RECYCLING—NONFERROUS METALS

By Gerald R. Smith

Introduction[1]

Recycling, a significant factor in the supply of many of the key metals used in our society, provides environmental benefits in terms of energy savings, reduced volumes of waste, and reduced emissions associated with the energy savings.

The estimated value of recycled nonferrous metals in 1994 was about $9.3 billion and is an increasingly important component of economic activity in the United States. Table 1 shows salient U.S. recycling statistics for selected metals. Table 1 also shows salient U.S. apparent supply and recycling statistics for selected metals.

As part of its Commodities and Materials Program, the U.S. Bureau of Mines (USBM) provides information and analysis on more than 100 raw and/or processed minerals. Collected data are assessed by commodity specialists, and information is disseminated to government, industry, and academia through consultative services and more than 100 recurring publications. This publication examines and reports on minerals and materials trends as well as environmental aspects of the entire life cycle of minerals use.

The USBM Research Directorate conducted research in 1994 on recycling of consumer products, advanced materials, copper processing waste, and metallurgical residues and effluents currently discarded. The Bureau also conducted research on impurity control during recycling and design for reuse or waste minimization. To increase the efficiency of recycling, the USBM investigated the control of impurities such as magnesium, zinc, and lithium in aluminum scrap and the removal of copper from ferrous scrap. The USBM also investigated methods to remove heavy-metal contaminants from mineral processing and manufacturing waste and to stabilize those heavy metals not removed.

Because of the increasing importance of recycling to domestic metal supply and the intense public interest, the USBM initiated this separate chapter on nonferrous metal recycling as part of its Annual Report series in 1991. A separate chapter on iron and steel scrap already had been part of this series for many years. The focus of this chapter is on aluminum, copper, lead, tin, and zinc recycling.

Aluminum[2]

Metal recovered from both new and old scrap reached an historic high of approximately 3.1 million tons in 1994, according to data derived by the USBM from its "Aluminum Scrap" survey. Of the 95 companies and/or plants to which monthly or annual survey requests were sent, 79 responded, representing 90% of the total scrap consumed shown in table 2.

According to figures released by the Aluminum Association Inc., the Can Manufacturers Institute, and the Institute of Scrap Recycling Industries Inc. a record 64.7 billion aluminum beverage cans were recycled in the United States during 1994. The recycling rate, based on the number of cans shipped during the year, was 65.4%, more than 2% higher than the 1993 recycling rate of 63.1%. According to the organizations' joint press release, every aluminum beverage can produced in 1994 had an average of 54.1% post-consumer recycled content, a far higher percentage than any other beverage container.

Imco Recycling Inc. announced plans to increase capacity at its used beverage can (UBC) recycling plant in Uhrichsville, OH. The $2.5-million expansion was expected to increase annual capacity at the plant by 25%, to 152,000 tons per year.[3] Imco also announced the purchase of Phoenix Smelting Corp., owner of Metal Resources Inc., which operated an aluminum recycling plant in Loudon, TN. The 54,000-ton-per-year recycling plant was near Imco's Rockwood, TN, facility.[4]

Alcan Aluminum Corp. announced plans to more than triple the UBC processing capacity at its Oswego, NY, aluminum rolling complex. Upon completion of the $23 million expansion project, the recycling unit reportedly would have the capacity to recycle 5 billion UBC's (75,000 tons) per year.[5] *(See tables 2, 3, and 4.)*

The London Metal Exchange (LME) reported that aluminum alloy ingot held at its U.S. warehouses at yearend 1994 increased to 1,100 tons, a slight increase from the 980 tons of alloy held at yearend 1993.

Prices.—Purchase prices for aluminum scrap, as quoted by American Metal Market (AMM), fluctuated during the year and closed the year at significantly higher levels than those at the beginning of the year. The yearend price ranges for selected types of aluminum scrap were as follows: mixed low copper-content aluminum clips, 69 to 70 cents per pound; old sheet and cast, 63 to 65 cents per pound; and clean, dry aluminum turnings, 64 to 65 cents per pound. Prices for aluminum UBC's also trended upward and closed at approximately twice the level of that at the beginning of the year. Aluminum producers' buying price range for processed and delivered UBC's, as quoted by AMM, began the year at 33 to 37 cents per pound. The price range at the end of the year narrowed and increased to 70 to 72 cents per pound.

The yearend indicator prices, as published by AMM, for selected secondary aluminum ingots also increased compared with those of the previous year and were as follows: alloy 380 (1% zinc content), 98.98 cents per pound; alloy 360 (0.6% copper content), 102.79 cents per pound; alloy 413 (0.6% copper content), 102.51 cents per pound; and alloy 319, 102.30 cents per pound. Metals Week published an annual average U.S. price of 74.71 cents per pound for A-380 alloy (3% zinc content). The average annual LME cash price for a similar aluminum 380 alloy was 65.90 cents per pound.

Foreign Trade.—Exports of aluminum scrap increased in 1994, reversing a 4-year downward trend. Japan continued to be the principal destination of exported scrap, accounting for almost 35% of the total.

Imports for consumption increased compared with those of the previous year. Canada remained the major shipping country to the United States, supplying 55% of the total aluminum scrap imports in 1994. *(See tables 5 and 6.)*

World Review.—According to preliminary estimates published by the World Bureau of Metal Statistics in June 1995, world production of secondary aluminum increased to 6.3 million tons in 1994 from the revised 1993 production figure of 6.1 million tons.

According to Aluminum Can Recycling Europe, 69,700 tons of aluminum UBC's were recycled in Europe, representing a recycling rate of 30%. The four countries with the highest individual recycling rates were Sweden (90%), Switzerland (83%), Iceland (80%), and Austria (65%).[6]

The recycling rate for aluminum UBC's in

Japan increased to 61.1% in fiscal year 1994 from 57.7% the previous year, according to the Japan Aluminum Can Recycling Association. The association estimated that 9.07 billion cans were recycled compared with 6.8 billion cans in fiscal year 1993.[7]

Outlook

The domestic and world secondary aluminum industries are expected to continue to expand. The growth in the use of aluminum beverage containers is continuing and helping to expand the aluminum recycling industry around the world. Increased use of cast aluminum by the automotive industry, a major market for secondary aluminum ingot, is also encouraging the expansion of the secondary aluminum industry. Growing markets and the increased sensitivity of the public to the issue of waste management have combined to foster the development and expansion of aluminum recycling around the world.

Copper and Copper Alloy Scrap[8]

Annual Review

World production of secondary refined copper fell by about 100,000 tons to 1.8 million tons in 1994, and accounted for about 16% of global refined production. The United States accounted for most of the decline in secondary refined production. Following 6 years of surplus production and a near tripling of world refined inventories to 1.4 million tons, copper demand in 1994 exceeded production and global copper inventories declined by 360,000 tons. Refined copper prices, which in November 1993 had fallen to their lowest level in 7 years, rose during 1994 in response to increasing supply tightness. The U.S. producer price for refined copper averaged $1.41 per pound in December, up from $0.92 in December 1993.

Domestic consumption of refined copper rose by more than 13% during 1994 to record high levels. This was the third consecutive year of large demand increases, consumption having risen by 6.3% and 8.5%, respectively, in 1992 and 1993. In 1994, copper recovered from all old and new refined or remelted scrap comprised 38% of total U.S. copper supply and had an equivalent refined value of $3.3 billion. *(See tables 7 through 13.)* Conversion of old scrap to alloys and refined copper declined by 43,000 tons, but contributed 500,000 tons of copper to the market, a quantity equivalent to about 18% of U.S. apparent consumption. Purchased new scrap, derived from copper fabricating operations, yielded 827,000 tons of copper, up almost 80,000 tons from that of the previous year, and accounted for 62% of copper recovered from all scrap. This large increase in new scrap consumption reflects the increased domestic consumption of mill products, which, according to the Copper Development Association Inc., rose by almost 13% in 1994. About 77% of the copper contained in new scrap was consumed at brass mills. During the year, 8 primary and 5 secondary smelters, 9 electrolytic and 6 fire refineries, and 15 electrowinning plants operated in the United States. Three of the electrolytic refineries were dedicated facilities associated with secondary smelters and mostly processed anode derived from scrap; several other refineries that mainly processed primary anode purchased or tolled some anode derived from scrap. All the fire refineries processed copper scrap. Copper was consumed, both 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. Of the total copper recovered from copper-, aluminum-, nickel-, and zinc-based scrap, copper smelters and refiners recovered 30%; brass mills, 51%; brass and bronze ingot makers, 10%; and miscellaneous manufacturers, foundries, and chemical plants, 9%. Unalloyed scrap accounted for 51% of copperbased scrap consumed, as shown on table 11.

While total smelter capacity remained unchanged at 1.9 million tons, investments made in 1993 and 1994 led to higher capacity usage and increased primary smelter production. Secondary smelter production however, declined slightly, and at yearend, Southwire Co. announced the immediate closure of its secondary smelter and the phase-out of the associated electrolytic refinery at its Gaston Copper Recycling Corp., Gaston, SC. High operating costs and the large additional capital investment needed to comply with environmental regulations were cited by the company as the reason for closure.

Prices.—Copper scrap prices trended upward in 1994, following the rise in refined copper prices. However, while the average producer price for refined copper rose about 53 cents per pound from January to December, the price rise for No. 2 scrap was only 32 cents per pound. Thus, the margin between the two materials widened from 18 cents per pound in January, to 39 cents per pound in December. While copper scrap prices correlate to the price of refined copper, the price paid for scrap at each level of processing must be sufficiently discounted to allow for all subsequent processing costs. Thus, a scrap collector who must perform such functions as sorting, shipping, chopping, baling, etc. will pay less for scrap than does the consumer of the scrap. Because of these inherent costs associated with the initial collection and processing of scrap, low refined copper prices, such as those experienced in January, squeeze processing and profit margins and reduce the quantity of scrap that can be recovered economically. Despite the increase in margins, consumption of No. 2 scrap, as well as lower grades of scrap consumed predominantly by secondary smelters, declined in 1994. Environmental and capacity constraints, along with constraints on materials availability, prevented secondary smelters from increasing throughput. As noted above, the Gaston smelter closed at yearend. Also, intense competition from exporters may have limited the availability of certain scrap types. This is also reflected in the decline of old scrap consumption; secondary smelters are the largest consumers of old scrap. On the other hand, consumption of No. 1 scrap and new scrap both increased, owing to high production levels at brass mills; brass mills are the principal consumers of No. 1 scrap and new scrap. Consumption of brass ingot, a product of brass scrap, also increased, owing to a rise in domestic casting production.

Foreign Trade.—Exports of both alloyed and unalloyed scrap rose significantly in 1994, while imports of copper alloy scrap declined markedly. Consequently, net exports of scrap rose to more than 250,000 tons, up from about 100,000 tons in 1993. The United States was one of the largest international sources for copper scrap, followed by France, Germany, and the United Kingdom. U.S. exports of copper scrap have been increasing since the 1960's, when the Asian nations began to industrialize. In 1994, China, Hong Kong, Japan, Korea, Singapore, and Taiwan, combined, accounted for 44% and 49%, respectively, of U.S. unalloyed and alloyed scrap exports. Exports of unalloyed scrap to Canada rose by more than 70%. Canada and Mexico were the leading sources for U.S. imports of copper and copper alloy scrap and accounted for 73% of imports in 1994. *(See tables 15 and 16.)*

Outlook

Over the next decade, new copper scrap will continue to be a premium material for the U.S. semifabricating industry, and its level of availability and the quantity recycled will be closely tied to the overall level of copper fabrication. The recovery of copper from old scrap declined in 1994 for the second consecutive year, and did not share in the strong growth in copper demand. Old scrap as a percentage of apparent consumption declined from 25% in 1991, to 19% in 1994. With the

closure of the Gaston smelter, domestic recovery of copper from old scrap is expected to remain at or below the current level. However, if it is assumed that most copper scrap exports were old scrap destined for recovery, the total quantity of domestic source copper in old scrap recycled in 1994 increased by about 30,000 tons. Be-cause scrap is usually a lower-cost alternative to primary metal, it will continue to be of great interest to Far Eastern countries as they expand their industries. The recovery of copper (old scrap) from the large and growing reservoir of copper products in use may be limited by the following factors: (1) copper prices, (2) life of products, (3) available recovery technologies, (4) changing end-use patterns (5) and environmental regulation. Regulations to limit the lead content of plumbing fixtures in potable water distribution systems could result in the land-filling of high-leaded brass scrap, absent new recovery technologies; leaded brass scrap is the prime feed material to the ingot-making and foundry industries. The Basel Convention, an international agreement on the transboundry movement of hazardous waste, could impede the international flow of copper scrap.

Lead[9]

Refined lead is a soft, heavy metal, one of the first metals used by humankind. Among the important characteristics of lead are its electrochemical energy storage capability, its good corrosion resistance, and its low melting point, the latter making it relatively easy to cast. The United States is the world's largest producer and consumer of refined lead; domestic demand for lead is surpassed only by that for aluminum, copper, and iron.

Legislation and Government Programs.— The Lead Exposure Reduction Act was passed by the U.S. Senate at the end of May 1994. Included in this legislation was the establishment of a mandatory recycling program that prohibits incineration and landfill disposal of used lead-acid batteries and creates a distribution system whereby the used batteries are returned by the retailers to the secondary lead smelters for recycling. The U.S. House of Representatives did not advance its version of this legislation during 1994.

The Lead-Based Paint Hazard Trust Fund Act introduced in the 1st session of the 103d Congress by 7 cosponsors on June 22, 1993, gained 36 additional sponsors in the U.S. House of Representatives by the end of the 2d session of the 103d Congress, but no further action was taken on the bill during 1994. Essentially, the bill proposes a unitary tax of 45 cents per pound on all primary and secondary lead produced domestically and imported. This tax is intended to provide a dedicated revenue of $1-billion-per-year for use in the cleanup of lead-based paint hazards in accordance with Title 10 of the Housing and Community Development Act of 1992.

Consumption.—Domestic demand patterns for lead have undergone significant change in recent years as a result of human health concerns related to lead exposure and subsequent Government actions taken to reduce that exposure. In 1972, dissipative uses of lead, particularly in gasoline additives, pigments, ammunition, and chemicals, coupled with other uses where the potential for human exposure exists, such as in packaging, solders, plumbing, and certain other construction materials, amounted to about 510,000 tons, or 38% of the reported consumption of lead. In 1985, these end uses represented 205,000 tons, 18% of consumption, and in 1994 were only 140,000 tons, 10% of consumption. Lead consumed in lead-acid storage batteries grew accordingly during these years from 660,000 tons, 49% of lead consumption in 1972, to 840,000 tons, 73% in 1985, to 1.22 million tons, 84% in 1994. Consequently, the number of used batteries available for recycling also grew during this period. By 1994, the gross weight of lead-containing battery scrap processed at secondary smelters reached 1.01 million tons. According to the most recent Battery Council International statistics, the leadacid battery recycling rate in the United States was about 93% in 1993. *(See table 17.)*

Production.—In 1994, about 816,000 tons of lead were produced at secondary smelters from used lead-acid batteries. This was approximately 89% of the refined lead recovered from both old and new scrap, and 72% of the total production of refined lead from primary and secondary sources. The estimated value of the lead recovered from secondary sources in 1994 was $748 million. Domestic secondary production of lead increased by about 2% in 1994, returning to near the level reached in 1992. *(See tables 1, 18, and 19.)*

Domestic data for secondary lead consumption and production are developed by the USBM from a voluntary survey that includes data from both monthly and annual respondents. In 1994, secondary smelting and/or consuming companies which were sent a survey request numbered 174, of which 139 responded, providing 88% of the total reported U.S. lead consumption. Of the 24 companies producing secondary lead to which a survey request was sent, exclusive of those recycling copper-base alloys, 21 responded, providing 91% of the total refinery production of secondary lead. Data for the nonrespondents was estimated using prior year levels adjusted for general industry trends.

In U.S. secondary lead industry actions during 1994, GNB Battery Technologies Inc., Atlanta, GA, received approval from the Georgia Environmental Protection Agency to build and operate a new and expanded lead-acid battery recycling facility at its present Columbus, GA, location. The new secondary smelter/refinery, expected to be completed in mid-1995, will have a production capacity of 90,000 tons per year of lead, 4.5 times that of the existing plant at the Columbus site. GNB also acquired Quenell Enterprises, a Los Angeles-based lead oxide producer, in October 1994. This purchase reportedly was intended to further support GNB's growing in-house demands in battery production, recycling, and distribution associated with the opening of the new Columbus plant. GNB's plans to build a Greenfield secondary lead smelter in Waynesboro, GA, continued to be suspended indefinitely.

In September 1994, RSR Corp., Dallas, TX, suspended the process of obtaining permits for its planned $60 million battery recycling plant in Aiken County, SC. The suspension of such activity was made at the request of the Aiken County Economic Development Partnership, pending the outcome of a Federal grand jury indictment alleging environmental violations at RSR's Indianapolis, IN, recycling plant.

Foreign Trade.—Exports of lead scrap in 1994 were about 88,000 tons, nearly 63% higher than in 1993, and were valued at approximately $24 million, about 69% greater than in 1993. Canada and the Republic of Korea received 78% and 11%, respectively, of the exports of lead scrap. Imports of lead scrap for the year totaled 144 tons worth $80,000. *(See table 20.)*

Outlook

After 2 years of increases in lead demand in the United States, owing mainly to the increased use of lead acid batteries as both original equipment and replacement batteries in the automotive industry, consumption of lead is expected to decline slightly in 1995.

The rate of economic growth domestically is anticipated to be somewhat slower in 1995, but the automotive manufacturing sector will remain relatively strong, resulting in a higher demand for original equipment batteries. Total new vehicle production is estimated to increase by 5.7%, to 12.9 million units in 1995. This demand increase, however, will be tempered by a decrease in demand for replacement batteries, following a fairly mild 1994-95 winter nationwide. The net result is a predicted

moderate decrease of about 2% in overall lead consumption during 1995.

Lead supply from domestic secondary and primary smelter production is expected to show a net decline of about 1% in 1995. While primary production should increase by about 4%, as a result of continued higher production at some of the larger operations, this increase will be countered by a decline in secondary production, a result of a modest shortage of available scrap.

Tin[10]

Tin was one of the earliest metals known to humankind. Tin occurs in nature principally as the oxide mineral cassiterite. Tin metal is commonly used as a protective coating or as an alloying metal with one or more other metals. Refined metal in the form of ingots is generally used as the starting point for most uses of tin. The major uses for tin are as follows: cans and containers, 32%; electrical, 22%; construction, 10%; and transportation, 11%; other uses account for the remaining 25%. Tinplating generally uses no scrap tin, but most other end-use items, especially solder and brass/bronze, use substantial quantities of tin scrap.

About 25% of the domestic supply of tin metal is metal recovered from scrap. In 1994, 10,893 tons of tin metal valued at an estimated $89 million was recovered from new and old tin scrap.

Old tin scrap is collected at hundreds of domestic scrap yards, at nine detinning plants, and at most municipal collection/ recycling centers. New tin scrap is generated mainly in the tin mills at six steel plants, scores of canmaking facilities, numerous brass and bronze plants, and many solder making plants.

Detinning facilities are unique to the tin scrap industry, in that no other major metal industry has such large-scale facilities to remove plated metal. There are nine domestic detinning plants scattered across the country. Until about 1989, they processed almost entirely new tinplate scrap that originated in the tin mills of steel plants and canmaking plants. Since 1989, with new technology that shreds used tin cans, some of the detinning facilities have the capability of also detinning old tin cans. Only in the detinning process does free tin metal see its way to the marketplace. All the alloy forms of tin are recycled within their own product line industries and thus reappear as regenerated alloys. *(See tables 21, and 22.)*

Most tin scrap processing facilities are close to the tin-using industries and to densely populated areas. Most are in the Midwest and Northeast.

Domestic scrap data for tin are developed by the USBM from a voluntary survey of the U.S. tin scrap industry. The smaller side of this industry is covered by a canvass sent to five detinning companies monthly; all five responded or are estimated for. The larger side of the tin scrap industry, involving the alloys of tin, is covered largely by a canvass of the copper and lead scrap industries (tin's major coalloys) from which estimates are made for the tin content.

The former Steel Can Recycling Institute (SCRI) completed its first full year under its new name, the Steel Recycling Institute (SRI). The name change reflected a broadening of its mission to encompass not only steel cans (which had been its sole focus since its 1988 founding), but all steel products ranging from appliances to filing cabinets to cars. Since SCRI's inception in 1988, the steel can recycling rate had grown from 15% to 53% in 1994. The overall steel recycling rate has been over 60% for more than 20 years and currently stands at 66%.

The SRI announced several recycling highlights for 1994: a) Steel can recycling rates in the United States reached an all-time high of 53%, with more than 17.6 billion cans, weighing 1.5 million tons, recycled. b) Utilization of used steel cans as a scrap charge continued to increase. Steel mills and foundries were remelting about 500 steel cans every second. c) Each year, more than 30 billion steel cans are produced, packaging a variety of products from food and beverages, to paints, chemicals and personal care products. d) Nine out of 10 aerosol cans are made of steel and are recyclable when empty. More than 1,700 communities currently recycle aerosol cans. e) More than 170 million Americans have convenient access to steel can recycling through curbside, drop-off and buyback programs, as well as through magnetic separation at resource facilities. f) The SRI's goal is to achieve a 66% recycling rate for steel cans by the end of 1995. g) The average American uses 144 steel cans each year. If every American recycled at least 95 steel cans in 1995, the goal of a 66% steel can recycling rate could be achieved.

The SRI continued to focus its attention on the recycling of aerosol steel cans. Some have felt that aerosol steel cans can be hazardous to recycle, but the SRI has maintained that as long as each can is first emptied it is no more hazardous to recycle than any other type of can. The SRI pointed to an especially successful aerosol steel can recycling program it coordinated in the State of Michigan. SRI claimed that over 1,500 communities are now recycling aerosol cans, including large cities such as Philadelphia, PA, and Washington, DC.

The Journal of Metals (February 1994) reported on studies conducted by the U.S. Bureau of Mines Rolla (MO) Research Center on characteristics of recycled automotive oil filters, many of which are made from tinplate. Increasingly, in recent years, used oil filters have become a steel scrap item used as an electric furnace scrap charge by steel minimills. TAMCO Steel Co., Rancho Cucamonga, CA, and Bayou Steel Co., LaPlace, LA, have been prominent in such scrap usage. The USBM research showed that crushed and drained oil filters have a bulk density that is higher than many traditional scrap steel grades, a chemical analysis low in residual elements (except tin), and an overall yield of oil-filter scrap to cast steel of 76% to 85% depending on the method used to prepare the scrap.

One of the major domestic detinners, Proler International Corp., announced plans to expand its capacity to recycle tin-bearing solutions from the electronics industry at its Coolidge, AZ, facility. Proler announced that the company developed its own process to extract tin from solutions and sludges by adapting detinning technology used internally. Proler produces tin anodes from these solutions and sludges, which it sells back to the electronics industry. Proler felt the need to expand because demand for the service exceeded capacity at its existing plant. Arizona is the home of numerous electronics plants.

World Review.—The United States, France, Germany, Japan, and the United Kingdom, generally lead the world in tin recycling activity and innovation. Environmental pressures in those countries for the past 20 years have acted as a powerful incentive.

In contrast to the United States and Europe, where detinning has long been a substantial activity, Japanese industry does little or no detinning because it feels that the tin coating on tinplate has become so thin in the past 20 years that detinning is not economical.

Outlook

The near- and long-term outlook for tin recycling is positive, with modest growth expected, about 1% annually. Tin is a high-value industrial material. In the form of tinplate, one of its main uses, it is easily separated magnetically for recycling. Tin consumption is expected to grow about 1% annually. Scrap is expected to grow from 25% of total metal consumed in 1994 to 27% annually by the year 2000. A major incentive is expected to be environmental legislation, mostly at the local and State level. If tin prices remain relatively high compared with prices of other major metals, the industry will have sufficient incentive to recycle this costly metal.

Zinc[11]

Zinc is the fourth most widely used metal after iron, aluminum, and copper. About three-fourths is in metal form and one-fourth in compound form. More than 90% of the metal is used for galvanizing steel and for alloys; the remainder is used to produce dust, oxide, and various chemicals. Most metal products find widespread use in the automotive, construction, electrical, and machinery sectors of the economy. Compounds similarly are dispersed in distribution and use, but are mainly used in agricultural, chemical, paint, pharmaceutical, and rubber sectors of the economy.

Nearly one-third of the 1.42 million tons of zinc consumed annually by domestic industries is secondary zinc. In 1994, about 367 tons of secondary zinc, valued at about $390 million, was recovered in refined metal, alloys, dusts, and chemicals. Scrap containing about 58,300 tons of zinc and valued at $34.4 million was exported in 1994, whereas 51,700 tons of zinc in scrap, valued at $19.8 million, was imported.

Recycled zinc was derived 70% from new scrap and 30% from old scrap. New zinc scrap was generated mainly in galvanizing and diecasting plants, brass mills, and manufacturing facilities where basic zinc materials were consumed. New scrap consisted mostly of drosses, skims, furnace dusts, and residues (from galvanizing and diecasting operations, brass mills, and chemical plants) and clippings from the processing (stamping, trimming, etc.) of galvanized steel sheet and strip, rolled zinc, and brass sheet. Old scrap consisted almost entirely of diecastings, (mainly from scrapped automobiles), brass products, and rolled zinc items, such as gutters, roofing, and engraving plates. Zinc recovery from the burning of tires for energy is small but growing, whereas recovery from both old and new galvanized steel scrap has increased dramatically. Old zinc and brass scrap were collected at hundreds of domestic scrap yards, at more than 200 U.S. automobile and appliance shredding operations, and at numerous municipal collection centers. In 1994, there were three primary and seven secondary smelters that processed scrap, drosses, skims, and/or steelworking electric arc furnace (EAF) dust into slab zinc, zinc alloys, and zinc dust. Seven other plants processed skims, drosses, scrap, and residues into zinc sulfate and/or chloride chemicals. Secondary brass and bronze were recycled at more than 500 secondary smelters, foundries, and ingot makers. Eagle Zinc, Hillsboro, IL, produced American-process zinc oxide from oxidic secondary materials. Most secondary zinc plants are in the Eastern and Midwestern United States; the ZCA plant in Monaca, PA, is, by far, the single largest processor secondary zinc. Crude zinc concentrates extracted from EAF dust were produced at four plants. *(See tables 23, 24, and 25.)*

Because of wide differences in the character and content of zinc-bearing scrap, zinc recycling processes vary widely. Zinc-containing metals generally are separated from other materials initially by physical means such as magnetic separation, sink-floating, and hand sorting. In the case of mixed nonferrous metal shredder scrap, zinc can be separated from higher-melting point metals, such as aluminum and copper, by selective melting in a sweat furnace. Zinc in galvanized scrap is largely recovered in furnace dust when the scrap is charged into a steelmaking furnace; however one commercial process has been developed to strip zinc from galvanized scrap with a caustic leach prior to recycling the substrate steel to the steelmaking process.

Clean new scrap, mainly brass and rolled zinc clippings and reject diecastings, generally only require remelting before reuse. Drosses, fragmentized diecastings, and mixed high-grade scrap typically are remelted, followed by zinc distillation with recovery as metal, dust, or oxide. Sometimes, high-purity drosses are simply melted and reacted with various fluxes to release the metallic content; often the recovered metal can be used directly as a galvanizing brightener or master alloy. Medium- and low-grade skims, oxidic dust, ash, and residues generally undergo an intermediate reduction-distillation-pyrometallurgical step to upgrade the zinc product before treatment or they are leached with acid, alkaline, or ammoniacal solutions to extract zinc, which is subsequently recovered as a compound by precipitation-crystallization or as a salable chemical retained in solution. Almost all of the zinc in EAF dusts is first recovered in an upgraded, impure zinc oxide product; however, several commercial EAF-dust-treatment plants are able to bypass the intermediate step and recover zinc metal directly. The upgraded zinc oxide pyrometallurgical production is almost always shipped to a primary pyrometallurgical zinc smelter for refinement to metal. For the most part, the zinc metals, alloys, dust, and chemicals recovered from secondary materials are comparable in quality to those derived from primary materials.

Recovery efficiency is very high from simple remelting, but declines as the number of processing steps increases and, generally, as the zinc content of the scrap declines. Zinc recovery from most secondary processes ranges between 40% and 85%; however, oxide materials, slags, and residues resulting from initial processes may, in turn, be recycled, resulting in further zinc recovery.

Zinc materials made from zinc-base scrap are slab zinc, alloys, dusts, and compounds. Brass scrap, on the other hand, typically is remelted and, with alloy adjustment, recast as brass. Zinc chloride and sulfate compounds are produced largely by acid leaching of zinc skims, drosses, and chemical residues. Impure zinc oxide products and zinc-bearing slags are sometimes used as trace element additives in fertilizers and animal feeds. Zinc in brass is the principal form of secondary recovery, although in the past few years, production of secondary slab zinc has risen substantially because it has been the principal zinc product of EAF dust recycling.

Prices.—Prices paid for scrap and secondary materials are negotiated, often on the basis of a daily or average LME price for zinc metal. Bids are required for U.S. Department of Defense scrap sales. Prices depend on factors such as geographic location, quantity available, quality, grade, the presence of other components or elements, and environmental difficulties in handling, transporting, or treating. In the case of EAF dust, the dust generator usually pays the dust processor a fee to recycle the material. Typically, there is a basic charge for dust with 20% zinc content; generators of dust with lower zinc content pay more, whereas generators of dust with higher zinc content pay less. Zinc and brass scrap prices are generally not available, although average daily, weekly, or monthly prices for a few specific common types are published in American Metal Market, Metal Bulletin, and Metal Bulletin Monthly.

Outlook

Driven by public concern for the environment and legislation intended to protect the environment, domestic and world secondary zinc recovery is expected to increase as a percentage of zinc consumption in the next decade. However, the prospect for recovery equivalent to more than 35% to 40% of consumption is relatively poor because of the dissipative nature and diversity of zinc uses. Greater recovery of zinc from galvanized steel scrap can be expected in the future as several processes for dezincing galvanized scrap have been developed and tested. Increased processing of low-zinc EAF dust, from other steelmaking processes, and zinc residues from energy-generating tire burning appear to be other sources for near term gains in secondary zinc output. Increased zinc recovery from the recycling of carbon-zinc and alkaline batteries and municipal incinerator dusts and residues are longer term possibilities. Secondary zinc

recycling could rise dramatically in the next decade if the powering of a substantial number of electric cars by zinc-air batteries become a reality.

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[1]Prepared by J. F. Papp, physical scientist, Branch of Metals.

[2]Prepared by P. Plunkert, physical scientist, Branch of Metals.

[3]American Metal Market. Imco to Raise Capacity 25% at Ohio UBC Plant. V. 102, No. 86, May 5, 1994, p. 7.

[4]Metal Bulletin Monthly. Imco Recycling. V. 288, Dec. 1994, p. 80.

[5]American Metal Market. Alcan to Triple UBCs at Oswego. V. 102, No. 87, May 6, 1994, p. 2.

[6]———. 1994 European Beverage Can Consumption. V. 103, No. 115, June 15, 1995, p. 5.

[7]———. Japanese UBC Recycling Rate Up. V. 103, No. 139, July 21, 1995, p. 10.

[8]Prepared by D. L. Edelstein, physical scientist, Branch of Metals.

[9]Prepared by G. R. Smith, physical scientist, Branch of Metals.

[10]Prepared by J. F. Carlin, Jr., physical scientist, Branch of Metals.

[11]Prepared by S. M. Jasinski, physical scientist, Branch of Metals.

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TABLE 1
SALIENT U.S. RECYCLING STATISTICS FOR SELECTED METALS 1/

Year	Quantity (metric tons)				Percent recycled	Value (thousand dollars)			
	New scrap 2/	Old scrap 3/	Recycled metal 4/	Apparent supply 5/		New scrap	Old scrap	Recycled metal	Apparent supply 6/
				ALUMINUM 7/					
1990	1,030,000	1,360,000	2,390,000	6,300,000	38	$1,690,000	$2,220,000	$3,910,000	$10,300,000
1991	969,000	1,320,000	2,290,000	6,010,000	38	1,270,000	1,730,000	3,000,000	7,880,000
1992	1,140,000	1,610,000	2,760,000	6,870,000	40	1,450,000	2,040,000	3,500,000	8,710,000
1993	1,310,000	1,630,000	2,940,000	7,920,000 r/	37	1,540,000	1,920,000	3,460,000	9,300,000 r/
1994	1,580,000	1,500,000	3,080,000	8,460,000	36	2,480,000	2,360,000	4,840,000	13,300,000
				COPPER 8/					
1990	774,000	537,000	1,310,000	2,920,000	44.8	2,100,000	1,460,000	3,560,000	7,940,000
1991	682,000	518,000	1,200,000	2,730,000	44.0	1,650,000	1,250,000	2,890,000	6,580,000
1992	723,000	555,000	1,280,000	3,030,000	42.2	1,710,000	1,310,000	3,030,000	7,170,000
1993	748,000	543,000	1,290,000	3,260,000	39.6	1,510,000	1,100,000	2,610,000	6,590,000
1994	827,000	500,000	1,330,000	3,500,000	37.9	2,030,000	1,230,000	3,250,000	8,580,000
				LEAD 9/					
1990	48,100	874,000	922,000	1,350,000	68.5	48,800	887,000	936,000	1,360,000
1991	55,000	830,000	885,000	1,280,000	68.9	40,600	612,000	653,000	947,000
1992	55,400	861,000	916,000	1,330,000	69.1	42,900	666,000	709,000	1,030,000
1993	55,000 r/	838,000 r/	893,000 r/	1,380,000 r/	64.7 r/	38,500	587,000	625,000	966,000
1994	55,100	858,000	913,000	1,460,000	62.3	45,200	703,000	748,000	1,200,000
				NICKEL 10/					
1990	--	--	57,400	170,000	33.74	--	--	509,000	1,510,000
1991	--	--	53,500	157,000	34.16	--	--	436,000	1,280,000
1992	--	--	55,900	159,000	35.06	--	--	391,000	1,120,000
1993	--	--	54,000	159,000	34.34	--	--	386,000 r/	839,000 r/
1994	NA	NA	58,600	164,000	35.64	NA	NA	371,000	1,040,000
				TIN 11/					
1990	4,040	13,200	17,300	53,400	32	34,300	112,000	147,000	455,000
1991	5,110	7,980	13,100	39,600	33	41,500	64,800	106,000	317,000
1992	4,890	8,850	13,700	37,300	37	43,400	78,400	122,000	331,000
1993 r/	4,630	7,420	12,000	43,300	28	35,700	57,300	92,900	334,000
1994	3,990	6,910	10,900	40,300	27	32,400	56,200	88,600	328,000
				ZINC 12/					
1990	232,000	109,000	341,000	1,240,000	27.5	381,000	179,000	560,000	2,040,000
1991	233,000	119,000	353,000	1,170,000	30.3	271,000	138,000	410,000	1,360,000
1992	234,000	132,000	366,000	1,280,000	28.7	301,000	170,000	471,000	1,640,000
1993	246,000	109,000	355,000	1,370,000	26.0 r/	250,000	111,000	361,000	1,400,000
1994	251,000	116,000	367,000	1,420,000	25.9	213,000	126,000	389,000	1,540,000

r/ Revised. NA Not available.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ New scrap is scrap that results from the manufacturing process, including metal and alloy production.

3/ Old scrap is scrap that results from consumer products.

4/ Recycled metal is metal recovered from new plus old scrap.

5/ Apparent supply is production plus net imports plus stock changes. Production is primary production plus recycled metal. Net imports is imports minus exports. Apparent supply is calculated on a contained weight basis.

6/ Same as apparent supply defined above but calculated on a monetary value basis.

7/ Scrap quantity is the calculated metallic recovery from reported purchased new and old aluminum-based scrap, estimated for full industry coverage. Monetary value is estimated based on average U.S. market price for primary aluminum metal ingot.

8/ Monetary value of recovered copper for consumption is estimated as average annual refined copper prices.

9/ Lead processors are segregated by primary and secondary producers. This segregation permits inclusion of stocks changes for secondary producers. Monetary value of scrap and apparent supply estimated upon average quoted price of common lead.

10/ Nickel scrap is nickel contained in ferrous and nonferrous scrap receipts. Monetary value of scrap and apparent supply is estimated as average annual LME cash price of nickel cathode.

11/ Monetary value estimate based on Platt's Metals Week (PMW) Tin Composite price. Reevaluation of the tin canvass in 1991 resulted in a substantial lowering of estimated old scrap.

12/ Monetary value based on average annual U.S. zinc metal price published in PMW; for 1990, the PMW average prices were based on U.S. or North American Producers' High Grade zinc delivered prices and for 1991-94, the LME spot prices for Special High Grade zinc plus premiums based on market conditions.

TABLE 2
U.S. CONSUMPTION OF AND RECOVERY FROM PURCHASED NEW AND OLD ALUMINUM SCRAP 1/, BY CLASS 2/

(Metric tons)

Class	Consumption	Calculated recovery	
		Aluminum	Metallic
1993			
Secondary smelters	1,130,000	882,000	946,000
Integrated aluminum companies	1,340,000	1,120,000	1,190,000
Independent mill fabricators	608,000	524,000	559,000
Foundries	89,900	74,300	79,900
Other consumers	9,560	9,560	9,560
Total	3,190,000	2,610,000	2,790,000
Estimated full industry coverage	3,360,000	2,750,000	2,940,000
1994			
Secondary smelters	1,150,000	887,000	951,000
Integrated aluminum companies	1,340,000	1,120,000	1,190,000
Independent mill fabricators	728,000	628,000	670,000
Foundries	103,000	83,700	90,100
Other consumers	10,900	10,900	10,900
Total	3,340,000	2,730,000	2,910,000
Estimated full industry coverage	3,530,000	2,880,000	3,080,000

1/ Excludes recovery from other than aluminum-base scrap.
2/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

TABLE 3
U.S. STOCKS, RECEIPTS, AND CONSUMPTION OF PURCHASED NEW AND OLD ALUMINUM SCRAP 1/ AND SWEATED PIG IN 1994 2/

(Metric tons)

Class of consumer and type of scrap	Stocks, Jan. 1	Net receipts 3/	Consump-tion	Stocks, Dec. 31
Secondary smelters:				
New scrap:				
Solids	4,250	167,000	167,000	4,720
Borings and turnings	3,970	188,000	187,000	4,490
Dross and skimmings	5,200	150,000	152,000	3,000
Other 4/	6,120	197,000	198,000	4,850
Total	19,500	702,000	705,000	17,100
Old scrap:				
Castings, sheet, clippings	15,000	294,000	292,000	16,800
Aluminum-copper radiators	1,100	9,060	9,340	816
Aluminum cans 5/	1,470 r/	101,000	100,000	1,680
Other 6/	254	41,400	41,200	453
Total	17,800 r/	445,000	443,000	19,700
Sweated pig	298	2,790	2,580	504
Total secondary smelters	37,600	1,150,000	1,150,000	37,300
Integrated aluminum companies, foundries, independent mill fabricators, other consumers:				
New scrap:				
Solids	12,800 r/	701,000	695,000	19,600
Borings and turnings	291	37,300	37,200	365
Dross and skimmings	14	13,600	13,500	89
Other 4/	11,300	232,000	234,000	9,320
Total	24,400 r/	984,000	979,000	29,400
Old scrap:				
Castings, sheet, clippings	7,490	380,000	378,000	9,080
Aluminum-copper radiators	163	2,610	2,400	371
Aluminum cans	10,700	815,000	803,000	22,600
Other 6/	737 r/	11,100	11,700	155
Total	19,100	1,210,000	1,200,000	32,300
Sweated pig	335	10,300	10,200	393
Total integrated aluminum companies, etc.	43,800 r/	2,200,000	2,190,000	62,000
All scrap consumed:				
New scrap:				
Solids	17,000 r/	869,000	861,000	24,300
Borings and turnings	4,260	225,000	224,000	4,850
Dross and skimmings	5,220	164,000	166,000	3,090
Other 4/	17,400	429,000	433,000	14,200
Total new scrap	43,900 r/	1,690,000	1,680,000	46,400
Old scrap:				
Castings, sheet, clippings	22,400	674,000	671,000	25,900
Aluminum-copper radiators	1,260	11,700	11,700	1,190
Aluminum cans	12,100	916,000	904,000	24,300
Other 6/	991 r/	52,500	52,900	608
Total old scrap	36,800	1,650,000	1,640,000	52,000
Sweated pig	633	13,100	12,800	897
Total of all scrap consumed	81,400 r/	3,350,000	3,340,000	99,300

r/ Revised.

1/ Data rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes imported scrap. According to reporting companies, 9.69% of total receipts of aluminum-base scrap, or 323,000 metric tons, was received on toll arrangements.

3/ Includes inventory adjustment.

4/ Includes data on foil, can stock clippings, and other miscellaneous.

5/ Used beverage cans toll treated for primary producers are included in secondary smelter tabulation.

6/ Includes municipal wastes (includes litter) and fragmentized scrap (auto shredder).

TABLE 4
PRODUCTION AND SHIPMENTS OF SECONDARY ALUMINUM ALLOYS BY
INDEPENDENT SMELTERS IN THE UNITED STATES 1/

(Metric tons)

	1993		1994	
	Production	Net shipments 2/	Production	Net shipments 2/
Die-cast alloys:				
13% Si, 360, etc. (0.6% Cu, maximum)	45,500	44,700	50,500	51,200
380 and variations	518,000	517,000	559,000	560,000
Sand and permanent mold:				
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	85,100	84,400	86,400	85,900
No. 12 and variations	W	W	W	W
No. 319 and variations	67,400	65,700	70,500	71,200
F-132 alloy and variations	24,000	25,800	29,000	29,000
Al-Mg alloys	639	641	639	639
Al-Zn alloys	3,220	3,470	3,530	3,530
Al-Si alloys (0.6% to 2.0% Cu)	10,800	11,000	10,800	10,700
Al-Cu alloys (1.5% Si, maximum)	1,740	1,730	1,680	1,710
Al-Si-Cu-Ni alloys	1,360	1,400	1,180	1,230
Other	3,790	3,810	2,830	2,860
Wrought alloys: Extrusion billets	80,900	84,900	151,000	152,000
Miscellaneous:				
Steel deoxidation	--	--	--	--
Pure (97.0% Al)	--	--	--	--
Aluminum-base hardeners	93	93	93	93
Other 3/	34,200	35,200	35,700	35,000
Total	877,000	880,000	1,000,000	1,000,000
Less consumption of materials other than scrap:				
Primary aluminum	79,600	--	86,000	--
Primary silicon	39,200	--	67,500	--
Other	4,600	--	5,880	--
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot 4/	753,000	XX	843,000	XX

W Withheld to avoid disclosing company proprietary data; included with "Sand and permanent mold: Other." XX Not applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes inventory adjustment.

3/ Includes other die-cast alloys and other miscellaneous.

4/ No allowance made for melt-loss of primary aluminum and alloying ingredients.

TABLE 5
U.S. EXPORTS OF ALUMINUM SCRAP, BY COUNTRY 1/

Country	Remelt scrap ingot		Used beverage container scrap		Other aluminum waste and scrap		Total	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1993:								
Belgium	--	--	--	--	26	$24	26	$24
Brazil	--	--	--	--	707	779	707	779
Canada	--	--	154	$134	46,300	47,200	46,500	47,300
China	17	$17	14	27	7,540	5,440	7,570	5,480
Finland	--	--	--	--	5,920	4,400	5,920	4,400
France	--	--	--	--	582	785	582	785
Germany	--	--	--	--	85	217	85	217
Hong Kong	455	331	--	--	7,510	5,280	7,970	5,620
Italy	--	--	3	3	52	53	55	56
Japan	27,000	32,500	134	111	65,200	62,200	92,300	94,800
Korea, Republic of	280	291	38	40	7,840	9,480	8,160	9,810
Mexico	4,820	6,580	--	--	13,500	13,400	18,300	20,000
Netherlands	78	118	--	--	195	187	272	305
Philippines	9	28	--	--	126	101	135	129
Taiwan	1,380	1,450	183	555	14,700	9,630	16,300	11,600
Thailand	--	--	--	--	1,030	1,130	1,030	1,130
United Kingdom	--	--	16	15	213	409	229	424
Other	1,490	1,660	455	606	3,550	6,240	5,490	8,510
Total	35,500	43,000	996	1,490	175,000	167,000	212,000	211,000
1994:								
Belgium	--	--	--	--	37	80	37	80
Brazil	--	--	2	6	628	862	631	868
Canada	--	--	64	70	57,900	61,100	57,900	61,200
China	415	554	7	6	13,400	10,000	13,800	10,600
Finland	--	--	--	--	4,750	2,630	4,750	2,630
France	--	--	--	--	33	211	33	211
Germany	--	--	--	--	189	144	189	144
Hong Kong	1,240	1,720	--	--	17,900	20,300	19,200	22,000
Italy	--	--	--	--	146	160	146	160
Japan	33,100	45,700	66	73	72,100	84,500	105,000	130,000
Korea, Republic of	257	342	--	--	15,800	20,400	16,100	20,700
Mexico	4,910	7,430	286	451	18,800	22,600	24,000	30,500
Netherlands	52	47	--	--	160	342	212	389
Philippines	--	--	--	--	37	21	37	21
Taiwan	3,070	3,550	108	128	52,900	47,000	56,100	50,700
Thailand	1,200	2,050	--	--	321	551	1,530	2,610
United Kingdom	--	--	--	--	52	45	52	45
Other	818	1,330	33	84	6,540	13,200	7,390	14,600
Total	45,100	62,700	565	818	262,000	284,000	307,000	348,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF ALUMINUM SCRAP, BY COUNTRY 1/

Country	Remelt scrap ingot		Used beverage container scrap		Other aluminum waste and scrap		Total	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1993:								
Australia	--	--	53	$27	247	$169	300	$196
Bahamas, The	--	--	--	--	354	102	354	102
Brazil	--	--	--	--	4	14	4	14
Canada	225	$223	21,900	17,400	157,000	148,000	179,000	166,000
China	--	--	--	--	199	183	199	183
Colombia	--	--	711	571	329	320	1,040	891
Germany	8,060	8,670	--	--	1,130	1,100	9,190	9,770
Guatemala	--	--	56	46	847	298	902	344
Honduras	--	--	--	--	136	97	136	97
Jamaica	--	--	--	--	482	255	482	255
Japan	--	--	84	53	165	446	250	499
Mexico	159	43	19,200	15,800	27,200	22,100	46,500	38,000
Netherlands	3,650	4,880	20	18	1,260	1,210	4,930	6,120
Panama	14	10	1,330	1,130	769	662	2,120	1,800
Russia	1,180	1,180	--	--	17,500	17,000	18,600	18,200
South Africa, Republic of	--	--	--	--	21	4	21	4
Spain	359	368	--	--	31	40	390	408
Ukraine	110	698	--	--	--	--	110	698
United Kingdom	2,100	2,360	60	53	2,560	2,200	4,730	4,620
Venezuela	3,200	3,100	7,080	4,020	15,500	9,790	25,700	16,900
Other	618	682	1,380	1,040	11,800	9,320	13,800	11,000
Total	19,700	22,200	51,800	40,200	237,000	214,000	309,000	276,000
1994:								
Australia	--	--	91	124	908	759	999	883
Bahamas, The	--	--	--	--	417	124	417	124
Brazil	--	--	--	--	8	23	8	23
Canada	376	471	27,900	29,500	186,000	218,000	214,000	248,000
China	--	--	13	15	91	121	104	136
Colombia	120	185	94	100	742	731	956	1,020
Germany	11,000	13,700	237	252	1,240	1,200	12,500	15,200
Guatemala	--	--	35	5	1,330	961	1,370	966
Honduras	--	--	102	132	140	141	242	272
Jamaica	--	--	9	19	691	429	699	448
Japan	35	87	439	553	304	399	779	1,040
Mexico	362	151	35,600	42,600	32,600	33,300	68,500	76,100
Netherlands	3,440	4,270	--	--	1,360	1,450	4,800	5,720
Panama	--	--	1,710	1,740	1,630	1,600	3,340	3,340
Russia	611	492	--	--	13,100	18,600	13,700	19,100
South Africa, Republic of	--	--	--	--	495	170	495	170
Spain	512	583	42	28	61	46	616	658
Ukraine	--	--	--	--	190	147	190	147
United Kingdom	3,390	4,110	456	502	9,670	10,100	13,500	14,700
Venezuela	5,410	7,210	5,630	5,620	24,800	19,800	35,800	32,600
Other	1,280	1,430	3,740	4,020	11,500	9,750	16,600	15,200
Total	26,600	32,700	76,100	85,200	287,000	318,000	390,000	436,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 7
COPPER RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES,
BY KIND OF SCRAP AND FORM OF RECOVERY 1/

(Metric tons)

	1993	1994
KIND OF SCRAP		
New scrap:		
Copper-base	719,000 r/	792,000
Aluminum-base	28,400	35,100
Nickel-base	117	89
Zinc-base	--	--
Total	748,000 r/	827,000
Old scrap:		
Copper-base	509,000 r/	472,000
Aluminum-base	33,300	28,100
Nickel-base	41	14
Zinc-base	17	23
Total	543,000 r/	500,000
Grand total	1,290,000	1,330,000
FORM OF RECOVERY		
As unalloyed copper:		
At electrolytic plants	337,000	269,000
At other plants	132,000	134,000
Total	470,000	403,000
In brass and bronze	759,000 r/	860,000
In alloy iron and steel	654	583
In aluminum alloys	61,100 r/	62,800
In other alloys	206	115
In chemical compounds	217	219
Total	821,000 r/	924,000
Grand total	1,290,000	1,330,000

r/ Revised.
1/ Previously published and 1994 data are rounded to three significant digits; may not add to totals shown.

TABLE 8
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	1993	1994	1993	1994	1993	1994
Ingot makers	34,700	34,000	92,100	93,500	127,000	128,000
Refineries 2/	113,000	92,900	347,000	299,000	460,000	392,000
Brass and wire-rod mills	552,000 r/	639,000	38,700 r/	46,900	590,000 r/	686,000
Foundries and manufacturers	19,900	25,300	31,600	32,900	51,600 r/	58,300
Chemical plants	217	219	--	--	217	219
Total	719,000 r/	792,000	509,000 r/	472,000	1,230,000 r/	1,260,000

r/ Revised.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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 9
PRODUCTION OF SECONDARY COPPER AND COPPER-ALLOY PRODUCTS
IN THE UNITED STATES, BY ITEM PRODUCED FROM SCRAP 1/

(Metric tons)

Item produced from scrap	1993	1994
Unalloyed copper products		
Electrolytically refined copper	337,000	269,000
Fire-refined copper	123,000	122,000
Copper powder	9,180	10,600
Copper castings	631	697
Total	470,000	403,000
Alloyed copper products		
Brass and bronze ingots:		
Tin bronzes	15,200	14,800
Leaded red brass and semi-red brass	91,400	95,400
High leaded tin bronze	10,100	11,300
Yellow brass	7,420	8,290
Manganese bronze	6,760	7,500
Aluminum bronze	7,930	8,070
Nickel silver	2,230	3,070
Silicon bronze and brass	7,080	7,630
Copper-base hardeners and master alloys	7,860	9,680
Miscellaneous	5,440	1,360
Total	161,000	167,000
Brass mill and wire rod mill products	733,000	849,000
Brass and bronze castings	43,900	49,000
Brass powder	263	342
Copper in chemical products	217	219
Grand total	1,410,000	1,470,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

TABLE 10
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/							
1993	131,000	4,850 r/	8,230 r/	17,300	319	42	161,000
1994	135,000	4,850	8,300	18,200	244	35	167,000
Secondary metal content of brass mill products:							
1993	590,000	612	6,050	134,000	W	W	733,000
1994	686,000	882	6,730	152,000	W	W	849,000
Secondary metal content of brass and bronze castings:							
1993	38,900	837	1,420	2,460	78	138	43,900
1994	43,800	1,000	1,460	2,480	110	131	49,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ About 96% from scrap and 4% from other than scrap in 1993 and in 1994.

TABLE 11
CONSUMPTION AND YEAR ENDING STOCKS OF COPPER-BASE SCRAP 1/

(Metric tons, gross weight)

Scrap type and processor	1993		1994	
	Consumption	Stocks	Consumption	Stocks
No. 1 wire and heavy:				
Smelters, refiners and ingot makers	178,000	7,210	151,000	7,740
Brass and wire-rod mills	274,000	NA	329,000	NA
Foundries and misc. manufacturers	28,600	NA	33,900	NA
No. 2 mixed heavy and light:				
Smelters, refiners and ingot makers	338,000	12,100	311,000	13,800
Brass and wire-rod mills	42,100	NA	46,200	NA
Foundries and misc. manufacturers	5,590	NA	4,170	NA
Total unalloyed scrap:				
Smelters, refiners and ingot makers	516,000	19,300	462,000	21,600
Brass and wire-rod mills	316,000	14,500 r/	375,000	13,900
Foundries and misc. manufacturers	34,200	2,840	38,100	3,320
Red brass: 2/				
Smelters, refiners and ingot makers	44,200	2,480	40,700	2,800
Brass mills	5,610	NA	8,340	NA
Foundries and misc. manufacturers	11,600	NA	13,300	NA
Leaded yellow brass:				
Smelters, refiners and ingot makers	24,000	1,460	25,400	1,410
Brass mills	309,000	NA	354,000	NA
Foundries and misc. manufacturers	1,960	NA	1,850	NA
Yellow and low brass:				
All plants	74,600	1,250	73,600	1,540
Cartridge cases and brass:				
All plants	54,300	NA	61,100	NA
Auto radiators:				
Smelters, refiners and ingot makers	65,700	2,010	64,700	1,910
Foundries and misc. manufacturers	6,100	NA	6,270	NA
Bronzes:				
Smelters, refiners and ingot makers	13,100	632	12,500	866
Brass mills and misc. manufacturers	10,500	NA	10,700	NA
Nickel-copper alloys:				
All plants	14,800	327	21,900	360
Low grade and residues:				
Smelters, refiners and misc. manufacturers	161,000	9,450	81,200	8,250
Other alloy scrap: 3/				
Smelters, refiners and ingot makers	27,900	1,530	50,300	2,840
Brass mills and misc. manufacturers	5,810	NA	6,900	NA
Total alloyed scrap:				
Smelters, refiners and ingot makers	376,000	19,100	316,000	20,000
Brass mills	428,000	24,300 r/	488,000	34,700
Foundries and misc. manufacturers	26,500	2,820 r/	29,000	3,340
Total scrap:				
Smelters, refiners and ingot makers	892,000	38,500	779,000	41,500
Brass and wire-rod mills	744,000	38,800 r/	862,000	48,600
Foundries and misc. manufacturers	60,700	5,650 r/	67,100	6,660

NA Not available. r/Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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 12
CONSUMPTION OF PURCHASED COPPER-BASE SCRAP 1/ 2/

(Metric tons, gross weight)

Type of operation	From new scrap		From old scrap		Total	
	1993	1994	1993	1994	1993	1994
Ingot makers	46,500	45,600	136,000	139,000	183,000	185,000
Smelters and Refineries	179,000	158,000	529,000	436,000	709,000	594,000
Brass and wire-rod mills	704,000	806,000	40,000	56,700	744,000	862,000
Foundries, etc.	24,600 r/	29,300	36,100 r/	37,800	60,700 r/	67,100
Total	955,000	1,040,000	742,000	670,000	1,700,000	1,710,000

r/ Revised.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Consumption at brass and wire-rod mills assumed equal to receipts.

TABLE 13
FOUNDRIES AND MISCELLANEOUS MANUFACTURERS CONSUMPTION
OF BRASS INGOT AND REFINED COPPER AND COPPER SCRAP
IN THE UNITED STATES 1/

(Metric tons)

Ingot type	1993	1994
Tin bronzes	32,800	30,800
Leaded red brass and semi-red brass	63,600 r/	71,800
Yellow, leaded and low brass 2/	7,540 r/	8,130
Manganese bronze	4,130	4,330
Nickel silver 3/	886	1,050
Aluminum bronze	4,160	3,630
Hardeners and master alloys 4/	3,010	2,650
Total brass ingot	116,000	122,000
Refined copper consumed	37,800	41,500
Copper scrap consumed	60,500	66,800

r/ Revised.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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 14
AVERAGE PRICES FOR COPPER SCRAP AND ALLOY-INGOT, BY TYPE

(Cents per pound)

Year	Brass mills No. 1 scrap	Refiners No. 2 scrap	Dealers' buying (New York) No. 2 scrap	Dealers' buying (New York) Red brass turnings and borings	Alloy-ingot (New York) No. 115 brass (85-5-5-5)	Alloy-ingot (New York) Yellow brass (405)
1993	81.28	69.65 r/	63.84	45.22	120.25 r/	116.92 r/
1994	100.83	85.15	69.83	47.45	121.50	118.54

r/ Revised.

Source: American Metal Market.

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

Country or Territory	Unalloyed copper scrap 1993 Quantity (metric tons)	Unalloyed copper scrap 1993 Value (thousands)	Unalloyed copper scrap 1994 Quantity (metric tons)	Unalloyed copper scrap 1994 Value (thousands)	Copper-alloy scrap 1993 Quantity (metric tons)	Copper-alloy scrap 1993 Value (thousands)	Copper-alloy scrap 1994 Quantity (metric tons)	Copper-alloy scrap 1994 Value (thousands)
Belgium	3,130	$1,400	1,130	$1,330	800	$2,500	4,060	$9,550
Canada	42,800	39,300	73,700	98,700	11,400	20,300	23,200	37,500
China	13,200	12,400	19,100	21,900	41,100	26,700	58,200	43,100
Germany	294	322	157	167	974	1,960	5,820	6,000
Hong Kong	10,000	7,690	13,700	12,900	4,230	4,050	10,100	7,590
India	690	695	1,830	1,700	39,400	30,100	59,700	42,000
Italy	231	278	445	818	124	147	3,810	5,480
Japan	25,300	44,000	19,700	39,100	17,900	28,900	14,600	47,100
Korea, Republic of	10,400	16,300	8,680	16,400	26,000	29,100	18,400	21,700
Mexico	430	459	177	194	724	925	1,320	2,400
Singapore	1,180	844	451	580	862	974	477	615
Spain	--	--	--	--	4	10	6,100	975
Sweden	--	--	--	--	645	1,230	681	1,350
Taiwan	1,080	759	1,420	2,090	4,400	2,190	4,040	3,870
Thailand	160	336	40	50	963	1,560	1,730	2,080
United Kingdom	102	110	41	61	761	492	1,380	3,040
Other	778 r/	1,180 r/	1,160	1,440	2,030 r/	2,500 r/	3,890	5,690
Total	110,000	126,000	142,000	197,000	152,000	154,000	218,000	240,000

r/ Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 16
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)
1993	45,800	$74,100	154,000	111,000	$233,000
1994:					
Canada	58,300	98,000	20,600	14,900	41,000
Chile	121	156	11,300	8,130	25,400
Colombia	1,650	2,470	174	125	192
Costa Rica	272	368	553	398	407
Dominican Republic	733	1,340	782	563	1,230
Ecuador	829	1,030	84	60	128
Finland	2,630	4,940	--	--	--
Jamaica	110	141	532	383	384
Mexico	24,100	32,800	17,900	12,900	29,700
Panama	606	727	683	492	1,210
Taiwan	1,650	1,420	109	78	63
United Kingdom	738	1,190	460	331	354
Venezuela	5,750	8,100	3,320	2,390	2,480
Other	4,640	7,570	1,860	1,340	2,120
Total	102,000	160,000	58,400	42,000	105,000

e/ Estimated.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ C.i.f. value at U.S. port.
3/ Under the Harmonized Tariff System that was implemented Jan. 1989, copper content is no longer available. Content is estimated to be 72% of gross weight.

Source: Bureau of the Census.

TABLE 17
STOCKS AND CONSUMPTION OF NEW AND OLD LEAD SCRAP IN THE UNITED STATES, BY TYPE OF SCRAP 1/

(Metric tons, gross weight)

Type of scrap	Stocks, Jan. 1	Receipts	Consumption			Stocks, Dec. 31
			New scrap	Old scrap	Total	
1993						
Smelters, refiners, others:						
Soft lead 2/	357	13,700 r/	--	13,200 r/	13,200 r/	894 r/
Hard lead	W	W	--	5,480 r/	5,480 r/	W
Cable lead	699 r/	4,300 r/	--	W	W	W
Battery-lead	19,700 r/	846,000 r/	--	834,000 r/	834,000 r/	31,300 r/
Mixed common babbitt	62 r/	838 r/	--	839 r/	839 r/	61
Solder and tinny lead	W	W	--	W	W	W
Type metals	165 r/	W	--	2,960 r/	2,960 r/	W
Drosses and residues	974 r/	65,800 r/	65,300 r/	--	65,300 r/	1,420 r/
Other	5	103	--	93	93	15
Total	23,800 r/	946,000 r/	65,300 r/	868,000 r/	934,000 r/	36,100 r/
1994						
Smelters, refiners, others:						
Soft lead 2/	894	16,000	--	16,300	16,300	551
Hard lead	W	9,750	--	9,590	9,590	W
Cable lead	W	2,260	--	2,390	2,390	W
Battery-lead	31,300	1,010,000	--	1,010,000	1,010,000	30,200
Mixed common babbitt	61	W	--	W	W	W
Solder and tinny lead	W	W	--	W	W	W
Type metals	W	1,230	--	1,270	1,270	94
Drosses and residues	1,420	62,300	62,200	--	62,200	1,550
Other	15	W	--	W	W	W
Total	36,100	1,110,000	62,200	1,050,000	1,110,000	34,700

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Includes remelt lead from cable sheathing plus other soft lead scrap processing.

TABLE 18
SECONDARY METAL RECOVERED 1/ FROM LEAD AND TIN SCRAP
IN THE UNITED STATES 2/

(Metric tons)

	Lead	Tin	Antimony	Other	Total
1993					
Refined pig lead 3/	444,000 r/	--	--	--	444,000 r/
Refined pig tin 4/	--	W	--	--	W
Lead and tin alloys:					
Antimonial lead	417,000 r/	748 r/	7,360 r/	W	425,000 r/
Lead-base babbitt	330	50	38	--	418
Solder	(5/)	(5/)	(5/)	W	(5/)
Type metal	849	43	118	3	1,010
Other alloys, including cable lead	15,900	3,850	74	--	19,800
Total	434,000 r/	4,690 r/	7,590 r/	3	446,000 r/
Grand total	878,000 r/	4,690 r/	7,590 r/	3	890,000 r/
1994					
Refined pig lead 3/	510,000	--	W	W	510,000
Refined pig tin 4/	--	W	--	--	W
Lead and tin alloys:					
Antimonial lead	371,000	733	8,480	W	380,000
Lead-base babbitt	W	39	W	W	39
Solder	(5/)	(5/)	(5/)	(5/)	(5/)
Type metal	827	41	114	W	982
Other alloys, including cable lead	15,000	3,340	39	327	18,700
Total	387,000	4,160	8,630	327	400,000
Grand total	897,000	4,160	8,630	327	910,000

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

1/ Most of the figures herein represent actual reported recovery of metal from scrap.

2/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

3/ Includes remelt lead.

4/ Includes remelt tin.

5/ Included with "Other alloys, including cable lead" to avoid disclosing company proprietary data.

TABLE 19
LEAD RECOVERED FROM SCRAP
PROCESSED IN THE UNITED
STATES, BY KIND OF SCRAP
AND FORM OF RECOVERY 1/

(Metric tons)

	1993	1994
KIND OF SCRAP		
New scrap:		
Lead-base	48,200 r/	47,100
Copper-base	6,870 r/	8,000 e/
Tin-base	(2/)	--
Total	55,000 r/	55,100
Old scrap:		
Battery-lead	796,000 r/	816,000
All other lead-base	33,500 r/	33,800
Copper-base	8,780 r/	8,000 e/
Tin-base	--	--
Total	838,000 r/	858,000
Grand total	893,000 r/	913,000
FORM OF RECOVERY		
As soft lead	444,000 r/	510,000
In antimonial lead	417,000 r/	371,000
In other lead alloys	17,000	16,100
In copper-base alloys	15,600 r/	16,000 e/
In tin-base alloys	(2/)	1
Total	893,000 r/	913,000
Value 3/ thousands	$625,000 r/	$748,000

e/ Estimated. r/ Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Revised to zero.

3/ Value based on average quoted price of common lead.

TABLE 20
U.S. EXPORTS AND IMPORTS FOR CONSUMPTION OF LEAD SCRAP, BY COUNTRY 1/

Country	1993		1994	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
EXPORTS				
Scrap (gross weight):				
Antigua and Barbuda	1	$20	91	$16
Bahamas, The	119	54	(2/)	27
Belgium	30	3	22	64
Brazil	4,680	643	4,110	936
Canada	38,700	6,840	68,400	13,000
Cayman Islands	--	--	100	10
China	1,550	372	458	288
Colombia	452	84	15	320
Costa Rica	30	24	558	208
Germany	105	35	15	119
Hong Kong	656	323	49	19
India	970	237	941	156
Jamaica	--	--	34	3
Japan	520	511	127	321
Korea, Republic of	2,680	3,000	9,440	6,070
Malaysia	134	59	--	--
Mexico	2,030	1,010	903	1,140
Panama	--	--	137	37
Philippines	107	42	--	--
Russia	--	--	34	78
Singapore	1	66	782	292
Spain	26	15	--	--
Taiwan	522	149	250	113
Thailand	189	23	(2/)	3
United Arab Emirates	39	4	268	27
United Kingdom	457	219	903	292
Venezuela	4	80	315	83
Other	113 r/	622 r/	143	864
Total	54,100	14,400	88,100	24,500
IMPORTS				
Reclaimed scrap, including ash and residues (lead content): 3/				
Canada	58	29	128	39
Other	19 r/	11	16	40
Total	78 r/	39	144	80

r/ Revised.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.
3/ Also includes other lead-bearing materials containing greater than 10% by weight of copper, lead, or zinc (any one).

Source: Bureau of the Census.

TABLE 21
TIN RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY FORM OF RECOVERY 1/

(Metric tons unless otherwise specified)

Form of recovery	1993	1994
Tin metal 2/	W	W
Bronze and brass e/ 3/	10,300 r/	10,800
Lead and tin alloys:		
Antimonial lead	748 r/	733
Babbitt	51	W
Type metal	43	41
Other alloys 4/	(5/)	(5/)
Total	842 r/	774
Tin content of chemical products	W	W
Grand total	11,100 r/	11,600
Value (thousands) e/ 6/	$85,900 r/	$94,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Grand total."
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Includes tin metal recovered at detinning and other plants.
3/ Includes tin recovered from copper-, lead-, and tin-base scrap.
4/ Includes foil, solder, terne metal, and cable lead.
5/ Withheld to avoid disclosing company proprietary data; not included in "Total."
6/ Based on Platt's Metals Week composite price.

TABLE 22
U.S. STOCKS, RECEIPTS, AND CONSUMPTION OF NEW AND OLD SCRAP AND TIN RECOVERED, BY TYPE OF SCRAP 1/

(Metric tons)

Type of scrap	Gross weight of scrap						Tin recovered e/ 2/		
	Stocks, Jan. 1	Receipts	Consumption New	Consumption Old	Consumption Total	Stocks, Dec. 31	New	Old	Total
1993									
Copper-base scrap	5,680	132,000	29,500	102,000	131,000	6,190	1,460	3,430	4,890
Brass mills 3/	--	26,300	26,300	(4/)	26,300	--	613	--	613
Foundries and other plants	2,560	20,900	9,620	11,500	21,100	2,290 r/	401	470	871
Total tin from copper-base scrap	XX	XX	XX	XX	XX	XX	2,480	3,900	6,370
Lead-base scrap r/	23,100	921,000	65,300	845,000	910,000	34,100	1,720	3,010	4,720
Tin-base scrap 5/	W	46	W	44	W	W	W	43	43
Grand total	XX	XX	XX	XX	XX	XX	4,190 r/	6,950 r/	11,100 r/
1994									
Copper-base scrap	6,190	129,000	26,600	102,000	129,000	6,570	1,270	3,520	4,800
Brass mills 3/	--	55,600	47,400	W	47,400	--	802	W	802
Foundries and other plants	2,290	24,200	10,200	13,500	23,800	2,730	477	574	1,050
Total tin from copper-base scrap	XX	XX	XX	XX	XX	XX	2,550	4,100	6,650
Lead-base scrap	34,100	1,080,000	62,200	1,020,000	1,080,000	33,000	1,630	3,230	4,860
Tin-base scrap 5/	W	59	W	53	W	W	W	51	51
Grand total	XX	XX	XX	XX	XX	XX	4,180	7,380	11,600

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Tin recovered from new and old copper-base scrap, brass mills, and foundries.

3/ Brass-mill stocks include home scrap, and purchased-scrap consumption is assumed equal to receipts; therefore, line does not balance.

4/ Revised to zero.

5/ Includes tinplate and other scrap recovered at detinning plants; U.S. Bureau of Mines not at liberty to publish separately.

TABLE 23
STOCKS AND CONSUMPTION OF NEW AND OLD ZINC SCRAP IN THE UNITED STATES IN 1994, BY TYPE OF SCRAP 1/

(Metric tons, zinc content)

Type of scrap	Stocks, Jan. 1	Receipts	Consumption New scrap	Consumption Old scrap	Consumption Total	Stocks, Dec. 31
Diecastings	W	4,620	--	4,550	4,550	W
Flue dust	W	10,500	4,940	4,920	9,860	4,380
Fragmentized diecastings	W	W	--	W	W	W
Galvanizer's dross	2,470 r/	65,300	65,800	--	65,800	1,940
Old zinc 2/	85 r/	839	--	863	863	61
Remelt die-cast slab	W	W	--	W	W	W
Remelt zinc 3/	W	W	W	--	W	W
Skimmings and ashes 4/	7,040 r/	29,500	29,900	--	29,900	6,660
Steelmaking dust	W	W	W	W	W	W
Other 5/	4,980 r/	88,300	6,110	81,600	87,700	1,850
Total	14,600 r/	199,000	107,000	91,900	199,000	14,900

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Other."

1/ Data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes engraver's plates and rod and die scrap.

3/ Includes new clippings.

4/ Includes sal skimmings and die-cast skimmings.

5/ Includes chemical residues and solutions and electrogalvanizing anodes.

TABLE 24
PRODUCTION OF ZINC PRODUCTS FROM ZINC-BASE SCRAP IN THE UNITED STATES 1/

(Metric tons)

Products	1993	1994
Electrogalvanizing anodes	W	W
Redistilled slab zinc	141,000	139,000
Remelt die-cast slab	W	W
Other metal alloys	W	W
Other zinc metal products	13,700	5,960
Secondary zinc in chemical products	65,000	70,700
Zinc dust	16,500	22,300

W Withheld to avoid disclosing company proprietary data, included in in "Other zinc metal products."
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits.

TABLE 25
ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY KIND OF SCRAP AND FORM OF RECOVERY 1/

(Metric tons)

	1993	1994
KIND OF SCRAP		
New scrap:		
Zinc-base	108,000	102,000
Copper-base	137,000	149,000
Magnesium-base	33	28
Total	246,000	251,000
Old scrap:		
Zinc-base	91,000	90,000
Copper-base	17,300	25,200
Aluminum-base	873	707
Magnesium-base	44	43
Total	109,000	116,000
Grand total	355,000	367,000
FORM OF RECOVERY		
Metal:		
Slab zinc	141,000	139,000
Zinc dust	16,500	22,300
Other 2/	10,900	3,050
Total	169,000	165,000
In zinc-base alloys	W	W
In brass and bronze	116,000	128,000
In other metal alloys	W	W
In chemical products:		
Zinc oxide (lead free)	36,000	36,800
Zinc sulfate	18,700	W
Zinc chloride	4,240	9,170
Miscellaneous	11,300	28,000
Total	186,000	202,000
Grand total	355,000	367,000

W Withheld to avoid disclosing company proprietary data, included in "Miscellaneous."
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Includes electrogalvanizing anodes and zinc content of slab made from remelt die-cast slab.