MANGANESE

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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.

In 2004, U.S. manganese apparent consumption was an estimated 1.03 million metric tons (Mt), a 60% increase from 643,000 metric tons (t) in 2003 (table 1). Increases in ferromanganese, silicomanganese, and manganese metal imports accounted for most of the growth in apparent consumption.

Manganese imports increased by 49% on a content basis compared with those of 2003. Manganese exports were quadruple those of 2003 on a content basis, based on the typical manganese contents of the materials noted in table 5.

In 2004, the price of ore rose from that of 2003, as did the average prices of manganese ferroalloys. The price of metallurgical-grade ore increased by about 16% internationally. Prices for high- and medium-carbon ferromanganese and silicomanganese were at an alltime high.

In 2004, sales of manganese materials from the Government's National Defense Stockpile (NDS) reduced the Government's inventory of manganese by about 22% (content basis), leaving an inventory of about three-fourths the annual domestic consumption. The larger disposals (reported sales) were of chemical- and metallurgical-grade ores.

World production of manganese ore in 2004 rose by 9% on a gross-weight basis and by 7% on a contained-weight basis compared with that in 2003 (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 18% on a gross-weight basis compared with that in 2003 (table 8). China was the leading producer of both these manganese ferroalloys.

Legislation and Government Programs

Air Quality, Emission Limits.—The U.S. Environmental Protection Agency (EPA) issued final national emission standards for hazardous air pollutants (HAPs) for several industrial sources during the year, including industrial, commercial, and institutional boilers and process heaters (boilers); iron and steel foundries; and lime manufacturing plants, including those captive plants at iron and steel mills. One of the metallic HAPs at each of these sources is manganese. The EPA used particulate matter (PM) as a surrogate limit for the metal HAPs, or in some cases total metal HAP as an alternate to the PM limits. Emission limits varied depending on the emission sources at the plants and whether the sources were existing or new (U.S. Environmental Protection Agency, 2004b, p. 55223-55224; 2004c, p. 21907-21908; 2004d, p. 397-398).

Air Quality, Public Health Study.—The Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Department of Health and Human Services announced an indeterminate public health hazard for air emissions from the former Union Carbide Corporation facility complex near Marietta, OH. The complex is currently occupied by Chevron-Phillips Chemical Company, Eramet Marietta, Inc., Eveready Battery Company, Inc., and Solvay Advanced Polymers, LLC. The ATSDR recommended that additional air sampling be conducted for at least 1 year as indicated by air emissions modeling to better determine whether air emissions from the complex could adversely impact the health of Marietta residents (Agency for Toxic Substances and Disease Registry, 2004a§[1], b§).

Drinking Water.—In January, the EPA published a drinking water health advisory for manganese, which recommended the reduction of manganese concentrations to or below EPA's secondary maximum contaminant level (SMCL) of 0.050 milligram per liter (U.S. Environmental Protection Agency, 2004a, p. 2). The manganese SMCL is a guideline based on aesthetic qualities, such as staining and taste, and is not federally enforceable.

Stockpile.—The revised Annual Materials Plan (AMP) for fiscal year 2004 that the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency issued on May 4 covered the period from October 1, 2003, through September 30, 2004. Under this AMP, the maximum disposal authority for manganese materials was 226,796 t for metallurgical-grade ore; 45,359 t for the manganese ferrogroup; 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, 2004). 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 2004, disposals (reported sales) of manganese materials announced by the DNSC totaled 280,401 t for stockpile-grade metallurgical-grade ore; 37,137 t for chemical-grade ore; 25,466 t for high-carbon ferromanganese; 24,604 t for natural battery-grade ore; and 43 t for synthetic manganese dioxide.

The NDS physical inventory of manganese materials, in gross weight, indicated that all inventories decreased except

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

for synthetic manganese dioxide (unchanged). The decreases consisted of 209,402 t for stockpile-grade metallurgical ore; 77,487 t for nonstockpile-grade metallurgical ore; 73,485 t for chemical-grade ore; 48,384 t for high-carbon ferromanganese; 31,412 t for natural battery-grade ore; and 454 t for electrolytic manganese metal (Defense National Stockpile Center, unpub. data, December 2004). In 2004, the estimated manganese content of manganese inventories being held by the Government at yearend was lowered by about 22% to 801,000 t. On the basis of manganese content, the total remaining inventory was about three-fourths of the current national apparent consumption.

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.

Ferroalloys, Metal, and Synthetic Dioxide.—Production statistics for these materials were concealed to avoid disclosing company proprietary data. Domestic producers of manganese materials are listed in table 3. In March, Kerr-McGee Chemical LLC restarted its electrolytic manganese dioxide (EMD) plant that had been shut down since September 2003. In October, Highlanders Alloy LLC resumed production of its silicomanganese plant that had been shut down since January 2003.

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. Reported U.S. ore consumption in 2004 indicated that unit consumption of manganese in ironmaking, which could not be published to avoid disclosing company proprietary data, increased by less than 10% from that of 2003 to remain a relatively minor component of overall manganese use in steelmaking. Reported consumption (gross weight) of ferromanganese, silicomanganese, and manganese metal increased from that in 2003, by 27%, 20%, and 11%, 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.

The combination of the indicated consumption pattern with estimates of apparent consumption, on a gross-weight basis, suggests that manganese unit consumption in steelmaking in 2004 was about 7.9 kilograms per metric tons or about 2.5 times that calculated on the basis of reported consumption. This level was the highest in history as a result of significant increases in apparent consumption of ferromanganese, silicomanganese, and manganese metal. Increases in apparent consumption were attributable to significant increases in imports of these materials that were either put into stocks (importer or consumers) or consumed, and not reported to the USGS.

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. 69).

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 2004, domestic consumption of manganese ore increased by 11% to 441,000 t, while corresponding yearend stocks increased by 2% to 159,000 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.

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 2004, 12 firms were canvassed that process ore or had processed ore in the past by such methods as grinding and roasting or that consume it in the manufacture of dry cell batteries and manganese ferroalloys, metal, and chemicals. Of those 12 companies, 8 consumed manganese ore in their processes. The collective consumption of these firms is believed to constitute all of 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 2004.

Prices

For 2004, if the price index of manganese in metallurgical-grade ore is set at 1.0, then the corresponding price index per manganese unit was approximately 6.9 for silicomanganese, 6.7 for manganese metal, 6.5 for medium-carbon ferromanganese, and 5.8 for high-carbon ferromanganese. All factors increased compared with those in 2003. The factors are based on year-average prices for ferroalloys derived from prices listed in Platts Metals Week and for metal as given in Ryan's Notes (North American transaction prices). The price indices for high-carbon ferromanganese and silicomanganese were calculated based on the typical manganese content of both materials—78% for standard high-carbon ferromanganese and 66% for silicomanganese.

Manganese Ore.—The USGS estimated the average price of metallurgical-grade ore containing 48% manganese to be about $2.89 per metric ton unit. Prices were somewhat above or below this value, depending on ore quality, time of year, and nature of transaction. The price of a metric ton of ore is obtained by multiplying the metric ton unit 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 various end uses as ferroalloy production, blast furnace ironmaking, and manufacture of manganese chemicals.

The price of manganese in ore in 2004 and 2003 was 28.9 cents per kilogram and 24.1 cents per kilogram, respectively. These values indicate an increase of about 20% in U.S. cost, insurance, and freight (c.i.f.) price or 25% more than the increase in free on board (f.o.b.) price in international markets.

In 2004, the international benchmark price for metallurgical-grade ore increased by 16% from that in 2003, when price negotiations between BHP Billiton Ltd. and major Japanese consumers were concluded in March. On an f.o.b. basis per metric ton unit for delivery during the annual contract year, the agreed price was $2.46 for ore from the Groote Eylandt Mine in Australia (Ryan's Notes, 2004a). 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[2] were $1,326.54 per gross ton for high-carbon ferromanganese, 85.49 cents per pound for medium-carbon ferromanganese, and 59.72 cents per pound for silicomanganese. These prices were 169%, 98%, and 119% higher, respectively, than those of 2003, and were at an alltime high. The year-average North American transaction price for manganese metal[3] was 87.51 cents per pound, which was a 41% increase compared with that of 2003. The year-average price for manganese metal was the highest since 1998, and about 24% 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 rose based on increased demand from the domestic steel sector and tight supply early in 2004. Manganese metal prices rose in response to increased demand from the domestic aluminum and steel sectors.

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 19 years. The ensuing comparisons of foreign trade data were made on the basis of gross weight.

[2]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, Chicago, IL, or Houston, TX, warehouse.

[3]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. shipping point.

U.S. exports of manganese ore and manganese metal increased during 2004, while exports of manganese dioxide and manganese ferroalloys decreased (table 5). The biggest year-to-year change in exports was that of manganese ore, which increased by 575% compared with those in 2003. The most likely origin of these exports was manganese ore released from the NDS. China accounted for 72% of manganese ore exports, followed by Germany with 9%.

U.S. imports of ferromanganese, manganese metal, manganese ore containing greater than 47% manganese, and silicomanganese increased during 2004 compared with those of 2003, while imports of manganese dioxide, manganese ore containing less than 47% manganese, and potassium permanganate fell (table 6). The most significant year-to-year change was for imports of ferromanganese; these were 80% more than those of 2003. Increases in this import subcategory were especially notable for those from South Africa, with an increase of 60,000 t (47%), and from China, with an increase of 58,000 t (466%) year-on-year.

Imports of spiegeleisen (pig iron containing about 20% manganese) increased to 389 t in 2004 from 292 t in 2003, on a gross weight basis, with a total customs value of $427,771 or $1,100 per metric ton. The majority of these imports were from South Africa (93%), with the remaining from Germany (U.S. Census Bureau, unpub. data, December 2004).

Pending U.S.-Southern African Customs Union Free Trade Agreement.—In December, the United States Trade Representative (USTR) met with trade ministers from the member nations of the Southern African Customs Union (Botswana, Lesotho, Namibia, South Africa, and Swaziland) to continue negotiations on the pending U.S.-Southern African Customs Union Free Trade Agreement (Office of the United States Trade Representative, 2004§). The free trade agreement 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.

Electrolytic Manganese Dioxide Imports from Australia, China, Greece, Ireland, Japan, and South Africa.—On March 9, the U.S. International Trade Commission (ITC) terminated the antidumping duty investigation on the subject imports based on Kerr-McGee's withdrawal of its antidumping petition filed in July 2003 (U.S. International Trade Commission, 2004a). The International Trade Administration (ITA) ended its corollary antidumping duty investigation on March 2, 2004 (International Trade Administration, 2004a).

Silicomanganese Imports From Brazil (December 1, 2001, Through November 30, 2002).—On May 24, the ITA amended the antidumping duty on the subject imports from Companhia Paulista de Ferroligas (CPFL), Electrosiderurgica Brasileira SA (SIBRA), and Urucum Mineracao S.A. These companies are subsidiaries of Brazilian mineral producer Companhia Vale do Rio Doce (CVRD); CPFL and SIBRA are now part of CVRD's Rio Doce Manganese S.A. (RDM) unit. The amended duty margin was 16.5%, up from 13.02% issued in March (International Trade Administration, 2004b, c).

Potassium Permanganate Imports From China.—On October 1, the ITC instituted a 5-year review of the antidumping duty order on potassium permanganate from China. Comments on whether revocation of the antidumping duty order would likely lead to a continuation of material injury to the domestic industry were due by November 22 (U.S. International Trade Commission, 2004b).

Silicomanganese Imports From Brazil (December 1, 2002, through November 30, 2003).—On December 8, the ITA preliminarily determined that RDM did not sell the subject imports at prices below normal value, and as a result no duty would be imposed (International Trade Administration, 2004d).

World Review

The bulk (98%) 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, Australia, Brazil, 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, Japan, Norway, India, Brazil, and Australia (table 8).

As reported by Ryan's Notes (2004c), Consolidated Minerals Limited forecast world apparent consumption of manganese ferroalloys to increase by an estimated 21% in 2004 from that of 2003 to 2.87 Mt, of which 1.79 Mt was silicomanganese, 940,000 t was high-carbon ferromanganese, and 140,000 t was refined (medium- and low-carbon) ferromanganese. This would require about an additional 950,000 t of manganese ore to be consumed, of which 560,000 t was for the manufacture of silicomanganese, 330,000 t for high-carbon ferromanganese, and 60,000 t for refined ferromanganese. (Manganese ore consumption is roughly equivalent to manganese ore production; the amount forecasted would be on a content-basis.)

Australia.—In April, Consolidated Minerals announced it would increase the production rate from its Woodie Woodie manganese mine to 800,000 metric tons per year (t/yr) from 600,000 t/yr by November at a cost of A$6.5 million (US$4.8 million). As part of the project, the company would expand its heavy-media separation capacity and make minor modifications to its existing crushing plant (Consolidated Minerals Ltd., 2004§). In December, the company announced plans to increase production capacity to 1 million metric tons per year (Mt/yr) from the mine starting in June 2005 (Ryan's Notes, 2004b).

In October, Consolidated Minerals reported reserve and resource estimates for the largest deposits discovered so far at the Woodie Woodie Mine—the Radio Hill South and Radio Hill West deposits. The deposits were estimated to contain the following: a combined measured resource of 5.2 Mt at 40.8% manganese dioxide (MnO_2), 19.5% silica (SiO_2), 4.5% iron oxide (FeO_2), and 1.2% aluminum oxide (Al_2O_3); indicated resources of 5.4 Mt at 42.8% MnO_2, 15.5% SiO_2, 5.4% FeO_2, and 1.3% of Al_2O_3; and inferred resources of 42.4 Mt at 42.4% MnO_2, 14.9% SiO_2, 7.1% FeO_2, and 1.1% Al_2O_3 (Mining Journal, 2004).

An independent exploration assessment report concluded that existing resources plus exploration potential in the immediate vicinity of the Woodie Woodie Mine would support a mine life of 14 to 19 years. The report also concluded there was further potential in surrounding areas to add another 10 to 20 years in mine life at the 2005 production rate (Etheridge, 2004§).

In September, Bootu Creek Resources (a subsidiary of Singapore's OM Holdings) announced it would begin development of a 600,000-t/yr mine in Australia's Northern Territory. The company expected operations to begin in June 2005 with an initial output of 350,000 t/yr of lumpy ore (45% manganese, 11% SiO_2, 5% iron, and 0.04% phosphorus) and 150,000 t/yr of fines (Ryan's Notes, 2004g). Bootu Creek would provide ore to OM's wholly owned Qinzhou ferroalloy plant in the Chinese province of Guangi (Metal-Pages, 2004f§).

HiTec Energy Ltd.'s plans to convert the solvent extraction/electrowinning plant it acquired from ABN AMRO in 2003 to EMD; production was delayed while the company evaluated different production scenarios and obtained additional financing (HiTec Energy Ltd., 2004§; 2005a§, b§).

China.—On May 1, the Central Government of China (The State Council) announced new measures to stem investment in and expansion of ferroalloy facilities throughout the country (TEX Report, 2004a). More details on this action can be found in the "Silicon" chapter of the 2004 USGS Minerals Yearbook, volume I, Metals and Minerals.

According to Jian (2005§), 17 companies were producing electrolytic manganese metal in the Guangxi Province at the beginning of 2004. Total production capacity was 116,000 t/yr, led by Guangxi Dameng Manganese Co., Ltd. (30,000 t/yr), Start Manganese Material Co., Ltd. (10,000 t/yr), and Tianyang Guihang Manganese Co. (10,000 t/yr). By yearend 2004, installed production capacity would be expanded to 202,000 t/yr by 20 companies. By yearend 2005, 4 of the 20 companies planned to add another 70,000 t/yr in production capacity.

Existing electrolytic manganese metal production capacity in the city of Chongqing and the provinces of Guizhou and Hunan during 2004 was reported to be 127,500 t/yr by 16 plants, 209,000 t/yr by 27 plants, and 222,200 t/yr by 42 plants, respectively (TEX Report, 2004c).

Several new silicomanganese smelters were under construction during 2004, including those in the Guangxi Province (three smelters), Inner Mongolia Autonomous Region (four smelters), Liaoning Province (two smelters), and Yunnan Province (three smelters). One 16.5-megavoltampere (MVA) furnace at OM Holding's Qinzhou silicomanganese smelter (Guangxi Province) was reported operational in September (Metal-Pages, 2004f§). The company expected two additional furnaces—one 16.5 MVA and the other 3.5 MVA—to come online by yearend 2004. The plant's production capacity was expected to be 60,000 t/yr (Ryan's Notes, 2004g).

In May, Yunnan Siliency reported construction on two silicomanganese plants with a combined production capacity of 70,000 t/yr. One plant would have two 12,600-kilovoltampere (kVA) furnaces and the other a 6,300-kVA furnace (Metal-Pages, 2004e§).

In August, Erdos Manganese Alloys Co. was established under a joint venture by Inner Mongolia's ERDOS Group (51%) and the Japanese firms JFE Steel (24.5%) and Mitsui & Co. (24.5%). The company planned to start construction in October on a 150,000-t/yr silicomanganese plant comprising four 25,500-kVA furnaces near the city of Wuhai in Inner Mongolia Autonomous Region. Construction was expected to be completed by June 2005 (Ryan's Notes, 2004d).

In November, Toyota Tsusho Corp. acquired a 25.2% stake in the Chinese silicomanganese joint-venture company Jinzhou Nichiden Ferroalloy. Remaining ownership in Jinzhou Nichiden was held by Nippon Denko (70%) and Jinzhou Ferroalloy (4.8%). Production at the 50,000-t/yr silicomanganese plant in the Liaoning Province was scheduled to start in August 2005 (Ryan's Notes, 2004e).

In December, China's Ministry of Finance revoked the 8% export tax rebate on ferromanganese and silicomanganese starting January 1, 2005. The Government did so to reduce metal exports in 2005 following shortages in the country's energy and transport sectors (Metal-Pages, 2004b§).

Gabon.—Compagnie Minière Trois Rivières (a subsidiary of CVRD) explored for manganese in the Franceville and Okondjá regions in Alto-Ogoué Province. The company planned to invest $5 million to explore the regions (Mining Review Africa, 2004§).

In June, Compagnie Miniere de l'Ogooue or Comilog (a subsidiary of Eramet SA) announced plans to boost production capacity at its Moanda Mine in Gabon to 3 Mt/yr from 2.5 Mt/yr in 2005 (Africa Mining Intelligence, 2004).

Ghana.—Grubaugh (2003) provided a profile of Ghana's mining industry, including information on manganese mineralization.

In November, Ghana Manganese Company Limited announced it expected to increase manganese ore exports to more than 1.6 Mt in 2004 from 1.5 Mt in 2003. About 45% of the company's exports go to Asian markets, particularly to China (Ghana Manganese Company Limited, 2004§).

India.—In May, the Steel Minister of India asked for the withdrawal of Manganese Ore India Ltd. (MOIL) from the disinvestments list developed by India's Ministry of Disinvestment (Ieport Daily News, 2004§). Plans to privatize MOIL were put on hold indefinitely (TEX Report, 2004d).

Imprex Ferro Tech Limited expanded silicomanganese production capacity by adding a fourth 8.25-MVA furnace at its ferroalloys plant in West Bengal. The company also converted a furnace from high- to medium-carbon ferromanganese. The plant has ferromanganese and silicomanganese capacities of 25,000 t/yr and 19,500 t/yr, respectively (Ryan's Notes, 2004b).

Iran.—For 2004, manganese ore reserves in Iran were estimated to be 9.7 Mt, with production of about 123,000 t (O'Driscoll, 2004, p. 29).

Japan.—Nippon Denko was scheduled to complete engineering work at its Tokushima plant to improve the operating efficiency of its No. 1 high-carbon ferromanganese furnace. Coupled with improvements made to the No. 2 furnace in 2003, the plant's capacity will increase to more than 200,000 t/yr from 178,000 t/yr (Ryan's Notes, 2004d).

Kazakhstan.—Alloy 2000 (KazChrome) assumed ownership of the Zhairemsky manganese mine located in the Karaganda Region (TEX Report, 2004b).

Mexico.—In 2004, Minera Autlán restarted four furnaces at its Gómez Palacio (two furnaces), Tamós, and Teziutlán ferromanganese plants. The company had restarted Furnace 9 at the Tamós plant in 2003 (Minera Autlán, 2005§).

Russia.—A study provided by the Government of the Yamal Nenets Autonomous Region in February to Interfax International Ltd. estimated proven manganese reserves in the Arctic Urals to be 1,100 Mt (Interfax Mining & Metals Report, 2004a).

Chelyabinsk Electrometallurgical Kombinat planned to develop the Marganits Komi manganese ore deposit in the subpolar Urals to support silicomanganese production at its Chelyabinsk Electrometallurgical Integrated Plant. The deposit was reported to contain about 4 Mt of proven reserves and 30 Mt of probable reserves (Metal-Pages, 2004a§).

South Africa.—Assmang Limited reported production at its new No. 3 shaft complex at the Nchwanning manganese mine in May 2004. The capital expenditure for the project, estimated to be R690 million (US$111 million), would be substantially completed by yearend 2004. The company also expected construction to start on a new metal from slag plant at Cato Ridge in late 2004 (Assmang Limited, 2004§). Anglovaal Mining (majority owner of Assmang) became part of African Rainbow Metals, South Africa's leading black empowerment diversified mining company (Ryan's Notes, 2004f).

Ukraine.—In April, the Government of Ukraine began a special investigation into manganese imports from all countries in 2003 at the request of the country's leading manganese ore producer, Ordzhonikidziyevsky GOK (OGOK). The leading Ukrainian manganese ferroalloy producer, Nikopol Ferroalloy Plant (NFZ), had ceased buying manganese concentrates from OGOK at the beginning of 2003 because it believed they were overpriced (Interfax Metals & Mining Weekly, 2004). NFZ resumed purchasing about 70,000 metric tons per month (t/mo) of manganese concentrates from OGOK in March 2004 before halting again in October, shortly after the Ukrainian Government ruled against applying special measures on manganese ore imports. The dispute between NFZ and the Ukrainian manganese ore producers continued into 2005 (Metal-Pages, 2005§).

In November, Ukraine's second ranked ferroalloys producer, Zaporizhia Ferroalloys Works, completed a major upgrade on its leading silicomanganese furnace, No. 32, at a cost of HRV2 million (US$387,000). As a result, the daily production capacity of the furnace increased to 105 t/yr from 90 t/yr (Metal-Pages, 2004g§).

In December, Ukraine's major ferrosilicon producer, Stakhanov Ferroalloy Plant, began producing silicomanganese after converting two ferrosilicon furnaces earlier in the year at a cost of HRV40 million (US$7.5 million). Production capacity of each furnace is about 2,500 t/mo (Platts Metals Week, 2004).

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:

Environment and Toxicology.—Researchers in Canada studied the level of outdoor and indoor respirable manganese in Montreal (urban area) and St-Phillipe (rural area) where methylcyclopentadienyl manganese tricarbonyl (MMT) has been used as an additive in gasoline since 1976. The mean manganese concentration in blood sampled from 10 women during the course of 2 years was not significantly different between those that lived in Montreal and those that lived in St-Phillipe (Bolte and others, 2004).

Extractive Hydrometallurgy.—Use of carbohydrates to leach low-grade manganese oxide ores to concentrate manganese, calcium and iron for food-additive production was reported by Pagnanelli and others (2004).

Lithium-Manganese Oxides.—A sol-gel combustion technique was used to synthesize layered lithium-nickel-manganese-oxide cathode materials at relatively low temperatures (850° C) (Gopukumar, Chung, and Kim, 2004). The National Institute of Advanced Industrial Science and Technology developed a new electrode material comprising lithium manganese oxide material that eliminates cobalt from the manufacture of lithium batteries, possibly reducing their cost by about 30% (Metal-Pages, 2004c§).

Manganese Ore Deposition (Land-Based).—Leal (2004) reported on manganese mineralogy and geochemistry in the Sierras Pampeanas ranges of Argentina.

Manganese Ocean Nodules.—In February, Petrotrans (a subsidiary of Kinex Holding of St. Petersburg, Russia) announced plans to invest $50 million to develop a deposit of manganese dioxide concretions in the Gulf of Finland near the Leningrad Region. The deposit is estimated to have a reserve base of 30 to 50 Mt at 18% manganese content, of which 5 Mt are proven reserves (Interfax Mining & Metals Report, 2004b).

During 2004, the Korea Ocean Research & Development Institute (KORDI) continued to explore part of the deep sea Clarion-Clipperton Fracture Zone to determine the best mining site in the area for commercial production of manganese nodules by 2010 (Korea Ocean Research & Development Institute, 2004§). In September, after 3 months of deep sea exploration by KORDI, the South Korean Ministry of Maritime Affairs and Fisheries (MOMAF) announced it would start developing a major new deposit of manganese nodules in 2010. According to MOMAF, 3 Mt/yr of key metals—manganese (27% to 30%), nickel (1.25% to 1.5%), copper (1% to 1.4%), and cobalt (0.2% to 0.25%)—would be produced for 100 years. MOMAF estimated the value of the nodules to be W200 trillion (US$174.7 billion) (KBS Global, 2004§; Metal-Pages, 2004d§).

Submerged-Arc Welding Technology.—Cruz and others (2004) reported the manufacture of manganous oxide and silica system fluxes from low-grade manganese ores (Margarita de Cambute deposit) containing appreciable amounts of aluminum, calcium, magnesium, and silica for use in submerged-arc welding.

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. (Raw steel production in 2004 increased by 6% in the United States and about 9% globally.) 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. The outlook for the steel industry is discussed in the "Outlook" section of the "Iron and Steel" chapter of the 2004 USGS Minerals Yearbook, volume I, Metals and Minerals.

As evidenced in 2004, 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 2004 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 about 65%. Secondary battery sales were forecasted 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)

		2000	2001	2002	2003	2004
United States:						
Manganese ore (35% or more Mn):						
Exports		10	9	15	18	123
Imports for consumption		447	358	427	347	451
Consumption[2]		486	425	360	398	441
Stocks, December 31, consumers[2]		226	138	151	156	159
Ferromanganese:						
Exports		8	9	9	11	9
Imports for consumption		312	251	275	238	429
Consumption		300	266	253	248	315
Stocks, December 31, consumers and producers		31	25	21	20	16
Consumption, apparent, manganese content[3]		768	692	696	643 r	1,030
Ore price, c.i.f.[4] U.S. ports	dollars per metric ton unit	2.39	2.44	2.30	2.41	2.89
World, production of manganese ore		19,600	20,900 r	22,200 r	24,100 r	26,300 e

[e]Estimated. [r]Revised.

[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 2004[1]

(Metric tons, gross weight)

		Physical inventory[e]				
		Uncommitted			Sold,	
	Disposal	Stockpile	Nonstockpile		pending	Grand
Material	authority	grade	grade	Total	shipment	total
Natural battery ore	1,700	1,700	--	1,700	22,200	23,900
Synthetic manganese dioxide	2,690	2,690	--	2,690	42	2,730
Chemical ore	31,200	31,200	--	31,200	7,300	38,500
Metallurgical ore	372,000	159,000	213,000	372,000	231,000	603,000
High-carbon ferromanganese	676,000	676,000	--	676,000	--	676,000
Electrolytic metal	--	--	--	--	--	--

[e]Estimated. -- 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 2004

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

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

[2]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 2004[1]

(Metric tons, gross weight)

End use	Ferromanganese: High carbon	Ferromanganese: Medium and low carbon	Ferromanganese: Total	Silicomanganese	Manganese metal
Steel:					
Carbon	150,000	87,400	237,000	68,100	642
High-strength, low-alloy	22,700	7,150	29,800	3,470	38
Stainless and heat-resisting	8,990	(2)	10,400	15,100	1,610
Full alloy	20,200	6,030	26,200	21,800	26
Unspecified[3]	1,590	1,540	1,670	939	1,700
Total	203,000	102,000	305,000	109,000	4,010
Cast irons	7,580	521	8,100	634	46
Superalloys	W	W	W	--	W
Alloys (excluding alloy steels and superalloys)	648	457	1,110	(4)	16,700 [5]
Miscellaneous and unspecified	--	W	W	(4)	W
Total consumption	212,000	103,000	315,000	110,000 [6]	20,800
Total manganese content[7]	165,000	82,500	247,000	72,700	20,800
Stocks, December 31, consumers and producers	7,300	8,500	15,800	5,220	908

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]Withheld to avoid disclosing company proprietary data; included with "Steel: Unspecified."

[3]Includes electrical and tool steel, and items indicated by footnote (2).

[4]Withheld to avoid disclosing company proprietary data.

[5]Approximately 85% of this combined total was for consumption in aluminum alloys.

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

[7]Estimated based on typical percent manganese content.

TABLE 5

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

Country	2003 Quantity, gross weight (metric tons)	2003 Value, f.a.s.[2] (thousands)	2004 Quantity, gross weight (metric tons)	2004 Value, f.a.s.[2] (thousands)
Ore and concentrates with 20% or more manganese:				
Brazil	160	$59	1,090	$137
Canada	2,620	697	5,130	1,450
China	--	--	89,000	5,360
France	8,890	272	242	119
Germany	1,870	917	10,900	2,320
Italy	1,160	310	74	36
Netherlands	204	100	6,240	808
Norway	555	272	1,790	430
Sweden	427	210	1,660	334
United Kingdom	609	298	4,010	410
Other	1,720	446	2,870	1,010
Total	18,200	3,580	123,000	12,400
Ferromanganese, all grades:				
Canada	9,240	7,800	6,230	6,400
Mexico	78	87	458	660
Venezuela	1,260	904	390	764
Other	38	46	2,040	2,810
Total	10,600	8,840	9,120	10,600
Silicomanganese:				
Canada	251	238	46	53
Mexico	223	175	277	314
Other	132	141	179	265
Total	606	554	502	632
Metal, including alloys and waste and scrap:				
Belgium	395	658	318	733
Canada	523	1,260	824	1,980
Japan	806	1,710	730	1,290
Mexico	295	578	273	605
Sweden	180	145	186	125
Other	145	439	458	1,360
Total	2,340	4,790	2,790	6,090
Manganese dioxide:				
Belgium	136	181	256	302
Canada	2,300	939	1,960	890
Israel	192	231	210	345
Mexico	394	275	400	327
United Kingdom	83	104	170	205
Other	1,360	2,860	1,000	1,610
Total	4,470	4,590	4,000	3,680

[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]

	2003			2004		
	Quantity		Value,	Quantity		Value,
	Gross weight	Mn content	customs	Gross weight	Mn content	customs
Country	(metric tons)	(metric tons)	(thousands)	(metric tons)	(metric tons)	(thousands)
Ore and concentrates with 20% or more manganese:						
All grades:						
Australia	24,500	12,900	$2,140	52,400	27,700	$5,550
Brazil	17	7	12	--	--	--
Gabon	239,000	123,000	19,300	363,000	188,000	28,200
Mexico	3,980	1,520	351	4,400	1,640	385
South Africa	78,900	36,900	5,070	26,900	13,200	2,070
Other	531	340	203	4,940	2,840	1,570
Total	347,000	175,000	27,000	451,000	234,000	37,700
More than 20% but less than 47% manganese:						
Brazil	17	7	12	--	--	--
Gabon	--	--	--	1,540	706	439
Mexico	3,940	1,500	315	4,400	1,640	385
South Africa	13,200	5,410	708	--	--	--
Other	217 r	98 r	46 r	18	8	8
Total	17,400	7,010	1,080	5,950	2,360	832
47% or more manganese:						
Australia	24,500	12,900	2,140	52,400	27,700	5,550
Gabon	239,000	123,000	19,300	361,000	188,000	27,700
Mexico	39	29	36	--	--	--
South Africa	65,700	31,500	4,360	26,900	13,200	2,070
Other	314 r	242 r	157 r	4,920	2,830	1,560
Total	330,000	168,000	26,000	445,000	231,000	36,900
Ferromanganese:						
All grades:						
Australia	7,350	5,690	2,950	31,500	22,900	24,900
Brazil	23,500	18,400	8,640	12,900	9,150	7,910
China	12,500	10,600	9,610	71,000	53,000	61,300
France	34,000	26,700	13,500	4,010	3,170	3,850
India	--	--	--	11,800	9,000	13,300
Japan	5,840	4,720	4,190	1,200	965	1,230
Korea, Republic of	2,540	2,070	1,570	13,300	10,700	13,700
Mexico	14,600	11,400	11,200	15,800	12,500	14,900
Norway	8,910	7,230	5,520	26,600	20,700	27,900
South Africa	128,000	100,000	59,700	188,000	146,000	193,000
Other	660	52	421	52,300	46,300	52,100
Total	238,000	187,000	117,000	429,000	335,000	414,000
1% or less carbon:						
China	5,110	4,580	4,760	8,850	7,830	12,700
Japan	5,840	4,720	4,190	1,200	965	1,230
Mexico	4,820	3,800	4,170	2,650	2,120	2,780
Norway	2,130	1,730	1,300	2,960	2,410	4,940
South Africa	3,980	3,690	4,680	1,890	1,750	2,860
Other	561	453	369	57	46	67
Total	22,400	19,000	19,500	17,600	15,100	24,600
More than 1% to 2% or less carbon:						
China	7,410	5,970	4,850	17,300	13,800	20,200
Korea, Republic of	2,500	2,030	1,530	10,100	8,330	10,400
Mexico	9,720	7,570	6,980	13,100	10,300	12,000
Norway	6,780	5,500	4,230	6,940	5,670	8,280
South Africa	22,100	18,000	15,100	43,100	35,000	46,800
Other	--	--	--	6,160	4,840	6,610
Total	48,600	39,100	32,600	96,700	78,000	104,000

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]

	2003			2004		
	Quantity		Value,	Quantity		Value,
	Gross weight	Mn content	customs	Gross weight	Mn content	customs
Country	(metric tons)	(metric tons)	(thousands)	(metric tons)	(metric tons)	(thousands)
Ferromanganese—Continued:						
More than 2% but not more than 4% carbon:						
China	--	--	--	476	393	$649
Georgia	--	--	--	5,990	5,640	5,530
Mexico	22	21	$11	--	--	--
South Africa	37	29	16	--	--	--
Total	59	50	27	6,470	6,030	6,180
More than 4% carbon:						
Australia	7,350	5,690	2,950	31,500	22,900	24,900
Brazil	23,500	18,400	8,640	12,900	9,150	7,910
China	20	15	10	44,300	31,000	27,800
France	34,000	26,700	13,500	4,010	3,170	3,850
India	--	--	--	11,800	9,000	13,300
Norway	--	--	--	16,700	12,700	14,700
South Africa	102,000	78,800	39,900	143,000	109,000	143,000
Other	158 r	127 r	92 r	43,400	38,200	43,200
Total	167,000	130,000	65,200	308,000	235,000	279,000
Silicomanganese:						
Australia	47,700	31,600	20,500	29,500	19,600	24,600
Georgia	20,600	18,300	10,100	34,300	26,300	33,200
Korea, Republic of	2,500	1,660	1,080	16,800	10,900	13,100
Mexico	11,600	7,710	5,870	12,300	8,070	8,160
Norway	28,400	17,300	18,400	77,500	41,000	59,900
Romania	34,000	24,600	17,200	70,300	50,300	75,200
Russia	3,830	1,770	1,900	28,900	11,400	15,500
South Africa	108,000	72,200	51,400	143,000	94,200	148,000
Spain	5,800	3,770	3,310	1,400	933	1,910
Other	5,040 r	3,340 r	2,900 r	8,100	5,830	6,760
Total	267,000	182,000	133,000	422,000	269,000	386,000
Metal:						
Unwrought[2]:						
China	5,490	XX	4,890	14,200	XX	21,100
Germany	153	XX	217	796	XX	1,580
South Africa	11,300	XX	13,000	15,000	XX	21,800
Other	27	XX	34	1,480	XX	2,540
Total	17,000	XX	18,200	31,500	XX	47,000
Other manganese, wrought:						
China	761	XX	843	349	XX	552
Spain	514	XX	813	208	XX	459
Other	140	XX	647	119	XX	643
Total	1,420	XX	2,300	676	XX	1,650
Waste and scrap:						
Canada	1,330	XX	230	2,470	XX	1,150
China	--	XX	--	17	XX	26
France	39	XX	75	20	XX	53
Mexico	3	XX	2	--	XX	--
Other	--	XX	--	21	XX	28
Total	1,370	XX	307	2,530	XX	1,250
Manganese dioxide:						

TABLE 6—Continued

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

Country	2003 Quantity Gross weight (metric tons)	2003 Quantity Mn content (metric tons)	2003 Value, customs (thousands)	2004 Quantity Gross weight (metric tons)	2004 Quantity Mn content (metric tons)	2004 Value, customs (thousands)
Manganese dioxide—Continued:						
South Africa	8,700	XX	$11,100	1,020	XX	$1,460
Other	3,260	XX	4,560	3,780	XX	5,220
Total	49,400	XX	61,800	26,400	XX	30,800
Potassium permanganate:						
Czech Republic	889	XX	1,720	767	XX	1,480
India	576	XX	1,130	342	XX	674
Other	2	XX	25	7	XX	64
Total	1,470	XX	2,880	1,120	XX	2,220

[r]Revised. XX Not applicable. -- Zero.

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

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

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]	2000	2001	2002	2003	2004
Australia:[5]						
Gross weight		1,614	2,069	2,187	2,555	3,381
Mn content	37-53	787	948	983	1,247	1,327
Brazil:[6]						
Gross weight		1,925	1,970 [r]	2,529	2,544 [r]	2,732
Mn content	37-51	719	988 [r]	1,095 [r]	1,286 [r]	1,300 [e]
China:[e, 7]						
Gross weight		3,500	4,300	4,500	4,600 [r]	4,500
Mn content	20-30	700	860	900	920 [r]	900
Gabon:[8]						
Gross weight		1,743	1,791	1,856	2,000	2,500
Mn content[e]	45-53	804 [9]	830	810	873	1,090
Ghana:						
Gross weight		896 [e, 10]	1,077	1,136	1,509 [r]	1,624
Mn content[e]	32-34	287	344	363	480 [r]	525
India:[e, 11]						
Gross weight		1,550	1,600	1,700	1,650	1,700
Mn content	10-54	590	600	630	620	630
Kazakhstan, crude ore:						
Gross weight		1,136	1,387	1,792	2,361	2,400
Mn content[e]	20-30	280	350	440	580	580
Mexico:[12]						
Gross weight		435	277	233	310 [e]	376
Mn content	27-50	156	100	88	112	136 [p]
South Africa:[8]						
Gross weight		3,635	3,266	3,322	3,501	4,207
Mn content	30-48+	1,578	1,479	1,504	1,585	1,905

See footnotes at end of table.

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

(Thousand metric tons)

Country[3]	Mn content percentage[e, 4]	2000	2001	2002	2003	2004
Ukraine:						
Gross weight		2,741	2,700	2,470	2,591	2,362
Mn content[e]	30-35	930	930	840	880	810
Other:[e, 13]						
Gross weight		433	490	474 r	490 r	494
Mn content	XX	125	150	148 r	147 r	150
Total:						
Gross weight		19,600	20,900 r	22,200	24,100 r	26,300
Mn content	XX	6,960	7,580 r	7,800 r	8,730 r	9,350

[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 22, 2005. 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 Mineral Summary, Brasilia, Brazil.

[7]Includes manganiferous ore.

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

[9]Reported figure.

[10]Sales.

[11]Much of India's production grades below 35% Mn; content averaged 38.3% Mn for fiscal years 2000-01 through 2004-05.

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

[13]Category represents the combined totals of Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burma, Chile, Colombia, Egypt, Georgia, Hungary, Indonesia, Iran, Italy (from wastes), Morocco, Namibia, Romania, Russia (crude ore), Thailand, and Turkey.

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

(Metric tons, gross weight)

Country[3]	2000	2001	2002	2003	2004[e]
Argentina, electric furnace, silicomanganese	4,900	5,150	5,000 e	5,000 e	5,000
Australia, electric furnace:[e]					
Ferromanganese	115,000	115,000	115,000	115,000	115,000
Silicomanganese	135,000	135,000	135,000	135,000	135,000
Total	250,000	250,000	250,000	250,000	250,000
Brazil, electric furnace:					
Ferromanganese	121,277	96,016	156,435 r	149,000 r	149,000
Silicomanganese	171,304	180,235	182,731 r	180,200 r	180,000
Total	292,581	276,251	339,166 r	329,200 r	329,000
Chile, electric furnace:					
Ferromanganese	4,011	2,213	-- r	-- r	--
Silicomanganese[e]	1,800 4	-- r	-- r	-- r	--
Total	5,811	2,213 r	-- r	-- r	--
China:[e]					
Blast furnace, ferromanganese	500,000	500,000	500,000	550,000	500,000
Electric furnace:					
Ferromanganese	520,000	670,000	490,000	700,000	1,000,000
Silicomanganese	900,000	1,170,000	1,580,000	1,800,000	2,600,000
Total	1,920,000	2,340,000	2,570,000	3,050,000	4,100,000

See footnotes at end of table.

TABLE 8—Continued

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

(Metric tons, gross weight)

Country[3]	2000	2001	2002	2003	2004[e]
Egypt, electric furnace, ferromanganese[e]	30,000	30,000	30,000	30,000	30,000
France:[e]					
Blast furnace, ferromanganese	300,000	300,000	300,000	180,000	--
Electric furnace:					
Ferromanganese	140,000	130,000	130,000	120,000	106,000
Silicomanganese[5]	60,000	50,000	50,000	107,000	64,000
Total	500,000	480,000	480,000	407,000	170,000
Georgia, electric furnace:[e]					
Ferromanganese	600 [r, 4]	100 [r, 4]	-- [r, 4]	-- [r]	--
Silicomanganese	25,000	25,000	25,000	25,000	25,000
Total	25,600 [r]	25,100 [r]	25,000 [r]	25,000 [r]	25,000
India, electric furnace:[e]					
Ferromanganese	160,000	165,000	165,000	165,000	170,000
Silicomanganese	185,000	150,000	150,000	160,000	160,000
Total	345,000	315,000	315,000	325,000	330,000
Indonesia, electric furnace:[e]					
Ferromanganese	12,000	12,000	12,000	12,000	12,000
Silicomanganese	7,000	7,000	7,000	7,000	7,000
Total	19,000	19,000	19,000	19,000	19,000
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	337,694	368,293	356,717	371,831 [r]	456,000
Silicomanganese	67,926	62,238	70,965	58,043 [r]	75,100
Total	405,620	430,531	427,682	429,874 [r]	531,000
Kazakhstan, electric furnace:					
Ferromanganese	1,075	5,349	2,278	1,931	2,000
Silicomanganese	102,719	141,200	164,000	178,920	180,000
Total	103,794	146,549	166,278	180,851	182,000
Korea, North, electric furnace, ferromanganese[e]	6,000	6,000	6,000	6,000	6,000
Korea, Republic of, electric furnace:					
Ferromanganese	146,373	143,525	137,000 [e]	141,000 [r]	145,000
Silicomanganese	103,522	101,877	94,000 [e]	-- [r]	--
Total	249,895	245,402	231,000 [e]	141,000 [r]	145,000
Mexico, electric furnace:[6]					
Ferromanganese	90,501	60,014	38,532	55,903	72,471 [4]
Silicomanganese	107,922 [r]	74,290	73,263	81,223	103,206 [4]
Total	198,423 [r]	134,304	111,795	137,126	175,677 [4]
Norway, electric furnace:[e]					
Ferromanganese	235,000	240,000	240,000	245,000	245,000
Silicomanganese	230,000	230,000	230,000	230,000	230,000
Total	465,000	470,000	470,000	475,000	475,000
Poland:					
Blast furnace, ferromanganese[e]	--	500	600	600	500
Electric furnace, silicomanganese	19,000	20,000	7,500 [r, e]	10,000 [e]	10,000
Total	19,000	20,500	8,100 [r, e]	10,600 [e]	10,500
Romania, electric furnace:					
Ferromanganese	1,044	384	--	-- [e]	--
Silicomanganese	21,158	71,921	88,665	85,000 [e]	80,000
Total	22,202	72,305	88,665	85,000 [e]	80,000

See footnotes at end of table.

TABLE 8—Continued

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

(Metric tons, gross weight)

Country[3]	2000	2001	2002	2003	2004[e]
Russia:[e]					
Blast furnace, ferromanganese	88,000 r	55,000 r	105,000 r	101,000 r	108,000
Electric furnace, silicomanganese	122,000	124,000	127,000	83,000	143,000
Total	210,000	179,000	232,000	184,000	251,000
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	596,873	498,000	618,954	607,362 r	640,000
Silicomanganese	310,000	253,000	315,802	313,152 r	340,000
Total	906,873	751,000	934,756	920,514 r	980,000
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]	85,400	85,000	85,000	85,000	85,000
Electric furnace:					
Ferromanganese	252,679	231,000	250,617	250,000 e	375,990 4
Silicomanganese	684,040	702,389	732,592	740,000 e	1,060,000 4
Total	1,022,119	1,018,389	1,068,209	1,080,000 e	1,520,000
United States, electric furnace, ferromanganese[7]	W	W	W	W	W
Venezuela, electric furnace:					
Ferromanganese	15,655	12,715	12,000 e	12,000 e	15,000
Silicomanganese	69,735	56,640	36,974	30,632	35,000
Total	85,390	69,355	48,974	42,632	50,000
Grand total	7,380,000 r	7,580,000 r	8,120,000 r	8,420,000 r	9,960,000
Of which:					
Blast furnace, ferromanganese	973,000 r	941,000 r	991,000 r	917,000 r	694,000
Electric furnace, excluding United States:					
Ferromanganese[8]	2,860,000	2,860,000	2,830,000	3,050,000 r	3,610,000
Silicomanganese[9]	3,550,000 r	3,780,000 r	4,300,000 r	4,450,000 r	5,660,000

[e]Estimated. [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 July 22, 2005.

[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.