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CHROMIUM [ADVANCE RELEASE]

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CHROMIUM

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In 2008, the U.S. chromium supply (measured in contained chromium) was 146,000 metric tons (t) from recycled stainless steel scrap, 559,000 t from imports, and 126,000 t from Government and industry stocks. Supply distribution was 287,000 t to exports, 112,000 t to Government and industry stocks, and 432,000 t to apparent consumption. Chromium apparent consumption decreased by 12.4% compared with that of 2007. 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. Its use in iron, nonferrous alloys, and steel is for enhancing hardenability or resistance to corrosion and oxidation. 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 (EPA) regulates chromium releases into the environment. The Occupational Safety and Health Administration (OSHA) regulates workplace exposure.

Because the United States 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) was held in the National Defense Stockpile (NDS) since before World War II. As a result of changed national security considerations since 1991, stockpile goals have been reduced, and inventory is being sold. Material for recycling is the only domestic commercial chromium supply source.

The U.S. Geological Survey (USGS) has conducted mineral resource surveys of the United States to assess the potential for occurrences of chromium and other mineral resources. The National Aeronautics and Space Administration, the National Institute of Standards and Technology, the U.S. Department of Defense (DOD), and the U.S. Department of Energy conduct alternative materials research.

Domestic Data Coverage

Domestic data for chromium materials were developed by the 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.

Legislation and Government Programs

The Defense National Stockpile Center (DNSC) disposed of chromium materials under its fiscal year 2008 (October 1, 2007, through September 30, 2008) Annual Materials Plan (AMP) and announced the fiscal year 2009 plan. The DNSC's fiscal year 2009 AMP set maximum disposal goals for chromium materials at 136,000 t of chromium ferroalloys and 907 t of chromium metal (Defense National Stockpile Center, 2008).

Production

The major marketplace chromium-containing materials are chromite ore and foundry sand; chromium chemicals, ferroalloys, and metal; and stainless steel. In 2008, the United States produced chromium chemicals, ferroalloys, and metal, and stainless steel. The United States is a major world producer of chromium chemicals, chromium metal, and stainless steel.

Oregon Resources Corp. (ORC) [a subsidiary of Industrial Minerals Corp. Ltd. (Australia)] developed a process designed to recover chromite from its paleo-beach placer (heavy-mineral sand) deposits in Coos County, OR. Because water availability at the mining area was seasonal and would not support a typical placer operation's water requirements for heavy-mineral concentration, ORC developed an offsite process, which includes both wet and dry processing facilities. Raw ore would be trucked about 30 kilometers one way from the mine site to the processing plant with return loads hauling de-watered tailings back to the active pit. ORC would be able to mine and perform reclamation concurrently in the same pit owing to the absence of water. To minimize the transportation of water, ORC determined that vacuum filtration would produce a dewatered tailing material suitable for return transport and reclamation at the mine when coarse tailings produced by the dry mill were added to the thickener underflow, followed by additional flocculent (Drew and Lessard, 2009). ORC started construction of the processing plant, which was designed to process up to 700,000 metric tons per year (t/yr) of heavy-mineral ore into 70,000 t/yr of chromite foundry sand (International Minerals Corp. Ltd., 2009a, p. 14). ORC reported heavy-mineral sand proven reserves of 8.683 Mt grading an average 7.5% chromite and indicated reserves of 3.675 Mt grading an average 9.1% chromite (International Minerals Corp. Ltd., 2009b).

Eramet Marietta produced ferrochromium and chromium metal at its Marietta, OH, plant. Earmet produced chromium metal via the electrolytic process with a production capacity of 3,000 t/yr.

The U.S. stainless steel industry produces more than 2 million tons per year (Mt/yr) of stainless steel and imports and exports stainless steel mill products and scrap, which account for a significant amount of chromium in U.S. trade. The stainless steel industry is the leading consumer of chromium materials. AK Steel Corp., ATI, and North American Steel Co. were the leading U.S. stainless steel producers.

AK Steel Corp. produced stainless steel at Butler, PA, and Coshockton, OH (AK Steel Corp., 2009). ATI produced stainless steel at Brackenridge, Midland, Natrona, and Latrobe, PA (ATI, 2009).

ThyssenKrupp AG reported progress in the construction of a stainless steel plant at Calvert, AL. The new plant would have a stainless steel melt shop production capacity of 1 Mt/yr of slabs. Construction started in 2008, and the plant was to be completed in 2010 (ThyssenKrupp AG, 2008).

North American Stainless (NAS) produced stainless steel in Ghent, KY. NAS reported melt shop production at 709,326 t in 2008 compared with 751,671 t in 2007. NAS completed capacity expansion that included the completion of a second ladle furnace in April and a second argon-oxygen decarburization (AOD) converter in September, bringing melt shop capacity to 1.415 Mt/yr (Acerinox S.A., 2009, p. 39–40, 169–171).

Environment

The EPA regulates chromium releases to the environment and reports on any such releases (U.S. Environmental Protection Agency, 2008, p. 23, 65, 154, 259). The OSHA regulates workplace exposure to chromium (U.S. Department of Labor, 2009).

Prices

Chromium materials are not openly traded. Purchase contracts are confidential between buyer and seller; however, trade journals report composite prices based on interviews with buyers and sellers, and traders declare the value of materials they import or export. Thus, industry publications and U.S. trade statistics are sources of chromium material prices and values, respectively.

The average South African Rand exchange rate is a potentially significant factor in the price of chromite ore and ferrochromium because South Africa was a leading producer of these materials. The South African Rand exchange rate increased to a time-weighted average of R8.27 per U.S. dollar in 2008 from R7.05 per U.S. dollar in 2007 (Pacific Exchange Rate Service, 2009). From 2001 through 2006, the change in U.S. dollar per Rand coincided with the change in U.S. import value of high-carbon ferrochromium; however, in 2007 and 2008 both the Rand per U.S. dollar and the import value of high-carbon ferrochromium increased. Expansion of the Chinese economy and that of India were thought to have been the leading influences causing chromium prices to increase from 2007 through part of 2008 until the global financial downturn in late 2008 caused those prices to decline. The monthly time-weighted average price of high-carbon ferrochromium based on prices sampled weekly peaked at the end of May and beginning of June in excess of $2 per pound of contained chromium.

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 collected by the U.S. Department of the Treasury and reported by the U.S. Department of Commerce for calendar year 2008, the value of foreign trade of these chromium materials excluding stainless steel mill products and scrap was $149 million for exports and $1,430 million for imports. A significant amount of chromium exits and enters the U.S. economy via stainless steel mill product and scrap trade. The value of foreign trade of chromium materials including stainless steel mill products and scrap was $3,640 million for exports and $5,690 million for imports.

World Industry Structure

The chromium industry comprises chromite ore, chromium chemicals and metal, ferrochromium, stainless steel, and chromite refractory producers. Several trends are simultaneously taking place in the chromium industry. The chromium chemical industry has eliminated excess production capacity, concentrating on production growth in surviving plants. Chromite refractory use has been declining; however, foundry use has been increasing slowly. Environmental concerns have reduced the use of chromite refractories and chromium chemicals. The fraction of chromite ore from independent producers is declining, while that from vertically integrated producers is increasing. In other words, chromite ore mines tend now to be owned and operated by chromite refractory, chromium chemical, or ferrochromium producers. This trend is associated with the migration of ferrochromium production capacity from stainless steel producing countries to chromite-ore-producing countries, a trend that has been interrupted with the emergence of China as a significant ferrochromium and leading stainless steel producer. 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 chromite ore producing areas. The electrical power and submerged-arc electric-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 (kVA) range were common.

Production process improvements, such as agglomeration of chromite ore, preheating and prereduction 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 processes have been or are being installed at existing plant sites. In South Africa, the leading chromite-ore- and ferrochromium-producing country, three trends are emerging—ferrochromium plants are being developed in the western belt of the Bushveld Complex, ferrochromium plants are being built in association with chromite ore mines, and ferrochromium production processes have been developed to accommodate chromite ore byproduct recovered from platinum operations.

Capacity.—Rated capacity 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 operating plants and plants temporarily closed that can be brought into production within a short period of time with minimum capital expenditure. Because not all countries or producers provide information about production capacity, historical chromium trade data also have been used to estimate national production capacities. Reported production capacity changes result from both facility changes and increased knowledge about facilities. New information about a facility may result in the reevaluation of production capacity for that facility. Production capacities have been rated for the chromite ore, chromium chemical, chromium metal, ferrochromium, and stainless steel industries (table 7).

Production.—In 2008, world chromite ore production was about 24.0 Mt gross weight, of which 94.5% was produced for the metallurgical industry; 2.0%, for the chemical industry; 2.8%, for the foundry industry; and 0.7%, for the refractory industry (International Chromium Development Association, 2009, p. 1).

In 2008, chromium demand reached historical levels early in the year. Ferrochromium producers could not get enough chromite ore and stainless steel manufacturers could not get enough ferrochromium. Stainless steel production reached record levels in China and India. Infrastructure was challenged to keep up with production levels and limited production at times. Chromite ore and ferrochromium prices reached record levels that lead governments and businesses to look for ways to reduce prices and costs. Tariffs were scrutinized and changed in some places; however, in countries where chromite ore, ferrochromium, and stainless steel were produced and consumed, there were conflicting pressures. Chromite ore producers wanted to export more ore, while ferrochromium producers wanted to limit chromite ore exports to secure their source of ore. As a result, ferrochromium producers promoted chromite ore export taxes and quotas that chromite ore producers sought to reduce. Stainless steel producers promoted reduced import duties on ferrochromium, while promoting increased import duties on stainless steel mill products. Manufacturers at all levels of the chromium supply chain planned capacity expansions. All the while, supply was low, prices rose, and transportation and electrical power supply infrastructure was challenged to keep pace with the high level of production and consumption. About midyear, demand evaporated and prices dropped, relieving the pressure on electrical power utilities and transportations systems as material stopped being produced and transported. Contracts were canceled or renegotiated. As prices dropped, stocks of high-cost materials built up as the manufacturing industries adjusted to the new economic conditions. Ferrochromium and stainless steel producers reduced production rates when it was perceived that stocks were too great. The problem was generally thought to have started with the financial downturn that turned quickly into a world recession. Stainless steel prices and alloy surcharges rose early in the year.

Chromium Chemicals.—Major chromium chemical producers included China, Russia, the United Kingdom, and the United States.

Chromium Metal.—Major chromium metal producers included Russia and the United States (by the electrolytic process) and China, France, Russia, and the United Kingdom (by the aluminothermic process).

Stainless Steel.—In 2008, world stainless steel production was 25.9 Mt, a decrease of 6.8% compared with that of 2007 (International Stainless Steel Forum, 2009). At 27% of world stainless steel production, China was the leading national producer in 2008.

Ferrochromium.—Ferrochromium demand was strong in the first part of the year based on economic expansion in China. Most producers closed furnaces in the second part of the year when demand plunged as a result of the world financial downturn.

Stainless Steel Scrap.—Stainless steel scrap is an important source of chromium to the stainless steel industry. Stainless steel scrap recycling accounts for a significant, but undocumented, fraction of world stainless steel production.

World Review

European Union.—The European Union (EU) was a major stainless steel-producing region. The leading European producers of stainless steel were Acerinox, ArcelorMittal Stainless, Outokumpu, and ThyssenKrupp Stainless. Registration, evaluation, authorisation and restriction of chemicals (REACH), carbon emissions, and scrap transportation were issues. The EU considered a carbon emissions program in which emissions credits would be auctioned. The program was to be decided in 2010 and implemented in 2013. European steelmakers researched ways to reduce carbon dioxide emissions from the steelmaking process. The European Parliament changed the EU Waste Framework Directive to encourage greater metal recycling (Metal Bulletin 2008r, p. 5; Metal Bulletin Daily Steel, 2008a).

Befesa processed stainless steel dust for recycling by stainless steel producers. Befesa reported processing 89,000 metric tons (t) in 2008, 79,000 t in 2007, and 63,000 t in 2006 (Metal Bulletin, 2008h, p. 6).

Albania.—Albania produced chromite ore and ferrochromium. Albania produced ferrochromium at Elbasan and exported chromite ore at Durres (Metal Bulletin Daily, 2008a, p. 3).

Australia.—The Government of Western Australia reported chromite ore sales by calendar and by fiscal year in contained Cr_2O_3. Sales by calendar year were: 2001, 6,087 t-Cr_2O_3 (36.68% Cr_2O_3); 2002, 22,668 t-Cr_2O_3 (39.67% Cr_2O_3); 2003, 67,271 t-Cr_2O_3 (41.52% Cr_2O_3); 2004, 110,273 t-Cr_2O_3 (41.90% Cr_2O_3); 2005, 90,260 t-Cr_2O_3; 2006, 107,103 t-Cr_2O_3 (39.67% Cr_2O_3); and 2007, 99,147 t-Cr_2O_3. Sales by fiscal year were: 2001-02, 5,678 t-Cr_2O_3; 2002–03, 31,187 t-Cr_2O_3 (40.15% Cr_2O_3); 2003–04, 95,162 t-Cr_2O_3 (41.85% Cr_2O_3); 2004–05, 101,295 t-Cr_2O_3 (41.90% Cr_2O_3); 2005–06, 105,951 t-Cr_2O_3; 2006–07, 106,063 t-Cr_2O_3; and 2007–08, 83,059 t-Cr_2O_3 (Government of Western Australia, 2002, p. 38, 42; 2003a, p. 38, 42; 2003b, p. 36, 40; 2004a, p. 28, 32; 2004b, p. 34, 38; 2005a, p. 30, 34; 2005b, p. 26, 30; 2006a, p. 12; 2006b, p. 32; 2007a, p. 19; 2007b, p. 42; 2008, p. 44). Consolidated Minerals Ltd. (ConsMin) planned to delist from the Australian stock exchange following its takeover by Palmary Enterprises Ltd. (Ukraine). ConsMin mined chromite, manganese, and nickel ore (Metal Bulletin, 2008n, p. 3).

Brazil.—Brazil produced chromite ore, ferrochromium, and stainless steel. Brazil reported 2007 chromite ore production of 627,772 t (253,254 t Cr_2O_3-content), 110,975 t of chromite ore (49,010 t Cr_2O_3-content) exports, and 28,234 t (12,705 Cr_2O_3-content) imports. Brazil produced from a chromite ore reserve of 14.2 Mt containing about 4.6 Mt Cr_2O_3-content, mostly in Bahia State. In 2007, Brazil produced 195,890 t of chromium ferroalloys and 416,000 t of stainless steel. Brazil exported 7,165 t of ferrochromium and imported 24,975 t (Gonçalves, 2008). Based on production of chromite ore and trade of chromite ore and chromium ferroalloys, Brazilian chromium apparent consumption in 2007 was 287,000 t.

Canada.—Canada reported chromium mineral imports of 50,692 t in 2007; 49,027 t in 2006; and 60,558 t in 2005; exports of 1,759 t in 2007; 2,733 t in 2006; and 2,991 t in 2005 (Natural Resources Canada, [undated], p. 64.9–64.10).

Noront Resources Ltd., a mineral resource exploration and development company, discovered chromite mineralization in the McFaulds Lake area of Ontario. Noront completed ground and airborne gravity surveys in the area and conducted a drilling program. Noront reported finding chromite ore containing 40% Cr_2O_3 with a chromium-to-iron ration of 2:1. Noront planned to continue drilling to collect enough data to make resource estimates (Noront Resources Ltd., 2009, p. 8–9, 16–17).

China.—China produced chromite ore, ferrochromium, chromium chemicals and metal, and stainless steel. China's industrialization has lead to its becoming the leading national producer of stainless steel, which also makes it the leading market for ferrochromium. China produced a small amount of chromite ore; a moderate amount of ferrochromium, mostly from imported chromite ore; and a large amount of stainless steel.

Minmetals and the Government of Hunan Province planned to buy Hunan Ferroalloys, Hunan Province, for 300 million Yuan ($40 million). The ferrochromium producer went bankrupt. Hunan Ferroalloys had the capacity to produce 300,000 t/yr of ferrochromium and ferromanganese. Jilin Ferroalloys reported production of 580,000 t of ferrochromium and ferromanganese in 2007. Jilin planned to reach a production capacity of 1 Mt/yr in 2008 by purchasing domestic rivals. Mingtuo Group reported ferrochromium production capacity of 200,000 t/yr from 14 submerged arc furnaces, 2 at 17,500 kVA, 8 at 7,500 kVA, and 4 at 12,500 kVA. Mingtuo planned to increase ferroalloy production capacity to 1 Mt/yr and to construct a stainless steel plant with production capacity of 1 Mt/yr in Inner Mongolia. Sinosteel Jilin reported 27,899 t of ferrochromium production in 2007. Sichuan Tianyi Metallurgical Group started construction of a 200,000 t/yr ferrochromium plant in Qinghai Province. The plant was to comprise 8 12,500-kVA submerged arc electric furnaces at a cost of 700 million Yuan ($101 million) (Metal Bulletin, 2008j, p. 3; 2008aa; 2008ae; Metal Bulletin Daily, 2008r, p. 3).

Eurasian Natural Resources Corporation PLC (United Kingdom) (ENRC), a producer of chromite ore and ferrochromium in Kazakhstan, purchased a 50% interest in Xinjiang Tuoli Taihang Ferro-Alloy Co. (China) for $15 million. Touli had a ferrochromium production capacity of 120,000 t/yr.

Baosteel, a leading stainless steel producer, contracted to buy ferrochromium from Sichuan Jiannanchun International Economic and Trade Co., Ltd., China National Minerals Co., Ltd., and Sichuan Ehui Ferroalloy Ltd. Corp. Baosteel planned to produce 1.1 Mt of crude stainless steel of which 38% would be ferritic grades. Baosteel planned to get 65% of ferrochromium supply from domestic sources (Metal Bulletin, 2008f, p. 1; 2008g, p. 1).

China planned 9% annual gross domestic product growth until 2018 driven by its industrialization and urbanization. China planned to tighten ferrochromium production regulations, increase ferrochromium export taxes, and reduce the number of ferrochromium traders. China planned to eliminate ferroalloy furnaces below 6,300 kVA electrical capacity by yearend 2010. China tightened the regulation of ferroalloy traders. In response to the world financial downturn, China pledged to spend 4 trillion Yuan ($583 billion) on public works during the next 2 years (Metal Bulletin, 2007, p. 3; Metal Bulletin, 2008i; 2008l, p. 2; 2008s; 2008t; Metal Bulletin Daily, 2008b, p. 3; 2008c, p. 5; Metal Bulletin Weekly, 2008a, p. 4–5).

The production capacities among China's raw stainless steel producers were Baosteel (1.5 Mt/yr), Huaye Special Steel, Jinchuan Group (400,000 t/yr by 2011), Jiuquan Iron and Steel, Shandong Taishan Steel (240,000 t/yr), Sichuan Southwest Stainless (600,000 t/yr), Taiyuan Iron & Steel (also known as Shanxi Taigang Stainless Steel, 3Mt/yr), Tsingshan Jinhui Stainless Industry Corp. (600,000 t/yr and 400,000 t/yr under construction), and Zhangjiagang Pohang Stainless Steel (1 Mt/yr). China's raw stainless steel production capacity was more than 13 Mt/yr; however, consumption reached only 6.76 Mt in 2008. Consumption was forecast to reach 9.54 Mt in 2012 (Metal Bulletin, 2008e; 2008ab; 2008af; 2008ah; Metal Bulletin Daily, 2008f, p. 5; 2008o, p. 5; 2008s, p. 5; Metal Bulletin Weekly, 2008e).

Finland.—Finland produced chromite ore (Kemi Mine), ferrochromium (Tornio Works), and stainless steel (Tornio Works). In 2008, Outokumpu produced 614,000 t of marketable chromite ore from 1.3 Mt of run-of-mine ore and 234,000 t of ferrochromium compared with 556,000 t of chromite ore from 1.2 Mt of run-of-mine ore and 242,000 t of ferrochromium in

2007. Outokumpu reported 2007 chromite ore proven reserves of 37 Mt grading at 26% Cr_2O_3 and resources of 13 Mt at 29% Cr_2O_3 indicated, and 72 Mt at 29% Cr_2O_3 inferred. Outokumpu produced stainless steel at meltshops in Tornio, Avesta (Sweden), and Sheffield (Britain) (Outokumpu, 2009, p. 33).

France.—France produced chromium metal and stainless steel. Delachaux S.A. produced chromium metal; ArcelorMittal produced stainless steel.

Germany.—Germany produced low-carbon ferrochromium and stainless steel. Elektrowerke Weisweiler GmbH produced low-carbon ferrochromium, and ThyssenKrupp, a multinational corporation, produced stainless steel. Elektrowerke Weisweiler was owned by Kermas Group (United Kingdom). Kermas also owned Serov Ferroalloys Plant (Russia), Samancor (South Africa), and other low-carbon ferrochromium producers.

India.—India produced chromite ore, chromium chemicals, ferrochromium, and stainless steel. India exported lumpy and friable chromite ore and chromite ore concentrates. India reported that 21 mines collectively produced 4,798,515 t of chromite ore in fiscal year 2007–08 (April 1, 2007, through March 31, 2008) compared with 5,295,551 t from 21 mines in fiscal year 2006–07, from a chromite ore reserves of 66.128 Mt (Indian Bureau of Mines, undated b). India reported chromite ore exports of 906,575 t in fiscal year 2007–08 (preliminary); 1,203,060 t in fiscal year 2006–07, and 692,673 t in fiscal year 2005–06 (Indian Bureau of Mines, undated a).

India planned to revise the Mines and Minerals Act of 1957, the law that regulates mineral exploration and exploitation, in anticipation of more than $125 million in mining sector investment between 2008 and 2013 (Metal Bulletin, 2008w, p. 5). India imposed a 5% tax on ferroalloy imports (Metal Bulletin, 2008y).

In March, Minerals and Metals Trading Corp. (MMTC) set chromite ore export price at $410/t to $510/t for friable ore and $407/t to $505/t for concentrate; the export duty was $25/t (Metal Bulletin, 2008w). Private exports were reported to have been selling for $580/t (Metal Bulletin, 2008x). In August, MMTC fixed the base export price for chromite, 46% to 48% Cr_2O_3, at $715/t fob, and for concentrates at $710/t until the end of September (Metal Bulletin Daily, 2008i, p. 3).

A summer power shortage was anticipated when the coal ministry allocated 10.2% less coal than required by the power sector. The shortfall was expected to hit producers of ferroalloys, iron, steel, and other power intensive industries (Metal Bulletin, 2008al). Coal-based powerplants provide two-thirds of India's energy requirements, and stocks at those plants fell to critical levels. More than one-half of the steel and ferroalloy producers depend on these power stations (Metal Bulletin, 2008z). In June, electricity generated fell 12% below target owing to a shortage of gas, under-utilization of coal-based powerplants, and poor hydroelectric generation as a result of a monsoon season that produced less rainfall than usual (Metal Bulletin Daily, 2008h, p. 5).

The Indian Ministry of Mines licensed Tata Steel to prospect for chromite ore in Manipur (Metal Bulletin Daily, 2008t, p. 5).

Indian Ferro-alloys Producers Association (IFAPA) planned to build a 1-Mt/yr ferroalloys complex at Haldia, West Bengal. IFAPA planned 65 new furnaces with an electrical capacity of 700 MVA. Some production would be ferrochromium (Metal Bulletin, 2008a, p. 3).

In the fiscal year ending March 31, 2008, chromium ferroalloy production increased by 18% to 948,300 t, while exports increased by 46% to 520,740 t compared with those of 2007. Ferroalloy producers were plagued by the shortage and high price of raw materials.

GMR Ferro Alloys and Industries Ltd., Andhra Pradesh, produced about 27,500 t/yr of ferrochromium, mostly for export, from two furnaces with electrical capacities of 6 MVA and 9 MVA. CRONIMET Mining GmbH, a part of the CRONIMET Group, and investors from Dubai acquired a 70.5% stake in the operation and changed the name to CRONIMET Ferro Alloys (India) Ltd. (CRONIMET Group, 2008).

Nava Bharat Ventures, Orissa, produced ferrochromium from a capacity of 100,000 t/yr but had no captive sources of chromite ore (Metal Bulletin, 2008ag). Indian Metals and Ferro Alloys Ltd. (IMFA) produced chromite ore and ferrochromium in Orissa. In the fiscal year ending March 31, 2008, IMFA produced 323,200 t of chromite ore and 170,000 t of ferrochromium (Metal Bulletin/Metal Bulletin Daily, 2008b). Industrial Development Corp. produced chromite ore and low-carbon ferrochromium in Orissa from a production capacity of 10,000 t/yr (Metal Bulletin Daily, 2008n, p. 3). Rohit Ferro-Tech Ltd., Bishnupur, West Bengal, produced ferrochromium from seven furnaces with a total production capacity of 200,000 t/yr (Metal Bulletin/Metal Bulletin Daily, 2008a). JSL Ltd. (formerly known as Jindal Stainless Steel) planned to produce ferrochromium in Vietnam, and ferrochromium and stainless steel in Turkey (Metal Bulletin/Metal Bulletin Daily, 2008c).

By November, declining demand had forced at least four of India's major producers of high-carbon ferrochromium to close down 300,000 t/yr of production capacity. Visa Steel, Rohit Ferro Tech, Nava Bharat Ventures, and Jindal Stainless Steel shut down their furnaces as stocks in the country rose to almost 200,000 t. The closures affected high-carbon ferrochromium producers without captive chromite ore sources, while those with captive ore sources, such as Balasore Alloys and IMFA Group continued to produce selling ferrochromium at Rs35,000/t, down from Rs50,000/t in October (Metal Bulletin Daily, 2008j, p. 3).

Ferro Alloys Corp. (Facor) produced chromite ore and ferrochromium in Orissa. Facor planned to double ferrochromium production capacity to 120,000 t/yr at its Balasore works by adding a second 45-MVA furnace (Metal Bulletin Daily, 2008g, p. 3).

Visa Steel Ltd., Kalinganagar, Orissa, produced ferrochromium from a production capacity of 50,000 t/yr and planned to add a second 50,000 t/yr of ferrochromium production capacity. Visa planned a joint venture with Baosteel (China) to build a 100,000 t/yr ferrochromium plant in India (Metal Bulletin, 2008am).

India produced more than 2 Mt/yr of stainless steel and planned to add about 4.6 Mt/yr of stainless steel production capacity by 2013, which would make India the second-leading stainless steel producer after China. Jindal Stainless planned to increase stainless steel production capacity to 2.5 Mt/yr by 2012. Facor planned the construction of a 500,000-t/yr stainless steel

plant adjacent to its 65,000-t/yr charge chrome facility in Orissa and another 50,000-t/yr of stainless steel production capacity to its 50,000-t/yr alloy and special steels plant near Nagpur, Maharashtra. Rohit Ferro Tech, a ferrochromium producer, planned a 200,000-t/yr stainless steel project. Steel Authority of India was in the process of adding 300,000-t/yr of stainless steel production capacity at its Salem, Tamil Nadu plant. Other producers planned to increase their stainless steel capacity as follows: Visa Steel, 500,000 t/yr; Viraj Group, 800,000 t/yr; and Adhunik Metaliks Ltd., Godavari Ispat, 200,000 t/yr (Metal Bulletin, 2008u).

Jindal Stainless planned to increase stainless steel production capacity to 2.5 Mt/yr by 2012. Jindal was constructing a greenfield stainless steel plant in Jajpur district, Orissa state, which would double capacity to 1.6 Mt/yr (Metal Bulletin, 2008ac).

Salem Stainless Steel [a subsidiary of Steel Authority of India (Sail)] started adding a meltshop at its Salem, Tamil Nadu plant. Sail planned to produce 200,000 t/yr of stainless steel slab at Durgapur (Metal Bulletin Daily, 2008q, p. 5).

Iran.—Rohit Ferro-Tech Ltd. (India) acquired a chromite ore deposit in Iran from which an estimated 500,000 t/yr of ore is produced. The company was also in preliminary talks to acquire a chromite ore deposit in South Africa. Rohit needed about 300,000 t/yr of chromite to sustain production of 120,000 t/yr of ferrochromium. Rohit bought chromite ore domestically and imported ore. The company operated ferroalloy plants in Orissa and West Bengal and planned to add seven furnaces to its Haldia works in West Bengal (Metal Bulletin Daily, 2008p, p. 3).

Italy.—Italy produced stainless steel.

Japan.—Japan produced stainless steel. The Government of Japan stockpiled ferrochromium in cooperation with the private sector in Japan as one of four measures to insure a stable supply of chromium (Japan Oil, Gas and Metals National Corp., 2008, p. 1–2, 7–8, 19). The Government of Japan started its Rare Metals Stockpiling Program in 1983 in response to two oil crises that revealed economic vulnerability to resource scarcity. The Rare Metals Stockpiling Program's goal was to hold an inventory equivalent to 60 days of standard Japanese consumption.

Kazakhstan.—Kazakhstan produced chromite ore and chromium chemicals, ferroalloys, and metal. Chromite ore was produced at Donskoy Mine, Aqtobe Oblysy; ferrochromium at Aksu, Pavlodar Oblysy, and Aktobe, Aqtobe Oblysy, ferroalloy smelters, and chromium metal at Aktobe.

The Government of Kazakhstan proposed to tax chromite ore production at the rate of 16.2% of market value starting in 2009. The rate was to increase to 16.8% in 2010, and then to increase again in 2011. There were 23 chromite deposits in the country (Metal Bulletin Daily, 2008k, p. 2; Metal Bulletin Weekly, 2008b).

Eurasian Natural Resources Corp. PLC (United Kingdom) (ENRC) reported chromite ore reserves of 183 Mt with an average grade of 41.4% Cr_2O_3 as of December 31, 2008. ENRC reported chromite ore production of 3.629 Mt in 2008 compared with 3.687 Mt in 2007. ENRC reported ferrochromium production of 1.054 Mt in 2008 compared with 1.070 Mt in 2007 ENRC produced ferrochromium at Aktobe and Aksu. ENRC was in the process of upgrading furnaces at Aktobe, converting to DC arc furnaces to permit greater use of chromite ore fines (Eurasian Natural Resources Corp. PLC, 2009, p. 13, 25, 37). ENRC planned the staged development of six new high-carbon ferrochromium furnaces with a collective capacity of 600,000 t/yr. The new furnaces, a mixture of replacement and new production, would meet increasing demand, especially from China, where 5% annual stainless steel production growth was expected to increase ferrochromium demand by about 500,000 t/yr (Metal Bulletin Daily, 2008e, p. 3).

Mechel OAO (Russia) acquired Oriel Resources, owner and developer of the Voskhod chromite mine (Metal Bulletin Daily, 2008m, p. 3). Mechel started production at the Voskhod chromite ore mine. The mine and processing plant had a production capacity of 1.3 Mt/yr from reserves of 19.5 Mt of ore. Annual production from the mine would be 0.950 Mt of chromite ore concentrates. Mechel planned to use one-third of the concentrate to produce ferrochromium at its Tikhvin Ferro-alloy Smelting Plant in Russia and to sell the remainder (Metal Bulletin Daily, 2008l, p. 1). Mechel planned to complete a feasibility study on a ferrochromium plant near its Voskhod Mine by 2009. The ferrochromium plant was expected to have a production capacity of 250,000 t/yr (Metal Bulletin Weekly, 2008d).

Korea, Republic of.—Korea produced stainless steel.

Malaysia.—Acerinox (Spain) and Nisshin Steel (Japan) constructed a stainless steel plant in Johor Bahru, Johor. The stainless steel plant would have a 1 Mt/yr-capacity melt shop and was expected to start production in 2011 (Metal Bulletin/ Metal Bulletin Daily, 2008d; Metal Bulletin Daily Steel, 2008b).

Netherlands.—KMR Stainless BV [a subsidiary of KMR Group (Germany)] purchased Capricorn Stainless BV, another specialty steel scrap processor, making KMR the world's third largest stainless scrap processor after ELG Haniel (Germany) and CRONIMET (Germany) (Metal Bulletin, 2008ad, p. 6).

Philippines.—Midwest Group (China) purchased the Misamis chromite mine (Metal Bulletin, 2008k).

Russia.—Russia produced chromite ore and chromium chemicals, ferroalloys, and metal, and stainless steel. ENRC, a producer of chromite ore and ferrochromium in Kazakhstan, purchased Serov Ferroalloys Plant Joint Venture (Russia) for $210 million. Serov had a ferrochromium production capacity of 200,000 t/yr.

Open Joint-Stock Company Kluchevsky Ferro-Alloy Plant reported that the price of chromium metal declined to $12,000 per metric ton in October, that demand for the metal was weak, and stocks were considerable. As a result, Kluchevsky stopped producing chromium metal for the first time in its 65-year history (Metal Bulletin Weekly, 2008c).

Saudi Arabia.—Armetal and Outokumpu Group (Finland) planned to set up a joint venture, Outokumpu Armetal Stainless Pipe Co Ltd. (OSTP), in Riyadh with a stainless steel pipe production capacity of 10,000 t/yr. Outokumpu would have a 51% stake in the company; Armetal, a 49% stake. Armetal planned to add 10,000 t/yr of stainless pipe up to about 20 centimeters in diameter to its existing products and to increase to about 61-centimeter diameter pipe. The Middle Eastern market for stainless steel pipe was reported to have

been growing fast as the oil, gas, and desalination industries expanded (Metal Bulletin, 2008ai, p. 4).

South Africa.—South Africa was the world's leading national producer of chromite ore and ferrochromium. Eskom, the South African electrical power supplier, reported that electrical power generation capacity shortage would require them to reduce electrical power to industrial users, a situation that was not expected for another 3 years and then projected to last for the next 5 to 8 years. Electrical power limitations restricted ferrochromium production early in the year and brought the feasibility of ferroalloy industry expansion into question (Metal Bulletin, 2008m, p. 14; 2008aj; 2008ak, p. 4).

African Rainbow Minerals Ltd. (ARM) produced chromite ore and ferrochromium in joint-venture partnerships with Assmang Ltd. (Dwarsrivier Chrome Mine, Machadodorp Ferrochrome Works) and with Norilsk Nickel Africa (Nkomati Nickel and Chrome Mine). Nkomati Nickel Mine produced 1.177 Mt of chromite ore in fiscal year 2008 compared with 0.631 Mt in 2007 and 0.392 Mt in 2006, the first year of production. Nkomati chromite ore proven and probable reserves reportedly were 2.90 Mt at 31.00% Cr_2O_3; measured and indicated resources were 4.6 Mt at 31.04% Cr_2O_3. Dwarsrivier Chrome Mine production was 0.849 Mt in fiscal year 2008 compared with 0.710 Mt in 2007, 0.526 Mt in 2006, and 0.568 Mt in 2005. Dwarsrivier proven and probable reserves were 35.1 Mt at 39.16% Cr_2O_3; measured and indicated resources were 44.02 Mt at 39.16% Cr_2O_3. Machadodorp ferrochromium production was 0.270 Mt in fiscal year 2008 compared with 0.242 Mt in 2007, 0.230 Mt in 2006, and 0.266 Mt in 2005 (African Rainbow Minerals Ltd., 2009, p. 30–31, 46).

Assore Ltd. produced chromite ore and ferrochromium in joint-venture partnership with ARM (Dwarsrivier Chrome Mine, Machadodorp Ferrochrome Works), and through its subsidiary companies Rustenburg Minerals Development Company (Proprietary) Ltd. (RMDC) and Zeerust Chrome Mines Ltd. RMDC produced 341,634 t run-of-mine chromite ore in 2008 compared with 286,032 t in 2007. RMDC developed shafts to mine underground as surface reserves diminished. RMDC chromite ore reserves reportedly were 1.3 Mt proven, 1.8 Mt probable; resources were 2.0 Mt measured, 2.9 Mt indicated, and 5.4 Mt inferred. Zeerust produced from chromite ore dumps. Zeerust chromite ore reserves were 0.8 Mt proven; resources were 0.9 Mt measured, 10.6 Mt inferred (Assore Ltd., 2009, p. 7, 15–16, 21, 33).

ASA Metals (Pty.) Ltd. (a joint venture between Sinosteel Corp. (China) and Limpopo Economic Development Enterprise) produced chromite ore and ferrochromium (Diloklong Chrome Mine, 24° 33' S, 30° 08' 35" E). Dilokong were producing about 320,000 t/yr of chromite ore from 420,000 t/yr run-of-mine production; reserves reportedly were 45 Mt. The smelter comprised one 33-MVA furnace and one 45-MVA furnace that produced about 115,000 t/yr of ferrochromium. ASA planned to increase chromite ore production to 1.2 Mt/yr. ASA's ferrochromium production capacity was 120,000 t/yr. ASA planned to increase ferrochromium production capacity to 360,000 t/yr (Metal Bulletin, 2008d).

Chromex Mining plc (United Kingdom) acquired the Stellite opencast mine in the western limb of the Bushveld Complex from Ilitha Mining (Pty.) Ltd. and Hernic Ferrochrome (Pty.) Ltd. Sales of Stellite chromite ore started in September. A processing facility designed to take 40,000 metric tons per month of run-of-mine ore was to be completed in 2009. Chromex reported 31.9 Mt of South African Code for Reporting of Mineral Resources and Mineral Reserves (SAMREC)-compliant resources at Stellite, an increase from the previously reported 15 Mt. Chromex planned to develop the Mecklenburg project (Limpopo Province) in the eastern limb of the Bushweld Complex once legal issues are resolved (Chromex Mining plc, 2009).

CRONIMET Mining GmbH (Germany) announced that it had acquired the mining rights to a substantial chromium ore deposit in South Africa in the Bushveld Complex near the town of Northam (CRONIMET Mining GmbH, 2008).

Hernic Ferrochrome (Pty.) Ltd. produced chromite ore and ferrochromium. Hernic produced chromite ore at its Maroelabult Mine and started development of Bokfontein Mine, which was planned to produce 1.5 Mt/yr of chromite ore. Hernic reported chromite ore reserves of 250 Mt and production capacity of 420,000 t/yr (Hernic Ferrochrome (Pty.) Ltd., 2007).

International Ferro Metals Ltd. (Australia) (IFM) produced chromite ore at the Buffelsfontein and Lesedi Mines and ferrochromium at its integrated works near Buffelsfontein. IFM planned to develop its Skychrome property. IFM reported proven and probable reserves of 13,856 Mt at 30.66% Cr_2O_3 and measured and indicated resources of 126.028 Mt at 32.96% Cr_2O_3. In the fiscal year that ended in June, IFM reported ferrochromium production of 205,607 t from a production capacity of 267,000 t/yr (International Ferro Metals Ltd., 2008, p. 3, 11–12).

Merafe Resources Ltd. produced chromite ore and ferrochromium via wholly owned subsidiary companies and in joint venture with Xstrata plc. In the eastern limb of the Bushveld Complex, Merafe mined at Boshoek, Horizon, Kroondal, Marikana, and Waterval Mines and produced ferrochromium at Lydenburg and Lion plants. In the western limb of the Bushveld Complex, Merafe mined at Helena, Magareng, and Thorncliffe and produced ferrochromium at Boshoek, Rustenburg, and Wonderkop plants. Collectively, these plants had ferrochromium production capacity of 1.979 Mt/yr from 20 furnaces at 5 production sites (Merafe Resources Ltd., 2009, p. 5, 64).

Samancor Chrome Ltd. [a subsidiary of the Kermas Group (Virgin Islands)] is the second leading chromite ore and ferrochromium producer in South Africa. Samancor operated two mining complexes (Eastern Chrome Mines, Lydenburg-Steelpoort area, Mpumalanga Province, and Western Chrome Mines, Rustenburg, North West Province) and four ferrochromium plants (Ferrometals, Witbank, Mpumalanga Province; Middelburg Ferrochrome and Middelburg Technochrome, Middelburg, Mpumalanga Province; and Tubatse Works, Lydenburg-Steelpoort area, Mpumalanga Province).

Tata started production from its two 75,000-t/yr furnaces at Richard Bay giving it a production capacity of 150,000 t/yr. Tata reported that 14% of the smelter's electricity was to be cogenerated using the smelter's gas emissions as fuel. Tata sought chromite ore supplies from the Southern African region.

Xstrata plc (Switzerland) was the leading world ferrochromium producer. Xstrata produced chromite ore and ferrochromium in South Africa at vertically integrated operations. Xstrata produced 1.126 Mt of ferrochromium in 2008 compared with 1.219 Mt in 2007. The Bokamoso pelletizing plant reached full production. Xstrata developed the Boshoek and Magareng opencast mines (Xstrata plc, 2009, p. 45–48). Xstrata reported JORC-compliant resources in which it held an interest. Reserves, as of June 30, 2008, were proven 51.131 Mt run-of-mine, 37.308 Mt salable; probable 21.041 Mt run-of-mine, 13.676 Mt salable: resources were 85.078 Mt measured, 62.774 Mt indicated, and 98.320 Mt inferred (Xstrata Alloys, 2009, p. 3).

Columbus Stainless Pty. Ltd. planned to increase production (Metal Bulletin, 2008b). In 2008, Columbus melt shop production was 528,336 t compared with 657,051 t in 2007 from a capacity of 1 Mt/yr (Acerinox S.A., 2008, p. 151–153; 2009, p. 40, 172–174). Columbus electrical power was limited to 90% of normal by ESKOM, a limitation which it offset by intensive use of liquid ferrochromium.

Spain.—Acerinox produced 2.0439 Mt of stainless steel in 2008 at three plants, one each in South Africa, Spain, and the United States. Acerinox produced 0.806 Mt of stainless steel (melt shop production) at the Campo de Gibraltar plant, Cadiz Province (Acerinox S.A., 2009, p. 23, 156–167). Acerinox planned to bring a fourth plant into production in Malaysia, in a joint venture with Nisshin Steel (Japan) (Metal Bulletin Daily Steel, 2008b).

Sweden.—Sweden produced ferrochromium and stainless steel. Vargön Alloys AB, Vargön, Västra Götalands Län, produced ferrochromium. Outokumpu (Finland) produced stainless steel at its Avesta plant in Avesta, Dalarnas Län (Outokumpu, 2009, p. 34).

Turkish ferrochromium producer Eti Krom owned by Yildirim Holding Group (Turkey) bought Vargön Alloys, which had a ferrochromium production capacity of 125,000 t/yr. Yildirim planned to increase production capacity by 65,000 t/yr at Vargön (Metal Bulletin, 2008p, p. 3; 2008q, p. 3).

Switzerland.—Xstrata plc was the leading world ferrochromium producer. More information can be found under the South Africa section.

Taiwan.—Taiwan produced stainless steel. Tang Eng Iron Works Co., Ltd. produced raw stainless steel at Kaohsiung Hsiao Kang Lin-Hai Industrial District. Yieh United Steel Corp. (also known as Yusco) produced raw stainless steel at Kang Shan Kaohsiung.

Turkey.—Turkey produced chromite ore, chromium chemicals, and ferrochromium. Eti Krom A.S., a Yildirim Group company, produced chromite ore and high-carbon ferrochromium (38° 39’ 10” N, 39° 46’ 10” E) from a ferrochromium production capacity of 150,000 t/yr (Eti Krom Inc., undated). Eti Elektrometalurji A.S. produced chromite ore and high- and low-carbon ferrochromium near Antalya (36° 56’ 08” N, 30° 39’ E) (Eti Elektrometalurji A.S., undated).

United Kingdom.—United Kingdom produced chromium metal and stainless steel. Outokumpu (Finland) produced stainless steel at its Sheffield plant (Outokumpu, 2008, p. 33). London & Scandinavian Metallurgical Co. Ltd. produced chromium metal by aluminothermic reduction at Rotherham, England. Consolidated Stainless Recycling Ltd. was purchased by ELG Haniel Group (Germany) (Metal Bulletin, 2008o, p. 4).

Zimbabwe.—Zimbabwe produced chromite ore and ferrochromium. Power shortages limited ferrochromium production. Zimbabwe Mining Development Corp. held mining rights to two chromite deposits in Zimbabwe, one in the Midlands and the other in the Zambezi Valley. Zimbabwe Mining and Jiangxi Corp. (China) planned to develop a chromite mine (Metal Bulletin Daily, 2008d, p. 3; 2008u).

Current Research and Technology

Mineral Processing and Industrial Applications.—South Africa’s Council for Mineral Technology (Mintek) has been conducting Government- and commercial-sponsored research and development on chromite ore and ferrochromium. Mintek developed mine-specific processes for chromite ore beneficiation, developed a platinum recovery process applied to chromite ore tailings, developed furnace controller technology for ferrochromium-producing furnaces, and developed stainless steel dust recycling technology (Mintek 2007, p. 20–21, 31, 34; 2008, p. 20–25; 2009, p. 31).

Outlook

The outlook for chromium consumption in the United States and the rest of the world is about the same as that for stainless steel, which is the major end use for chromium worldwide. In 2008, China and India were in the process of economic expansion that resulted in increasing need for chromium to produce stainless steel; however, the world financial downturn interrupted chromium industry expansion setting off raw material price and consumption declines.

The practice of supplying chromium in the form of ferrochromium by countries that mine chromite ore was interrupted as China became a major consumer of chromite ore to directly produce ferrochromium. That trend was not expected to continue as China closed small, inefficient, environmentally unfriendly ferroalloy production facilities. The rising cost of ferrochromium sustained independent ferrochromium producers; however, other factors being equal, ferrochromium production is most cost effective when the ferrochromium plant is close to the chromite mine. With new efficient and reliable ferrochromium production facilities in chromite-ore-producing countries, ferrochromium production capacity and production are expected to diminish in market-driven economies that produce ferrochromium without nearby 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 production capacity was expected to remain about the same as average consumption. To improve chromite ore availability and to stabilize feed material price, ferrochromium producers invest in mines that produce chromite ore. Indeed, 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, a greater portion of chromite is likely to be supplied as byproduct from such operations. In addition, platinum may become a byproduct of some chromite operations.

Chromium Chemicals.—Leading chromium-chemical-producing countries where large sodium dichromate plants (production capacity in excess of 100,000 t/yr) operate included Kazakhstan, Russia, and the United States. Moderate-sized production facilities were located in China, Japan, Romania, South Africa, Turkey, and the United Kingdom. Small-scale local producers operated in China and India. With the exception that the plant in the United Kingdom planned to close, this general geographic distribution was expected to continue.

Ferrochromium.—Ferrochromium production is electrical energy intensive. Charge-grade ferrochromium requires 2,900 to 4,100 kilowatthours of electrical energy per metric ton of product, with efficiency varying by ore grade, operating conditions, and production process. Thus, ferrochromium plant location will reflect a cost balance between raw materials and electrical energy supply.

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TABLE 1

SALIENT CHROMIUM STATISTICS[1]

		2004	2005	2006	2007	2008
World, production, contained chromium:						
Chromite ore (mine)[2]	metric tons	5,010,000 r	5,600,000 r	5,760,000 r	6,700,000 r	6,980,000
Ferrochromium (smelter)[3]	do.	3,750,000	3,940,000	4,190,000	4,680,000 r	4,390,000
Stainless steel[4]	do.	4,180,000	4,130,000 r	4,820,000 r	4,730,000 r	4,460,000
U.S. supply:						
Components of U.S. supply, contained chromium:						
Domestic mines	do.	--	--	--	--	--
Secondary[5]	do.	177,000	174,000	179,000	162,000	146,000
Imports:						
Chromite ore[2]	do.	49,500	52,900	53,800	46,400	64,300
Chromium chemicals	do.	6,040	11,400	12,100	10,600	18,000
Chromium ferroalloys	do.	261,000	278,000	265,000	259,000	307,000
Chromium metal	do.	9,630	11,000	10,900	11,700	13,100
Stainless steel mill products and scrap	do.	163,000	150,000	179,000	158,000	157,000
Stocks, January 1:						
Government	do.	560,000	466,000	375,000	253,000	115,000
Industry[6]	do.	9,870	7,900	8,600	9,700	10,000
Total	do.	1,240,000	1,150,000	1,080,000	910,000	831,000
Distribution of U.S. supply, contained chromium:						
Exports:						
Chromite ore[2]	do.	14,000	13,700	17,400	12,000	2,280
Chromium chemicals	do.	14,500	18,900	16,700	21,000	22,600
Chromium ferroalloys and metal	do.	6,250	24,700	22,300	27,000	11,300
Stainless steel mill products and scrap	do.	136,000	162,000	156,000	231,000	250,000
Stocks, December 31:						
Government[7]	do.	466,000	375,000	272,000	115,000	105,000 [8]
Industry[6]	do.	7,900	8,600	9,700	10,000	7,370
Total	do.	645,000	603,000	494,000	416,000	399,000
Production, reported, chromium ferroalloy and metal net production[9]		W	W	W	W	W
Consumption:						
Apparent, contained chromium	do.	591,000	548,000	589,000	493,000	432,000
Reported:						
Chromite ore and concentrates, gross weight	do.	W	W	W	W	W
Chromium ferroalloys:[10]						
Gross weight	do.	449,000	431,000	429,000	469,000	434,000
Contained chromium	do.	262,000	250,000	252,000	275,000	254,000
Chromium metal, gross weight	do.	5,710 r	7,270 r	6,160	5,410	4,700
Stocks, December 31, gross weight:						
Government:[7]						
Chromite ore	do.	135,000	73,400	1,160	--	--
Chromium ferroalloys	do.	595,000	492,000	373,000	155,000	140,000
Chromium metal	do.	6,670	6,190	5,280	4,970	4,820
Industry:						
Producer[11]	do.	W	W	W	W	W
Consumer:						
Chromium ferroalloys[12]	do.	12,900	14,000	15,700	16,500	11,900
Chromium metal	do.	186 r	229 r	220	221	234
Other	do.	229 r	304 r	231	216	271
Prices, average annual:						
Chromite ore[13]	dollars per ton	NA	NA	119	244	348
Ferrochromium, chromium content[14]	dollars per pound	0.690	0.684	0.695	1.048	1.748
Electrolytic chromium metal, gross weight[15]	do.	4.50	4.50	4.50	NA	NA
Aluminothermic chromium metal, gross weight[16]	do.	2.27	2.72	2.94	3.66	5.30

See footnotes at end of table.

TABLE 1—Continued

SALIENT CHROMIUM STATISTICS[1]

		2004	2005	2006	2007	2008
Value of trade:[17]						
Exports, contained chromium	thousands	$80,700 r	$116,000 r	$121,000 r	$150,000 r	$149,000
Imports, contained chromium	do.	$477,000 r	$583,000 r	$529,000 r	$699,000 r	$1,430,000
Net exports, contained chromium[18]	do.	-$397,000 r	-$468,000 r	-$408,000 r	-$548,000 r	-$1,280,000
Stainless steel:						
Production:						
Gross weight[19]	metric tons	2,400,000	2,240,000	2,460,000	2,170,000	1,930,000
Contained chromium[20]	do.	407,000	373,000	419,000	360,000 r	294,000
Average grade, dimensionless[21]		0.1697	0.1667	0.1705	0.1656 r	0.1684
Shipments, gross weight[22]	metric tons	1,880,000	1,730,000	1,890,000	1,700,000	1,380,000
Exports, gross weight	do.	323,000	371,000	410,000	476,000	471,000
Imports, gross weight	do.	811,000	770,000	872,000	809,000	783,000
Scrap, gross weight:						
Receipts	do.	1,040,000	1,030,000	1,050,000	953,000	858,000
Consumption	do.	1,480,000	1,480,000	1,500,000	1,430,000	1,330,000
Exports	do.	478,000	585,000	506,000	882,000	1,000,000
Imports	do.	146,000	111,000	180,000	118,000	140,000
Value of trade:						
Exports	thousands	$1,030,000	$1,340,000	$1,580,000	$2,110,000	$2,300,000
Imports	do.	$2,230,000	$2,630,000	$3,210,000	$4,300,000	$4,040,000
Scrap exports	do.	$548,000	$670,000	$716,000	$1,620,000	$1,190,000
Scrap imports	do.	$160,000	$124,000	$209,000	$198,000	$217,000
Net exports[18, 23]	do.	-$809,000	-$744,000	-$1,130,000	-$770,000	-$773,000

rRevised. do. Ditto. NA Not available. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

[2]Calculated assuming chromite ore to average 44% Cr_2O_3, which is 68.42% chromium.

[3]Calculated assuming chromium content of ferrochromium to average 57% chromium.

[4]Calculated from American Iron and Steel Institute reported stainless steel production assuming chromium content of stainless steel to average 16.7% chromium.

[5]Calculated assuming chromium content of stainless steel to average 17% chromium.

[6]Includes consumer stocks of chromium ferroalloys and metal and other chromium-containing materials.

[7]"Summary of Commodities" as reported by the Defense National Stockpile Center (DNSC) through 2006. "Inventory of Stockpile Material" as reported by DNSC starting in 2007 except where noted otherwise.

[8]Between January 1, 2008 to December 31, 2008, the DNSC changed its high-carbon and low-carbon ferrochromium stocks accounting method making them incompatible for the purpose of computing stock change for that year. December stocks were estimated based on monthly stock changes excluding the accounting-change month.

[9]Includes chromium ferroalloys and metal and other chromium materials in the United States.

[10]Chromium ferroalloy, chromite ore, and other chromium-containing materials excluding chromium metal.

[11]Chromium ferroalloy and metal producer stocks of chromium ferroalloys and metal.

[12]Consumer stocks of high- and low-carbon ferrochromium and ferrochromium silicon.

[13]Time-weighted average price of South African chromite ore that contains 44% Cr_2O_3 f.o.b. South Africa started in June 2006.

[14]Time-weighted average U.S. price of imported high-carbon chromium that contains 50% to 55% chromium as reported in Platts Metals Week.

[15]Time-weighted average U.S. price of domestically produced electrolytic chromium metal as reported by Ryan's Notes.

[16]Time-weighted average U.S. price of imported aluminothermic chromium metal as reported by Ryan's Notes.

[17]Includes chromite ore and chromium ferroalloys, metal, and chemicals.

[18]Negative data indicate that imports are greater than exports.

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

[20]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.

[21]Ratio of estimated mass-weighted average chromium content of stainless steel production by grade to production. Expressed as a fraction. Source: American Iron and Steel Institute quarterly reports of stainless and heat-resisting raw steel production by grade.

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

[23]Includes stainless steel and stainless steel scrap.

TABLE 2

U.S. REPORTED CONSUMPTION AND STOCKS OF CHROMIUM PRODUCTS[1]

(Metric tons)

	2007		2008		Change[2]	
	Gross weight	Chromium content	Gross weight	Chromium content	Quantity	Percentage
Consumption by end use:						
Alloy uses:						
Steel:						
Carbon steel	6,570	4,010	6,200	3,740	-376	-6
High-strength low-alloy steel	3,410 r	2,240 r	3,690	2,490	283	8
Stainless and heat-resisting steel	376,000	218,000	345,000	199,000	-31,400	-8
Full alloy steel	21,200 r	13,000 r	23,600	14,400	2,410	11
Unspecified steel[3]	32,000	19,600	27,600	17,200	-97	-2
Superalloys	13,500	10,400	10,100	7,840	-3,350	-25
Other alloys and uses[4]	21,800	12,600	23,200	13,600	1,430	7
Total	474,000	280,000	439,000	259,000	-35,500	-7
Consumption by material:						
Low-carbon ferrochromium	43,400 r	29,400 r	44,300	30,300	904	2
High-carbon ferrochromium	390,000	232,000	353,000	209,000	-37,100	-10
Ferrochromium silicon	33,100	12,900	34,500	13,500	1,380	4
Chromium metal	5,410	5,140	4,700	4,630	-710	-13
Chromium ore	1,160	378	1,150	375	-9	-1
Chromium-aluminum alloy	464	302	454	293	-11	-2
Other chromium materials	446	211	554	265	109	24
Total	474,000	280,000	439,000	259,000	-35,500	-7
Consumer stocks:						
Low-carbon ferrochromium	1,970	1,340 r	1,970	1,340	-8	(5)
High-carbon ferrochromium	13,300	7,920 r	8,770	5,190	-4,580	-34
Ferrochromium silicon	1,160	451	1,160	456	4	(5)
Chromium metal	221	210	234	230	13	6
Chromium-aluminum alloy	79	52	126	82	47	59
Other chromium materials	137	53	146	61	9	7
Total	16,900	10,000	12,400	7,370	-4,520	-27
National Defense Stockpile stocks:[6, 7]						
Chromium ferroalloys:[8]						
High-carbon ferrochromium[9]	99,400	71,000	94,100	67,200	-5,310	-5
Low-carbon ferrochromium[9]	55,400	39,500	45,700	32,700	-9,620	-17
Chromium metal[10]	4,970	4,970	4,820	4,820	-153	-3

rRevised.

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

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

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

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

[5]Less than ½ unit.

[6]The source for stockpile materials is the Defense Logistics Agency, Defense National Stockpile Center (DNSC).

[7]The DNSC data is based on the "Total Uncommitted Inventory" of stockpile material D–1 report.

[8]Ferrochromium silicon was used up in 2002.

[9]Chromium content estimated using 71.4% chromium.

[10]Chromium content estimated using 100% chromium.

TABLE 3

VALUE OF IMPORTS AND U.S. PRICE QUOTATIONS FOR CHROMIUM MATERIALS[1]

Material		2007		2008	
		Contained chromium	Gross weight	Contained chromium	Gross weight
Value:[2, 3]					
Chromite ore:					
Not more than 40% chromic oxide	dollars per metric ton	2,030	507	NA	NA
More than 40% but less than 46% chromic oxide	do.	263	83	788	247
46% or more chromic oxide	do.	537	172	675	222
Average	do.	488	156	696	227
Ferrochromium:					
Not more than 0.5% carbon	do.	3,130	2,080	7,520	5,130
More than 0.5% but not more than 3% carbon	do.	2,140	1,210	4,880	3,160
More than 3% but not more than 4% carbon	do.	992	534	2,290	1,360
Average (not more than 4%)	do.	2,960	1,910	7,340	4,990
More than 4% carbon	do.	1,830	1,040	3,370	1,940
Average (all grades)	do.	1,950	1,120	3,730	2,180
Chromium metal[4]	do.	XX	8,330	XX	11,100
Price:[5]					
Chromite ore:[6]					
Turkey[7]					
40% to 42% Cr_2O_3	do.	XX	360	XX	487
44% Cr_2O_3	do.	1,270	382	1,750	527
South Africa					
39% Cr_2O_3	do.	914	244	1,170	311
44% Cr_2O_3	do.	811	244	1,130	339
High-carbon ferrochromium:[8]					
50% to 55% chromium	cents per pound	104.85	XX	176.00	XX
60% to 65% chromium	do.	119.59	XX	206.65	XX
Low-carbon ferrochromium:[8]					
0.05% carbon	do.	175	XX	466	XX
0.10% carbon	do.	156	XX	435	XX
0.15% carbon	do.	155	XX	432	XX
Chromium metal:					
Domestic, electrolytic[9, 10]	do.	XX	450	XX	NA
Imported, aluminothermic[9]	do.	XX	366	XX	530

do. Ditto. NA Not available. XX Not applicable.

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

[2]Mass-weighted average based on customs value and weight of imported material.

[3]Reported by the U.S. Census Bureau.

[4]Average over all grades.

[5]Time-weighted average based on prices reported by material in trade journals.

[6]Source: Ryan's Notes.

[7]Price is cfr China.

[8]Source: Platts Metals Week.

[9]Source: Ryan's Notes.

[10]Price discontinued in February 2007.

TABLE 4

U.S. EXPORTS OF CHROMIUM MATERIALS, BY TYPE[1]

HTS[2] code	Type	2007 Quantity (kilograms)	2007 Value (thousands)	2008 Quantity (kilograms)	2008 Value (thousands)	Principal destinations in 2008 (Quantity in metric tons, value in thousands)
2610.00.0000	Chromite ore and concentrate, gross weight	37,600,000	5,560	7,000,000	4,370	Canada (5,480, $2,920); Mexico (973, $582).
	Metal and alloys, gross weight:					
8112.21.0000	Unwrought chromium powders	402,000	6,670	389,000	7,030	Japan (178, $2,670); Brazil (46, $362); Germany (46, $1,020); Mexico (45, $612).
8112.22.0000	Chromium metal waste and scrap	132,000	1,930	67,900	1,410	Japan (44, $685); Taiwan (8, $284); Germany (6, $232); United Kingdom (5, $80); Singapore (2, $56); Sweden (2, $34); Ghana (1, $43).
8112.29.0000	Chromium metal other than unwrought powders and waste and scrap	674,000	14,600	541,000	12,000	Japan (401, $5,160); Brazil (26, $1,270); Singapore (21, $543).
	Total chromium metal	1,210,000	23,200	998,000	20,400	
	Chromium ferroalloys:					
7202.41.0000	High-carbon ferrochromium:[3]					
	Gross weight	24,700,000	25,100	10,800,000	14,500	Mexico (4,350, $6,300); Canada (3,530, $3,550); Brazil (830, $730).
	Contained weight	15,500,000	XX	4,280,000	XX	
7202.49.0000	Low-carbon ferrochromium:[4]					
	Gross weight	16,200,000	25,700	13,400,000	27,500	Canada (4,060, $6,050); Netherlands (2,590, $6,780); Belgium (2,150, $6,990); Japan (1,890, $3,080); Mexico (822, $1,120).
	Contained weight	10,200,000	XX	5,990,000	XX	
7202.50.0000	Ferrochromium-silicon:					
	Gross weight	328,000	434	216,000	1,140	Brazil (100, $207); Netherlands (92, $903); Thailand (12, $14); Canada (11, $20).
	Contained weight	94,400	XX	18,200	XX	
	Total chromium ferroalloys:					
	Gross weight	41,100,000	51,200	24,500,000	43,100	
	Contained weight	25,800,000	XX	10,300,000	XX	
	Chemicals, gross weight:					
	Chromium oxides:					
2819.10.0000	Chromium trioxide	15,900,000	21,400	17,400,000	24,700	United Kingdom (2,730, $3,420); India (2,140, $2,680); Brazil (2,110, $2,870); China (1,780, $3,070); Chile (966, $1,310); Republic of Korea (754, $942); Poland (608, $760); Belgium (565, $706); Canada (512, $947); Mexico (510, $1,440); Russia (498, $624); Estonia (490, $612); Indonesia (468, $585).
2819.90.0000	Other	2,680,000	10,300	3,610,000	14,100	Canada (1,550, $3,780); Chile (506, $1,050); Brazil (264, $548); France (224, $2,120); Philippines (133, $716); United Kingdom (118, $466); Republic of Korea (115, $822).
	Total chromium oxides	18,600,000	31,700	21,000,000	38,900	
2833.29.4000	Chromium sulfates	23,400	250	52,400	362	Mexico (21, $137); Venezuela (12, $93); Switzerland (10, $50); China (4, $26); Argentina (3, $14); Hong Kong (1, $6); United Kingdom (1, $7).
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Zinc and lead chromate	18,100	82	17,100	157	Mexico (10, $59); New Zealand (2, $7); Israel (2, $57); Jamaica (2, $13); Trinidad and Tobago (1, $5).
2841.30.0000	Sodium dichromate	30,900,000 r	24,600	31,300,000	26,000	Japan (22,700, $18,100); Canada (2,990, $3,370).
2841.50.1000	Potassium dichromate	288,000	758	77,000	338	Canada (43, $126); Germany (26, $205); Hong Kong (8, $7).

See footnotes at end of table.

TABLE 4—Continued

U.S. EXPORTS OF CHROMIUM MATERIALS, BY TYPE[1]

HTS[2] code	Type	2007 Quantity (kilograms)	2007 Value (thousands)	2008 Quantity (kilograms)	2008 Value (thousands)	Principal destinations in 2008 (Quantity in metric tons, value in thousands)
	Salts of oxometallic or peroxometallic acids—Continued:					
2841.50.9100	Other	795,000	2,950	1,380,000	4,650	Canada (213, $729); Republic of Korea (173, $709); Taiwan (169, $534); United Kingdom (159, $592); Mexico (127, $236); Indonesia (105, $149); China (84, $335); Hong Kong (51, $211); India (44, $78).
	Total salts	32,000,000 r	$28,400	32,800,000	$31,200	
3206.20.0000	Pigments and preparations, gross weight	1,410,000	9,930	1,230,000	10,600	Canada (379, $1,550); Mexico (219, $1,570); Japan (123, $1,740); Colombia (116, $1,340); Hong Kong (86, $943); Belgium (32, $231); Costa Rica (24, $88); China (20, $214).

rRevised. XX Not applicable.

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

[2]Harmonized Tariff Schedule of the United States of America.

[3]More than 4% carbon.

[4]Not more than 4% carbon.

Source: U.S. Census Bureau.

TABLE 5

U.S. IMPORTS FOR CONSUMPTION OF FERROCHROMIUM, BY COUNTRY[1]

Country	Not more than 0.5% carbon (HTS[2] code 7202.49.5090)			More than 0.5% carbon, but not more than 3% carbon (HTS[2] code 7202.49.5010)			More than 3% carbon, but not more than 4% carbon (HTS[2] code 7202.49.1000)			More than 4% carbon (HTS[2] code 7202.41.0000)			Total all grades		
	Gross weight (metric tons)	Cr content (metric tons)	Value (thousands)	Gross weight (metric tons)	Cr content (metric tons)	Value (thousands)	Gross weight (metric tons)	Cr content (metric tons)	Value (thousands)	Gross weight (metric tons)	Cr content (metric tons)	Value (thousands)	Gross weight (metric tons)	Cr content (metric tons)	Value (thousands)
2007:															
Brazil	5	3	$10	--	--	--	--	--	--	--	--	--	5	3	$10
China	225	148	479	--	--	--	--	--	--	--	--	--	225	148	479
France	6	4	21	--	--	--	--	--	--	--	--	--	6	4	21
Germany	5,720	4,020	12,900	--	--	--	--	--	--	--	--	--	5,720	4,020	12,900
India	--	--	--	--	--	--	--	--	--	4,300	2,710	$7,590	4,300	2,710	7,590
Japan	5,620	3,760	10,100	--	--	--	--	--	--	--	--	--	5,620	3,760	10,100
Kazakhstan	3,600	2,500	7,930	1,110	777	$2,090	--	--	--	107,000	74,400	162,000	111,000	77,700	172,000
Mexico	14	9	41	--	--	--	--	--	--	40	28	71	53	37	112
Netherlands	--	--	--	--	--	--	--	--	--	1,140	719	2,070	1,140	719	2,070
Russia	15,500	10,000	32,600	--	--	--	267	144	$143	18,500	11,600	22,600	34,300	21,800	55,300
South Africa	718	427	1,050	6,000	3,250	6,520	--	--	--	233,000	116,000	178,000	239,000	119,000	185,000
Sweden	218	153	622	--	--	--	--	--	--	41	28	105	258	181	728
Switzerland	--	--	--	--	--	--	--	--	--	3,500	1,680	2,130	3,500	1,680	2,130
Tajikistan	--	--	--	--	--	--	--	--	--	5	3	9	5	3	9
Turkey	13	8	40	--	--	--	--	--	--	255	158	157	268	166	197
United Kingdom	--	--	--	--	--	--	--	--	--	1	(3)	3	1	(3)	3
Zimbabwe	--	--	--	--	--	--	--	--	--	17,100	10,200	23,700	17,100	10,200	23,700
Total	31,700	21,000	65,800	7,110	4,020	8,610	267	144	143	384,000	217,000	398,000	423,000	242,000	473,000
2008:															
Brazil	37	25	116	--	--	--	--	--	--	2,000	1,040	3,820	2,030	1,070	3,940
China	4,550	2,920	23,000	340	212	1,200	--	--	--	632	400	1,730	5,520	3,530	25,900
Germany	5,200	3,580	29,400	--	--	--	--	--	--	--	--	--	5,200	3,580	29,400
India	--	--	--	--	--	--	--	--	--	58,000	35,800	105,000	58,000	35,800	105,000
Italy	--	--	--	--	--	--	--	--	--	159	100	260	159	100	260
Japan	4,220	2,750	15,100	--	--	--	--	--	--	--	--	--	4,220	2,750	15,100
Kazakhstan	2,130	1,460	6,880	--	--	--	--	--	--	114,000	79,300	310,000	117,000	80,700	317,000
Mexico	--	--	--	--	--	--	--	--	--	38	28	123	38	28	123
Russia	20,100	14,100	113,000	1,490	1,010	5,220	344	204	466	40,500	26,200	89,900	62,500	41,500	209,000
South Africa	408	249	769	420	227	666	--	--	--	220,000	107,000	310,000	220,000	108,000	312,000
Sweden	359	243	1,550	--	--	--	--	--	--	718	448	1,370	1,080	691	2,910
Zimbabwe	--	--	--	--	--	--	--	--	--	33,200	19,400	87,200	33,200	19,400	87,200
Total	37,000	25,300	190,000	2,250	1,450	7,090	344	204	466	469,000	270,000	910,000	509,000	297,000	1,110,000

-- Zero.

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

[2]Harmonized Tariff Schedule of the United States of America.

TABLE 5—Continued

U.S. IMPORTS FOR CONSUMPTION OF FERROCHROMIUM, BY COUNTRY[1]

[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE[1]

HTS[2] code	Type	2007 Quantity (kilograms)	2007 Value[3] (thousands)	2008 Quantity (kilograms)	2008 Value[3] (thousands)	Sources in 2008 (Quantity in metric tons, value in thousands)
	Chromite ore:					
2610.00.0020	Not more than 40% Cr_2O_3:					
	Gross weight	52,000	$26	--	--	
	Cr_2O_3 content	19,000	XX	--	XX	
2610.00.0040	More than 40%, but less than 46% Cr_2O_3:					
	Gross weight	26,400,000	2,180	38,400,000	$9,470	South Africa (all).
	Cr_2O_3 content	12,100,000	XX	17,600,000	XX	
2610.00.0060	46% or more Cr_2O_3:					
	Gross weight	119,000,000	20,400	159,000,000	35,300	South Africa (all).
	Cr_2O_3 content	55,600,000	XX	76,400,000	XX	
	Total chromite ore:					
	Gross weight	145,000,000	22,700	197,000,000	44,800	
	Cr_2O_3 content	67,800,000	XX	94,000,000	XX	
	Chromium ferroalloys:					
7202.49.5090	Not more than 0.5% carbon:					
	Gross weight	31,700,000	65,800	37,000,000	190,000	Russia (20,100, $113,000); Germany (5,200, $29,400); China (4,550, $23,000); Japan (4,220, $15,100); Kazakhstan (2,130, $6,880); South Africa (408, $769); Sweden (359, $1,550); Brazil (37, $116).
	Cr content	21,000,000	XX	25,300,000	XX	
7202.49.5010	More than 0.5%, but less than 3% carbon:					
	Gross weight	7,110,000	8,610	2,250,000	7,090	Russia (1,490, $5,220); South Africa (420, $666); China (340, $1,200).
	Cr content	4,020,000	XX	1,450,000	XX	
7202.49.1000	More than 3%, but less than 4% carbon:					
	Gross weight	267,000	143	344,000	466	Russia (all).
	Cr content	144,000	XX	204,000	XX	
7202.41.0000	More than 4% carbon:					
	Gross weight	384,000,000	398,000	469,000,000	910,000	South Africa (220,000, $310,000); Kazakhstan (114,000, $310,000); India (58,000, $105,000); Russia (40,500, $89,900); Zimbabwe (33,200, $87,200); Brazil (2,000, $3,820); Sweden (718, $1,370); China (632, $1,730); Italy (159, $260); Mexico (38, $123).
	Cr content	217,000,000	XX	270,000,000	XX	
7202.50.0000	Ferrochromium-silicon:					
	Gross weight	42,700,000	42,700	24,200,000	57,900	Kazakhstan (20,600, $49,500); Russia (3,610, $8,370).
	Cr content	16,700,000	XX	9,810,000	XX	
	Total chromium ferroalloys:					
	Gross weight	466,000,000	515,000	533,000,000	1,170,000	
	Cr content	259,000,000	XX	307,000,000	XX	
	Chromium metal, gross weight:					
8112.21.1000	Unwrought chromium powders	822,000	10,500	1,050,000	11,700	China (396, $3,720); Russia (322, $2,240); United Kingdom (205, $3,140); Germany (38, $681); Japan (36, $1,610); France (33, $128); Netherlands (20, $173).

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE[1]

HTS[2] code	Type	2007 Quantity (kilograms)	2007 Value[3] (thousands)	2008 Quantity (kilograms)	2008 Value[3] (thousands)	Sources in 2008 (Quantity in metric tons, value in thousands)
	Chromium metal, gross weight—Continued:					
8112.22.0000	Waste and scrap	357,000	2,200	523,000	3,000	Mexico (377, $1,400); China (66, $582); Malaysia (25, $201); Japan (25, $397); Singapore (19, $323); Canada (9, $49); Taiwan (2, $39).
8112.29.0000	Other than waste and scrap	10,500,000	84,700	11,500,000	131,000	Russia (3,340, $35,400); France (3,050, $38,200); United Kingdom (2,490, $29,500); China (2,290, $22,900); Germany (238, $4,270); India (126, $170); Japan (17, $255); Italy (1, $20).
	Total chromium metal	11,700,000	97,400	13,100,000	145,000	
	Chemicals, gross weight:					
	Chromium oxides and hydroxides:					
2819.10.0000	Chromium trioxide	8,210,000	$17,100	8,890,000	$22,500	Turkey (5,280, $12,600); Kazakhstan (2,460, $5,470); China (484, $2,430); South Africa (405, $1,010); Colombia (130, $356); United Kingdom (54, $154); Germany (50, $345); Spain (26, $116); Mexico (3, $10); Canada (1, $6).
2819.90.0000	Other	2,280,000	9,070	2,550,000	9,850	China (1,210, $5,340); Canada (683, $811); United Kingdom (284, $1,370); Germany (218, $1,430); Japan (70, $366); Colombia (31, $185); Poland (19, $157); Finland (16, $89); France (5, $29); Taiwan (4, $40); Singapore (3, $11); Hong Kong (1, $6).
	Total oxides	10,500,000	26,200	11,400,000	32,300	
2833.29.4000	Sulfates of chromium	186,000	546	56,400	92	Turkey (55, $90); Germany (1, $3).
	Salts of oxometallic or peroxometallic acids:					
2841.90.4500	Chromates of lead and zinc	1,130,000	3,320	298,000	1,310	Republic of Korea (174, $708); Austria (79, $408); France (21, $63); Japan (14, $48); China (7, $57); South Africa (3, $10).
2841.30.0000	Sodium dichromate	13,100,000	15,600	33,000,000	28,600	United Kingdom (32,800, $28,000); China (151, $344); Colombia (33, $148); Germany (20, $58).
	Other chromates and dichromates; Peroxochromates:					
2841.50.1000	Potassium dichromate	34,600	110	4,810	29	India (4, $10); Mexico (1, $6); Japan (1, $7).
2841.50.9100	Other	343,000	812	320,000	905	Austria (131, $348); Colombia (120, $343); Brazil (39, $125); Canada (17, $44); Germany (12, $31); China (1, $12).
	Total salts	14,600,000	19,900	33,600,000	30,800	
2849.90.2000	Chromium carbide	143,000	1,800	129,000	2,460	Japan (39, $488); China (25, $380); Canada (22, $370); United Kingdom (19, $278); Austria (17, $659); Germany (6, $237); Russia (1, $44).
	Pigments and preparations based on chromium, gross weight:					
3206.20.0010	Chrome yellow	2,250,000	8,710	1,120,000	5,590	Canada (731, $4,100); Mexico (225, $871); Taiwan (43, $129); Germany (39, $180); Colombia (26, $74); China (21, $60); Venezuela (18, $76); India (9, $53); Hong Kong (7, $38); Japan (1, $6).

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF CHROMIUM MATERIALS, BY TYPE[1]

HTS[2] code	Type	2007 Quantity (kilograms)	2007 Value[3] (thousands)	2008 Quantity (kilograms)	2008 Value[3] (thousands)	Sources in 2008 (Quantity in metric tons, value in thousands)
	Pigments and preparations based on chromium, gross weight—Continued:					
3206.20.0020	Molybdenum orange	600,000	4,040	373,000	3,110	Canada (324, $2,840); Mexico (31, $203); Colombia (12, $29); India (4, $28); Germany (2, $12).
3206.20.0030	Zinc yellow	92,700	242	71,500	192	China (68, $177); Mexico (4, $15).
3206.20.0050	Other	487,000	1,760	531,000	1,830	France (365, $740); China (110, $502); Germany (27, $223); Japan (13, $195); Taiwan (3, $27); Republic of Korea (2, $16); Mexico (2, $9); Canada (2, $26); Italy (2, $14); Brazil (1, $23); Panama (1, $15); India (1, $2); United Kingdom (1, $39).
	Total pigments	3,430,000	14,700	2,100,000	10,700	

XX Not applicable. -- Zero.

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

[2]Harmonized Tariff Schedule of the United States of America.

[3]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
WORLD PRODUCTION CAPACITY OF CHROMITE ORE, FERROCHROMIUM, CHROMIUM METAL, CHROMIUM CHEMICALS, AND STAINLESS STEEL, AND APPARENT CONSUMPTION IN 2008[1]

(Thousand metric tons of contained chromium)

	Production capacity					
Country	Ore	Ferrochromium	Metal	Chemicals	Stainless steel	Apparent consumption[2]
Afghanistan	2	--	--	--	--	--
Albania	90	21	--	--	--	-9
Argentina	--	--	--	13	--	24
Australia	80	--	--	--	--	-25
Austria	--	--	--	--	11	101
Belgium	--	--	--	--	259	200
Brazil	230	117	--	--	105	208
Canada	--	--	--	--	--	23
China	60	770	6	70	1,290	2,580
Cuba	10	--	--	--	--	--
Czech Republic	--	--	--	--	2	12
Finland	174	145	--	--	222	172
France	--	--	7	--	51	57
Germany	--	15	1	--	293	305
Greece	1	--	--	--	--	(3)
India	1,170	451	(3)	4	315	741
Indonesia	--	--	--	--	--	-2
Iran	74	4	--	2	--	-4
Italy	--	--	--	--	311	211
Japan	1	8	1	17	695	534
Kazakhstan	1,110	660	2	37	--	91
Korea, Republic of	--	--	--	--	389	220
Madagascar	42	--	--	--	--	-10
Oman	122	--	--	--	--	-34
Pakistan	97	--	--	3	--	-19
Philippines	14	--	--	--	--	-2
Poland	--	--	--	--	1	17
Russia	290	360	16	31	19	435
Slovakia	--	1	--	--	--	2
Slovenia	--	--	--	--	15	13
South Africa	2,910	1,960	--	23	117	164
Spain	--	--	--	--	214	106
Sudan	10	--	--	--	--	-25
Sweden	--	75	--	--	116	128
Taiwan	--	--	--	--	279	185
Turkey	210	38	--	17	--	-35
Ukraine	--	--	--	--	21	--
United Arab Emirates	10	--	--	--	--	-3
United Kingdom	--	--	7	17 [4]	69	70
United States	--	20	3	38	418	323
Vietnam	58	--	--	--	--	-1
Zimbabwe	240	135	--	--	--	56
Total	6,950	4,780	43	272	5,210	XX

XX Not applicable. -- Zero.

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

[2]Apparent consumption is chromite ore production plus chromite ore, ferrochromium, and chromium metal net imports. Net imports are imports minus exports. Based on data reported by the International Chromium Development Association. A negative apparent consumption indicates that exports are greater than production plus imports.

[3]Less than ½ unit.

[4]Production was planned to cease in June 2009.

TABLE 8

CHROMITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons, gross weight)

Country[3]	2004	2005	2006	2007	2008
Afghanistan[4]	6,600	6,800	7,300	7,300 e	7,000 e
Albania[5]	160,300 r	170,000 r	210,120 r	323,570 r	203,850
Australia	265,987	241,865	258,087 r	253,400 r	224,809
Brazil[6]	593,476	616,534	562,739	627,772	630,000 p, e
Burma[4]	360	410	-- r	-- r	--
China[e]	200,000	200,000	200,000	200,000	200,000
Cuba	40,300	34,000	27,900	25,000	25,000 e
Finland	579,780	571,103	548,713	556,100	613,543
Greece[4]	1,600	1,500	1,500	1,400	1,400 e
India	2,948,944	3,255,162	3,600,400	3,320,000	3,900,000
Iran	138,775	223,563	244,603	185,760	188,000
Kazakhstan	3,287,100	3,581,242	3,366,078	3,687,200	3,629,000
Madagascar	77,386	140,847	132,335	122,260 r	84,000
Oman	26,600 r	50,400 r	70,500	407,822 r	784,082
Pakistan	129,500	148,432	199,000	323,100	320,000 e
Philippines	42,140	38,081	46,728	31,592 r	15,268
Russia	320,200	772,000	966,065	776,681	750,000 e
South Africa	7,677,000	7,552,000	7,418,326	9,646,958	9,682,640 p
Sudan	26,000	21,654	28,772	15,476	31,890
Turkey	506,421	688,377	1,059,901 r	1,678,932 r	1,885,712
United Arab Emirates	7,089	--	--	19,000	34,350
Vietnam	194,909	78,915	73,037	103,830	55,880
Zimbabwe	621,269 r	819,903 r	712,908	663,593	484,482
Total	17,900,000 r	19,200,000 r	19,700,000 r	23,000,000 r	23,800,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through August 7, 2009.

[3]Figures for all countries represent marketable output unless otherwise noted.

[4]Gross weight estimated assuming an average grade of 44% chromic oxide (Cr_2O_3).

[5]Direct shipping plus concentrate production.

[6]Average chromic oxide (Cr_2O_3) content was as follows: 2004–42.6%; 2005–41.1% (revised); 2006–40.6% (revised); and 2007–40.3% (revised).

TABLE 9

FERROCHROMIUM: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons, gross weight)

Country	2004	2005	2006	2007	2008[e]
Albania	34,650	34,400	17,040	-- [r]	11,916 [3]
Brazil[4]	216,277	197,653	166,577	195,890 [r]	196,000 [p]
China[e]	640,000	850,000	1,000,000	1,300,000 [r]	1,400,000
Finland	264,492	234,881	243,350	241,760	233,550 [3]
Germany	24,857	22,672	26,710	22,030	26,960 [3]
India[5]	527,100	611,373	634,200	820,000 [r]	750,000
Iran[e]	7,750 [3]	8,000	7,000	8,000	8,000
Japan[4]	13,472	12,367	13,056	12,016 [r]	12,500
Kazakhstan	1,080,993	1,156,168	1,200,000 [e]	1,307,536 [r]	1,220,315 [3]
Russia[e]	454,000	578,000 [3]	600,000	570,000	530,000
Slovakia	1,784	867	19	-- [r]	--
South Africa[6]	2,965,000	2,812,000	3,030,000	3,561,491	3,100,000
Sweden	128,191	127,451	136,374	124,403	117,053 [3]
Turkey	33,686	26,043	67,975	69,730	79,840 [3]
United States[7]	W	W	W	W	W
Zimbabwe[e]	193,077 [3]	235,000	200,000	150,000	150,000
Total	6,590,000	6,910,000	7,340,000	8,380,000 [r]	7,840,000

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table inculdes data available through July 1, 2009.

[3]Reported figure.

[4]Includes high- and low-carbon ferrochromium.

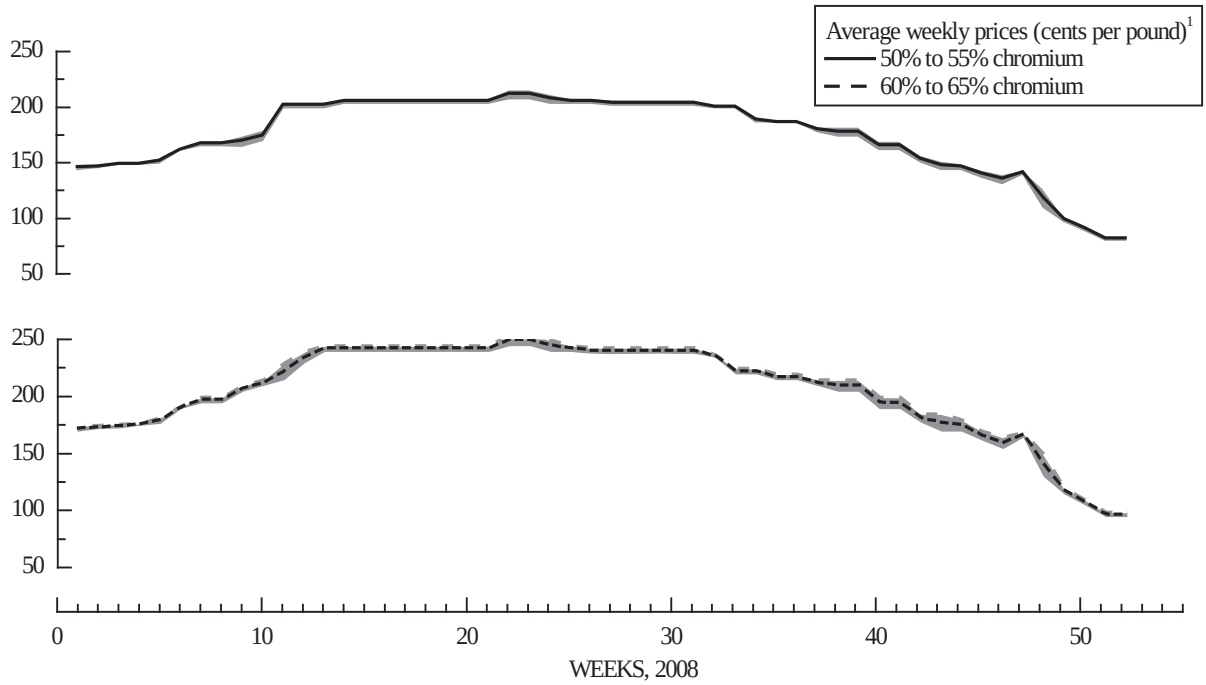
[5]Includes ferrochrome and charge chrome.

[6]Includes high- and low-carbon ferrochromium and ferrochromiumsilicon.

[7]Includes chromium metal, high- and low-carbon ferrochromium, ferrochromiumsilicon, and other chromium materials.

FIGURE 1

U.S. IMPORTED HIGH-CARBON FERROCHROMIUM IN 2008

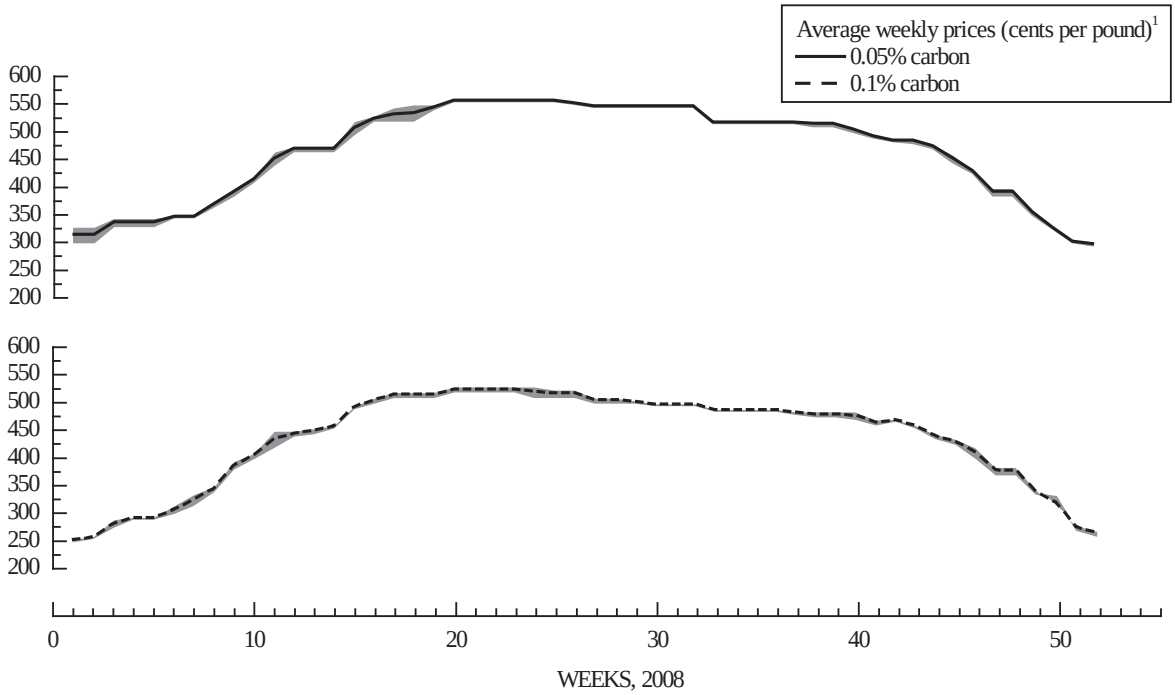


[1]Average weekly price shown against price range background.

Source: Platts Metals Week

FIGURE 2

U.S. IMPORTED LOW-CARBON FERROCHROMIUM IN 2008



[1]Average weekly price shown against price range background.

Source: Platts Metals Week