

2022 Minerals Yearbook

CHROMIUM [ADVANCE RELEASE]

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CHROMIUM

By Ruth F. Schulte

Domestic survey data and tables were prepared by Benjamin N. Bryden, statistical assistant.

In 2022, U.S. chromium apparent consumption (including recycling) was 569,000 metric tons (t) on a chromium content basis, essentially unchanged from that in 2021 (table 1). Because stainless-steel mill products contributed a significant amount of chromium to the domestic economy, trade in these products and their contribution was accounted for in chromium apparent consumption calculations. U.S. chromium apparent consumption in 2022 was 64% of the recorded high of 893,000 t in 1965.

Domestic reported consumption of chromium materials, excluding stainless steel, decreased by 29% (chromium content) in 2022 from that in 2021. Steelmaking was the leading end use for chromium materials and accounted for 93% of consumption in 2022. Superalloys and other end uses made up the remaining 7% (table 2).

Based on U.S. Census Bureau trade data, exports of chromite ore, chromium chemicals, chromium ferroalloys, chromium metal, and stainless-steel mill products and scrap increased by 16% to 133,000 t in 2022 from those in 2021. Total chromium imports of chromite ore, chromium chemicals, chromium ferroalloys, chromium metal, and stainless-steel mill products and scrap increased by 7% on a chromium content basis to 609,000 t from imports in 2021 (table 1).

World production of chromite ore in 2022 decreased slightly to 41.9 million metric tons (Mt) gross weight from the revised amount in 2021 (table 7). South Africa was the leading producer of chromite ore, accounting for an estimated 46% of global production. World production of ferrochromium increased by 5% to 15.2 Mt from the amount in 2021. China was the leading producer of ferrochromium, accounting for an estimated 42% of global production (table 8).

Government Actions and Legislation

Critical Minerals List.—On February 24, 2022, pursuant to section 7002 of the Energy Act of 2020 (Public Law 116–260) and using the definition of “critical mineral” and the criteria specified therein, the U.S. Geological Survey (USGS) published the “2022 Final List of Critical Minerals” in the Federal Register (87 FR 10381). The 2022 list of critical minerals, which revised the U.S. critical minerals list published in 2018 (83 FR 23295), included 50 mineral commodities instead of 35 mineral commodities or mineral groups; both lists included chromium (U.S. Department of the Interior, 2022).

Infrastructure Investment and Jobs Act.—In February, the USGS Earth Mapping Resources Initiative (Earth MRI), a collaborative project between the USGS and State geological surveys to collect and modernize the Nation’s geologic mapping and data resources, received additional funding of \$64 million per year for 5 years from the Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Law) (U.S. Geological Survey, 2022b). In July 2022, the Earth MRI released two reports. The first report,

Open-File Report 2019–1023–D, “Focus Areas for Data Acquisition for Potential Domestic Resources of 13 Critical Minerals in the Conterminous United States and Puerto Rico—Antimony, Barite, Beryllium, Chromium, Fluorspar, Hafnium, Helium, Magnesium, Manganese, Potash, Uranium, Vanadium, and Zirconium,” defined focus areas for future data collection for resources for the 13 critical minerals evaluated in the conterminous United States and Puerto Rico during phase 3 of the study (Hammarstrom and others, 2022). The second report, Open-File Report 2019–1023–E, “Alaska Focus Area Definition for Data Acquisition for Potential Domestic Sources of Critical Minerals in Alaska for Antimony, Barite, Beryllium, Chromium, Fluorspar, Hafnium, Magnesium, Manganese, Uranium, Vanadium, and Zirconium,” similarly defined focus areas for further investigation into critical mineral resources in Alaska (Kreiner, Jones, and Case, 2022).

In October 2022, the USGS announced a \$3.2 million project to collect geophysical data to improve mapping of critical mineral resources, which included chromite, in parts of Iowa, Minnesota, Nebraska, and South Dakota. The project would be funded and conducted by the Earth MRI (U.S. Geological Survey, 2022a).

Stockpile.—The Defense Logistics Agency Strategic Materials (DLA Strategic Materials), U.S. Department of Defense, sold chromium materials under its fiscal year 2022 (October 1, 2021, through September 30, 2022) Annual Materials Plan (AMP). Maximum disposal limits were based on the 2022 AMP for chromium materials, which were set at 21,800 t of chromium ferroalloys and 450 t of chromium metal (Defense Logistics Agency Strategic Materials, 2021).

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

The EPA also regulates total chromium in drinking water under the national primary drinking water regulations. The maximum contaminant level for total chromium in drinking water, including Cr(III) and Cr(VI), was established in 1991 at 0.1 milligrams per liter and is undergoing further review as part of an Integrated Risk Information System assessment (U.S. Environmental Protection Agency, undated).

Consumption

Domestic data for chromium materials were developed by the USGS by means of monthly “Chromite Ores and Chromium Products” and “Consolidated Consumers” consumer surveys. Based on the results of these surveys, stainless-steel and heat-resisting-steel producers were the leading chromium consumers, and high-carbon ferrochromium was the leading chromium-containing material consumed (table 2).

The major marketplace chromium-containing materials were chromite ore and foundry sand; chromium chemicals, ferroalloys, and metal; and stainless steel. In 2022, the United States produced chromium chemicals and stainless steel.

Chromium Chemicals.—Chemical-grade chromite ore, which has a high chromium content with greater than 45% chromium oxide (Cr_2O_3), is typically processed via conversion to sodium dichromate. Sodium dichromate can then be used in other applications as oxidizing agents or in the production of dyes and inorganic chemicals, such as leather tanning liquors, metal plating and finishing solutions, drilling muds, and wood preservatives. In the United States, Elementis Chromium, a subsidiary of Elementis plc (United Kingdom), produced sodium dichromate from chromite ore at its production facilities in Castle Hayne, NC, and Corpus Christi, TX.

In December, Yildirim Group of Companies (Yildirim Group) (Turkey) signed an acquisition agreement for the purchase of Elementis plc’s chromium business, Elementis Chromium, which included Elementis’ production operations in the United States and three additional U.S. processing facilities in Amarillo, TX, Dakota, NE, and Milwaukee, WI. Following regulatory approval in 2023, Elementis Chromium would become American Chrome & Chemicals (Yildirim Group of Companies, 2022b; 2023, p. 22).

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 also is used to reduce stress corrosion susceptibility and improve toughness in aluminum-magnesium, aluminum-magnesium-silicon, and aluminum-magnesium-zinc alloys.

In 2022, the U.S. stainless-steel industry produced 2.02 Mt (2.22 million net tons) of stainless steel and imported and exported stainless-steel mill products and scrap, making it a leading consumer of chromium materials in the United States (American Iron and Steel Institute, 2023). North American Stainless Company (NAS), Cleveland-Cliffs Inc., and Outokumpu Oyj (Finland), listed in descending order of production, were the leading United States stainless-steel producers.

NAS was a subsidiary of Acerinox S.A., based in Spain, and produced stainless steel in its Ghent, KY, facility. Melt shop production decreased by 13% to 1.00 Mt in 2022 from 1.16 Mt in 2021, which made it the leading producer in the United States with 45% of production (Acerinox S.A., 2022, p. 30; 2023, p. 30).

Cleveland-Cliffs Inc. produced stainless steel at manufacturing plants in Butler, PA, Mansfield, OH, and Middletown, OH. Stainless-steel and electrical-steel shipments were approximately 690,000 t (763,000 net tons) in 2022, an increase of 13% from approximately 610,000 t (674,000 net

tons) in 2021. The increase in shipments was attributed to increased consumption in the automotive sector (Cleveland-Cliffs Inc., 2023, p. 30, 45).

Outokumpu Stainless USA, LLC, a subsidiary of Outokumpu Oyj, produced stainless steel at its Calvert, AL, and Richburg, SC, plants. Outokumpu reported that its total global stainless-steel shipments in 2022 were 2.1 Mt, a 7% decrease from shipments in 2021. In 2022, 31% of the stainless-steel shipments (approximately 650,000 t) were from the United States and Mexico combined. Outokumpu reported it possessed 23% of the stainless-steel market share in the United States and Mexico in 2022 (Outokumpu Oyj, 2023, p. 5, 13).

Allegheny Technologies Inc. (ATI) began exiting the lower margin, standard stainless-steel sheet production market in 2021 to focus on specialty alloys for the aerospace and defense markets. Global overcapacity and increased competition in the stainless-steel sheet market were cited as reasons for the shift in the structure of its Advanced Alloys & Solutions (AA&S) segment. ATI reported that strategic repositioning of the AA&S segment was substantially completed in 2022 and consisted of nickel-base alloys, titanium and titanium-base alloys, as well as specialty alloys (many of which contain chromium). Sales in the AA&S segment increased by 33% from those in 2021 and made up 57% of overall sales. The increase in sales was attributed to improved sales to the aerospace and defense markets. Nickel-base alloys and specialty alloys accounted for 54% of all AA&S sales (Allegheny Technologies Inc., 2023, F-5–F-6, F-27–F-28).

Meltshop production was suspended at Universal Stainless & Alloy Products, Inc.’s stainless-steel mill in Bridgeville, PA, in April. The suspension followed a liquid metal spill caused by a breakthrough at the bottom of a furnace shell. Operations resumed in May, and no injuries or environmental effects were reported. Universal Stainless also reported that there were no immediate delays in product delivery (Universal Stainless & Alloy Products, Inc., 2022a, b).

Prices

Chromium materials were not openly traded. Purchase contracts were confidential between buyer and seller; however, trade journals reported composite prices based on interviews with buyers and sellers, and the U.S. Department of Commerce reported 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).

In 2022, the annual average import unit value (gross weight) of chromite ore increased by 29% from that in 2021; the annual average import unit value of ferrochromium increased by 60% from that in 2021; and the annual average import unit value of chromium metal increased by 65% from that in 2021. Prices and unit values of specific grades of chromite ore, chromium metal, and ferrochromium are reported in tables 1 and (or) 3.

Chromite ore and high-carbon ferrochromium price increases were attributed to the conflict between Russia and Ukraine, increased production costs, logistical challenges, rising energy prices, continued increases in demand, and tightening supply. Chromium metal price increases were attributed to increased duty rates of material from Russia and concerns regarding supply constraints (CRU Group, 2022a, b).

Foreign Trade

Chromium-containing material exports from and imports to the United States included chromite ore, chromium chemicals, ferroalloys, metal, pigments, and stainless steel (tables 4, 5). Based on foreign trade statistics reported by the U.S. Department of Commerce for 2022, the value of foreign trade of these chromium materials excluding stainless-steel mill products and scrap was \$25.7 million for exports (7% more than that in 2021) and \$1,520 million for imports (69% more than that in 2021). A significant amount of chromium exited and entered the U.S. economy in the form of stainless-steel mill products and scrap trade. The value of foreign trade of chromium materials including stainless-steel mill products and scrap was \$2.8 billion for exports (26% more than that in 2021) and \$5.6 billion for imports (54% more than that in 2021).

World Review

Albania.—Yildirim Group acquired Albchrome sh.p.k. (Albania), a chromite and ferrochromium producer in Albania, in January 2022. The acquisition included the Bulqiza Mine, a high-grade (38% to 44% Cr₂O₃) chromite mine operated by Vlaahen Mining sh.p.k., and two ferrochromium smelters in Burrel and Elbasan. The acquisition increased Yildirim Group's total ferrochromium capacity to 650,000 metric tons per year (t/yr) (Yildirim Group of Companies, 2022a).

Finland.—Outokumpu Oyj owned and operated the Kemi chromite mine, the only chromite mine in Finland. Outokumpu also produced 430,000 t of ferrochromium at its Tornio ferrochromium production facility (a decrease of 17% from production in 2021) using chrome extracted from its Kemi chrome mine (table 8). The decrease in production was attributed to rising energy prices, particularly in the second part of the year, and the decision to delay restarting a ferrochromium furnace that had been taken offline for planned maintenance. In September, the company reported that ferrochromium production would continue to operate at 70% capacity for the remainder of the year (Outokumpu Oyj, 2022; 2023, p. 8).

Outokumpu continued to work on its Deep Mine project to extend the depth of the Kemi Mine to 1,000 meters below sea level. Completion of the expansion project, however, continued to be delayed owing to an incident during construction. Outokumpu expected that the expansion would be commissioned in the first quarter of 2023 (Outokumpu Oyj, 2023, p. 194).

India.—Vedanta Resources Ltd. reported its subsidiary, Ferro Alloys Corporation Ltd. (FACOR), increased chromite ore production by 70% in 2022, its highest production on record, owing to operational enhancements and improved productivity at its Ostapal and Kalarangiatta Mines. Vedanta also reported 75,000 t of ferrochromium production at FACOR's Charge Chrome plant, a 10% increase from 2021 and its highest production since it was commissioned (Vedanta Resources Ltd., 2022, p. 11, 35, 115).

The European Commission announced that the European Union (EU) would impose import duties on stainless-steel cold-rolled flat products originating from India in March. The antisubsidy duties for India were set at 7.5% (European Commission, 2022).

Environmental activists identified irregularities in the Environmental Impact Assessment (EIA) of a sodium saccharin

chemical plant proposed by Krishna Godavari Power Utilities Ltd. in the Nalgonda district of Telangana State. The EIA claimed that the facility would produce sodium dichromate, basic chromium sulfate, and white sodium sulfate as byproducts during production. Farmers and environmentalists opposed the plant on grounds that sodium dichromate is not a byproduct of sodium saccharin but used to oxidize o-Toluene sulfonamide to saccharin and, therefore, the EIA report did not address their public health concerns. A public hearing was scheduled for October 10 in the State of Andhra Pradesh but postponed for unspecified reasons. No public hearing was scheduled in the State of Telangana (U.S. Environmental Protection Agency, 2000; Rohini, 2022).

Shyam Metallics and Energy of India (Shyam) purchased a stainless-steel, wire rod, and bar mill from Mittal Corp. Ltd. through India's National Company Law Tribunal, which assisted financially troubled companies like Mittal Corp. The mill added 150,000 t/yr of stainless-steel production capacity to Shyam's holdings (CRU Group, 2022e).

Indonesia.—In March, the European Commission announced that the EU would impose import duties on stainless-steel cold-rolled flat products originating from Indonesia. The antisubsidy duties for Indonesia were set at 21% and arose from the determination of preferential financing by China. The antisubsidy duties were in addition to antidumping duties on stainless-steel cold-rolled flat products between 10.2% and 20.2% that were imposed by the EU in 2021 (European Commission, 2022).

In August, Tsingshan Holding Group Co. Ltd. (China) entered into definitive discussions with China Baowu Steel Group Corp. Ltd. (China) over the potential sale of its stainless-steel and nickel pig iron manufacturing facilities in the Morowali Industrial Park. Some terms were agreed upon in April, but no additional information was available about the acquisition (Mining Technology, 2022).

Italy.—In January, thyssenkrupp AG (Germany) announced the completion of the sale of its stainless-steel mill in Italy, thyssenkrupp Acciai Speciali Terni S.p.A. (AST), to Arvedi Group. thyssenkrupp AG would maintain a 15% minority stake in AST to support the existing operation while realigning its portfolio (thyssenkrupp AG, 2022).

Oman.—Oman Chromite Co. S.A.O.G. (Oman Chromite) signed a joint exploration agreement with Minerals Development Oman (MDO) in June to determine the feasibility of mining chromite ore at two sites in the Governorates of Al Batinah North and Al Buraymi. MDO was a state-owned mining and minerals-processing company affiliated with Oman Investment Authority (a wealth fund of the Sultanate of Oman) that had been working to develop Oman's mineral resources (Al Maashani, 2022).

In October, Oman Chromite signed a purchase agreement for a 20% stake in a low-carbon ferrochromium plant that was under construction in the Sohar Port and Freezone in Oman (Mendoza, 2022). Operations were expected to commence in March 2023 (Oman Chromite Co. S.A.O.G., 2022).

Spain.—Acerinox cut back on production at the Acerinox Europa stainless-steel plant in Algeciras owing to high energy costs and market disruptions caused by the conflict between Russia and Ukraine. Acerinox also temporarily furloughed employees at its Acerinox Europa facility in March. No information was provided on when the employees would return to work (CRU Group, 2022b, p. 8; Acerinox S.A., 2023, p. 61).

South Africa.—Afarak Group Plc (Finland) reported that it resumed mining operations in 2022 after it halted all mining operations in South Africa in 2021 to reduce debt (Afarak Group Plc, 2022b, p. 3; 2023, p. 9). In August, Afarak announced that it planned to shift its stainless-steel production from specialty grades to more standard grades during the second half of 2022 owing to slow economic growth, a decrease in ferrochromium prices, and a rise in energy prices in South Africa (Afarak Group Plc, 2022a).

Tharisa Plc (Cyprus) reported that production at its mine near Rustenburg contained lower grades of chromite concentrate owing to a breakdown of its secondary mill. The secondary mill had been calibrated for the recovery of platinum-group metals (PGMs) and thus reduced the chromite grade from 18.1% to 17.1%. As a result, chromite concentrate production guidance was lowered to 1.75 Mt from 1.85 Mt for the year ending in September (CRU Group, 2022d).

In June, Bauba Resources Ltd. (Bauba) announced that its subsidiary, Bophuthatswana (Pty) Ltd. (Nuco Chrome), had been granted an 8-year mining right to mine for chromite, cobalt, copper, gold, nickel, and PGMs in the Kookfontein and Boschfontein Mines of the Bushveld Complex. The mining right would expire on June 2, 2030. In July 2022, Bauba purchased an additional 52% of Nuco Chrome shares, bringing its overall interest to 74% (Bauba Resources Ltd., 2022, p. 10, 63).

Merafe Resources Ltd. (Merafe) reported that ferrochromium production increased slightly in 2022 from production in 2021. However, the cost of production increased by 30% owing to decreased demand, electrical supply challenges, higher ore prices, and general inflation. Merafe also reported that the Lydenburg ferrochromium smelter, the Rustenburg furnace 6, and the Waterval Mine remained in care-and-maintenance status (Merafe Resources Ltd., 2023, p. 10).

Jubilee Metals Group Plc (United Kingdom) announced the completion of its Inyoni Operations expansion in 2022, which increased chromite concentrate production capacity to 1.2 million metric tons per year (Jubilee Metals Group Plc, 2022, p. 11, 35).

United Kingdom.—AMG Superalloys UK Ltd., a subsidiary of AMG Advanced Metallurgical Group N.V. (Netherlands), announced that it had changed its name to AMG Chrome Ltd. effective May 11. The name change would not affect existing contracts, production, or product offerings, including chromium metal and superalloys amongst others (AMG Chrome Ltd., 2022).

Zimbabwe.—Tsingshan Holding Group (China) began construction on a fully integrated steel mill in Manhize, Zimbabwe, through its subsidiary Dinson Iron and Steel Co. The facility would have a steel production capacity of 600,000 t/yr and would include a ferrochromium plant, an iron ore mine, and an industrial park. Production was anticipated to begin in October 2023 (CRU Group, 2022c, p. 5).

Outlook

Domestic and global consumption of chromium is expected to follow closely the trend in stainless-steel production. U.S. stainless-steel production was reported by the American Iron and Steel Institute to be 2.02 Mt (gross quantity of stainless steel) in 2022, a decrease of 15% from that in 2021 (American Iron and Steel Institute, 2022, 2023). World stainless-steel and

heat resisting-steel melt shop production (ingot or slab equivalent) was reported to be 55.3 Mt in 2022, a decrease of 5% from that in 2021 (International Stainless Steel Forum, 2023, p. 8). Details of the outlook for the steel industry are discussed in the “Outlook” section of the Iron and Steel chapter of the 2022 USGS Minerals Yearbook, volume I, Metals and Minerals.

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TABLE 1
SALIENT CHROMIUM STATISTICS¹

		2018	2019	2020	2021	2022
Components of U.S. supply, chromium content:						
Secondary supply, recycled scrap ²	metric tons	139,000	137,000	119,000	114,000	91,300 ^e
Imports:						
Chromite ore	do.	92,600	92,500	83,200	107,000	92,500
Chromium chemicals ³	do.	4,220 ^r	3,990 ^r	4,870 ^r	5,500 ^r	6,430
Chromium ferroalloys	do.	320,000	254,000	202,000	243,000	262,000
Chromium metal	do.	15,500	14,400	11,600	12,100	14,900
Stainless-steel mill products and scrap ²	do.	219,000	165,000	146,000 ^r	204,000 ^r	233,000
Stocks, January 1, Industry ⁴	do.	6,060	5,060	4,970	5,720	6,000
Total ⁵	do.	796,000	672,000	572,000	692,000	707,000
Distribution of U.S. supply, chromium content:						
Exports:						
Chromite ore ⁶	do.	2,960	1,400	1,470	1,550	1,700
Chromium chemicals ³	do.	687 ^r	226 ^r	121 ^r	101 ^r	191
Chromium ferroalloys and metal	do.	1,910	1,370	1,200	2,130	2,740
Stainless-steel mill products and scrap ²	do.	206,000	146,000	135,000	110,000	128,000
Stocks, December 31, Industry ⁴	do.	5,060	4,970	5,720	6,000	5,080
Total ⁵	do.	217,000	154,000	144,000	120,000	138,000
Consumption:						
Apparent, chromium content ⁷	do.	580,000 ^r	518,000 ^r	428,000 ^r	572,000 ^r	569,000
Reported:						
Chromite ore and concentrates, gross weight	do.	W	W	W	W	W
Chromium ferroalloys: ⁸						
Gross weight	do.	508,000	465,000	345,000	327,000	230,000
Chromium content	do.	290,000	267,000	199,000	189,000	134,000
Chromium metal, gross weight	do.	4,630	4,860	4,580	4,550	4,450
Stocks, December 31, gross weight, industry, consumer:						
Chromium ferroalloys ⁹	do.	5,180	4,900	4,770	5,260	5,050
Chromium metal	do.	270	282	273	279	274
Other	do.	4,280	4,270	4,280	4,260	4,250
Price, average annual:						
Chromite ore, gross weight ¹⁰	dollars per metric ton	209	174	154	201	274
Ferrochromium, chromium content ¹¹	dollars per pound	1.37	1.00	0.90	1.56	3.21
Aluminothermic chromium metal, gross weight ¹²	do.	5.53	4.13	3.22	4.35	7.12
Value of trade:						
Imports	thousands	\$1,100,000	\$779,000	\$545,000	\$898,000	\$1,520,000
Exports	do.	\$28,000	\$25,200	\$19,000	\$24,100	\$25,700
Net imports ¹³	do.	\$1,080,000	\$753,000	\$526,000	\$874,000	\$1,490,000
Stainless steel:						
World production, chromium content ¹⁴	metric tons	8,620,000	8,880,000	8,800,000 ^r	9,910,000	9,390,000
U.S. production:						
Gross weight ¹⁵	do.	2,810,000	2,590,000	2,140,000	2,370,000	2,010,000
Chromium content ¹⁶	do.	493,000	455,000	375,000	407,000 ^r	345,000
Average grade, dimensionless ¹⁷		0.1755	0.1755	0.1749	0.1719 ^r	0.1715
Shipments, gross weight ¹⁸	do.	2,490,000	2,280,000	1,990,000 ^r	2,250,000	1,990,000
Imports, gross weight	do.	959,000	767,000	642,000 ^r	930,000 ^r	1,130,000
Exports, gross weight	do.	668,000	436,000	321,000	355,000	350,000
Scrap, gross weight:						
Receipts	do.	819,000	804,000	701,000	672,000	537,000 ^e
Consumption	do.	1,230,000	1,240,000	1,080,000	1,010,000	806,000 ^e
Imports	do.	331,000	204,000	219,000	268,000	240,000
Exports	do.	545,000	422,000	474,000	293,000	403,000
Value of trade:						
Imports	thousands	\$3,440,000	\$2,820,000	\$2,240,000 ^r	\$3,270,000 ^r	\$5,190,000
Scrap imports	do.	\$345,000	\$183,000	\$197,000	\$368,000	\$387,000
Exports	do.	\$2,470,000	\$1,990,000	\$1,570,000	\$1,910,000	\$2,450,000
Scrap exports	do.	\$319,000	\$345,000	\$273,000	\$334,000 ^r	\$387,000
Net imports ^{13, 19}	do.	\$994,000	\$675,000	\$596,000 ^r	\$1,390,000 ^r	\$2,750,000

See footnotes at end of table.

TABLE 1—Continued
SALIENT CHROMIUM STATISTICS¹

^cEstimated. ^rRevised. ^{do} Ditto. ^W Withheld to avoid disclosing company proprietary data.

¹Table includes data available through August 30, 2023. Data are rounded to no more than three significant digits except average grade; may not add to totals shown.

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

³Excludes pigments and preparations.

⁴Includes consumer stocks of chromium ferroalloys and metal and other chromium-containing materials.

⁵U.S. Government National Defense Stockpile inventory statistics are no longer available.

⁶Calculated based on the chromium content of imported chromite ore, typically between 46% and 63% chromium oxide (Cr₂O₃).

⁷Apparent consumption calculated as total U.S. supply minus total U.S. distribution.

⁸Chromium ferroalloys, chromite ore used in foundry sand, and other chromium-containing materials excluding chromium metal.

⁹Consumer stocks of high- and low-carbon ferrochromium and ferrosilicon-chromium.

¹⁰Time-weighted average price of South African chromite ore that contains 44% Cr₂O₃ free on board as reported by CRU Group.

¹¹Time-weighted average U.S. price of imported high-carbon chromium that contains 62% to 70% chromium as reported by CRU Group.

¹²Time-weighted average U.S. price of imported aluminothermic chromium metal as reported by CRU Group.

¹³Defined as imports minus exports.

¹⁴Production estimated from worldstainless. Chromium content estimated at 17%.

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

¹⁶Estimated mass-weighted average of the mean chromium content of stainless-steel production by grade.

¹⁷Ratio 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.

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

¹⁹Includes stainless-steel and stainless steel scrap.

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

(Metric tons)

	2021		2022		Change ²	
	Gross weight	Chromium content	Gross weight	Chromium content	Quantity	Percent
Consumption by end use:						
Steel:						
Carbon steel	3,870	2,520	3,580	2,270	-252	-10
High-strength low-alloy steel	1,960	1,290	1,110	711	-582	-45
Stainless and heat-resisting steel	270,000	155,000	195,000	112,000	-42,200	-27
Fully alloy steel	11,300	6,960	8,180	5,060	-1,900	-27
Unspecified steel ³	31,200	18,000	14,000	7,950	-10,000	-56
Superalloys	6,460	5,180	6,220	5,060	-118	-2
Other alloys and uses ⁴	6,400	4,510	6,360	4,130	-380	-8
Total	331,000	193,000	234,000	138,000	-55,400	-29
Consumption by material:						
Low-carbon ferrochromium	25,500	17,400	18,100	12,600	-4,890	-28
High-carbon ferrochromium	285,000	162,000	206,000	118,000	-44,800	-28
Ferrochromium silicon	W	W	W	W	W	W
Chromium metal	4,550	4,250	4,450	4,140	-111	-3
Chromium-aluminum alloy	397	289	415	300	11	4
Other chromium materials	16,500	8,640	5,670	3,000	-5,640	-65
Total	331,000	193,000	234,000	138,000	-55,400	-29
Consumer stocks:						
Low-carbon ferrochromium	1,440	978	1,030	715	-263	-27
High-carbon ferrochromium	3,370	1,920	3,860	2,210	284	15
Ferrochromium silicon	(5)	(5)	(5)	(5)	(5)	(5)
Chromium metal	279	261	273	254	-7	-3
Chromium-aluminum alloy	(5)	(5)	(5)	(5)	(5)	(5)
Other chromium materials	4,710	2,840	4,400	1,900	-936	-33
Total	9,800	6,000	9,570	5,080	-922	-15

W Withheld to avoid disclosing company proprietary data; included in "Consumption by material: Other chromium materials."

¹Table includes data available through August 30, 2023. Data are rounded to no more than three significant digits; may not add to totals shown.

²Change based on chromium content of unrounded data of 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 "Consumer stocks: Other chromium materials."

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

(Dollars per metric ton unless otherwise specified)

Material	2021		2022	
	Gross weight	Chromium content	Gross weight	Chromium content
Value: ²				
Chromite ore:				
Not more than 40% chromium oxide (Cr ₂ O ₃)	137	621	274	900
More than 40% but less than 46% Cr ₂ O ₃	164	378	215	496
46% or more Cr ₂ O ₃	212	244	259	306
Average	197	268	254	332
Ferrochromium:				
Not more than 0.5% carbon	3,620	5,170	6,230	8,880
More than 0.5% but not more than 3% carbon	2,830	4,090	6,650	9,840
More than 3% but not more than 4% carbon	820	1,600	6,100	8,840
Average (not more than 4% carbon)	3,320	4,870	6,250	8,930
More than 4% carbon	1,300	2,360	2,190	3,900
Average (all grades)	1,620	2,840	2,600	4,510
Chromium metal ³	8,760	XX	14,500	XX
Price: ⁴				
Chromite ore, South Africa:				
38% to 40% chromium (Cr)	194	727 ⁵	244	914 ⁵
42% Cr	159	555	232	808
44% Cr	201	667	274	912
High-carbon ferrochromium, 62% to 70% Cr ⁶	XX	156	XX	321
Low-carbon ferrochromium: ⁶				
0.05% carbon	XX	264	XX	591
0.10% carbon	XX	260	XX	548
0.15% carbon	XX	255	XX	546
Chromium metal, imported, aluminothermic ⁷	435	XX	712	XX

XX Not applicable.

¹Table includes data available through August 30, 2023. Data are rounded to no more than three significant digits; may not add to totals shown.

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

³Average for all grades.

⁴Source: CRU Group.

⁵Calculated assuming average chromium content of 39%.

⁶Reported by CRU Group in cents per pound.

⁷Reported by CRU Group in dollars per pound.

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

Schedule B ² code	Type	2021		2022		Principal destinations in 2022 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
2610.00.0000	Chromite ore and concentrates:					
	Gross weight	2,110	\$1,430	2,220	\$1,640	Canada (1,130; \$688), Mexico (786; \$717), Venezuela (128; \$72), Colombia (56; \$49), Netherlands (39; \$22).
	Cr ₂ O ₃ content ³	1,550	XX	1,700	XX	
	Chromium metal, gross weight:					
8112.21.0000	Unwrought chromium powders	385	6,840	465	9,110	Netherlands (188; \$4,140), Canada (137; \$1,620), Japan (30; \$316), Mexico (21; \$459), Switzerland (17; \$547).
8112.22.0000	Chromium metal waste and scrap	12	104	27	466	Taiwan (13; \$223), United Kingdom (9; \$212), Canada (5; \$30).
8112.29.0000	Chromium metal other than unwrought powders and waste and scrap	59	2,720	75	3,210	Mexico (11; \$617), United Kingdom (9; \$274), Japan (8; \$345), Ireland (6; \$207), Canada (6; \$103).
	Total chromium metal	456	9,660	567	12,800	
	Chromium ferroalloys:					
7202.41.0000	High-carbon ferrochromium: ⁴					
	Gross weight	1,690	2,140	3,640	3,370	Canada (2,750; \$2,540), Mexico (751; \$715), Republic of Korea (77; \$70), Colombia (21; \$18), Italy (19; \$17).
	Chromium content	840	XX	1,860	XX	
7202.49.0000	Low-carbon ferrochromium: ⁵					
	Gross weight	1,580	4,070	637	954	Canada (274; \$431), Mexico (271; \$365), Argentina (38; \$52), Pakistan (22; \$60), Venezuela (18; \$25).
	Chromium content	786	XX	290	XX	
7202.50.0000	Ferrochromium-silicon:					
	Gross weight	134	304	40	96	Canada (all).
	Chromium content	47	XX	14	XX	
	Total chromium ferroalloys:					
	Gross weight	3,410	6,520 ^r	4,310	4,420	
	Chromium content	1,670	XX	2,170	XX	
	Chemicals:					
2833.29.4000	Chromium sulfates:					
	Gross weight	3	19	1	19	China (<1; \$7), Taiwan (<1; \$3).
	Chromium content	1	XX	(6)	XX	
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Zinc and lead chromate:					
	Gross weight	8	544	4	344	South Africa (2; \$318), Mexico (1; \$26).
	Chromium content ⁷	2	XX	1	XX	
2841.50.1000	Potassium dichromate:					
	Gross weight	104	192	489	946	Mexico (228; \$519), Netherlands (112; \$104), Guyana (56; \$52), Taiwan (32; \$101), Panama (18; \$22).
	Chromium content ⁸	30	XX	139	XX	

See footnotes at end of table.

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

Schedule B ² code	Type	2021		2022		Principal destinations in 2022 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	
Chemicals:—Continued						
Salts of oxometallic or peroxometallic acids:—Continued						
2841.50.9100	Other:					
	Gross weight	224	\$1,440	166	\$1,550	Canada (82; \$210), Taiwan (23; \$146), South Africa (17; \$450), Colombia (10; \$41), Jamaica (8; \$60).
	Chromium content ⁸	70 ^r	XX	52	XX	
Total salts:						
	Gross weight	340	2,190	660	2,860	
	Chromium content	101 ^r	XX	191	XX	
Pigments and preparations:						
3206.20.0000	Gross weight	1,040	4,280	1,220	4,040	Uruguay (944; \$955), Mexico (88; \$1,040), Brazil (68; \$380), Canada (46; \$920), Taiwan (13; \$120).
	Chromium content	NA	XX	NA	XX	

^rRevised. NA Not available. XX Not applicable.

¹Table includes data available through July 12, 2023. Data are rounded to no more than three significant digits; may not add to totals shown. In addition to the schedule B codes listed, the United States exports chromium oxides, but those data have been withheld by the U.S. Census Bureau to avoid disclosing proprietary data.

²Schedule B codes based on the Harmonized System commodity classification system of the United States.

³Calculated based on the chromium content of imported chromite ore, typically between 46% and 76% chromium oxide (Cr₂O₃).

⁴More than 4% carbon.

⁵Not more than 4% carbon.

⁶Less than ½ unit.

⁷Calculated assuming the average chromium content was about 20%.

⁸Calculated based on fraction of chromium in the chemical formula.

Source: U.S. Census Bureau.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2021		2022		Principal sources in 2022 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	
Chromite ore:						
2610.00.0020	Not more than 40% chromium oxide (Cr ₂ O ₃):					
	Gross weight	15,800	\$2,170	5,750	\$1,580	South Africa (4,860; \$1,200), Brazil (608; \$265), Germany (206; \$63), China (79; \$49).
	Cr ₂ O ₃ content	3,490	XX	1,750	XX	
2610.00.0040	More than 40%, but less than 46% Cr ₂ O ₃ :					
	Gross weight	21,400	3,500	17,100	3,670	South Africa (16,300; \$3,390), Italy (431; \$157), Germany (112; \$43), China (100; \$36), Netherlands (89; \$44).
	Cr ₂ O ₃ content	9,270	XX	7,400	XX	
2610.00.0060	46% or more Cr ₂ O ₃ :					
	Gross weight	108,000	23,000	98,200	25,500	South Africa (98,000; \$25,400), Belgium (148; \$31), Canada (19; \$18), China (5; \$9).
	Cr ₂ O ₃ content	94,300	XX	83,300	XX	
Total chromite ore:						
	Gross weight	146,000	28,700	121,000	30,700	
	Cr ₂ O ₃ content	107,000	XX	92,500	XX	
Chromium ferroalloys:						
Ferrochromium:						
7202.49.5090	Not more than 0.5% carbon:					
	Gross weight	57,700	209,000	42,100	262,000	Kazakhstan (14,500; \$124,000), Russia (10,800; \$62,500), Germany (8,900; \$37,400), Japan (2,460; \$13,600), China (2,460; \$10,600).
	Chromium content	40,400	XX	29,500	XX	
7202.49.5010	More than 0.5%, but less than 3% carbon:					
	Gross weight	1,810	5,140	2,250	15,000	Kazakhstan (1,530; \$11,400), Brazil (708; \$3,580), China (8; \$28).
	Chromium content	1,250	XX	1,520	XX	
7202.49.1000	More than 3%, but less than 4% carbon:					
	Gross weight	6,700	5,490	36	219	India (20; \$129), Kazakhstan (16; \$90).
	Chromium content	3,420	XX	25	XX	
7202.41.0000	More than 4% carbon:					
	Gross weight	347,000	449,000	399,000	875,000	South Africa (194,000; \$260,000), Kazakhstan (72,100; \$314,000), Zimbabwe (35,100; \$46,400), Finland (25,400; \$34,600), Turkey (24,500; \$84,500).
	Chromium content	191,000	XX	224,000	XX	
7202.50.0000	Ferrosilicon-chromium:					
	Gross weight	19,800	39,300	17,100	41,400	
	Chromium content	7,400	XX	6,840	XX	Kazakhstan (all).
Total chromium ferroalloys:						
	Gross weight	433,000	708,000	461,000	1,190,000	
	Chromium content	243,000	XX	262,000	XX	

See footnotes at end of table.

TABLE 5—Continued
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2021		2022		Principal sources in 2022 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	
	Chromium metal, gross weight:					
8112.21.0000	Unwrought chromium powders	10,300	\$90,900 ^r	13,500	\$197,000	China (5,130; \$57,500), United Kingdom (3,600; \$72,200), France (2,400; \$40,600), Russia (1,960; \$21,100), India (138; \$2,160).
8112.22.0000	Waste and scrap	112	673	519	4,890	United Kingdom (338; \$3,330), China (131; \$1,100), Canada (26; \$143), South Africa (14; \$180), Japan (9; \$129).
8112.29.0000	Other than waste and scrap	1,680 ^r	14,700 ^r	927	13,800	Russia (762; \$8,980), United Kingdom (65; \$1,090), Germany (42; \$1,920), South Africa (32; \$348), Spain (10; \$45).
	Total chromium metal	12,100	106,000	14,900	216,000	
	Chemicals:					
	Chromium oxides and hydroxides:					
2819.10.0000	Chromium trioxides:					
	Gross weight	2,830 ^r	8,450 ^r	5,080	18,500	Kazakhstan (3,100; \$10,000), India (1,230; \$4,800), South Africa (342; \$1,150), China (275; \$1,650), France (64; \$340).
	Chromium content ⁴	1,470	XX	2,640	XX	
2819.90.0000	Other:					
	Gross weight	4,440	15,200	3,800	19,200	China (1,400; \$7,960), Germany (1,030; \$9,060), Italy (637; \$747), Canada (596; \$674), India (62; \$390).
	Chromium content ⁴	3,040	XX	2,600	XX	
	Total oxides:					
	Gross weight	7,270 ^r	23,600 ^r	8,870	37,700	
	Chromium content ⁴	4,510	XX	5,240	XX	
2833.29.4000	Sulfates of chromium:					
	Gross weight	519	1,030	900	797	China (500; \$282), Turkey (326; \$419), India (65; \$61), Germany (8; \$17), Japan (1; \$12).
	Chromium content ⁴	87	XX	151	XX	
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Chromates of lead and zinc:					
	Gross weight	50	1,060	83	1,630	Italy (73; \$1,600), Mexico (10; \$28).
	Chromium content ⁵	10	XX	16	XX	
2841.30.0000	Sodium dichromate:					
	Gross weight	779	1,060	1,060	2,440	South Africa (1,010; \$2,310), India (18; \$52), China (18; \$43), Turkey (18; \$38).
	Chromium content ⁴	272	XX	371	XX	
2841.50.1000	Other chromates and dichromates; peroxochromates:					
	Potassium dichromate:					
	Gross weight	2	25	3	38	Colombia (3; \$15).
	Chromium content ⁴	(6)	XX	1	XX	
2841.50.9100	Other:					
	Gross weight	1,520	4,670	1,430	6,210	Austria (1,320; \$5,410), France (95; \$683), India (5; \$37), Colombia (5; \$28), China (4; \$47).
	Chromium content ⁴	475	XX	444	XX	
	Total salts:					
	Gross weight	2,350	6,820 ^r	2,570	10,300	
	Chromium content	757	XX	832	XX	

See footnotes at end of table.

TABLE 5—Continued
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE¹

HTS ² code	Type	2021		2022		Principal sources in 2022 (quantity in metric tons, value in thousands)
		Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	
Chemicals:—Continued						
2849.90.2000	Chromium carbide:					
	Gross weight	162	\$4,340	244	\$8,730	Israel (117; \$5,980), China (88; \$1,380), Canada (36; \$1,230), Germany (2; \$84), Austria (1; \$56).
	Chromium content ⁴	140	XX	212	XX	
Total chromium chemicals:						
	Gross weight	10,300	35,800 ^r	12,600	57,500	
	Chromium content	5,500	XX	6,430	XX	
Pigments and preparations based on chromium, gross weight:						
3206.20.0010	Chrome yellow	465	2,470	351	1,680	Canada (313; \$1,510), China (17; \$65), Colombia (15; \$74), India (5; \$30).
3206.20.0020	Molybdenum orange	128	1,010	174	1,260	Canada (172; \$1,250), India (1; \$7).
3206.20.0030	Zinc yellow	99	283	96	318	China (69; \$240), India (11; \$34), Mexico (10; \$26) Austria (6; \$15), Colombia (1; \$4).
3206.20.0050	Other	1,820	15,600	1,760	18,100	Mexico (1,413; \$15,000), Germany (118; \$1,690), Netherlands (99; \$428), China (83; \$705), France (23; \$139).
Total pigments		2,510	19,400	2,380	21,300	

^rRevised. XX Not applicable.

¹Table includes data available through July 12, 2023. 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.

⁴Calculated based on fraction of chromium in the chemical formula.

⁵Calculated assuming the average chromium content was about 20%.

⁶Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 6
ESTIMATED WORLD PRODUCTION CAPACITY (CHROMITE ORE, FERROCHROMIUM, CHROMIUM METAL,
CHROMIUM CHEMICALS, AND STAINLESS STEEL) AND CONSUMPTION FOR SELECTED COUNTRIES¹

(Thousand metric tons, chromium content, unless otherwise specified)

Country or locality	Production capacity in 2022					Chromium consumption ²		
	Ore ³	Ferro-chromium ³	Metal	Chemicals ⁴	Stainless steel ⁵	2020	2021	2022
Afghanistan	35	--	--	--	--	1	4 ^r	9
Albania	1,700	150	--	--	--	88 ^r	54 ^r	114
Austria	--	--	--	--	15	22	24	23
Belgium	--	--	--	--	290	110	200 ^r	160
Brazil	1,500	300	--	--	80	350 ^r	420 ^r	410
Canada	--	--	--	--	--	19	24	21
China	200	12,000	61	360	5,700	6,200 ^r	6,100	5,900
Finland	2,800	530	--	--	250	520	540	480
France	--	--	12	--	60	25	36	18
Germany	--	36	2	4	100	100	130	120
Greece	40	--	--	--	--	1	1	1
India	6,000	1,630	--	60	690	410	980 ^r	1,100
Indonesia	--	600	--	--	860	580	1,000	1,100
Iran	200	200	--	2	--	-- ^r	-- ^r	--
Italy	--	--	--	8	270	--	-- ^r	4
Japan	--	25	3	11	560	320 ^r	400 ^r	380
Kazakhstan	8,500	2,400	--	59	--	1,100	1,100 ^r	1,100
Korea, Republic of	--	--	--	--	500	260	320	250
Kosovo	70	--	--	--	--	7	5	6
Madagascar	320	--	--	--	--	-- ^r	-- ^r	4
Oman	1,700	125	--	--	--	21 ^r	-- ^r	77
Pakistan	580	--	--	1	--	--	--	--
Papua New Guinea	150	--	--	--	--	37 ^r	30 ^r	31
Philippines	57	--	--	--	--	--	--	--
Poland	--	--	--	8	--	5	10	13
Russia	1,200	450	27	60	20	140	160	180
Slovenia	--	--	--	--	25	18	18	11
South Africa	26,000	5,150	--	30	100	--	--	--
Spain	--	--	--	4	170	75	110	88
Sudan	120	--	--	--	--	3 ^r	2	1
Sweden	--	255	--	--	110	10	--	9
Taiwan	--	--	--	--	240	75	110	90
Turkey	14,000	185	--	57	--	1,600	1,700	1,300
Ukraine	--	--	--	--	15	14	12	3
United Arab Emirates	240	58	--	--	--	13	9 ^r	9
United Kingdom	--	--	10	3	60	15	21	45
United States	--	--	--	48	480	280	340	290
Zimbabwe	2,400	310	--	--	--	16	410	500
Total	67,800	24,400	115	715	11,000	XX	XX	XX

^rRevised. XX Not applicable. -- Zero.

¹Table includes data available through August 30, 2023. Data are rounded to no more than two significant digits; may not add to totals shown.

²In chromium content. Estimated based on U.S. Geological Survey reported chromite ore production and trade statistics for chromite ore, chromium metal, and ferrochromium as reported by Global Trade Tracker in July 2023. Assumed average grade of chromite ore is 45% chromium oxide; ferrochromium, 57% chromium; and chromium metal, 100% chromium.

³Reported in gross weight.

⁴Chromium content was calculated assuming chemicals were in the form of anhydrous sodium dichromate.

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

TABLE 7
CHROMITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY^{1,2}

(Metric tons, gross weight)

Country or locality	2018	2019	2020	2021	2022
Afghanistan ^e	4,500	3,000	3,000	12,000 ^r	30,000
Albania	1,142,719	1,288,315	626,627	650,200	932,686
Brazil, ore and concentrates	1,496,425 ^r	1,237,549 ^r	1,340,396 ^r	1,431,207 ^r	1,400,000 ^e
China	71,100	84,400	128,000 ^r	130,000 ^e	130,000 ^e
Finland, ore	2,211,284	2,415,287	2,293,330	2,273,857	1,997,701
Greece, crude ore	34,690	25,171	1,651	1,800 ^e	2,000 ^e
India	4,075,560	4,138,817	2,401,508	4,248,973	4,000,000 ^e
Iran, concentrates	119,456	122,083	135,049	47,400	50,000 ^e
Kazakhstan, ore ³	6,688,800	7,018,900	6,326,400	6,192,000 ^r	6,000,000 ^e
Kosovo	66,000	66,000 ^e	24,427	16,656	17,000 ^e
Madagascar	109,200	76,126	12,400	13,500 ^r	14,000 ^e
Oman	884,876	732,600	456,800 ^r	269,000 ^r	250,000 ^e
Pakistan	111,586	120,698	121,435	140,126	194,964
Papua New Guinea	92,139	115,573	119,773 ^r	98,705 ^r	100,000 ^e
Philippines	45,011	36,423	35,112	30,721	18,036
Russia	511,000	594,000	608,000	600,000 ^e	600,000 ^e
South Africa:					
44% to 48% chromium oxide (Cr ₂ O ₃)	1,132,581	1,428,471	1,155,904	1,792,254 ^r	2,316,105
Less than 44% Cr ₂ O ₃	16,717,882	16,227,031	12,040,976	16,588,719 ^r	16,788,530
Total	17,850,463	17,655,502	13,196,880	18,380,973 ^r	19,104,635
Sudan	27,000	12,728	9,000 ^r	5,600 ^r	2,800 ^e
Turkey, 34% to 43% Cr ₂ O ₃	10,757,199	8,666,114	6,164,598	6,960,683	5,410,034
United Arab Emirates	190,146	136,100	62,413	21,800	19,000 ^e
Zimbabwe	1,756,126	1,550,064	1,196,837	1,325,126	1,623,159
Grand total	48,200,000 ^r	46,100,000 ^r	35,300,000 ^r	42,900,000 ^r	41,900,000

^eEstimated. ^rRevised.

¹Table includes data available through August 29, 2023. All data are reported unless otherwise noted; grand totals may include estimated data. Grand totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Figures for all countries or localities represent marketable output.

³Reported in gross weight by the Statistical Committee of the Ministry of National Economy of the Republic of Kazakhstan.

TABLE 8
FERROCHROMIUM: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons, gross weight)

Country or locality	2018	2019	2020	2021	2022
Albania	92,850	66,402	53,543	103,700	80,194
Brazil ²	175,061	136,780	254,346	213,756	205,371
China	5,280,000	6,030,000	5,700,000 ^e	5,900,000 ^e	6,400,000 ^e
Finland	492,774	505,000	498,000	515,000	430,000
Germany	30,927 ^r	25,515 ^r	16,409 ^r	23,252 ^r	26,624
India	944,000	930,000	826,000	1,090,000	1,100,000 ^e
Indonesia	190,000	190,000	230,000	252,000	388,000
Iran	13,000	12,000	10,000 ^e	17,000 ^r	15,000 ^e
Japan ^e	15,000	13,000	9,900	11,000	12,000
Kazakhstan	1,740,000 ^e	1,858,130	1,841,309	1,704,561	1,658,378
Oman	70,000	84,938	23,500	82,250	84,250
Russia	332,261	384,089	342,622	350,000 ^e	300,000 ^e
South Africa	3,515,945	3,247,609	2,404,088	3,700,000 ^e	3,900,000 ^e
Sweden	101,370	118,198	87,000	114,600	114,600
Turkey	91,799	81,743	94,200	100,750	98,813
Zimbabwe	365,000	311,500	134,000	306,847	395,097
Total	13,400,000 ^r	14,000,000	12,500,000	14,500,000	15,200,000

^eEstimated. ^rRevised.

¹Table includes data available through August 29, 2023. All data are reported unless otherwise noted; totals may include estimated data. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Includes ferrosilicon-chromium.