala Chrome Pty. Ltd., International Ferro Metals Ltd. (RSA), Lanxess Pty. Ltd., Makgomo Chrome Pty. Ltd., Marico Chrome Corp., Masa Chrome Co. RSA, Merafe Resources, Northam Chrome Producers Pty., Northam Platinum Ltd., Platcro Minerals, Rustenburg Platinum Mines, Samancor Chrome Holdings Pty. Ltd., and Tharisa Mining Pty. Ltd.

Entering 2013, the supply of chromite ore in South Africa was in excess as a result of consumption limited by electrical power supply availability and increased production of difficult-to-process chromite ore byproduct of UG2 platinum production. Demand for chromite ore was dependent primarily upon the world use of ferrochrome in the stainless steel and alloy steel manufacturing. Chromite ore and ferrochromium production outside South Africa (for example, in China, India, and Kazakhstan) as well as possible changes in South Africa's chromite ore export policy were expected to affect the domestic chromium market. However, China's influence was anticipated to wane owing to wage growth in China and a declining inexpensive excess electrical power supply in China. Chromite ore local sales increased in the second quarter of 2013 and export sales declined owing to weak demand from the euro area. Ferrochromium accounted for more than three-fourths of South Africa's ferroalloy production (Ntshobane, 2013b, p. 8–10; 2013c, p. 4–6; Ratshomo, 2013, p. 8–10).

**Spain.**—Spain produced 820,000 t of stainless steel in 2013 compared with 844,000 t in 2012 and consumed 157,000 t of high-carbon ferrochromium in 2013 compared with 154,000 t in 2012 (CRU Chrome Monitor, 2014a, b). Acerinox S.A. produced stainless steel.

**Sudan.**—Sudan produced chromite ore. Low-grade chromite ore (20% to 35% Cr<sub>2</sub>O<sub>3</sub>) was beneficiated by laboratory-scale shaking table to commercial-grade chromite ore (Seifelnasr and others, 2011).

**Sweden.**—Sweden produced ferrochromium and stainless steel. Sweden produced 486,000 t of stainless steel in 2013 compared with 510,000 t in 2012. Sweden produced 49,000 t of high-carbon ferrochromium in 2013 compared with 40,000 t in

2012 and consumed 111,000 t in 2013 compared with 110,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

Vargon Alloys AB, a Yildirim Group (Turkey) company, produced ferrochromium from a ferrochromium production capacity of 120,000 to 295,000 t/yr (Vargon Alloys AB, undated). Avesta Jernverk [Outokumpu (Finland)] produced stainless steel (Outokumpu Ojy, undated).

**Taiwan.**—Taiwan produced about 1.03 Mt of stainless steel in 2013 compared with about 1.11 Mt in 2012 and consumed 299,000 t of high-carbon ferrochromium in 2013 compared with 291,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

Yieh United Steel Corp. and Tang Eng Iron Works Co., Ltd. produced stainless steel.

**Turkey.**—Turkey produced chromite ore, chromium chemicals, and ferrochromium. Turkey produced 133,000 t of high-carbon ferrochromium in 2013 compared with 70,000 t in 2012 and consumed 13,000 t in 2013 compared with 10,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

Eti Krom Inc., a Yildirim Group company, mined chromite ore and produced ferrochromium. Eti Krom operated 20, mostly underground, chromite ore mines producing at about 1 Mt/yr. Soda Sanayii Anonim Şirketi, a ŞİŞECAM Group company, produced chromium chemicals.

**Ukraine.**—Ukraine produced 111,000 t of stainless steel in 2013 compared with 118,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

**United Kingdom.**—The United Kingdom produced chromium metal and stainless steel. The United Kingdom produced 261,000 t of stainless steel in 2013 compared with 290,000 t in 2012 and consumed 42,000 t of high-carbon ferrochromium in 2013 compared with 49,000 t in 2012 (CRU Chrome Monitor, 2014a, b). AMG Superalloys UK Ltd., formerly London & Scandinavian Metallurgical Co. Ltd. (LSM), produced chromium metal at Rotherham (Austen, 2014). The Sheffield facility [Outokumpu (Finland)] produced stainless steel.

**Zimbabwe.**—Zimbabwe produced chromite ore and ferrochromium. Zimbabwe produced 126,000 t of high-carbon ferrochromium in 2013 compared with 155,000 t in 2012 and consumed 9,000 t in 2013 compared with 8,000 t in 2012 (CRU Chrome Monitor, 2014a, b).

## Outlook

The outlook for chromium consumption in the United States and the rest of the world follows that of stainless steel, which is the leading end use for chromium worldwide. In 2013, China was the leading stainless steel producer.

The practice of supplying chromium in the form of ferrochromium by the leading chromite-ore-producing countries was interrupted as China became a major consumer of chromite ore (and a minor chromite ore producer) to produce ferrochromium for its domestic stainless steel industry, and South Africa experienced limited electrical power; however, that trend was not expected to continue as China closed small, inefficient, environmentally unfriendly ferroalloy production facilities. The price of ferrochromium sustained independent ferrochromium producers with the aid of vertical integration across international boundaries; however, other factors being



equal, ferrochromium production was most cost-effective when the ferrochromium plant was close to the chromite mine. With the construction of new, efficient, and reliable ferrochromium production facilities in leading chromite-ore-producing countries, ferrochromium production capacity and production is expected to diminish in countries where ferrochromium production facilities are not located near chromite ore resources. Other factors of production, such as electrical energy or labor costs, can offset chromite ore transportation costs. Further vertical integration of the chromium industry is expected as countries that produce chromite ore expand ferrochromium or stainless steel production capacity.

**Chromite Ore.**—Chromite ore is used predominantly to make ferrochromium that is used to make metal alloys. Lesser amounts of chromite ore are used to make chromium chemicals or refractory products. Chromite ore production capacity is expected to remain in balance with consumption. To improve chromite ore availability and to stabilize feed material price, ferrochromium producers have invested in mines that produce chromite ore. Most chromite ore is produced under vertically integrated mine-smelter or mine-plant ownership. As platinum mining moves to chromite-bearing seams in South Africa, more chromite is likely to be supplied as coproduct from such operations. Platinum may become a coproduct of some chromite operations when efficient recovery of platinum from chromite ore tailings is developed. In addition to increased production from the leading chromite ore producers (India, Kazakhstan, and South Africa), chromite ore production has increased in the Middle East (Oman, Turkey, and the United Arab Emirates) to meet increasing demand.

**Ferrochromium.**—Ferrochromium is predominantly used to make stainless steel. Lesser amounts of ferrochromium are used to make alloy steel or superalloys. Ferrochromium consumption is expected to follow the trend in stainless steel production the same as that for metal alloys.

**Chromium Chemicals.**—Weak demand for chromium chemicals and strong competition from plants in the Commonwealth of Independent States and China has resulted in the closure of chromium chemical plants in Italy, Romania, and the United Kingdom. In addition, the barriers to entry (high investment cost and environmental compliance) contributed to the absence of new plants. Nippon Denko and Nippon Chemicals consolidated production facilities in 2012. Roskill anticipated further consolidation among the world's chromium-chemical-producing plants, especially in China and India where there are many small producers (Roskill, 2014, p. 63–65).

**Chromium Metal.**—Major chromium metal producers included Russia (by the electrolytic process), Japan (by the silicothermic process), and China, France, Germany, Kazakhstan, Russia, and the United Kingdom (by the aluminothermic process). World chromium metal production capacity was estimated to have been 52,550 t/yr in 2012 (Roskill Information Services Ltd., 2014, p. 58).

**Stainless steel.**—Roskill Information Services Ltd. (2014, p. 2) forecast annual average stainless steel production growth of 4.5% per year to 47 Mt in 2018 from 36 Mt in 2012.

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

	2009	2010	2011	2012	2013	
U.S. supply:						
Components of U.S. supply, contained chromium:						
Domestic mines	metric tons	--	--	NA	NA	NA
Secondary <sup>2</sup>	do.	141,000	144,000	147,000	146,000	150,000
Imports:						
Chromite ore	do.	23,000	43,800	70,300	90,800	54,100
Chromium chemicals	do.	10,600	5,120	4,270	5,880	5,860
Chromium ferroalloys	do.	140,000	305,000	311,000	302,000	266,000
Chromium metal	do.	7,570	13,000	13,600	15,300	13,700
Stainless steel mill products and scrap <sup>2</sup>	do.	91,800	133,000	132,000	140,000	135,000
Stocks, January 1:						
Government	do.	155,000 <sup>3</sup>	129,000	115,000	111,000	107,000
Industry <sup>4</sup>	do.	7,290	6,820	7,300	7,770	7,580
Total	do.	576,000	779,000	800,000	819,000	739,000
Distribution of U.S. supply, contained chromium:						
Exports:						
Chromite ore <sup>5</sup>	do.	743	1,390	1,930	6,930	2,670
Chromium chemicals	do.	13,500	21,600	20,600	17,700	16,800
Chromium ferroalloys and metal	do.	2,900	4,850	3,060	3,070	3,360
Stainless steel mill products and scrap	do.	263,000	246,000	206,000	206,000	212,000
Stocks, December 31:						
Government	do.	129,000	115,000	111,000	107,000	96,500
Industry <sup>4</sup>	do.	6,820	7,300	7,770	7,580 <sup>r</sup>	7,760
Total	do.	416,000	396,000	351,000	348,000	339,000
Production, reported, chromium ferroalloy and metal net production <sup>6</sup>						
		W	--	--	--	--
Consumption						
Apparent, contained chromium	do.	160,000	384,000	450,000	471,000 <sup>r</sup>	400,000
Reported:						
Chromite ore and concentrates, gross quantity	do.	W	W	W	W	W
Chromium ferroalloys: <sup>7</sup>						
Gross quantity	do.	383,000	423,000	429,000	435,000 <sup>r</sup>	435,000
Contained chromium	do.	224,000	248,000	248,000	251,000	248,000
Chromium metal, gross quantity	do.	4,190	4,540	4,490	4,470 <sup>r</sup>	4,270
Stocks, December 31, gross quantity:						
Government						
Chromium ferroalloys	do.	175,000	154,000	150,000	144,000	129,000
Chromium metal	do.	4,670	4,430	4,230	4,090	4,090
Industry, consumer						
Chromium ferroalloys <sup>8</sup>	do.	10,900	11,500	12,600	12,500	13,000
Chromium metal	do.	149	284	186	169 <sup>r</sup>	159
Other	do.	263	244	239	211	210
Prices, average annual:						
Chromite ore <sup>9</sup>	dollars per metric ton	159	208	216	168	162
Ferrochromium, contained chromium <sup>10</sup>	dollars per pound	0.81	1.17	1.15	1.08	1.00
Aluminothermic chromium metal, gross quantity <sup>11</sup>	do.	4.08	5.23	6.56	5.87	4.57
Value of trade:						
Exports	thousands	\$86,600	\$131,000	\$124,000	\$145,000	\$152,000
Imports	do.	\$444,000	\$1,010,000	\$1,130,000	\$1,100,000	\$839,000
Net imports <sup>12</sup>	do.	-\$358,000	-\$884,000	-\$1,010,000	-\$952,000	-\$687,000
Stainless steel:						
World production, contained chromium <sup>13</sup>	metric tons	4,430,000 <sup>r</sup>	5,370,000 <sup>r</sup>	5,710,000 <sup>r</sup>	5,840,000 <sup>r</sup>	6,520,000
U.S. production:						
Gross quantity <sup>14</sup>	metric tons	1,620,000	2,200,000	2,070,000	1,980,000	2,030,000
Contained chromium <sup>15</sup>	do.	276,000	383,000	353,000	343,000	354,000
Average grade, dimensionless <sup>16</sup>		0.1703	0.1738	0.1703	0.1733	0.1744
Shipments, gross quantity <sup>17</sup>	metric tons	1,200,000	1,510,000	1,890,000	1,900,000	NA
Exports, gross quantity	do.	414,000	508,000	558,000	590,000	603,000
Imports, gross quantity	do.	416,000	585,000	605,000	668,000	570,000
Scrap, gross quantity:						
Receipts	do.	832,000	846,000	866,000	858,000	882,000
Consumption	do.	1,260,000	1,280,000	1,300,000	1,300,000	1,300,000

See footnotes at end of table.



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

		2009	2010	2011	2012	2013
Stainless steel:—Continued						
Scrap, gross quantity:—Continued						
Exports	do.	1,130,000	937,000	656,000	624,000	644,000
Imports	do.	124,000	195,000	169,000	155,000	226,000
Value of trade:						
Exports	thousands	\$1,450,000	\$2,120,000	\$2,510,000	\$2,380,000	\$2,360,000
Imports	do.	\$1,710,000	\$2,310,000	\$2,650,000	\$2,690,000	\$2,180,000
Scrap exports	do.	\$777,000	\$936,000	\$958,000	\$804,000	\$743,000
Scrap imports	do.	\$138,000	\$305,000	\$295,000	\$236,000	\$211,000
Net imports <sup>12, 18</sup>	do.	\$384,000	\$433,000	\$523,000	\$260,000	\$720,000

<sup>1</sup>Revised. do. Ditto. NA Not Available. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

<sup>3</sup>Calculated assuming average chromium content of stainless steel and stainless steel scrap to average 17% chromium.

<sup>4</sup>From January 1, 2009, to December 31, 2009, the Defense Logistics Agency Strategic Materials made an accounting adjustment to low-carbon ferrochromium stocks making them (the stocks for those months) incompatible for the purpose of computing stock change for that year. January stocks were estimated.

<sup>5</sup>Includes consumer stocks of chromium ferroalloys and metal and other chromium-containing materials.

<sup>6</sup>Calculated assuming chromite ore to average 44% Cr<sub>2</sub>O<sub>3</sub>, which is 68.42% chromium.

<sup>7</sup>Includes chromium ferroalloys and metal and other chromium materials in the United States.

<sup>8</sup>Chromium ferroalloys, chromite ore, and other chromium-containing materials excluding chromium metal.

<sup>9</sup>Consumer stocks of high- and low-carbon ferrochromium and ferrochromium-silicon.

<sup>10</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 Ryan's Notes.

<sup>11</sup>Time-weighted average U.S. price of imported high-carbon chromium that contains 49% to 51% chromium as reported in Ryan's Notes.

<sup>12</sup>Time-weighted average U.S. price of imported aluminothermic chromium metal as reported by Ryan's Notes.

<sup>13</sup>Negative data indicate that imports are greater than exports.

<sup>14</sup>Production estimated from publicly available sources. Chromium content estimates at 17%.

<sup>15</sup>Source: American Iron and Steel Institute annual report of stainless and heat-resisting raw steel production and shipments.

<sup>16</sup>Ratio of estimated mass-weighted average chromium content of stainless steel production by grade to production.

<sup>17</sup>Estimated mass-weighted average of the mean chromium content of stainless steel production by grade. Uncertainty is approximately ± 0.01, owing to the range of chromium chemical specification limits by stainless steel grade.

<sup>18</sup>Source: American Iron and Steel Institute annual report of stainless and heat-resisting raw steel shipments.

<sup>19</sup>Includes stainless steel and stainless steel scrap.

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

(Metric tons)

	2012		2013		Change <sup>2</sup>	
	Gross quantity	Chromium content	Gross quantity	Chromium content	Quantity	Percent
<b>Consumption by end use:</b>						
Alloy uses:						
Steel:						
Carbon steel	6,730	4,310	4,800	2,900	-1,940	-29
High-strength low-alloy steel	2,730	1,790	2,040	1,330	-690	-25
Stainless and heat-resisting steel	374,000	213,000	380,000	215,000	5,750	2
Full alloy steel	16,900	10,100	14,700	8,760	-2,250	-13
Unspecified steel <sup>3</sup>	23,600	13,900	24,900	14,800	1,280	5
Superalloys	11,200 <sup>r</sup>	8,290 <sup>r</sup>	7,590	5,380	-3,590	-32
Other alloys and uses <sup>4</sup>	4,860	3,420	5,490	3,840	629	13
<b>Total</b>	<b>440,000<sup>r</sup></b>	<b>255,000<sup>r</sup></b>	<b>439,000</b>	<b>252,000</b>	<b>-811</b>	<b>(5)</b>
<b>Consumption by material:</b>						
Low-carbon ferrochromium	25,600	17,500 <sup>r</sup>	25,400	16,800	-201	-1
High-carbon ferrochromium	380,000	221,000	379,000	219,000	-1,330	(5)
Ferrochromium silicon	(6)	(6)	(6)	(6)	(6)	W
Chromium metal	4,470 <sup>r</sup>	4,470 <sup>r</sup>	4,270	4,270	-202	-5
Chromium-aluminum alloy	371	257	371	264	-1	(5)
Other chromium materials	29,100	11,400	30,000	11,700	926	3
<b>Total</b>	<b>440,000<sup>r</sup></b>	<b>255,000<sup>r</sup></b>	<b>439,000</b>	<b>252,000</b>	<b>-811</b>	<b>(5)</b>
<b>Consumer stocks:</b>						
Low-carbon ferrochromium	1,720 <sup>r</sup>	1,180 <sup>r</sup>	1,810	1,190	84	5
High-carbon ferrochromium	10,100	5,870	10,300	5,980	258	3
Ferrochromium silicon	(6)	(6)	(6)	(6)	(6)	(6)
Chromium metal	169 <sup>r</sup>	169 <sup>r</sup>	159	159	-10	-6
Chromium-aluminum alloy	(6)	(6)	(6)	(6)	(6)	(6)
Other chromium materials	863	366	1,020	429	157	18
<b>Total</b>	<b>12,800<sup>r</sup></b>	<b>7,580<sup>r</sup></b>	<b>13,300</b>	<b>7,760</b>	<b>489</b>	<b>4</b>
<b>National Defense Stockpile stocks:<sup>7,8</sup></b>						
Chromium ferroalloys: <sup>9</sup>						
High-carbon ferrochromium	94,300	67,300	85,100	60,800	-9,230	-10
Low-carbon ferrochromium	49,400	35,200	44,300	31,600	-5,070	-10
Chromium metal <sup>10</sup>	4,090	4,090	4,090	4,090	--	--

<sup>1</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

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

<sup>3</sup>Change based on gross quantity of unrounded data of current year compared with that of previous year.

<sup>4</sup>Includes electrical, tool, and unspecified steel end uses.

<sup>5</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>6</sup>Less than ½ unit.

<sup>7</sup>Withheld to avoid disclosing company proprietary data; included in "Other chromium materials."

<sup>8</sup>The source for stockpile information is the Defense Logistics Agency Strategic Materials (DLA Strategic Materials).

<sup>9</sup>The DLA Strategic Materials data are based on the "Total Uncommitted Inventory" of stockpile material D-1 report.

<sup>10</sup>Chromium content estimated using 71.4% chromium.

<sup>11</sup>Chromium content estimated using 100% chromium.

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

Country	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		
	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)
2012:															
Albania	--	--	--	--	--	--	--	--	--	3,440	2,240	\$5,080	3,440	2,240	\$5,080
Belgium	35	23	\$128	--	--	--	40	22	\$22	--	--	--	75	46	151
Brazil	316	179	855	--	--	--	--	--	--	--	--	--	316	179	855
China	60	38	295	144	95	\$205	--	--	--	197	137	347	401	270	847
France	1	1	3	--	--	--	--	--	--	--	--	--	1	1	3
Germany	5,760	4,000	25,800	1,340	886	1,960	--	--	--	--	--	--	7,100	4,890	27,800
India	--	--	--	--	--	--	--	--	--	13,400	8,150	17,300	13,400	8,150	17,300
Japan	1,790	1,250	8,770	--	--	--	--	--	--	--	--	--	1,790	1,250	8,770
Kazakhstan	3,830	2,680	10,400	3,070	2,130	8,090	--	--	--	92,700	64,200	126,000	99,600	69,000	144,000
Russia	27,800	19,100	85,600	2,600	1,810	7,320	371	200	198	29,400	19,300	41,000	60,200	40,400	134,000
South Africa	500	338	1,530	442	242	898	--	--	--	235,000	116,000	228,000	236,000	117,000	231,000
Spain	--	--	--	--	--	--	--	--	--	20	13	33	20	13	33
Sweden	--	--	--	--	--	--	--	--	--	12,800	8,550	23,000	12,800	8,550	23,000
Switzerland	--	--	--	--	--	--	--	--	--	16	8	28	16	8	28
Turkey	3,810	2,730	12,800	--	--	--	--	--	--	32,000	21,100	49,600	35,800	23,800	62,300
Zimbabwe	--	--	--	--	--	--	--	--	--	29,400	16,900	35,700	29,400	16,900	35,700
Total	43,900	30,300	146,000	7,580	5,150	18,500	411	222	221	449,000	257,000	\$26,000	500,000	293,000	691,000
2013:															
Albania	--	--	--	--	--	--	--	--	--	1,730	1,180	2,340	1,730	1,180	2,340
Belgium	--	--	--	--	--	--	60	44	31	--	--	--	60	44	31
Brazil	396	251	850	--	--	--	--	--	--	--	--	--	396	251	850
China	80	36	261	--	--	--	--	--	--	--	--	--	80	36	261
France	1	1	4	--	--	--	--	--	--	--	--	--	1	1	4
Germany	6,240	4,360	24,800	2,090	1,390	3,040	--	--	--	--	--	--	8,340	5,750	27,900
India	120	79	630	--	--	--	--	--	--	2,590	1,570	3,320	2,710	1,650	3,950
Japan	1,530	1,060	6,600	--	--	--	--	--	--	--	--	--	1,530	1,060	6,600
Kazakhstan	405	106	585	3,790	2,620	9,410	--	--	--	71,300	49,300	87,000	75,500	52,000	97,000
Malta	20	14	69	--	--	--	--	--	--	--	--	--	20	14	69
Netherlands	--	--	--	--	--	--	--	--	--	199	131	295	199	131	295
Russia	24,700	16,800	69,900	7,470	5,160	19,700	310	167	207	14,500	9,500	18,700	46,900	31,600	108,000
South Africa	500	316	1,350	460	250	958	--	--	--	294,000	145,000	262,000	295,000	146,000	264,000
Sweden	13	12	64	--	--	--	--	--	--	4,900	3,250	9,100	4,910	3,260	9,160
Taiwan	108	74	299	--	--	--	--	--	--	--	--	--	108	74	299
Turkey	2,400	1,710	7,680	--	--	--	--	--	--	22,000	14,500	30,300	24,400	16,200	38,000
Zimbabwe	--	--	--	--	--	--	--	--	--	4,090	2,310	4,340	4,090	2,310	4,340
Total	36,500	24,800	113,000	13,800	9,410	33,100	370	210	238	416,000	227,000	417,000	466,000	262,000	564,000

-- Zero.

<sup>1</sup>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 of America.

Source: U.S. Census Bureau.



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

HTS <sup>2</sup> code	Type	2012		2013		Principal destinations in 2013 (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 quantity	21,200	\$9,870	8,530	\$3,040	Netherlands (5,536, \$770); Canada (1,266, \$585); Mexico (962, \$651).
	Metal and alloy, gross quantity:					
8112.21.0000	Unwrought chromium powders	326	8,130	379	7,640	Japan (59, \$698); Brazil (50, \$517); Switzerland (40, \$599); Germany (32, \$1,403); Mexico (32, \$561); United Kingdom (28, \$852); Netherlands (27, \$251); China (20, \$434); Canada (13, \$318); Singapore (12, \$510).
8112.22.0000	Chromium metal waste and scrap	3	53	7	125	Canada (3, \$21); Mexico (2, \$44); Spain (1, \$34); United Kingdom (1, \$10).
8112.29.0000	Chromium metal other than unwrought powders and waste and scrap	134	4,820	470	11,200	Taiwan (249, \$5,652); India (89, \$861); Brazil (22, \$843); Canada (22, \$347).
	Total chromium metal	462	13,000	856	19,000	
	Chromium ferroalloys:					
7202.41.0000	High-carbon ferrochromium: <sup>3</sup>					
	Gross quantity	4,460	5,790	4,460	6,580	Brazil (1,389, \$2,328); Canada (586, \$886); Thailand (496, \$708); Argentina (424, \$422); Republic of Korea (420, \$577); Mexico (397, \$464).
	Contained chromium	2,240	XX	2,320	XX	
7202.49.0000	Low-carbon ferrochromium: <sup>4</sup>					
	Gross quantity	768	1,350	379	698	Canada (243, \$411); Argentina (84, \$139); Mexico (35, \$102); China (10, \$13); Colombia (5, \$29); Saudi Arabia (3, \$4).
	Contained chromium	347	XX	169	XX	
7202.49.0000	Ferrochromium-silicon:					
	Gross quantity	64	105	16	23	Canada (all).
	Contained chromium	22	XX	6	XX	
	Total chromium ferroalloys:					
	Gross quantity	5,300	7,250	4,850	7,300	
	Contained chromium	2,610	XX	2,500	XX	
	Chemicals, gross quantity:					
	Chromium oxides:					
2819.10.0000	Chromium trioxide	17,300	48,600	15,000	54,300	China (3,454, \$10,672); Brazil (2,714, \$9,917); Japan (1,238, \$4,773); United Kingdom (1,107, \$3,777); Republic of Korea (913, \$3,998); India (807, \$2,533); Indonesia (612, \$2,630); Germany (478, \$1,791); Italy (466, \$1,669); Turkey (378, \$1,536).
2819.90.0000	Other	5,480	39,600	5,580	31,400	United Kingdom (2,631, \$10,593); Spain (760, \$3,465); Belgium (553, \$3,719); Canada (275, \$2,086); Brazil (212, \$1,122); Germany (144, \$1,524).
	Total chromium oxides	22,800	88,200	20,600	85,700	
2833.29.4000	Chromium sulfates	40	254	128	701	Republic of Korea (82, \$401); Taiwan (13, \$66); Mexico (11, \$116); Singapore (8, \$39); Hong Kong (7, \$37); Dominican Republic (4, \$18); United Kingdom (2, \$9); China (1, \$6).
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Zinc and lead chromate	3	227	7	366	Mexico (3, \$58); South Africa (3, \$295); Grenada (1, \$3); Trinidad and Tobago (1, \$3).
2841.30.0000	Sodium dichromate	14,000	18,600	14,800	27,100	Japan (8,280, \$16,353); Canada (4,484, \$6,398).
2841.50.1000	Potassium dichromate	103	188	101	199	Mexico (27, \$35); Taiwan (24, \$69); France (24, \$66); Australia (10, \$14); Netherlands (10, \$10); Brazil (5, \$4).
2841.50.9100	Other	388	1,710	207	2,260	Canada (76, \$465); United Kingdom (23, \$130); Taiwan (18, \$75); South Africa (16, \$369); France (16, \$121); Mexico (12, \$75); Malaysia (12, \$52).
	Total salts	14,500	20,700	15,100	29,900	
3206.20.0000	Pigments and preparations, gross quantity	791	5,480	649	6,090	Mexico (401, \$3,609); Canada (82, \$592); Peru (44, \$99).
	XX Not applicable.					

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

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

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

<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<sup>1</sup>

Country	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		
	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)	Gross quantity (metric tons)	Cr content (metric tons)	Value (thousands)
2012:															
Albania	--	--	--	--	--	--	--	--	--	--	--	3,440	2,240	3,440	2,240
Belgium	35	23	\$128	--	--	--	40	22	\$22	--	--	--	75	46	\$5,080
Brazil	316	179	855	--	--	--	--	--	--	--	--	--	316	179	855
China	60	38	295	144	95	\$205	--	--	--	197	137	347	401	270	847
France	1	1	3	--	--	--	--	--	--	--	--	--	1	1	3
Germany	5,760	4,000	25,800	1,340	886	1,960	--	--	--	--	--	--	7,100	4,890	27,800
India	--	--	--	--	--	--	--	--	--	13,400	8,150	17,300	13,400	8,150	17,300
Japan	1,790	1,250	8,770	--	--	--	--	--	--	--	--	--	1,790	1,250	8,770
Kazakhstan	3,830	2,680	10,400	3,070	2,130	8,090	--	--	--	92,700	64,200	126,000	99,600	69,000	144,000
Russia	27,800	19,100	85,600	2,600	1,810	7,320	371	200	198	29,400	19,300	41,000	60,200	40,400	134,000
South Africa	500	338	1,530	442	242	898	--	--	--	235,000	116,000	228,000	236,000	117,000	231,000
Spain	--	--	--	--	--	--	--	--	--	20	13	33	20	13	33
Sweden	--	--	--	--	--	--	--	--	--	12,800	8,550	23,000	12,800	8,550	23,000
Switzerland	--	--	--	--	--	--	--	--	--	16	8	28	16	8	28
Turkey	3,810	2,730	12,800	--	--	--	--	--	--	32,000	21,100	49,600	35,800	23,800	62,300
Zimbabwe	--	--	--	--	--	--	--	--	--	29,400	16,900	35,700	29,400	16,900	35,700
Total	43,900	30,300	146,000	7,580	5,150	18,500	411	222	221	449,000	257,000	526,000	500,000	293,000	691,000
2013:															
Albania	--	--	--	--	--	--	--	--	--	1,730	1,180	2,340	1,730	1,180	2,340
Belgium	--	--	--	--	--	--	60	44	31	--	--	--	60	44	31
Brazil	396	251	850	--	--	--	--	--	--	--	--	--	396	251	850
China	80	36	261	--	--	--	--	--	--	--	--	--	80	36	261
France	1	1	4	--	--	--	--	--	--	--	--	--	1	1	4
Germany	6,240	4,360	24,800	2,090	1,390	3,040	--	--	--	--	--	--	8,340	5,750	27,900
India	120	79	630	--	--	--	--	--	--	2,590	1,570	3,320	2,710	1,650	3,950
Japan	1,530	1,060	6,600	--	--	--	--	--	--	--	--	--	1,530	1,060	6,600
Kazakhstan	405	106	585	3,790	2,620	9,410	--	--	--	71,300	49,300	87,000	75,500	52,000	97,000
Malta	20	14	69	--	--	--	--	--	--	--	--	--	20	14	69
Netherlands	--	--	--	--	--	--	--	--	--	199	131	295	199	131	295
Russia	24,700	16,800	69,900	7,470	5,160	19,700	310	167	207	14,500	9,500	18,700	46,900	31,600	108,000
South Africa	500	316	1,350	460	250	958	--	--	--	294,000	145,000	262,000	295,000	146,000	264,000
Sweden	13	12	64	--	--	--	--	--	--	4,900	3,250	9,100	4,910	3,260	9,160
Taiwan	108	74	299	--	--	--	--	--	--	--	--	--	108	74	299
Turkey	2,400	1,710	7,680	--	--	--	--	--	--	22,000	14,500	30,300	24,400	16,200	38,000
Zimbabwe	--	--	--	--	--	--	--	--	--	4,090	2,310	4,340	4,090	2,310	4,340
Total	36,500	24,800	113,000	13,800	9,410	33,100	370	210	238	416,000	227,000	417,000	466,000	262,000	564,000

-- Zero.

<sup>1</sup>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 of America.

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	2012		2013		Sources in 2013 (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 quantity	--	--	6,380	\$2,230	South Africa (all).
	Cr <sub>2</sub> O <sub>3</sub> content	--	XX	1,610	XX	
2610.00.0040	More than 40%, but less than 46% Cr <sub>2</sub> O <sub>3</sub> :					
	Gross quantity	29,000	\$6,910	68,400	14,200	South Africa (all).
	Cr <sub>2</sub> O <sub>3</sub> content	12,900	XX	30,800	XX	
2610.00.0060	46% or more Cr <sub>2</sub> O <sub>3</sub> :					
	Gross quantity	248,000	102,000	98,400	37,200	South Africa (98,366, \$37,109); Belgium (12, \$26); Canada (4, \$22);
	Cr <sub>2</sub> O <sub>3</sub> content	120,000	XX	46,700	XX	Netherlands (3, \$4).
	Total chromite ore:					
	Gross quantity	277,000	109,000	173,000	53,600	
	Cr <sub>2</sub> O <sub>3</sub> content	133,000	XX	79,100	XX	
Chromium ferroalloys:						
Ferrochromium:						
7202.49.5090	Not more than 0.5% carbon:					
	Gross quantity	43,900	146,000	36,500	113,000	Russia (24,677, \$69,898); Germany (6,243, \$24,836); Turkey (2,397, \$7,675); Japan (1,529, \$6,602); South Africa (500, \$1,347); Kazakhstan (405, \$585); Brazil (396, \$850); India (120, \$630); Taiwan (108, \$299);
	Cr content	30,300	XX	24,800	XX	China (80, \$261); Malta and Gozo (20, \$69); Sweden (13, \$64); France (1, \$4).
7202.49.5010	More than 0.5%, but less than 3% carbon:					
	Gross quantity	7,580	18,500	13,800	33,100	Russia (7,471, \$19,671); Kazakhstan (3,790, \$9,407); Germany (2,094, \$3,038);
	Cr content	5,150	XX	9,410	XX	South Africa (460, \$958).
	More than 3%, but less than 4% carbon:					
	Gross quantity	411	221	370	238	Russia (310, \$207); Belgium (60, \$31).
	Cr content	222	XX	210	XX	
	More than 4% carbon:					
	Gross quantity	449,000	526,000	416,000	417,000	South Africa (294,449, \$262,034); Kazakhstan (71,328, \$86,994);
	Cr content	257,000	XX	227,000	XX	Turkey (22,034, \$30,327); Russia (14,489, \$18,665); Sweden (4,897, \$9,100); Zimbabwe (4,085, \$4,342); India (2,586, \$3,315);
						Albania (1,725, \$2,335); Netherlands (199, \$295).
7202.50.0000	Ferrochromium-silicon:					
	Gross quantity	25,800	36,500	12,000	16,200	Kazakhstan (10,510, \$14,027); Russia (1,508, \$2,170).
	Cr content	9,730	XX	4,230	XX	
	Total chromium ferroalloys:					
	Gross quantity	526,000	728,000	478,000	580,000	
	Cr content	302,000	XX	266,000	XX	
Chromium metal, gross quantity:						
8112.21.0000	Unwrought chromium powders	3,060	43,000	3,350	39,800	China (1,803, \$19,749); Russia (521, \$5,306); France (500, \$6,842); United Kingdom (274, \$4,130); Belgium (190, \$2,867); Turkey (32, \$62); Germany (22, \$696); Japan (4, \$114).

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	2012			2013			Sources in 2013 (Quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value <sup>3</sup> (thousands)	Quantity (metric tons)	Value <sup>3</sup> (thousands)	Quantity (metric tons)	Value <sup>3</sup> (thousands)	
8112.22.0000	Chromium metal, gross quantity:—Continued							
	Waste and scrap	415	1,950	70	684			Canada (33, \$175); Japan (17, \$288); Germany (9, \$159); United Kingdom (8, \$55); Singapore (2, \$6).
8112.29.0000	Other than waste and scrap	11,800	159,000	10,200	112,000			Russia (2,769, \$25,231); France (2,721, \$32,935); China (2,428, \$23,315); United Kingdom (2,145, \$25,262); Germany (97, \$2,694); Japan (46, \$326); Canada (22, \$1,841); Netherlands (9, \$76); Spain (9, \$43); Liechtenstein (1, \$110).
	Total chromium metal	15,300	203,000	13,700	152,000			
	Chemicals, gross quantity:							
	Chromium oxides and hydroxides:							
2819.10.0000	Chromium trioxides	8,170	27,800	7,010	23,800			Turkey (4,517, \$13,657); Kazakhstan (1,634, \$5,342); China (575, \$3,086); South Africa (130, \$443); Colombia (106, \$865); Spain (37, \$303); Canada (12, \$41); France (1, \$7).
2819.90.0000	Other	1,790	10,500	2,880	12,200			Canada (957, \$1,070); Germany (901, \$5,637); China (864, \$4,634); Kazakhstan (56, \$269); Ukraine (40, \$149); Hong Kong (20, \$190); Russia (19, \$62); Colombia (16, \$143); United Kingdom (5, \$31); Japan (5, \$26); Republic of Korea (1, \$13).
	Total oxides	9,960	38,200	9,900	36,000			
2833.29.4000	Sulfates of chromium	346	376	490	547			Turkey (360, \$397); Uruguay (57, \$55); India (33, \$27); China (23, \$19); Italy (17, \$50).
	Salts of oxometallic or peroxometallic acids:							
2841.90.4500	Chromates of lead and zinc	69	351	83	389			Colombia (34, \$169); Japan (25, \$101); China (23, \$66); Austria (1, \$36).
2841.30.0000	Sodium dichromate	267	681	171	470			China (135, \$388); Turkey (36, \$76).
	Other chromates and dichromates;							
	Peroxo-chromates:							
2841.50.1000	Potassium dichromate	399	698	1	13			India (all).
2841.50.9100	Other	597	2,230	707	2,660			Austria (558, \$2,087); Italy (59, \$192); Brazil (39, \$119); Colombia (21, \$93); Republic of Korea (18, \$58); France (6, \$25); Germany (3, \$59); China (3, \$27).
	Total salts	1,330	3,960	962	3,530			
2849.90.2000	Chromium carbide	171	3,600	132	3,280			China (70, \$1,717); Canada (34, \$1,003); United Kingdom (23, \$324); Germany (5, \$231); Japan (1, \$8).
	Total chromium chemicals	11,800	46,200	11,500	43,400			
	Pigments and preparations based on chromium, gross quantity:							
3206.20.0010	Chrome yellow	1,190	6,500	695	4,620			Canada (499, \$3,593); Colombia (138, \$604); Germany (24, \$136); Mexico (21, \$100); China (12, \$186).
3206.20.0020	Molybdenum orange	355	2,910	274	2,430			Canada (181, \$1,888); Colombia (64, \$375); Germany (20, \$100); China (6, \$49); India (2, \$14).
3206.20.0030	Zinc yellow	43	134	79	268			China (74, \$242); Mexico (5, \$23).
3206.20.0050	Other	267	1,840	342	2,480			France (150, \$554); Germany (71, \$685); India (35, \$267); Japan (27, \$189); China (24, \$574); Poland (19, \$123); Australia (11, \$46); Canada (4, \$14); Netherlands (2, \$16).
	Total pigments	1,850	11,400	1,390	9,800			

See footnotes at end of table.

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

XX Not applicable. -- Zero.

<sup>1</sup>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 of America.

<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.

TABLE 7  
ESTIMATED WORLD PRODUCTION CAPACITY AND APPARENT CONSUMPTION OF CHROMITE ORE,  
FERROCHROMIUM, CHROMIUM METAL, CHROMIUM CHEMICALS, AND STAINLESS STEEL<sup>1</sup>

(Thousand metric tons of contained chromium)

Country	Production capacity in 2013					Apparent consumption <sup>2</sup>		
	Ore	Ferro-chromium	Metal	Chemicals	Stainless steel	2011	2012	2013
Afghanistan	2	--	--	--	--	2 <sup>r</sup>	2 <sup>r</sup>	2
Albania	159	20	--	--	--	-20 <sup>r</sup>	-30 <sup>r</sup>	-84
Argentina	--	--	--	13	--	17 <sup>r</sup>	21 <sup>r</sup>	21
Australia	--	--	--	--	--	19 <sup>r</sup>	-- <sup>r</sup>	20
Austria	--	--	--	--	12	28 <sup>r</sup>	29 <sup>r</sup>	27
Belgium	--	--	--	--	240	126 <sup>r</sup>	133 <sup>r</sup>	173
Brazil	158	120	--	--	73	155 <sup>r</sup>	160 <sup>r</sup>	162
Canada	--	--	--	--	--	14 <sup>r</sup>	16 <sup>r</sup>	17
China	60	2,320	15	140	3,650	3,830 <sup>r</sup>	3,670 <sup>r</sup>	4,640
Czech Republic	--	--	--	--	3	8 <sup>r</sup>	8 <sup>r</sup>	5
Finland	296	224	--	--	211	165 <sup>r</sup>	89 <sup>r</sup>	144
France	--	--	12	--	55	59 <sup>r</sup>	63 <sup>r</sup>	70
Germany	--	12	1	--	256	262 <sup>r</sup>	245 <sup>r</sup>	207
Greece	(3)	--	--	--	--	1	1	1
India	1,300	516	(3)	31	465	1,010 <sup>r</sup>	542 <sup>r</sup>	572
Indonesia	--	--	--	--	NA	-- <sup>r</sup>	-22 <sup>r</sup>	-2
Iran	126	10	--	2	--	15 <sup>r</sup>	120 <sup>r</sup>	120
Italy	--	--	--	--	289	236 <sup>r</sup>	238 <sup>r</sup>	222
Japan	--	13	1	17	576	473 <sup>r</sup>	427 <sup>r</sup>	416
Kazakhstan	1,140	763	--	37	--	-211 <sup>r</sup>	-557 <sup>r</sup>	140
Korea, Republic of	--	--	--	--	367	288 <sup>r</sup>	290 <sup>r</sup>	302
Madagascar	40	--	--	--	--	-- <sup>r</sup>	-- <sup>r</sup>	-2,630
Oman	241	--	--	--	--	186 <sup>r</sup>	90 <sup>r</sup>	71
Pakistan	54	--	--	3	--	-51 <sup>r</sup>	-95 <sup>r</sup>	-98
Philippines	11	--	--	--	--	8 <sup>r</sup>	11 <sup>r</sup>	12
Poland	--	--	--	--	--	13 <sup>r</sup>	13 <sup>r</sup>	19
Russia	210	277	16	31	17	26 <sup>r</sup>	336 <sup>r</sup>	321
Slovenia	--	--	--	--	24	9 <sup>r</sup>	14 <sup>r</sup>	21
South Africa	4,250	1,870	--	23	90	117 <sup>r</sup>	-116 <sup>r</sup>	-33
Spain	--	--	--	--	160	86 <sup>r</sup>	101 <sup>r</sup>	94
Sudan	19	--	--	--	--	19 <sup>r</sup>	2 <sup>r</sup>	9
Sweden	--	74	--	--	100	41 <sup>r</sup>	1 <sup>r</sup>	16
Taiwan	--	--	--	--	232	NA <sup>r</sup>	NA <sup>r</sup>	NA
Turkey	992	50	--	17	--	222 <sup>r</sup>	361 <sup>r</sup>	320
Ukraine	--	--	--	--	25	29 <sup>r</sup>	19 <sup>r</sup>	6
United Arab Emirates	--	--	--	--	--	NA <sup>r</sup>	NA <sup>r</sup>	NA
United Kingdom	--	--	8	--	56	24 <sup>r</sup>	21 <sup>r</sup>	19
United States	--	--	--	38	437	361 <sup>r</sup>	354 <sup>r</sup>	334
Vietnam	12	--	--	--	--	10 <sup>r</sup>	12 <sup>r</sup>	13
Zimbabwe	180	111	--	--	--	99 <sup>r</sup>	62 <sup>r</sup>	27
Total	9,260	6,380	53	352	7,330	XX	XX	XX

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

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

<sup>2</sup>Estimated based on U.S. Geological Survey reported chromite ore production and United Nations trade statistics (COMTRADE) assuming that chromite ore imports are reported in contained Cr<sub>2</sub>O<sub>3</sub>; chromium ferroalloys, contained chromium; and exports, gross quantity.

<sup>3</sup>Less than ½ unit.

TABLE 8  
CHROMITE: WORLD PRODUCTION, BY COUNTRY<sup>1,2,3</sup>

(Metric tons, gross weight)

Country	2009	2010	2011	2012	2013 <sup>e</sup>
Afghanistan <sup>e,4</sup>	6,700	5,727 <sup>5</sup>	6,204 <sup>5</sup>	6,000	6,000
Albania <sup>6</sup>	283,558	328,322	330,938	380,349 <sup>r</sup>	529,592 <sup>5</sup>
Australia	119,314	180,000	323,800	452,300	400,000
Brazil <sup>7</sup>	365,210	520,129	542,512	543,000	545,000
China <sup>e</sup>	200,000	200,000	200,000	200,000	200,000
Finland	246,817	598,000	692,527	425,217	981,752 <sup>5</sup>
Greece <sup>e,4</sup>	1,400	1,400	1,200 <sup>r</sup>	1,200 <sup>r</sup>	1,200
India	4,073,000 <sup>r</sup>	3,426,000 <sup>r</sup>	4,326,000 <sup>r</sup>	2,923,000 <sup>r</sup>	2,950,000 <sup>p</sup>
Iran	268,586	45,000	417,554 <sup>r</sup>	400,000 <sup>r,e</sup>	400,000
Kazakhstan <sup>e</sup>	3,544,000 <sup>5</sup>	3,760,000	3,800,000	3,590,000 <sup>r,5</sup>	3,700,000
Madagascar, exports	133,000	134,500	66,700	111,500	75,000 <sup>5</sup>
Oman	636,482	801,856	616,700	602,225 <sup>r</sup>	787,645 <sup>5</sup>
Pakistan <sup>e</sup>	90,000 <sup>r,5</sup>	257,000 <sup>r,5</sup>	148,000 <sup>r</sup>	179,000 <sup>r</sup>	164,000
Philippines	14,322	14,807	25,483 <sup>r</sup>	36,628 <sup>r</sup>	40,000
Russia, marketable	347,000 <sup>r</sup>	699,000 <sup>r</sup>	662,000 <sup>r</sup>	670,000 <sup>r,e</sup>	670,000
South Africa	7,560,938	10,871,095	11,865,380 <sup>r</sup>	11,310,223 <sup>r</sup>	13,652,883 <sup>5</sup>
Sudan	14,087	56,823	64,128	18,300	30,870 <sup>5</sup>
Turkey	1,573,993	1,904,461	2,901,027	3,295,399 <sup>r</sup>	3,300,000
United Arab Emirates	23,770	25,000	--	--	--
Vietnam <sup>e</sup>	37,105 <sup>5</sup>	40,000	40,000	40,000	40,000
Zimbabwe	193,673	510,000	599,079	408,745 <sup>r</sup>	350,000
Total	19,700,000 <sup>r</sup>	24,400,000	27,600,000 <sup>r</sup>	25,600,000	28,800,000

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

<sup>1</sup>World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes data available through November 20, 2014.

<sup>3</sup>Figures for all countries represent marketable output.

<sup>4</sup>Gross weight estimated assuming an average grade of 44% chromic oxide (Cr<sub>2</sub>O<sub>3</sub>).

<sup>5</sup>Reported figure.

<sup>6</sup>Ore grade was 18% to 42% chromic oxide (Cr<sub>2</sub>O<sub>3</sub>).

<sup>7</sup>Average chromic oxide (Cr<sub>2</sub>O<sub>3</sub>) content was as follows: 2009—40.0%; 2010—49.7%; 2011—45.2%; 2012—45.0% (revised estimate); and 2013—40.0% (estimated).



TABLE 9  
FERROCHROMIUM: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons, gross weight)

Country <sup>3</sup>	2009	2010	2011	2012	2013 <sup>c</sup>
Albania	5,705 <sup>r</sup>	23,233	28,433 <sup>r</sup>	30,000 <sup>r</sup>	30,000
Brazil <sup>4</sup>	131,048	277,114	145,122	165,532 <sup>r</sup>	164,500 <sup>5</sup>
Chile <sup>c</sup>	11	184	35	67	70
China <sup>c</sup>	1,810,000	2,400,000	2,700,000	3,040,000 <sup>r</sup>	3,200,000
Finland	123,310 <sup>5</sup>	125,000	125,000	125,000	125,000
Germany <sup>c</sup>	13,667 <sup>5</sup>	18,300 <sup>r</sup>	18,500 <sup>r</sup>	17,800 <sup>r</sup>	17,500
India <sup>c,6</sup>	873,385 <sup>5</sup>	850,000	830,000	800,000	800,000
Japan	7,698	16,208	17,217	19,392 <sup>r</sup>	20,000
Kazakhstan	1,173,286	1,311,302	1,289,917	1,305,566	1,300,000
Oman	--	--	--	--	20,630 <sup>5</sup>
Romania	15,000	14,000	--	--	--
Russia	378,000	414,288	501,700	477,600 <sup>r</sup>	480,000
South Africa <sup>7</sup>	2,346,132	3,607,132	3,425,911	3,063,257 <sup>r</sup>	3,219,000 <sup>5</sup>
Sweden <sup>c</sup>	31,345 <sup>5</sup>	36,000	36,000	36,000	36,000
Turkey <sup>c</sup>	41,028 <sup>5</sup>	60,000	60,000	60,000	62,000
United States	-- <sup>r</sup>	--	--	--	--
Zimbabwe <sup>c</sup>	72,223 <sup>5</sup>	146,000	140,000	137,534 <sup>5</sup>	100,000
Total	7,020,000	9,300,000	9,320,000	9,280,000 <sup>r</sup>	9,570,000

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

<sup>1</sup>World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes data available through July 17, 2015.

<sup>3</sup>Iran is known to have produced ferrochromium, but information is inadequate to make reliable estimates of output levels.

<sup>4</sup>Reported figure.

<sup>5</sup>Includes high- and low-carbon ferrochromium.

<sup>6</sup>Reported on a fiscal year basis, which is from April 1 to March 31. Includes ferrochrome and charge chrome.

<sup>7</sup>Includes high- and low-carbon ferrochromium and ferrochromium-silicon.