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MANGANESE

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MANGANESE

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In 2005, U.S. manganese apparent consumption was an estimated 766,000 metric tons (t), a 24% decrease from 1.01 million metric tons (Mt) in 2004 (table 1). Decreases in manganese ore shipments from the Government's National Defense Stockpile, and ferromanganese, silicomanganese, and manganese metal imports accounted for most of the decline in apparent consumption.

Manganese imports decreased by 9% on a content basis compared with those of 2004 (table 6). Manganese exports decreased by 66% compared with those of 2004 on a content basis, based on the typical manganese contents of the materials noted in table 5.

In 2005, the price of ore rose from that of 2004, while the average prices of manganese ferroalloys declined (except manganese metal). The price of metallurgical-grade ore increased by 63% internationally. Prices for high- and medium-carbon ferromanganese and silicomanganese declined from the historic high in 2004 by 52%, 31%, and 42%, respectively.

In 2005, sales of manganese materials from the Government's National Defense Stockpile (NDS) reduced the Government's inventory of manganese by 10% (content basis), leaving an inventory of 94% of the annual apparent consumption. The larger disposals (reported sales) were of metallurgical-grade ore and high-carbon ferromanganese.

World production of manganese ore in 2005 rose by 5% on a gross-weight basis and by 9% on a contained-weight basis, compared with that in 2004 (table 7). China was the leading producer on a gross-weight basis; South Africa was the leading producer on a contained-weight basis. Combined world production of ferromanganese and silicomanganese rose by 8% on a gross-weight basis compared with that in 2004 (table 8). China was the leading producer of these manganese ferroalloys.

Manganese is essential to iron and steel production by virtue of its sulfur-fixing, deoxidizing, and alloying properties. Steelmaking, including its ironmaking component, accounted for most of the domestic manganese demand, currently in the range of 85% to 90% of the total consumption. Among a variety of other uses, manganese is a key component of certain widely used aluminum alloys, and is used in oxide form in dry cell batteries.

Legislation and Government Programs

Air Quality, Emission Limits.—The U.S. Environmental Protection Agency (EPA) issued amended national emission standards for hazardous air pollutants (HAPs) for industrial, commercial, and institutional boilers and process heaters. One of the metallic HAPs at each of these sources is manganese. The EPA used a health-based alternative standard for manganese emissions (U.S. Environmental Protection Agency, 2005, p. 76921, 76933-76935).

Air Quality, Public Health Study.—In July, the Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Department of Health and Human Services reported the results of the residential-rain-water-cistern sampling investigation conducted by the Ohio Department of Health (ODH) on June 29, 2004. The ODH sampled 9 cisterns for 15 metals, including manganese, as part of the ATSDR investigation on potential health impacts from air emissions around the former Union Carbide facility complex near Marietta, OH. The complex is currently occupied by Chevron-Phillips Chemical Company, Eramet Marietta, Inc., Eveready Battery, and Solvay Advanced Polymers, LLC. The ODH found that the levels of metals detected in the cistern water would not be expected to cause adverse health effects to the residents (Agency for Toxic Substances and Disease Registry, 2005§[1]).

Stockpile.—The revised Annual Materials Plan (AMP) for fiscal year 2005 that the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency issued on February 1, 2005, covered the period from October 1, 2004, through September 30, 2005. Under this AMP, the maximum disposal authority for manganese materials was 453,592 t for metallurgical-grade ore; 90,718 t for the high-carbon ferromanganese; 36,287 t for chemical-grade ore; 27,216 t for natural battery-grade ore; 2,732 t for synthetic manganese dioxide; and 1,814 t for electrolytic manganese metal (Defense National Stockpile Center, 2005). The maximum disposal authority under an AMP is the maximum quantity of material that may be disposed in a given fiscal year as authorized by Congress; these may differ from the disposal authority quantities listed in table 2.

For 2005, disposals (reported sales) of manganese materials announced by the DNSC totaled 248,981 t for stockpile-grade metallurgical-grade ore; 69,967 t for high-carbon ferromanganese; 34,542 t for chemical-grade ore; 2,964 t for synthetic manganese dioxide; and 1,083 t for natural battery-grade ore.

The NDS physical inventory of manganese materials, in gross weight, indicated that all inventories decreased except stockpile-grade metallurgical ore (increased by 106,694 t). The decreases consisted of 308,187 t for nonstockpile-grade metallurgical ore; 49,250 t for high-carbon ferromanganese; 11,503 t for chemical-grade ore; 5,532 t for natural battery-grade ore; and 2,466 t for electrolytic manganese metal (Defense National Stockpile Center, unpub. data, December 2005). In 2005, the estimated manganese content of manganese inventories being held by the Government at yearend was lowered by 10% to 721,000 t. On the basis of manganese content, the total remaining inventory was 94% of the current national apparent consumption.

[1]References that include a section mark (§) are found in the Internet References Cited section.

Production

Ore and Concentrate.—The only mine production of manganese in the United States consisted of small amounts of manganiferous material having a natural manganese content of less than 5%. This type of material was produced in South Carolina for use in coloring brick.

Chemicals, Ferroalloys, and Metal.—Production statistics for these materials were concealed to avoid disclosing company proprietary data. Domestic producers of manganese ferroalloys, metal, and synthetic dioxide are listed in table 3.

Globe Metallurgical Inc., a U.S. silicon company, produced silicomanganese for the first time during January through March. In March, Prince Mineral Company, Inc. acquired American Minerals, Inc., a manganese chemical producer, from Imerys SA of France (Palladium Equity Partners LLC, 2005§).

Highlanders Alloy LLC sporadically produced silicomanganese during the year; the company reportedly shut down a furnace in April after restarting it in October 2004, resumed production in August 2005 and then was shut down again in October and November (Ryan's Notes, 2005b, g). On May 27, Highlanders and its holding company, Global Industrial Projects LLC, filed Chapter 11 bankruptcy (Ryan's Notes, 2005c). On January 6, 2006, the U.S. bankruptcy court agreed to the $20 million sale of Highlanders to Felman Production, a Delaware corporation owned by Ukrainian Privat Group (Ryan's Notes, 2006a). The new owners planned to produce high-carbon ferromanganese and silicomanganese (Ryan's Notes, 2006b).

In October, Kerr-McGee Corp. (a division of Anadarka Petroleum Corporation) spun off its chemical business, which included electrolytic manganese dioxide, through an initial public offering (IPO) of its wholly owned subsidiary Tronox Incorporated (formerly Kerr-McGee Chemical LLC) (Anadarka Petroleum Corporation, 2005§). The IPO closed on November 28 (Tronox Incorporated, 2005§).

Consumption, Uses, and Stocks

Data relating to manganese end use and certain other information have indicated that metallurgical applications account for most domestic manganese consumption, 85% to 90% of which has been for steelmaking. In 2005, reported U.S. ore consumption indicated that unit consumption of manganese in ironmaking, which could not be published to avoid disclosing company proprietary data, declined from that of 2004 to remain a relatively minor component of overall manganese use in steelmaking. Reported consumption (gross weight) of silicomanganese, manganese metal, and ferromanganese decreased from that in 2004, by 16%, 12%, and 9%, respectively (table 4). Because of the incompleteness of reporting to the U.S. Geological Survey (USGS) voluntary consumption survey, the figures in this table are more representative of relative rather than absolute quantities.

Data on domestic consumption of manganese ore, exclusive of that consumed within the steel industry, are collected by means of the "Manganese Ore and Products" survey. In 2005, 12 firms were canvassed that process ore or had processed ore in the past by such methods as grinding and roasting or that consume ore in the manufacture of dry cell batteries and manganese ferroalloys, metal, and chemicals. Of those 12 companies, 9 consumed manganese ore in their processes. The collective consumption of these firms is thought to constitute all the manganese ore consumption in the United States, exclusive of that by the steel industry. Full-year responses or a basis upon which to estimate the data were obtained from all of these firms for 2005, excluding Highlanders.

The combination of the indicated consumption pattern with estimates of apparent consumption, on a gross-weight basis, suggests that manganese unit consumption in steelmaking was 5.4 kilograms per ton (kg/t) or 1.9 times that calculated on the basis of reported consumption in 2005. This level was 29% less than the revised quantity of 7.6 kg/t estimated for 2004 and was a result of significant decreases in apparent consumption of ferromanganese and silicomanganese. Decreases in apparent consumption were attributable to significant decreases in imports of these materials.

Relatively small quantities of manganese were used for alloying with nonferrous metals, chiefly in the aluminum industry as manganese-aluminum briquettes that typically contained either 75% or 85% manganese. Manganese plays an important alloying role in aluminum to increase corrosion resistance. The most important use of aluminum-manganese alloys is in the manufacture of soft drink cans. Other uses include automobiles, cookware, radiators, and roofing (Harben and others, 1998, p. 80-105).

Comparatively small amounts of manganese were used domestically in animal feed, brick coloring, dry cell batteries, fertilizers, and manganese chemicals. These were among the many nonmetallurgical applications of manganese (Weiss, 1977, p. 221-323; Harben and others, 1998, p. 80-105). The source of manganese units for these applications was mainly manganese ore.

In 2005, domestic consumption of manganese ore decreased by 17% to 368,000 t, while corresponding yearend stocks increased by 112% to 337,000 t (table 1). To avoid disclosing company proprietary data, these figures exclude the relatively small quantities associated with ironmaking and cannot be disaggregated into end-use segments.

Prices

Manganese Ore.—The USGS estimated the average annual contract price of metallurgical-grade ore containing 48% manganese to be $4.39 per metric ton unit (mtu). Prices were above or below this value, depending on ore quality, time of year, and nature of transaction. The year-average spot market price for this grade of ore based on weekly averages of North American transaction prices as reported by Ryan's Notes was $3.21 per mtu. The range in spot market prices hit a high in March at $4.20 to $4.50 per mtu, and a low in early December at $2.30 to $2.40 per mtu. The price of a metric ton of ore is obtained by multiplying the mtu price by the percentage manganese content of the ore; for example, by 48 when the manganese content is 48%. The ore market consisted of a number of submarkets because of differences between ores according to such end uses as ferroalloy production, blast furnace ironmaking, and manufacture of manganese chemicals.

The price of manganese in ore in 2005 and 2004 was 43.9 and 28.9 cents per kilogram, respectively. These values indicate an increase of 52% in U.S. cost, insurance, freight (c.i.f.) price, or 17% less than the increase in free on board (f.o.b.) price in international markets compared with those in 2004.

In fiscal year 2005 (April 2005 to March 2006), the international benchmark price for metallurgical-grade ore increased by 63% from that in 2004, when price negotiations between BHP Billiton Ltd. and major Japanese consumers were concluded in February. On an f.o.b. basis for delivery during the annual contract year, the agreed price was $3.99 per mtu for ore from the Groote Eylandt Mine in Australia (Ryan's Notes, 2005d). The rise in manganese ore prices was attributable primarily to increased demand for manganese ferroalloys by the steel industry coupled with tight ore supplies and rising transportation costs.

Manganese Ferroalloys and Metal.—Prices for manganese ferroalloys tend to vary in response to changes in demand by the steel and ferrous foundry industries, while those of manganese metal predominantly follow changes in demand by the aluminum industry. Manganese ferroalloy prices are also influenced by changes in the product mix of the world's suppliers because they are largely interchangeable.

Year-average import prices for manganese ferroalloys are given by Platts Metals Week. These prices are based on free market spot prices per unit of measurement, f.o.b. Pittsburgh, PA, or Chicago, IL, warehouse. Year-average import prices were $638.83 per gross ton for high-carbon ferromanganese, 59.37 cents per pound for medium-carbon ferromanganese, and 34.84 cents per pound for silicomanganese. These prices were 52%, 31%, and 42% lower, respectively, than those of 2004. The year-average price for manganese metal is based on weekly averages of North American transaction prices published by Ryan's Notes for bulk shipments of manganese metal, f.o.b. Chicago, IL or Pittsburgh, PA, warehouse. The year-average North American transaction price for manganese metal was 89.20 cents per pound, which was a 2% increase compared with that of 2004. The year-average price for manganese metal was 22% less than the last listed U.S. price for domestically produced electrolytic manganese metal of $1.15 per pound at the beginning of 1996.

Prices for both grades of ferromanganese and silicomanganese declined based on decreased demand from the domestic steel sector and greater supply during 2005. Manganese metal prices rose in response to increased demand from the domestic aluminum sector.

According to Platts Metals Week, the price range for high-carbon ferromanganese containing 78% manganese, per gross ton, began the year unchanged from the end of 2004 at $880 to $950 and ended the year at $710 to $750, for a net decrease of 20%. The price range for medium-carbon ferromanganese with a manganese content of 80% to 85% and a nominal carbon content of 1.5%, per pound of manganese, began the year at 78 to 82 cents (about the same as that of yearend 2004) and ended the year at 48 to 51 cents, for a net decrease of 38%. The price range for imported silicomanganese with 2% carbon, per pound of alloy, started the year unchanged from that at the end of 2004 at 40 to 43 cents and ended 2005 at 36 to 39 cents, for a net decrease of 10%.

According to the North American transaction prices listed by Ryan's Notes, the 2005 yearend price of bulk manganese metal shipments was 70 to 74 cents per pound, a net decrease of 26% from the 2004 yearend price of 95 to 100 cents per pound.

Foreign Trade

In the absence of domestic mine production and recycling, U.S. net import reliance, as a percentage of apparent consumption, was 100% for manganese, the same as it has been for the past 20 years. The ensuing comparisons of foreign trade data were made on the basis of gross weight.

U.S. exports of ferromanganese, manganese dioxide, and silicomanganese increased during 2005, while exports of manganese metal and ore decreased (table 5). The biggest year-to-year change in exports was that of manganese ore, which decreased 89% compared with those in 2004. China accounted for 47% of manganese ore exports, followed by France at 24%.

U.S. imports of manganese dioxide and manganese ore increased during 2005 compared with those of 2004, while imports of ferromanganese, manganese metal, potassium permanganate, and silicomanganese fell (table 6). The most significant year-to-year change was for imports of manganese ore; these were 45% more than those of 2004. Increases in this import subcategory were especially notable for those from Gabon, with an increase of 123,000 t (34%), and from South Africa, with an increase of 41,000 t (153%) year-on-year.

Imports of spiegeleisen (pig iron containing 20% manganese) decreased to 291 t in 2005 from 389 t in 2004, on a gross-weight basis, with a total customs value of $291,454 or $1,000 per metric ton. Most of these imports were from South Africa (99%), with the remaining from India (U.S. Census Bureau, unpub. data, December 2005).

Pending U.S.-Southern African Customs Union Free Trade Agreement.—Representatives from the Office of the United States Trade Representative (USTR) and member nations of the Southern African Customs Union (Botswana, Lesotho, Namibia, South Africa, and Swaziland) continued negotiations on the pending U.S.-Southern African Customs Union Free Trade Agreement (FTA). In April 2006, the parties agreed to establish a framework for pursuing the FTA over the longer term (Office of the United States Trade Representative, 2006§). The USTR launched negotiations for the FTA on June 2, 2003 (Office of the United States Trade Representative, 2003§). The FTA could result in the permanent elimination of the 14% ad valorem duty on all imports of unwrought manganese—manganese flake [Harmonized Tariff Schedule of the United States (HTS) subheading 8111.00.47] and "other" unwrought manganese articles, such as manganese powder and manganese-aluminum briquettes (HTS subheading 8111.00.49)—from South Africa.

Silicomanganese Imports from Brazil (December 1, 2002, through November 30, 2003).—On April 13, the International Trade Administration (ITA) of the U.S. Department of Commerce made a final determination that two of Companhia Vale do Rio Doce's (CVRD) wholly owned subsidiaries—Rio Doce Manganês S.A. (RDM) and Urucum Mineracao S.A. (Urucum)—did not sell the subject imports at prices below

normal value, and as a result no duty would be imposed (International Trade Administration, 2005a).

Silicomanganese Imports from Brazil (December 1, 2003, through November 30, 2004).—On September 9, the ITA preliminarily determined that RDM and Urucum did not sell the subject imports at prices below normal value, and as a result no duty would be imposed (International Trade Administration, 2005b).

Potassium Permanganate Imports from China.—On May 18, the U.S. International Trade Commission (ITC) announced the results of its 5-year (sunset) review of the antidumping duty order on potassium permanganate from China. The ITC found that revocation of the existing antidumping duty order would likely lead to a continuation or recurrence of material injury within the foreseeable time to the domestic industry. Therefore, the existing order would remain in place (U.S. International Trade Commission, 2005§).

World Industry Structure

The bulk (97%) of manganese ore was produced in 10 countries. On a content basis, the leading producer countries of manganese ore were, in decreasing order, South Africa, Brazil, Australia, Gabon, China, and Ukraine (table 7). On a gross weight basis, the leading producer countries of manganese ferroalloys were, in decreasing order, China, Ukraine, South Africa, Brazil, Japan, Norway, Australia, and Russia (table 8).

Francaviglia (2006§) estimated that world apparent consumption of manganese ferroalloys declined by 2% to 10.7 Mt in 2005 compared with that of 2004. Of that amount, 6.1 Mt was silicomanganese, 3.6 Mt was high-carbon ferromanganese, and 1.0 Mt was refined (medium- and low-carbon) ferromanganese. Manganese ore apparent consumption was 10.75 Mt (content basis), about the same as that of 2004.

World Review

Australia.—The Australian Government reported manganese ore resources increased by 7.6% in 2004 to 133 Mt, primarily because of the addition of Bootu Creek resources in the Northern Territory and an increase in resources at the Woodie Woodie Mine. (These resources are described in the Manganese chapter of the 2004 Minerals Yearbook, volume I, Metals and Minerals). Manganese ore reserves that met the Australasian Joint Ore Resources Committee (JORC) code were 95 Mt in 2004, all of which were located in the Groote Eylandt deposit owned by Groote Eylandt Mining Company Pty. Ltd. (GEMCO) in the Northern Territory (Geoscience Australia, 2005§).

Bootu Creek Resources Pty. Ltd. (a subsidiary of Singapore's OM Holdings) continued development of a 600,000-metric-ton-per-year (t/yr) manganese mine in the Northern Territory. Mine operations were expected to start in March or April 2006 (Intierra Resource Intelligence, 2005§). In December, the company assumed complete ownership of the project by acquiring GEMCO's remaining 25% interest (OM Holdings Limited, 2005§).

In December, Churchill Mining PLC purchased Black Peak Holdings Pty. Ltd.'s 20% stake in the mining tenement that includes the Enacheddong Creek prospect within Churchill's South Woodie Woodie Manganese project area. As a result, Churchill now wholly owns the tenement (Churchill Mining PLC, 2005§). The South Woodie Woodie Manganese Project is located 40 kilometers south of Consolidated Minerals Ltd.'s Woodie Woodie Mine. The highest priority target within the project area is the Enacheddong Creek prospect; rock samples collected during 2005 returned assays up to 51.5% manganese, with 57 of 74 samples containing greater than 30% manganese. The company continued to explore other deposits in the region (Churchill Mining PLC, 2006§).

Consolidated Minerals Ltd. (2006§) reported a 46% increase in manganese ore production to 888,432 t at its Woodie Woodie Mine during fiscal year 2006 (July 1, 2005, to June 30, 2006). Production capacity also increased to 1.1 million metric tons per year (Mt/yr) of 48% manganese ore from 800,000 Mt/yr. As a result of recent exploration activities, the company augmented its total manganese resources by 823,900 t to 15.5 Mt, after allowance for depletion by mining. Of that amount, JORC reserves were estimated to be 9.5 Mt with an average grade of 42.7% manganese. The increased resources equate to a 15-year mine life.

Bahrain.—Bahrain Ferroalloys B.S.C. (c) planned to start a new ferroalloys plant in May by first producing manganese ferroalloys. Initial production capacity was set at 60,000 t/yr, increasing to 90,000 t/yr in 2006 (Metal-Pages, 2005a§). The plant, located in the Hidd Industrial Area, is the first nonintegrated ferroalloy producer in the country. The plant can produce a mix of alloys, which includes ferrochromium, ferrosilicon, high- and medium-carbon ferromanganese, and silicomanganese (Bahrain Ferro Alloys B.S.C. (c), 2006§).

Brazil.—Mining Journal (2005a) reported that the production capacity of CVRD's Azul Mine, located in Carajas, State of Para, would expand to 2.5 Mt/yr by yearend 2005. In September, Carvalho (2005§) reported that CVRD would invest R$140 million ($59.4 million) through 2008 to modernize its Rio Doce Manganês ferroalloy processing plant located in Simoes Filho, State of Bahia. Of that amount, R$45 million ($19.5 million) would first be spent on installing a 165,000-t/yr sinter plant to agglomerate fine manganese ores for more efficient use in mill furnaces. As a result of these investments, productivity was expected to increase to 210,000 t/yr from 170,000 t/yr in 2005.

China.—To reduce ferroalloy and metal exports, China's Ministry of Finance revoked the 8% export tax rebate on ferromanganese and silicomanganese starting January 1, 2005, and the 13% export tax rebate on manganese metal effective August 1 (TEX Report, 2005e, Metal-Pages, 2004§). Effective August 22, China's Ministry of Commerce abolished its so-called preferential "Red Book" system for toll refining agreements whereby the 13% value-added tax on manganese ore imports and 5% export tax on manganese ferroalloy exports had been waived (TEX Report, 2005b). A toll refining agreement, or tolling, describes the situation in which the owner of ore or concentrate contracts the refining of the metal to another party for a fee, but the refined metal remains under the original ownership for final sale or disposition (U.S. Bureau of Mines, 1996).

The Central Government of China, through the National Development and Reform Commission (NDRC), estimated the

number of ferroalloy producers in the country to be 1,570; total installed production capacity was 22 Mt/yr (twice that of 2000). Some 1.16 Mt of ferroalloy capacity was under construction, with an additional 1.23 Mt planned. Ferroalloy production during the year was 10.67 Mt, and the amounts consumed, exported, and imported were 9.30 Mt, 1.74 Mt, and 370,000 t, respectively. China accounted for 40% of global ferroalloy production and 30% each of global consumption and exports (TEX Report, 2006c, d).

Because of overcapacity, the NDRC issued a bulletin on July 5 that established a national system for approving state-owned ferroalloy companies. The new system would also reduce energy consumption and increase environmental protection by the ferroalloys industry. The NDRC also set the following limits for energy consumed in the production of manganese ferroalloys: 5,800 kilowatthours per metric ton (kWh/t) of medium-carbon ferromanganese; 4,200 kWh/t of silicomanganese; and 2,600 kWh/t of high-carbon ferromanganese (TEX Report, 2005c, d).

As part of the approval process, state-owned ferroalloy producers were required to report the following information: total capital, profit, number of production facilities, the amount of energy consumed, and environmental protection controls at plant operations. Plant inspections would be conducted to verify compliance with regulations instituted in 2004 as described in the Silicon chapter of the 2004 Minerals Yearbook, volume I, Metals and Minerals. The NDRC announced the names of 33 manganese ferroalloy producers that met environmental standards as of December 31 (TEX Report, 2006c, d).

The Central Government of China also ordered electrolytic manganese metal producers in the Huaheng area of Hunan Province to cease operations in late September because of noncompliance with environmental regulations. The Government allowed one company, Dongfang Mengye, to restart production shortly thereafter. Dongfang's electrolytic manganese metal production capacity was reported to be 30,000 t/yr (TEX Report, 2005f). In 2005, China produced 569,000 t of electrolytic manganese metal, and had the capacity to produce 1.118 Mt/yr. Production was primarily centered in the following areas: Chongqing City, Guangxi Zhuang Autonomous Region, Guizhou Province, and Hunan Province. The number of Chinese electrolytic manganese metal producers was estimated to be 156 (TEX Report, 2006a).

China Metal Market (2005) reported that construction began in early spring on the Xianming Manganese Mine in Daxin County of Guangxi Zhuang Autonomous Region. The mine, with an initial investment of Y5 million (US$604,000), was to start in June. No production capacity or average grade of the 300,000-t proven manganese reserves was reported. According to the TEX Report (2006a), 600 mines produced 10.75 Mt of manganese ore in 2005; of that amount, 55% was manganese dioxide and 45% was manganese carbonate. Chinese manganese ore production capacity was estimated to be 12 Mt/yr.

Jinzhou Nichiden Ferroalloy Ferroalloy Co., Ltd. delayed the startup of its new 50,000-t/yr silicomanganese plant in the Liaoning Province until April 2006 from August 2005. Construction of the facility began in July 2005 (TEX Report, 2005h).

Eramet SA began construction of a new electrolytic manganese dioxide plant for alkaline batteries in Chongzuo, Guangxi Province. Total production capacity is planned to be 20,000 t/yr, starting with 10,000 t/yr in early 2007 (Eramet SA, 2006a§).

France.—In March, a major transformer failure caused a decline in production at Eramet's Dunkerque silicomanganese facility; a loss of at least 15,000 t was expected. The company made up for some of the lost output from its Norwegian facilities (Ryan's Notes, 2005a). From August to December, Rio Doce Manganèse Europe (CVRD) operated its ferroalloy plant in Dunkerque at 50% of capacity (5,670 metric tons per month) (Companhia Vale Do Rio Doce, 2006a§, b§).

Gabon.—Compagnie Minière Trois Rivières (CMTR) (a subsidiary of CVRD) continued exploring manganese deposits in the Franceville and Okondjá regions in Haute Ogooué Province. As part of its feasibility studies, CMTR began operating a pilot plant with a feed capacity of 5 metric tons per hour in Franceville at the end of 2005. Should the project prove feasible, CVRD announced it would invest US$33 million in infrastructure and logistics projects needed to commence mining; these would start in January 2007 and conclude in 2009 (Companhia Vale do Rio Doce, 2006c§).

According to Eramet SA's online manganese profile, production capacity at its Moanda Mine in Gabon would increase to 3.5 Mt/yr from 3 Mt/yr in 2008 (Eramet SA, 2006c§). The Moanda Mine is operated by the company's subsidiary Compagnie Miniere de l'Ogooue (Comilog). The company planned to spend €30 million (US$37.8 million) on the mine expansions (Ryan's Notes, 2005f). Gross production at the mine reportedly was 2.859 Mt in 2005 (Eramet SA, 2006b§).

Georgia.—The Chiatura district court initiated bankruptcy proceedings against Georgian manganese ore producer Chiaturmarganets. This action will allow the future sale of the company's net assets (Interfax Metals & Mining Weekly, 2005).

Ghana.—Ghana Manganese Company Limited increased production at its Nsuta Mine by 5.8% to 1.6 Mt in 2005 (Mining Journal, 2005b).

Kazakhstan.—The parent company of Alloy 2000, owner of the Zhairem GOK manganese mine complex (Zhairem) located in the Karaganda Region, reorganized as Eurasian Natural Resources Corporation (ENRC) in October. ENRC is based in Zurich, Switzerland. As a result, Alloy 2000 changed its name to ENR Ferroalloys AG (TEX Report, 2005a).

Sittard (2005§), chairman and chief executive officer of ENRC, reported the following information: (1) manganese ore reserves of 10.8 Mt (22.8% manganese content) at the Tur Mine, 3.9 Mt (19% manganese content) at the Vostochny Kamys Mine, and 91 Mt (28% manganese content) at Zhairem; (2) total manganese concentrate capacity in 2004 was 700,000 t/yr; (3) construction of a new 400,000-t/yr ore preparation (dressing) plant at Vostochny Kamys Mine by 2006; and (4) capital investments in Zhairem were planned at US$16 million in 2004, US$30 million in 2005, US$17.5 million in 2006, US$11 million in 2007; US$7.5 million in 2008, and US$2 million in 2009. The planned expansions at Zhairem would increase production capacity to 1.8 Mt/yr by yearend 2006 and to 2.5 Mt/yr by 2008 (TEX Report, 2005g).

Mexico.—Minera Autlán planned to start its new US$5 million sinter plant at the company's Tamós ferroalloy plant during the third quarter of 2005. The plant would have an annual production capacity of 300,000 t/yr (Metal Pages, 2005b§).

Norway.—From August to December, Rio Doce Manganese Norway (owned by CVRD) curtailed ferroalloy production at its Mo I Rana plant. Production capacity of the plant is 110,000 t/yr (Companhia Vale do Rio Doce, 2006a§, b§).

Russia.—In 2005, Chelyabinsk Electrometallurgical Kombinat (Chelyabinsk) expected to produce 275,000 t of high-carbon ferromanganese, and 125,000 t of low-carbon ferromanganese (TEX Report, 2005i).

Sittard (2005§) reported that silicomanganese production in Russia during 2004 was 113,000 t, and ferromanganese production was 87,500 t. The major silicomanganese producer in 2004 was Chelyabinsk at 97%. OAO Kosgorsky Metallurgical Plant and Satkinsky Iron Works accounted for 52% and 48% of the ferromanganese domestic market in 2004, respectively.

South Africa.—The South African Government awarded new manganese leases (or farms) to seven companies pursuant to the mining charter requirements mandated by the South African Mineral and Petroleum Resources Development Act of 2002; these became effective May 1, 2004. The mining charter, which was established, in part, to encourage black economic empowerment (BEE), calls for a 26% ownership of South African mining industry assets by historically disadvantaged South Africans (HDSAs) in 10 years, with a 15% HDSA-ownership level in 5 years (South Africa Department of Minerals and Energy Affairs, 2002§). As noted in the charter, HDSAs include blacks, people living in mining communities, and women.

Ownership of the new manganese leases are as follows: Asia Minerals Ltd (Hong Kong) and Dirleton Minerals & Energy (Pty.) Ltd. (South Africa) will divide the Devon, Hotazel, Kipling, Perth, Telele, and York farms; Metmar Trading (Pty.) Ltd. (Kalahari Rescources (Pty.) Ltd., South Africa), the Gama, Olive Pan, and Umtu farms; Renova Group (Russia) and its BEE partners, Chancellor House and Pitsa Ya Setshaba Holdings, the Botha, Middelplatts, Mooidraai, Rissik, Roldraai, and Smartt farms; and Xstrata Plc (Switzerland) and its BEE partner, Ditswammung Mineral Resources Consortium, the Belgravia, Bergheim, Epsom, Olivewood, Santoy, and Tigerplan farms (Ryan's Notes, 2005h).

By the end of September, Highveld Steel and Vanadium Corporation Limited (2005b§) brought five of its seven manganese ferroalloy furnaces back online at its Transalloys plant. The company had shut all the furnaces down in June because of low export prices, high electricity, and raw material costs (Highveld Steel and Vanadium Corporation Limited, 2005a§). The plant comprises two medium-carbon ferromanganese and five silicomanganese furnaces (Ryan's Notes, 2005i).

Ukraine.—Sittard (2005§) reported that silicomanganese and ferromanganese production in Ukraine was 900,000 t and 430,000 t, respectively. The major silicomanganese producers in 2004 were Nikopol Ferroalloy Plant (NFZ) (68%) and OAO Zaporozhsky Ferro-Alloy Works (32%). NFZ, Kramatorsky Metallurgical Plant, and Zaporozhsky accounted for 65%, 18%, and 17% of the ferromanganese domestic market, respectively.

The dispute between NFZ and the Ukrainian manganese ore producers continued in 2005. Since 2003, NFZ sporadically purchased manganese concentrates from Ordzhonikidziyevsky GOK, the country's largest manganese ore producer, because it thought they were overpriced (Interfax Metals & Mining Weekly, 2004). NFZ turned to imports to meet all its raw material needs in October 2004, shortly after the Ukrainian government ruled against applying special measures on manganese ore imports (Metal-Pages, 2005c§).

In addition to its impasse with Ukrainian manganese ore producers, NFZ was beset by uncertainties in ownership during 2005. In late August, the Dnipropetrovsk Regional Economic Court (DREC) ruled that Ukrainian Interpipe Group's purchase of 50% plus one share in NFZ from the State Property Fund of Ukraine (SPFU) in 2003 was illegal, and ordered the Government to reprivatize NFZ (Ryan's Notes, 2005e, p. 2). The Supreme Court upheld the DREC decision in January 2006 (State Property Fund of Ukraine, 2006a§). In February 2006, Ryan's Notes (2006c) reported that the Ukrainian Government had asked the country's privatization board to prepare NFZ for reprivatization, although it had not yet received the disputed Interpipe shares being held by Ukrsocbank. The Ministry of Justice confirmed on February 23, 2006, that the SPFU could not become owner of those shares until Ukrsocbank transferred them (State Property Fund of Ukraine, 2006b§). In addition to the court cases, the Parliament passed a law to prevent the NFZ sale on February 9, 2006; the law was vetoed by President Victor Yushcenko on February 20, 2006 (President of Ukraine, 2006§).

Current Research and Technology

Among many items in the current literature that reported on various aspects of manganese and the topics addressed were the following:

Battery Technology.—A123Systems, Watertown, MA, introduced new lithium-ion rechargeable batteries whose cathodes are made out of nanoscale-phosphate materials doped with metal ions, such as manganese (Amato, 2006, p. 82). The company reported that the new batteries have up to five times the power density and 10 times the life of current rechargeable, high-power batteries. Targeted applications include advanced medical devices, consumer electronics, hybrid vehicles, and mobility products, such as electric scooters, power tools, and robotics (A123Systems, 2005§).

Environment and Toxicology.—Researchers at the Medical Research Council's Institute for Environment (University of Leicester, England) and the Institute of Occupational Medicine recommended a respirable manganese limit of 0.1 milligrams per cubic meters (mg/m^3), and a supplementary respirable limit of 0.5 mg/m^3 in cases where gastrointestinal exposure is significant after inhalation, for workers exposed to inorganic forms of manganese. A short-term occupational exposure limit is not required (Institute for Environment and Health/Institute of Occupational Medicine, 2004§).

Wyckoff and McBride (2004) reported on the health effects and increasing number of worker lawsuits in the United States resulting from occupational exposure to manganese from welding.

Manganese Ocean Nodules.—The United Nations' International Seabed Authority (ISA) (2005§) deferred consideration and adoption of new regulations governing the exploration of deep seabeds for deposits such as polymetallic sulfide nodules and cobalt-rich iron-manganese crusts. As these sites are typically in international waters, the ISA has been trying to develop complex regulations dealing with legal, business, and environmental issues regarding their mining and dredging (Mining Journal, 2005c).

Pyrometallurgy.—Kumba Resources Limited successfully demonstrated its new AlloyStream™ technology to produce ferromanganese directly from fine manganese ore at its Pretoria, South Africa, pilot plant. The use of such ores was previously limited by existing smelting technologies (Kumba Resources Limited, 2006§). The AlloyStream technology reportedly lowers the cost of ferromanganese production by 30% to 50% by using cheaper reductant and less electric power than conventional technology (Metals Place, 2006§).

Outlook

The trend of domestic and global demand for manganese is expected to follow closely that of steel production, for which the combined annual growth rates have been typically in the range of 1% to 2% in the United States. Although growth rates for some nonmetallurgical components of manganese demand, especially batteries, may be higher than for steel production, this situation will have only a minor effect on overall manganese demand.

Details of the outlook for the steel industry are discussed in the Outlook section of the Iron and Steel chapter of the 2005 USGS Minerals Yearbook, volume I, Metals and Minerals. Raw steel production decreased by 5% in the United States while increasing 6% globally from that in 2004. According to the International Iron and Steel Institute, world apparent consumption of finished steel products increased by 4.1% to 1,013 Mt in 2005 from that in 2004 (International Iron and Steel Institute, 2006§). This increase was primarily attributed to steel consumption in Asia, particularly in China. Asia accounted for 55% of steel consumed worldwide in 2005, up 10.1% to 554.9 Mt from that in 2004. China alone consumed 315 Mt, a 16.7% increase from that of the prior year. Steel consumption in 2005 was also up in Africa, the Commonwealth of Independent States, and the Middle East.

As evidenced in 2005, manganese apparent consumption does not always track steel production precisely because of the influence of unmeasured changes in stocks of manganese materials, such as those of importers and consumers. The effect of this may outweigh changes in demand by steelmakers and may explain why for some years calculated apparent consumption showed positive or negative deviations from that which could be estimated on the basis of steel production.

Demand for manganese metal comes primarily from the aluminum industry followed by the steel industry. The outlook for the aluminum industry is discussed in the Outlook section of the Aluminum chapter of the 2005 USGS Minerals Yearbook, volume I, Metals and Minerals.

Demand for EMD comes from the primary and secondary battery industries. As a rough indicator of EMD demand, U.S. demand for primary and secondary batteries is projected to increase 5.9% annually through 2009 to $14.8 billion. Of that amount, secondary battery demand was 65%. Secondary battery sales were forecast to rise faster than those of primary batteries, at an annual rate of 6.5% compared with 5.0% for primary batteries, owing in part to strong growth in the use of high-drain portable electronic products (Freedonia Group, Inc., The, 2005§).

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TABLE 1
SALIENT MANGANESE STATISTICS[1]

(Thousand metric tons, gross weight, unless otherwise specified)

	2001	2002	2003	2004	2005
United States:					
Manganese ore (35% or more Mn):					
Exports	9	15	18	123	13
Imports for consumption	358	427	347	451	656
Consumption[2]	425	360	398	441	368
Stocks, December 31, consumers[2]	138	151	156	159	337
Ferromanganese:					
Exports	9	9	11	9	14
Imports for consumption	251	275	238	429	255
Consumption	266	253	248	315	286
Stocks, December 31, consumers and producers	25	21	20	25 r	30
Consumption, apparent, manganese content[3]	692	696	643	1,010 r	766
Ore price, c.i.f.[4] U.S. ports, dollars per metric ton unit	2.44	2.30	2.41	2.89	4.39
World, production of manganese ore	20,900	22,200 r	24,100 r	27,700 r	29,100 e

eEstimated. rRevised.
[1]Data are rounded to no more than three significant digits.
[2]Exclusive of iron and steel plants.
[3]Based on estimates of average content for all significant components except imports, for which content is reported.
[4]Cost, insurance, and freight.

TABLE 2
U.S. GOVERNMENT DISPOSAL AUTHORITIES AND INVENTORIES FOR MANGANESE MATERIALS AS OF YEAREND 2005[1]

(Metric tons, gross weight)

		Physical inventory[e]				
		Uncommitted			Sold,	
Material	Disposal authority	Stockpile grade	Nonstockpile grade	Total	pending shipment	Grand total
Synthetic manganese dioxide	--	--	--	--	266	266
Natural battery ore	--	--	--	--	18,400	18,400
Chemical ore	--	--	--	--	27,000	27,000
Metallurgical ore	144,000	--	144,000	144,000	265,000	409,000
High-carbon ferromanganese	612,000	612,000	--	612,000	14,900	627,000
Electrolytic metal	--	--	--	--	--	--

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

Source: Defense National Stockpile Center.

TABLE 3
DOMESTIC PRODUCERS OF MANGANESE PRODUCTS IN 2005

Company	Plant location	Products[1]			Type of process
		FeMn	SiMn	MnO_2	
Energizer Holdings, Inc., Eveready Battery Co.	Marietta, OH			X	Electrolytic.
Erachem Comilog	Baltimore, MD			X	Chemical.
Do.	New Johnsonville, TN			X	Electrolytic.
Eramet Marietta Inc.	Marietta, OH	X	X		Electric furnace.
Globe Metallurgical, Inc.[2]	Beverly, OH		X		Do.
Highlanders Alloys LLC[3]	New Haven, WV		X		Do.
Tronox LLC	Henderson, NV			X	Electrolytic.

[1]FeMn, ferromanganese; SiMn, silicomanganese; MnO_2, synthetic manganese dioxide.

[2]Globe produced SiMn from January through March 2005.

[3]Product information obtained from various industry trade publications.

TABLE 4
U.S. CONSUMPTION, BY END USE, AND INDUSTRY STOCKS OF MANGANESE FERROALLOYS AND METAL IN 2005[1]

(Metric tons, gross weight)

End use	Ferromanganese			Silicomanganese	Manganese metal
	High carbon	Medium and low carbon	Total		
Steel:					
Carbon	128,000	82,700	211,000	52,400	793
High-strength, low-alloy	16,600	7,100	23,700	3,440	11
Stainless and heat-resisting	7,700	1,140	8,850	13,600	1,220
Full alloy	17,300	5,300	22,600	19,400	25
Unspecified[2]	1,210	72	1,290	736	1,690
Total	171,000	96,300	267,000	89,600	3,740
Cast irons	6,750	505	7,260	440	5
Superalloys	W	W	W	--	W
Alloys (excluding alloy steels and superalloys)	522	330	852	2,980	14,600
Miscellaneous and unspecified		W	W	(3)	W
Total consumption	183,000	103,000	286,000	93,000 [4]	18,300
Total manganese content[5]	143,000	82,300	225,000	61,400	18,300
Stocks, December 31, consumers and producers	10,800	19,600	30,300	8,330	2,500

W Withheld to avoid disclosing company proprietary data; included with "Alloys (excluding alloy steels and superalloys)." -- Zero.

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

[2]Includes electrical and tool steel.

[3]Withheld to avoid disclosing company proprietary data.

[4]Internal evaluation indicates that silicomanganese consumption is considerably understated.

[5]Estimated based on typical percent manganese content.

TABLE 5

U.S. EXPORTS OF MANGANESE ORE, FERROALLOYS, AND METAL, BY COUNTRY[1]

Country	2004		2005	
	Quantity, gross weight (metric tons)	Value, f.a.s.[2] (thousands)	Quantity, gross weight (metric tons)	Value, f.a.s.[2] (thousands)
Ore and concentrates with 20% or more manganese:				
Brazil	1,090	$137	--	--
Canada	5,130	1,450	3,000	$893
China	89,000	5,360	6,390	1,820
France	242	119	3,300	99
Germany	10,900	2,320	172	407
Italy	74	36	--	--
Netherlands	6,240	808	--	--
Norway	1,790	430	--	--
Sweden	1,660	334	94	244
United Kingdom	4,010	410	--	--
Other	2,870	1,010	511	480
Total	123,000	12,400	13,500	3,940
Ferromanganese, all grades:				
Canada	6,230	6,400	10,400	12,000
Mexico	458	660	4,070	2,850
Venezuela	390	764	--	--
Other	2,040	2,810	30	39
Total	9,118	10,634	14,500	14,889
Silicomanganese:				
Canada	46	53	300	351
Mexico	277	314	359	409
Other	179	265	240	457
Total	502	632	899	1,220
Metal, including alloys and waste and scrap:				
Belgium	318	733	1,100	1,590
Canada	824	1,980	273	805
Japan	730	1,290	564	1,170
Mexico	273	605	197	435
Sweden	186	125	124	87
Other	458	1,360	420	1,880
Total	2,790	6,090	2,670	5,960
Manganese dioxide:				
Belgium	256	302	292	368
Canada	1,960	890	3,400	1,630
Israel	210	345	67	85
Mexico	400	327	635	641
United Kingdom	170	205	19	19
Other	1,000	1,610	1,490	2,290
Total	4,000	3,680	5,900	5,030

-- Zero.

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

[2]Free alongside ship.

Source: U.S. Census Bureau.

TABLE 6

U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY[1]

Country	2004			2005		
	Quantity		Value,	Quantity		Value,
	Gross weight (metric tons)	Mn content (metric tons)	customs (thousands)	Gross weight (metric tons)	Mn content (metric tons)	customs (thousands)
Ore and concentrates with 20% or more manganese:						
All grades:						
Australia	52,400	27,700	$5,550	41,100	21,300	$5,700
Gabon	363,000	188,000	28,200	485,000	252,000	39,100
Mexico	4,400	1,640	385	8,810	4,320	1,030
South Africa	26,900	13,200	2,070	68,000	33,100	7,170
Other	4,940	2,840	1,570	52,900	23,200	5,170
Total	451,000	234,000	37,700	656,000	334,000	58,200
More than 20% but less than 47% manganese:						
Gabon	1,540	706	439	4,060 [2]	4,950 [2]	1,180
Mexico	4,400	1,640	385	8,810	4,320	1,030
Other	18	8	8	31,300	11,500	3.21
Total	5,950	2,360	832	44,100	20,800	4,200
47% or more manganese:						
Australia	52,400	27,700	5,550	41,100	21,300	5,700
Gabon	361,000	188,000	27,700	481,000 [3]	247,000 [3]	37,900
South Africa	26,900	13,200	2,070	68,000	33,100	7,170
Other	4,920	2,830	1,560	21,700	11,700	3,180
Total	445,220	231,730	36,880	612,000	313,000	53,990
Ferromanganese:						
All grades:						
Australia	31,500	22,900	24,900	4,960	3,810	2,630
Brazil	12,900	9,150	7,910	19,900	15,700 [3]	12,200
China	71,000	53,000	61,300	26,900	22,000	34,500
France	4,010	3,170	3,850	4,100	3,200	2,830
India	11,800	9,000	13,300	--	--	--
Japan	1,200	965	1,230	3,300	2,650	3,830
Korea, Republic of	13,300	10,700	13,700	15,700	12,400	14,300
Mexico	15,800	12,500	14,900	22,400	17,800	23,500
Norway	26,600	20,700	27,900	2,170	1,680	3,090
South Africa	188,000	146,000	193,000	149,000	117,000	99,300
Other	52,300	46,300	52,100	6,330	5,420	3,380
Total	428,000	334,000	414,000	255,000	202,000	200,000
1% or less carbon:						
China	8,850	7,830	12,700	14,700	12,600	24,100
Japan	1,200	965	1,230	3,300	2,650	3,830
Mexico	2,650	2,120	2,780	7,940	6,360	8,610
Norway	2,960	2,410	4,940	240	197	385
South Africa	1,890	1,750	2,860	3,250	2,730	5,340
Other	57	46	67	2,710	2,090	3,070
Total	17,600	15,100	24,600	32,200	26,600	45,300
More than 1% to 2% or less carbon:						
China	17,300	13,800	20,200	3,150	2,520	4,490
Korea, Republic of	10,100	8,330	10,400	13,000	10,400	11,400
Mexico	13,100	10,300	12,000	13,700	10,800	14,200
Norway	6,940	5,670	8,280	1,810	1,480	2,610
South Africa	43,100	35,000	46,800	28,700	23,300	30,800
Other	6,160	4,840	6,610	14	9	25
Total	96,700	78,000	104,000	60,300	48,500	63,400

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY[1]

Country	2004			2005		
	Quantity		Value,	Quantity		Value,
	Gross weight (metric tons)	Mn content (metric tons)	customs (thousands)	Gross weight (metric tons)	Mn content (metric tons)	customs (thousands)
Ferromanganese—Continued:						
More than 2% but not more than 4% carbon:						
China	476	393	$649	--	--	--
Georgia	5,990	5,640	5,530	--	--	--
South Africa	--	--	--	61	48	$31
Total	6,470	6,030	6,180	61	48	31
More than 4% carbon:						
Australia	31,500	22,900	24,900	4,960	3,810	2,630
Brazil	12,900	9,150	7,910	19,900	15,700 [3]	12,200
China	44,300	31,000	27,800	9,040	6,890	5,940
France	4,010	3,170	3,850	4,100	3,200	2,830
India	11,800	9,000	13,300	--	--	--
Norway	16,700	12,700	14,700	114	92	100
South Africa	143,000	109,000	143,000	117,000	90,900	63,100
Other	43,400	38,200	43,200	7,060	5,460	4,010
Total	308,000	235,000	279,000	162,000	126,000	90,900
Silicomanganese:						
Australia	29,500	19,600	24,600	35,400	23,500	20,900
Georgia	34,300	26,300	33,200	14,500	10,900	8,890
Korea, Republic of	16,800	10,900	13,100	5,220	3,410	3,280
Mexico	12,300	8,070	8,160	27,300	18,100	18,600
Norway	77,500	41,000	59,900	53,400	33,700	52,000
Romania	70,300	50,300	75,200	71,100	48,100	51,500
Russia	28,900	11,400	15,500	14,500	9,960	11,400
South Africa	143,000	94,200	148,000	101,000	66,600	61,100
Spain	1,400	933	1,910	4,000	2,670	2,770
Other	8,100	5,830	6,760	1,210	916	711
Total	422,000	269,000	386,000	327,000	218,000	231,000
Metal:						
Unwrought[4]:						
China	14,200	XX	21,100	16,000	XX	24,100
Germany	796	XX	1,580	2,550	XX	4,900
South Africa	15,000	XX	21,800	11,000	XX	20,500
Other	1,480	XX	2,540	2,800	XX	6,600
Total	31,500	XX	47,000	32,300	XX	56,200
Other manganese, wrought:						
China	349	XX	552	320	XX	522
Spain	208	XX	459	94	XX	204
Other	119	XX	643	37	XX	453
Total	676	XX	1,650	451	XX	1,180
Waste and scrap:						
Canada	2,470	XX	1,150	639	XX	178
China	17	XX	26	--	XX	--
France	20	XX	53	--	XX	--
Mexico	--	XX	--	--	XX	--
Other	21	XX	28	(5)	XX	5
Total	2,530	XX	1,250	639	XX	183

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY[1]

	2004			2005		
	Quantity		Value,	Quantity		Value,
Country	Gross weight (metric tons)	Mn content (metric tons)	customs (thousands)	Gross weight (metric tons)	Mn content (metric tons)	customs (thousands)
Manganese dioxide:						
Australia	7,970	XX	$9,780	15,900	XX	$21,000
China	11,300	XX	11,400	10,300	XX	10,900
Greece	2,340	XX	2,960	--	XX	--
Ireland	--	XX	--	--	XX	--
South Africa	1,020	XX	1,460	--	XX	--
Other	3,780	XX	5,220	5,290	XX	7,550
Total	26,400	XX	30,800	31,500	XX	39,500
Potassium permanganate:						
Czech Republic	767	XX	1,480	666	XX	1,410
India	342	XX	674	317	XX	634
Other	7	XX	64	65	XX	140
Total	1,120	XX	2,220	1,050	XX	2,190

XX Not applicable. -- Zero.

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

[2]All or part of these data have been referred to the U.S. Census Bureau for verification.

[3]Part of these data were revised by the U.S. Census Bureau.

[4]Imports of unwrought metal include flake, powder, and other.

[5]Less than ½ unit.

Source: U.S. Census Bureau, adjusted by the U.S. Geological Survey.

TABLE 7
MANGANESE ORE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country[3]	Mn content, percentage[e, 4]	2001	2002	2003	2004	2005
Australia:[5]						
Gross weight		2,069	2,187	2,555	3,381	4,000
Mn content	37-53	948	983	1,247	1,327	1,450
Brazil:[6]						
Gross weight		1,970	2,529	2,544	3,143 [r]	3,150
Mn content	37-51	988	1,095	1,286	1,346 [r]	1,592
China:[e, 7, 8]						
Gross weight		4,300	4,500	4,600	5,500 [r]	5,500
Mn content	20-30	860	900	920	1,100 [r]	1,100
Gabon:[9]						
Gross weight		1,791	1,856	2,000	2,460 [r]	2,500
Mn content[e]	45-53	830	810	873	1,090	1,290
Ghana:						
Gross weight		1,077	1,136	1,509	1,624	1,915
Mn content[e]	32-34	344	363	480	525	613
India:[e, 10]						
Gross weight		1,600	1,700	1,650	1,700	1,750
Mn content	10-54	600	630	620	630	640
Kazakhstan, crude ore:						
Gross weight		1,387	1,792	2,361	2,318 [r]	2,208
Mn content[e]	20-30	350	440	580	570 [r]	540
Mexico:[11]						
Gross weight		277	245 [r]	320 [r]	377 [r]	470
Mn content	36-37[r]	100	88	115 [r]	136	180
South Africa:[9]						
Gross weight		3,266	3,322	3,501	4,207	4,612
Mn content	30-48+	1,479	1,504	1,585	1,905	2,100
Ukraine:						
Gross weight		2,700	2,470	2,591	2,362	2,260
Mn content[e]	30-35	930	840	880	810	770
Other:[e, 12]						
Gross weight		490	478 [r]	484 [r]	651 [r]	762
Mn content	XX	142 [r]	143 [r]	137 [r]	191 [r]	239
Total:						
Gross weight		20,900	22,200	24,100	27,700 [r]	29,100
Mn content	XX	7,570 [r]	7,800	8,720 [r]	9,630 [r]	10,500

[e]Estimated. [p]Preliminary. [r]Revised. XX Not applicable.

[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 July 21, 2006. Data pertain to concentrates or comparable shipping product, except that in a few instances, the best data available appear to be for crude ore, possibly after some upgrading.

[3]In addition to the countries listed, Cuba, Panama, and Sudan may have produced manganese ore and/or manganiferous ore, but available information is inadequate to make reliable estimates of output levels.

[4]May be average content of each year's production rather than for content of typical products.

[5]Metallurgical ore.

[6]Production of beneficiated ore as reported in the Mineral Summary for each year listed, as published by the National Department of Mineral Production, Brasilia, Brazil.

[7]Includes manganiferous ore.

[8]The International Manganese Institute estimated Chinese manganese ore production, in gross weight and Mn content, respectively, to be as follows: 2004—8,500,000 metric tons (t) and 1,700,000 t; and 2005—12,000,000 t and 2,400,000 t.

[9]Calculated metal content includes allowance for assumed moisture content. Includes ore and sinter.

[10]Much of India's production grades below 35% Mn; content averaged 38.3% Mn for fiscal years 2001-02 through 2005-06.

[11]Mostly oxide nodules; may include smaller quantities of direct-shipping carbonate and oxide ores for metallurgical and battery operations.

[12]Category represents the combined totals of Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burma, Chile, Colombia, Egypt, Georgia,

TABLE 8

FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons, gross weight)

Country[3]	2001	2002	2003	2004[e]	2005[e]
Argentina, electric furnace, silicomanganese[e]	5,150 [4]	5,000	5,000	5,000	5,000
Australia, electric furnace:[e]					
Ferromanganese	115,000	115,000	115,000	115,000	120,000
Silicomanganese	135,000	135,000	135,000	135,000	140,000
Total	250,000	250,000	250,000	250,000	260,000
Brazil, electric furnace:					
Ferromanganese	276,000 [r]	339,000 [r]	438,000 [r]	508,000 [r]	510,000 [p]
Silicomanganese	180,235	182,731	180,200	180,000	108,200 [p]
Total	456,235 [r]	521,731 [r]	618,200 [r]	688,000 [r]	618,200 [p]
Chile, electric furnace, ferromanganese	2,213	--	--	--	--
China:[e]					
Blast furnace, ferromanganese	500,000	500,000	550,000	590,000 [r]	600,000
Electric furnace:					
Ferromanganese	670,000	490,000	700,000	1,120,000 [r]	1,100,000
Silicomanganese	1,170,000	1,580,000	1,800,000	2,600,000	3,800,000
Total	2,340,000	2,570,000	3,050,000	4,310,000 [r]	5,500,000
Egypt, electric furnace, ferromanganese[e]	30,000	30,000	30,000	30,000	30,000
France:[e]					
Blast furnace, ferromanganese	300,000	300,000	180,000	--	--
Electric furnace:					
Ferromanganese	130,000	130,000	120,000	106,000	110,000
Silicomanganese[5]	50,000	50,000	107,000	64,000	65,000
Total	480,000	480,000	407,000	170,000	175,000
Georgia, electric furnace:[e]					
Ferromanganese	100 [4]	-- [4]	--	--	--
Silicomanganese	25,000	25,000	25,000	25,000	25,000
Total	25,100	25,000	25,000	25,000	25,000
India, electric furnace:[e]					
Ferromanganese	165,000	165,000	165,000	170,000	170,000
Silicomanganese	150,000	150,000	160,000	160,000	170,000
Total	315,000	315,000	325,000	330,000	340,000
Indonesia, electric furnace:[e]					
Ferromanganese	12,000	12,000	12,000	12,000	12,000
Silicomanganese	7,000	7,000	7,000	7,000	4,000
Total	19,000	19,000	19,000	19,000	16,000
Italy, electric furnace:[e]					
Ferromanganese	40,000	40,000	40,000	40,000	40,000
Silicomanganese	90,000	90,000	90,000	90,000	90,000
Total	130,000	130,000	130,000	130,000	130,000
Japan, electric furnace:					
Ferromanganese	368,293	356,717	371,831	437,389 [r, 4]	448,616 [4]
Silicomanganese	62,238	70,965	58,043	73,041 [r, 4]	94,725 [4]
Total	430,531	427,682	429,874	510,430 [r, 4]	543,341 [4]
Kazakhstan, electric furnace:					
Ferromanganese	5,349	2,278	1,931	2,000	2,100
Silicomanganese	141,200	164,000	178,920	155,324 [r, 4]	170,214 [4]
Total	146,549	166,278	180,851	157,324 [r, 4]	172,314 [4]
Korea, North, electric furnace, ferromanganese[e]	6,000	6,000	6,000	6,000	6,000
Korea, Republic of, electric furnace:					
Ferromanganese	143,525	137,000 [e]	141,000	165,525 [r, 4]	165,000
Silicomanganese	101,877	94,000 [e]	90,942 [r]	82,917 [r, 4]	83,000
Total	245,402	231,000 [e]	231,942 [r]	248,442 [r, 4]	248,000

See footnotes at end of table.

TABLE 8—Continued
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons, gross weight)

Country[3]	2001	2002	2003	2004[e]	2005[e]
Mexico, electric furnace:[6]					
Ferromanganese	60,014	38,532	55,903	72,471 [4]	89,641 [4]
Silicomanganese	74,290	73,263	81,223	103,206 [4]	104,780 [4]
Total	134,304	111,795	137,126	175,677 [4]	194,421 [4]
Norway, electric furnace:[e]					
Ferromanganese	240,000	240,000	245,000	245,000	250,000
Silicomanganese	230,000	230,000	230,000	230,000	230,000
Total	470,000	470,000	475,000	475,000	480,000
Poland:[e]					
Blast furnace, ferromanganese	500	600	1,000 [r]	1,000 [r]	1,000
Electric furnace, silicomanganese	20,000 [4]	7,500	-- [r]	-- [r]	--
Total	20,500 [4]	8,100	1,000 [r]	1,000 [r]	1,000
Romania, electric furnace:					
Ferromanganese	384	--	--	--	--
Silicomanganese	71,921	84,720 [r]	141,899 [r]	194,945 [r, 4]	200,000
Total	72,305	84,720 [r]	141,899 [r]	194,945 [r, 4]	200,000
Russia:[e]					
Blast furnace, ferromanganese	55,000	105,000	101,000	108,000	108,000
Electric furnace, silicomanganese	124,000	127,000	83,000	143,000	145,000
Total	179,000	232,000	184,000	251,000	253,000
Slovakia, electric furnace:[e]					
Ferromanganese	20,000	20,000	20,000	20,000	20,000
Silicomanganese	35,000	35,000	35,000	35,000	35,000
Total	55,000	55,000	55,000	55,000	55,000
South Africa, electric furnace:					
Ferromanganese	524,000 [r]	618,954	607,362	612,000 [r, 4]	510,000
Silicomanganese	253,000	315,802	313,152	340,000	280,000
Total	777,000 [r]	934,756	920,514	952,000 [r]	790,000
Spain, electric furnace:[e]					
Ferromanganese	10,000	10,000	10,000	10,000	10,000
Silicomanganese	100,000	100,000	100,000	100,000	100,000
Total	110,000	110,000	110,000	110,000	110,000
Ukraine:					
Blast furnace, ferromanganese[e]	85,000	85,000	85,000	79,000 [r]	30,000
Electric furnace:					
Ferromanganese	231,000	250,617	250,000 [e]	375,990 [4]	330,000
Silicomanganese	702,389	732,592	740,000 [e]	1,060,000 [4]	1,000,000
Total	1,018,389	1,068,209	1,080,000 [e]	1,510,000 [r]	1,360,000
United States, electric furnace, ferromanganese[7]	W	W	W	W	W
Venezuela, electric furnace:					
Ferromanganese[e]	12,715 [4]	12,000	12,000	15,000	15,000
Silicomanganese	56,640	36,974	30,632	35,000	35,000
Total	69,355	48,974	42,632	50,000	50,000
Grand total	7,790,000 [r]	8,300,000 [r]	8,850,000 [r]	10,700,000 [r]	11,600,000
Of which:					
Blast furnace, ferromanganese	941,000	991,000	917,000	778,000 [r]	739,000
Electric furnace, excluding United States:					
Ferromanganese[8]	3,060,000 [r]	3,010,000 [r]	3,340,000 [r]	4,060,000 [r]	3,940,000
Silicomanganese[9]	3,780,000	4,300,000	4,590,000 [r]	5,820,000 [r]	6,880,000

See footnotes at end of table.

TABLE 8—Continued

FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY[1, 2]

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

[1]World totals, U.S. data, 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 2, 2006.

[3]In addition to the countries listed, Iran is believed to have produced ferromanganese and silicomanganese, but production information is inadequate for the formulation of estimates of output levels.

[4]Reported figure.

[5]Includes silicospiegeleisen, if any.

[6]Salable products from Cía Minera Autlán S.A. de C.V.

[7]U.S. output of ferromanganese includes silicomanganese.

[8]Ferromanganese includes silicomanganese, if any, for North Korea.

[9]Includes silicospiegeleisen, if any, for France.