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, has accounted for most of the domestic manganese demand, presently in the range of 85% to 90% of the total demand. 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. The overall level and nature of manganese use in the United States is expected to remain about the same in the near term. No practical technologies exist for replacing manganese with other materials or for using domestic deposits or other accumulations to reduce the complete dependence of the United States on foreign countries for manganese ore.

Domestic consumption of manganese ore, exclusive of the relatively small quantities used at iron and steel plants, decreased by 15% from the estimate of 425,000 metric tons (t) in 2001, and was at its lowest level since at least 1993. Unit consumption of manganese in steel, as ferroalloys and metal, was 5.1 kilograms per metric ton (kg/t) of raw steel produced, as estimated from apparent consumption calculations. This level was the second lowest since 1992, when it was 4.6 kg/t of raw steel produced.

For U.S. foreign trade in manganese materials, volumes generally increased for exports and imports compared with those in 2001. On a content basis, the number of manganese units exported increased by 5%, while the number of units imported rose by 4%.

In 2002, the price of ore fell from that of 2001, and prices of ferroalloys rose in 2002. The amount of decrease of the price of metallurgical-grade ore was about 7% internationally. The amount of increase of the price of imported ferroalloys on a year-average basis was 11% for high-carbon ferromanganese, 25% for medium-carbon ferromanganese, and 5% for silicomanganese. In 2002, high-carbon ferromanganese and silicomanganese prices were at their highest at the end of the third quarter; prices for medium-carbon ferromanganese were highest at the beginning of the fourth quarter. In 2002, sales of manganese materials from the Government's National Defense Stockpile reduced the Government's inventory of manganese by about another 7% (content basis), leaving an inventory about 1.6 times the annual domestic consumption. The larger disposals were of high-carbon ferromanganese and metallurgical-grade ore.

World production of manganese ore in 2002 rose by 6% on a gross-weight basis and by 4% on a contained-weight basis compared with that in 2001 (table 7). China was the largest producer on a gross-weight basis; South Africa was the largest producer on a contained-weight basis.

Most data in this report are rounded by the U.S. Geological Survey (USGS) to no more than three significant digits. Table footnotes indicate which statistics have been rounded.

Legislation and Government Programs

Stockpile.—The Annual Materials Plan (AMP) for fiscal year 2003 that the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency issued on October 1, 2002, was the same with respect to manganese as in the revised fiscal year 2002 AMP issued on October 1, 2001, with the exception of the manganese ferrogroup. The AMP for fiscal year 2003 became effective October 1, 2002, the start of the 2003 fiscal year. Under this AMP, the maximum disposal authority for manganese materials was 226,796 t for metallurgical-grade ore; 36,287 t for chemical-grade ore; 27,216 t for natural battery-grade ore; 22,680 t for the manganese ferrogroup; 2,732 t for synthetic manganese dioxide; and 1,814 t for electrolytic manganese metal.

For 2002, disposals of manganese materials announced by the DNSC totaled 236,304 t for stockpile-grade metallurgical-grade ore; 38,955 t for high-carbon ferromanganese; 27,216 t for natural battery-grade ore; 24,909 t for chemical-grade ore; and 818 t for electrolytic manganese metal. All disposals were cash transactions.

Estimated data on physical inventory of manganese materials, in gross weight, in the National Defense Stockpile based on reports by the DNSC indicated that all net changes in 2002 were decreases, except for a 67,556 t increase in non-stockpile-grade metallurgical-grade ore. The decreases consisted of 94,120 t for stockpile-grade metallurgical-grade ore; 37,166 t for high-carbon ferromanganese; 26,183 t for chemical-grade ore; 2,987 t for natural battery-grade ore; and 898 t for electrolytic manganese metal. In 2002, the estimated manganese content of manganese inventories being held by the Government at yearend was lowered by about another 7%, to more than 1.1 million metric tons (Mt) (table 2). On the basis of manganese content, the total remaining inventory was about 1.6 times the current national apparent consumption.

Other.—In November 2001, the U.S. Environmental Protection Agency (EPA) made a preliminary determination that regulating manganese in drinking water would not present a meaningful opportunity for health risk reductions because available data suggest manganese is generally not considered toxic when ingested with the diet, and drinking water accounts for a relatively small proportion of manganese intake (U.S. Environmental Protection Agency, 2001). Because manganese is an essential nutrient, the EPA noted that concern over potential toxic effects from high oral exposure must be balanced against concern for adverse health effects resulting from a manganese deficiency in the diet. Manganese was one of nine constituents on the Contaminant Candidate List that the EPA evaluated whether or not to regulate under the national primary drinking water regulations as required by the Safe Drinking Water Act. The EPA published a draft health effects support document for manganese in April 2002 (U.S. Environmental Protection Agency, 2002§[1]). In July 2003, the EPA made its final determination that no regulatory action was necessary for regulating manganese in drinking water (U.S. Environmental Protection Agency, 2003).

On January 23, 2002, the EPA issued a final rule establishing National Pollutant Discharge Elimination System (NPDES) effluent limitations and standards for a new subcategory under the coal mining point source category to address preexisting discharges at "coal remining operations" (coal mining operations that began after February 4, 1987). In 1987, section 301(p) was added to the Clean Water Act of 1977 to provide an incentive for remining abandoned coal mine lands that predate the passage of the Surface Mining Control and Reclamation Act of 1977 (August 3, 1977). Specifically, section 301(p) gave an exemption for preexisting discharges from abandoned coal mine lands that were part of a remining operation from the best available technology economically achievable (BAT) effluent limits for iron, manganese, and pH. The new EPA rule would allow site-specific numerical BAT limits to be set for the preexisting discharges so long as those discharges do not exceed the preexisting baseline levels of iron, manganese, and pH (U.S. Environmental Protection Agency, 2002a).

On October 17, the EPA issued a final rule on NPDES effluent limitations guidelines, pretreatment standards, and new source performance standards for the iron and steel manufacturing point source category under the Clean Water Act. While the EPA made no changes to the existing technology-based standards under the categories of "best practicable control technology currently available" and "best conventional pollutant control technology" (40 CFR part 420), the EPA deleted effluent limitations for obsolete operations, which included ferromanganese blast furnaces (U.S. Environmental Protection Agency, 2002b).

Production

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

Ferroalloys, Metal, and Synthetic Dioxide.—Production statistics for these materials were not published to avoid disclosing proprietary data. Two companies produced manganese ferroalloys domestically—Eramet Marietta Inc. at Marietta, OH; and Highlanders Alloys LLC at New Haven, WV (table 3). Synthetic manganese dioxide was produced by the following three companies: Erachem Comilog at its Baltimore, MD, and New Johnsonville, TN, plants; Eveready Battery Company, Inc. (Energizer Holdings, Inc.) in Marietta, OH; and Kerr-McGee Chemical LLC in Henderson, NV.

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. This usage pattern is typical for most industrialized countries (Mining Magazine, 1990). Reported data for U.S. ore consumption in 2002 indicated that unit consumption of manganese in ironmaking, which could not be published to avoid disclosing proprietary data, declined from that of 2001 to become an even smaller comparatively minor component of overall manganese use in steelmaking. Reported data for U.S. consumption of manganese ferroalloys and metal in 2002 are presented in table 4. Reported consumption of ferromanganese, silicomanganese, and manganese metal, on a gross-weight basis, decreased from that in 2001 by 5%, 3%, and 1%, respectively. Data in this table are not directly comparable with those for years prior to 1998, especially for ferromanganese. Also, because of the incompleteness of reporting to the USGS's 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 suggests that manganese unit consumption in steelmaking in 2002 was about 5.1 kg/t or about twice that if calculated on the basis of reported consumption. In 2002, overall domestic manganese apparent consumption was an estimated 689,000 t.

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, Raleigh, and Harris, 1998). In 2002, domestic consumption of manganese ore decreased by 15% to 360,000 t, while corresponding yearend stocks increased by 9% to 151,000 t. Because of the need to avoid disclosing proprietary data, these figures do not include the relatively small quantities associated with ironmaking and cannot be disaggregated into end-use segments.

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; Harben, Raleigh, and Harris, 1998). The source of manganese units for these applications was mainly manganese ore.

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 2002, 16 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 16 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 but one of these firms for 2002.

In primary batteries containing manganese, those of the alkaline type in which electrolytic manganese dioxide (EMD)

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

is used continued to expand their share of the market at the expense of the carbon-zinc type, of which natural battery-grade ore is a component. Primary batteries continue to find growing applications, particularly in digital cameras. Matsushita Electronic Components Co., Ltd. introduced a new, higher power alkaline battery for digital cameras, and SANYO introduced a new primary lithium-manganese dioxide cell that can replace two alkaline "AA" cells (MacArthur and Blomgren, 2003, p. 13). In the secondary or rechargeable battery market, lithium-based technologies, including lithium-ion batteries comprising lithium manganese oxides, are rapidly gaining ground on nickel-metal-hydride and nickel-cadmium cells. Lithium batteries recharge more quickly than nickel and are very lightweight. They are currently used in consumer electronics (cell phones, laptop computers, and PDAs) and in military electronics (radios, mine detectors, and thermal weapon sights) (Ehrlich, 2002, p. 35.1). In 1992, the United States accounted for almost 50% of the secondary battery market; today, the market is about equally divided between North America, Europe, and Asia (MacArthur and Blomgren, 2003, p. 1).

Prices

For 2002, if the price of manganese in metallurgical-grade ore is set to be 1.0, the corresponding price per manganese unit was approximately 2.7 for high-carbon ferromanganese, 3.8 for medium-carbon ferromanganese, 5.0 for silicomanganese, and 5.2 for manganese metal. All factors increased compared with those in 2001, except that for manganese metal, which decreased by 19%. The factors are based on year-average prices for ferroalloys as derived from prices listed in Platts Metals Week and for metal as given in Ryan's Notes (North American transaction prices).

Manganese Ore.—The average price, on the basis of cost, insurance, and freight (c.i.f.) U.S. ports, of metallurgical-grade ore containing 48% manganese was assessed to be $2.30 per metric ton unit. Prices were somewhat above or below this value, depending on ore quality, the time of year, and the nature of the transaction. The price of a metric ton of ore is obtained by multiplying the metric ton unit price by the percentage of 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 blast furnace ironmaking, ferroalloy production, and manufacture of manganese chemicals.

The metric ton unit is 1% of a metric ton (that is, 10 kilograms of contained manganese); therefore, the price of manganese in ore in 2002 and 2001 can be expressed as 23.0 and 24.4 cents per kilogram, respectively. These values indicate a decrease of 6% in U.S. c.i.f. price or somewhat less than the decrease in free on board (f.o.b.) price in international markets.

In 2002, the international benchmark price for metallurgical-grade ore decreased by about 7% from that in 2001. Price negotiations between BHP Billiton Ltd. and major Japanese consumers were concluded in early August. On an f.o.b. basis per metric ton unit for delivery during the annual contract year, the agreed price was $1.97 for ore from the Groote Eylandt Mine in Australia.

Manganese Ferroalloys.—Prices for high-carbon and medium-carbon ferromanganese increased from the beginning of 2002 to the end of the year, generally mirroring the growth in the domestic and world raw steel production rate. Silicomanganese prices increased as a result of improved crude steel demand with slight silicomanganese supply deficits in the domestic market (CRU Bulk Ferroalloys Monitor, 2002).

The price information that follows pertains to quotations for U.S. imports from Platts Metals Week because public information on current prices for domestic product was not available. All prices are based on free market spot prices per unit of measurement, f.o.b. Pittsburgh, PA, Chicago, IL, or Houston, TX, warehouse. English units were the basis for price quotes in the United States.

For ferromanganese, the price range for high-carbon grade containing 78% manganese, per long ton of alloy, began the year unchanged from the end of 2001 at $445 to $465 and ended the year at $495 to $515, for a net increase of about 11%. For the year, the average for the middle of the price range was $493.46, which was an increase of 9% from that of 2001. The price range per pound of alloy 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 unchanged from the end of 2001 at 36 to 38.5 cents and ended the year at 45 to 48 cents, for a net increase of about 25%. The middle of the price range averaged 40.05 cents for the year, about the same as that of 2001.

For imported silicomanganese with 2% carbon, the price range per pound of alloy started the year unchanged from the end of 2001 at 22.75 to 24 cents and ended the year at 24 to 25 cents, for a net increase of 5%. The middle of the price range averaged 24.37 cents, for an increase of 6% from that of 2001.

Manganese Metal.—According to the North American transaction prices listed in Ryan's Notes, bulk shipments of domestic manganese metal, per pound f.o.b. shipping point, started the year unchanged from yearend 2001 at 53 to 55 cents, and ended the year at 50 to 52 cents, for a net decrease of about 6%. Prices decreased steadily after reaching a plateau-like high range of 56 to 62 cents in May. The year-average price of 53.8 cents for this listing was 24% less than that for 2001.

Foreign Trade

Compared with those of 2001, on a gross weight basis, total manganese exports, including 3,620 t of manganese dioxide, increased by 9% (table 5). Total manganese imports increased by 8% (table 6). In terms of manganese units contained, exports (including 2,170 t of manganese dioxide) and imports increased by 5% and 4%, respectively, compared with those of 2001. Also on the basis of content, the ratio of imports of manganese ferroalloy plus metal divided by imports of ore plus dioxide increased by 1.74:1 in 2002 from 1.69:1 in 2001. In the absence of domestic mine production, U.S. net import reliance, as a percentage of apparent consumption, was 100% for manganese, the same as it has been for the past 17 years. Unless otherwise noted, the ensuing comparisons of foreign trade data were made on the basis of manganese content.

Exports of manganese ore and metal increased during 2002, while exports of manganese ferroalloys and manganese dioxide decreased. The biggest year-to-year changes were for exports of silicomanganese, which decreased by 86% compared with those in 2001. Compared with those in 2001, exports of manganese dioxide decreased by 15%, while exports of ferromanganese were about the same. Percentage increases in manganese ore and metal exports from 2001 were 63% and 21%, respectively.

On a gross weight basis, reexports of ore, ferromanganese, silicomanganese, dioxide, and metal were 14,400 t, 4,340 t, 2,390 t, 70 t, and 60 t; respectively. Except for manganese ore and manganese dioxides, all or nearly all the reexports went to Canada. Other main destinations of metal reexports were Germany, Italy, Mexico, and Taiwan. The majority of manganese dioxide reexports went to Canada (48%), with the remaining going to Australia, China, and France. All the manganese ore reexports went to China.

Among imports, the overall average manganese contents were tentatively 79.2% for ferromanganese and 50.2% for ore. The average manganese content for ferromanganese was high, although it was at a slightly lower level than that for 2001 (since 1960, the average content of ferromanganese imports has varied from 76.7% to 78.8%). Thus, the average manganese content for ferromanganese imports for the year was being questioned. This was especially applicable to those imports from South Africa in the trade subcategory of "more than 4% carbon" (or high-carbon ferromanganese) and China in the trade subcategory of "1% or less carbon" (or low-carbon ferromanganese). In the case of the South African high-carbon ferromanganese imports, the manganese content was 95%, greatly exceeding the normal content range of 74% to 82%. The manganese content of the medium-carbon ferromanganese imports from China was reported higher than the associated gross weight. These questions were unresolved at the time this report was prepared.

Imports of total ferromanganese rose by 9% from those in 2001. The most significant year-to-year change was for high-carbon ferromanganese, imports for which increased by 18%. Increases in this import subcategory during 2002 were especially notable for Brazil and India—imports from Brazil quadrupled from those of 2001, and 27,100 t was imported from India compared with zero in 2001. Comparing leading supplying countries of medium-carbon ferromanganese with those in 2001, import volumes increased from Ukraine (197%) and from Norway (13%) and decreased significantly for Mexico (52%), China (31%), and South Africa (13%). No imports of medium-carbon ferromanganese were received from France during 2002. High-carbon ferromanganese imports increased for South Africa (31%) and decreased for Australia (91%) and France (24%).

Silicomanganese imports decreased by 7% from those of 2001. Comparing leading supplying countries of silicomanganese with those in 2001, imports increased from Georgia (230%), Romania (96%), South Africa (27%), and Norway (22%) and decreased for Venezuela (100%), India (98%), Spain (56%), and Mexico (47%). Manganese metal imports, on a gross weight basis, were 37% greater than for 2001. The bulk of metal imports (75%) consisted of unwrought manganese imports primarily from China, Germany, and South Africa (especially). Imports in the "other" subcategory fell by 73%. Waste and scrap metal imports were about seven times those of 2001. Reported imports of spiegeleisen (pig iron containing about 20% manganese) increased to 413 t in 2002 from 301 t in 2001, on a gross weight basis, all of which was from South Africa at a high unit value.

Among imports of manganese chemicals, on a gross weight basis, those of manganese dioxide decreased by 4% from those in 2001. Australia continued to be the leading source of manganese dioxide. Manganese dioxide imports from South Africa were less than those from Ireland for the first time since 1999, falling by 60% from those in 2001. Data for imports under the classification of "sulfates, other" suggested that imports of manganese sulfate, on a gross weight basis, increased by 13%; the volume of imports of material in that class increased by 16% from China and by 40% from Mexico. Receipts from China in 2002 were 14,000 t, up from 12,100 t in 2001, at a value of $5.9 million, and those from Mexico were 17,400 t, up from 12,500 t in 2001, at a value of $8.9 million.

Silicomanganese Imports from India, Kazakhstan, and Venezuela.—On April 2, the International Trade Administration (ITA) of the U.S. Department of Commerce issued its final determinations on less-than-fair-value sales of silicomanganese, excluding low-carbon silicomanganese, from India, Kazakhstan, and Venezuela. The final antidumping margins were as follows: India—Nava Bharat Ferro Alloys, Ltd., 15.32%; Universal Ferro and Allied Chemicals, Ltd., 20.42%; all others, 17.69%; Kazakhstan—Kazakhstan Alloy 2000, S.A., 247.88%; Kazakhstan-wide, 247.88%; and Venezuela—Hornos Eléctricos de Venezuela, S.A. (Hevenesa), 24.62%; all others, 24.62% (International Trade Administration, 2002e-g). The U.S. International Trade Commission (ITC) issued its final determination on May 16 that an industry in the United States was materially injured by imports from these three countries (U.S. International Trade Commission, 2002b). The ITA also determined Kazakhstan to be a market economy country effective October 1, 2001 (International Trade Administration, 2002e).

Manganese Metal Flake Imports From South Africa.—On May 1, the ITC released a public version of its confidential report to the President of the United States on lifting the 14% duty on imports of manganese metal flake from South Africa under the U.S. Generalized System of Preferences (U.S. International Trade Commission, 2002§). The report "Advice Concerning Possible Modifications to the U.S. Generalized System of Preferences With Respect to Certain Products Imported From AGOA Countries," which was submitted to the President on April 25, provided advice as to the probable economic effect on domestic producers and consumers of manganese metal regarding the elimination of the subject import duty as requested by the U.S. Trade Representative on January 16, 2002 (U.S. International Trade Commission, 2002a). The ITC's recommendation was confidential.

On January 10, 2003, Presidential Proclamation 7637 granted duty-free status of unwrought metal flake [Harmonized Tariff Schedule of the United States (HTS) subheading 8111.00.47.00] to any beneficiary sub-Saharan African country that produces them (Bush, 2003). The proclamation essentially applies to South Africa, the only sub-Saharan African country that produces manganese flake. The proclamation also called for the phaseout by January 1, 2005, of the 5.6% tariff on unwrought manganese flake and other unwrought manganese imports from

Jordan established under the United States-Jordan Free Trade Area Implementation Act.

Proposed U.S.-Southern African Customs Union Free Trade Agreement.—On November 4, the United States Trade Representative (USTR) formally notified congressional leaders of the administration's intent to initiate negotiations for a free trade agreement (FTA) with the nations of the Southern African Customs Union—Botswana, Lesotho, Namibia, South Africa, and Swaziland (Office of the United States Trade Representative, 2002§). The FTA could result in the permanent elimination of the 14% ad valorem duty on all imports of unwrought manganese—manganese flake (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. The USTR convened a public hearing on the proposed FTA on December 16 (Office of the United States Trade Representative, 2002).

On November 7, the USTR requested that the ITC prepare a report on the probable economic effects of the FTA. On November 26, the ITC announced the start of its investigation and public hearings scheduled for January 28, 2003 (U.S. International Trade Commission, 2002c). The ITC submitted its confidential probable economic effect report to the USTR in April 2003 (U.S. International Trade Commission, 2003§). A public version of the report has not yet been released.

Administrative Reviews.—On February 26, 2002, the ITA announced the initiation of its antidumping duty administrative review of potassium permanganate imports from China during the period January 1, 2001, through December 31, 2001, in response to a request by Groupstars Chemical LLC, a U.S. importer of potassium permanganate (International Trade Administration, 2002d). As a result of the review, the ITA found that Groupstars sold the subject merchandise at prices below normal value and issued a preliminary duty rate of 13.31% on Groupstars Chemical Co., Ltd. (Groupstars LLC's Chinese affiliate) on February 18, 2003 (International Trade Administration, 2003e). The ITA extended its deadline for issuing the final results of this review to August 17, 2003 (International Trade Administration, 2003d).

Later in February 2003, the ITA began its antidumping duty administrative review of potassium permanganate imports by Groupstars for the period January 1, 2002, through December 31, 2002 (International Trade Administration, 2003b). In March 2003, the ITA initiated an antidumping duty administrative review of potassium permanganate from the following Chinese exporters during the period January 1, 2002, through December 31, 2002: Groupstars Chemicals Co., Ltd. (Shandong) and (Yunnan); Yunnan Jianshui County Chemical Industry Factory; and Jianshui Chemical Plant (International Trade Administration, 2003c).

On September 3, 2002, the ITA gave notice of the opportunity to request an administrative review of the antidumping order of silicomanganese from Ukraine for the period September 17, 2001, through August 31, 2002 (International Trade Administration, 2002b). No requests for an administrative review were received by the September 30, 2002, deadline; therefore, the 163% antidumping duty that had been reinstated on Ukrainian silicomanganese imports effective September 17, 2001, remained in effect (International Trade Administration, 2001). The ITA issued a similar notice in October regarding the suspension agreement covering silicomanganese imports from Ukraine for the period October 1, 2001, through September 30, 2002 (International Trade Administration, 2002a). The publication of the October notice was inadvertent because the suspension agreement with the Ukraine was terminated at the request of the Ukrainian Government in August 2001 (James Doyle, International Trade Administration oral commun., 2003).

On December 2, the ITA gave notice of the opportunity to request an administrative review of the antidumping order of silicomanganese from Brazil and China for the period December 1, 2001, through November 30, 2002 (International Trade Administration, 2002c). Based on requests for review, the ITA began an administrative review of silicomanganese imports by the two Brazilian companies—SIBRA-Electrosiderurgica Brazileira S.A. and Compania Paulista De Ferro-Ligas-Ligas—on January 22, 2003 (International Trade Administration, 2003a).

World Review

The bulk (98%) of manganese ore was produced in 10 countries. On a content basis, the leading producing countries of manganese ore, in decreasing order, were South Africa, Brazil, Australia, Ukraine, China, Gabon, and India (table 7). On a gross weight basis, the leading producer countries of manganese ferroalloys, in decreasing order, were China, Ukraine, South Africa, France, Norway, Japan, and India (table 8).

Central Europe and Middle Asia.—Varentsov describes the impact of marine hydrothermal activity during the late Eocene-early Oligocene epochs on the genesis of the large manganese ore deposits of the Eastern Paratethys region, which extends from Central Europe to Middle Asia along a line connecting the Aral, Black, and Caspian Seas. The manganese ore deposits include those of southern Ukraine (Nikopol and others), Georgia (Chiatura and others), Kazakhstan (Mangyshlak Peninsula), northeastern Bulgaria, northwestern Turkey, and the small deposits of Hungary and Slovakia (Varentsov, 2002).

European Union.—In May, the European Commission amended its government resolution of December 1, 2001, allowing two Ukrainian companies that own the Nikopol and Zaporizhia ferroalloy plants to ship silicomanganese duty-free under licenses to the European Union. The €150-per-metric-ton duty on silicomanganese imports remains in effect for all other companies (Interfax Mining & Metals Report, 2002d).

Australia.—In July, Consolidated Minerals Ltd. (CML) announced a long-term mining plan for its Woodie Woodie manganese operation in Western Australia beginning in 2003. The plan called for a 10-year mine life, rather than the 6 years originally expected, coupled with continuing exploration. CML is projecting a mine production rate of 350,000 metric tons per year (t/yr) for the life of the mine (Metal Bulletin, 2002a; Mining Journal, 2002b).

Elkedra Diamonds NL announced that assay results from grab samples around two airborne geophysical survey anomalies in the Altjawarra Craton of Australia's Northern Territory indicate a potential for high-grade and high-tonnage manganese reserves (Mine Box, 2002§). Manganese content in the samples ranged from 29% to 42%. The company was following up with a rotary core drilling program in the area.

In early July, HiTec Energy Ltd. entered into a 50/50 joint venture with Pilbara Manganese Pty. Ltd. for further exploration for and potential mining and marketing of manganese ore from HiTec's Sunday Hill property, which is approximately 170 kilometers from Newman, Western Australia (HiTec Energy Ltd., 2002§).

China.—Eramet SA acquired the Guilin Ferro-Alloy Works in the Guangxi autonomous region in mid-September. The name of the formerly state-owned smelter was changed to Guilin Comilog Ferro-Alloy Works (Metal Bulletin, 2002b). The smelter, comprising three blast furnaces for ferromanganese production and two electric furnaces for silicomanganese production, has a combined production capacity of about 145,000 t/yr (120,000 t/yr ferromanganese and 20,000 to 25,000 t/yr silicomanganese) (Metal Bulletin, 2002c).

France.—In March, an explosion caused by problems in the gas exhaust plant caused the temporary closure of the new HF7 furnace at Eramet SA's ferromanganese plant in Boulogne-sur-Mer (American Metal Market, 2002b). In late June, another explosion in the furnace forced the company into a partial production shutdown for the second time this year. The second closure of the furnace, caused when water entered the furnace through a crack in one of the tuyeres, came just a few weeks after it reopened following the explosion in March (Metal Bulletin, 2002f). When the furnace ceased operating in March, the company estimated the lost production would be 20,000 t to 40,000 t in the second quarter and 20,000 t in the third quarter of the year (Ryan's Notes, 2002a). The furnace was brought back online in mid-September but was not expected to reach its full production capacity of 350,000 t/yr until early in 2003 (Ryan's Notes, 2002§).

Kazakhstan.—Aksu Ferroalloy Works announced plans to increase ore production from the Tur manganese deposit in the Karaganda region by about 68% in 2002, to 700,000 t, compared with that of 2001. The company expected to increase production of manganese concentrate to 188,000 t in 2002 from 102,930 t in 2001 (Interfax Mining & Metals Report, 2002c). The company was forced to stop production from one of its silicomanganese furnaces for 3 months during 2002. The company has four silicomanganese furnaces, each with a capacity of about 40,000 t/yr (Metal Bulletin, 2002h).

The Kazakhstani Government announced in September plans to sell the production assets of Atasuruda, an iron ore and manganese producer in the Karaganda region. The assets had been held in trusteeship since the summer of 2001 by Ispat-Karmet, Kazakhstan's largest steelworks (Interfax Mining & Metal Reports, 2002a).

India.—In April, the Industrial Development Bank of India offered for sale the cooling, pollution control, and smelting assets of Sandur Manganese & Iron Ores Ltd. Prior to the offering, the Sandur manganese ferroalloy facility had been closed for nearly 2 years. The company's mines, which produced 250,000 to 300,000 t/yr of manganese ore, were not for sale (American Metal Market, 2002c).

In July, the Indian Cabinet Committee on Disinvestment approved the sale of 51% of the Government's shareholding in Manganese Ore India Ltd. (MOIL) to a strategic partner, along with the transfer of management control. Prior to the sale, the Indian Government held an 81.57% stake in the company. The Government will retain a 26% stake in the company after the sale, with the remainder offered to company employees. MOIL derives its revenues from 10 manganese mines located in the States of Maharashtra and Madhya Pradesh, with current production at 700,000 t/yr (Metal Bulletin, 2002e; Mining Journal, 2002a). On May 12, 2003, India's Ministry of Disinvestment opened the bidding process for the Government's 51% equity in MOIL as well as the Madhya Pradesh State Government's 8.81% stake in the company. The Maharashtra State Government may also sell its 9.62% in the company (India Ministry of Disinvestment, 2003§). Bids were to be accepted until June 23.

Namibia.—Operations at the recently recommissioned Otjosondu Mine at Otjizondu were halted in late February owing to an unspecified major technical problem. Production at the mine (owned by Purity Manganese) had been erratic since its restart in early 2001 (Namibia Economist, 2002§). Production data for 2001 and 2002 were not available at the time of this publication.

Norway.—Eramet shut down its FD12 ferromanganese furnace at Sauda for 2 months starting in October for relining. The company converted production of the other furnace at Sauda—FD11—from silicomanganese to ferromanganese to address the company's ferromanganese shortage caused by furnace problems at its Boulogne-sur-Mer, France, plant. Once the reline is completed, the FD11 furnace will be switched back to silicomanganese production (Metal Bulletin, 2002d).

Brazilian manganese ferroalloy producer Companhia Vale do Rio Doce S.A. (CVRD) completed its acquisition of Elkem ASA's closed Rana ferrochrome plant on February 14, 2003 (PR Newswire Europe, Ltd., 2003§). Production at the plant, renamed Rio Doce Manganese Norway, AS, will be converted to manganese ferroalloys by late 2003.

South Africa.—In May, Pyromet Technologies reported it was conducting a detailed feasibility study for erecting a preowned sinter plant at Assmang Ltd.'s Cato Ridge Works ferromanganese smelter approximately 60 kilometers from Durbin (Ryan's Notes, 2002b). The company had problems with two of its furnaces at the Cato Ridge Works smelter—the No. 6 furnace was shut down for 2 weeks in July to repair the electrodes, and the No. 2 furnace was closed in late July for rebuilding. Both furnaces have a production capacity of 47,500 t/yr (American Metal Market, 2002a, b).

On October 10, Japan Metals & Chemicals Co. Ltd. announced it had sold its 35% share in Advalloy (Proprietary) Ltd. to partner Mitsui & Co. Ltd. This sale brings Mitsui's ownership in Advalloy to 50%, equal to that held by Samancor Ltd. (American Metal Market, 2002§).

On October 11, the South African Government issued its final version of a new mining charter, as required by the South African Mineral and Petroleum Resources Development Act of 2002. The charter calls for a 26% ownership of South African mining industry assets by historically disadvantaged South Africans (HDSAs) in 10 years, with a 15% HDSA-ownership level in 5 years (South African Department of Minerals and Energy and others, 2002§). The charter defines HDSAs as "any person, category of persons or community, disadvantaged by unfair discrimination before the Constitution of the Republic of South Africa, 1993 (Act No. 200 of 1993) came into operation."

On March 20, 2003, the South African Government issued a proposed mineral and petroleum royalty bill for public review and comment (South African National Treasury, 2003b§). The bill would require manganese mine operators to pay a 2% ad valorem royalty on gross quarterly sales. The comment deadline was extended to April 30, 2003 (South African National Treasury, 2003a§). Action on the proposed bill was still pending in August 2003.

Ukraine.—Privat Bank acquired a 50% share in the Zaporozhye Ferro-Alloys Work's ferromanganese plant from Metallurgia group in mid-July. Zaporozhye is Ukraine's main producer of ferromanganese. Privat Bank also owns 13% of the Nikopolsky ferroalloys plant, which produces silicomanganese (an estimated 70% of Ukraine's total production) and ferromanganese (Metal Bulletin, 2002g).

Margentsky GOK, a manganese concentrate producer from the Dnepropetrovsk region, announced it plans to add 500,000 t/yr of manganese ore production capacity once it completes work on two faces of its No. 14/15 mine by 2004. The company expects the new capacity to offset the mine capacity to be lost during the next 4 years (Interfax Mining & Metals Report, 2002b).

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:

Advanced Materials.—The Naval Air Systems Command, Patuxent River, MD, reported the development of a new molten salt electroplating system in which aluminum-manganese replaces cadmium in certain coating applications (Advanced Materials & Processes, 2002).

Electrochemistry of Manganese Oxides.—The discharge mechanisms of lithiated heated EMD in primary lithium/manganese dioxide battery cells were reported (Bowden and others, 2002).

Lithium-Manganese Oxides.—NEC Corp. and Fuji Heavy Industries Ltd. announced the formulation of a joint-venture company NEC Lamilion Energy Ltd. in Miyameae-ku, Kawasaki, Japan, to develop manganese lithium-ion rechargeable batteries for use in automobiles [ITE Letters on Batteries, New Technologies, & Medicine (with News), 2002].

Biology.—The Institute of Medicine (2001, p. 1-13, 394-419) published a report on the dietary reference intakes for manganese in adults.

Environment and Toxicology.—Publications included a report on field and modeling test results indicating that sunlight generally promoted oxidation and removal of manganese from Lake Fork Creek, CO (Scott and others, 2002); a discussion on the implications of high lead adsorption by biogenic manganese hydroxide on trace metal transport in aquatic environments and removal of toxic trace metals from drinking water or wastewater (Nelson and others, 2002); a summary of research demonstrating that naturally occurring manganese dioxide abiotically catalyzes the oxidation of pentachlorophenol, a common biocide for wood preserving, to less toxic forms (Petrie, Grossl, and Sims, 2002); and a study showing no direct relation between avian embryo exposure and atmospheric levels of manganese in three Californian cities (Hui, 2002).

Outlook

The trend of domestic and global demand for manganese is expected to closely follow that of steel production. 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.

From 1998 to 2002, U.S. apparent consumption of manganese has been within about plus or minus 6% of 729,000 t of contained manganese. This largely has been a consequence of a reasonably comparable degree of variation in domestic steel production. During this period, manganese apparent consumption has tended to increase or decrease at about the same rate as raw steel production during this period (table 1). Manganese apparent consumption may not 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 calculated apparent consumption for some years showed positive or negative deviations from that which could be estimated on the basis of steel production. This was certainly the case in 2002.

Details of the outlook for the steel industry are discussed in the "Outlook" section of the annual review for 2002 for iron and steel. While raw steel production in 2002 increased by 2% in the United States compared with that of 2001, manganese apparent consumption decreased slightly (less than 0.5%) to 689,000 t in 2002 from 692,000 t in 2001. Raw steel production in 2002 increased by 6.5% globally. Apparent consumption of finished steel products grew to 802 Mt in 2002 from 772 Mt in 2001, an increase of 3.9% (Sweeney, 2003). This increase was primarily attributed to steel consumption in China; steel consumption in the rest of the world rose to 607 Mt in 2002 from 602 Mt in 2001, an increase of 0.8%. Steel consumption in most regions of the world was flat. Globally, high-carbon ferromanganese consumption in 2003 was expected to be roughly that of 2002, with a slight increase, to 1.600 Mt in 2003 from 1.577 Mt in 2002 (Metal Bulletin Research Ferro-alloys Monthly, 2003a). Similarly, world silicomanganese consumption was expected to increase slightly to 1.560 Mt in 2003 from 1.525 Mt in 2002 (Metal Bulletin Research Ferro-alloys Monthly, 2003b).

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TABLE 1
SALIENT MANGANESE STATISTICS[1]

(Thousand metric tons of gross weight unless otherwise specified)

		1998	1999	2000	2001	2002
United States:						
Manganese ore (35% or more Mn):						
Exports		8	4	10	9	15
Imports for consumption		332	460	447	358	427
Consumption[2]		499	479	486	425	360
Stocks, December 31, consumers[2]		163	172	226	138	151
Ferromanganese:						
Exports		14	12	8	9	9
Imports for consumption		339	312	312	251	275
Consumption[3]		290	281	300	266	253
Stocks, December 31, consumers and producers		26	40	31	25	21
Consumption, apparent, manganese[4]		776	719	768	692	689
Ore price, c.i.f.[5] U.S. ports	dollars per metric ton unit	2.40	2.26	2.39	2.44	2.30
World, production of manganese ore		19,900	17,800	19,600 r	20,800 r	22,000

[r]Revised.
[1]Data are rounded to no more than three significant digits.
[2]Exclusive of iron and steel plants.
[3]Data for 1998 and later not directly comparable to that for prior years.
[4]Thousand metric tons, manganese content. Based on estimates of average content for all significant components except imports, for which content is reported.
[5]Cost, insurance, and freight.

TABLE 2
U.S. GOVERNMENT DISPOSAL AUTHORITIES AND
INVENTORIES FOR MANGANESE MATERIALS AS OF YEAREND 2002[1]

(Metric tons, gross weight)

		Physical inventory[e]				
		Uncommitted			Sold,	
Material	Disposal authority	Stockpile grade	Nonstockpile grade	Total	pending shipment	Grand total
Natural battery ore	75,600	75,600	--	75,600	24,700	100,000
Synthetic manganese dioxide	2,730	2,730	--	2,730	--	2,730
Chemical ore	84,000	84,000	--	84,000	28,300	112,000
Metallurgical ore	689,000	359,000	331,000	689,000	229,000	919,000
High-carbon ferromanganese	731,000	731,000	--	731,000	29,300	760,000
Electrolytic metal	1,470	1,470	--	1,470	621	2,100

[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 2002

		Products[1]			
Company	Plant location	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	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 2002[1]

(Metric tons, gross weight)

	Ferromanganese				
End use	High carbon	Medium and low carbon	Total	Silico-manganese	Manganese metal
Steel:					
Carbon	108,000	82,500	190,000	53,300	220
High-strength, low-alloy	17,800	3,940	21,700	2,920	(2)
Stainless and heat-resisting	11,800	(2)	11,800	8,680	1,350
Full alloy	15,200	4,430	19,600	17,900	(2)
Unspecified[3]	598	364	962	211	158
Total	153,000	91,200	245,000	83,000	1,730
Cast irons	6,950	478	7,420	1,190	5
Superalloys	W	W	W	--	W
Alloys, excluding alloy steels and superalloys	823	484	1,310	(4)	17,100 [5]
Miscellaneous and unspecified	--	W	W	(4)	W
Total consumption	161,000	92,200	253,000	84,200 [6]	18,800
Total manganese content[7]	125,000	73,500	200,000	59,000	18,800
Stocks, December 31, consumers and producers	9,020	12,200	21,200	13,600	1,470

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	2001		2002	
	Gross weight (metric tons)	F.a.s.[2] value (thousands)	Gross weight (metric tons)	F.a.s.[2] value (thousands)
Ore and concentrates with 20% or more manganese:				
Canada	4,340	$1,030	2,820	$654
China	15	7	1,190	581
Germany	577	280	2,150	427
Italy	515	250	1,670	346
Mexico	76	22	2,520	832
Netherlands	345	169	1,710	362
Norway	596	292	513	229
United Kingdom	1,270	620	265	130
Other	1,430 r	604 r	2,130	543
Total	9,170	3,270	15,000	4,100
Ferromanganese, all grades:				
Canada	8,030	4,660	8,120	5,390
Mexico	171	123	947	694
Venezuela	848	686	7	3
Other	190	316	150	214
Total	9,240	5,780	9,230	6,300
Silicomanganese:				
Canada	999	567	334	197
Mexico	2,500	1,630	67	63
Other	142	147	122	179
Total	3,640	2,350	523	439
Metal, including alloys and waste and scrap:				
Belgium	169	413	502	1,660
Canada	164	393	174	488
Japan	724	1,580	1,120	2,710
Mexico	207	397	89	229
Netherlands	198	288	2	6
Sweden	128	290	141	354
Other	226 r	3,540 r	682	2,220
Total	1,820	6,900	2,200	6,000

[r]Revised.
[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]

	2001			2002		
Country	Gross weight (metric tons)	Manganese content (metric tons)	Customs value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Customs value (thousands)
Ore and concentrates with 20% or more manganese:						
All grades:						
Australia	34,300	18,000	$3,140	34,700	18,400	$3,340
Brazil	7,720	3,480	476	30,000	12,900	682
Gabon	271,000	158,000	21,600	272,000	140,000	19,000
Mexico	4,520	1,720	391	2,910	1,100	232
South Africa	39,500	17,400	2,290	86,500	41,800	5,740
Other	114	95	94	251	191	199
Total	358,000	199,000	28,000	427,000	214,000	29,200
More than 20% but less than 47% manganese:						
Brazil	7,700	3,460	466	29,900	12,800	682
Gabon	23,300	11,000	1,600	45,100	19,800	1,990
Mexico	4,520	1,720	391	2,910	1,100	232
South Africa	11,600	4,160	566	--	--	--
Total	47,100	20,300	3,030	77,900	33,700	2,900
47% or more manganese:						
Australia	34,300	18,000	3,140	34,700	18,400	3,340
Gabon	248,000	147,000	20,000	227,000	120,000	17,000
South Africa	27,900	13,200	1,730	86,500	41,800	5,740
Other	131 r	111 r	105 r	319	259	199
Total	310,000	178,000	25,000	349,000	180,000	26,300
Ferromanganese:						
All grades:						
Australia	28,700	22,000	10,100	2,510	1,900	728
Brazil	7,990	6,230	3,780	27,900	21,900	11,800
China	5,110	4,400	4,350	4,920	4,150	3,730
France	50,100	41,800	18,000	39,100	31,600	14,800
India	--	--	--	27,700	21,100	11,300
Italy	2,330	1,970	2,090	--	--	--
Japan	(2)	31	22	2,720	1,630	1,980
Korea, Republic of	--	--	--	6,900	5,510	3,470
Mexico	19,300	15,500	13,000	8,440	6,740	6,280
Norway	5,020	3,790	3,140	3,030	2,390	1,600
South Africa	125,000	98,600	55,400	144,000	116,000	64,400
Ukraine	1,360	1,020	538	5,890	3,030	2,320
Other	6,240 r	5,030 r	1,460 r	2,100	1,600	1,490
Total	251,000	200,000	112,000	275,000	218,000	124,000
1% or less carbon:						
China	1,310	1,360	1,380	2,280	2,050	2,220
Italy	2,330	1,970	2,090	--	--	--
Japan	(2)	31	22	2,700	1,620	1,960
Mexico	2,010	1,610	1,490	58	48	79
Norway	2,910	2,060	2,080	552	448	422
South Africa	6,280	5,520	6,060	4,840	4,450	5,780
Other	77	62	55	1,080	908	799
Total	14,900	12,600	13,200	11,500	9,510	11,300
More than 1% to 2% or less carbon:						
Brazil	1,330	1,060	652	1,790	1,440	989
China	3,800	3,040	2,260	2,640	2,100	1,510
Korea, Republic of	--	--	--	4,400	3,610	2,440
Mexico	17,300	13,900	11,500	8,380	6,690	6,200
Norway	2,110	1,730	1,120	2,480	1,940	1,180
South Africa	29,500	23,800	17,400	25,500	20,700	13,700
Other	1,160 r	1,170 r	876 r	794	519	574
Total	55,100	44,700	33,800	46,000	37,000	26,600
More than 2% but not more than 4% carbon, Ukraine	1,360	1,020	538	5,890	3,030	2,320

See footnotes at end of table.

TABLE 6--Continued

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

Country	2001 Gross weight (metric tons)	2001 Manganese content (metric tons)	2001 Customs value (thousands)	2002 Gross weight (metric tons)	2002 Manganese content (metric tons)	2002 Customs value (thousands)
Ferromanganese:						
More than 4% carbon:						
Australia	28,700	22,000	$10,100	2,510	1,900	$728
Brazil	6,660	5,170	2,400	26,100	20,400	10,800
France	50,100	41,800	18,000	39,100	31,600	14,800
India	--	--	--	27,700	21,100	11,300
South Africa	89,400	69,300	31,900	114,000	91,000	45,000
Other	5,050	3,840	1,950	2,750	2,090	1,170
Total	180,000	142,000	64,300	212,000	168,000	83,800
Silicomanganese:						
Australia	47,100	31,200	19,600	47,900	32,000	19,700
France	--	--	--	4,000	2,640	1,890
Georgia	4,920	3,200	2,070	14,600	10,600	7,080
India	39,800	25,400	16,000	770	424	446
Kazakhstan	32,300	22,100	13,700	--	--	--
Mexico	14,900	9,730	7,090	7,850	5,130	3,780
Norway	10,400	6,320	6,000	13,100	7,730	7,940
Romania	12,000	7,840	5,620	22,600	15,400	10,800
South Africa	92,000	62,500	37,400	118,000	79,100	50,800
Spain	7,430	3,440	2,340	1,930	1,500	1,240
Venezuela	1,500	960	615	--	--	--
Other	6,880	4,670	2,910	15,500	10,300	7,290
Total	269,000	177,000	113,000	247,000	165,000	111,000
Metal:						
Unwrought:						
China	3,600	XX	4,400	6,100	XX	4,860
Germany	2,210	XX	3,140	3,600	XX	4,470
South Africa	12,700	XX	17,800	12,200	XX	15,100
Other	876 r	XX	1,500 r	193	XX	312
Total	19,400	XX	26,800	22,100	XX	24,800
Other:						
China	178	XX	217	113	XX	154
Netherlands	61	XX	145	73	XX	135
Russia	385	XX	410	--	XX	--
Other	502 r	XX	1,490 r	119	XX	638
Total	1,130	XX	2,260	305	XX	927
Waste and scrap:						
Canada	993	XX	162	3,360	XX	545
China	60	XX	15	--	XX	--
France	6	XX	22	3,730	XX	711
South Africa	--	XX	--	82	XX	123
Manganese dioxide:						
Australia	20,600	XX	30,800	22,000	XX	30,200
China	1,650	XX	1,670	1,170	XX	1,340
Greece	563	XX	728	1,480	XX	1,910
Ireland	7,250	XX	10,000	6,550	XX	8,680
South Africa	7,270	XX	10,400	2,900	XX	4,170
Other	903 r	XX	1,990 r	2,560	XX	4,410
Total	38,300	XX	55,600	36,700	XX	50,700
Potassium permanganate:						
China	80	XX	88	405	XX	500
Czech Republic	870	XX	1,720	721	XX	1,390
India	594	XX	1,140	372	XX	738
Other	9	XX	18	43	XX	129
Total	1,550	XX	2,960	1,540	XX	2,760

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

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

[2]Less than 1/2 unit.

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

TABLE 7

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

(Thousand metric tons)

Country[3]	Range percent Mn[e, 4]	Gross weight 1998	Gross weight 1999	Gross weight 2000	Gross weight 2001	Gross weight 2002	Metal content 1998	Metal content 1999	Metal content 2000	Metal content 2001	Metal content 2002[e]
Australia[5]	37-53	1,500	1,892	1,614	2,069	2,187	729	926	787	948	983 [6]
Brazil[7]	30-65	1,940	1,656	1,925 r	1,863 r	2,000 e	1,261	1,076	1,250 r	1,210 r	1,300
China[e, 8]	20-30	5,300	3,190	3,500 r	4,300 r	4,500	1,060	630	700 r	860 r	900
Gabon[9]	45-53	2,092	1,908	1,743	1,791	1,856	966	881	804	830 e	810
Ghana	32-34	537	639 [10]	896 e, 10	1,077 r	1,136	172 e	204	287 e	344 r, e	363
India[e, 11]	10-54	1,557 [6]	1,500	1,550	1,600	1,700	592	570	590	600	630
Kazakhstan, crude ore	20-30	634	980	1,136	1,387 r	1,792	155 e	240 e	280 e	350 e	440
Mexico[12]	27-50	510	459	435	277 r	233	187	169	156	100	88 [6]
South Africa[9]	30-48+	3,044	3,122	3,635	3,266	3,322	1,298	1,343	1,578	1,479	1,504 [6]
Ukraine	30-35	2,226	1,985	2,741	2,700	2,736	755 e	675 e	930 e	930 e	940
Other[e, 13]	XX	522 r	451 r	434 r	499 r	487	151 r	133 r	126 r	152 r	149
Total	XX	19,900	17,800	19,600 r	20,800 r	21,900	7,330 r	6,850 r	7,490 r	7,800 r	8,110

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

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

[2]Table includes data available through July 25, 2003. 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 grading.

[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]Reported figure.

[7]Production of beneficiated ore as reported in Sumário Mineral (Brasilia).

[8]Includes manganiferous ore.

[9]Calculated metal content includes allowance for assumed moisture content.

[10]Sales.

[11]Much of India's production grades below 35% Mn; content averaged 37.7% Mn for fiscal years 1998-99 through 2002-03.

[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]

(Thousand metric tons, gross weight)

	1998					1999					2000				
	Ferromanganese			Silico-		Ferromanganese			Silico-		Ferromanganese			Silico-	
Country[3]	Blast furnace	Electric furnace	Total	manga-nese	Grand total	Blast furnace	Electric furnace	Total	manga-nese	Grand total	Blast furnace	Electric furnace	Total	manga-nese	Grand total
Argentina	--	5	5	25	30	--	--	--	--	--	--	--	--	5	5
Australia[e]	--	110	110	105	215	--	98	98	116	214	--	115	115	135	250
Belgium[e, 4]	--	20	20	--	20	--	--	--	--	--	--	--	--	--	--
Brazil	--	122	122	124	246	--	117 e	117 e	117 e	234 e	--	121	121	171	293
Chile	--	4	4	4	8	--	3	3	2	5	--	4 r	4 r	2	6 r
China[e]	550	500	1,050	639	1,690	550	550	1,100	822	1,920	500	520	1,020	900	1,920
Egypt[e]	--	18	18	--	18	--	30	30	--	30	--	30	30	--	30
France[e, 5]	321	100	421	65	486	302 [6]	138	440	55	495	300	140	440	60	500
Georgia[e]	--	10	10	35	45	--	7	7	25	32	--	7	7	25	32
India[e]	--	165	165	193	358	--	160	160	190	350	--	160	160	185	345
Indonesia[e]	--	13	13	7	20	--	12	12	7	19	--	12	12	7	19
Italy	--	49	49	70	119	--	19	19	67	86	--	40 e	40 e	90 e	130 e
Japan	--	334	334	71	405	--	315	315	66	381	--	338	338	68	406
Kazakhstan	--	--	--	57	57	--	--	--	78	78	--	1	1	103	104
Korea, North[e, 4]	--	6	6	--	6	--	6	6	--	6	--	6	6	--	6
Korea, Republic of	--	158	158	107	265	--	140	140	116	256	--	146	146	104	250
Mexico[7]	--	87 r	87 r	105 r	191 r	--	80 r	80 r	114 r	193 r	--	91	91	108	198
Norway[e]	--	235	235	230	465	--	235	235	230	465	--	235	235	230	465
Poland	50 e	--	50 e	15	65	(8) e	--	(8) e	10	10	-- r	--	-- r	19 r	19 r
Romania	--	4 e	4 e	84	88	--	(8) e	(8) e	1 e	1 e	--	1	1	21	22
Russia[e]	65 [6]	--	65 [6]	--	65 [6]	90	--	90	--	90	71	--	71	--	71
Slovakia[e]	--	20	20	47 [6]	67	--	20	20	35	55	--	20	20	35	55
South Africa	--	542	542	265 e	807	--	527	527	267	794	--	597	597	310 r	907 r
Spain[e]	--	18	18	108	126	--	10	10	95	105	--	10	10	100	110
Taiwan	--	13	13	--	13	--	--	--	--	--	--	--	--	--	--
Ukraine	112	150 e	262	486	748	58 e	200	257	499	756	85 e	253	338	684	1,022
Venezuela	--	8	8	49	56	--	11	11	48	58	--	16	16	70	85
Total	1,100	2,690 r	3,790 r	2,890	6,680 r	1,000	2,680 r	3,680 r	2,960 r	6,640 r	956	2,860	3,820	3,430 r	7,250 r

See footnotes at end of table.

TABLE 8--Continued

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

(Thousand metric tons, gross weight)

	2001					2002[e]				
	Ferromanganese			Silico-		Ferromanganese			Silico-	
Country[3]	Blast furnace	Electric furnace	Total	manga- nese	Grand total	Blast furnace	Electric furnace	Total	manga- nese	Grand total
Argentina	--	--	--	5	5	--	--	--	5	5
Australia[e]	--	115	115	135	250	--	115	115	135	250
Belgium[e, 4]	--	--	--	--	--	--	--	--	--	--
Brazil	--	96	96	180	276	--	96	96	180	276
Chile	--	4 [r, e]	4 [r, e]	2 [r, e]	6 [r, e]	--	4	4	2	6
China[e]	500	670 [r]	1,170 [r]	1,170 [r]	2,340 [r]	500	700	1,200	1,300	2,500
Egypt[e]	--	30	30	--	30	--	30	30	--	30
France[e, 5]	300	130	430	50	480	300	130	430	50	480
Georgia[e]	--	7	7	25	32	--	7	7	25	32
India[e]	--	165	165	150	315	--	165	165	150	315
Indonesia[e]	--	12	12	7	19	--	12	12	7	19
Italy	--	40 [e]	40 [e]	90 [e]	130 [e]	--	40	40	90	130
Japan	--	368	368	62	431	--	357 [6]	357 [6]	71 [6]	428 [6]
Kazakhstan	--	5	5	141	147	--	2	2	164	166
Korea, North[e, 4]	--	6	6	--	6	--	6	6	--	6
Korea, Republic of	--	144 [r]	144 [r]	102 [r]	245 [r]	--	146	146	105	251
Mexico[7]	--	60	60	74	134	--	39 [6]	39 [6]	73 [6]	112 [6]
Norway[e]	--	240	240	230	470	--	240	240	230	470
Poland	1 [r]	--	1 [r]	20 [r]	21 [r]	1	--	1	20	21
Romania	--	(8) [r]	(8) [r]	72 [r]	72 [r]	-- [6]	-- [6]	-- [6]	89 [6]	89 [6]
Russia[e]	70	--	70	--	70	80	--	80	--	80
Slovakia[e]	--	20	20	35	55	--	20	20	35	55
South Africa	--	498 [r]	498 [r]	253 [r]	751 [r]	--	500	500	260	760
Spain[e]	--	10	10	100	110	--	10	10	100	110
Taiwan	--	--	--	--	--	--	--	--	--	--
Ukraine	85	250	335	685	1,020	85	250	335	685	1,020
Venezuela	--	13 [r]	13 [r]	57 [r]	69 [r]	--	12	12	55	67
Total	956 [r]	2,880 [r]	3,840 [r]	3,650 [r]	7,480 [r]	966	2,880	3,850	3,830	7,680

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

[1]Table includes data available through July 25, 2003.

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

[3]In addition to the countries listed, Hungary is believed to have produced some blast furnace ferromanganese and Iran is believed to have produced ferromanganese and silicomanganese, but production figures are not reported; general information is inadequate for the formulation of reliable estimates of output levels. Data for United States production of manganese ferroalloys are not included to avoid disclosing company proprietary data.

[4]Ferromanganese includes silicomanganese if any.

[5]Silicomanganese includes silicospiegeleisen if any.

[6]Reported figure.

[7]Salable products from Autlán.

[8]Less than 1/2 unit.