TIN

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Tin was not mined in the United States during 1999. Twenty-five firms consumed 81% of reported primary tin used domestically. The major uses were as follows: cans and containers, 22%; electrical, 22%; transportation, 13%; construction, 11%; and others, 32%. The estimated value of primary metal consumed domestically was about $310 million. Industry stocks remained steady (tables 2 and 4).

About 16,300 metric tons (t) of tin in old and new scrap, including tin alloys, were recycled (table 5); of this, about 7,700 t was old scrap. Almost one-fifth of the tin consumed in the United States was produced at 5 detinning plants and 46 secondary nonferrous-metal-processing plants. Interest remained strong in the recycling of used tin cans, partly because of rising fees and limited space at landfills. The recycling rate for steel cans was 58% in 1999, compared with 56% in 1998, 61% in 1997, 58% in 1996, 56% in 1995, 53% in 1994, and 15% in 1988.

During 1999, 765 t of pig tin in the National Defense Stockpile (NDS) was sold; by yearend, 71,671 t remained in the stockpile.

World tin mine output decreased by 5% (tables 1 and 9). Industry observers believed that world supply and demand were in approximate equilibrium. The average Platt's Metals Week composite price for tin declined by 2%.

Of the 21 countries in which tin was mined, the top 6 accounted for 88% of the world total of 198,000 t. China was the largest producer (31% of the world total) and was followed by Indonesia (24%), Peru (15%), Brazil (7%), Bolivia (6%), and Australia (5%) (table 9).

World tin reserves, estimated to be 8 million metric tons (Mt), were considered to be adequate to meet the world's future tin requirements. Assuming that world primary tin consumption will be about 200,000 metric tons per year (t/yr), these reserves would last 38 years. Most tin reserves are in Asia and South America.

Legislation and Government Programs

The NDS continued to be managed by the Defense Logistics Agency (DLA). In 1999, the DLA sold 765 t of pig tin from the stockpile. Due to the large sale in September 1998, DLA did not have any long-term offerings in 1999. The DLA, however, continued its monthly spot tin sales program under the same format as in recent years, with sales being held on the first Wednesday of every month.

The following NDS depots held the largest inventories of tin, in descending order: Hammond, IN; Baton Rouge, LA; Point Pleasant, WV; and New Haven, IN. At yearend, 71,671 t of tin remained in the NDS.

Production

***Mine.*—**Tin was not produced at any U.S. mine in 1999. Until 1993, a few small tin mines had operated in the United States for many years. However, U.S. Geological Survey (USGS) canvasses confirm that there has been no domestic tin production since that year.

Secondary.—The United States is believed by industry observers to be the world's largest producer of secondary tin. Most secondary tin was produced from various scrapped alloys of tin and recycled in those same alloy industries. In 1999, however, tin metal recovered from new tinplate scrap and used tin cans was the only type of secondary tin available in the marketplace as free tin. Secondary tin from recycled fabricated parts was used in many kinds of products and was particularly important for solder production and the brass and bronze industries.

The former Steel Can Recycling Institute, created in 1988 and funded by five domestic tinplate producers to advance the collection, preparation, and transportation of steel can scrap, was in its fifth full year of expanded activities in 1999 under its new name, the Steel Recycling Institute (SRI). The SRI fostered the collection of all steel scrap (ranging from appliances to cars), not just steel cans. Its representatives in various regions of the United States continued to work with municipalities, scrap dealers, and detinners to promote the recycling of tin cans. The SRI announced that the recycling rate for steel cans, most of which are made from tinplate, increased slightly in 1999 to 58% (Steel Recycling Institute, 2000).

In the European Union (EU), a 1994 Directive on Packaging and Packaging Waste set mandatory targets for the recovery and recycling of packaging waste that each member state must achieve by the end of June 2001. Tinplate constitutes a very significant segment of Europe's packaging waste flow, along with aluminum, glass, plastics, etc. In fact, Europe is a larger user of tin for tinplate than is the United States. The EU directive requires that between 50% and 65% of all packaging waste be recovered by 2001, and within this general target, between 25% and 45% of all packaging waste should be recycled. In order to share the burden more equally among all packaging materials, a minimum recycling rate of 15% must be achieved by each packaging material. The directive also specifies that the recycling and recovery targets should be "substantially increased" by 2006. Despite objections from industry, and reservations among member states to delay a new

version, the EU's Waste Unit, which drafted the original directive, is determined to maintain its original timetable. In a move to implement this strategy, EU's Waste Unit recently proposed a new text with very ambitious targets. The text suggests that, by 2006, 75% of all packaging waste shall be recycled with a minimum of 45% for each packaging material (APEAL NEWS, 1999).

Consumption

In 1999, domestic consumption of primary tin increased by 4%, and consumption of secondary tin increased by 3%. Domestic consumption data for tin were developed by the USGS from a voluntary survey of tin consumers. Of the 159 firms to which a survey form was sent, 123 responded, for a 77% response rate (table 3).

In 1999, tinplated steel and tin-free cans accounted for 23% of the 139 billion metal cans shipped domestically; aluminum cans accounted for the remainder. The proportions were the same as in 1998. Steel tinplate dominated in the food, pet, and the "general line" can markets, and aluminum held 100% of the beverage can market (Can Manufacturers Institute, 1999).

The United States Army announced that it had begun producing lead-free 5.56-millimeter bullets for the M-16 rifle in order to reduce lead in the environment. In place of lead, the bullet's core is made of tungsten-tin or a tungsten-nylon mix. Army tests also indicated that the new bullet is more accurate and causes less barrel erosion in the rifle. About 200,000 of the bullets were produced at the Lake City Army Ammunition Plant near Independence, MO, where a million of the bullets are slated to be manufactured in 2000. However, the Army indicated that it would be several years before plants were tooled to make the bullets in larger quantities, and even longer before all small-caliber munitions would be lead-free (Platt's Metals Week, 1999a).

In England, the International Tin Research Institute (ITRI), the world's foremost organization devoted to tin research and market development, distributed tin-shot shotgun shells at a major trade show in Atlanta, GA. The U.S. Fish and Wildlife Service is considering approval of tin shot for shotgun shells used in waterfowl hunting in selected National Wildlife Refuge System areas. If granted, the approval would be in effect for about 1 year. The Fish and Wildlife Service, part of the U.S. Department of the Interior, banned lead shot in 1991 because of concern about contamination of wildlife and the environment. Steel-shot shells are now widely used domestically. ITRI will be acting in partnership with domestic ammunition producer, Kent-Gamebore Co. ITRI officials hope that Kent-Gamebore's sales of tin-shot shells for the next waterfowl hunting season will create a market in America that may motivate worldwide ammunition producers to make their own tin shotgun shells. Kent-Gamebore representatives indicate that they are currently selling tin shotgun shells in Scandinavia and the United Kingdom. They claim that as a "soft metal," tin causes little, if any damage to most gun barrels, unlike steel shot (Platt's Metals Week, 1999b).

Several Japanese electronic equipment manufacturers announced voluntary plans to reduce their use of lead, mostly in solders. Hitachi Ltd. aims to reduce its use of lead solder (compared with 1997 levels) by half in 1999 and to cease using lead solder by 2001. Matsushita (Panasonic) Co. will also stop using lead solder by 2001. Nippon Electric Corp. intends to cut its lead use by 50% by 2002 compared with that of 1997. NTT Corp. is planning to implement a "green procurement of materials" policy by 2001, which will phase out its current use of lead and calcium. Toshiba Corp. is developing lead-free solders for high-density cellular phones. Any displacement of lead in solder is usually a positive note for tin usage, since most solders are lead-tin alloys (ITRA News, 1998).

The polyvinyl chloride (PVC) heat stabilizer market has long represented an important application for tin. The world market for PVC heat stabilizers has been estimated to be $1.5 billion per year. There are major regional differences in the market. In Europe and Asia, lead-based stabilizers are used in applications ranging from rigid PVC, the largest volume market, to wire and cable and packaging. However, plans are underway to use substitutes for lead in many applications. In Europe, substitution for lead has led to the introduction of mixed-metal alternatives by leading manufacturers. In the United States, rigid PVC is dominated by organotin stabilizers, which are not environmentally harmful. Recently, a leading producer introduced two methyltin stabilizers for rigid PVC, adding to its butyltin and octyltin lines (Chemical Week, 1999).

Prices

The Platt's Metals Week average composite price for tin metal rose somewhat during 1999, increasing from $3.49 per pound in January to $3.87 per pound in December. The average composite price for the year was 2% lower than that of 1998.

The London Metal Exchange (LME) remained the primary trading arena for tin. Tin was one of only six metals to be traded on the LME; the other metals included aluminum, copper, lead, nickel, and zinc. The Kuala Lumpur Commodities Exchange in Malaysia continued as an active tin trading forum.

The LME announced the start of an internet-based service offering a full LME trading and execution service. Metallgesellschaft A.G. claimed the new service is the world's first futures system trading tin and base metals on the internet. The system, called Metallgesellschaft Internet Trading System will include a real-time price screen for the LME metals, a multicurrency facility and a voice commentary from the floor of the LME during trading sessions (Metal Bulletin, 1999b).

Foreign Trade

Imports of refined tin, which supplied most domestic tin requirements, increased by 8% in 1999. Imports of tin in all forms (ore and concentrate, metal, waste, and scrap) remained duty free (tables 7 and 8). In the United States, trading firms marketed most of the tin metal imported from a variety of countries and warehoused in this country until sold to customers. Foreign-owned trading firms tended to dominate the field. Some tin was also marketed directly in the United

States by large foreign producers that maintained U.S. sales offices and sold tin metal usually on a 1-year contract basis, only to the largest users. Perhaps foremost among these direct-sale operations was Indo-Metal Corp., which served as the exclusive North American sales outlet for tin metal produced by Indonesia's largest tin producer, PT Tambang Timah.

Imports of tin from the two leading suppliers registered strong gains: imports from China increased 41% and imports from Peru increased 27%. Indonesia and Brazil ranked third and fourth, respectively, as suppliers to the United States. Tin exports were small compared with imports (table 6).

World Review

Argentina.—Sunshine Mining and Refining Co. (USA) appointed Barclay's Capital, the investment banking division of Barclays Bank Plc., and Warrior, a division of Standard Bank London Ltd., as advisors to provide financial advice to Sunshine in relation to the financing and development of the Pirquitas silver-tin mine in Argentina. The advisors will review the project's feasibility study, develop a financing structure, and arrange the necessary bank financing for the project. The goal was to commence mine development in late 1999 and be in production by mid-2001. The deposit remains open at depth and on strike, with numerous other opportunities for expanding silver-tin resources in the immediate area (Tin International, 1999e).

Australia.—Tin Australia NL, formerly the Australian tin mining company Norminco NL, announced that it would reopen the Leichardt Creek Mine in Queensland. Tin production ceased at Leichardt Creek in January 1997 amid financial difficulties. Although it did not mine any tin ore, Tin Australia continued to explore its deposits in recent years. The company estimated that its reserves (tin content) total 19,000 t at its Leichardt alluvial site in addition to 1,400 t in a hardrock deposit at Gift, Queensland. The firm expected to start mining the Gift hardrock reserves in 1999. A full production level of about 2,000 t/yr of tin-in-concentrate was expected to be attained in 2000 (CRU Tin Monitor, 1999c).

Broken Hill Proprietary Company Ltd. (BHP), based in Australia, announced that it would consolidate its steel subsidiary, BHP Steel Co. BHP Steel's projected divestment would involve about one-half of its steel activities, including a tin mill operation. The new, smaller firm will concentrate on flat-rolled products made in Australia, Asia, and New Zealand, taking advantage of relatively low cost steel from the Port Kembla, Australia, steel plant. The firm's tin mill is also based at Port Kembla. BHP Steel recently finished implementation of its tin mill 2000 upgrade at the Port Kembla plant, bringing it up to a capacity of 500,000 t/yr. A second continuous electrolytic tinning line, which has the dual capability of producing tinplate or tin-free-steel, was installed along with a single reduction temper mill, as well as a coil preparation and oiling line. The project also involved major upgrades of the four-high temper and double reduction mill, the continuous annealing line, and the existing electrolytic tinning line. The process of divestiture is scheduled to take place over the next 12 to 18 months. BHP stressed that the tin mill, and all other units to be divested, will continue to operate if they can not be sold (Tin International, 1999b).

The Renison Bell tin mine in Tasmania has had a 38-year history as one of the major tin mines of the world. For most of that period, it was owned by RGC Ltd., formerly known as Renison Goldfields Ltd. But, in 1998, RGC announced that it intended to concentrate on its core business, mineral sands, and thus offered for sale its other operations, including The Renison Bell tin mine. In 1998, Renison Bell was bought by Murchison United Ltd. of Perth, Australia. Before that purchase, Murchison was a small operator with a 60% interest in the Mount Cuthbert solvent extraction-electrowinning copper project, which it managed in Western Australia. The purchase was effected by a complex use of debt financing. In addition, Murchison entered into foreign exchange hedging contracts and tin metal put options to underwrite the debt servicing obligations. During 1999, the new management reduced the work force at Renison Bell from 307 to 225 and began a steady overhaul of the entire treatment circuit. Murchison has renegotiated the existing tin smelter contracts with Malaysia Smelting Corporation (Malaysia) and the Thaisarco tin smelter (Thailand). Renison Bell currently supplies 5% of the Western World's tin concentrate. It treats 750,000 t/yr of tin ore grading 1.8% tin to produce 9,600 t/yr of tin-in-concentrate (Metal Bulletin Monthly, 1999a).

Bolivia.—The Government sold its Vinto tin smelter and Huanuni tin mine for $27 million to Allied Deals Corp. (the United Kingdom). The only other bidders — a consortium of Corporacíon Minera del Sur (COMSUR), Bolivia's largest mining company, and Britain's CDC Corp. — bid $20 million. However, the COMSUR/CDC combine did win exploration rights for the nearby Colquiri tin mine. Vinto has a capacity of 30,000 t/yr of refined tin but is currently operating at less than one-half that level. Allied officials have given some indication that they plan to boost Vinto's output of low-lead tin and also to invest in Huanuni so as to increase the feedstock for Vinto (Ryan's Notes, 1999).

Brazil.—MAMORE S.A., the tin segment of the conglomerate Grupo PARANAPANEMA, announced plans to boost its declining tin production. For several years, the alluvial tin deposits at the Pitinga Mine have been declining. MAMORE plans to change to hard-rock mining of tin during the next 4 to 5 years. An initial regrinding project will produce 16,000 t of tin over a 4-year period, commencing in 2001, from Pitinga's 20 Mt of tailings. MAMORE's production is expected to decline from around 10,500 t in 1999 to 9,000 t in 2000 before stabilizing at 10,000 t over the following 4 years. Production should rise to13,000 t/yr after 2005, assuming that the hardrock program is fully implemented (CRU Tin Monitor, 1999a).

China.—Officials at Yunnan Tin Corp., the country's largest tin smelter, in Gejiu City, produced 23,000 t of tin ingots in 1998. It expected to produce about 24,000 t in 2000, nearly the same as in 1999. China produces about one-third of the world's tin supply, and Yunnan provides about 40% of China's total. Yunnan was privatized in 1999 and sold shares on the Shenzhen Stock Exchange later in the year. Yunnan holds 62% of the issued shares. The Yunnan tin smelter has a

maximum capacity of 30,000 t/yr of tin but could not produce at that level owing to a shortage of raw materials. Reportedly, Yunnan's tin mine sources are rapidly depleting their top-grade ore and are financially unable to further develop the mines or explore for new prospects. However, Yunnan expected to contract with Australia's Ausmelt Technology Corp. for an upgrade of its tin smelter. The project is expected to be completed in 2 years and will include a single Ausmelt furnace that replaces Yunnan's current seven reverberatory furnaces. The new furnace will have the capacity to process 50,000 t of concentrate and produce 24,000 t/yr of ingots (Platt's Metals Week, 1999a).

China's demand for tinplate is forecast to grow strongly in the near term, but the country is expected to remain heavily dependent on imports despite increasing domestic production capacity. Impressive growth in the food and beverage can sector pushed Chinese tinplate demand up to 760,000 t in 1998. By 2000, this figure is expected to reach almost 1 Mt. Currently, China has 11 tinplate producers. In addition, the tinplate production lines at Shenyang Zhongyi Tinplate Co. were due to start up in 1999. This would bring China's total production capacity to 1.5 million metric tons per year (Mt/yr). However, domestic output was only 550,000 t in 1998. This was largely because Chinese-produced tinplate is often of lower quality than imported material in terms of flatness, uniformity of tin coating, and surface finish. Also, many Chinese tinplating lines rely on imported blackplate as a feedstock. Only the Baoshan and Wuhan steelworks are capable of producing blackplate that matches the quality of imports (Metal Bulletin, 1999a).

The Hainan Haiwoo Tinplate Company, owned by Chinese, Japanese, and South Korean interests, started the manufacture of tinplate in July 1997 to supply local can manufacturers. In 1999, Kawasaki Steel Corp. (Japan) acquired a 16% interest in Hainan. In addition, the trading firm, Nissho Iwai Corp. (Japan), is increasing its investment share in Hainan from 5% to 18%. Hainan owns a tin electroplating line with an annual capacity of 100,000 t of tinplate. Its production of tinplate is running at about 30,000 t/yr with sales of $23 million. But this is expected to rise to 60,000 to 70,000 t with sales of $40 to $50 million in 2000. Hainan Island is designated by the Chinese Government as a special economic zone with tax incentives. Value-added tax on processed materials, including tin, is exempted (American Metal Market, 1999c).

The Ministry of Land and Natural Resources announced that it had issued a notice banning new mining projects between April 23, 1999, and December 31, 2000, for eight minerals to ease "overproduction and reckless exports." The eight minerals included tin as well as antimony, barite, coal, fluorite, molybdenum, rare earths, and tungsten (American Metal Market, 1999a).

Indonesia.—The Government announced that it plans to dispose of its majority ownership in PT Timah, the world's largest integrated tin producer, during the 1999-2000 financial year. PT Timah is 1 of the 12 Indonesian state firms whose privatization was required by the International Monetary Fund in return for a multibillion dollar bail-out of the country's economy. The Government owns about 65% of PT Timah, and it is seeking to sell 30% of Timah to a private investor, leaving it with a minority holding of about 35%. In fact, the Government reportedly has indicated that it will consider selling more than 30% of Timah if bid prices prove to be strong. Reportedly, there is considerable interest in the available shares, owing to the company's recent profitability. Aided by the devaluation of the Indonesian currency (the rupiah), tin production costs fell from $4,083 per metric ton in 1997 to $2,538 per metric ton in 1998, while the average tin price received by the company remained fairly steady between 1997 and 1998. Recently, Timah has expressed a desire to diversify into the coal and gold markets with the goal of enhancing the firm's status in world commodity markets. However, tin appears certain to remain its key business in the near future, given its profitability (CRU Tin Monitor, 1999d).

Kyrgyzstan.—A new company, Sarynzhasolovo, was set up by the Deputatsky Mining Company (Russia) and the Sibenergomos Group (Finland) to start tin mining operations in Kyrgyzstan. Deputatsky and Sibenergomos hold equal shares in the joint-venture company, with the technical expertise being provided by Deputatsky and the capital by Sibenergomos. The tin deposit is at Trudovoy, which is believed to have reserves of 280,000 t of tin and 120,000 t of tungsten. Production is expected to be 1,000 t of tin concentrate and 500 t/yr of tungsten concentrate, with the tin concentrates to be smelted at the Novosibirsk Tin Combine (Tin International, 1999c).

Mexico.—A major steel producer, Altos Hornos de Mexico (AHMSA), announced that it intends to increase its annual production of tinplate from 130,000 t to 320,000 t. The company also plans to develop the capacity to produce double-reduced tinplate as part of the expansion. Double-reduced tinplate is produced using extra-thin cold-rolled steel, enabling much lighter corrosion-resistant metal packaging. The expansion is scheduled to be fully commissioned during 2001. AHMSA, which is in the state of Coahuila, is the only producer of tinplate in Mexico, and therefore excess demand for metal packaging currently is met by imports. The proposed expansion of AHMSA's tinplate production is expected to at least double the amount of refined tin consumed by the company. Currently, AHMSA consumes about 420 t/yr of refined tin. At present, the firm imports all of its refined tin from Bolivia (CRU Tin Monitor, 1999b).

Pakistan.—The country gained its first domestic source of tinplate in June, when the Siddiqsons Group started commercial production on a 120,000-t/yr line at Winder in Baluchistan. The new line was equipped by Itam, and Sollac (France) and Mitsubishi Corp. (Japan) are shareholders in the facility. Siddiqsons officials said the facility is targeted to produce at about 70% of capacity in its first year of operation. Sollac is contracted to supply 50% of the blackplate feedstock in the first year and Mitsubishi 25%. The project's total cost is $30 million, of which 40% is equity financed. Sollac and Mitsubishi hold 7% each and Siddiqsons 45%; another 25% has been privately placed. Siddiqsons planned to sell the remaining 16% of the equity. The facility is expected to sell its output mainly to the clarified butter industry, which constitutes about 70% of the tinplate demand in Pakistan (Metal Bulletin, 1999c).

Russia.—The London-based Russian Tin Sales Ltd. (RTS) announced its plans for boosting the Russian tin industry. RTS intends to provide feedstock for the Novosibirsk Tin Works in Russia, which continues to produce well below capacity. RTS also planned to restart Siberian Tin Mines with the help of Novosibirsk. With a nominal capacity of 20,000 t/yr, Novosibirsk has the capability to process complex feedstock (Metal Bulletin, 1999d).

Slovakia.—VSZ/U.S. Steel, the joint venture of Pittsburgh-based U.S. Steel Corp. and Slovak steelmaker VSZ, announced that it would restart an expansion project at its steel mill in Slovakia that was suspended early in 1999 because of VSZ's financial troubles. In the first phase of the expansion, VSZ intends to complete a double cold-reducing temper mill and associated upgrades that will lift tinplate production capacity from the current 140,000 t/yr to 340,000 t/yr. VSZ will then have the widest product range among central European Steel manufacturers, enabling it to meet the region's demand for value-added tinplate. The project will be funded partly by capital from U.S. Steel Corp. All new facilities were designed to exceed western European environmental standards. Upon completion of the first phase at the end of 2000, Italian plant builder Danieli SpA. is to deliver new continuous annealing and electrolytic tinning lines (American Metal Market, 1999d).

Thailand.—Thaisarco, the country's only tin smelter, has registered steady increases in refined tin production each of the 5 years that it had been part of the AMC Group. Officials explained the substantial production increases of the previous 2 years by noting that Thaisarco has been filling the supply gap that opened when AMC closed its Escoy Smelter in Penang, Malaysia. The smelter has a capacity of 36,000 t/yr. The company estimated domestic tin demand to be 4,600 t in 1999, still well below the 6,000 t/yr reached in 1996 before the major Asian economic crisis. Government officials indicated that the country had 29 tin mines operating, compared with 23 in 1998 (Platt's Metals Week, 1999d).

United Kingdom.—Early in 1999, there appeared to be a buyer for the South Crofty tin mine in the Cornwall district, the last tin mine operating in the United Kingdom. The mine had closed in March 1998, but the pumps were kept operating. When financing for the sale was not forthcoming, however, the mine was officially closed (Platt's Metals Week, 1999c).

A report on the environmental impact of the former Capper Pass tin smelter once operated by Rio Tinto Plc. in Hull was awaiting the release of occupational health records on former employees. The report was being prepared on behalf of the Transport and General Workers Union and has encompassed 2 years of study thus far. Attorneys needed the occupational health records to evaluate what responsibility Capper Pass may have had for any possible health problems of former employees (Metal Bulletin, 1999e). Capper Pass ceased operations in 1991. The facility was the world's largest tin smelter for many decades. It was rather unique in its ability to process concentrates and residues with tin content as low as 18%. Rio Tinto had purchased the tin smelter in 1965 and sold it to Melton Land Ltd. in 1995 following its decommissioning.

British Steel Corp. (the United Kingdom) and Hoogovens Ijmuiden BV (the Netherlands) jointly announced their intention to merge and thereby become the third largest steel producer in the world, second only to Posco Corp. (The Republic of Korea) and Nippon Steel Corp. (Japan). The new name for the merged entity would be Corus Group. British Steel, being the larger company, would constitute 60% of the new group. Both firms have a strong presence in the tinplate industry. This is the third major merger within the European Steel industry in the last 2 years. The combination, follows the merger of Thyssen Corp. and Krupp Corp. (both in Germany) and the merger of Usinor (France) and Cockerill-Sambre (Belgium). Almost all of the merging firms are tinplate producers; the mergers reduce the number of the EU tinplate producers to three. Hoogovens made about 800,000 t of tinplate in 1998 at its five tinning lines, including the one in Norway. British Steel's tinplate production is of the same order. At a combined production of about 1.5 Mt/yr, Corus emerges as the largest tinplate producer in Europe; the next two in size each make just over 1 Mt/yr. Corus will hold an expected 35% of the European tinplate market (Tin International, 1999a).

Current Research

The ITRI, based in Uxbridge, United Kingdom, the largest laboratory for tin scientific research and market development, completed its fifth full year under a new structure. It is now privatized, with funding supplied by several major tin producers and user organizations rather than by the Association of Tin Producing Countries, as had been the case in earlier years. The ITRI continued to focus its research efforts in several areas that would take advantage of tin's relative nontoxicity compared with other metals: lead-free solders, antimony-free flame-retardant chemicals, and lead-free shotgun pellets (Metal Bulletin Monthly, 1999b).

The ITRI also announced the opening of its new SOLDERTEC center, also located at Uxbridge. The center is designed to be a focal point for:

a) information on worldwide legislative movements which could encompass a ban on the use of lead in solder,
b) initiatives being taken in leading industrial countries to adapt to the possibility of bans on lead, and
c) approaches to ease the way for industry to use new technologies that will be needed to cope with alternative materials.

Research into lead-free alloys for soldering has been proceeding for more than 10 years, beginning with new alloys for potable water plumbing, and now is concentrating on the use of lead-free solder alloys in electronics manufacturing. ITRI's specialists generally have been recommending alloys within a certain composition range of the tin-copper-silver system as replacements for tin-lead alloys. This system appears to be most suitable for surface mount, wave and hand soldering, etc. While the electronics industry has for some time recognized that tin-lead solder will eventually need to be eliminated in their products, there is currently no "one-size-fits-all" specific alloy to replace it (Tin International, 1999b).

In Tokyo, Japan, Honda Motor Co. announced the development of a lead-free fuel tank for automobiles made from

tin-zinc plated steel supplied by Nippon Steel Corp. The new fuel tank involves not only tin-zinc plated steel but also tin-gold soldering, seam-welding, and spot welding techniques. Honda claimed that the new tin-zinc plated steel was adopted because it was able to meet requirements involving processability, corrosion resistance, soldering, and paintability (American Metal Market 1999b).

In Pittsburgh, PA, researchers at the University of Pittsburgh's School of Engineering developed a lead-free alternative to steel grade 12L14, a commonly used free-machining steel. Tin is used as the replacement for lead, which traditionally has been added to steel to make it more machinable. The development may not only eliminate an environmental hazard, but may also offer cost savings. The research was largely supported by an international consortium of steel producers and users. The University created the international consortium to commercialize the technology and has also signed a technology licensing agreement with the consortium. The consortium is a limited liability company (LLC) known as the Nonleaded Free Machining Steel Consortium LLC. The producer members of the LLC will produce the lead-free steel commercially and license it to others. Members include the University of Pittsburgh; United Alloys and Steel Corp.; MacSteel Co., a division of Quanex Corp.; Curtis Screw Co.; Saarstahl Steel AG; and Laurel Steel Co., a division of Harris Steel Ltd. USS/Kobe Steel Co., which has the option of joining the consortium, has also provided financial support. After selecting tin as the most suitable replacement for lead, researchers at the University of Pittsburgh experimented with different ratios of tin in steel. The final selected tin content reportedly not only makes the steel more machinable but also could permit a substantial reduction in the machining cost of the final components. A test of the final product, completed recently at USS/Kobe Steel Co., found that a 200-ton heat of the steel performed well. The most common use for the steel could be in automobile parts, and there are indications that major automakers in Germany and the United States will be willing to use lead-free steel if it is competitively available (JOM, 1999).

Outlook

Domestic demand for primary tin is expected to grow slowly in the next few years, at a rate of perhaps 1% per year. That rate could double in a few years, however, if new applications, especially those in which tin is substituted for toxic materials, find acceptance in the marketplace.

World tin reserves appear to be adequate to meet forseeable demand. Secondary sources of tin are likely to remain an important component of tin supply, especially in the United States. The NDS sales are expected to continue in coming years and remain an important segment of domestic tin supply. Domestic tin needs, however, will probably continue to be met primarily through imports.

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TABLE 1
SALIENT TIN STATISTICS 1/

(Metric tons of contained tin, unless otherwise specified)

	1995	1996	1997	1998	1999
United States:					
Production:					
Secondary e/	11,600	11,600	12,400	16,300 r/	16,300
Exports, refined tin	2,790	3,670	4,660	5,020	6,770
Imports for consumption, refined tin	33,200	30,200	40,600	44,000	47,500
Consumption:					
Primary	35,200	36,500	36,200	37,100	38,400
Secondary	10,800	8,180	8,250	8,620	8,890
Stocks, yearend, U.S. industry	11,700	10,900	11,200	10,500 r/	10,700
Prices, average cents per pound:					
New York market	294.54	288.10	264.45	261.38	254.54
Platt's Metals Week composite	415.61	412.43	381.49	373.26	365.98
London	282.00	279.00	256.00	251.00	245.00
Kuala Lumpur	277.50	275.19	252.24	246.06	240.70
World: Production:					
Mine	201,000 r/	220,000 r/	217,000 r/	208,000 r/	198,000
Smelter:					
Primary	204,000	211,000	226,000 r/	226,000 r/	243,000 e/
Secondary	18,900	16,700	17,500 r/	20,400 r/	25,900 e/
Undifferentiated	200	200	200	200	100 e/

e/ Estimated. r/ Revised.

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

TABLE 2
U.S. CONSUMPTION OF PRIMARY AND SECONDARY TIN 1/

(Metric tons of contained tin)

	1998	1999
Stocks, January 1 2/	9,280 r/	9,290
Net receipts during year:		
Primary	39,900	40,800
Secondary	2,490	2,790
Scrap	6,240	6,380
Total receipts	48,600 r/	50,000
Total available	57,900 r/	59,300
Tin consumed in manufactured products:		
Primary	37,100	38,400
Secondary	8,620	8,890
Total	45,700	47,300
Intercompany transactions in scrap	137	110
Total processed	45,800	47,400
Stocks, December 31 (total available less total processed)	12,000 r/	11,900

r/ Revised.

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

2/ Includes tin in transit in the United States.

TABLE 3
U.S. CONSUMPTION OF TIN, BY FINISHED PRODUCT 1/

(Metric tons of contained tin)

Product	1998			1999		
	Primary	Secondary	Total	Primary	Secondary	Total
Alloys (miscellaneous) 2/	W	W	W	W	W	W
Babbitt	831	185	1,020	1,450	156	1,610
Bar tin	704	W	704	718	W	718
Bronze and brass	1,700	1,910	3,610	1,450	1,960	3,410
Chemicals	8,180 r/	W	8,180 r/	8,220	W	8,220
Collapsible tubes and foil	238	W	238	45	W	45
Solder	11,900	4,960	16,900	12,800	5,960	18,700
Tinning	1,100	W	1,100	862	W	862
Tinplate 3/	8,900	W	8,900	9,150	--	9,150
Tin powder	W	W	W	W	W	W
Type metal	W	W	W	W	W	W
White metal 4/	778	W	778	892	W	892
Other	2,700	1,560	4,260	2,800	822	3,620
Total	37,100	8,620	45,700	38,400	8,890	47,300

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Other." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes terne metal.
3/ Includes secondary pig tin and tin acquired in chemicals.
4/ Includes pewter, britannia metal, and jewelers' metal.

TABLE 4
U.S. INDUSTRY YEAREND TIN STOCKS 1/

(Metric tons)

	1998	1999
Plant raw materials:		
Pig tin:		
Virgin 2/	7,470 r/	6,990
Secondary	716	882
In process 3/	1,080	1,100
Total	9,260 r/	8,970
Additional pig tin:		
Jobbers-importers	804	1,470
Afloat to United States	425	240
Total	1,230	1,710
Grand total	10,500 r/	10,700

r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes tin in transit in the United States.
3/ Data represent scrap only, tin content.

TABLE 5
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, January 1	Receipts	Consumption New	Consumption Old	Consumption Total	Stocks, December 31	New	Old	Total
1998:									
Copper-base scrap	5,800	127,000 r/	27,300 r/	99,200 r/	127,000 r/	6,350 r/	1,210 r/	3,620 r/	4,830 r/
Brass mills 3/	--	47,000	47,000	--	47,000	--	987	--	987
Foundries and other plants	1,880	14,700 r/	5,840	8,660 r/	14,500 r/	2,110 r/	275	342 r/	617 r/
Total	XX	XX	XX	XX	XX	XX	2,470 r/	3,960 r/	6,430 r/
Lead-base scrap	23,400 r/	1,400,000	65,600	1,340,000	1,400,000	25,400	1,720	3,830	5,550
Tin-base scrap 4/	W	W	W	W	W	W	4,280	W	4,280
Grand total r/	XX	XX	XX	XX	XX	XX	8,470	7,790	16,300
1999:									
Copper-base scrap	6,350	124,000	28,000	96,000	124,000	6,420	1,230	3,620	4,860
Brass mills 3/	--	57,600	57,600	--	57,600	--	947	--	947
Foundries and other plants	2,110	17,400	5,970	11,400	17,400	2,170	282	401	683
Total	XX	XX	XX	XX	XX	XX	2,460	4,020	6,490
Lead-base scrap	25,400	1,310,000	61,200	1,250,000	1,310,000	21,500	1,610	3,670	5,280
Tin-base scrap 4/	W	W	W	W	W	W	4,580	W	4,580
Grand total	XX	XX	XX	XX	XX	XX	8,650	7,700	16,300

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

1/ Data are rounded to no more than 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 to be equal to receipts; the line, therefore, does not balance.

4/ Includes tinplate and other scrap recovered at detinning plants.

TABLE 6
U.S. EXPORTS OF TIN IN VARIOUS FORMS 1/

Year	Tinplate and terneplate: Quantity (metric tons, gross weight)	Tinplate and terneplate: Value (thousands)	Ingots and pigs: Quantity (metric tons)	Ingots and pigs: Value (thousands)	Tin scrap and other tin-bearing material except tinplate scrap 2/: Quantity (metric tons, gross weight)	Tin scrap and other tin-bearing material except tinplate scrap 2/: Value (thousands)
1998	262,000	$162,000	5,020	$29,200	36,100	$51,200
1999	290,000	172,000	6,770	38,100	33,200	56,100

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

2/ Includes rods, profiles, wire, powders, flakes, tubes, and pipes.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF TIN IN VARIOUS FORMS 1/

Year	Miscellaneous 2/: Value (thousands)	Dross, skimmings, scrap, residues, tin alloys, n.s.p.f.: Quantity (metric tons, gross weight)	Dross, skimmings, scrap, residues, tin alloys, n.s.p.f.: Value (thousands)	Tinplate and terneplate: Quantity (metric tons, gross weight)	Tinplate and terneplate: Value (thousands)	Tin compounds: Quantity (metric tons, gross weight)	Tin compounds: Value (thousands)	Tinplate scrap: Quantity (metric tons, gross weight)	Tinplate scrap: Value (thousands)
1998	6,760	4,600	4,590	291,000	186,000	482	3,610	72,100	6,380
1999	4,830	3,870	7,840	449,000	255,000	411	3,550	58,000	5,270

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

2/ Includes tinfoil, tin powder, flitters, metallics, manufactures, n.s.p.f.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF UNWROUGHT TIN METAL,
BY COUNTRY 1/

Country	1998		1999	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	516	$2,690	258	$1,250
Belgium	324	1,880	182	1,110
Bolivia	5,160	28,700	3,850	20,800
Brazil	4,710	26,400	4,700	25,800
Canada	190	1,150	72	451
Chile	894	4,970	3,980	21,100
China	9,870	54,700	13,900	71,800
Hong Kong	840	4,600	261	3,360
India	359	2,010	--	--
Indonesia	7,880	43,800	7,930	42,200
Malaysia	1,870	10,200	944	5,200
Netherlands	20	111	19	2,110
Peru	8,650	47,400	11,000	58,100
Singapore	822	4,510	60	306
Thailand	540	2,760	20	101
United Kingdom	790	4,680	60	352
Other	544	3,030	284	1,440
Total	44,000	244,000	47,500	255,000

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

Source: U.S. Census Bureau.

TABLE 9
TIN: WORLD MINE PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999
Australia	8,656	8,828	10,169	10,204	10,038
Bolivia	14,419	14,802	12,898	11,308 r/	11,300 e/
Brazil	17,317	19,617	19,065 r/	14,607 r/	13,200
Burma 3/	747	459	335	221 r/	149
Burundi e/	15 4/	25 4/	(5/)	23	10
Cameroon e/	2	1	1	1	1
China e/	61,900	69,600	67,500	70,100 r/	61,700
Indonesia	46,058 r/	52,304 r/	55,175 r/	53,959 r/	47,754
Kazakhstan e/	15	--	--	--	--
Laos	200 e/	906	1,030	895	703
Malaysia	6,402	5,175	5,065	5,756	7,340
Mexico	1	2 e/	5	5	5 e/
Mongolia	34	18	10	40	--
Namibia	2	--	--	--	--
Niger e/	20	10	10	10	20
Nigeria e/ 6/	357 4/	139 4/	150	200	200
Peru	22,331	27,004	27,952	25,747	30,403
Portugal	4,627	4,637 r/	2,667 r/	3,000 r/ e/	3,000 e/
Russia e/	9,000	8,000	7,500	4,500	4,500
Rwanda e/	242 4/	200 4/	--	--	--
Spain e/	2	2	2	2	2
Tanzania e/	3 4/	--	--	--	--
Thailand	2,201	1,457	756	2,124 r/	2,722
Uganda e/	43	(5/)	(5/)	(5/)	(5/)
United Kingdom	1,973	2,103	2,396	376	--
Vietnam e/	4,500	4,500	4,700 r/	4,500	5,000
Zambia	3	--	--	--	--
Zimbabwe e/	10 4/	10 4/	10 r/	1	1
Total	201,000 r/	220,000 r/	217,000 r/	208,000 r/	198,000

e/ Estimated. r/ Revised. -- Zero.

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

2/ Table includes data available through June 30, 2000.

3/ Includes content of tin tungsten concentrate.

4/ Reported figure.

5/ Less than 1/2 unit.

6/ Concentrate gross weight reported, estimated 62% Sn content.

TABLE 10
TIN: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Argentina: Primary e/	100	100	100	100	100
Australia:					
Primary	570	460	605	655	585 3/
Secondary e/	300	300	300	300	300
Total e/	870	760	905	955	885
Belgium: Secondary e/	5,000	3,000	3,000	2,500	8,000
Bolivia: Primary	17,709	16,733	16,853	11,102	11,000
Brazil:					
Primary	16,787	18,361	17,525	17,500 e/	13,200 3/
Secondary e/	250	250	250	250	250
Total e/	17,000	18,600	17,800	17,800	13,500
Bulgaria: Secondary	12	8	10	10 e/	10
Burma: Primary	190 e/	--	--	--	--
China: Primary e/	67,700	71,500	67,700	79,300 r/	92,300
Congo (Kinshasa): Primary e/ 4/	100	--	--	--	--
Czech Republic: Secondary e/	100	100	100	100	100
Denmark: Secondary e/	100	100	100	100	100
Germany: Primary and secondary e/	100	100	100	100	--
Greece: Secondary e/	150	100	150 r/	200 r/	200
India: Secondary e/	100	--	--	--	--
Indonesia: Primary	38,628	39,000 e/	52,658 r/	53,401 r/	49,105 3/
Japan: Primary	630	524	507	500	600 3/
Malaysia: Primary	39,433	38,051	38,400	27,900	35,800 3/
Mexico: Primary	770	1,234	1,188	102 r/	500
Nigeria: Primary	259	100	100 e/	150	50
Norway: Secondary e/	70	50	50	50	50
Peru: Primary	--	2,370	8,999	14,363	16,960 3/
Portugal: Primary and secondary e/	100	100	100	100	100
Russia: e/					
Primary	9,500	9,000	6,700	3,000	2,800
Secondary	1,000	1,000	1,000	500	450
Total	10,500	10,000	7,700	3,500	3,250
Spain: e/					
Primary	500	150	150	100 r/	50
Secondary	100	50	50	50	50
Total	600	200	200	150 r/	100
Thailand: Primary	8,243	10,981	11,986 r/	15,353 r/	17,306 3/
United Kingdom: Secondary e/	100	100	100	50 r/	--
United States: Secondary	11,600	11,600	12,400	16,300 r/	16,300
Vietnam: Primary	2,400	2,300	2,400	2,400 e/	2,400
Grand total:	223,000	228,000	244,000 r/	246,000 r/	269,000
Of which:					
Total primary	204,000	211,000	226,000 r/	226,000 r/	243,000
Total secondary	18,900	16,700	17,500 r/	20,400 r/	25,900
Total undifferentiated	200	200	200	200	100

e/ Estimated. r/ Revised. -- Zero.

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

2/ Whenever possible, total output has been separated into primary (from ores and concentrates) and secondary (tin metal recovered from old scrap). This tab reflects metal production at the first measurable stage of metal output. Table includes data available through June 30, 2000.

3/ Reported figure.

4/ Formerly Zaire.