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 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 13% from that in 2000, and was at its lowest level since 1993. Unit consumption of manganese in steel, as ferroalloys and metal, was 5.4 kilograms per metric ton (kg/t) of raw steel produced, as estimated from apparent consumption calculations. This level was the least 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 decreased for imports. On a content basis, the number of manganese units exported increased by 11%, while the number of units imported declined by 19%.

While 2001 prices of ore continued the rising trend of 2000, prices of ferroalloys fell in 2001. The amount of increase for metallurgical-grade ore was about 4% internationally. The amount of decrease for imported ferroalloys on a year-average basis was 7% for high-carbon ferromanganese, 13% for medium-carbon ferromanganese, and 3% for silicomanganese. In 2001, ferromanganese prices were at their highest in the first half of the year; prices for silicomanganese were highest near the end of the year. Sales of manganese materials from the Government's National Defense Stockpile in 2001 reduced the Government's inventory for manganese by about another 2%, leaving an inventory about 1.8 times the annual domestic consumption. The larger disposals were of natural battery-grade and metallurgical-grade ore.

World production of manganese ore in 2001 was virtually the same, both on a gross-weight and contained-weight basis, as that in 2000 (table 7). China was assumed to be 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 proposed Annual Materials Plan (AMP) for fiscal year 2002 that the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency issued on October 3 was the same with respect to manganese as in the revised fiscal year 2001 AMP issued on April 9, 2001. The AMP for fiscal year 2002 became effective October 1, 2001, the start of the 2002 fiscal year. Under this AMP, the maximum disposal authority for manganese materials was 27,216 metric tons (t) for natural battery-grade ore; 2,732 t for synthetic manganese dioxide; 36,287 t for chemical-grade ore; 226,796 t for metallurgical-grade ore; 68,039 t for the manganese ferro group; and 1,814 t for electrolytic manganese metal.

For 2001, disposals of manganese materials announced by the DNSC totaled 1,352 t for natural battery-grade ore; 11,378 t for chemical-grade ore; 1,361 t for stockpile-grade metallurgical-grade ore; and 3,349 t for electrolytic metal. All disposals were cash transactions.

Estimated data on physical inventory of manganese materials in the National Defense Stockpile based on reports by the DNSC, in gross weight, indicated that all net changes in 2001 were decreases, except for a 57,574 t increase in nonstockpile-grade metallurgical-grade ore. The decreases consisted of 3,881 t for natural battery-grade ore; 2,759 t for chemical-grade ore; 94,178 t for stockpile-grade metallurgical-grade ore; 52,946 t for high-carbon ferromanganese; and 2,794 t for electrolytic manganese metal. The estimated manganese content of manganese inventories being held by the Government at yearend was lowered in 2001 by about another 7%, to somewhat greater than 1.1 million metric tons (Mt) (table 2). The total remaining inventory was about 1.7 times the current national apparent consumption.

Other.—In response to a July 1999 petition filed by Eramet Marietta Inc., the U.S. Environmental Protection Agency (EPA) issued new national emission standards for hazardous air pollutants (NESHAPs) for certain ferromanganese and silicomanganese production sources in a direct and final rule on March 22, 2001 (U.S. Environmental Protection Agency, 2001c). The affected sources include submerged arc furnaces, metal oxygen refining (MOR) process, crushing and screening operations, and fugitive dust sources. The final rule, which became effective May 21, 2001, also contained compliance dates, and requirements for performance testing, monitoring, recordkeeping, and reporting.

In November 2001, the 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, 2001a). 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 its Contaminant Candidate List that the EPA evaluated whether or not to regulate under the national primary drinking water regulations (NPDWR) 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]). Final regulatory determinations will be published in late 2002 after stakeholder review and comment.

Also in November, the EPA deferred listing manganese wastes generated from inorganic chemical manufacturing processes, which included steelmaking, as hazardous under the Resource Conservation and Recovery Act. The EPA made this decision so it could meet a court-ordered schedule that required final hazardous waste listing determinations for the inorganic chemical industry, and to allow more time to evaluate manganese-containing wastes (U.S. Environmental Protection Agency, 2001b).

In December 2001, the Agency for Toxic Substances and Disease Registry (ASTDR) of the U.S. Department of Health and Human Services published a draft interaction profile on mixtures containing lead, manganese, zinc, and copper (Agency for Toxic Substances and Disease Registry, 2001§). Based on the available data, the ASTDR predicted an increase in the hazards for neurological and hematological effects for mixtures in which manganese and lead predominate, and a decrease in the hazards for mixtures that contain relatively low levels of manganese and higher levels of zinc, copper, and lead (relative to health guidance values for these metals). The ASTDR also predicted a decrease in the hazard for hepatic effects for mixtures in which copper and zinc predominate. The draft interaction profile was available for public comment during June 1, 2002, through September 2, 2002.

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 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. The only plant at which manganese ferroalloys were produced domestically was that of Eramet Marietta Inc. at Marietta, OH (table 3). Kerr-McGee Chemical LLC, Oklahoma City, OK, ended production of electrolytic manganese metal by the end of the second quarter of 2001. Kerr-McGee Chemical reportedly had been producing about 12,000 metric tons per year (t/yr) of metal at its plant at Hamilton, MS. This action, coupled with the ending of metal production by Eramet Marietta at its Marietta, OH, plant in 2001, ended domestic production of the metal. Kerr-McGee Chemical and Eramet Marietta gave the same reasons for ending production—cheap imports and declining prices (Metal Bulletin, 2001d; Smith 2001).

Around December 1, Israel's Ubex Group purchased the closed ferrosilicon plant of American Alloys through an affiliate, Highlanders Alloys LLC. The sale to Highlanders stipulated conversion of the plant to manganese ferroalloys production by mid-2002 (Ryan's Notes, 2001a, c). After several delays, Highlanders started producing silicomanganese in early September 2002 (TEX Report, 2002a).

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 2001 indicated that unit consumption of manganese in ironmaking, which could not be published to avoid disclosing proprietary data, declined from that of 2000 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 2001 are presented in table 4. Reported consumption of ferromanganese, silicomanganese, and manganese metal, on a gross weight basis, decreased from that in 2000 by 11%, 19%, and 11%, 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. Combination of the indicated consumption pattern with estimates of apparent consumption suggests that manganese unit consumption in steelmaking in 2001 was about 5.4 kg/t or about twice that if calculated on the basis of reported consumption (Sibley and others, 2001). Overall domestic manganese apparent consumption in 2001 was estimated to be 692,000 t.

Relatively small quantities of manganese were used for alloying with nonferrous metals, chiefly in the aluminum industry as manganese-aluminum briquets 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 cookware, roofing, automobiles and radiators (Harben, Raleigh, and Harris, 1998).

In 2001, domestic consumption of manganese ore decreased by about 13% to 425,000 t, while corresponding yearend stocks decreased by about 39% to 138,000 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, manganese chemicals, and fertilizers. 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. Approximately 15 firms were canvassed that process ore by such methods as grinding and roasting or that consume it in

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

the manufacture of dry cell batteries and manganese ferroalloys, metal, and chemicals. The collective consumption of these firms is believed to constitute all 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 these firms for 2001.

In batteries containing manganese, those of the alkaline type in which electrolytic manganese dioxide (EMD) is used continued to expand their share of the market at the expense of the carbon-zinc type, in which natural battery-grade ore is a component. In the rechargeable battery market, lithium-based technologies, including lithium-ion batteries comprised of lithium manganese oxides, are gaining ground rapidly on nickel-metal-hydride and nickel-cadmium cells. Lithium batteries recharge more quickly than nickel and are very lightweight. They are currently being sold primarily in the laptop and cell phone markets, but have very broad potential (Advanced Battery Technology, 2002).

Prices

For 2001, if the price of manganese in metallurgical-grade ore is set at 1.0, then the corresponding price per manganese unit was approximately 2.4 for high-carbon ferromanganese, 3.6 for medium-carbon ferromanganese, 2.4 for silicomanganese, and 6.4 for manganese metal. All factors decreased compared with those in 2000. 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 at $2.44 per metric ton unit. Prices were somewhat above or below this value, depending on ore quality, time of year, and nature of transaction. The price of a metric ton of ore is obtained by multiplying the metric ton unit price by the percentage manganese content of the ore; that is, by 48 when the manganese content is 48%. The ore market consisted of a number of submarkets because of differences between ores according to such various end uses as ferroalloy production, blast furnace ironmaking, and manufacture of manganese chemicals.

Because the metric ton unit is 1% of a metric ton (i.e., 10 kilograms of contained manganese), the price of manganese in ore in 2001 and 2000 can be expressed as 24.4 and 23.9 cents per kilogram, respectively. These values indicate an increase of about 2% in U.S. c.i.f. price or somewhat less than the increase in free on board (f.o.b.) price in international markets.

The international benchmark price for metallurgical-grade ore increased by 4% in 2001; in 2000 the price increase was 7%. Price negotiations between Samancor Ltd. and major Japanese consumers were concluded in late June 2001. On an f.o.b. basis per metric ton unit for delivery during the annual contract year, the prices agreed to were $2.11 for ore from the Groote Eylandt Mine in Australia and $2.02 for ore from the Wessels Mine in South Africa.

Manganese Ferroalloys.—Prices for high-carbon and medium-carbon ferromanganese decreased from the beginning of 2001 to the end of the year, generally mirroring the decline in the domestic raw steel production rate. Silicomanganese prices increased as a result of reduced world production capacity, and relatively strong steel production within the minimill sector compared with that of integrated producers (CRU Bulk Ferroalloys Monitor, 2002).

The price information that follows pertains to quotations for U.S. imports because public information on current prices for domestic product was not available. 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 f.o.b. Pittsburgh or Chicago warehouse, began the year unchanged from the end of 2000 at $475 to $490 and ended the year at $445 to $465, for a net overall decrease of about 7%. For the year, the average for the middle of the price range was $452.14, which was a decrease of more than 6% from that of 2000. 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 f.o.b. warehouse, began the year unchanged from the end of 2000 at 42 to 45 cents and ended the year at 36 to 38.5 cents, for a net overall decrease of about 14%. The middle of the price range averaged 40.16 cents for the year, for a decrease of 13% over that of 2000.

For imported silicomanganese with 2% carbon, the price range per pound of alloy f.o.b. Pittsburgh or Chicago warehouse started the year unchanged from the end of 2000 at 21 to 22 cents and ended the year at 22.75 to 24 cents, for a net increase of about 9%. Even so, the 2001 annual average for the middle of the price range of about 23.0 cents was 3% less than that of 2000.

Manganese Metal.—According to the North American transaction prices listed by Ryan's Notes, bulk shipments of domestic manganese metal, per pound f.o.b. shipping point, started the year unchanged from yearend 2000 at 72 to 77 cents, and ended the year at 53 to 55 cents, for a net decrease of about 28%. Prices decreased steadily after reaching a plateau-like high range of 79 to 92 cents in mid-May. The year-average price of 70.4 cents for this listing was about 13% less than that for 2000, and about 39% below the producer price that was listed through June 2001. Ryan's Notes discontinued reporting producer list prices starting in July 2001.

Foreign Trade

Compared with those of 2000, total volumes of manganese exports and imports, on a gross weight basis, increased by 10% and decreased by 22%, respectively (tables 5, 6). In terms of manganese units contained, exports increased by 11% and imports decreased by 19% compared with those of 2000. Also on the basis of content, the ratio of imports of manganese ferroalloy plus metal divided by imports of ore plus dioxide tentatively decreased to 1.69:1 in 2001 from 2.0:1 in 2000. 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 16 years. Unless otherwise noted, the ensuing comparisons of foreign trade data were made on the basis of manganese content.

Exports of manganese ferroalloys and manganese dioxide increased during 2001, while exports of manganese ore and metal decreased. The biggest year-to-year changes were for exports of silicomanganese, which increased by 95% compared with those in 2000. Percentage increases for exports of ferromanganese and manganese dioxide from 2000 were 16% and 23%, respectively. Most of the increase in ferromanganese exports was in the trade subcategory of "carbon content greater than 2%." For this category, exports increased by 31% on a gross weight basis and 45% on a manganese content basis.

On a gross weight basis, reexports of ore, ferromanganese, silicomanganese, metal, and dioxide were 740 t, 10,208 t, 2,880 t, 127 t, and 70 t, respectively. Except for manganese dioxides, all or nearly all the reexports went to Canada. Other main destinations of metal reexports were Mexico and Italy. The majority of manganese dioxide reexports went to South Africa (84%), with the remaining going to France and Canada.

Among imports, the overall average manganese contents were tentatively 79.9% for ferromanganese and 55.6% for ore. The average manganese content for ferromanganese was abnormally high, and was at its greatest level in over 40 years (since 1960, the average content of ferromangenese 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 China and Japan in the trade subcategory of "1% or less carbon" (or "low-carbon ferromanganese"), where the manganese contents of both countries' imports were reported higher than their associated gross weights. Also being questioned was the abnormally high average manganese content of the ores, especially those imported from Gabon. These questions were unresolved at the time this report was prepared.

The import volume for total ferromanganese fell by 19% from that in 2000. The most significant year-to-year change was for low-carbon ferromanganese, for which imports decreased by 33%. Declines in this import subcategory during 2001 were especially notable for South Africa and Italy; imports from South Africa fell by 64% and those from Italy by 58%. Also, no imports of low-carbon ferromanganese were received from Brazil. Comparing leading supplying countries of medium-carbon ferromanganese with those in 2000, import volumes increased for South Africa by 16% and decreased significantly for Norway (80%), China (39%), France (27%), and Mexico (16%). High-carbon ferromanganese imports increased for France (17%), and decreased, in order of volume, for South Africa (28%), Brazil (19%), and Australia (15%). No imports of medium-carbon ferromanganese were received from Japan or Korea during 2001.

Silicomanganese imports decreased by 30% from those of 2000. Comparing leading supplying countries of silicomanganese with those in 2000, import volumes increased for Spain (303%), Norway (136%), and Romania (23%), and decreased for France (100%), Venezuela (94%), Mexico (67%), Kazakhstan (51%), India (35%), and Georgia (27%). Manganese metal imports, on a gross weight basis, were 33% greater than for 2000. The bulk of metal imports (86%) consisted of unwrought manganese imports from China, Germany, and South Africa (especially). Imports in the "other" subcategory rose by about 70%. Reported imports of spiegeleisen (pig iron containing about 20% manganese) increased from 270 t in 2000 to 306 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 25% from those in 2000. Australia and South Africa continued to lead Ireland as the leading sources of manganese dioxide. Data for imports under the classification of "sulfates, other" suggested that imports of manganese sulfate, on a gross weight basis, decreased by 21%, as the volume of imports of material in that class decreased by 18% for China and decreased by 34% for Mexico. Receipts from China in 2001 were 12,100 t, down from a revised figure of 14,800 t in 2000, at a value of $5.3 million, and those from Mexico were 12,500 t at a value of $6.9 million, down from 19,000 t in 2000.

Government trade agencies took actions that affected antidumping duties on electrolytic manganese dioxide, manganese metal, and silicomanganese. Based on the preliminary results of its antidumping duty administrative review that imports of electrolytic manganese dioxide from Japanese producer Tosoh Corporation and its Greek subsidiary Tosoh Hellas A.I.C. were not made below normal value during the period of review (POR) April 1, 1999, through December 31, 1999, the International Trade Administration (ITA) of the U.S. Department of Commerce issued final duty margins of 0% in March 2001 (International Trade Administration, 2001a-d).

Also in March, the ITA announced the final results of its antidumping review of manganese metal from China for the POR February 1, 1999, through January 31, 2000. The ITA determined a margin of 12.12% for China Metallurgical Import & Export Hunan Corporation/Hunan Nonferrous Metals Import & Export Associated Corporation; 0% for Minmetals Precious and Rare Minerals Import & Export Company; 3.49% for London & Scandinavian Metallurgical Co. Ltd./Shieldalloy Metallurgical Corporation; and 143.32% for Sumitomo Canada, Ltd. (International Trade Administration, 2001f). In April 2001, the ITA revoked its antidumping duty order on manganese metal imported from China on or after February 6, 2001. The ITA took this action because the only domestic participant, Kerr-McGee Chemical LLC, withdrew from its sunset review of the order. This action did not apply to material imported prior to the date of revocation or to administrative reviews thereof (International Trade Administration, 2001e).

On February 5, the U.S. International Trade Commission (ITC) determined that revocation of the antidumping duty orders on silicomanganese from Brazil and China and termination of the suspended investigation on silicomanganese from Ukraine would likely lead to a continuation or recurrence of material injury to the U.S. silicomanganese industry (U.S. International Trade Commission, 2001a). On June 11, the ITA determined that the Government of Ukraine was not in compliance with the suspension agreement it signed on October 31, 1994, regarding silicomanganese imports to the United States (International Trade Administration, 2001h). The ITA made this determination in response to the November 30, 1999, request by Eramet Marietta Inc. for agency review of the suspension agreement for the POR November 1, 1998, through October 31, 1999. Effective September 17, 2001, the ITA terminated the suspension agreement between the Governments of Ukraine and the United States for imports of silicomanganese from Ukraine. The ITA also imposed antidumping duties of 163% on all silicomanganese imports from Ukraine (International

Trade Administration, 2001i). Effective August 24, the Office of the United States Trade Representative (USTR) suspended duty-free treatment under the Generalized System of Preferences program for all products of Ukraine, including the importation of manganese materials (Office of the United States Trade Representative, 2001). The USTR decided not to impose additional ad valorem duties on the importation of manganese materials from Ukraine (Office of the United States Trade Representative, 2002).

In response to a petition filed April 6, 2001, by Eramet Marietta Inc., and the Paper, Allied-Industrial, Chemical and Energy Workers International Union, the ITC began preliminary antidumping investigations concerning silicomanganese from India, Kazakhstan, and Venezuela (U.S. International Trade Commission, 2001b). On May 18, the ITC made an affirmative determination of a reasonable indication of material injury to a U.S. industry. This decision means that the ITA would continue its related investigation (U.S. International Trade Commission, 2001c). The ITA initiated its investigation on May 3 of silicomanganese imports from India and Venezuela during the POR April 1, 2000, through March 21, 2001, and from Kazakhstan during the POR October 1, 2000, through March 31, 2001 (International Trade Administration, 2001g). On April 2, 2002, the ITA issued its final determinations on less than fair value sales of silicomanganese, excluding low-carbon silicomanganese, from these three countries. The final antidumping margins were India—Nava Bharat Ferro Alloys, Ltd., 15.32%; Universal Ferro and Allied Chemicals, Ltd., 20.42%; and all others, 17.69%; Kazakhstan—Kazakhstan Alloy 2000, S.A., 247.88%; and Kazakhstan-wide, 247.88%; and Venezuela—Hornos Eléctricos de Venezuela, S.A. (Hevenesa), 24.62%, and all others, 24.62% (International Trade Administration, 2002 a-c).

World Trade

Leading producer countries among a relatively concentrated production of manganese ore, in decreasing order, were South Africa, Brazil, Australia, Ukraine, Gabon, India, and China (table 7). Leading producer countries among a more widely distributed production of manganese ferroalloys, in decreasing order, were China, Ukraine, South Africa, France, Norway, Japan, and India (table 8).

***Australia.*—**On June 29, BHP Ltd. of Australia and Billiton plc of the United Kingdom completed their merger. The plans for the merger were announced in mid-March (Mining Journal, 2001a, b). The resulting BHP Billiton had a dual-listed structure in which BHP Billiton Ltd. was registered and listed in Australia and BHP Billiton plc was registered in London and listed in South Africa and the United Kingdom. Manganese assets included in the merger were mines and smelters in South Africa that were being operated by Samancor Ltd. and in Tasmania that were sold by BHP to Billiton in December 1998 and were being administered by Samancor. Under BHP Billiton, these assets were placed in the carbon-steel materials "Customer Sector Group," which was one of seven such groups established.

In late May, HiTec Energy Ltd. commissioned a demonstration plant for EMD at Murdoch University in Perth, Western Australia. The plant was operated for about 6 months to prove out the technology of HiTec's Electrofuel project (Metal Bulletin, 2001b). The company put the demonstration plant on care and maintenance in November, while it sought capital investment to construct a commercial plant with a staged EMD production capacity, starting at 20,000 t/yr, followed by a debottlenecking capacity increase of 4,000 t/yr, to which another 24,000 t/yr capacity would be added at a later time, bringing the total operating capacity to 48,000 t/yr (HiTec Energy Ltd., 2002§).

***Brazil.*—**Beginning June 1, ferroalloys production was cut back because of a government-mandated program of electricity rationing. This program called for a 25% reduction in energy use because of a depletion of hydropower caused by severe draught conditions (Kepp, 2001). Brazilian producers tended to reduce production of ferromanganese alloys in favor of silicomanganese production. As a consequence, production of high-carbon ferromanganese and medium- and low-carbon ferromanganese fell by 26% and 8%, respectively, while silicomanganese production rose by 5% (TEX Report, 2002b). The Government completely lifted the power restriction at the beginning of March 2002.

***Canada.*—**Wabush Mines, an iron ore miner in northeast Canada, announced plans to reduce iron ore pellet production at its Pointe-Noire, Quebec, facility by about 25% to 4.8 Mt in 2001 and 2002 as a result of two key clients deciding to stop taking shipments. In 2001, Wabush produced four different pellet grades, with the principal product being 1.20% manganese pellets averaging (dry) 66.00% iron, and 3.25% silica. The other major products are 2.00% manganese pellets of 62.50% iron and 3.35% silica (Jones, 2001; Skillings Mining Review, 2001).

***China.*—**Within the past 5 years, about 70% to 80% of China's ferromanganese output became concentrated in the midwestern provinces of Sichuan, Yunnan, Hunan, Guangxi, and Guizhou. The relatively strong resource base in the region drove this trend. Ferromanganese producers in northern and eastern China substituted production to other ferroalloys (Metal Bulletin, 2001a). Late in May, Xiangtan Managanese Industry Group Co., Ltd. indefinitely suspended its blast furnace production of high-carbon ferromanganese, which was the latest of a number of cutbacks of blast furnace production of ferromanganese in China (TEX Report, 2001c). Although Xiangtan's action would remove from the market about 8,000 t of ferromanganese each month, it was reported that other producers in the area were raising their production and making up any shortfall (Metal Bulletin, 2001c). The Guangixi Bayi Ferroalloy operation boosted its combined silicomanganese and ferromanganese output to 180,000 t/yr from 160,000 t/yr by starting two new furnaces (Platts Metals Week, 2001).

Two Chinese producers started construction of high-grade electrolytic manganese metal (99.99% manganese content) plants. Huayuan Zhenxing and Zunyi Ferro-Alloy works were building plants each having 10,000 t/yr capacity. Completion of both plants is expected by the first-half of 2002. These companies would join two other Chinese companies, Sanjiaotan and Dalong, in producing the high-grade material. The only producer of high-grade electrolytic manganese metal in the Western World is Manganese Metal Company of South Africa (TEX Report, 2001b).

France.—France's Eramet made changes in the operation of plants it controlled in France, Italy, and Norway. In France, of the three blast furnaces for production of high-carbon ferromanganese at the coastal Boulogne-sur-Mer plant of Société du Ferromanganèse de Paris-Outreau, the only working furnace was refurbished to accept manganese from Gabon. The other two were shut down, one temporarily for scheduled maintenance (TEX Report, 2001d). In Italy, production was suspended at the silicomanganese smelter at Cairo Montenotte, inland and to the west of Genoa in northwestern Italy. Capacity of this plant was 37,000 t/yr (TEX Report, 2001e). In Norway at the Sauda plant on the southwestern coast northeast of Stavanger, the smaller of three electric furnaces was shut down (TEX Report, 2001d). The changes in France and Norway were effective as of the end of June, while that in Italy was effective from the end of May.

Georgia.—In the Caucasian republic of Georgia, efforts to revitalize that country's manganese industry underwent yet another transformation. The Georgian Government voided an agreement made in 1999, under which Saga-Print, a Czech investment firm, acquired a 75% shareholding in Chiaturmarganets. Under this agreement, production of manganese concentrates from the Chiatura Mine was to be raised to more than 200,000 t/yr. After voiding the agreement, the Government decided that control of Chiaturmarganets and its main customer, the nearby Zestafoni Ferroalloy Works, should be offered to investors as a unit (Interfax Mining & Metals Report, 2001a, b).

India.**—**In November, Bhutan Ferro Alloys reported plans to add capacity for either silicon metal or low- or medium-carbon silicomanganese production at its existing plant that currently has a ferrosilicon capacity of 15,000 t/yr. India does not produce silicon metal owing to high power costs, although plants constructed by Indian Metal Ferro Alloys Ltd. and Ispat Alloys Ltd. are being used for the production of ferrosilicon and other ferroalloys (American Metal Market, 2001).

Iran**.—**A survey of the Iranian ferroalloy industry was published in 2001, outlining total proven deposits and average grade of manganese ores and production capacity of high-carbon ferromanganese, among other ferroalloys (Sargheini, Heshmati-Manesh, and Ataie, 2001).

Italy**.—**The history, geology, mines, and numerous minerals of the Val Graveglia manganese district east of Genoa in northwestern Italy were discussed in an article published in fall 2001 (Marchesini and Pagano, 2001).

Mexico.**—**Cía Minera Autlán SA de CV began consolidating ferroalloy production at its Tamos plant (Veracruz State). A shutdown in production at the Gomez Palacio plant (Durango State) and Teziutlan plant (Puebla State) also began, with the furnaces from these plants scheduled to be moved to the Tamos plant by 2004 (Ryan's Notes, 2001b). As a result, Autlán's ferroalloy output in 2001 was about 68% of that for 2000.

South Africa.**—**Assmang Ltd. (formerly Associated Manganese Mines of South Africa Ltd.) resumed production of silicomanganese after a lapse of 15 years. This broadening of its line of manganese ferroalloys was achieved by switching production of a furnace at its Cato Ridge plant west of Durban from high-carbon ferromanganese to silicomanganese (TEX Report, 2001a).

Samancor idled several small silicomanganese furnaces and switched production from one of its 3 high-carbon ferromanganese furnaces to silicomanganese at its Meyerton plant in South Africa in 2001, resulting in declines for the year in high-carbon ferromanganese and silicomanganese production of 50,000 t and 75,000 t, respectively (CRU Bulk Ferroalloys Monitor, 2002).

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:

Ore Reduction.—Outokumpu Technology reported the development of a new process for reducing manganese ore employing steel belt sintering furnace technology that is currently used to sinter iron, chromite, and niobium ores and concentrates (Metals Technology, 2001).

Electrochemistry of Manganese Oxides.—Several articles on the electrochemistry of manganese oxides, including improvements of anode and electrolysis procedure for EMD at low temperature (75° C) (Na and others, 2001); discharge characteristics of alkaline zinc manganese dioxide based on EMD material characteristics (Swart, Naude, and Swinkels, 2001); and procedures for synthesizing and characterizing highly porous, nanostructured manganese oxides for electrochemical charge-storage applications (Long, Swider-Lyons, and others, 2000, 2001; Long, Qadir, and others, 2001).

Lithium-Manganese Oxides.—Various research articles on lithium-manganese, including development of high power lithium-ion rechargeable batteries using manganese spinel cathodes for use in hybrid electric vehicles (Amemiya and others, 2001); modeling charge-discharge dynamics of lithium manganese oxide electrodes (Deiss and others, 2001); a new process for producing lithium manganese oxide spinel from alkali permanganates (Pillai and others, 2001); optimization of lithium manganese oxide spinel cathode formulation (Grivei, Soupart, and Lahdily, 2001); and discovery of a new manganese dioxide for use in lithium primary batteries (Iltchev and others, 2001).

Uses of Manganese Oxides.—A discussion on sulfide-manganese dioxide battery capacity (Thiemann and others, 2001).

Biology.**—**Summary of research into possible neurotoxicological effects caused by heavy exposure to manganese (Hileman, 2001) and possible neurotoxicological effects of manganese in violent criminals (Glenn, 2001).

Environment and Toxicology.—The development of a battery charge that can recharge and recycle discarded primary alkaline zinc manganese oxide cells (Mizumoto, Suzuki, and Kozawa, 2001) and articles on the effect of manganese oxides on metal contaminant fate and transport in aquatic systems (Hansel and others, 2001; Kay and others, 2001; Trivedi, Axe, and Tyson, 2001).

Outlook

The trend of domestic and global demand for manganese will continue to follow closely 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 2001, U.S. apparent consumption of manganese has been within about plus or minus 14% of 680,000 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 (table 1) has tended to increase at about the same rate as raw steel production. Manganese apparent consumption may not have tracked steel production precisely because of the influence of unmeasured changes in stocks of manganese materials, such as those of importers. The effect of this may have outweighed changes in demand by steelmakers and may explain why for some years calculated apparent consumption showed positive or negative deviations from that which could be estimated on the basis of steel production.

Details of the outlook for the steel industry are discussed in the "Outlook" section of the annual review for 2001 for Iron and Steel. In 2001, raw steel production decreased by about 12% in the United States, and manganese apparent consumption decreased by about 19%. Globally, growth trends for manganese demand are similarly linked strongly with steel production. The International Iron and Steel Institute's spring 2002 short-term outlook for steel demand projected world steel consumption to increase by 2.0% in 2002 and by 3.5% in 2003 based on a world economic recovery starting in late 2002 (International Iron and Steel Institute, 2002§). One of the major companies in the world's manganese industry was not optimistic about growth in the midterm, foreseeing a growth of only 1.9% in the amount of steel produced worldwide during 2000 through 2005 (Bacardats, 2000). Like the steel industry, the manganese industry continued to be challenged by overcapacity for mining and smelting.

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TABLE 1
SALIENT MANGANESE STATISTICS 1/

(Thousand metric tons, gross weight)

		1997	1998	1999	2000	2001
United States:						
Manganese ore (35% or more Mn):						
Exports		84	8	4	10	9
Imports for consumption		355	332	460	447 r/	358
Consumption 2/		510	499	479	486	425
Stocks, December 31, consumers 2/		241	163	172	226	138
Ferromanganese:						
Exports		12	14	12	8	9
Imports for consumption		304	339	312	312	251
Consumption 3/		337	290	281	300	266
Stocks, December 31, consumers and producers		21	26	40	31	25
Consumption, apparent, manganese 4/	thousand metric tons, manganese content	643	776	719	768 r/	692
Ore price, cost, insurance, and freight U.S. ports	dollars per metric ton unit	2.44	2.40	2.26	2.39	2.44
World production of manganese ore		21,900	19,900 r/	17,800 r/	19,100 r/	19,100 e/

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

TABLE 2
U.S. GOVERNMENT DISPOSAL AUTHORITIES AND INVENTORIES FOR MANGANESE MATERIALS
AS OF YEAREND 2001 1/

(Metric tons, gross weight)

		Physical inventory e/				
		Uncommitted			Sold,	
	Disposal	Stockpile	Nonstockpile		pending	Grand
Material	authority	grade	grade	Total	shipment	total
Natural battery ore	103,000	103,000	--	103,000	178	103,000
Synthetic manganese dioxide	2,730	2,730	--	2,730	--	2,730
Chemical ore	134,000	123,000	--	123,000	15,400	138,000
Metallurgical ore	848,000	453,000	243,000	696,000	249,000	945,000
High-carbon ferromanganese	582,000	772,000	--	772,000	25,800	797,000
Electrolytic metal	3,860	2,290	--	2,290	3,350	5,640

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 2001

		Products 1/				
Company	Plant location	FeMn	SiMn	Mn	MnO_2	Type of process
Erachem Comilog	Baltimore, MD				X	Chemical.
Do.	New Johnsonville, TN				X	Electrolytic.
Eramet Marietta Inc.	Marietta, OH	X	X			Electric furnace and electrolytic.
Kerr-McGee Chemical LLC 2/	Hamilton, MS			X		Electrolytic.
Do.	Henderson, NV				X	Do.
Energizer Holdings, Inc., Eveready Battery Co.	Marietta, OH				X	Do.

1/ FeMn, ferromanganese; SiMn, silicomanganese; Mn, manganese metal; MnO_2, synthetic manganese dioxide.
2/ Kerr-McGee phased out production of manganese metal at its Hamilton, MS, plant by mid-2001.

TABLE 4
U.S. CONSUMPTION, BY END USE, AND INDUSTRY STOCKS OF MANGANESE FERROALLOYS AND METAL IN 2001 1/

(Metric tons, gross weight)

End use	Ferromanganese: High carbon	Ferromanganese: Medium and low carbon	Ferromanganese: Total	Silico-manganese	Manganese metal
Steel:					
Carbon	122,000	85,300	207,000	61,200	621
High-strength, low-alloy	16,900	3,230	20,100	2,620	(2/)
Stainless and heat-resisting	9,680	(2/)	9,680	4,180	1,210
Full alloy	14,300	4,080	18,400	16,900	(2/)
Unspecified 3/	998	292	1,290	678	1,120
Total	163,000	92,900	256,000	85,500	2,950
Cast irons	8,100	454	8,560	1,040	5
Superalloys	W	W	W	--	W
Alloys (excluding alloy steels and superalloys)	902	436	1,340	(4/)	16,100 5/
Miscellaneous and unspecified	--	W	W	(4/)	W
Total consumption	172,000	93,800	266,000	86,500 6/	19,100
Total manganese content 7/	134,000	75,300	210,000	59,900	19,100
Stocks, December 31, consumers and producers	9,240	15,700	24,900	16,200	2,210

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	2000: Gross weight (metric tons)	2000: Free alongside ship value (thousands)	2001: Gross weight (metric tons)	2001: Free alongside ship value (thousands)
Ore and concentrates with 20% or more manganese:				
Canada	4,160	$1,020	4,340	$1,030
Germany	589	278	577	280
Italy	350	172	515	250
Netherlands	24	12	345	169
Norway	333	136	596	292
United Kingdom	3,800	304	1,270	620
Other	776	277	1,520	633
Total	10,000	2,200	9,170	3,270
Ferromanganese, all grades:				
Canada	7,610	4,910	8,030	4,660
Mexico	231	266	171	123
Venezuela	--	--	848	686
Other	111	106	190	316
Total	7,950	5,290	9,240	5,780
Silicomanganese:				
Canada	1,460	942	999	567
Mexico	373	221	2,500	1,630
Other	34	35	142	147
Total	1,870	1,200	3,640	2,350
Metal, including alloys and waste and scrap:				
Canada	762	1,680	164	393
Japan	773	1,620	724	1,580
Mexico	248	491	207	397
Netherlands	73	136	198	288
United Kingdom	17	43	(2/)	56
Other	349	1,050	523	4,190
Total	2,220	5,020	1,820	6,900

See footnotes at end of table.

TABLE 5--Continued

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

-- 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.

TABLE 6

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

Country	2000 Gross weight (metric tons)	2000 Manganese content (metric tons)	2000 Customs value (thousands)	2001 Gross weight (metric tons)	2001 Manganese content (metric tons)	2001 Customs value (thousands)
Ore and concentrates with 20% or more manganese:						
All grades:						
Australia	34,800	18,100	$3,280	34,300	18,000	$3,140
Brazil	7,030	3,250	373	7,720	3,480	476
Gabon	380,000 r/	188,000 r/	27,200	271,000	158,000	21,600
Ghana	17,400	6,510	209	--	--	--
Mexico	8,080	3,250	1,050	4,520	1,720	391
South Africa	--	--	--	39,500	17,400	2,290
Other	132	97	29	114	95	94
Total	447,000 r/	219,000 r/	32,100	358,000	199,000	28,000
More than 20%, but less than 47% manganese:						
Brazil	7,030	3,250	373	7,700	3,460	466
Gabon	38,000	16,100	2,170	23,300	11,000	1,600
Ghana	17,400	6,510	209	--	--	--
Mexico	8,080	3,250	1,050	4,520	1,720	391
South Africa	--	--	--	11,600	4,160	566
Total	70,500	29,100	3,800	47,100	20,300	3,030
47% or more manganese:						
Australia	34,800	18,100	3,280	34,300	18,000	3,140
Brazil	--	--	--	17	16	11
Gabon	342,000 r/	172,000 r/	25,000	248,000	147,000	20,000
South Africa	--	--	--	27,900	13,200	1,730
Other	132	97	29	114	95	94
Total	377,000 r/	190,000 r/	28,300	310,000	178,000	25,000
Ferromanganese:						
All grades:						
Australia	30,400	22,800	11,500	28,700	22,000	10,100
Brazil	14,800	11,600	6,370	7,990	6,230	3,780
China	7,630	6,240	5,330	5,110	4,400	4,350
France	45,300	35,800	19,500	50,100	41,800	18,000
Italy	5,520	4,700	5,390	2,330	1,970	2,090
Japan	10,900	9,060	8,080	(3/)	31	22
Korea, Republic of	8,550	6,840	5,060	--	--	--
Mexico	23,600	19,000	15,800	19,300	15,500	13,000
Norway	10,500	8,560	6,170	5,020	3,790	3,140
South Africa	151,000	119,000	66,600	125,000	98,600	55,400
Other	3,400	2,690	1,510	7,600	6,050	2,000
Total	312,000	246,000	151,000	251,000	200,000	112,000
1% or less carbon:						
Brazil	6,410	5,140	2,920	--	--	--
China	1,410	1,250	1,490	1,310	1,360	1,380
Italy	5,520	4,700	5,390	2,330	1,970	2,090
Japan	4,660	3,920	3,980	(3/)	31	22
Mexico	1,570	1,260	1,350	2,010	1,610	1,490
Norway	50	40	26	2,910	2,060	2,080
South Africa	2,490	2,330	3,880	6,280	5,520	6,060
Other	180 4/	171 4/	203 4/	77	62	55
Total	22,300	18,800	19,200	14,900	12,600	13,200

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	2000 Gross weight (metric tons)	2000 Manganese content (metric tons)	2000 Customs value (thousands)	2001 Gross weight (metric tons)	2001 Manganese content (metric tons)	2001 Customs value (thousands)
Ferromanganese--Continued:						
More than 1% to 2% or less carbon:						
China	6,230	4,990	3,840	3,800	3,040	2,260
France	60	48	37	44	35	28
Japan	6,250	5,140	4,100	--	--	--
Korea, Republic of	8,550	6,840	5,060	--	--	--
Mexico	20,700	16,700	13,800	17,300	13,900	11,500
Norway	10,500	8,520	6,140	2,110	1,730	1,120
South Africa	25,300	20,500	15,800	29,500	23,800	17,400
Other	188	150	130	2,440	2,200	1,500
Total	77,800	62,900	48,900	55,100	44,700	33,800
More than 2%, but not more than 4% carbon:						
Brazil	1	(3/)	2	--	--	--
South Africa	57	46	46	--	--	--
Ukraine	--	--	--	1,360	1,020	538
Total	58	46	48	1,360	1,020	538
More than 4% carbon:						
Australia	30,400	22,800	$11,500	28,700	22,000	$10,100
Brazil	8,310	6,410	3,370	6,660	5,170	2,400
France	45,200	35,700	19,500	50,100	41,800	18,000
South Africa	124,000	96,000	46,900	89,400	69,300	31,900
Other	4,540	3,550	1,880	5,050	3,840	1,950
Total	212,000	164,000	83,200	180,000	142,000	64,300
Silicomanganese:						
Australia	52,400	35,500	24,300	47,100	31,200	19,600
France	1,350	918	636	--	--	--
Georgia	6,250	4,390	2,940	4,920	3,200	2,070
India	60,500	39,300	26,200	39,800	25,400	16,000
Kazakhstan	66,400	45,200	28,400	32,300	22,100	13,700
Mexico	45,400	29,700	21,000	14,900	9,730	7,090
Norway	4,400	2,680	2,780	10,400	6,320	6,000
Romania	9,630	6,360	4,170	12,000	7,840	5,620
South Africa	97,400	65,400	43,600	92,000	62,500	37,400
Spain	1,380	854	909	7,430	3,440	2,340
Venezuela	24,100	16,100	10,500	1,500	960	615
Other	8,920 4/	5,860 4/	3,990 4/	6,880	4,670	2,910
Total	378,000	252,000	169,000	269,000	177,000	113,000
Metal:						
Unwrought:						
China	3,320	XX	4,410	3,600	XX	4,400
Germany	1,760	XX	2,360	2,210	XX	3,140
South Africa	9,160	XX	13,900	12,700	XX	17,800
Ukraine	20	XX	23	--	XX	--
United Kingdom	627	XX	1,120	149	XX	216
Other	193	XX	288	727	XX	1,280
Total	15,100	XX	22,100	19,400	XX	26,800
Other:						
China	92	XX	162	178	XX	217
France	92	XX	841	69	XX	506
Netherlands	80	XX	148	61	XX	145
Russia	--	XX	--	385	XX	410
Ukraine	189	XX	204	--	XX	--
Other	211	XX	911	433	XX	985
Total	663	XX	2,270	1,130	XX	2,260
Waste and scrap:						
Canada	433	XX	357	993	XX	162
China	--	XX	--	60	XX	15
France	--	XX	--	6	XX	22
Norway	20	XX	16	--	XX	--

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	2000 Gross weight (metric tons)	2000 Manganese content (metric tons)	2000 Customs value (thousands)	2001 Gross weight (metric tons)	2001 Manganese content (metric tons)	2001 Customs value (thousands)
Manganese dioxide:						
Australia	25,400	XX	36,500	20,600	XX	30,800
Belgium	769	XX	1,260	463	XX	751
China	1,060	XX	1,320	1,650	XX	1,670
Greece	1,580	XX	2,060	563	XX	728
Ireland	9,510	XX	13,100	7,250	XX	10,000
South Africa	12,200	XX	17,200	7,270	XX	10,400
Other	633	XX	1,300	440	XX	1,240
Total	51,200	XX	72,700	38,300	XX	55,600
Potassium permanganate:						
Czech Republic	824	XX	1,590	870	XX	1,720
India	481	XX	873	594	XX	1,140
Spain	156	XX	352	--	XX	--
Other	60	XX	136	89	XX	106
Total	1,520	XX	2,950	1,550	XX	2,960

r/ Revised. XX Not applicable. -- Zero.

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

2/ Includes U.S. Geological Survey's conversion of part of reported data (from apparent MnO_2 content to Mn content).

3/ Less than 1/2 unit.

4/ Revised; unspecified group of countries differs from that in the 2000 annual report.

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 1997	Gross weight 1998	Gross weight 1999	Gross weight 2000	Gross weight 2001 e/	Metal content 1997	Metal content 1998	Metal content 1999	Metal content 2000	Metal content 2001 e/
Australia 5/	37-53	2,136	1,500	1,892	1,614	2,069 6/	1,024	729	926	787	948 6/
Brazil 7/	30-65 r/	2,124	1,940 r/	1,656 r/	2,192 r/	2,200	977	1,261 r/	1,076 r/	1,424 r/	1,430
China e/ 8/	20-30	6,000	5,300	3,190	2,640 r/	2,500	1,200	1,060	630	528 r/	500
Gabon 9/	45-53	1,904	2,092	1,908	1,743	1,791 6/	879	966	881	804	830
Ghana	32-34 r/	437	537	639 10/	896 e/ 10/	813	149	172 e/	204	287 e/	260
India e/ 11/	10-54	1,596 6/	1,557 6/	1,500	1,550	1,600	606	592	570	590	600
Kazakhstan (crude ore) e/	20-30	400	634 6/	980 6/	1,136 6/	1,403 6/	98	155	240	280	350
Mexico 12/	27-50	534	510	459	435 r/	270	193	187	169	156	100
South Africa 9/	30-48 +	3,121	3,044	3,122	3,635	3,266 6/	1,324	1,298	1,343	1,578	1,479 6/
Ukraine	30-35	3,040	2,226	1,985	2,741	2,700 6/	1,030 e/	755 e/	675 e/	930 e/	930
Other e/ 13/	XX	608	560 r/	469 r/	518 r/	488	181	166 r/	146 r/	145 r/	143
Total	XX	21,900	19,900 r/	17,800 r/	19,100 r/	19,100	7,660	7,340 r/	6,860 r/	7,510 r/	7,570

e/ Estimated. r/ Revised. XX Not applicable.

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

2/ Table includes data available through July 27, 2002. Data pertain to concentrates or comparable shipping product, except that in a few instances the best data available appear to be for crude ore, possibly after some upgrading.

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

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

5/ Metallurgical ore.

6/ 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 38.3% Mn for fiscal years 1998-1999 through 2000-2001.

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, Greece, Hungary, Indonesia, Iran, Italy (from wastes), Japan (low-grade ore), Malaysia, 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)

	1997					1998					1999				
	Ferromanganese			Silico-		Ferromanganese			Silico-		Ferromanganese			Silico-	
	Blast	Electric		manga-	Grand	Blast	Electric		manga-	Grand	Blast	Electric		manga-	Grand
Country 3/	furnace	furnace	Total	nese	total	furnace	furnace	Total	nese	total	furnace	furnace	Total	nese	total
Argentina	--	8	8	26	35	--	5	5	25	30	--	-- r/	-- r/	-- r/	-- r/
Australia e/	--	95	95	95	190	--	110	110	105	215	--	98	98	116	214
Belgium e/ 4/	--	25	25	--	25	--	20	20	--	20	--	--	--	--	--
Brazil	--	153	153	175	328	--	122	122	124	246	--	117 r/ e/	117 r/ e/	117 r/ e/	234 r/
Chile	--	6	6	3	9	--	4	4	4	8	--	3 r/	3 r/	2 r/	5 r/
China e/	500	680	1,180	770	1,950	550	500	1,050	639	1,690	550	550	1,100	822	1,920
Egypt e/	--	26	26	--	26	--	18	18	--	18	--	30	30	--	30
France e/ 5/	326 6/	100 6/	426 6/	66	492	321	100	421	65	486	302 6/	138	440	55	495
Georgia e/	--	4	4	17	21	--	10	10	35	45	--	7	7	25	32
India e/	--	166	166	198	364	--	165	165	193	358	--	160	160	190	350
Indonesia e/	--	15	15	7	22	--	13	13	7	20	--	12	12	7	19
Italy	--	40	40	100 e/	140 e/	--	49	49	70 e/	119 e/	--	19	19	67 e/	86 e/
Japan	--	377	377	78	455	--	334	334	71	405	--	315	315	66	381
Kazakhstan	--	--	--	55 e/	55 e/	--	--	--	57 e/	57 e/	--	--	--	78 r/	78 r/
Korea, North e/ 4/	--	6	6	--	6	--	6	6	--	6	--	6	6	--	6
Korea, Republic of	--	159	159	77	236	--	158	158	107	265	--	140	140	116	256
Mexico 7/	--	132 r/	132 r/	117 r/	249 r/	--	154 r/	154 r/	105 r/	258 r/	--	148 r/	148 r/	128 r/	276 r/
Norway e/	--	235	235	230	465	--	235	235	230	465	--	235	235	230	465
Poland	48 e/	--	48 e/	20	68 e/	50 e/	--	50 e/	15	65	(8/) r/	--	(8/) r/	10 r/	10 r/
Romania	--	12	12	63	74	--	4 e/	4 e/	84	88	--	(8/) e/	(8/) e/	1 e/	1 e/
Russia	47	--	47	--	47	65	--	65	--	65	90 e/	--	90 e/	--	90 e/
Slovakia e/	--	20	20	45 6/	65	--	20	20	47 6/	67	--	20	20	35 r/	55 r/
South Africa	--	499	499	286 e/	785 e/	--	542	542	265 e/	807 e/	--	527	527	267	794
Spain e/	--	23	23	122	145	--	18	18	108	126	--	10	10	95	105
Taiwan	--	12	12	--	12	--	13	13	--	13	--	--	--	--	--
Ukraine	125 e/	160 e/	285 e/	560 e/	845 e/	112	150 e/	262 e/	486	748	58	200	257	499	756
Venezuela	--	--	--	58 r/	58 r/	--	8 r/	8 r/	49	56 r/	--	11 r/	11 r/	48	58 r/
Total	1,050	2,950 r/	4,000 r/	1,370 r/	7,170 r/	1,100	2,760 r/	3,860 r/	2,890	6,750 r/	1,000 r/	2,750 r/	3,740 r/	2,970 r/	6,720

See footnotes at end of table.

TABLE 8--Continued
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons, gross weight)

Country 3/	2000					2001 e/				
	Ferromanganese			Silico-manga-nese	Grand total	Ferromanganese			Silico-manga-nese	Grand total
	Blast furnace	Electric furnace	Total			Blast furnace	Electric furnace	Total		
Argentina	--	-- e/	-- e/	5 r/	5 r/	--	--	--	5	5
Australia e/	--	115	115	135	250	--	115	115	135	250
Belgium e/ 4/	--	--	--	--	--	--	--	--	--	--
Brazil	--	121 r/	121 r/	171 r/	293 r/	--	96 6/	96 6/	180 6/	276 6/
Chile	--	3 r/ e/	3 r/ e/	2 r/ e/	5 r/ e/	--	3	3	2	5
China e/	500	520	1,020	900	1,920	500	600	1,100	950	2,050
Egypt e/	--	30	30	--	30	--	30	30	--	30
France e/ 5/	300	140	440	60	500	300	130	430	50	480
Georgia e/	--	7	7	25	32	--	7	7	25	32
India e/	--	160	160	185	345	--	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	--	338	338	68	406	--	368 6/	368 6/	62 6/	431 6/
Kazakhstan	--	1 r/	1 r/	103 r/	104 r/	--	5 6/	5 6/	141 6/	147 6/
Korea, North e/ 4/	--	6	6	--	6	--	6	6	--	6
Korea, Republic of	--	146 r/	146 r/	104 r/	250	--	146	146	105	251
Mexico 7/	--	91	91	108	198 r/	--	60 6/	60 6/	74 6/	134 6/
Norway e/	--	235	235	230	465	--	240	240	230	470
Poland	(8/) e/	--	(8/) e/	10 r/	10 r/	(8/)	--	(8/)	10	10
Romania	--	1	1	21	22	--	1	1	20	21
Russia	71 e/	--	71 e/	--	71	70	--	70	--	70
Slovakia e/	--	20	20	35	55	--	20	20	35	55
South Africa	--	597 r/	597 r/	268 r/	865 r/	--	600	600	270	870
Spain e/	--	10	10	100	110	--	10	10	100	110
Taiwan	--	-- e/	-- e/	--	-- e/	--	-- 6/	-- 6/	--	-- 6/
Ukraine	85 e/	253	338	684	1,022	85	250	335	685	1,020
Venezuela	--	16 r/	16 r/	70 r/	85 r/	--	15	15	70	85
Total	956 r/	2,860 r/	3,820 r/	3,380 r/	7,200 r/	955	2,920	3,880	3,400	7,270

e/ Estimated. r/ Revised. -- Zero.
1/ Table includes data available through July 25, 2002.
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 U.S. production of manganese ferroalloys are not included to avoid disclosing company proprietary data.
4/ Ferromanganese includes, if any, silicomanganese.
5/ Silicomanganese includes, if any, silicospiegeleisen.
6/ Reported figure.
7/ Salable products from Autlán.
8/ Less than 1/2 unit.