COPPER

By Daniel L. Edelstein

Mine production of recoverable copper in the United States continued its upward trend, rising by almost 4% to a record high level. A 20% decline in the average price received for refined copper, however, caused the estimated value of domestic mine production to decline by about 18%, to $4.6 billion. The United States maintained its position as the world's second largest mine producer of copper, accounting for about 18% of world production. Chile, where mine production increased 25%, was the largest mine producer, accounting for about 28% of world production.

Of the 37 mines operating in 10 States that produced reportable quantities of copper, the top 17 accounted for more than 98% of production. The principal mining States, in descending order, Arizona, Utah, New Mexico, Montana, Nevada, and Wisconsin, accounted for more than 99% of production. Mine capacity of 2.08 million metric tons was essentially unchanged from that of 1995. Capacity declines from the closure of one mine in Michigan and the depletion of ore reserves at several other mines were offset by the startup of one major new mine in Nevada and the incremental expansions of several mines in Arizona and New Mexico. Capacity utilization in 1996 rose to more than 92% as production rose at recently expanded mines. Capacity is expected to increase by about 50,000 metric tons in 1997.

During the year, 7 primary and 4 secondary smelters, 8 electrolytic and 6 fire refineries, and 13 electrowinning plants operated in the United States. Although capacity and capacity utilization changed, the operating status of these plants remained unchanged. The electrolytic refinery in Michigan, whose associated mine and smelter were closed in 1995, processed copper anode imported from Canada.

Electrowon production continued its upward trend, rising by about 6% from that of the previous year, and accounted for 30% and 25% of domestic mine production and refinery production, respectively. Conversion of old scrap to alloys and refined copper declined slightly, continuing a 4-year downward trend, but still contributed 428,000 tons of copper to the market, a quantity equivalent to about 16% of industrial copper consumption. Lower copper prices contributed to the decline in old scrap collection, accounting for the decline in copper recovered from scrap and the export of scrap materials.

Copper was consumed, as refined copper and as direct melt scrap, at about 35 brass mills, 15 wire-rod mills, and 600 foundries, chemical plants, and miscellaneous consumers. According to data compiled by the Copper Development Association Inc. (CDA), mill product shipments to the U.S. market, including net imports, rose to a record high level of 3.44 million tons. According to the CDA, copper and copper alloys found both structural and electrical uses in building construction (43%), electrical products (24%), industrial machinery and equipment (12%), transportation equipment (12%), and consumer and general products (9%) (Copper Development Association Inc., 1997).

The United States retained its position as the largest producer and consumer of refined copper, accounting for 19% and 21%, of world production and consumption, respectively. Domestic consumption of refined copper rose by about 3% in 1996, yet remained about 2% below the record-high consumption reported in 1994.

The net import reliance for refined copper, as a percentage of apparent consumption, rose to more than 13% from 6% in 1995. Canada was the largest U.S. trading partner for unwrought copper, accounting for 52% of refined copper imports, 47% of all imports of unwrought copper, and 42% of unwrought copper exports. Japan and Taiwan were the largest recipients of refined copper, together accounting for 51% of refined exports.

Copper was mined in about 50 countries, of which the top 2, Chile and the United States, accounted for 46% and the top 10, for about 83% of the world total. The world reserve base for copper was estimated to be 630 million tons, and world reserves, 320 million tons. The United States had about 15% each of reserves and reserve base.

Following a near balance between world production and consumption of refined copper in 1995, world inventories of refined copper resumed a downward trend. Combined inventories held on the London Metal Exchange (LME) and the New York Commodity Exchange (COMEX) declined by about 170,000 tons and were down 520,000 tons from 1993 peak levels. Though global copper prices remained, on average, high, mixed market signals, including near-term tightness in supply contrasted with forecasts of significant rises in mine production, led to high volatility in copper prices during the first 5 months of the year. Prices, however, plummeted in June following the revelation that a major international copper trading firm had sustained massive losses on unauthorized copper trades over a 10-year period. The U.S. producer price, which averaged $1.22 per pound during the first 5 months of the year, averaged only about $0.99 for the latter part of the year.

Legislation and Government Programs

The 1996 amendment to the Safe Drinking Water Act, which regulates the amount of lead that can be released into drinking water, was signed into law on August 6. It was well received by industry because it regulates the release of lead and not the

absolute level of lead used in copper-base alloys used in plumbing fixtures and fittings. Under the new regulation, water used in prescribed leaching tests must acquire no more than 11 parts per billion lead from plumbing fixtures and fittings. Typical fixtures contain 2% to 3% lead; some cast products, however, contain up to 8% lead, the limit set in 1986. The new standard will allow engineering solutions, such as sealing of surfaces contacting water to prevent the leaching of exposed lead, to be applied to reduce lead levels in water and will not automatically require the use of low lead alloys (Platt's Metals Week, 1996c).

In October, the U.S. Environmental Protection Agency (EPA) denied a petition by the National Electrical Manufacturers Association to remove copper metal, other than fume or dust, from the list of toxic chemicals subject to the annual release reporting requirements of the Emergency Planning and Community Right-to-Know Act of 1986. Among other obligations, the act requires certain facilities manufacturing, or otherwise using listed toxic chemicals, including copper, to report their environmental releases of such chemicals on an annual basis. EPA also regulates copper metal smaller than 100 microns as a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act and has promulgated national primary drinking water regulations for copper ion in drinking water under the Safe Drinking Water Act (Environmental Protection Agency, 1996a).

In accordance with the Clean Air Act, EPA proposed new national ambient air quality standards for particulate matter and for ozone in December. The new particulate matter standard, which could have a significant impact on the mining and mineral-processing industries, was to provide increased protection against a wide range of particulate-matter-related health hazards. The new standard for particles that are 2.5 microns or smaller sets concentration limits of 15 micrograms per cubic meter as an annual mean and 50 micrograms per cubic meter as the 24-hour mean. The current standard regulates particles that are 10 microns in size or smaller and sets an average annual concentration limit of 50 micrograms per cubic meter and an average daily limit of 150 micrograms per cubic meter. A final copy of the proposed standard was expected in June 1997, with implementation anticipated in 2002 or 2003 (Environmental Protection Agency, 1996b).

In August, Congress enacted the extension of the Generalized System of Preferences (GSP) Program. The extension is retroactive to July 31, 1995, the previous expiration date of the program. The GSP Program grants duty-free status to certain imports from developing countries, subject to a threshold per capita gross national product and to specific import ceiling guidelines. Copper materials eligible for the GSP Program include copper ores and concentrates, unwrought copper, and certain copper semifabricates (Platt's Metals Week, 1996e).

In 1989, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal came into force and has since been ratified by more than 100 countries, including the United States. Although the United States has not passed legislation necessary to implement the convention, the domestic scrap industry feels that the Basel Convention's imprecise definition of hazardous wastes threatens to place obstacles in the path of trade in recyclable materials, including copper scrap. In the Third Conference of the Parties to the Basel Convention held in September 1995, a proposal was adopted that would ban exports of hazardous waste from countries belonging to the Organization for Economic Cooperation and Development (OECD), which includes the United States, to non-OECD countries. Exports of scrap from the United States to non-OECD countries could be adversely affected. An international Technical Working Group met four times between September 1995 and February 1997 to consider which materials should be classified as hazardous and, hence, affected by the various bans. As of February 1997, copper scrap, copper slags, and copper oxide mill scale had been included in the B list, the list of materials not covered by the Basel Convention as hazardous and, thus, not subject to any export ban (Buchholtz, 1997).

Production

Following a break in 1995 in the 10-year upward trend in mine production, mine production in 1996 rose about 4% to a record high level owing to the opening of one major new mine, the Robinson Mine in Nevada, and incremental expansions at several others, including the Mission and Ray Mines in Arizona, and the Continental Mine in New Mexico. Partially offsetting these increases in production, however, were decreases from the closures of the White Pine Mine in Michigan and the Pinos Altos Mine in New Mexico and the depletion of open-pit oxide reserves at the San Manuel Mine in Arizona in 1995, and closure of the Superior and Oracle Ridge Mines in Arizona in 1996.

Capacity utilization at domestic mines averaged about 92% in 1996, an increase from the past 2 years when the utilization rate averaged 90%. The increase was attributed to the 1995 closure of several mines that had operated significantly below capacity and the attainment of full production potential at mines that had undergone incremental capacity expansions in 1995. Capacity utilization rates, on average, have trended upward since 1982, when contraction in the domestic copper industry lowered the mine utilization rate to 61%. As a result of the higher capacity utilization rates and the closure of several labor-intensive underground mines in 1995 and 1996, productivity at domestic mines in 1996, as calculated from employment data compiled by the Mine Health and Safety Administration, rose to a record-high 68 kilograms of copper per worker-hour, compared with 64 kilograms in 1995; productivity has generally trended upward since 1989, when only 50 kilograms of copper per worker-hour was produced.

Although domestic smelter production rose slightly from the 1995 depressed level, it remained well below the 1994 level owing to closure of Southwire Co.'s Gaston, SC, secondary smelter in 1994 and White Pine's primary smelter in 1995. With the exception of Kennecott's new smelter in Utah, which

continued to experience startup difficulties, domestic copper producers reported record-high primary smelter output. Primary refined production rose by almost 5% to a record high level owing to increased electrowon production and increased production from imported anode. Capacity utilization at domestic smelters and refineries was estimated to be 88% and 87%, respectively.

Company Reviews.—ASARCO Incorporated's copper mine production, including its share of Southern Peru Copper Corp.'s (SPCC) production, rose 13% to more than 460,000 tons, making it the fourth largest private sector copper producer in the world. Production at its Mission Mine in Arizona increased by 16% to 118,000 tons owing to higher ore grades afforded by underground operations. Developmental drilling expanded proven reserves by 7% to 485 million tons of ore, and construction began on a conveyor to haul an estimated 53 million tons of waste per year from stripping operations at the pit beginning in early 1997. Production at the Ray Mine rose to 248,000 tons, an increase of about 12,000 tons, following an 11-month accelerated stripping program that provided access to high-grade ore. Production would have been higher had it not been reduced during the fourth quarter to lower concentrate inventory and to accelerate removal of overburden. At the Hayden smelter, production rose by 11% to a record 390,000 tons owing to improved equipment reliability. Production at the El Paso CONTOP furnace declined by about 9% to 104,000 tons. The acid plant was refurbished and additional equipment upgrades were planned for 1997 to improve smelter reliability. In January, construction began on a solvent extraction-electrowinning (SX-EW) plant at the Silver Bell Mine. The project was projected to produce 16,000 tons of refined copper per year when completed in mid-1997. Mitsui & Co. Ltd. of Japan held a 25% interest in the project (ASARCO Incorporated, 1997).

At yearend, Arimetco International Inc., owner and operator of the Yerington Mine in Nevada and the Johnson Camp Mine in Arizona, announced that it had filed for reorganization under Chapter 11 of the U.S. Federal Bankruptcy Code. The company cited as the source of its financial difficulties the compound impact of lower copper prices, serious production problems at its Yerington Mine that temporarily lowered output and raised unit production costs, and the high cost of maintaining and developing nonproducing properties (Platt's Metals Week, 1997a). Arimetco had reported a net loss for the third quarter of 1996 and a year-to-date modest net income of $163,000 compared with a 9-month profit of $5.8 million in 1995. The company reported that the installation of a three-stage crushing unit to expand SX-EW capacity at Yerington to 65,000 pounds per day had been completed; a similar system had been installed at its Johnson Camp Mine in 1995 to boost production to 35,000 pounds per day. Arimetco also reported completing the purchase of the Sullivan ore body and the adjacent fully-permitted Paradise Peak processing plant near Gabbs, NV, from FMC Gold Corp. The company anticipated that environmental permits would be approved, and production would begin in late 1997 (Arimetco International Inc., 1996).

In January, Broken Hill Proprietary Co. Ltd. (BHP) of Australia acquired 87% of Magma Copper Co.'s voting shares to become the third multinational corporation after RTZ-CRA Group (Kennecott) and Inmet Mining Corp. (Copper Range) to acquire the assets of a major U.S. copper producer. With the purchase of Magma, BHP became the world's second largest producer of copper, with production in excess of 800,000 tons of copper per year, and formed a new operating entity, BHP Copper Group, headquartered in San Francisco. BHP already owned 57.5% of the Escondida Mine in Chile, the world's largest copper project in terms of annual mine output (Graham and Allum, 1995).

In June, BHP Copper closed its underground Superior Mine in Arizona because of depletion of ore in the C-Bed ore body. Ore grade had been a rich 5.5% copper with significant gold and silver values (Carter, 1996). The mine was placed on care and maintenance pending discovery of an additional ore body, although the company temporarily suspended its underground and surface exploration drilling programs. When fully operational, the mine capacity was about 20,000 tons per year of copper in concentrate (Southwestern Pay Dirt, 1996b). In February, BHP reported its first production from its Robinson Mine at the former Liberty Pit, last operated by Kennecott (Southwestern Pay Dirt, 1996a). The Robinson Property encompasses three principal mining areas—the Liberty, the Veteran-Trip, and the Ruth Pits—that BHP intends to mine sequentially. By yearend, Robinson was operating at its rated capacity of 70,000 tons of copper per year in concentrate. At the company's San Manuel Mine, the Lower Kalamazoo ore body was accessed; a tunnel boring machine was used to excavate a 9.5- kilometer tunnel. The Kalamazoo ore was expected to extend mine life until 2001 (Carter, 1996). Development of the ore body progressed throughout the year, and production began during the fourth quarter. Underground production capacity is projected to rise to 118,000 tons per year of copper in concentrate in 1997 from the current 100,000 tons per year. Production of electrowon copper at San Manuel continued to decline following depletion of open-pit oxide reserves. Production from in situ leaching was projected to stabilize at about 23,000 tons of cathode per year.

Cobre Mining Company, Inc., which operates the two underground mines and one open pit that constitute the Continental Mine in New Mexico, reported production increases of 30% in each of the past 2 years and produced a record 32,000 tons of copper in concentrate in 1996. At yearend, Cobre, which employed contract miners, was looking to reduce costs through the purchase of its own mining fleet, and was seeking permit approval and outside financing for the construction of a 20,000-ton-per-year SX-EW plant (Cobre Mining Company, Inc., 1997).

According to the Cyprus Amax Minerals Company annual report, total company copper production rose by about 12% to a record 348,000 tons, and cash operating costs declined by $0.05 per pound owing to improvements to domestic operations and to additional lower cost Chilean production. In December 1996, commercial production of electrowon copper cathode

began at the El Abra project in Chile. In June 1994, Cyprus Amax acquired a 51% interest in the project from Corporacion Nacional de Chile at a cost of $330 million, and construction began in February 1995.

At Cyprus Amax's Bagdad Mine in Arizona, production rose by 7% to about 100,000 tons owing to a 10% increase in concentrate production. Electrowon production of 12,000 tons was down from 14,000 tons in 1995. At the adjacent Sierrita and Twin Buttes Mines, production declined about 4% to 105,000 tons owing to reduced concentrate production. Electrowon production from oxide and low-grade sulfide dumps at the two mines rose to 16,000 tons, increasing by about 2,700 tons. Sulfide reserves at Twin Buttes were exhausted in 1994. At its Miami, AZ, operations, SX-EW production rose by 12% to 65,000 tons, and the smelter processed a record-high 574,000 tons of concentrate, allowing the new electrolytic refinery to increase production by 20% to 156,000 tons. At the Tohono operations in Casa Grande, AZ, SX-EW production rose by 15% to almost 18,000 tons. At yearend 1996, however, Cyprus suspended mining operations at its test open pit while it further evaluated mining options for large-scale production at Tohono. Production was expected to continue from existing tailings, leach pads, and in situ ore (Cyprus Amax Minerals Co., 1997).

Oracle Ridge Mining Partners, 70% owned by Santa Catalina Mining Corp. (formerly South Atlantic Ventures, Ltd.) and 30% owned by Continental Materials, suspended production at the Oracle Ridge Mine in Arizona in midyear and was reported to be interested in selling the mine. According to the Arizona Department of Mines and Resources, Oracle Ridge produced about 4,400 tons of copper in concentrate in 1995 (Phillips, 1997).

At Phelps Dodge Corp.'s domestic mines, production, including minority participants' share, rose by almost 12% to a record-high 690,000 tons, 54% of which was from SX-EW production. At the Morenci Complex, which consists of an open pit, two concentrators, three solvent extraction facilities, and two electrowinning tankhouses, production of both concentrate and SX-EW cathode rose to record-high levels. Recoverable copper in concentrate increased by 17% owing to increased grinding capacity, improvements in the process control system, and a rise in mill-head grade from 0.64% to 0.70%. SX-EW production rose by 16% to 238,000 tons owing to a full year's operation of the Southside Extension project, completed during the third quarter of 1995. At the Chino Mine, production of 90,000 tons of copper in concentrate remained essentially unchanged, as higher mill throughput compensated for lower ore grades. Electrowon production of 63,000 tons also was unchanged. During the year, the Chino Mine operators began to integrate a variety of artificial intelligence concepts to better manage the varied ore found within the pit. SX-EW production at the Tyrone Mine rose by almost 9% to a record high 69,000 tons (Phelps Dodge Corp., 1997a).

During the year, Phelps Dodge maintained an active domestic exploration program. At Tyrone, an additional 300 million tons of leachable reserves grading 0.32% copper was identified. A feasibility study and the environmental permitting process were initiated for the development of the Dos Pobres deposit, where more than 550 million tons of leach and sulfide ore had thus far been identified. A resource and feasibility study was completed at the Ajo Property, where operations had been discontinued in 1985 (Phelps Dodge Corp., 1997a). In April 1997, Phelps Dodge announced that it planned to invest $238 million to construct a new 38,000-ton-of-ore-per-day concentrator, to purchase mining equipment, and to improve the infrastructure at Ajo. Construction was projected to begin in early 1998 and startup was scheduled for late 1999 (Phelps Dodge Corp., 1997b).

According to the RTZ-CRA annual report, production at the Bingham Canyon Mine in Utah declined by 3% to 297,000 tons as lower ore grades were partially offset by higher mill throughput. Refined production, however, fell by 24% from its already low level owing to continued production shortfalls from its new smelter. The new smelter, billed as the environmentally cleanest in the world, had performance difficulties with the anode furnace and casting facilities. The company announced plans to close the smelter for 6 weeks during the second quarter of 1997 to replace refractories and furnace cooling blocks and to rebuild anode- casting facilities. Production at the Flambeau Mine in Wisconsin rose by 6% to 41,500 tons. Flambeau reserves will be exhausted in 1997, and mine reclamation is scheduled to begin by midyear (RTZ-CRA, 1997).

Trade

In response to increased demand, net imports of refined copper rose to 374,000 tons, compared with 211,000 tons in 1995. With the exception of the category containing matte, ash, and residues, all exports of unmanufactured copper products declined in 1996. Combined with increases in imports of both refined copper and anode copper, this resulted in the United States switching from being a net exporter of unwrought copper products in 1995, to a net importer in 1996. Exports of copper ore and concentrate to Canada declined by 46,000 tons following the closure of the White Pine Mine in September 1995 and lower shipments from the Flambeau Mine in Wisconsin. White Pine had been exporting concentrate to Canada since early 1995 when its captive smelter was closed. Following closure of the White Pine smelter, imports of blister and anode from Canada increased in 1995 and 1996. The White Pine refinery continued to operate on imported anode. Increased substitution of imported blister and anode at refineries that traditionally processed secondary anode also contributed to the rise in blister/anode imports. Exports of copper and copper-alloy scrap declined in 1996 owing to lower scrap availability and lower foreign demand.

According to Bureau of the Census data compiled by the Copper and Brass Fabricators Council, U.S. net imports of all copper and copper-alloy semifabricated products (63,000 tons) were down about 30% from those of the previous year. Canada and Mexico, the largest U.S. trading partners, together accounted for 59% of semifabricated copper exports and 34% of imports. An increase in net imports from Canada of about

14,000 tons was essentially balanced by a decline in net imports from Mexico. Imports and exports of semifabricates to Mexico of about 45,000 tons were essentially balanced in 1996 (Copper and Brass Fabricators Council, Inc., 1997).

Prices and Stocks

According to data compiled by the International Copper Study Group (ICSG), global inventories of refined copper declined by almost 200,000 tons, or 24%, in 1996. Most of the decline occurred at LME warehouses, where inventories declined by 177,000 tons (International Copper Study Group, 1997). In the United States, inventories fell by 17,000 tons as increases in consumer and COMEX inventories were more than offset by a decline in LME stocks held in U.S. warehouses.

While yearend inventories were down by about 200,000 tons, inventories at the end of May were down only about 27,000 tons from yearend 1995. During this period, the average U.S. monthly producer price was reasonably stable, ranging from a low of $1.20 per pound in February to a high of $1.27 in May. Daily prices during this period, however, exhibited extreme volatility. In January, the U.S. producer price ranged from a high of $1.28 cents per pound to a low of $1.16 per pound. In May, the U.S. producer price rose to more than $1.33 per pound after news of a strike at the Chuquicamata Mine in Chile and other possible supply disruptions but fell back to under $1.20 per pound 1 week later after resolution of the strike. The price volatility was underlain by a tight balance between supply and demand and uncertain market fundamentals. While most analysts were predicting a large growth in mine production during the year, signals concerning refined copper supply were mixed. Spot treatment and refining charges were reported to be at high levels, indicating a possible smelter bottleneck, and tight supplies in the United States relative to Europe led to Comex trading at a $0.05-per-pound premium to LME prices in February.

In June, copper prices plummeted following revelations that Sumitomo Corp., a major global copper trader, had sustained losses in excess of $1.8 billion on unauthorized copper trades during a 10-year period (Platt's Metals Week, 1996g). By the second week in July, the U.S. producer price declined to $0.92 per pound, the lowest level in more than 2 years. Despite company denials, rumors that Sumitomo held large unreported inventories of copper continued to have a dampening effect on prices. In September, the company revised its estimated losses upward to $2.6 billion (Platt's Metals Week, 1996h). The Sumitomo losses sparked a continuing controversy over the clearing practices of the LME and its oversight by regulators. By yearend, LME practices in conjunction with the Sumitomo losses were under investigation by the Commodities Futures Trading Commission and Congress in the United States and by the Securities and Investments Board in the United Kingdom (Platt's Metals Week, 1996i). Congress was investigating the possibility of amending the U.S. Commodity Exchange Act to allow for regulation of foreign futures contracts that are deliverable in the United States; this was directed at the LME warehouses that had opened in the United States during 1995 (Platt's Metals Week, 1996d).

With stabilization of copper prices at a lower level following the Sumitomo revelations, the U.S. producer price averaged $0.95 per pound between July and October. World inventories rose slightly in August and September, further serving to hold down prices. Inventories, however, declined sharply in October, and by November, in response to tight global supplies, price volatility returned to the market, though prices, on average, trended upward. The U.S. producer price averaged $1.04 per pound for both November and December.

Consumption

Consumption of refined copper by domestic manufacturers rose by more than 3% in 1996, to 2.62 million tons, yet remained below the record level established in 1994. In addition to refined copper, domestic manufacturers directly consumed (melted or processed into chemicals) 1.13 million tons of copper-base scrap containing about 885,000 tons of recoverable copper. An additional 70,000 tons of copper was recovered in the consumption of aluminum-, nickel-, and zinc-base scrap. The total quantity of copper recoverable from the direct consumption of scrap, 956,000 tons, was unchanged from that of the previous year.

Consumption of refined copper at wire-rod mills increased by about 2% and accounted for about 76% of domestic consumption of refined copper despite the closure of two wire-rod mills in September, 1995—one, owned by Southwire, in Gaston, SC, and the other, owned by Westinghouse Electric Co., in Abingdon, VA; the mills had a combined annual capacity of about 225,000 tons of rod. In response to these closures, several mills took steps to increase capacity. According to its company annual report, Asarco completed an upgrade to its wire-rod mill at Amarillo that increased capacity by 17% (ASARCO Incorporated, 1997). Cyprus Amax Minerals Co. reported that its Miami, AZ, wire-rod mill operated above design capacity in 1996, producing 125,000 tons of rod, and that its total rod sales increased to 213,000 from 206,000 tons in 1995 (Cyprus Amax Minerals Company, 1997). Phelps Dodge, the world's largest producer of copper wire rod, boosted the combined wire-rod capacity and production at its El Paso, TX, and Norwich, CT, plants by 50,000 tons, to 635,000 and 645,000 tons, respectively (Phelps Dodge Corp., 1997a).

Brass mills were the second largest consumers of refined copper and largest consumers of copper base scrap, accounting for 22% of refined consumption and about 55% of scrap consumption. Consumption of refined copper at brass mills rose by 10%, while copper recovered from scrap consumed at brass mills was essentially unchanged. The increase in refined copper consumption, as a percentage of total consumption of materials at brass mills, reflected reduced scrap availability. The tightness in the scrap market was attributed to several factors, including lower copper prices and less scrap generation from more-efficient manufacturing.

According to data compiled by the CDA, shipments of

copper and copper-alloy products to the U.S. market by fabricators (wire mills, brass mills, foundries, and powder producers), including net imports, rose by about 3% to a record-high 3.4 million tons containing an estimated 3.1 million tons of copper. About 70% of these shipments were as pure (unalloyed) copper products. Wire mill products accounted for about 45% of total shipments to the domestic market. In building construction, the largest end use, shipments rose by almost 8% and accounted for about 43% of the market. Building construction included products used for building wire, plumbing and heating, air conditioning and commercial refrigeration, builders hardware, and architectural applications. Other uses included: electric and electrical products, 24% of shipments; industrial machinery and transportation equipment, each 12%; and consumer and general products, 9% (Copper Development Association, 1997).

World Review

World production and consumption of refined copper were in near balance in 1996 for the second consecutive year. Depending on whether stock changes or the balance between apparent consumption and production is used as the measurement of refined copper availability, the world either experienced a slight deficit or slight surplus in refined copper production relative to demand. According to data compiled by the ICSG, world inventories of refined copper declined by about 200,000 tons, although calculation of the world supply balance, production minus consumption, indicated a slight surplus of 100,000 tons. Compared with a demand of 12.5 million tons, however, the surplus or deficit was relatively small, and the world copper market was marked by tightness in spot supplies and volatility in prices (International Copper Study Group, 1997a).

According to ICSG data, world demand for refined copper rose by about 440,000 tons, an increase of 3.6%, despite stagnant demand in Western Europe. In addition to that in the United States, demand growth was significant in Turkey, 16%; the newly industrialized Asian countries of Indonesia, Malaysia, the Republic of Korea and Thailand, 13%; China, 10%; and Japan, 4.6% (International Copper Study Group, 1997a). Growth in Turkey and the newly industrialized coun-tries corresponds to recent increases in semfabricate capacity.

World mine production rose by a record 890,000 tons, 9%, to almost 11 million tons. Large production increases in Australia, Chile, Indonesia, and Peru, whose combined production of copper rose by more than 900,000 tons, were partially offset by declines in several countries, including Canada, the Philippines, and Russia. According to data compiled by the ICSG, the world mine capacity utilization rate has trended upward for at least the past 5 years, rising above 90% in 1996 (International Copper Study Group, 1997a).

World smelter production rose by about 380,000 tons in 1996, to 10.6 million tons. The increase was accounted for by increased primary production; the quantity of copper recovered from scrap was unchanged from that of 1995. Estimated world smelter capacity rose by only about 250,000 tons. Although improved, the average capacity utilization rate at smelters remained low at about 81%, compared with about 80% in 1995. Although numerous smelter projects were planned and capacity was forecast to rise by almost 1.4 million tons during the next 2 years, only a handful of major expansions took place in 1996. In Spain, Atlantic Copper Holdings, S.A., formerly Rio Tinto Minera S.A., completed expansion of its smelter/refinery, doubling capacity to 270,000 tons of copper per year. Further smelter modifications were underway that were expected to raise capacity by an additional 20,000 tons per year in 1997 (Freeport-McMoRan Copper and Gold Inc., 1997). In China, Daye Nonferrous Metals Company commissioned a new Noranda smelter late in 1995 that was expected to produce as much as 100,000 tons of copper at capacity. At Finland's Harjavalta smelter, a converter modernization completed in 1995 helped boost 1996 capacity by 60,000 tons.

World production of refined copper rose substantially for the second straight year, increasing by 650,000 tons, or 5%. More than 50% of the increased refined production (360,000 tons) was from expansion of electrowon production, especially in Chile, Peru, and the United States, where SX-EW production rose by 263,000, 55,000, and 34,000 tons, respectively. Chile, with electrowon production of 636,000 tons, surpassed the United States as the largest producer of SX-EW copper.

Argentina.—Development was proceeding on the Bajo el Alumbrera Mine, owned by MIM Holdings Ltd. (50%), North Ltd. (25%), and Rio Algol (25%). The project, with proven and probable ore reserves of almost 700 million tons, is expected to cost almost $1 billion to develop and is projected to come on-stream in 1997. Capacity is projected to rise to 190,000 tons of copper per year by 1999 (Mining Magazine, 1997). A second property nearby, Agua Rica, 70% owned by BHP, was reported to have 1.2 billion tons of copper resources; development has not been announced (Platt's Metals Week, 1996b).

Australia.—Mine production increased owing to production at several mines that started up during 1995, including Placer Pacific Ltd.'s Osborne Mine, with a projected capacity of 36,000 tons per year, and North Broken Hill Ltd.'s Goonumbla Mine, with a projected annual capacity of 72,000 tons by 1998 (International Copper Study Group, 1997a).

Canada.— Although production and capacity declined in 1996, several projects were under development in Canada that are expected to significantly increase capacity by 1999. In British Columbia, Princeton Mining Co. suspended operations in November at its Similco Mine because of lower copper prices. In August, Inco completed its acquisition of Diamond Fields Resources, Inc., giving it a controlling interest in the Voisey's Bay nickel-copper-cobalt project, which contains an estimated 150 million tons of ore reserves. Voisey's Bay is expected to produce as much as 90,000 tons of copper in concentrate per year beginning in mid-1999. Royal Oak Mines Inc. began construction in July at its Kemess project in British Columbia. Production of 26,000 tons per year of copper in concentrate was expected to begin in 1998. Princeton Mining announced that it had received British Columbia Government

approval to develop its Huckleberry copper-molybdenum mine, which was projected to produce 29,500 tons of contained copper per year beginning in late 1997 (Bokovay, 1997). In April, Asarco announced its intended development of the Minto copper-gold-silver mine in the Yukon Territory. Asarco obtained an 84% interest in the project from Minto Explorations Ltd. earlier in the year. Production of 12,000 tons per year of copper in concentrate was scheduled to begin in 1998 (ASARCO Incorporated, 1997).

Chile.—Mine production and capacity continued to soar, both rising by about 600,000 tons. The Escondida Mine became the world's largest copper mine following the completion of a $560 million Phase 3 expansion that raised production capacity from 480,000 to more than 800,000 tons per year. Production in 1996 rose to 853,000 tons of copper in concentrate. Permit applications were submitted for a $470 million oxide ore SX-EW project to produce 125,000 tons per year of refined copper. If approved, production could begin in late 1998 (RTZ-CRA, 1997).

Cyprus Amax Minerals completed construction of its El Abra project ahead of schedule and reported its first commercial production of almost 19,000 tons of cathode in December. Projections called for an annualized production of 225,000 tons by the end of the first quarter of 1997. With identified leach reserves of 800 million tons, El Abra was expected to have a mine life of at least 17 years (Cyprus Amax Minerals Company, 1997).

In 1996, production at the Candelaria Mine, owned by Phelps Dodge (80%), declined to about 137,000 tons of copper in concentrate owing to lower ore grades. The mine, which began production in 1994, had reached full capacity of 150,000 tons in 1995. In May, Phelps Dodge announced a $337 million concentrator expansion project that will increase capacity to about 200,000 tons of copper in concentrate and reduce projected mine life from 35 years to 19 years (Phelps Dodge Corp., 1997a).

The Andacollo Mine, a majority share of which was sold by the state-owned Empresa Nacional de Mineria (ENAMI) to Canada Tungsten (63%) and Compania Minera del Pacifico (27%), began production late in 1996. At capacity, Andacolla is expected to produce 20,000 tons per year of SX-EW cathode (Platt's Metals Week, 1996a).

Despite a 10-day strike, production rose to 631,000 tons, an increase of about 10,000 tons, at the Chuquicamata Division of state-owned Codelco (Platt's Metals Week, 1997b). At the El Teniente Division, production was resumed at the sublevel 6 area of the mine. Production from that section had been abandoned in 1991 after numerous rock bursts. At the Andina Division, Codelco reported plans for a $200 million expansion that would increase capacity to 250,000 tons per year, an increase of 100,000 tons. Codelco also began construction of the Redeemer Tomic open pit leach/SX-EW project. Initial output at a rate of 150,000 tons of cathode per year was expected to start up by January 1998 (CRU Copper Monitor, 1996).

Indonesia.—Continued expansion of Freeport-McMoRan Copper and Gold Inc.'s Grasberg Mine in Irian Jaya raised production by 14% to 507,000 tons of recoverable copper. In 1996, an average of 127,000 tons of ore per day having an average grade of 1.35% copper was processed through Grasberg's two crushing stations and three concentrators. Feasibility studies were completed, and construction begun on a fourth concentrator that will boost ore processing to between 190,000 and 200,000 tons per day. At yearend, proven and probable reserves at Grasberg reportedly amounted to 2 billion tons of ore grading 1.19% copper (Freeport-McMoRan Copper and Gold Inc., 1997).

Peru.—Production from SPCC operations rose by 22% to a record high 308,000 tons. In April, Asarco announced the discovery of new reserves at SPCC's Cuajone and Toquepala Mines that boosted SPCC's yearend 1995 reserves to almost 1.8 billion tons (1.2 billion tons of sulfide ore and 6 million tons of oxide ore) (Platt's Metals Week, 1996f); yearend 1994 reserves had been listed at only 500 million tons. By yearend 1996, total SPCC reserves had been expanded to 2.2 billion tons owing to development drilling that further increased reserves at Cuajone by 44%. As a result of the large reserve potential at Cuajone, engineering work was underway at yearend 1996 to expand milling capacity by 50% and production by 118,000 tons per year. Downstream at SPCC's Ilo smelter, the new El Teniente converter and acid plant, which started up in October 1995, was operating successfully, and expansion of the acid plant was begun to increase sulfur dioxide capture from 18% to 30% by 1998. Capacity at the Ilo electrolytic refinery was increased by 20% in 1996 to 224,000 tons per year (ASARCO Incorporated, 1996).

Zambia.—Following 4 years of studies, the state-owned Zambia Consolidated Copper Mines Ltd. (ZCCM) proceeded with plans to privatize copper operations. In January, it reached an agreement with South Africa's Anglo American Corp. by which Anglo would lead a syndicate of investors to fund the estimated $600 million needed to develop the Konkola Deep project. At yearend, ZCCM was offering at least nine different packages to a group of prequalified investors for distribution of ZCCM's mining and electrical power assets (Mining Annual Review, 1997).

Current Research and Technology

Asarco and Freeport-McMoRan Copper & Gold are joint venture partners in the Santa Cruz In situ Research Project in Casa Grande, AZ, which is managed by Asarco, and 75% funded by the Federal Government. Based on earlier research conducted by the former U.S. Bureau of Mines, the project objective is to recover copper from deep mineralized zones through surface injection of an acid solvent and recovery of pregnant leach solutions. The joint venture owns a deep mineralized ore deposit estimated to contain 1 billion tons of acid-soluble ore grading 0.55% copper. The grade of the ore body is too low for economic recovery of copper using underground mining methods and too deep for open-pit extraction. A pilot-scale SX-EW plant was completed in 1995,

copper-bearing leach solutions were recovered following surface injection in 1996, and electrowon copper was recovered at the pilot plant in early 1997. Asarco reported that the commercial viability of the project had yet to be determined (ASARCO Incorporated, 1997). Meanwhile, Inmet Mining suspended pilot-scale solution mining from its closed White Pine Mine pending the outcome of permit applications for a full-scale plant.

Southwire, a leading domestic cable manufacturer, as well as a secondary smelter and refiner of copper, is developing a commercial superconducting power transmission cable that could replace conventional cables in congested urban underground distribution networks, delivering three to five times as much power as a similarly sized conventional copper conductor. At yearend Southwire and the U.S. Department of Energy had completed an 18-month joint test program of 1-meter lengths of prototype superconducting cable using copper oxide-based powder conductors. Southwire hoped to have a commercial cable available in 5 to 7 years (Metal Bulletin Monthly, 1997).

During the past several years, a broad-based group of companies, headed by the American Foundrymen's Society, Inc., with financial support from the U.S. Department of Commerce and industry trade groups, has been working to develop alternatives to the leaded red brasses used in casting alloys. In part, these efforts are in response to EPA drinking water regulations which lower the maximum permissible lead levels in drinking water and to Occupational Safety and Health Administration regulations of lead emissions at nonferrous foundries. A new series of bismuth/selenium modified alloys were developed, trademarked as Se-Biloy, that exhibit many of the same casting and machining properties of the leaded brasses they are intended to replace (Peters, 1997).

Outlook

U.S. mine production is expected to increase in 1997 by about 50,000 tons owing to incremental expansions at the Continental, the Mission, the Robinson, the San Manuel, and the Silver Bell Mines. Only one small heap-leach operation at Centurion Mines Corp.'s OK Mine is scheduled for startup, and one mine, the Flambeau Mine, was scheduled to close by mid-1997 because of ore depletion. Domestic capacity is projected to grow an additional 60,000 tons in 1998 with the startup of several new SX-EW projects.

Refinery production is expected to increase by about 75,000 tons with the startup of electrowinning at Asarco's Silver Bell Mine and the completion of anode casting modifications at the Kennecott smelter in Utah. In the first half of 1997, Kennecott's new smelter, and associated refinery, operated well below capacity, as they had since the smelter was installed in 1995. Domestic refined production in 1998 could rise by an additonal 100,000 tons, assuming full-year, full-capacity production at Kennecott.

Consumption of refined copper during the first 6 months of 1997 was about 4% higher than in the equivalent period in 1996; consumption for the full year 1997 is projected to rise only about 3% above that of 1996. Increased domestic production, coupled with increased net imports, is expected to be adequate to meet the increased demand. The amount of copper recovered from old scrap, which has trended downward over the past several years, increased during the first half of 1997 in response to higher average copper prices but, in the longterm, is expected to remain near that of 1996. No new secondary capacity is expected, and lower prices could further depress scrap collection. Recycling of new scrap has trended upward with increased domestic consumption of mill products. Its future growth is expected to lag behind that of copper demand growth owing to improvements in manufacturing processes that reduce scrap generation.

World mine capacity is expected to grow rapidly in the next several years. According to data compiled by the ICSG, world mine capacity can be expected to grow by about 500,000 tons in 1997. Smelter and refinery capacity are projected to at least keep pace, or outstrip the growth in mine production (International Copper Study Group, 1997b). Assuming a 3% growth rate, world consumption is expected to grow by about 400,000 tons.

Beyond 1997, growth of mine capacity is expected to accelerate and outstrip that of consumption. Annual capacity at operating mines or mines now under development is projected to rise from the current 12 million tons to 15 million tons by 2000. About 1.1 million tons of the increase is projected to come from SX-EW production. Chile is expected to account for most of the increase, where capacity is expected to grow from the current 3.1 million tons to as much as 4.9 million tons per year. Significant increases are also projected for Argentina, Australia, Canada, Indonesia, Peru, and Zambia. This growth has been stimulated by changes in the global investment climate. Such countries as Chile, Peru, and Argentina have changed mining laws to encourage foreign investment. In 1996, Zambia finally committed to privatization of the state-controlled mining industry, which may reverse its downward production trend.

With new smelter projects under consideration in more than a dozen countries, smelter capacity could rise by more than 2 million tons by 2000, thus keeping pace with the projected growth in copper contained in concentrates.

References Cited

Arimetco International, Inc., 1996, Third quarter report: Tucson, AZ.

ASARCO Incorporated, 1997, Asarco 1996 annual report: New York, p. 40.

Bokovay, Geoffrey, 1997, Copper: Canadian Minerals Yearbook, Preprint, 27 p.

Buchholtz, Rainer, 1997, Transfrontier movements of secondary materials under the rules of the Basel convention—The impact of the export ban for hazardous wastes on industrialized and developed countries: Copper Bulletin, v. 4, no. 7, p. 41-42.

Carter, R.A., 1996, Magma puts the pedal to the metal: Engineering & Mining Journal, v. 197, no. 1, p. 34-45.

Cobre Mining Company, Inc., 1997, Investor fact sheet: Cobre Mining Company, Inc., April, 2 p.

Copper and Brass Fabricators Council, Inc., 1997, Import/Export report: Washington, D.C., February 21, 117 p.

Copper Development Association Inc., 1997, Annual data 1997—Copper

supply and consumption: New York, 20 p.
CRU Copper Monitor, 1996, Mining projects & explorations: CRU Copper Monitor, August, 8 p.
Cyprus Amax Minerals Company, 1997, Cyprus Amax Minerals Company 10-K report 1996: Securities and Exchange Commission, 39 p.
Environmental Protection Agency, 1996a, Copper metal—Toxic chemical release reporting—Community right-to-know: Federal Register, v. 61, no. 203, October 18, p. 54381-54383.
———1996b, National ambient air quality standards for particulate matter: Federal Register, v. 61, no. 241, December 13, p. 65637-65713.
Freeport-McMoRan Copper & Gold Inc., 1997, Freeport-McMoRan Copper & Gold Inc. 1996 annual report: New Orleans, 48 p.
Graham, John, and Allum, Ron, 1995, Tunnel-boring work at Magma's lower Kalamazoo is completed: Southwestern Pay Dirt, December, p. 10A-11A.
International Copper Study Group, 1997a, Copper bulletin: Lisbon, Portugal, v. 4, no. 6, 44 p.
———1997b, Directory of copper mines and plants: Lisbon, Portugal, August, 66 p.
Metal Bulletin Monthly, 1997, Southwire shows confidence in commercial superconducting cable: Metal Bulletin Monthly, Copper Supplement, May, p. 33.
Mining Annual Review, 1997, Zambia—Mining annual review: Mining Journal Preprint, 3 p.
Mining Magazine, 1997, Alumbrera copper-gold mine: Mining Magazine, v. 176, No. 4, p. 235-239.
Phelps Dodge Corp., 1997a, Phelps Dodge Corp. 10-K report 1996: Securities and Exchange Commission, 95 p.
———1997b, Phelps Dodge to reopen Ajo Mine: Phelps Dodge Corporation News Release, Phoenix, AZ, May 7, 2 p.
Peters, D.T., 1997, New bismuth/selenium red brass alloys solve lead concerns: Modern Casting, v. 87, no. 2, p. 57-59.
Phillips, K.A., Niemuth, N.J., and Bain, D.R., 1996, Active mines in Arizona: Arizona Department of Mines and Mineral Resources, Phoenix, AZ, 26 p.
Platt's Metals Week, 1996a, Andacollo copper mine on stream: Platt's Metals Week, v. 67, no. 48, December 2, p. 3.
———1996b, BHP mum on Agua Rica's reputed 13.5-bil lb reserves: Platt's Metals Week, v. 67, no. 8., February 19, p. 6.
———1996c, Brass, copper industries back drinking water amendment: Platt's Metals Week, v. 67, no. 34, August 19, p. 8.
———1996d, CEA should regulate foreign futures contracts—US house: Platt's Metals Week, v. 67, no. 39, September 23, p. 10-11.
———1996e, GSP program extension to have little impact on metals market: Platt's Metals Week, v. 67, no. 34, August 19, p. 8.
———1996f, SPCC considering 70% mine expansion, flash smelter: Platt's Metals Week, v. 67, no. 18, April 29, p. 2.
———1996g, Sumitomo copper position raises market anxiety: Platt's Metals Week, v. 67, no. 25, June 17, p. 1.
———1996h, Sumitomo says position unwound—market cautious: Platt's Metals Week, v. 67, no. 39, September 23, p. 1, 6.
———1996i, Sumitomo spurs need for international cooperation—CFTC: Platt's Metals Week, v. 67, no. 50, December 16, p. 8.
———1997a, Arimetco files for chapter 11: Platt's Metals Week, v. 68, no. 1, January 6, p. 8.
———1997b, Chuqui exceeds output target: Platt's Metals Week, v. 68, no. 2, January 13, p. 3.
RTZ-CRA, 1997, RTZ-CRA 1996 annual report to shareholders: London, England and Melbourne, Australia, 72 p.
Southwestern Paydirt, 1996a, BHP Copper's Robinson operation celebrates first anniversary: Southwestern Paydirt, August, p.14.
———1996b, BHP Copper suspends drilling at Superior Mine: Southwestern Pay Dirt, December, p. 14.

SOURCES OF INFORMATION

U.S. Geological Survey Publications

Copper. Ch. in Mineral Commodity Summaries, annual.[1]

Copper. Ch. in United States Mineral Resources, U.S. Geological Survey Professional Paper 820, 1973.

Copper. Mineral Industry Surveys, monthly.[1]

Other

ABMS Non-Ferrous Metal Data.

Annual Data 1997—Copper Supply and Consumption: Copper Development Assoc. Inc.

The Availability of Copper in Market Economy Countries, IC 9310, U.S. Bureau of Mines, 1992.

Copper. Ch. in Metal Prices in the United States Through 1991. U.S. Bureau of Mines, 1993.

Copper. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

International Copper Study Group, monthly Copper Bulletin.

World Bureau of Metal Statistics (WBMS, London), monthly World Metals Statistics.

[1]Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
SALIENT COPPER STATISTICS 1/

(Metric tons unless otherwise specified)

		1992	1993	1994	1995	1996
United States:						
Mine production:						
Ore concentrated 2/	thousand metric tons	263,000	262,000	271,000	267,000	274,000
Average yield of copper 2/	percent	0.48	0.49	0.47	0.46 r/	0.46
Recoverable copper:						
Arizona		1,150,000	1,160,000	1,160,000	1,170,000	1,240,000
Michigan, Montana, Utah		385,000	387,000	397,000	384,000	339,000
New Mexico		211,000	224,000	234,000	250,000	256,000
Other States		16,000	31,100	55,700	47,400	84,700
Total recoverable		1,760,000	1,800,000	1,850,000	1,850,000	1,920,000
Total value	millions	$4,180	$3,640	$4,430	$5,640	$4,610
Smelter production: 3/						
From domestic and foreign ores		1,180,000	1,270,000	1,310,000	1,250,000 r/	1,300,000
From scrap (new and old)		394,000	415,000	397,000	354,000 r/	339,000
Total smelter		1,570,000	1,680,000	1,710,000	1,600,000	1,640,000
Byproduct sulfuric acid	thousand metric tons	1,090	1,230	1,200	1,210	1,430
Refinery production:						
Primary materials:						
Electrolytic from domestic ores		1,110,000	1,210,000	1,280,000	1,300,000 r/	1,290,000
Electrolytic from foreign materials		96,100	88,600	63,500	91,200 r/	147,000
Electrowon		502,000	491,000	493,000	539,000	574,000
Total primary		1,710,000	1,790,000	1,840,000	1,930,000	2,010,000
Secondary materials (scrap):						
Electrolytic		331,000	337,000	269,000	215,000	193,000
Fire refined		102,000	123,000	122,000	137,000	140,000
Total secondary		433,000	460,000	392,000	352,000	333,000
Total refined		2,140,000	2,250,000	2,230,000	2,280,000	2,340,000
Secondary copper produced:						
Recovered from new scrap		723,000	748,000	827,000	874,000	872,000
Recovered from old scrap		555,000	543,000	500,000	442,000	428,000
Total copper from scrap		1,280,000	1,290,000	1,330,000	1,320,000	1,300,000
Copper sulfate:						
Production		46,800	46,400	48,400	52,000	43,400
Stocks, Dec. 31		2,860	2,990	2,510	2,770	W
Exports:						
Refined		177,000	217,000	157,000	217,000	169,000
Unmanufactured 4/		676,000	685,000	752,000	894,000	683,000
Imports:						
Refined		289,000	343,000	470,000	429,000	543,000
Unmanufactured 4/		593,000	637,000	763,000	825,000 r/	924,000
Copper stocks, Dec. 31:						
Blister and in-process material		166,000	146,000	171,000	174,000	173,000
Refined copper:						
Refineries		35,500	33,400	42,500	38,000	32,200
Wire rod mills		37,000	34,700	39,800	24,800	32,100
Brass mills		12,500	14,100	8,530	7,110	14,000
Other industry		23,800	3,650	4,090	3,030 r/	2,700
New York Commodity Exchange (COMEX)		96,000	67,200	24,200	21,500	26,600
London Metal Exchange (LME), U.S. warehouses.		--	--	--	68,200	38,300
Total refined		205,000	153,000	119,000	163,000	146,000
Consumption:						
Refined copper, reported		2,180,000	2,360,000	2,680,000	2,530,000	2,620,000
Apparent consumption, primary refined and old scrap		2,300,000	2,510,000	2,690,000	2,540,000	2,830,000
Price:						
Producer, weighted average	cents per pound	107.42	91.56	111.05	138.33	109.04
COMEX, first position	do.	102.72	85.28	107.05	134.72	105.87
LME, Grade A cash	do.	103.72	86.76	104.64	133.12	104.05
World production:						
Mine	thousand metric tons	9,470 r/	9,450 r/	9,500 r/	10,100 r/	11,000
Smelter	do.	9,920 r/	9,940 r/	10,100	10,200 r/	10,600
Refinery	do.	11,200	11,300 r/	11,200	11,900 r/	12,500

r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Data, except prices, are rounded to three significant digits; may not add to totals shown.

2/ Yield calculations include precipitates but excludes copper recovered from leaching by solvent extraction-electrowinning.

3/ Includes primary copper produced from foreign ores, matte, and so forth, to avoid disclosing company proprietary data.

4/ Includes copper content of alloy scrap.

TABLE 2
LEADING COPPER-PRODUCING MINES IN THE UNITED STATES IN 1996, IN ORDER OF OUTPUT 1/

Rank	Mine	County and State	Operator	Source of copper	Capacity (thousand metric tons)
1	Morenci	Greenlee, AZ	Phelps Dodge Corp.	Copper-molybdenum ore, concentrated and leached.	475
2	Bingham Canyon	Salt Lake, UT	Kennecott Utah Copper Corp.	do.	320
3	Ray	Pinal, AZ	ASARCO Incorporated	Copper ore, concentrated and leached.	160
4	Chino	Grant, NM	Phelps Dodge Corp.	Copper-molybdenum ore, concentrated and leached.	160
5	Mission Complex	Pima, AZ	ASARCO Incorporated	Copper ore, concentrated.	120
6	San Manuel	Pinal, AZ	BHP Copper Co.	Copper-molybdenum ore, concentrated and leached.	130
7	Sierrita	Pima, AZ	Cyprus Amax Minerals Co.	do.	135
8	Bagdad	Yavapai, AZ	do.	do.	110
9	Pinto Valley	Gila, AZ	BHP Copper Co.	do.	85
10	Tyrone	Grant, NM	Phelps Dodge Corp. and Burro Chief Copper Co.	Copper ore, concentrated and leached.	70
11	Inspiration	Gila, AZ	Cyprus Amax Minerals Co.	Copper ore, leached.	73
12	Continental	Silver Bow, MT	Montana Resources Inc.	Copper-molybdenum ore, concentrated.	50
13	Robinson	White Pine, NV	BHP Copper Co.	Copper ore, concentrated.	50
14	Continental	Grant, NM	Cobre Mining Co.	do.	35
15	Flambeau	Rusk, WI	Kennecott Minerals Corp.	do.	30
16	Casa Grande	Pinal, AZ	Cyprus Amax Minerals Co.	Copper ore, concentrated and leached.	20
17	Miami	Gila, AZ	BHP Copper Co.	Copper ore, leached.	12

1/ The mines in this list accounted for 98% of the U.S. mine production in 1996.

TABLE 3
MINE PRODUCTION OF COPPER-BEARING ORES AND RECOVERABLE COPPER CONTENT OF ORES PRODUCED IN THE UNITED STATES, BY SOURCE AND TREATMENT PROCESS

(Metric tons)

Source and treatment process	1995		1996	
	Gross weight	Recoverable copper	Gross weight	Recoverable copper
Mined copper ore:				
Concentrated	267,000,000	1,250,000	274,000,000 1/	1,290,000
Leached	NA	538,000 r/	NA	574,000
Total	NA	1,790,000	NA	1,860,000
Copper precipitates shipped; leached from tailings, dump, and in-place material	28,000	21,500	25,100	18,900
Other copper-bearing ores 2/	6,820,000	41,000	7,480,000	39,600
Grand total	XX	1,850,000	XX	1,920,000

r/ Revised. NA Not available. XX Not applicable.

1/ In 1996, 715,000 ounces of gold and 12,500,000 ounces of silver were recovered from concentrated ore. The average value of gold and silver per metric ton of ore concentrated was $1.25.

2/ Includes gold ore, gold-silver ore, lead ore, lead-copper ore, lead-zinc ore, molybdenum ore, silver ore, tungsten ore, zinc ore, fluorspar, flux ores, clean up, ore shipped directly to smelters, and tailings.

TABLE 4
CONSUMPTION OF COPPER AND BRASS MATERIALS IN THE UNITED STATES, BY ITEM 1/

(Metric tons)

Item	Brass mills	Wire-rod mills	Foundries, chemical plants, miscellaneous users	Smelters, refiners, ingot makers	Total
1995:					
Copper scrap	886,000 2/	(3/)	71,500	692,000 r/	1,650,000
Refined copper 4/	533,000	1,950,000	55,900 5/	(6/)	2,530,000
Hardeners and master alloys	1,030	--	1,970 r/	--	3,000
Brass ingots	--	--	120,000	--	120,000
Slab zinc	64,700	--	23,200 r/	3,580	91,500 r/
Miscellaneous	--	--	--	2	2
1996:					
Copper scrap	902,000 2/	(3/)	61,300	663,000	1,630,000
Refined copper 4/	588,000	1,980,000	49,400 5/	(6/)	2,620,000
Hardeners and master alloys	893	--	2,160	--	3,050
Brass ingots	--	--	121,000	--	121,000
Slab zinc	63,600	--	(7/)	(7/)	86,400
Miscellaneous	--	--	--	23	23

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes consumption of copper scrap at wire rod mills to avoid disclosing company proprietary data.
3/ Withheld to avoid disclosing company proprietary data; included in "Brass mills."
4/ Detailed information on consumption of refined copper can be found in table 5.
5/ Includes consumption of refined copper at ingot makers to avoid disclosing company proprietary data.
6/ Withheld to avoid disclosing company proprietary data; included in "Foundries, chemicals plants, and miscellaneous users."
7/ Withheld to avoid disclosing company proprietary data; included in "Total."

TABLE 5
CONSUMPTION OF REFINED COPPER SHAPES IN THE UNITED STATES, BY CLASS OF CONSUMER 1/

(Metric tons)

Class of consumer	Cathodes	Ingots and ingot bars	Cakes and slabs	Wirebar, billets, other	Total
1995:					
Wire-rod mills	1,950,000	--	--	--	1,950,000
Brass mills	298,000	27,800	75,900	130,000	533,000
Chemical plants	--	--	--	1,070	1,070
Ingotmakers	W	W	W	7,740	7,740
Foundries	2,380	3,440 r/	W	9,810 r/	15,600 r/
Miscellaneous 2/	W	W	W	31,400 r/	31,400
Total	2,250,000	31,300	75,900	181,000 r/	2,530,000
1996:					
Wire-rod mills	1,980,000	--	--	--	1,980,000
Brass mills	357,000	23,700	80,800	126,000	588,000
Chemical plants	--	--	--	1,110	1,110
Ingotmakers	W	--	W	3,640	3,640
Foundries	1,750	3,290	W	11,000	16,000
Miscellaneous 2/	W	W	W	28,600	28,600
Total	2,340,000	27,000	80,800	170,000	2,620,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Wirebar, billets, other."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes iron and steel plants, primary smelters producing alloys other than copper, consumers of copper powder and copper shot, and other manufacturers.

TABLE 6
COPPER RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES,
BY KIND OF SCRAP AND FORM OF RECOVERY 1/

(Metric tons)

	1995	1996
Kind of scrap:		
New scrap:		
Copper-base	837,000	835,000
Aluminum-base	37,100	37,200
Nickel-base	85	91
Zinc-base	--	--
Total	874,000	872,000
Old scrap:		
Copper-base	415,000	394,000
Aluminum-base	27,900	33,100
Nickel-base	33	47
Zinc-base	21	17
Total	442,000	428,000
Grand total	1,320,000	1,300,000
Form of recovery:		
As unalloyed copper:		
At electrolytic plants	215,000	193,000
At other plants	149,000	151,000
Total	364,000	344,000
In brass and bronze	887,000	885,000
In alloy iron and steel	756	739
In aluminum alloys	64,700 r/	69,900
In other alloys	114	110
In chemical compounds	183	305
Total	953,000	956,000
Grand total	1,320,000	1,300,000

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 7
COPPER RECOVERED AS REFINED COPPER AND IN ALLOYS AND OTHER FORMS
FROM COPPER-BASE SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF OPERATION 1/

(Metric tons)

	From new scrap		From old scrap		Total	
Type of operation	1995	1996	1995	1996	1995	1996
Ingot makers	34,700	36,200	89,300 r/	90200	124,000	126,000
Refineries 2/	112,000	111,000	240,000	222000	352,000	333000
Brass and wire-rod mills	664,000	670,000	49,300	46700	713,000	717000
Foundries and manufacturers	26,700	17,100	35,500	35900	62,200	53000
Chemical plants	183	305	--	--	183	305
Total	837,000	835,000	415,000 r/	394,000	1,250,000	1230000

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Electrolytically refined and fire-refined scrap based on source of material at smelter level.

TABLE 8
PRODUCTION OF SECONDARY COPPER AND COPPER-ALLOY PRODUCTS
IN THE UNITED STATES, BY ITEM PRODUCED FROM SCRAP 1/

(Metric tons)

Item produced from scrap	1995	1996
Unalloyed copper products:		
Electrolytically refined copper	215,000	193,000
Fire-refined copper	137,000	140,000
Copper powder	10,600	10,100
Copper castings	699	706
Total	364,000	344,000
Alloyed copper products:		
Brass and bronze ingots:		
Tin bronzes	11,900	12,500
Leaded red brass and semired brass	96,500	92,000
High leaded tin bronze	12,400	12,000
Yellow brass	6,700 r/	6,810
Manganese bronze	7,500 r/	7,400
Aluminum bronze	7,640	7,910
Nickel silver	1,760 r/	1,860
Silicon bronze and brass	5,280	5,630
Copper-base hardeners and master alloys	13,100	13,700
Miscellaneous	12 r/	11
Total	163,000	160,000
Brass mill and wire-rod mill products	873,000	888,000
Brass and bronze castings	52,900	44,000
Brass powder	530	634
Copper in chemical products	183	305
Grand total	1,450,000	1,440,000

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 9
COMPOSITION OF SECONDARY COPPER-ALLOY PRODUCTION IN THE UNITED STATES 1/

(Metric tons)

	Copper	Tin	Lead	Zinc	Nickel	Aluminum	Total
Brass and bronze ingot production: 2/							
1995	132,000	4,990 r/	8,650 r/	17,000 r/	232	29	163,000
1996	130,000	4,800	8,010	16,300	264	26	160,000
Secondary metal content of brass mill products:							
1995	713,000	833	6,680	150,000	W	W	873,000
1996	717,000	886	7,270	160,000	W	W	888,000
Secondary metal content of brass and bronze castings:							
1995	47,400 r/	1,130	1,610	2,530	136	150	52,900
1996	39,000	1,050	1,460	2,330	85	120	44,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes about 96% from scrap and 4% from other than scrap.

TABLE 10
CONSUMPTION AND YEAR ENDING STOCKS OF COPPER-BASE SCRAP 1/

(Metric tons, gross weight)

Scrap type and processor	1995		1996	
	Consumption	Stocks	Consumption	Stocks
No. 1 wire and heavy:				
Smelters, refiners, ingot makers	161,000	9,080	148,000	6,720
Brass and wire-rod mills	375,000	NA	355,000	NA
Foundries and miscellaneous manufacturers	36,000	NA	28,500	NA
No. 2 mixed heavy and light:				
Smelters, refiners, ingot makers	221,000 r/	5,880	217,000	7,950
Brass and wire-rod mills	33,400	NA	34,600	NA
Foundries and miscellaneous manufacturers	3,690	NA	3,880	NA
Total unalloyed scrap:				
Smelters, refiners, ingot makers	382,000 r/	15,000	366,000	14,700
Brass and wire-rod mills	408,000	11,600	390,000	14,200
Foundries and miscellaneous manufacturers	39,700	2,730	32,400	2,470
Red brass: 2/				
Smelters, refiners, ingot makers	58,800	2,440	58,600	2,250
Brass mills	7,410	NA	7,390	NA
Foundries and miscellaneous manufacturers	15,700	NA	15,100	NA
Leaded yellow brass:				
Smelters, refiners, ingot makers	26,100	1,270	27,400	1,500
Brass mills	341,000	NA	371,000	NA
Foundries and miscellaneous manufacturers	1,520	NA	1,930	NA
Yellow and low brass: All plants	55,600	723	59,600	725
Cartridge cases and brass: All plants	49,900	NA	46,100	NA
Auto radiators:				
Smelters, refiners, ingot makers	73,000	1,860	65,700	1,670
Foundries and miscellaneous manufacturers	6,910	NA	4,700	NA
Bronzes:				
Smelters, refiners, ingot makers	11,700	821	12,500	793
Brass mills and miscellaneous manufacturers	13,300	NA	13,400	NA
Nickel-copper alloys: All plants	20,500	442	23,300	360
Low grade and residues:				
Smelters, refiners and miscellaneous manufacturers	92,600	2,460	83,100	4,080
Other alloy scrap: 3/				
Smelters, refiners, ingot makers	39,700	1,600	42,000	2,410
Brass mills and miscellaneous manufacturers	6,140	NA	6,180	NA
Total alloyed scrap:				
Smelters, refiners, ingot makers	310,000	11,600	297,000	13,800
Brass mills	478,000	29,900	512,000	25,100
Foundries and miscellaneous manufacturers	31,800	4,020 r/	28,900	3,570
Total scrap:				
Smelters, refiners, ingot makers	692,000 r/	26,600	663,000	28,400
Brass and wire-rod mills	886,000	41,400	902,000	39,300
Foundries and miscellaneous manufacturers	71,500	6,740 r/	61,300	6,050

r/ Revised. NA Not available.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes composition turnings, silicon bronze, railroad car boxes, cocks and faucets, gilding metal, and commercial bronze.

3/ Includes refinery brass, beryllium copper, and aluminum bronze.

TABLE 11
CONSUMPTION OF PURCHASED COPPER-BASE SCRAP 1/ 2/

(Metric tons, gross weight)

Type of operation	From new scrap		From old scrap		Total	
	1995	1996	1995	1996	1995	1996
Ingot makers	46,400	47,700	136,000	126,000	182,000	174,000
Smelters and refineries	129,000 r/	130,000	381,000 r/	359,000	510,000 r/	489,000
Brass and wire-rod mills	827,000	845,000	59,400	57,700	886,000	902,000
Foundries and miscellaneous manufacturers	30,800	21,000	40,700 r/	40,200	71,500	61,300
Total	1,030,000	1,040,000	617,000 r/	583,000	1,650,000	1,630,000

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Consumption at brass and wire-rod mills assumed to be equal to receipts.

TABLE 12
FOUNDRIES AND MISCELLANEOUS MANUFACTURERS CONSUMPTION
OF BRASS INGOT AND REFINED COPPER AND COPPER SCRAP
IN THE UNITED STATES 1/

(Metric tons)

Ingot type	1995	1996
Tin bronzes	35,100	33,900
Leaded red brass and semired brass	68,400 r/	70,200
Yellow, leaded, and low brass 2/	7,310	8,330
Manganese bronze	4,230 r/	3,710
Nickel silver 3/	1,210 r/	960
Aluminum bronze	3,770 r/	3,590
Hardeners and master alloys 4/	1,970 r/	2,160
Total brass ingot	122,000	123,000
Refined copper consumed	48,100 r/	45,700
Copper scrap consumed	71,500 r/	61,300

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes silicon bronze and brass.
3/ Includes copper nickel and nickel bronze and brass.
4/ Includes special alloys.

TABLE 13
AVERAGE PRICES FOR COPPER SCRAP AND ALLOY-INGOT, BY TYPE

(Cents per pound)

			Dealers' buying (New York)		Alloy-ingot (New York)	
Year	Brass mills No. 1 scrap	Refiners No. 2 scrap	No. 2 scrap	Red brass turnings and borings	No. 115 brass (85-5-5-5)	Yellow brass (405)
1995	123.28	104.73	91.26	63.38	137.38	135.14
1996	101.53	84.42	75.27	51.85	140.25	136.50

Source: American Metal Market.

TABLE 14
U.S. EXPORTS OF UNMANUFACTURED COPPER (COPPER CONTENT), BY COUNTRY 1/

	Ore and concentrate		Matte, ash, and precipitates		Refined		Unalloyed copper scrap		Blister and anodes		Total	
Country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1995	239,000	$438,000	35,100	$43,300	217,000	$616,000	223,000	$403,000	29,200	$79,700	743,000	$1,580,000
1996:												
Belgium	--	--	3	3	46	71	9,380	20,200	239	368	9,660	20,700
Canada	79,900	124,000	31,500	38,200	28,500	70,100	104,000	170,000	17,900	42,000	262,000	443,000
China	54,500	30,700	2	3	233	447	12,600	18,900	44	50	67,400	50,100
Germany	76	211	1	8	189	372	7,190	10,700	463	1,200	7,920	12,500
Hong Kong	16	24	29	41	525	837	28,600	41,200	1,170	2,240	30,300	44,300
India	--	--	271	297	7	19	3,960	3,740	3	5	4,250	4,060
Italy	8	3	2	3	2,150	3,460	22	32	451	1,070	2,640	4,570
Japan	47,600	59,600	2,130	14,300	31,800	77,400	19,300	61,000	456	1,130	101,000	214,000
Korea, Republic of	1,570	2,420	19	62	3,480	6,730	5,140	11,600	1,100	10,200	11,300	31,100
Malaysia	--	--	--	--	6,470	15,200	34	59	(2/)	5	6,510	15,300
Mexico	2,340	1,310	2,790	4,170	11,800	26,300	2,470	4,010	380	686	19,700	36,500
Singapore	--	--	8	118	2,690	6,200	234	378	44	148	2,980	6,850
Spain	2,800	3,410	6	24	7	10	39	62	15	21	2,870	3,520
Switzerland	--	--	--	--	23	35	2,760	2,590	(2/)	3	2,780	2,630
Taiwan	--	--	--	--	54,100	128,000	1,340	2,200	330	582	55,800	131,000
Thailand	--	--	--	--	26,100	63,200	37	46	112	286	26,200	63,500
Other	6,370	8,180	230	485	1,030	3,170	538	3,700	390	991	8,560	16,500
Total	195,000	230,000	37,000	57,700	169,000	401,000	197,000	350,000	23,100	61,000	622,000	1,100,000

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 15
U.S EXPORTS OF COPPER SEMIMANUFACTURES, BY COUNTRY 1/

Country	Pipes and tubing		Plates, sheets, foil, and bars		Bare wire, including wire rod 2/		Wire and cable, stranded		Copper sulfate	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1995	21,700	$88,500	36,200	$145,000	34,300	$115,000	8,760	$54,900	3,080	$3,440
1996:										
Australia	217	1,220	14	58	11	80	46	288	5	4
Austria	67	374	616	1,650	11	129	(3/)	13	--	--
Brazil	144	1,510	19	116	50	202	401	1,950	--	--
Canada	7,650	26,700	12,900	43,200	14,900	43,500	2,920	10,500	2,050	2,070
China	1,020	5,160	309	1,690	29	294	84	646	--	--
Costa Rica	21	85	511	1,830	4	16	35	264	32	25
Dominican Republic	31	65	3	15	1,910	4,950	115	517	9	12
France	117	790	11	68	81	679	112	2,310	--	--
Germany	10	74	649	2,740	130	1,680	163	3,320	--	--
Hong Kong	680	2,590	1,250	9,820	159	1,320	279	2,270	--	--
India	201	625	188	326	21	87	72	644	--	--
Indonesia	84	264	361	784	--	--	218	2,700	--	--
Israel	259	1,640	76	461	45	401	104	588	--	--
Italy	727	3,220	441	1,700	1	44	239	1,990	--	--
Japan	223	1,030	10,100	31,800	3,070	7,200	139	2,060	--	--
Korea, Republic of	357	1,520	956	6,420	28	504	66	563	--	--
Malaysia	751	3,400	1,170	3,990	601	1,690	19	164	--	--
Mexico	6,920	21,900	6,030	21,200	14,500	45,100	1,490	5,490	5	10
Netherlands	380	1,520	68	269	9	105	28	426	--	--
Philippines	241	964	99	363	63	308	115	797	12	10
Saudi Arabia	483	1,950	30	152	33	151	376	3,600	--	--
Singapore	62	284	238	1,560	59	444	37	377	--	--
Spain	349	990	20	208	5	48	1	27	--	--
Sweden	--	--	(3/)	8	12	196	20	153	--	--
Taiwan	715	2,450	9,200	32,400	234	1,480	34	616	69	55
Thailand	751	3,170	1,510	4,470	283	966	19	203	--	--
Trinidad and Tobago	--	--	5	38	1,040	2,870	51	175	--	--
United Kingdom	215	2,060	448	1,490	137	1,120	284	3,740	6	9
Venezuela	149	656	85	383	208	509	148	802	--	--
Other	1,840	7,500	938	4,850	1,070	5,250	1,450	8,930	139	134
Total	24,700	93,700	48,200	174,000	38,700	121,000	9,070	56,100	2,320	2,320

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Total exports of wire rod were 12,900 tons valued at $30,700,000 in 1995 and 15,000 tons valued at $34,500,000 in 1996.
3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 16
U.S. IMPORTS FOR CONSUMPTION OF UNMANUFACTURED COPPER (COPPER CONTENT), BY COUNTRY 1/

	Ore and concentrate		Matte, ash, and precipitates		Blister and anode		Refined		Unalloyed scrap		Total	
Country	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
1995	127,000	$129,000	2,860	$3,550	94,100	$257,000	429,000	$1,290,000	88,100 r/	$192,000 r/	741,000 r/	$1,870,000 r/
1996:												
Brazil	--	--	--	--	--	--	15,600	39,200	--	--	15,600	39,200
Canada	9,000	16,300	236	466	80,200	87,900	278,000	847,000	40,500	73,200	408,000	1,020,000
Chile	59,800	51,800	--	--	51,700	127,000	119,000	264,000	11,800	27,900	242,000	471,000
Colombia	--	--	--	--	--	--	540	1,400	668	1,270	1,210	2,670
Costa Rica	--	--	--	--	--	--	--	--	1,320	2,460	1,320	2,460
Germany	--	--	--	--	--	--	9,960	20,700	102	29	10,100	20,700
Japan	--	--	--	--	(3/)	2	3,940	10,600	2	26	3,940	10,600
Kazakstan	--	--	--	--	--	--	2,630	6,470	--	--	2,630	6,470
Malaysia	--	--	79	233	--	--	--	--	--	--	79	233
Mexico	3,680	4,360	2,050	1,790	19,600	48,000	30,300	79,000	27,900	52,200	83,500	185,000
Peru	--	--	--	--	9,550	21,900	64,700	131,000	785	1,450	75,000	155,000
Russia	--	--	--	--	--	--	15,000	32,000	--	--	15,000	32,000
Spain	--	--	--	--	2,710	2,610	--	--	138	210	2,850	2,820
Taiwan	--	--	24	111	--	--	(3/)	6	102	130	126	247
Uzbekistan	--	--	--	--	--	--	3,570	8,150	--	--	3,570	8,150
Venezuela	--	--	--	--	--	--	--	--	2,600	3,990	2,600	3,990
Other	3	16	2	20	649	1,360	308	1,020	4,440	7,460	5,400	9,870
Total	72,400	72,500	2,390	2,620	164,000	289,000	543,000	1,440,000	90,300	170,000	873,000	1,980,000

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ C.i.f. value at U.S. port.
3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF COPPER SEMIMANUFACTURES, BY COUNTRY 1/

Country	Pipes and tubing		Plates, sheets, foil, and bars		Bare wire, including wire rod		Wire and cable, stranded		Copper sulfate	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
1995	103	$869	57,000	$256,000	41,800	$137,000	3,540	$21,900	12,400	$11,900
1996:										
Australia	--	--	80	307	--	--	--	--	--	--
Austria	--	--	151	386	9	141	6	84	3	4
Brazil	--	--	600	2,100	--	--	--	--	(3/)	3
Canada	61	266	13,700	49,000	54,400	135,000	50	145	4,240	3,860
Chile	6	21	1,020	3,260	--	--	--	--	391	375
China	--	--	773	2,930	1,130	3,420	17	105	878	852
Finland	1	4	4,060	16,300	244	1,300	(3/)	3	--	--
France	--	--	286	1,110	136	1,860	94	819	--	--
Germany	458	2,830	8,890	36,900	72	809	194	1,750	43	68
Israel	--	--	1	25	--	--	2,340	14,700	1,200	1,120
Italy	--	--	140	436	26	209	19	215	56	58
Japan	(3/)	4	9,160	45,600	77	1,390	96	1,110	8	72
Luxembourg	--	--	610	6,460	--	--	--	--	--	--
Malaysia	--	--	876	7,250	3	60	--	--	--	--
Mexico	65	189	1,400	4,880	155	523	32	99	9,550	8,620
Netherlands	1	5	570	2,300	9	161	--	--	--	--
Peru	--	--	2,580	4,780	--	--	--	--	1,010	855
Sweden	--	--	12,500	51,600	22	80	2	53	--	--
Turkey	--	--	2	5	522	2,070	27	154	--	--
United Kingdom	2	30	606	4,900	7	101	4	125	--	--
Venezuela	--	--	66	232	8	6	1,590	4,410	--	--
Other	17	110	559	4,280	190	1,750	153	1,380	42	38
Total	611	3,460	58,700	245,000	57,000	149,000	4,620	25,200	17,400	15,900

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ C.i.f. value at U.S. port.
3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 18
U.S. EXPORTS OF COPPER SCRAP, BY COUNTRY 1/

Country or Territory	Unalloyed copper scrap				Copper-alloy scrap			
	1995		1996		1995		1996	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Belgium	2,730	$10,100	9,380	$20,200	3,030	$9,730	1,440	$3,710
Canada	110,000	191,000	104,000	170,000	42,600	60,900	41,900	$53,900
China	28,000	40,300	12,600	18,900	50,100	50,100	24,900	27,400
Germany	1,580	1,820	7,190	10,700	4,310 r/	8,240	5,290	5,660
Hong Kong	31,400	47,900	28,600	41,200	30,900	41,000	43,200	62,900
India	7,020	7,520	3,960	3,740	42,500	48,900	29,800	31,600
Japan	20,000	64,800	19,300	61,000	16,700	34,600	18,700	33,700
Korea, Republic of	10,300	19,900	5,140	11,600	24,100	35,800	11,200	19,400
Mexico	6,470	11,000	2,470	4,010	1,710	3,050	4,030	6,000
Switzerland	17	39	2,760	2,590	56	97	18	28
Taiwan	1,680	2,490	1,340	2,200	3,730	4,910	4,970	6,460
Thailand	--	--	37	46	2,490	3,650	2,460	4,190
United Kingdom	338	510	194	2,970	2,810	5,620	381	792
Other	3,570 r/	5,070 r/	673	1,250	8,350 r/	12,400 r/	7,030	10,500
Total	223,000	403,000	197,000	350,000	233,000	319,000	195,000	266,000

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF COPPER SCRAP, BY COUNTRY 1/

Country or Territory	Unalloyed copper scrap		Copper-alloy scrap		
	Quantity (metric tons)	Value 2/ (thousands)	Gross weight (metric tons)	Copper content e/ 3/ (metric tons)	Value (thousands)
1995	88,100 r/	$192,000 r/	95,100 r/	68,900 r/	$208,000 r/
1996:					
Canada	40,500	73,200	57,700	41,500	80,400
Chile	11,800	27,900	178	128	275
Colombia	668	1,270	3,020	2,170	5,950
Costa Rica	1,320	2,460	386	278	351
Dominican Republic	603	1,130	1,940	1,390	3,730
Ecuador	29	55	872	628	1,680
Honduras	275	529	1,040	752	1,510
Jamaica	710	1,100	592	426	531
Mexico	27,900	52,200	42,400	30,500	59,800
Panama	1,020	1,850	1,100	792	1,290
Peru	785	1,450	784	564	919
Taiwan	102	130	1,480	1,060	1,450
United Kingdom	(4/)	5	1,310	945	1,450
Venezuela	2,600	3,990	2,540	1,830	3,240
Other	2,050	3,050	6,490	4,670	8,050
Total	90,300	170,000	122,000	87,700	171,000

e/ Estimated. r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ C. i. f. value at U.S. Port.

3/ Under the Harmonized Tarriff System that was implemented January 1989, copper content is no longer available. Content is estimated to be 72% of gross weight.

4/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 20
COPPER: WORLD MINE PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Albania	900	900	800	800 e/	800
Argentina e/	300 3/	300	300	300	300
Armenia e/	1,000 r/	500	1,000 r/	3,500 r/	4,000
Australia:					
By concentration or cementation	363,500 r/	384,000 r/	392,000 r/	379,700 r/	471,000
Leaching (electrowon)	14,500 r/	18,000 r/	23,600 r/	40,200 r/	53,800
Total	378,000	402,000	415,600	419,900	525,000
Bolivia	101	94	79	127	105
Botswana 4/	20,400	20,132	22,780	21,029	20,900 3/
Brazil	39,845	43,568 r/	39,690	47,933 r/	26,400 3/
Bulgaria	47,400	60,400	73,900 r/	75,400 r/	88,700 3/
Burma	3,731	3,581	5,025	5,282 r/	5,500
Canada:					
By concentration or cementation	765,500	729,900	615,000	726,380	686,339 3/
Leaching (electrowon)	3,100	2,700	2,300	2,300	2,500 3/
Total	768,600	732,600	617,300	728,680	688,839 3/
Chile 5/	1,932,700	2,055,400	2,219,900	2,488,600 r/	3,115,800 3/
China e/	334,000	345,000	396,000	445,000 r/	439,100 3/
Colombia e/	3,940 3/	-- r/	1,000 r/	1,400 r/	2,800
Cuba e/	1,500	1,500	1,400	1,500	1,500
Cyprus	--	--	--	--	1,688 3/
Czechoslovakia 6/ 7/	2,500 e/	XX	XX	XX	XX
Ecuador e/	100	100 r/	100 r/	100 r/	100
Finland	10,246	11,131	9,790 r/	9,500 r/ e/	9,000
France	149	72	50 r/	--	--
Georgia e/	5,000	3,000	2,000	1,000	1,000
Honduras e/	1,600 3/	1,000	500	390	-- 3/
India	49,036	49,416	45,944	46,975 r/	35,800 3/
Indonesia 6/	280,819	298,648	322,190	443,618	507,484 3/
Iran	105,000	86,600	117,900 r/	102,200 r/	107,600 3/
Japan	12,074	10,277	6,043	2,376	1,145 3/
Kazakstan e/	270,000 r/	300,000	265,000 r/	240,000 r/	250,000
Korea, North e/	16,000	16,000	16,000	16,000	16,000
Korea, Republic of	4	5	5 e/	31 r/	7 3/
Macedonia	7,200 e/	5,800	6,500	6,500 e/	6,500
Malaysia	28,556	25,182	25,267	20,751 r/	22,771 3/
Mexico:					
By concentration or cementation	251,100	277,000	279,700	304,300	297,710 3/
Leaching (electrowon)	27,900	24,100	25,800	38,900 r/	43,000 3/
Total	279,000	301,100	305,500	343,200	340,710 3/
Mongolia	105,100	96,900	99,600	100,400	101,900 3/
Morocco	14,300	12,990	13,020	14,000 r/	14,300 3/
Namibia	31,300	29,500	26,555	22,530	14,904 3/
Nepal	2	2	2 e/	2 e/	2
Norway	12,668	8,696	7,408	6,799	7,000
Oman	13,600	8,800 r/	4,300 r/	--	-- 3/
Papua New Guinea	193,359	203,945	209,329 r/	212,737	186,715 3/
Peru: 8/					
By concentration or cementation	327,200	328,000	326,400	409,693 r/	484,231 3/
Leaching (electrowon)	18,400	20,300	17,200	33,392 r/	88,171 3/
Total	345,600	348,300	343,600	443,085	572,402 3/
Philippines	123,523	136,257	116,163 r/	108,063 r/	61,600 3/
Poland	331,900	383,600	378,000	383,600	422,000 3/
Portugal	152,311	153,797	133,629	134,181	110,000
Romania 6/	24,700	25,300	26,034	24,528 r/	24,310 3/
Russia	698,500	583,600	573,300	525,000 r/	520,000
Saudi Arabia	868	925	917	925 e/	900
Serbia and Montenegro	97,811	68,007	65,000	87,575 r/	82,526 3/
Slovakia e/ 9/	XX	500	-- r/	-- r/	386 3/
South Africa	176,074	166,348	160,100 r/	161,600 r/	152,595 3/
Spain	9,432	6,691 r/	5,944 r/	22,112 r/	25,000
Sweden	89,145	88,909	79,384	83,600 e/	72,900
Turkey 10/	38,554	39,163	34,902	37,900 r/	45,000

See footnotes at end of table.

TABLE 20--Continued
COPPER: WORLD MINE PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
United States: 6/					
By concentration or cementation	1,260,000	1,310,000	1,320,000	1,310,000	1,340,000 3/
Leaching (electrowon) 11/	502,000	491,000	493,000	539,000	574,000 3/
Total	1,760,000	1,800,000	1,820,000	1,850,000	1,920,000 3/
Uzbekistan e/	75,000	65,000 r/	80,000 r/	50,000 r/	65,000
Zaire: 6/					
By concentration or cementation	21,900	6,900 r/	7,200 r/	6,800	6,200
Leaching (electrowon)	111,000	39,400 r/	22,800 r/	22,600 r/	22,600
Total	132,900	46,300 r/	30,000 r/	29,400 r/	28,800
Zambia: 12/					
By concentration or cementation (smelted)	321,800	284,900	289,800 r/	268,900 r/	279,000
Leaching (electrowon)	107,700	111,300	83,400 r/	54,800 r/	55,000
Total	429,500	396,200	373,200 r/	323,700 r/	334,000
Zimbabwe: 6/					
By concentration or cementation	10,100	8,200 r/	9,350	7,900 r/	9,000
Leaching (electrowon)	--	--	--	200	3,200
Total	10,100	8,200 r/	9,350	8,100 r/	12,200
Grand total	9,470,000 r/	9,450,000 r/	9,500,000 r/	10,100,000 r/	11,000,000

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

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Data represent copper content by analysis of concentrates produced except where otherwise noted. Table includes data available through July 10, 1997.

3/ Reported figure.

4/ Copper content of pelletized nickel-copper matte produced in smelter.

5/ Reported by Comision Chilena del Cobre (COCHILCO). Includes recoverable copper content of nonduplicative mine and metal products produced from domestic ores and concentrates, and leach production for electrowinning.

6/ Recoverable content.

7/ Dissolved Dec. 31, 1992. Production in Czechoslovakia for 1992 came from Slovakia.

8/ Prior to 1993 nonduplicative shipments of concentrates, smelter and refinery products. Beyond 1992, recoverable mine production sourced from Ministry Energy and Mines, General Directorate of Mines.

9/ Formerly part of Czechoslovakia; data were not reported separately until 1993.

10/ Excludes copper content of pyrite.

11/ Includes electrowon from concentrates roast-leached.

12/ Data are for fiscal years beginning Apr. 1 of year stated. Zambian-mined copper reported recovered during smelting and electrowinning.

TABLE 21
COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1992	1993	1994	1995	1996 e/
Albania, primary	2,300	2,300	1,500 e/	3,000 r/ e/	2,400
Australia:					
Primary	304,300	323,100	315,000 e/	215,000 r/	289,000
Secondary e/	10,000	10,000	9,600 r/	1,200 r/	1,200
Total e/	314,000	333,000	325,000	216,000 r/	290,000
Austria, secondary	48,975	46,856	49,562	53,400 e/	65,400
Belgium: e/					
Primary	800	200	2,600	2,700 r/	3,500
Secondary	102,000	142,000	145,000	152,000 r/	154,000
Total	103,000	142,000	148,000	155,000 r/	157,300 4/
Brazil, primary	157,950	161,102	170,033	164,966 r/	165,000
Bulgaria: e/					
Primary	61,000	58,500	84,400 r/	87,200 r/	95,300
Secondary	5,000	5,000	5,000	5,000	5,000
Total	66,000	63,500	89,400 r/	92,200 r/	100,000
Canada:					
Primary	515,000	518,000	515,000	522,761 r/	529,349 p/
Secondary	37,400	44,100	45,000 e/	90,929	83,344 p/
Total	552,400	562,100	560,000 e/	613,690 r/	612,693 p/
Chile, primary 5/	1,191,000	1,234,000	1,259,400	1,293,800	1,355,600 p/

See footnotes at end of table.

TABLE 21--Continued
COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1992	1993	1994	1995	1996 e/
China: e/					
Primary	418,000	443,000	482,000	538,000 r/	615,600 4/
Secondary	128,000	183,000	212,000	466,000 r/	382,000
Total	546,000	626,000	694,000	1,000,000 r/	998,000
Czech Republic, primary 6/	XX	500	-- e/	--	--
Czechoslovakia: 7/					
Primary e/	5,000	XX	XX	XX	XX
Secondary e/	3,000	XX	XX	XX	XX
Total	8,000	XX	XX	XX	XX
Finland:					
Primary	110,502	107,201	129,265	130,000 e/	125,000
Secondary e/	12,000	12,000	12,000	12,000	15,000
Total e/	123,000	119,000	141,000	142,000	140,000
France, secondary e/	6,100	5,900	4,400	2,600 r/	3,100
Germany:					
Primary	164,900	141,300	237,400	242,100	297,000
Secondary e/	70,000	60,000	54,800 4/	66,000	88,600
Total e/	235,000 r/	201,000	292,200 4/	308,000	385,400 4/
Hungary, secondary e/	100	100	100	100	100
India, primary	47,712	37,372	51,232	39,496 r/	28,286 4/
Iran: 8/					
Primary	86,400	85,000	125,000	100,000 r/	91,300
Secondary e/	6,400	7,000	6,800 r/	6,100 r/	6,000
Total	92,800 e/	92,000 e/	131,800 r/	106,100 r/	97,300
Japan:					
Primary	1,046,200	1,099,100	1,025,500	1,081,200 r/	1,134,100 4/
Secondary	128,700	85,700	96,500	87,300 r/	89,300 4/
Total	1,174,900	1,184,800	1,122,000	1,168,500	1,223,400 4/
Kazakstan: e/					
Primary	300,000	280,000 r/	275,000	242,800 r/ 4/	245,000 4/
Secondary	20,000	20,000	20,000	20,000	20,000
Total	320,000	300,000 r/	295,000	263,000 r/	265,000
Korea, North: e/					
Primary	21,000	23,000	23,000	24,000	24,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	26,000	28,000	28,000	29,000	29,000
Korea, Republic of, primary e/	170,100 4/	142,000	160,000	165,000	165,000
Mexico, primary	228,200	282,000	277,000	298,000	300,800 4/
Namibia, primary 9/	37,500	34,800 e/	29,781	29,799	25,100
Norway, primary	39,259	37,205	39,416	31,146 r/	36,000
Oman, primary	14,973	27,700	31,200	34,200	34,800 4/
Peru, primary	336,000	343,400	349,900	345,119 r/	323,707 4/
Philippines, primary	168,831	212,446 r/	200,255 r/	158,109 r/	155,800 4/
Poland:					
Primary	385,486	396,000 e/	388,600 r/	374,600 r/	375,000
Secondary e/	15,963 4/	16,000	15,000	15,000	15,000
Total e/	401,449 4/	412,000	404,000 r/	390,000 r/	390,000
Portugal, secondary e/	1,000	1,000	--	--	--
Romania: e/					
Primary	23,400 4/	25,200	23,449 4/	23,345 4/	32,562 4/
Secondary	1,000	1,000	1,000	1,000	1,000
Total	24,400	26,200	24,400 r/	24,300	33,600
Russia:					
Primary	651,000 r/	533,700 r/	514,300 r/	512,000 r/	510,000
Secondary	50,000 r/	40,000 r/	15,000 r/	40,000 r/	55,000
Total	701,000 r/	573,700 r/	529,300 r/	552,000 r/	565,000
Serbia and Montenegro:					
Primary	79,953	44,112	69,000	70,074	59,940 4/
Secondary	47,967	13,286	17,400	17,336	65,287 4/
Total	127,920	57,398	86,400	87,410	125,227 4/
Slovakia, primary e/ 6/	XX	3,000	3,000	3,000	3,000
South Africa, primary	158,700	156,600	165,900	154,400	148,400 4/

See footnotes at end of table.

TABLE 21--Continued
COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1992	1993	1994	1995	1996 e/
Spain:					
Primary	110,000	135,700	141,600	134,000 e/	130,000
Secondary	37,000	44,800	46,800	47,100 e/	50,000
Total	147,000	180,500	188,400	181,000 e/	180,000
Sweden:					
Primary	77,804	76,298	79,100 e/	78,000 e/	80,000
Secondary	20,596	22,102	19,600 e/	20,000 e/	20,000
Total	98,400	98,400	98,700 e/	98,000 e/	100,000
Turkey, undifferentiated 10/	31,568	39,638	30,400	33,700 e/	35,000
United States:					
Primary 11/	1,180,000	1,270,000	1,310,000	1,250,000 r/	1,300,000 4/
Secondary	394,000	415,000	397,000	354,000 r/	339,000 4/
Total	1,570,000	1,680,000	1,710,000	1,600,000 r/	1,640,000 4/
Uzbekistan: e/					
Primary	75,000 r/	65,000	80,000 r/	50,000 r/	65,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	80,000 r/	70,000	85,000 r/	55,000 r/	70,000
Zaire, primary: e/					
Electrowon	111,000	40,000	22,800	22,000	22,000
Other	19,900	6,500	7,200	5,600	6,000
Total	131,000	46,500	30,000	27,600	28,000
Zambia, primary: 12/					
Electrowon	63,980	62,414	26,700	65,400 r/	73,900
Other	356,367	305,146	241,000 r/	234,500 r/	250,000
Total	420,347	367,560	267,700 r/	299,900 r/	324,000
Zimbabwe, primary e/ 13/	9,700	8,200	10,100	12,000	12,000
Grand total	9,920,000 r/	9,940,000 r/	10,100,000	10,200,000 r/	10,600,000
Of which:					
Primary:					
Electrowon	175,000	102,000	49,500	87,400 r/	95,900
Other	8,550,000 r/	8,610,000 r/	8,820,000 r/	8,650,000 r/	9,010,000
Secondary	1,160,000 r/	1,180,000 r/	1,180,000	1,470,000 r/	1,470,000
Undifferentiated	31,600	39,600	30,400	33,700	35,000

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

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ This table includes total production of copper metal at the unrefined stage, including low-grade cathode produced by electrowinning methods. The smelter feed may be derived from ore, concentrates, copper precipitate or matte (primary), and/or scrap (secondary). To the extent possible, primary and secondary output of each country is shown separately. In some cases, total smelter production is officially reported, but the distribution between primary and secondary has been estimated. Table includes data available through July 10, 1997.

3/ Argentina presumably produces some smelter copper utilizing its own small mine output together with domestically produced cement copper, and possibly using other raw materials including scrap, but the levels of such output cannot be reliably estimated.

4/ Reported figure.

5/ Data include low-grade electrowon which is re-refined. Low-grade electrowon production is as follows, in thousand metric tons: 1992--31.1; 1993--28.7; 1994--24.5; and 1995-96--not available.

6/ Formerly part of Czechoslovakia; data not reported separately until 1993.

7/ Dissolved Dec. 31, 1992.

8/ Data are for year beginning Mar. 21 of year stated. Secondary production is estimated to be about 5% of total.

9/ Includes products of imported concentrate.

10/ Secondary production is estimated to be about 5% to 10% of total.

11/ Figures for U.S. primary smelter production may include a small amount of copper derived from precipitates shipped directly to the smelter for further processing; production derived from electrowinning and fire-refining is not included. Copper content of precipitates shipped directly to smelter are as follows, in metric tons: 1992--27,196; 1993--19,043; 1994--26,400; 1995--21,500; and 1996--18,900.

12/ For fiscal year beginning Apr. 1 of year stated. Electrowon is total electrowon production reported, less the quantity reported as "finished production, leach cathodes."

13/ Includes impure cathodes produced by electrowinning in nickel processing.

11/ May include copper-nickel matte (copper content more than 6,000 tons per year) imported from Botswana for toll refining.

TABLE 22
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Albania, primary e/	1,500	1,500	1,000	1,000	1,000
Argentina, secondary e/	15,000	15,000	14,400 r/ 3/	16,000 r/ 3/	15,500
Australia:					
Primary	271,000	285,000	311,900	242,000 r/	314,000 3/
Secondary	32,000	24,000	24,000	18,000 r/ e/	--
Total	303,000	309,000	335,900	260,000 r/ e/	314,000 3/
Austria:					
Primary	5,705	5,871	2,904	530 r/ e/	1,000
Secondary	48,975	46,856	49,562	53,000 r/ e/	57,000
Total	54,680	52,727	52,466	53,500 r/ e/	58,000
Belgium: 4/					
Primary	253,318	275,900	227,600	159,000 r/	137,000 3/
Secondary	114,000	103,000	147,600	217,000 r/	217,000 3/
Total	367,318	378,900	375,200	376,000 r/	354,000 3/
Brazil, primary	157,950	161,102	170,033	164,966	172,000 3/
Bulgaria:					
Primary e/	13,008 3/	24,300	21,500	25,500 r/	25,000
Secondary e/	5,000	2,000	5,000	3,330 r/	5,000
Total	18,008	26,347	26,500	28,800 r/	30,000
Canada:					
Primary	501,900	521,200	504,600	479,100 r/	477,500 3/
Secondary	37,400	40,400	45,400	93,500 r/	81,700 3/
Total	539,300	561,600	550,000	572,600 r/	559,200 3/
Chile, primary	1,242,300	1,268,200	1,277,400 r/	1,491,500 r/	1,748,200 p/
China: e/					
Primary	430,000	485,000	482,000	612,000 r/	692,000
Secondary	229,000	245,000	254,000	467,000 r/	428,000
Total	659,000	730,000	736,000	1,080,000 r/	1,120,000
Czech Republic, primary 5/	XX	500	--	--	--
Czechoslovakia: 6/					
Primary	8,000	XX	XX	XX	XX
Secondary	20,561	XX	XX	XX	XX
Total	28,561	XX	XX	XX	XX
Egypt, secondary e/	4,000	4,000	4,000	4,000	4,600
Finland:					
Primary	65,900	67,700	58,400	63,700 r/ e/	64,000
Secondary	5,000	6,000	10,800	10,000 e/	10,000
Total	70,900	73,700	69,200	73,700 r/ e/	74,000
France:					
Primary e/	16,600	18,400	16,600	4,200 r/	10,500
Secondary e/	26,200	26,000	25,200	38,300 r/	28,600
Total	42,800	44,400	41,800	42,500 r/ e/	39,100
Germany:					
Primary	236,282	270,592	253,000 e/	247,200	316,000
Secondary e/	345,000	361,000	339,000	369,100 3/	355,000
Total	581,682	632,079	591,859	616,300	671,000
Hungary, primary and secondary e/	12,000	11,000	11,000	11,000	11,000
India:					
Primary: Electrolytic	38,300	30,100	40,100	33,900 r/	29,100 3/
Secondary	8,500	6,700	8,900	7,300 e/	6,500
Total e/	46,800	36,800	49,000	41,200 r/	35,600
Iran, primary 7/ 8/	101,800	84,900	90,200	90,400 r/	99,100 3/
Italy, primary and secondary	76,000 e/	90,300	84,000	98,000 e/	85,800 3/
Japan:					
Primary	1,046,155	1,099,083	1,025,510	1,081,235 r/	1,134,060 3/
Secondary	114,704	89,693	93,658	106,724 r/	117,313 3/
Total	1,160,859	1,188,776	1,119,168	1,187,959	1,251,373 3/
Kazakstan: e/					
Primary	300,000 r/	290,000 r/	280,000 r/ 3/	255,600 r/ 3/	263,300 3/
Secondary	20,000	20,000	20,000	20,000	20,000
Total	320,000 r/	310,000 r/	300,000 r/	276,000 r/	283,000

See footnotes at end of table.

TABLE 22--Continued
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Korea, North: e/					
Primary	20,000	22,000	22,000	22,000	23,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	25,000	27,000	27,000	27,000	28,000
Korea, Republic of:					
Primary	209,000	218,000	244,169 r/	234,895 r/	246,305 3/
Secondary e/	2,000	2,000	2,000	2,000	2,000
Total e/	211,000 3/	220,000	246,000 r/	237,000 r/	248,000
Mexico:					
Primary:					
Electrowon	27,940	24,100	25,800	27,600	43,000 3/
Other	82,600	69,800	78,500	75,500	64,200
Secondary	80,500	77,200	92,700	98,800 e/	96,400 3/
Total	191,040	171,100	197,000	202,000 e/	204,000
Norway, primary 8/	39,259	37,205	39,416	34,322 r/	28,526 3/
Oman, primary	16,236	20,539	24,194	21,300 r/	21,600
Peru, primary	252,647 r/	258,934 r/	265,413 r/	295,100 r/	338,100 3/
Philippines, primary	145,674 r/	165,954	154,713	158,109 r/	82,972 3/
Poland:					
Primary	387,010	404,170	405,093	406,708 r/	425,000
Secondary	67,420	56,989	20,318 r/	28,976 r/	20,000
Total	454,430	461,159	425,411	435,684 r/	445,000
Romania: e/					
Primary	21,000	22,000	22,113 3/	22,013 r/ 3/	28,323 3/
Secondary	3,080	3,000	4,600	1,000	1,000
Total	24,100	25,000	26,700	23,000 r/	29,300
Russia:					
Primary e/	525,000	522,000	481,000	519,000 r/	545,000
Secondary e/	50,000	40,000	15,000 r/	41,700 r/	25,000
Total	575,400	562,000	496,000 r/	560,300 r/	570,000
Serbia and Montenegro:					
Primary	78,560	43,410	66,308 r/	71,304 r/	59,940 3/
Secondary	36,203	7,890	5,841 r/	7,147 r/	44,060 3/
Total	114,763	51,300	72,149	78,451 r/	104,000 3/
Slovakia, primary and secondary 5/	XX	28,000	25,000	25,000 e/	25,000
South Africa, primary 8/	120,100	127,900	129,622	124,300	130,000
Spain:					
Primary	134,325	137,230	142,000 e/	117,000 e/	210,000
Secondary	44,775	42,000	46,800 e/	47,100 e/	54,000
Total	179,100	179,230	188,000 e/	164,000 r/	264,000
Sweden:					
Primary	71,634	76,300	77,300 e/	80,000 r/ e/	100,000
Secondary	30,000 e/	22,486	25,750	30,000 r/ e/	25,000
Total	101,634	98,786	103,000 e/	110,000 r/ e/	125,000
Taiwan, secondary e/	12,000	10,000	10,000	8,000	6,000
Turkey, primary	104,000	92,400	82,700	98,500 e/	120,000
United Kingdom:					
Primary	10,363	10,629	11,078	28,000 r/ e/	12,869 3/
Secondary	31,704	35,949	35,586	50,500 r/ e/	43,746 3/
Total	42,067	46,578	46,664	78,500 r/ e/	56,615 3/
United States:					
Primary:					
Electrowon	502,000	491,000	493,000	539,000	574,000 3/
Other	1,210,000	1,300,000	1,350,000	1,390,000	1,440,000 3/
Secondary	433,000	460,000	392,000	352,000	327,000 3/
Total	2,140,000	2,250,000	2,230,000	2,280,000	2,340,000 3/
Uzbekistan: e/					
Primary	70,000	55,000 r/	85,000 r/	75,000 r/	75,000
Secondary	10,000	10,000	5,000	5,000	5,000
Total	80,000	65,000 r/	90,000 r/	80,000 r/	80,000
Zaire, primary 9/	47,503	34,100 r/	29,000	33,000 r/	28,000

See footnotes at end of table.

TABLE 22--Continued
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Zambia, primary: 10/					
Electrowon	43,712	48,845	67,300	45,700 r/	54,600
Other	428,495	363,247	284,800	275,600 r/	270,000
Total	472,207	412,092	352,100	321,300 r/	325,000
Zimbabwe: 11/					
Electrowon	--	--	--	200	3,200
Primary	9,673	8,187	9,350	12,000 r/ e/	12,000
Secondary e/	8,200	8,200	6,000	6,000	6,000
Total e/	17,900	16,400	15,400	18,200 r/	21,200
Total, primary	8,980,000 r/	9,190,000 r/	9,090,000 r/	9,410,000 r/	10,200,000
Total, secondary	1,840,000 r/	1,770,000 r/	1,710,000 r/	2,110,000 r/	2,010,000
Total, primary and secondary, undifferentiated	349,000 r/	379,000 r/	379,000 r/	383,000 r/	379,000
Grand total	11,200,000	11,300,000 r/	11,200,000	11,900,000 r/	12,500,000

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

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ This table includes total production of refined copper, whether produced by pyrometallurgical or electrolytic refining methods and whether derived from primary unrefined copper or from scrap. Copper cathode derived from electrowinning processing is also included. Table includes data available through July 10, 1997.

3/ Reported figure.

4/ Includes leach cathode from Zaire, which is processed.

5/ Formerly part of Czechoslovakia; data were not reported separately until 1993.

6/ Dissolved Dec. 31, 1992.

7/ Data are for Iranian years beginning Mar. 21 of that stated.

8/ May include secondary.

9/ Excludes leach cathode exported for processing in Belgium.

10/ Data are for fiscal year beginning Apr. 1 of that stated. Electrowon covers only presumably high-grade electrowon cathodes reported as "finished production leach cathodes." Other, in addition to electrowon cathodes, includes a smaller amount of "finished product shapes" presumably cast from electrorefined cathodes, or any blister-anodes and low-anodes and low-grade electrowon cathodes that were furnace- or fire-refined.

11/ May include copper-nickel matte (copper content more than 6,000 tons per year) imported from Botswana for toll refining.