



2007 Minerals Yearbook

MANGANESE [ADVANCE RELEASE]

MANGANESE

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In 2007, U.S. manganese apparent consumption was an estimated 1.03 million metric tons (Mt), a 2% decrease from 1.05 Mt in 2006 (table 1). Decreases in manganese ore and high-carbon ferromanganese shipments from the U.S. Government's National Defense Stockpile (NDS) and in ferromanganese imports accounted for most of the decrease in apparent consumption.

Manganese imports increased slightly on a content basis to 879,000 metric tons (t) compared with those of 2006 (table 6). Manganese exports increased by 113% to 73,700 t compared with those of 2006 on a content basis, based on the typical manganese contents of the materials as calculated in table 4.

In 2007, the price of ore decreased slightly from that of 2006, while the average prices of manganese ferroalloys and manganese metal rose. The price of metallurgical-grade ore decreased by about 10% internationally. Average spot-market prices for high- and medium-carbon ferromanganese, manganese metal, and silicomanganese increased from those in 2006 by 64%, 57%, 164%, and 94%, respectively.

In 2007, sales of manganese materials from the NDS reduced the Government's inventory of manganese by 32% (content basis), leaving an inventory of about 38% 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 2007 rose by 9% on a gross weight basis and by 3% on a contained-weight basis, compared with that in 2006 (table 8). 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 5% to 12.8 Mt on a gross weight basis compared with that in 2006 (table 9). 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 reported domestic manganese consumption, currently in the range of 77% to 90% of U.S. apparent 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

Stockpile.—The revised Annual Materials Plan (AMP) for fiscal year 2007 that the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency issued on October 3, 2006, covered the period from October 1, 2006, through September 30, 2007. 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; and 2,732 t for synthetic manganese dioxide (Defense National Stockpile Center, 2006). 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 calendar year 2007, disposals (reported sales) of manganese materials announced by the DNSC totaled 322,942 t for nonstockpile-grade metallurgical-grade ore; 65,294 t for high-carbon ferromanganese; 22,727 t for stockpile-grade metallurgical-grade ore; 1,740 t of natural battery-grade ore; and 1,400 t of synthetic manganese dioxide.

The NDS physical inventory of manganese materials, in gross weight, indicated that all inventories decreased from those of 2006. The decreases consisted of 326,886 t for nonstockpile-grade metallurgical ore; 139,766 t for stockpile-grade metallurgical ore; 90,538 t for high-carbon ferromanganese; 1,661 t for natural battery-grade ore; 1,374 t for synthetic manganese dioxide; and 412 t for chemical-grade ore (Defense National Stockpile Center, unpub. data, December 2007). In 2007, the estimated manganese content of manganese inventories being held by the Government at yearend was lowered by 32% to 392,000 t. On the basis of manganese content, the total remaining inventory was about 38% 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.

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.

The strike by hourly workers at Eramet Marietta Inc.'s plant in Marietta, OH, that began on August 27, 2006, ended on February 2, 2007, with a ratification of a new collective bargaining agreement. The new agreement would remain in effect until February 28, 2010 (United Steelworkers Union, 2007). Shortly after the contract ratification, Eramet Marietta declared force majeure on silicomanganese production after its No. 1 furnace suffered a burn-through of molten metal on March 8. The company restarted silicomanganese six weeks later (Metal-Pages, 2007b; Platts Metals Week, 2007a).

Felman Production Inc. sporadically produced silicomanganese during the year; the company reportedly reached a peak production of about 300 metric tons per day (t/d) in December 2006, but suffered problems with two of its three furnaces in January 2007, which reduced output to 80 t/d to 100 t/d. On March 30, Felman declared force majeure on silicomanganese production. However, the company was reportedly operating two furnaces to produce 180 t/d to 200 t/d in October (Metal-Pages, 2007c; Platts Metals Week, 2007b).

Consumption, Uses, and Stocks

Data relating to manganese end use and other information have shown that metallurgical applications account for most domestic manganese consumption, 85% to 90% of which has been for steelmaking. In 2007, reported U.S. ore consumption indicated that unit consumption of manganese in ironmaking, which could not be published to avoid disclosing company proprietary data, was about the same as that of 2006 and remained a relatively minor component of overall manganese use in steelmaking. Reported consumption (gross weight) of ferromanganese and silicomanganese decreased by 8% and 2%, respectively, from that in 2006, and increased by 9% for manganese metal (table 4). Because of incomplete reporting to the U.S. Geological Survey (USGS) voluntary consumption survey, the figures in this table represent relative rather than absolute quantities.

The combination of the indicated consumption pattern with estimates of apparent consumption, on a gross weight basis, suggested that manganese alloys unit consumption in steelmaking was about 7.5 kilograms per metric ton (kg/t) or about 2.9 times that calculated on the basis of reported consumption in 2006. This level was 10% more than the quantity of 6.8 kg/t estimated for 2006 and was a result of significant increases in apparent consumption of ferromanganese, manganese metal, and silicomanganese. Increases in apparent consumption were attributable to significant increases in manganese metal and silicomanganese imports and NDS shipments of ferromanganese.

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 2007, reported domestic consumption of manganese ore decreased by 18% to 298,000 t, while corresponding yearend stocks decreased by 37% to 100,000 t compared with that in

2006 (table 1). Apparent consumption of manganese ore on a contained-weight basis in 2007 was about 998,000 t, which excluded some manganese ore consumed directly by ironmaking and steelmaking plants. The USGS must exclude reporting by these operations to avoid disclosing company proprietary information. The discrepancy between apparent and reported consumption represented incomplete reporting to the USGS voluntary consumption survey.

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 2007, nine 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 chemicals, ferroalloys, and metals. Of those nine companies, all consumed manganese ore in their processes in 2007. The collective consumption of these firms was considered to constitute all the manganese ore consumption in the United States, exclusive of that consumed by the steel industry. Full-year responses on a basis upon which to estimate the data were obtained from all of these firms for 2007, excluding Felman Production Inc.

Prices

Manganese Ore.—The USGS estimated the annual average contract price of metallurgical-grade ore containing 48% manganese to be about \$3.48 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 Chinese cost and freight transaction prices as reported by Ryan’s Notes was \$6.05 per mtu. The range in spot market prices peaked in December at \$11.50 to \$12.00 mtu, up from a low of \$2.70 to \$2.80 mtu at the beginning of the year. 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 in ore quality requirements by end use—ferroalloy production, blast furnace ironmaking, and manufacture of manganese chemicals.

The price of manganese in ore in 2007 and 2006 was 34.8 and 35.1 cents per kilogram, respectively. These values indicate a slight decrease in U.S. cost, insurance, freight (c.i.f.) price, or slightly less than the increase in free on board (f.o.b.) price in international markets compared with those in 2006.

In fiscal year 2007 (April 2007 to March 2008), the international benchmark price for metallurgical-grade ore decreased by 10% from that of 2006, when price negotiations between BHP Billiton Ltd. and major Japanese consumers were concluded in January 2007. On an f.o.b. basis for delivery during the annual contract year, the agreed price was \$2.71 per mtu for ore from the Groote Eylandt Mine in Australia (Ryan’s Notes, 2007a). The decrease in manganese ore prices at that time was attributable primarily to an increased supply of manganese ore.

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 different manganese ferroalloys are largely interchangeable with each other.

Annual 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. Annual average import prices were \$1,422.79 per gross ton for high-carbon ferromanganese, 104.98 cents per pound for medium-carbon ferromanganese, and 76.72 cents per pound for silicomanganese. These prices were 64%, 57%, and 94% higher, respectively, than those of 2006. The annual 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 annual average North American transaction price for manganese metal was 199.39 cents per pound, which was a 164% increase compared with that of 2006. The year-average price for manganese metal was 73% more than the last listed U.S. price for domestically produced electrolytic manganese metal of \$1.15 per pound at the beginning of 1996.

Manganese alloy spot-market prices rose because of the following reasons: concerns that temporary production cuts by manganese producers in Brazil, France, and the United States might lead to supply shortages; increased demand by the global steel industry; higher manganese ore spot prices, especially towards the end of 2007; and higher ocean transportation costs. Manganese metal prices rose in response to increased demand from the domestic aluminum sector, and higher manganese ore spot prices and ocean transportation costs.

According to Platts Metals Week, the price range for high-carbon ferromanganese containing 78% manganese, per gross ton, began the year at \$840 to \$900 and ended the year at \$1,875 to \$1,950, for a net increase of 120%. 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 66 to 72 cents and ended the year at 155 to 162.50 cents, for a net increase of 130%. The price range for imported silicomanganese with 2% carbon, per pound of alloy, started the year at 38 to 40 cents and ended 2007 at 81 to 83 cents, for a net increase of 110%.

According to Ryan's Notes North American transaction prices, the 2007 yearend price of bulk manganese metal shipments was 190 to 200 cents per pound, a net increase of 109% from the price of 92 to 95 cents per pound at the beginning of the year.

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

U.S. exports of ferromanganese, manganese dioxide, manganese ore, and silicomanganese increased during 2007, while exports of manganese metal decreased compared with exports for 2006 (table 5). The biggest year-to-year change in exports was that of manganese ore, which were about 12 times greater than those in 2006. China accounted for 93% of manganese ore exports, followed by Canada at 4%.

U.S. imports of manganese metal, manganese ore, and silicomanganese increased during 2007 compared with those of 2006, while imports of ferromanganese, manganese dioxide, and potassium permanganate fell (table 6). The most significant year-to-year change was for imports of ferromanganese; these were 12% less than those of 2006. Decreases in this import category were especially notable for those from the Republic of Korea, with a decrease of 28,700 (-75%), China, with a decrease of 23,300 t (-35%), and from Brazil, with a decrease of 10,800 t (-100%) year-on-year.

Imports of spiegeleisen (pig iron containing about 20% manganese) decreased to 2 t in 2007 from 247 t in 2006, on a gross weight basis, with a total customs value of \$682,011. This would equate to \$341,000 per metric ton, which would seem to be implausible. All of these imports were from South Africa (U.S. Census Bureau, unpub. data, December 2008).

2007 Review of Manganese Metal Powder under the U.S. Generalized System of Preferences (GSP).—The Office of the United States Trade Representative (USTR) denied the petition brought by Manganese Metal Co., Ltd. (MMC), Nelspruit, South Africa, to grant GSP eligibility for manganese metal powder imported from South Africa (Office of the United States Trade Representative, 2008a, b). MMC is the sole producer of manganese metal powder in South Africa. Had GSP eligibility been granted, the 14% ad valorem duty on South African manganese metal powder imports would have been eliminated.

Antidumping Duty Administrative Reviews.—Final antidumping duty rates assessed in 2007 on imports of manganese materials to the United States are summarized in table 7.

World Industry Structure

World manganese ore production was an estimated 12.6 Mt (contained manganese) in 2007, up 3% from that in 2006. The bulk (98%) of manganese ore was produced in 10 countries. On a manganese-content basis, the leading producer countries of manganese ore were, in decreasing order, South Africa (21%), Australia (20%), China (16%), Gabon (12%), and Brazil (7%) (table 8). World manganese ferroalloy production in 2007 was 12.5 Mt (gross weight), a 5% increase from that of 2006. On a gross weight basis, the leading producer countries of manganese ferroalloys were, in decreasing order, China (47%), Ukraine (13%), South Africa (8%), Brazil (5%), Japan (4%), and Norway (4%) (table 9).

Camaj (2008) estimated world consumption of manganese ferroalloys increased by 13.9% to 13.4 Mt in 2007 compared with that of 2006. Of that amount, 7.6 Mt was silicomanganese, 4.6 Mt was high-carbon ferromanganese, and 1.2 Mt was refined (medium- and low-carbon) ferromanganese. World production

of manganese ferroalloys was estimated at 13.2 Mt, slightly less than world consumption. Global manganese ore production was about 12.7 Mt (contained manganese), which was an increase of 9% from that of 2006. The world production of manganese ferroalloys exceeded the supply of manganese ore mined in 2007 by about 4%.

New manganese materials projects scheduled for completion around the world from 2007 through 2012 are listed in table 10.

World Review

European Union.—On September 17, the Council of the European Union assessed a provisional antidumping duty of 14.9% on electrolytic manganese dioxide (EMD) imported during the period of October 1, 2005, to September 30, 2006, from South Africa. The provisional duty rate was for EMD that had not undergone heat treatment after the electrolytic process (Official Journal of the European Union, 2007b, p. 20).

On December 4, the Council of the European Union assessed antidumping duties on silicomanganese imported during the period of July 1, 2005, to June 30, 2006, from China (8.2%) and Kazakhstan (6.5%). No duties were imposed on silicomanganese imports from Ukraine (Official Journal of the European Union, 2007c, p. 31). The Commission of the European Communities immediately suspended the imposed duties for 9 months (Official Journal of the European Union, 2007a).

Australia.—Bootu Creek Resources Pty. Ltd. (a subsidiary of Singapore's OM Holdings Limited) produced 516,448 t of manganese ore at an average grade of 42.2% manganese in 2007 at its mine in the Northern Territory. Ore reserves at the Bootu Creek Manganese Mine were 10.3 Mt (24.5% average manganese content); mineral resources were estimated to be 17.75 Mt (25.7% average manganese content) (OM Holdings Limited, 2008).

Palmary Enterprises Limited, a private Ukrainian company, finalized its purchase of Australian manganese ore producer Consolidated Minerals Limited in January 2008. As a result, Consolidated was delisted from public securities trading on the Australian Securities Exchange and the Alternative Investment Market of the London Stock Exchange (Consolidated Minerals Limited, 2008).

Brazil.—Companhia Vale do Rio Doce (Vale) was the largest manganese ore and ferroalloy producer in Brazil. Vale produced 1.3 Mt of manganese ore in 2007, a decrease of 41% from that of 2006. The Azul Mine in Carajás produced 945,000 t. The decrease in manganese ore production took place because the company suspended operations at its Azul Mine from July until mid-December to give priority to the transportation of iron on the Carajás railroad. Vale's manganese alloy production was higher in 2007 than in 2006, increasing to 542,000 t from 534,000 t. The increase in manganese alloy production was attributable to the company's facilities in Brazil and Mo I Rana, Norway (Companhia Vale do Rio Doce, 2008, p. 4).

Burkina Faso.—Namibian copper producer Weatherly International plc. and Australian Territory Resources Limited agreed to acquire 72% interest in the Tambao manganese deposit from Dubai-based Wadi Al Rawda Industrial Investments, and carry out a prefeasibility mining study by September

2008 (Territory Resources Limited, 2007). The deposit, which is located about 340 kilometers northeast of the capital Ouagadougou in the Tambao region of Burkina Faso, had proven, probable, and predicted reserves of approximately 19 Mt with an average manganese content of 50%. Reserve estimates were based on exploration activities conducted by Interstar Mining Group Inc. in 1992 (Weatherly International plc, 2008).

Cameroon.—American company Geovic Mining Corp. announced plans to expand cobalt-nickel reserves and resources at its Nkamouna deposit in southeastern Cameroon. The deposit was estimated in 2006 to contain 26.3 Mt of proven reserves and 26.4 Mt of probable ore reserves at average grades of 0.24% cobalt, 0.72% nickel, and 1.22% manganese (Geovic Mining Corp., 2007). In 2008, the company changed its processing designs to include coproduction of manganese in carbonate form rather than disposing manganese in the form of manganese hydroxide, as originally planned. Proven manganese ore reserves of the Nkamouna deposit were about 728,000 t at a revised average grade 1.3% manganese (Geovic Mining Corp., 2008). Geovic planned to be fully producing manganese carbonate by 2011 at a rate of 55,000 t/yr (47.5% manganese content) (David C. Beling, chief operating officer, Geovic Mining Corp., unpub. data, October 3, 2008).

China.—Chinese imports of manganese ore were at an alltime high of 6.64 Mt (gross weight) in 2007, up 7% from that of 2006 (TEX Report, 2008a). This was 53% of the USGS estimated total world production in 2007. The bulk of the imported manganese ore was most likely used to blend with lower-grade domestic manganese ore for the production of manganese ferroalloys and metal.

China, the leading producer of electrolytic manganese metal in the world, exported about 320,000 t of manganese metal in 2007, a decrease of about 6% from that in 2006 (TEX Report, 2008b). Only two countries—China and South Africa—produced electrolytic manganese metal in 2007. China's electrolytic manganese metal capacity was estimated to be about 71% of the world total (1.7 Mt) in 2007.

The Central Government of China instituted the following actions, which affected manganese materials: 1) a new export licensing system on domestic manganese ferroalloy exports; 2) export floor prices for high-carbon ferromanganese, manganese metal, and silicomanganese; 3) higher duty on manganese ore exports; 4) a ban on ferromanganese production by small blast furnaces; and 5) higher duties on ferromanganese and silicomanganese exports.

The new export licensing system, effective January 1, was established to monitor the amount of domestic ferroalloys being exported. The new system required exporters of ferromanganese, manganese metal, manganese scrap, and silicomanganese to get export licenses from the Commission of Foreign Economic Relations and Trade (TEX Report, 2007c).

A new system of export floor prices for high-carbon ferromanganese, manganese metal, and silicomanganese, effective April 1, was implemented to stem low-priced exports. The export floor prices were expected to fluctuate depending on market conditions (TEX Report, 2007b).

The duty on exports of manganese ore (minimum 20% manganese content) was raised to 15% from 10% effective June 1 (TEX Report, 2007d). China, however, has historically been a net importer of manganese ore and exporting very little. In 2007, Chinese manganese ore exports were less than 0.1% of the amount imported as calculated from United Nations commodity trade statistics.

On August 18, regulations were implemented that would prohibit ferromanganese production by small blast furnaces of less than 300 cubic meters to reduce air pollution. The regulations were not expected to significantly decrease ferromanganese production in the country because the amount of ferromanganese produced by such small blast furnaces is thought to be minor (TEX Report, 2007a).

The Central Government of China raised the duty on ferromanganese and silicomanganese exports to 20% from 10% effective January 1, 2008. With these duties, the Chinese Government aimed to reduce exports of these materials from the country so more material would be available for the domestic market (TEX Report, 2008c).

France.—Vale's Rio Doce Manganese Europe stopped manganese ferroalloy production at its Dunkerque plant from August 24 through mid-October to repair a slag leak at an electric furnace. As a result, production was down 29% to 103,000 t in 2007 from that of 2006. This loss was partially offset by increased production at the company's Mo I Rana manganese ferroalloys plant in Norway (Metal-Pages, 2007a; Companhia Vale do Rio Doce, 2008).

Georgia.—Georgian Manganese Ltd. (a subsidiary of United Kingdom-based Stemcor Holdings Ltd.) purchased the Chiaturmanganets Manganese Mine from the Government of Georgia in an auction for about \$77 million. Georgian Manganese also owns Georgia's manganese ferroalloy producer Zestafonskiy Ferro-Alloy Works. As part of the purchase, Georgian Manganese agreed to increase ore production to 300,000 t/yr from 100,000 t/yr, of which 200,000 t/yr would supply the Zestafonskiy plant. Zestafonskiy's output would increase to 300,000 t/yr in 2 years (Ryan's Notes, 2007c).

Ghana.—Ukrainian Privat Group purchased Ghana Manganese Company Ltd. (GMC), which mines about 1.7 Mt/yr of ore from its Nsuta-Wassaw manganese deposit. Privat was expected to shift GMC's Chinese exports (35%) to its manganese ferroalloy operations in Ukraine and the United States (Felman Productions, Inc.) (Ryan's Notes, 2007d).

Mexico.—Minera Autlan restarted its Gómez Palacio silicomanganese plant for the first time since August 2005. The plant has a production capacity of 30,000 t/yr (Ryan's Notes, 2007b).

Slovakia.—The world's leading steel producer, ArcelorMittal, acquired OFZ, a.s., the sole producer of ferroalloys in Slovakia. OFZ produces mainly ferromanganese, ferrosilicon, and silicomanganese, having a 150,000-t/yr production capacity (ArcelorMittal, 2007).

South Africa.—Russian miner and steelmaker Evraz Group S.A. acquired an 80.9% stake in Highveld Steel & Vanadium Corporation Limited, which included the Transalloys division. Transalloys produces mainly medium-carbon ferromanganese and silicomanganese (Evraz Group, S.A., 2008, p. 14–15).

Vietnam.—The Ministry of Industry approved a US\$363 million master plan for the country's exploration, exploitation, processing, and usage of chromite and manganese ores during 2007 to 2015. The plan called for the mining of 190,000 t/yr of chromite and manganese ores by 2007, increasing to about 530,000 t/yr by 2015. Manganese processing plants would be established on a small-scale in the Provinces of Ha Giang, Ha Tinh, and Tuyen Quang, and on a larger-scale—40,000 t/yr total—in the Provinces of Cao Bang and Thai Nguyen (Vietnam Ministry of Industry, 2007).

Outlook

The trend of domestic and global consumption 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 consumption, 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 2007 USGS Minerals Yearbook, volume I, Metals and Minerals. According to the World Steel Association (formerly the International Iron and Steel Institute), 2007 raw steel production was about the same in the United States while increasing about 8% globally from that in 2006 (World Steel Association, 2009).

World apparent consumption of finished steel products increased by 6.6% to 1.202 billion metric tons in 2007 from that in 2006. This increase was primarily attributed to steel consumption in Asia, particularly in China. Asia accounted for 56% of steel consumed worldwide in 2007, up by 10% to 670.6 Mt from that in 2006. China alone consumed about 408 Mt, a 9% increase from that of 2006. Steel consumption in 2007 was also up in all other regions of the world except North America (-9.1%); Brazil, China, India, and Russia accounted for about 43% of the total. Global steel apparent consumption was projected to increase by 6.7% and 6.3% in 2008 and 2009, respectively. Brazil, China, India, and Russia were expected to lead this growth with a combined increase in steel consumption of 11.1% and 10.3% in 2008 and 2009, respectively. Steel consumption in North America was forecast to increase by about 2% to 144.2 Mt in 2008 compared with that in 2007, and by 1% between 2008 and 2009 (International Iron and Steel Institute, 2008).

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 2007 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. consumption for primary and secondary batteries was projected to increase 2% annually through 2012 to \$16.4 billion. Primary battery sales were forecast to rise faster than those of secondary batteries, owing in part to the growing need for replacement primary batteries in portable devices. Sales of secondary

batteries were expected to increase at an annual rate of 1.5% through 2012 (Freedonia Group, Inc., The, 2009).

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TABLE 1
SALIENT MANGANESE STATISTICS¹

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

	2003	2004	2005	2006	2007
United States:					
Manganese ore (35% or more Mn):					
Exports	18	123	13	2	29
Imports for consumption	347	451	656	572	602
Consumption ²	398	441	368	365	298
Stocks, December 31, consumers ²	156	159	337	159	100
Ferromanganese:					
Exports	11	9	14	22	29
Imports for consumption	238	429	255	358	315
Consumption	248	315	286	297	272
Stocks, December 31, consumers and producers	20	25	30	31	16
Consumption, apparent, manganese content ³	643	1,030	773	1,050	1,030
Ore price, c.i.f. ⁴ U.S. ports, dollars per metric ton unit	2.41	2.89	4.39	3.51	3.48
World, production of manganese ore	24,200 ^r	27,900 ^r	31,000 ^r	32,800 ^r	35,700 ^e

^eEstimated. ^rRevised.

¹Data are rounded to no more than three significant digits.

²Exclusive of iron and steel plants.

³Based on estimates of average content for all significant components except imports, for which content is reported.

⁴Cost, insurance, and freight.

TABLE 2
U.S. GOVERNMENT DISPOSAL AUTHORITIES AND INVENTORIES FOR MANGANESE MATERIALS
AS OF YEAREND 2007¹

(Metric tons, gross weight)

Material	Disposal authority	Physical inventory ^e				Grand total
		Stockpile grade	Uncommitted		Sold, pending shipment	
			Nonstockpile grade	Total		
Synthetic manganese dioxide	2,610	1,240	--	1,240	1,370	2,610
Natural battery ore	17,600	15,900	--	15,900	1,660	17,600
Chemical ore	868	456	--	456	412	868
Metallurgical ore	332,000	--	5,200	5,200	327,000	332,000
High-carbon ferromanganese	517,000	461,000	--	461,000	55,600	517,000

^eEstimated. -- Zero.

¹Data 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 2007

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.
Felman Productions Inc. ²	New Haven, WV		X		Do.
Tronox LLC	Henderson, NV			X	Electrolytic.

Do. Ditto.

¹FeMn, ferromanganese; SiMn, silicomanganese; MnO₂, synthetic manganese dioxide.

²Product information obtained from various industry trade publications.

TABLE 4
U.S. CONSUMPTION, BY END USE, AND INDUSTRY STOCKS OF MANGANESE FERROALLOYS AND METAL IN 2007¹

(Metric tons, gross weight)

End use	Ferromanganese			Silicomanganese	Manganese metal
	High carbon	Medium and low carbon	Total		
Steel:					
Carbon	104,000	80,500	185,000	52,400	1,140
High-strength, low-alloy	16,500	9,960	26,400	4,260	16
Stainless and heat-resisting	7,470	1,140	8,620	14,400	1,030
Full alloy	21,800	9,010	30,800	16,400	23
Unspecified ²	1,290	638	1,920	902	2,130
Total	151,000	101,000	253,000	88,400	4,340
Cast irons	6,620	391	7,020	455	5
Superalloys	W	W	W	(3)	439
Alloys (excluding alloy steels)	4	--	4	--	15,000 ⁴
Miscellaneous and unspecified	(5)	(5)	(5)	(5)	(5)
Grand total	164,000	108,000	272,000	92,400 ⁶	19,700
Total manganese content ⁷	958	86,300	214,000	61,000	20,200
Stocks, December 31, consumers and producers	5,930	9,690	15,600	4,480	920

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

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

²Includes electrical and tool steel.

³Less than ½ unit.

⁴Approximately 85% of this combined total was for consumption in aluminum alloys.

⁵Withheld to avoid company proprietary data.

⁶Internal evaluation indicates that silicomanganese consumption is considerably understated.

⁷Estimated based on typical percentages of manganese content.

TABLE 5
U.S. EXPORTS OF MANGANESE ORE, FERROALLOYS, AND METAL, BY COUNTRY¹

Country	2006		2007	
	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:				
Canada	1,470	\$506	1,090	\$409
China	35	15	26,700	3,700
Germany	180	365	469	859
Indonesia	23	25	--	--
Japan	103	43	--	--
Korea, Republic of	--	--	124	102
Mexico	--	--	50	22
Sweden	19	49	--	--
Venezuela	361	71	--	--
Vietnam	--	--	209	58
Other	43 ^r	44 ^r	96	51
Total	2,240	1,120	28,700	5,200
Ferromanganese, all grades:				
Canada	6,340	5,250	5,030	4,440
Mexico	1,560	1,220	16,400	15,400
Netherlands	13,700	7,550	6,370	3,820
Other	78	77	1,240	1,290
Total	21,700	14,100	29,100	25,000
Silicomanganese:				
Brazil	123	103	21	20
Canada	596	533	2,960	2,870
Dominican Republic	--	--	32	26
Mexico	129	135	301	311
Other	100	117	3	6
Total	947	888	3,310	3,230
Metal, including alloys and waste and scrap:				
Belgium	1,370	2,440	615	1,330
Canada	547	1,430	168	451
China	157	342	235	512
France	347	1,370	5	11
Germany	154	425	178	387
Hong Kong	96	314	469	1,200
India	74	162	306	843
Japan	846	2,250	736	2,630
Other	313 ^r	882 ^r	563	1,510
Total	3,900	9,610	3,280	8,880
Manganese dioxide:				
Belgium	283	373	277	510
Canada	3,340	1,960	5,060	2,740
Germany	502	980	430	874
Indonesia	4	10	305	210
Mexico	708	628	1,020	900
Poland	120	225	116	175
Russia	251	284	372	433
Other	613 ^r	1,110 ^r	1,740	2,800
Total	5,820	5,580	9,320	8,640

^rRevised. -- Zero.

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

²Free alongside ship.

Source: U.S. Census Bureau.

TABLE 6

U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY¹

Country	2006			2007		
	Quantity		Value, customs (thousands)	Quantity		Value, customs (thousands)
	Gross weight (metric tons)	Mn content (metric tons)		Gross weight (metric tons)	Mn content (metric tons)	
Ore and concentrates with 20% or more manganese:						
All grades:						
Australia	25,000	12,800	\$3,900	70,500	34,900	\$9,230
Belgium	2,090	1,100	305	64	42	26
Brazil	9,400	5,800	1,520	39,600	20,000	3,960
Canada	6,510	1,850	309	24,500	5,380	1,000
China	6,700	3,120	617	36,300	10,600	1,690
Colombia	39,200	17,500	675	--	--	--
Gabon	230,000	120,000	26,600	307,000	170,000	31,200
Ghana	41,200	15,400	2,410	--	--	--
Mexico	5,900	1,320	708	9,020	3,670	895
South Africa	206,000	91,200	16,800	115,000	53,600	9,590
Other	38	29	15	3	1	5
Total	572,000	270,000	53,900	602,000	298,000	57,600
More than 20% but less than 47% manganese:						
Australia	--	--	--	27,500	12,500	2,940
Brazil	1,790	812	280	--	--	--
Canada	6,510	1,850	309	24,500	5,380	1,000
China	2,410	858	115	31,500	7,830	1,060
Colombia	39,200	17,500	675	--	--	--
Gabon	--	--	--	46,600	20,300	3,860
Ghana	41,200	15,400	2,410	--	--	--
Mexico	2,950	1,030	353	5,980	2,150	712
South Africa	107,000	40,600	7,660	60,400	26,900	4,370
Other	--	--	--	3	1	5
Total	201,000	78,000	11,800	196,000	75,000	13,900
47% or more manganese:						
Australia	25,000	12,800	3,900	43,000	22,500	6,300
Belgium	2,090	1,100	305	64	42	26
Brazil	7,600	4,990	1,240	39,600	20,000	3,960
China	4,300	2,260	502	4,760	2,760	630
Gabon	230,000	120,000	26,600	261,000	149,000	27,300
Ghana	--	--	--	--	--	--
Mexico	2,950	287 ²	354	3,040	1,520	183
South Africa	98,300	50,700	9,140	54,200	26,700	5,230
Other	38	29	15	--	--	--
Total	371,000	192,000	42,100	405,000	223,000	43,700
Ferromanganese:						
All grades:						
Australia	4,000	3,090	2,240	--	--	--
Brazil	10,800	8,480	7,110	--	--	--
China	67,000	53,400	61,400	43,700	61,100	99,400
France	1,500	1,170	764	1,300	1,050	970
Georgia	1,470	1,160	637	2,010	1,580	1,910
Hong Kong	500	375	327	--	--	--
India	3,000	2,280	2,170	2,450	1,850	2,880
Japan	3,500	2,810	3,690	2,800	2,380	3,390
Korea, Republic of	38,200	30,400	32,600	9,500	7,690	14,300
Mexico	19,500	15,600	16,500	16,800	13,600	17,900
Norway	4,370	3,580	5,200	1,680	1,360	3,610
South Africa	193,000	151,000	133,000	182,000	142,000	189,000

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY¹

Country	2006			2007		
	Quantity		Value, customs (thousands)	Quantity		Value, customs (thousands)
	Gross weight (metric tons)	Mn content (metric tons)		Gross weight (metric tons)	Mn content (metric tons)	
Ferromanganese—Continued:						
All grades:						
Ukraine	10,800	8,300	\$7,500	--	--	--
Other	1,050	809	1,050	52,700	14,900	\$24,200
Total	358,000	282,000	275,000	315,000	247,000	358,000
1% or less carbon:						
China	21,100	17,900	25,700	32,100	27,000	57,400
Japan	3,500	2,810	3,690	1,100	935	1,400
Korea, Republic of	9,310	7,670	9,420	4,200	3,390	7,210
Mexico	6,920	5,580	7,230	6,560	5,320	7,600
Norway	1,080	869	1,350	1,170	934	2,510
South Africa	2,790	2,560	4,100	5,400	4,410	4,990
Other	42	37	58	60	50	188
Total	44,800	37,500	51,500	50,600	42,000	81,300
More than 1% to 2% or less carbon:						
Brazil	1,550	1,250	1,500	--	--	--
China	13,200	10,700	13,200	11,600	9,270	10,800
Korea, Republic of	15,700	12,700	14,000	5,300	4,290	7,090
Mexico	12,500	10,000	9,260	9,900	7,950	9,930
Norway	3,270	2,690	3,830	516	424	1,100
South Africa	32,500	26,400	28,700	24,800	20,100	34,300
Other	255	204	288	1,800	1,530	2,170
Total	79,000	63,900	70,800	53,900	43,600	65,400
More than 2% but not more than 4% carbon:						
Brazil	19	14	19	--	--	--
Georgia	1,470	1,160	637	--	--	--
Total	1,490	1,170	656	--	--	--
More than 4% carbon:						
Australia	4,000	3,090	2,240	3,410	2,500	3,880
Brazil	9,200	7,220	5,590	2,220	1,710	1,980
China	32,700	24,800	22,600	32,600	24,800	31,200
France	1,500	1,170	764	1,300	1,050	970
Hong Kong	500	375	327	--	--	--
India	3,000	2,280	2,170	2,450	1,850	2,880
Korea, Republic of	13,200	10,000	9,190	--	--	--
Mexico	44	35	53	370	295	414
Norway	21	18	25	--	--	--
South Africa	157,000	122,000	101,000	152,000	117,000	150,000
Ukraine	10,800	8,300	7,500	5,010	3,870	7,290
Other	749	569	700	11,300	8,300	12,600
Total	233,000	180,000	152,000	211,000	162,000	211,000
Silicomanganese:						
Australia	29,000	19,400	19,400	36,300	24,700	40,200
Georgia	49,400 ²	36,000 ²	32,600	52,600	37,600	68,500
Korea, Republic of	13,000	8,330	9,920	7,430	4,810	10,100
Macedonia	--	--	--	29,900	19,900	37,100
Mexico	17,300	11,300	12,000	15,700	10,300	12,600
Norway	77,800	48,300	68,200	55,700	34,600	72,700
Romania	32,300	21,400	22,700	37,800	26,500	49,900
Russia	3,960 ²	2,030 ²	2,920	7,160	4,990	10,600
Saudi Arabia	7,510	4,820	4,370	3,540	2,250	3,350
South Africa	168,000	111,000	115,000	166,000	110,000	181,000

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY¹

Country	2006			2007		
	Quantity		Value, customs (thousands)	Quantity		Value, customs (thousands)
	Gross weight (metric tons)	Mn content (metric tons)		Gross weight (metric tons)	Mn content (metric tons)	
Silicomanganese—Continued:						
Other	2,200 ²	1,450 ²	\$1,080	2,490	1,710	\$3,440
Total	400,000	264,000	288,000	415,000	278,000	489,000
Metal:						
Unwrought³:						
China	21,200	XX	28,000	27,900	XX	72,800
Germany	836	XX	1,580	1,420	XX	4,840
South Africa	7,800	XX	13,400	5,950	XX	11,900
Spain	496	XX	827	181	XX	380
Other	112	XX	253	387	XX	1,490
Total	30,400	XX	44,000	35,900	XX	91,400
Other manganese, wrought:						
Brazil	463	XX	601	--	XX	--
China	710	XX	883	372	XX	914
Mexico	223	XX	376	420	XX	1,870
Other	97	XX	439	166	XX	1,100
Total	1,490	XX	2,300	958	XX	3,890
Waste and scrap:						
Canada	1,010	XX	349	1,140	XX	413
Total	1,010	XX	349	1,140	XX	413
Manganese dioxide:						
Australia	13,700	XX	19,300	16,300	XX	21,700
Brazil	344	XX	322	118	XX	178
China	15,100	XX	16,000	9,050	XX	9,520
Japan	6,480	XX	8,940	3,560	XX	4,860
South Africa	2	XX	4	161	XX	274
Other	867 ^r	XX	2,060 ^r	958	XX	1,870
Total	36,400	XX	46,600	30,100	XX	38,400
Potassium permanganate:						
Czech Republic	584	XX	1,290	403	XX	948
India	582	XX	1,370	554	XX	1,340
Other	130	XX	293	161	XX	392
Total	1,300	XX	2,950	1,120	XX	2,680

^rRevised. XX Not applicable. -- Zero.

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

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

³Imports of unwrought metal include flake, powder, and other.

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

TABLE 7
MANGANESE MATERIALS: FINAL ANTIDUMPING DUTY RATES ASSESSED IN 2007, BY DATE¹

Date	Imported material	Country of origin	Period of investigation	Producer and duty rate
August 2	Silicomanganese	India	5-year review ²	All imports (17.74%), except those from: Nava Bharat Ventures Limited (15.32%); Universal Ferro and Allied Chemicals, Ltd. (20.53%)
Do.	do.	Kazakhstan	do.	All imports (247.88%)
Do.	do.	Venezuela	do.	All imports (24.62%), except those from, Hornos Eléctricos de Venezuela, S.A. (--)

Do., do. Ditto. -- Zero.

¹Antidumping duties are assessed by the International Trade Administration (ITA) of the U.S. Department of Commerce.

²Conducted on existing antidumping duty order(s) by the ITA and the U.S. International Trade Commission.

Source: Federal Register.

TABLE 8
MANGANESE ORE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons)

Country ³	Mn content, percentage ^{c,4}	2003	2004	2005	2006	2007
Australia: ⁵						
Gross weight		2,564	3,431	3,136	4,556	5,289
Mn content	37–53	1,247	1,570	1,500	2,192	2,540
Brazil: ⁶						
Gross weight		2,544	3,143	3,200	3,128	1,866 ^p
Mn content	37–51	1,286	1,346	1,370	1,845 ^r	933 ^e
China: ^{c,7,8}						
Gross weight		4,600	5,500	7,500	8,000	10,000
Mn content	20–30	920	1,100	1,500	1,600	2,000
Gabon: ⁹						
Gross weight		2,000	2,460	2,859	3,000	3,300
Mn content ^c	45–53	873	1,090	1,290	1,350	1,485
Ghana:						
Gross weight		1,509	1,597	1,715	1,600 ^e	1,600 ^e
Mn content ^c	32–34	528	559	600	600	600
India: ¹⁰						
Gross weight		1,650	1,776	2,386	2,084 ^r	2,300 ^e
Mn content	10–54	620	630	927	844 ^r	900 ^e
Kazakhstan, crude ore:						
Gross weight		2,361	2,318	2,208	2,531 ^r	2,482
Mn content ^c	20–30	580	570	540	550	600
Mexico: ¹¹						
Gross weight		320	377	369	346 ^r	350 ^e
Mn content	36–37	115	136	133	124 ^r	125
South Africa: ⁹						
Gross weight		3,501	4,282	4,612	5,213	5,996
Mn content	30–48+	1,585	1,905	2,100	2,300	2,600
Ukraine:						
Gross weight		2,591	2,362	2,260	1,606 ^r	1,720
Mn content ^c	30–35	880	810	770	546 ^r	580
Other: ^{c,12}						
Gross weight		547 ^r	612 ^r	724 ^r	741 ^r	818
Mn content	XX	153 ^r	181 ^r	233 ^r	228 ^r	256
Total:						
Gross weight		24,200	27,900	31,000 ^r	32,800 ^r	35,700
Mn content	XX	8,790 ^r	9,900 ^r	11,000 ^r	12,200 ^r	12,600

^eEstimated. ^pPreliminary. ^rRevised. XX Not applicable.

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

²Table includes data available through July 22, 2008. 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.

³In 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.

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

⁵Metallurgical ore.

⁶Production of beneficiated ore as reported in Mineral Summary, Brasilia, Brazil.

⁷Includes manganiferous ore.

⁸The International Manganese Institute estimated Chinese manganese ore production, in gross weight and Mn content, respectively, to be in metric tons, as follows: 2004—8,500,000 and 1,700,000; 2005—12,000,000 and 2,400,000; 2006—11,000,000 and 2,200,000; and 2007—14,000,000 and 2,800,000.

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

¹⁰Reported on a fiscal year-basis. Much of India's production grades below 35% Mn; content averaged 38.3% Mn for fiscal years 2002–03 through 2006–07.

TABLE 8—Continued
MANGANESE ORE: WORLD PRODUCTION, BY COUNTRY^{1,2}

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

¹²Category represents the combined totals of Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burma, Chile, Colombia, Cote d'Ivoire, Egypt, Georgia, Hungary, Indonesia, Iran, Italy (from wastes), Morocco, Namibia, Romania, Russia (crude ore), Thailand, Turkey, and Zambia.

TABLE 9
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons, gross weight)

Country ³	2003	2004	2005	2006	2007 ^c
Argentina, electric furnace, silicomanganese ^c	5,000	24,000 ^r	24,000 ^r	24,000 ^r	24,000
Australia, electric furnace: ^c					
Ferromanganese	115,000	115,000	120,000	125,000	125,000
Silicomanganese	135,000	135,000	140,000	140,000	140,000
Total	250,000	250,000	260,000	265,000	265,000
Brazil, electric furnace:					
Ferromanganese	176,076	466,000 ^r	480,000 ^r	573,000 ^{r,p}	575,000
Silicomanganese	261,924	303,784	297,600	292,230	350,370 ^{p,4}
Total	438,000	769,784 ^r	777,600 ^r	865,230 ^r	925,000
China: ^c					
Blast furnace, ferromanganese	550,000	590,000	500,000	600,000 ^r	620,000
Electric furnace:					
Ferromanganese	700,000	1,120,000	1,150,000	1,400,000 ^r	1,500,000
Silicomanganese	1,800,000	2,600,000	3,000,000	3,600,000 ^r	3,800,000
Total	3,050,000	4,310,000	4,650,000	5,600,000	5,920,000
Egypt, electric furnace, ferromanganese ^c	30,000	30,000	30,000	30,000	30,000
France:					
Blast furnace, ferromanganese	162,000	--	--	--	--
Electric furnace:					
Ferromanganese	120,000	106,000 ^r	109,000 ^r	140,000 ^r	140,000
Silicomanganese ⁵	60,700	64,100	52,300	63,300	65,000
Total	342,700	170,100 ^r	161,300 ^r	203,300 ^r	205,000
Georgia, electric furnace: ^c					
Ferromanganese	12,400	12,800	13,900	5,130	5,000
Silicomanganese	50,900	93,800 ^r	109,000	117,000	120,000
Total	63,300	107,000 ^r	123,000	122,000	125,000
India, electric furnace: ^c					
Ferromanganese	165,000	170,000	170,000	180,000	180,000
Silicomanganese	160,000	160,000	170,000	180,000	180,000
Total	325,000	330,000	340,000	360,000	360,000
Indonesia, electric furnace: ^c					
Ferromanganese	12,000	12,000	12,000	12,000	12,000
Silicomanganese	7,000	7,000	4,000	5,000	6,000
Total	19,000	19,000	16,000	17,000	18,000
Italy, electric furnace: ^c					
Ferromanganese	25,000 ^r	38,000 ^r	32,000 ^r	13,000 ^r	15,000
Silicomanganese	100,000	100,000	100,000	96,600 ^r	95,000
Total	125,000 ^r	138,000 ^r	132,000 ^r	110,000 ^r	110,000
Japan, electric furnace:					
Ferromanganese	371,831	437,389	448,616	406,489	431,000
Silicomanganese	58,043	73,041	94,725	59,604	55,400
Total	429,874	510,430	543,341	466,093	486,000
Kazakhstan, electric furnace:					
Ferromanganese ^c	1,931 ⁴	2,000	2,100	2,100	2,100
Silicomanganese	178,920	155,324	170,214	220,000 ^c	220,000
Total	180,851	157,324	172,314	222,000 ^c	222,000
Korea, Republic of, electric furnace:					
Ferromanganese	141,480	165,525	124,434	169,202 ^r	209,321 ⁴
Silicomanganese	90,942	82,917	74,193	94,119 ^r	105,607 ⁴
Total	232,422	248,442	198,627	263,321 ^r	314,928 ⁴

See footnotes at end of table.

TABLE 9—Continued
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons, gross weight)

Country ³	2003	2004	2005	2006	2007 ^c
Mexico, electric furnace:⁶					
Ferromanganese	55,903	72,471	89,641	62,000 ^r	62,000
Silicomanganese	81,223	103,206	104,780	97,000 ^r	97,000
Total	137,126	175,677	194,421	159,000 ^r	159,000
Norway, electric furnace:^c					
Ferromanganese	245,000	245,000	250,000	245,000	245,000
Silicomanganese	230,000	230,000	230,000	230,000	225,000
Total	475,000	475,000	480,000	475,000	470,000
Poland:					
Blast furnace, ferromanganese	1,000	46,900	7,800	4,100 ^r	4,000
Electric furnace, silicomanganese	5,000	29,600	10,242	3,310 ^r	3,000
Total	6,000	76,500	18,042	7,410 ^r	7,000
Romania, electric furnace, silicomanganese	141,899	194,945	200,000 ^c	53,085 ^r	26,868 ⁴
Russia:^c					
Blast furnace, ferromanganese	101,000	108,000	108,000	125,000	120,000
Electric furnace, silicomanganese	83,000	80,000 ^r	70,000 ^r	70,000 ^r	70,000
Total	184,000	188,000 ^r	178,000 ^r	195,000 ^r	190,000
Slovakia, electric furnace:					
Ferromanganese ^c	20,000	20,000	20,000	20,000	20,000
Silicomanganese	52,733	64,842	47,843 ^r	59,128 ^r	60,000
Total	72,733	84,842	67,843 ^r	79,128 ^r	80,000
South Africa, electric furnace:					
Ferromanganese	607,362	611,914	570,574	656,235 ^r	750,000
Silicomanganese ^c	270,000 ^r	330,000 ^r	230,000 ^r	250,000 ^r	280,000
Total	877,362 ^r	941,914 ^r	800,574 ^r	906,235 ^r	1,030,000
Spain, electric furnace:^c					
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 ^c	85,000	79,000	30,000	30,000	30,000
Electric furnace:					
Ferromanganese	250,000 ^c	375,990	359,000	373,000	368,000
Silicomanganese	740,000 ^c	1,060,000	1,040,000	1,168,000	1,281,000 ⁴
Total	1,080,000 ^c	1,514,990	1,429,000	1,571,000	1,680,000
United States, electric furnace, ferromanganese ⁷	W	W	W	W	W
Venezuela, electric furnace:^c					
Ferromanganese	12,000	15,000	15,000	15,000	15,000
Silicomanganese	30,632 ⁴	35,000	35,000	35,000	35,000
Total	42,632 ⁴	50,000	50,000	50,000	50,000
Grand total	8,610,000 ^r	10,900,000 ^r	11,000,000 ^r	12,200,000 ^r	12,800,000
Of which:					
Blast furnace, ferromanganese	899,000	824,000	646,000	759,000 ^r	774,000
Electric furnace, excluding United States:					
Ferromanganese ⁸	3,070,000 ^r	4,030,000 ^r	4,010,000 ^r	4,440,000 ^r	4,690,000
Silicomanganese ⁹	4,640,000 ^r	6,030,000 ^r	6,300,000 ^r	6,960,000 ^r	7,340,000

^cEstimated. ^PPreliminary. ^rRevised. W Withheld to avoid disclosing company proprietary data; not included in "Grand total." -- Zero.

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

²Table includes data available through July 22, 2008.

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

⁴Reported figure.

⁵Includes silicospiegeleisen, if any.

TABLE 9—Continued
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY^{1,2}

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

⁷U.S. output of ferromanganese includes silicomanganese.

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

⁹Includes silicospiegeleisen, if any, for France.

TABLE 10
MANGANESE MATERIALS: PROJECTS SCHEDULED FOR COMPLETION, BY YEAR, BEFORE 2012^{1,2}

(Metric tons, gross weight, unless otherwise specified)

Projected year of first production	Country	Project and company	Project type	Incremental annual production capacity	Total annual production capacity	Manganese product ³
2007	Cote d' Ivoire	NA Taurian Resources	new mine	80,850	NA	Mn ore.
2007	Ukraine	Stakhanov Ferroalloy Plant Stakhanov Ferroalloy JSC ⁴	furnace conversion—FeSi to SiMn	200,000	50,000 ^c 150,000 ^c	FeSi. SiMn.
2007	Zambia	Kabwe Manganese Mine ⁵ Chiman Manufacturing Ltd.	new mine	16,000	16,000	Mn ore.
2008	Australia	Bootu Creek Manganese Mine OM (Manganese) Ltd.	mine expansion	100,000	700,000	do.
2008	Brazil	Mineração Buritirama Manganese Alloy Plant Mineração Buritirama S.A.	new ferroalloys plant	NA	90,000	HC FeMn, MC FeMn, SiMn.
2008	China	Erdos EJM Manganese Alloys Co. ERDOS Group (51%), JFE Steel Corporation (24.5%), and Mitsui & Co. (24.5%)	ferroalloys plant expansion	75,000	150,000	SiMn.
2008	South Africa	Krugersdorp Manganese Metal Plant Mogale Alloys (Pty.) Limited ⁶	plant conversion—EMM to SiMn, charge Cr, and Cr alloys	20,000	150,000	do.
2009	Australia	Balfour Downs Manganese Project Hancock Prospecting Pty. Ltd.	new mine	NA	350,000	Mn ore. ⁷
2009	Do.	Groote Eylandt Mining Company Pty. Ltd. BHP Billiton Limited (60%) and Anglo American Corporation (40%)	mine expansion	700,000	4,100,000	Mn ore. ⁸
2009	Gabon	Manganese Project, Bembélé Mountains Compagnie Industrielle et Commerciale des Mines de Huazhou (CICMH)	new mine	NA	1,000,000	Mn ore.
2009	Do.	Moanda Mine Compagnie Minière de l'Ogooue (Comilog)	mine expansion	3,500,000	3,700,000	Mn ore. ⁸
2009	India	Corporate Ispat Alloys Limited Abhijeet Group	ferroalloys plant expansion	18,000	58,000	HC FeMn, SiMn.
2009	Do.	Bhilai Ferro-Alloys Plant Manganese Ore (India) Limited (MOIL) (50%) and Steel Authority of India Limited (50%)	new ferroalloys plant	NA NA	70,000 30,000	SiMn. FeMn.
2009	Do.	Maithan Meghalaya Ferro-Alloys Plant Maithan Alloys Limited	do.	NA	28,000	Mn alloys.
2009	Do.	Yona Ferro-Alloys Plant Yona Smelters Pvt. Ltd.	do.	18,000	54,000	FeMn, SiMn.
2009	Japan	Tokushima Plant Nippon Denko	ferroalloys plant expansion	20,000 12,000	220,000 30,000	HC FeMn. MC FeMn, LC FeMn.
2010	Cameroon	Nkamouna Cobalt-Nickel-Manganese Project Geovic Mining Corp.	new mine	NA	55,000	Mn ore. ⁹
2010	India	Balasore Alloys Balasore Alloys Limited	ferroalloys plant expansion	NA	100,000	FeMn, SiMn.

See footnotes at end of table.

TABLE 10—Continued
MANGANESE MATERIALS: PROJECTS SCHEDULED FOR COMPLETION, BY YEAR, BEFORE 2012^{1,2}

(Metric tons, gross weight, unless otherwise specified)

Projected year of first production	Country	Project and company	Project type	Incremental annual production capacity	Total annual production capacity	Manganese product ³
2010	India	Bobbili Ferro-Alloys Plant Manganese Ore (India) Limited (MOIL)	new ferroalloys plant	NA	45,000 30,000	SiMn. FeMn.
2010	South Africa	Kalagadi Manganese Project Kalagadi Manganese (50%) and ArcelorMittal (50%)	new mine-beneficiation- sinter complex and ferroalloys plant	NA	3,000,000 ¹⁰ 320,000	Mn ore. ⁹ FeMn.
2010	Do.	Kalahari Manganese Project United Manganese of Kalahari	new mine	250,000	1,500,000	Mn ore.
2010	Do.	Mamatwan Mine BHP Billiton Limited	mine expansion	1,000,000	3,800,000	Mn ore. ^{8,9}
2011	India	Maithan Vizag Ferro-Alloys Plant Maithan Alloys Limited	new ferroalloys plant	NA	120,000	Mn alloys.
2011	Do.	Orissa Manganese and Minerals Pvt. Ltd. Adhunik Metaliks Ltd.	mine expansion	700,000	1,000,000	Mn ore.
2011	Do.	10 mines ¹¹ Manganese Ore (India) Limited (MOIL)	do.	600,000	2,000,000	do.
2012	Russia	Sosnovoborsk Ferroalloys Plant Turkhansky Meridian	new ferroalloys plant	112,000	211,000	FeMn.
2012	South Africa	Wessels Mine BHP Billiton Limited	mine expansion	700,000	1,600,000	Mn ore.

⁶Estimated. Do., do. Ditto. NA Not available.

¹Estimated data are rounded to no more than three significant digits.

²Projects in feasibility or later stages of development in 2007. Actual startup dates may be postponed, owing to economic or other factors. Additional projects might produce manganese materials by 2012, but not enough information was available to include them.

³Cr Chromium. EMM Electrolytic manganese metal. FeMn Ferromanganese. HC FeMn High-carbon ferromanganese. LC FeMn Low-carbon manganese. MC FeMn Medium-carbon ferromanganese. Mn Manganese. SiMn Silicomanganese.

⁴JSC joint-stock company.

⁵The mine began operation in March 2007. In May, the Zambian Government shut the mine down indefinitely, owing to environmental and safety issues.

⁶Mogale Alloys (Pty.) Limited acquired the Krugersdorp manganese metal plant from Manganese Metal Company (Pty.) Ltd. in 2007.

⁷Ferruginous manganese ore containing an average of more than 25% manganese.

⁸Ores of manganese oxides.

⁹Ores of manganese carbonate.

¹⁰The Kalagadi Manganese sinter plant will have a capacity of 2.4 million metric tons per year.

¹¹Manganese Ore (India) Limited (MOIL) operates 10 mines, 6 of which are located in the Nagpur and Bhandara Districts of Maharashtra and 4 in the Balaghat District of Madhya Pradesh. The company has not specified which mines would be affected by the planned capacity expansion.

Sources: Company annual reports, presentations, and press releases; unpublished personal communications; and trade publications.