

LEAD

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Domestic lead mine production decreased by 4% compared with that of 2003. Alaska and Missouri were the dominant producing States with a 95% share. Other appreciable lead mine production was in Idaho, Montana, and Washington. Lead was produced at 10 U.S. mines employing about 880 people. The value of domestic mine production was more than \$523 million. Lead concentrates produced at the Missouri mines were processed into primary metal at the only remaining domestic smelter-refineries, also located in Missouri.

Secondary lead, derived principally from scrapped lead-acid batteries, accounted for 88% of refined lead production in the United States. Nearly all the secondary lead was produced by 6 companies operating 14 smelters.

Lead was consumed in about 110 U.S. plants to manufacture end-use products, including ammunition; building-construction materials; covering for power and communication cable; lead oxides in glass, ceramics, pigments and chemicals; solders for motor vehicles, metal containers, construction, and electrical/electronic components and accessories; storage batteries; added in small amounts to some machining steel and aluminum; and used molten to cool and anneal some specialty steels.

Lead-acid batteries, including starting-lighting-ignition (SLI) and industrial types, continued to be the overwhelmingly dominant use of lead, accounting for about 87% of reported lead consumption. SLI battery shipments in North America totaled 107.2 million units in 2004. This total included original equipment and replacement automotive-type batteries. An estimated 1.14 million metric tons (Mt) of lead was contained in new SLI batteries shipped during the year.

Monthly sales of lead from the National Defense Stockpile (NDS) totaled about 42,000 metric tons (t) (46,300 short tons) in 2004, leaving about 41,700 t (45,900 short tons) in the NDS at yearend.

Lead prices increased during the year to an average of \$0.4019 per pound on the London Metal Exchange (LME) and to \$0.5514 per pound for the North American Producer price.

Government Programs

Monthly sales of lead from the NDS continued during 2004 under the basic ordering agreement (BOA) DLA-Lead-005. The Defense National Stockpile Center's (DNSC) annual materials plan (AMP) approved by the U.S. Congress for fiscal years 2004 and 2005—the fiscal year runs from October 1 to September 30—included a maximum sales authority for lead of 54,400 t (60,000 short tons) for each fiscal year (Defense National Stockpile Center, 2003, 2004). As a result of the BOA sales and the delivery of previously committed inventory, lead disposal from stockpile inventory during the calendar 2004 totaled about 52,600 t (58,000 short tons). On December 31, 2004, a little

more than 41,600 t (45,900 short tons) of lead remained in the NDS. At the rate lead has been selling from the stockpile for the past 2 years, the inventory will probably sell out in 2006.

Production

Primary.—In 2004, domestic mine production of recoverable lead decreased by about 20,000 t, or about 4%, compared with that of 2003. The major share of the U.S. mine output of lead continued to be derived from production in Alaska and Missouri. Appreciable lead mine production also was reported in Idaho, Montana, and Washington. Domestic mine production data were collected by the U.S. Geological Survey (USGS) from a precious-metal and base-metal voluntary survey on lode-mine production. All lead-producing mines responded to the survey. The lead concentrates produced from the mined ore were processed into primary metal at one domestic smelter-refinery in Missouri (tables 1-4).

Doe Run Resources Corp., St. Louis, MO, produced primary lead at one smelter-refinery facility in Missouri—the Herculaneum smelter. Concentrates for the smelter-refinery were provided mainly from the Doe Run mills—Brushy Creek, Buick, Fletcher, Sweetwater, and Viburnum. During 2004, these mills were supplied ore from production shafts—Brushy Creek, Buick, Fletcher, Sweetwater, Viburnum #29, and Viburnum #35 mine shafts—located along the mineralized Viburnum Trend in southeastern Missouri. The company sold concentrate on the open market that was produced in excess of the quantity required to maintain operations at its Herculaneum, MO, smelter-refinery. As of October 31, 2004, Doe Run's proven and probable ore reserves in the United States were about 45 Mt, containing an estimated 2.49 Mt of lead, 0.59 Mt of zinc, and 0.13 Mt of copper (Doe Run Resources Corp., 2005^{§1}).

Teck Cominco Alaska Inc. (a wholly owned subsidiary of Teck Cominco Limited, Vancouver, British Columbia, Canada) operated the Red Dog zinc-lead mine in northwestern Alaska under a leasing agreement with NANA Regional Corp., the sole owner of the property. NANA is a corporation organized under the provisions of the Alaska Native Claims Settlement Act. During 2004, production of lead in concentrate at Red Dog decreased by 6.3% to 117,000 t compared with 124,900 t in 2003. The average mill recovery of lead at Red Dog was 65.9% in 2004 compared with 63.9% in 2003. Proven ore reserves at Red Dog, as of December 31, 2004, were estimated to be 22.9 Mt grading 20.5% zinc and 5.7% lead. Continued improvements in operational efficiencies, higher prices for zinc and lead, and favorable smelter treatment charges resulted in a significant increase in profitability at Red Dog in 2004. Lead production in 2005 was estimated to be 105,000 t of lead in

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

concentrates. Limited exploration in the Red Dog district included a drill hole north of Anarraaq which intersected 35 meters of 14.7% zinc (Teck Cominco Limited, 2005§). During exploration in the Red Dog district, several gravity anomalies were drilled resulting in the discovery and delineation of indicated and inferred resources as listed in table 4.

Teck Cominco's Pend Oreille zinc-lead mine near Metaline Falls, WA, went into production at the beginning of 2004, with an operational design production capacity of 8,000 metric tons per year (t/yr) of lead in concentrates and 50,000 t/yr of zinc in concentrates. Pend Oreille, an underground room and pillar operation, was expected to have a mine life of about 8 years. Proven and probable ore reserves at Pend Oreille, as of December 31, 2004, were estimated to be 5.3 Mt grading 7.5% zinc and 1.2% lead; an additional, more speculative 3.3-Mt resource has been inferred at the property grading 6.6% zinc and 1.3% lead (Teck Cominco Limited, 2005§).

Hecla Mining Company, Coeur d'Alene, ID, operated the Lucky Friday Mine in Mullan, ID, throughout 2004. Lucky Friday is an underground silver-lead mine 100% owned by Hecla that has been producing since 1958. Concentrates at Lucky Friday were produced in a 1,100-metric-ton-per-day (t/d) conventional flotation mill. In 2004, ore was processed at a rate of approximately 456 t/d, and production decreased by about 6% compared with that of 2003 to a level of 12,200 t lead contained in concentrates. All silver, lead, and zinc concentrate production from the Lucky Friday operation was shipped to Teck Cominco's smelter in Trail, British Columbia, Canada, in 2004. Proven and probable ore reserves at Lucky Friday were estimated to be about 0.76 Mt grading 504 g/t (reported as 14.7 troy ounces per short ton) silver, 7.9% lead, and 2.4% zinc at yearend 2004 (Hecla Mining Company, 2005b§).

In late 2003, Hecla management and board of directors approved \$8.0 million in capital expenditures necessary to develop the adjacent Gold Hunter deposit. Production from below the 4,900-foot-level and diamond drilling during 2004 resulted in an extension to the economic limits of the ore body. Because of this extension, management and the board decided to spend \$3.0 million on additional development. It was anticipated that the development of the Gold Hunter deposit would result in resuming near-capacity production at the Lucky Friday mill (Hecla Mining Company, 2005a§).

Hecla Mining also held a 29.7% interest in the Greens Creek Mine on Admiralty Island near Juneau, AK, through a joint-venture arrangement with Kennecott Greens Creek Mining Co. (the manager of the mine) and Kennecott Juneau Mining Company; wholly owned subsidiaries of Kennecott Minerals Company. The Greens Creek unit is a polymetallic, stratiform, massive sulfide deposit lying within the Admiralty Island Monument area and includes 17 patented lode claims and 1 patented millsite claim. In addition, it includes property leased from the U.S. Department of Agriculture's Forest Service and has title to mineral rights on 7,500 acres of Federal land adjacent to the mine properties. The mineral rights were acquired pursuant to a 1996 land exchange agreement whereby the Greens Creek joint venture transferred private property valued at \$1.0 million to the Forest Service in exchange for access to the resources within the acquired Federal land. Production from new ore discoveries on the exchanged lands will be subject to

Federal royalties included in the land-exchange agreement (Hecla Mining Company, 2005a§).

In 2004, approximately 2,300 t/d of ore was mined (underground) and milled onsite at Greens Creek to yield lead, zinc, and bulk concentrates as well as a gold-silver dore. Total production of lead in concentrate was about 24,800 t in 2004 compared with about 27,900 t in 2003. Proven and probable reserves at the Greens Creek Mine at yearend 2004 were estimated to be 7.9 Mt grading 483 g/t (reported as 14.1 ounces per short ton) silver, 3.77 g/t (0.11 ounces per short ton) gold, 10.2% zinc, and 3.9% lead (Hecla Mining Company, 2005a§).

In 2004, Apollo Gold Corporation completed a capital stripping program at its Montana Tunnels polymetallic open pit mine near Helena, MT, which extended the life of the mine well into 2007. When an additional permitting process is completed, a pit expansion is designed to add 5 years of production. Apollo Gold reported 2004 production was 1,050 kilograms (kg) (33,700 troy ounces) of gold, 30,200 kg (971,000 ounces) of silver, 4,560 t of lead, and 11,900 t of zinc. Proven and probable reserves at Montana Tunnels were estimated to be about 41 Mt (Apollo Gold Corporation, 2005§).

Secondary.—Domestic secondary lead production decreased by about 2% in 2004, dropping to approximately 1.1 Mt. Secondary lead accounted for 88% of domestic lead refinery production compared with 82% in 2003; the percentage increase was attributed to Doe Run's primary smelter at Glover, Missouri, closing in December 2003. Lead-acid batteries continued to be the dominant source of recoverable lead scrap, accounting for 92% of all lead produced from secondary sources. The domestic secondary statistics were derived by the USGS from a combined secondary producer and consumer survey that included data from monthly and annual surveys. All the 11 companies producing secondary lead, exclusive of that produced from copper-based scrap, were surveyed; 9 responded, representing more than 99% of the total production of secondary lead. Of the total lead recycled in 2004, about 99.6% was produced by 7 companies operating 14 plants in Alabama, California, Florida, Indiana, Louisiana, Minnesota, Missouri, New York, Pennsylvania, and Texas. Production and consumption for the nonrespondents were estimated by using prior-year levels as a basis (tables 1, 5-9).

From 1992 to 2004, U.S. lead production from scrap has increased from 916,000 t to 1,110,000 t, a 21% increase. Scrap lead exported in 2004 was at the lowest level in more than 13 years. Scrap exports have been equivalent to about 4% to 10% of domestic lead produced from scrap during this period, but in a tight market situation, even the equivalent of a few percentage of scrap production diverted from scrap exports to domestic secondary plants can ease supply constraints. Increased consumer demand for lead and the closure of the Glover primary smelter in December 2003 resulted in increased production by the secondary smelters (secondary representing 85% of lead producing capacity).

The lead-acid battery industry recycled 99.2% of the available lead scrap from spent lead-acid batteries during the period 1999 through 2003, according to a report issued by the Chicago, IL-based Battery Council International (BCI) in mid-2005. Lead-acid batteries remained the United States most highly recycled consumer product. Historically, the recycling rate of

battery lead has consistently ranked higher than other recyclable materials. The latest BCI report indicated the recycling rate of available discarded lead-acid batteries increased from 97.1% to 99.2% between 2001 and 2003, but the estimates and assumptions required for these studies lead to the conclusion that while battery recycling rates were improving, this study can not be considered a precise measure of that improvement (Battery Council International, 2005).

Exide Technologies, one of the world's leading producers and recyclers of lead-acid batteries (operations in 89 countries) completed reorganization on May 6, and its new common stock began trading on the NASDAQ under the symbol XIDE (Platts Metals Week, 2004a). Soros Fund Management controls approximately 6.3% of Exide Technology's stock, which brought to three the number of large investment funds to purchase 5% or more of the company's stock. This stock purchasing activity ran the stock price up to nearly \$13 and was fueling speculation about a breakup of Exide (Ryan's Notes, 2004a, b, d).

Environment

The European Parliament on April 20, 2004, approved legislation that would effectively ban lead in batteries, with some possible exceptions. The European Commission (EC) recommended in a directive in November 2003 that the recycling of spent batteries and the recovery of lead be required. In response to the vote of the European Parliament, the Commission stated it would not endorse a ban on lead in batteries and affirmed its original proposal for close-loop recycling regulations (Ryan's Notes, 2004b). In the next step, the EC introduced a modified proposal, accepting some of the amendments and rejecting others. The European Council then issued its opinion on the proposed directive. The codecision procedure resulted in the Parliament and the Council reaching an agreement and adopting a directive more in line with the Commission's original proposal for a closed-loop recycling regulation. After publication in the Official Journal and its entry into force, member states will have 18 months to transpose the obligations of this directive into national legislation (European Union, 2004§).

Hitachi Ltd. expected to cease using lead-based solder in consumer electronic products ahead of the European Union's (EU) directive on the use of certain hazardous substances effective in 2006. Hitachi reportedly confirmed that reliability and workability could be obtained by adding indium to commonly used "lead free" tin/silver/copper solders. Hitachi expected to stop using lead-base solder at all its overseas plants and in procured parts by March 2005. Japan's Mitsui Chemical Inc., Casio Computer Co., and Matsushita Electric Industrial Co. stopped using lead-base solder in July 2002 (Platts Metals Week, 2004b). Also motivated by the EU directive, Japanese engineering giant Kawasaki Heavy Industries announced that it would cease using lead in parts for products, such as motorcycles and robots by 2007 (Platts Metals Week, 2004f).

Representative organizations from Europe, Japan, and North America agreed to a framework to eliminate lead from solder in manufacturing. This agreement could increase the demand for some of the minor (and precious) metals during the next

several years. Many Japanese manufacturers are using lead-free solder in some or all their soldering applications, and studies on how best to develop lead-free solders were being performed independently by the EU, Japan, the Republic of Korea, and the U.S. researchers (EFSOT, 2004a§). In a paper prepared by EFSOT, it was estimated that with a move to lead-free solders, overall lead consumption would be reduced by only 0.8%, but the increased consumption of some of the minor metals would be quite substantial, representing up to 25% of present consumption rates (EFSOT, 2004b§). Although metal alloy solders using minor nontoxic metals were being pursued as a short-term solution to lead-free electronics, research into "smart glues" may provide a metal-less solution in the longer term (Penman, 2003).

Consumption

Reported U.S. consumption of lead increased by about 6.5% in 2004 as the demand for original equipment and replacement automotive batteries increased. Consumption of lead in lead-acid batteries increased in 2004 by 10%. This increase is for all uses, automotive batteries, buses, general utility vehicles, golf cars, marine craft, motorcycles, tractors, trucks, and industrial-type sealed lead-acid batteries in backup power systems. Most other consumption categories, however, showed decreases, with significant decreases in bearing metals, casting metals, ceramics, chemicals, paints, pigments and miscellaneous uses, significant increases in lead consumption were in the ammunition and sheet metal for building construction and radiation shielding categories. Contributing to some of the declining lead consumption categories in the United States was the relocation of some lead-consuming industries to other areas of the world.

Consumption of lead in SLI- and industrial-type lead-acid storage batteries represented 87% of the total reported consumption of lead. Industrial-type batteries included stationary batteries (such as those used in uninterruptible power-supply equipment for computer and telecommunications networks, hospitals, and load-leveling equipment for commercial electrical power systems) as well as traction batteries (such as those used in airline ground equipment, industrial forklifts, and mining vehicles).

Of the 109 consuming operations (combination of companies and/or plants) to which a USGS survey request were sent, 99 responded, representing more than 98% of the total reported U.S. lead consumption. The Battery Council International reports North American SLI battery shipments were approximately 111 million units in 2004, 21 million original equipment and 90 million replacement automotive-type batteries (Metal Week, 2005). This was an approximately 3.5% increase from shipments in 2003. Using an estimate of 10.6 kilograms (kg) (23.3 pounds) of lead per unit, SLI shipments in 2004 accounted for about 1.18 Mt of lead. SLI batteries included those used for automobiles (tables 6-13).

Trade

Lead metal imports in 2004 were 197,000 t, a 13% increase from those of 2003. Exports of metal went down 33% to 82,600 t.

In 2004, the United States exported 28,940 t of lead metal and 22,000 t of contained lead in mine concentrates to Mexico, and imported only 9,910 t of lead metal. U.S. net exports to Mexico were 41,000 t. If the lead metal in imported lead-acid batteries were included, then a different trade relationship becomes apparent. In 2004, the U.S. imported 13,200,000 lead-acid batteries of all sizes from Mexico—95% was for cars and light trucks. These imports contained approximately 127,000 t of lead metal, while the United States exported to Mexico approximately 25,000 t of lead metal in batteries, for a net import of approximately 102,000 t of lead metal in batteries. The United States imported back the net lead metal exports and an additional amount equivalent to about 40% of Mexico's primary lead production in the form of lead-acid batteries.

The total U.S. net imports—total imports minus total exports—of lead metal contained in lead-acid batteries in 2004 was estimated to be more than 250,000 t, with Mexico, mentioned above, the United States leading trading partner followed by China, the Republic of Korea, Brazil, and Taiwan. It was estimated that during the past 5 years the United States has imported nearly 1.1 Mt of lead in lead-acid batteries.

World Industry Structure

World mine production of lead decreased in 2004 by about 29,000 t to 3.15 Mt, or a 1% decrease when compared with production in 2003. Of the 38 countries in which lead was mined, the top 6 accounted for 82% of the world's total production. China was the leading producer, with 30% of the world total, followed by Australia, 22%; the United States, 14%; Peru, 10%; Mexico, 4%; and Canada 2%.

Worldwide reserves of lead contained in demonstrated resources in producing and nonproducing deposits at yearend were estimated to be 67 Mt by the USGS (Gabby, 2005). Reserves for the three leading producers in the world, Australia, China, and the United States, were about 15 Mt, 11 Mt, and 8.1 Mt of contained lead, respectively. The reserve base (reserves plus measured and indicated resources that are marginally economic and some of those that are currently subeconomic) for Australia and China was 28 Mt and 36 Mt, respectively. The reserve base for the United States was 20 Mt. The total world reserve base at the end of 2004 was estimated to be 140 Mt.

World production of refined lead decreased to 6.74 Mt in 2004 from 6.78 Mt in 2003. Other statistics for 2004, as reported by the International Lead and Zinc Study Group, were as follows: world consumption increased to 7.14 Mt from 6.83 Mt in 2003; commercial stocks of refined lead in industrialized countries were 299,000 t, or 3 weeks of consumption, at yearend 2004 compared with 407,000 t at yearend 2003 and 483,000 t at yearend 2002 (International Lead and Zinc Study Group, 2005, p. 6-21).

LME lead prices sustained increases that began in the second half of 2003. LME prices started 2004 at approximately \$740 per metric ton, steadily increasing to a little more than \$970 per ton in mid-February. In late July, prices increased to more than \$1,000 per ton and stayed in the \$875 to \$1,000 per ton range for the remainder of the year. These sustained price increases were attributed to the continued strength of the Chinese

economy and a second year of refined lead world supply deficit. The average LME and North American Producer prices were up in 2004 by \$0.168 per pound and \$0.114 per pound, respectively, from the average prices of \$0.233 per pound and \$0.438 per pound, respectively, in 2003 (table 1).

The structure of the lead mining and refining industries was affected by a number of changes, including the opening and development of new facilities as well as the closing, reopening, expanding, selling, restructuring, and modernizing of existing facilities.

World Review

Australia.—Australia's lead mine production dropped a little more than 2% in 2004 (table 14). Australia exported an estimated 36% of its lead mine production as lead concentrates to be smelted and refined elsewhere. The leading export trade partners in concentrates were the Republic of Korea, China, Belgium, and Japan. Approximately 53% of Australia's lead mine production was exported as lead, lead alloys, and unwrought lead. The leading export trade partners in lead metal were the United Kingdom, the Republic of Korea, Switzerland, and India (United Nations Statistics Division, 2005§).

Pasminco Ltd. revealed firm plans for a refloating of the company's assets. A new company, Zinifex Ltd. was established, which acquired Pasminco's assets and then launched a public offering for investment in the new company. Pasminco first announced its intentions to refloat the company's assets in May 2002 and has continued operations under an administrator. The company's principal asset is the 100%-owned Century Mine in Queensland. About 5.2 Mt of ore was treated at Century for the year ending June 30, 2003, yielding 520,327 t of zinc in concentrate and 65,020 t of lead in concentrate. Many of Pasminco's smaller operations were either sold or closed in the past 2 years to ease the company's financial difficulties. A Canadian-based company, Ontzinc Corp., made a bid for the takeover of Pasminco in late 2003, but the bid was rejected by the administrator (Mining Journal, 2004). Zinifex's first reporting quarter ending June 30 (Zinifex created April 5) showed after tax profits were \$36 million, and mine production of contained lead for the quarter was 34,339 t (Platts Metals Week, 2004i).

Intec Ltd., an Australian metals technology company, and Canada-based Ivanhoe Mines Ltd. have agreed, as a joint venture, to purchase the Hellyer lead-zinc project in Tasmania from the receivers of Western Metals Ltd. The Hellyer project has been on care-and-maintenance status since mid-2000. The project comprises mining and exploration claims, a milling plant, and a tailings dam, as well as a metallurgical research and development facility. A spokesperson for Intec indicated that the tailings dam contained significant quantities of lead, zinc, silver, gold, and copper. The joint-venture partners planned to construct a pilot plant in 2004, employing a process developed by Intec that was expected to provide a more efficient recovery of metals from the tailings (Platts Metals Week, 2004e).

Ivernica, Inc. (Toronto, Ontario, Canada) announced that development work at the Magellan Mine in Western Australia had exposed the ore body and that construction had been completed on its lead processing facilities. The project was on

schedule for the commissioning of the plant in January 2005 (Platts Metals Week, 2004c). Ivernia also announced it had agreed to supply up to 100,000 t of lead concentrates during 2005 and 2006 to Metal Reclamation Industries' secondary lead smelter in Malaysia. It is fairly unusual for primary lead concentrates to be going to a secondary smelter, but in this case the lead minerals at the Magellan Mine were oxides, and the resulting concentrates would be compatible with secondary smelter metallurgy (CRU Monitor, 2004d).

Canada.—Teck Cominco Limited announced in late March that its subsidiary Teck Cominco Metals Ltd. had terminated the declaration of force majeure on its refined lead contracts that it had instituted on February 25, 2004. The declaration had resulted from damage to the KIVCET lead furnace and boiler at the Trail Metallurgical Operations caused by an explosion on February 2, 2004. Repairs at the Trail plant were completed in March, permitting inventories to be increased to a level where normal shipments could resume (Teck Cominco Limited, 2004).

China.—Preliminary Chinese refined lead metal production for 2004 was 1.75 Mt, up 8.2% compared with that of 2003. Imports of lead contained in concentrate were 831,000 t, up 22.3% (Beijing Antaika Information Development Co. Ltd., 2005a). U.S. Census Bureau data indicated that companies in the United States shipped approximately 98,000 t of lead contained in concentrates to China (12% of China's total concentrate imports). These U.S. exports were further broken down as 68,600 t shipped from New Orleans (possibly Missouri mines), 28,600 t shipped from Anchorage (Red Dog Mine), and 800 t shipped from New York (Beijing Antaika Information Development Co. Ltd., 2005b).

Extraordinary growth in China's gross domestic product (GDP) has driven the recent phenomenal growth in lead production and consumption. The Beijing Antaika Information Development Co., Ltd. (2005b) expected that in 2005 production of refined lead would be 2.04 Mt, an increase of 16.6% compared with that of 2004; lead consumption would be 1.51 Mt, an increase of 10%; and imports of lead concentrates would be 1.02 Mt, an increase of 22.7%.

Yuguang Gold-Lead Group's Jiyuan smelter in Henan Province, China, expected to produce 200,000 to 210,000 t of refined lead in 2004. The company reported that, because lead production requires less electricity than aluminum and zinc production, the tight power situation in China had less impact on its production. In the first half of the year, the company produced nearly 100,000 t of refined lead, of which 50,000 t was exported (Platts Metals Week, 2004d).

Japanese zinc smelter Toho Zinc Ltd. and Japanese trading company Yuasa Trading Ltd. set up a joint venture in Tianjin City, China, to produce recycled lead from used batteries. According to Toho Zinc, the number of vehicles in China totals almost 20 million units. Production in China had grown at a rate of nearly 30% per year since 2001 and was expected to surpass total output by Japanese automobile makers in 2010. The joint venture was expected to cost almost \$2.26 million (Platts Metals Week, 2004h). China produced 200,000 to 300,000 t of secondary lead per year, contributing 20% to 28% of their total lead output, compared with 60% in western countries (more than 80% in the United States). According to Antaika, China's

secondary lead industry had several problems to overcome: low recycling rate, in the range of 80% to 85%, against 95% in foreign countries (99% in the United States); no separation of battery parts was done, and alloys were not recycled—resulting in lower recovery rates; high-energy usage, 500 to 600 kg of coal per ton of lead compared with 150 to 200 kg in other countries; and heavy pollution, far exceeding national standards (Beijing Antaika Information Development Co. Ltd., 2004b).

India.—As with China, India's growing economy has increased consumers demand for lead. In 2004, Indian lead production was 35,000 t of primary and 23,000 t of secondary. With lead demand for 2004 at approximately 150,000 t, the shortfall was filled by increased imports. The major suppliers of this imported lead were China (54%), the Republic of Korea (15%), and Australia (10%) according to the latest full year data (2003) (CRU Monitor, 2005).

Hindustan Zinc's Chanderiya smelter expansion, due to be completed by June 2005, was expected to add 50,000 t/yr to India's lead supplies. India's expanding lead-acid battery industry had been experiencing a widening lead metal deficit in recent years, from about 50,000 t in 2000 to 80,000 t in 2003 (CRU Monitor, 2004b).

Iran.—China's Non-ferrous Metal Industry's Foreign Engineering & Construction Company, Ltd. negotiated and signed a cooperation memorandum with Iran's ITOK Engineering and Technological Company to develop and mine a large lead-zinc-silver deposit. The deposit has reserves containing 15.7 Mt of zinc, 5 Mt of lead, and 11,000 t of silver; the ores are mainly carbonate minerals and the average grade is more than 9% base metals (Beijing Antaika Information Development Co. Ltd., 2004a; CRU Monitor, 2004c).

Italy.—Reports from market and union sources indicated that the Porto Vesme lead and zinc facilities in Sardinia, Italy, reopened in 2004. The facilities include a 100,000-t/yr lead smelter, an Imperial smelting furnace (85,000 t/yr zinc production capacity, 40,000 t/yr lead capacity), and an electrolytic smelter with a capacity of 100,000 t/yr zinc. Porto Vesme is owned by Switzerland-based Glencore International AG (Platts Metals Week, 2004g). In July, Glencore International decided to slow the paced of the startup (Ryan's Notes, 2004c).

Mexico.—Mexico's lead mine production dropped a slightly in 2004 (table 14). Mexico exported an estimated 12% of its lead mine production as lead concentrates to be smelted and refined elsewhere. The first and second leading export trade partners in concentrates were Switzerland and France, respectively. Approximately 7% of Mexico's lead mine production was exported as lead, lead alloys, and unwrought. The leading export trade partners in lead metal were the United States and Switzerland (United Nations Statistics Division, 2005§). U.S. Census Bureau data indicated that the equivalent of about 73% of Mexico's lead mine production was exported to United States contained in the net export of lead-acid batteries.

Morocco.—Société des Fonderies de Plomb de Zelligja's lead smelter in Morocco had significant financial, labor, and technical problems for most of May (CRU Monitor, 2004a). These problems continued through the summer and into the fall (CRU Monitor, 2004c).

Peru.—Peru's lead mine production dropped slightly in 2004 (table 14). Peru exported an estimated 60% of its lead mine production as lead concentrates to be smelted and refined elsewhere. The leading export trade partners in concentrates were China, Mexico, Canada, and the Republic of Korea. Approximately 38% of Peru's lead mine production was exported as lead, lead alloys, and unwrought metal. The leading export trade partners in lead metal were Brazil, Spain, Italy, and Venezuela (United Nations Statistics Division, 2005§).

Current Research and Technology

In the EU, Japan, and the Republic of Korea, researchers continued to develop system solutions for advanced and sustainable lead-free soldering. The Next Generation Environment-Friendly Soldering Technology (EFSOT) effort is an Intelligent Manufacturing Systems (IMS) project. Almost 60% of the effort would be expended on the upgrading of soldering technology as well as new material and process technology; 20% of the effort would be to investigate the biological impacts of soldering materials; about 10% of the effort would be to examine the environmental impact, including evaluations of resource depletion and metal toxicity issues; and the final stage, about 10% of the effort, would be to investigate recycling and component recovery. A portion of a study analyzing the biological impact, environmental effects, and recycling criteria was planned for completion in September 2005. In the EU, Japan, and the Republic of Korea, researchers continued to develop system solutions for advanced and sustainable lead-free soldering.

Outlook

World usage of refined lead was forecast to rise by about 4.7% in 2005. It is anticipated that European consumption of lead will rise by about 1.7% in 2005. Demand in the United States was expected to slightly decline in 2005. Some of this decline was attributed to the rising number of imports of finished automotive batteries as well as to the increased longevity of automotive batteries. In China, further increases in the vehicle fleet, increased exports of automotive batteries, and ongoing investment in the telecommunications and information technology sectors were expected to result in a demand growth of more than 20% in 2005. On the supply side, global lead mine production was expected to rise by about 6% in 2005. The increase was attributed to the cumulative effect of increases in production in several countries, including Australia, China, India, Ireland, Mexico, and Peru. Global output of refined lead was also forecast to increase by about 9% in 2005. There had been a loss of smelting and refining capacity in recent years through closures in Europe and the United States, resulting in a trade shift in lead concentrates to China where primary smelter and refinery capacity has been significantly underutilized. A world supply deficit of a little more than 100,000 t was anticipated in 2005 (International Lead and Zinc Study Group, 2005).

Mine production in the United States was expected to decline by about 2% in 2005 as a result of additional temporary production cutbacks at several of the larger facilities. Refined lead production from the one remaining primary smelter and

refinery was expected to remain at a level comparable with that of 2004. Secondary production of lead was also expected to remain at a level comparable with that of 2004 but could rise slightly should weather-related temperature extremes increase the demand for replacement automotive-type batteries.

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TABLE 1
SALIENT LEAD STATISTICS¹

		2000	2001	2002	2003	2004
United States:						
Production:						
Mine, recoverable lead content: ²	metric tons					
Quantity	do.	449,000	454,000	440,000	449,000	430,000
Value	thousands	\$431,000	\$437,000	\$423,000	\$433,000	\$415,000
Primary lead, refined, lead content:						
Domestic ores and base bullion	metric tons	341,000	290,000	262,000	245,000	148,000
Foreign ores and base bullion	do.	W	W	W	--	--
Secondary lead, lead content	do.	1,130,000	1,100,000	1,120,000	1,140,000 ^r	1,110,000
Exports, lead content:						
Lead ore and concentrates	do.	117,000	181,000	241,000	253,000	292,000
Lead materials, excluding scrap	do.	92,000	52,400	43,400	123,000	82,600
Imports for consumption, lead content:						
Lead in ore and concentrates	do.	31,200	2,240	6	--	--
Lead in base bullion	do.	65	--	--	--	--
Lead in pigs, bars, and reclaimed scrap	do.	356,000	271,000	210,000	175,000	197,000
Stocks, December 31, lead content:						
Primary lead	do.	18,600	W ³	W ³	W	W
At consumers and secondary smelters	do.	106,000	100,000	111,000	84,600 ^r	59,000
Consumption of metal, primary and secondary, lead content	do.	1,720,000	1,550,000	1,440,000	1,390,000	1,480,000
Price, North American Producer average, delivered ⁴	cents per pound	43.57	43.64	43.56	43.76	55.14
World:						
Production, gross weight:						
Mine	thousands metric tons	3,170	3,120 ^r	2,870 ^r	3,140 ^r	3,110 ^e
Refinery ⁵	do.	3,270	3,190 ^r	3,100 ^r	3,200 ^r	3,100 ^e
Secondary refinery	do.	3,060	3,080 ^r	3,230 ^r	3,330 ^r	3,340 ^e
Price, London Metal Exchange, pure lead, cash average ⁴	cents per pound	20.57	21.58	20.52	23.34	40.19

^eEstimated. ^rRevised. W Withheld to avoid disclosing company proprietary data; included with "Primary lead, refined, domestic ores and base bullion." -- Zero.

¹Data are rounded to no more than three significant digits, except prices.

²Lead recoverable after smelting and refining. Number in table 15 represents lead in concentrate.

³Included with stocks at consumers and secondary smelters.

⁴Platts Metals Week.

⁵Primary metal production only; includes secondary metal production, where inseparable.

TABLE 2
MINE PRODUCTION OF RECOVERABLE LEAD IN THE UNITED STATES, BY STATE¹

(Metric tons, lead content)

State	2003	2004
Alaska and Missouri	431,000 ¹	407,000
Other States ²	17,300 ¹	23,400
Total	449,000	430,000

¹Revised.

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

²Idaho, Montana, Nevada, and Washington.

TABLE 3
LEADING LEAD-PRODUCING MINES IN THE UNITED STATES IN 2004, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of lead
1	Red Dog	Northwest Arctic, AK	Teck Cominco Alaska Inc.	Lead-zinc ore.
2	Buick	Iron, MO	Doe Run Resources Corp.	Lead ore.
3	Brushy Creek	Reynolds, MO	do.	Do.
4	Fletcher	do.	do.	Do.
5	Viburnum (#28 and #35)	Iron, MO	do.	Do.
6	Sweetwater	Reynolds, MO	do.	Do.
7	Greens Creek	Juneau, AK	Kennecott Greens Creek Mining Co.	Zinc ore.
8	Lucky Friday	Shoshone, ID	Hecla Mining Company	Silver ore.
9	Pend Oreille	Pend Oreille, WA	Teck Cominco American Inc.	Zinc ore.
10	Montana Tunnels	Jefferson, MT	Apollo Gold Corp.	Gold ore.

TABLE 4
RESOURCES IN THE RED DOG DISTRICT, ALASKA¹

Deposits	Quantity (million metric tons)	Zinc content (weight percent)	Lead content (weight percent)	Silver content (grams per metric ton)
Aqqaluk	73.0	15.2	4.0	74.4
Qanaiyaq	10.6	17.8	5.5	117.0
Paalaaq	14.3	15.0	4.0	90.2
Anarraaq	19.0	15.8	4.8	71.0
Total or weighted average	116.9	15.5	4.3	78.9

¹In addition to indicated and inferred resources, at the end of 2004, Red Dog had proven reserves of 22.9 Mt grading 20.5% zinc and 5.7% lead (Teck Cominco Limited, 2005§).

Source: Alaska Department of Commerce, 2005, Special report 56, accessed April 13, 2006, at URL http://www.commerce.state.ak.us/dca/AEIS/PDF_Files/AK_Mineral_Industry_2001.pdf.

TABLE 5
REFINED LEAD PRODUCED AT PRIMARY REFINERIES IN THE UNITED STATES, BY SOURCE MATERIAL¹

Source material		2003	2004
Refined lead, lead content:			
Domestic ores and base bullion	metric tons	245,000	148,000
Foreign ores and base bullion	do.	--	--
Total	do.	245,000	148,000
Calculated value of primary refined lead ²	thousands	\$236,000	\$143,000

-- Zero.

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

²Value based on average quoted price.

TABLE 6
LEAD RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES,
BY KIND OF SCRAP AND FORM OF RECOVERY¹

		2003	2004
Kind of scrap, lead content:			
New scrap:			
Lead-base	metric tons	19,000 ^r	12,500
Copper-base	do.	-- ^r	--
Tin-base	do.	326 ^r	329
Total	do.	19,300 ^r	12,900
Old scrap:			
Battery-lead	do.	1,050,000 ^r	1,040,000
All other lead-base	do.	63,000 ^r	63,000
Copper-base	do.	-- ^r	--
Total	do.	1,120,000 ^r	1,100,000
Grand total	do.	1,140,000 ^r	1,110,000
Form of recovery, lead content:			
As soft lead	do.	829,000	830,000
In antimonial lead	do.	303,000	279,000
In other lead alloys	do.	4,230	2,960
In copper-base alloys	do.	-- ^r	--
Total:			
Quantity	do.	1,140,000 ^r	1,110,000
Value ²	thousands	1,100,000 ^r	1,070,000

^rRevised. -- Zero.

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

²Value based on average quoted price of common lead.

TABLE 7
U.S. CONSUMPTION OF LEAD, BY PRODUCT¹

(Metric tons, lead content)

SIC code	Product	2003	2004
Metal products:			
3482	Ammunition, shot and bullets	48,800	61,500
Bearing metals:			
35	Machinery except electrical	W	W
36	Electrical and electronic equipment	W	W
371	Motor vehicles and equipment ²	13,300 [†]	1,140
37	Other transportation equipment	W	W
	Total	13,500 [†]	1,300
3351	Brass and bronze, billets and ingots	2,810	2,390
36	Cable covering, power and communication	(3)	(3)
15	Calking lead, building construction	(3)	(3)
Casting metals:			
36	Electrical machinery and equipment	W	W
371	Motor vehicles and equipment	27,500	16,400
37	Other transportation equipment	W	W
3443	Nuclear radiation shielding	227	325
	Total	31,700	17,900
Pipes, traps, other extruded products:			
15	Building construction	1,550 [†]	744
3443	Storage tanks, process vessels, etc.	(4)	(4)
	Total	1,550 [†]	744
Sheet lead:			
15	Building construction	17,000 [†]	20,600
3443	Storage tanks, process vessels, etc.	(4)	(4)
3693	Medical radiation shielding	7,370	10,900
	Total	24,400 [†]	31,500
Solder:			
15	Building construction	1,480	777
	Metal cans and shipping containers	W	W
367	Electronic components, accessories and other electrical equipment	2,690 [†]	5,900
371	Motor vehicles and equipment	W	W
	Total	6,310	7,440
Storage batteries:			
3691	Storage battery grids, post, etc.	523,000	657,000
3691	Storage battery oxides	642,000	630,000
	Total storage batteries	1,170,000	1,290,000
371	Terne metal, motor vehicles and equipment	(5)	--
27	Type metal, printing and allied industries	(6)	--
34	Other metal products ⁷	9,730 [†]	474
	Grand total	1,310,000	1,420,000
Other oxides:			
285	Paint	W	W
32	Glass and ceramics products	W	W
28	Other pigments and chemicals	W	W
	Total	35,600 [†]	25,700
	Miscellaneous uses	40,700 [†]	33,900
	Grand total	1,390,000	1,480,000

[†]Revised. W Withheld to avoid disclosing company proprietary data; included in appropriate totals. -- Zero.

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

²Includes "Metal products: Storage batteries: Terne metal, motor vehicles and equipment."

³Included in "Metal products: Grand total."

⁴Included with "Metal products: Sheet lead: Building construction" to avoid disclosing company proprietary data.

⁵Included with "Metal products: Bearing metals: Motor vehicles and equipment."

⁶Included with "Metal products: Storage batteries: Other metal products" to avoid disclosing company proprietary data.

⁷Includes lead consumed in foil, collapsible tubes, annealing, galvanizing, plating, electrowinning, and fishing weights.

TABLE 8
U.S. CONSUMPTION OF LEAD IN 2004, BY STATE^{1,2}

(Metric tons, lead content)

State	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
California and Washington	27,200	10,500	3,720	--	41,300
Georgia	2,320	497	24,200	--	27,000
Illinois	6,990	24,000	7,950	--	38,900
Iowa, Michigan, Missouri	1,380	4,790	2	--	6,170
Ohio and Pennsylvania	88,900	111,000	57,700	722	258,000
Arkansas and Texas	55,500	17,300	7,080	--	79,900
Alabama, Louisiana, Oklahoma	117,000	1,290	--	--	118,000
Colorado, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Tennessee, Wisconsin	154,000	59,700	56,800	203	270,000
Connecticut, Maryland, New Jersey, New York, North Carolina, South Carolina	25,600	15,300	14,500	--	55,400
Various States	323,000	172,000	85,700	--	581,000
Total	801,000	416,000	258,000	925	1,480,000

-- Zero.

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

²Includes lead that went directly from scrap to fabricated products.

TABLE 9
U.S. CONSUMPTION OF LEAD IN 2004, BY CLASS OF PRODUCT^{1,2}

(Metric tons, lead content)

Product	Soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
Metal products	45,100	76,100	7,210	488	129,000
Storage batteries	715,000	339,000	233,000	--	1,290,000
Other oxides	W	--	--	--	W
Miscellaneous	40,900	562	17,700	437	59,600
Total	801,000	416,000	258,000	925	1,480,000

W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous." -- Zero.

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

²Includes lead that went directly from scrap to fabricated products.

TABLE 10
STOCKS OF LEAD AT CONSUMERS AND SECONDARY SMELTERS
IN THE UNITED STATES, DECEMBER 31^{1,2}

(Metric tons, lead content)

Year	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
2003	46,200 ^r	23,000 ^r	15,300 ^r	151	84,600 ^r
2004	34,400	11,500	13,000	89	59,000

^rRevised.

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

²Includes stocks at primary refineries.

TABLE 11
 PRODUCTION AND SHIPMENTS OF LEAD PIGMENTS AND OXIDES IN THE UNITED STATES^{1,2}

(Metric tons and dollars)

Product	2003				2004			
	Production		Shipments		Production		Shipments	
	Gross weight	Lead content	Quantity (lead content)	Value ³	Gross weight	Lead content	Quantity (lead content)	Value ³
Litharge, red lead and white lead, dry	1,290	1,170	14,800	9,600,000	1,300	1,180	15,000	9,560,000
Lead oxide	649,000	616,000	NA	NA	663,000	630,000	NA	NA
Total	650,000	618,000	NA	NA	663,000	630,000	NA	NA

NA Not available.

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

²Excludes basic lead sulfate to avoid disclosing company proprietary data.

³At plant, exclusive of container.

TABLE 12
 U.S. IMPORTS FOR CONSUMPTION OF LEAD PIGMENTS AND COMPOUNDS, BY KIND¹

Kind	Quantity (metric tons, lead content)	Value (thousands)
2003:		
White lead carbonate	1	\$2
Red and orange lead	40	317
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	6,700	17,600
Litharge	2,180	1,200
Glass frits (undifferentiated)	27,100	31,000
Total	36,000	50,100
2004:		
White lead carbonate		
Red and orange lead	323	549
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	7,040	18,800
Litharge	983	878
Glass frits (undifferentiated)	24,900	27,800
Total	33,200	48,000

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

Source: U.S. Census Bureau.

TABLE 13
U.S. EXPORTS OF LEAD, BY COUNTRY¹

Country	2003		2004	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Ore and concentrates, lead content:				
Australia	--	--	157	\$13
Belgium	5,500	\$1,250	14,800	13,900
Bulgaria	--	--	2,890	1,990
Canada	17,600	11,500	31,500	17,200
China	72,000	25,700	98,000	56,000
France	6,320	3,330	--	--
Germany	11,500	4,360	--	--
Italy	7,000	1,490	--	--
Japan	49,200	18,600	63,500	31,700
Korea, Republic of	39,500	14,300	52,800	22,600
Mexico	43,600	16,400	22,000	9,910
Taiwan	--	--	5,770	3,970
Other	1,080	841	131	106
Total	253,000	97,700	292,000	157,000
Base bullion, lead content:				
Canada ²	556	488	--	--
Japan	30	389	58	757
Mexico	7	8	70	84
Total	593	885	129	841
Unwrought lead and lead alloys, lead content:				
Belgium	1,900	1,210	8,640	6,700
Brazil	2	13	1,200	943
Canada	910	691	2,460	2,220
France	3,620	2,270	30	296
Germany	437	543	47	112
Haiti	--	--	116	112
India	7	21	1,550	1,270
Ireland	2,090	1,250	36	22
Israel	63	848	38	525
Italy	30,600	18,900	2,500	1,870
Korea, Republic of	1	11	2,900	2,730
Malaysia	9	31	775	746
Mexico	33,600	22,200	24,800	22,000
Netherlands	14,200	6,930	6	84
Portugal	79	45	1,260	945
Spain	1,290	692	--	--
Taiwan	31	46	4,520	3,700
Turkey	13	236	1,110	868
United Kingdom	1,590	1,050	5,410	3,630
Other	1,690 ^r	1,550 ^r	1,240	1,310
Total	92,100	58,500	58,600	50,100
Wrought lead and lead alloys, lead content:				
Belgium	137	1,620	146	2,310
Canada	2,540	4,950	3,750	7,310
China	793	779	1,270	2,660
Costa Rica	525	1,080	1,020	2,590
France	16	230	34	204
Germany	1,700	1,960	2,980	2,770
Hong Kong	1,020	2,270	1,640	2,610
Ireland	1,030	640	42	284
Korea, Republic of	1,970	1,760	975	1,270
Mexico	820	2,420	4,140	6,360

See footnotes at end of table.

TABLE 13—Continued
U.S. EXPORTS OF LEAD, BY COUNTRY¹

Country	2003		2004	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Wrought lead and lead alloys, lead content—Continued:				
Netherlands	49	\$103	86	\$631
Poland	5,850	3,630	--	--
Saudi Arabia	14	73	32	108
Singapore	1,270	996	405	444
South Africa	59	661	334	1,460
Switzerland	10,800	6,730	79	86
United Kingdom	498	998	852	1,280
Other	1,340 ^r	3,600 ^r	6,020	9,910
Total	30,500	34,500	23,800	42,300
Scrap, gross weight:				
Belgium	66	113	114	189
Canada	40,900	4,930	44,400	8,500
China	40,800	13,000	174	118
Dominican Republic	1,270	1,580	674	805
France	--	--	--	--
Haiti	--	--	--	--
India	2,080	1,190	1,280	1,030
Jamaica	--	--	70	15
Japan	1	24	--	--
Kenya	--	--	91	40
Korea, Republic of	6,770	1,610	8,800	3,140
Mexico	189	178	268	195
Spain	--	--	--	--
Sweden	--	--	77	245
Taiwan	58	34	16	57
Other	607 ^r	590 ^r	346	417
Total	92,800	23,300	56,300	14,800

^rRevised. -- Zero.

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

²Country was erroneously reported as Belgium in the 2003 publication.

Source: U.S. Census Bureau.

TABLE 14
U.S. IMPORTS FOR CONSUMPTION OF LEAD, BY COUNTRY¹

Country	2003		2004	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Pigs and bars, lead content:				
Argentina	129	\$93	133	\$115
Australia	107	61	13,700	10,700
Belgium	4	21	26	178
Canada	167,000	88,600	166,000	149,000
China	1	7	2	4
Colombia	--	--	80	58
Germany	--	--	309	1,410
Mexico	8,270	3,520	8,810	5,110
Panama	75	48	375	235
Peru	--	--	7,270	7,220
Poland	--	--	126	107
Venezuela	50	34	367	318
Other	1 ^r	4 ^r	29	63
Total	175,000	92,400	197,000	175,000
Reclaimed scrap, including ash and residues, lead content:				
Canada	673	394	612	446
Colombia	3,070	1,250	3,280	2,290
Mexico	406	720	525	669
Other	--	--	365	112
Total	4,150	1,740	4,780	3,510
Wrought lead, all forms, including wire and powders, gross weight:				
Canada	4,310	6,560	4,530	8,010
Chile	27	53	1,150	1,740
China	716	2,220	922	3,380
France	37	173	50	187
Germany	964	3,060	843	3,550
Italy	4	19	2	19
Japan	81	795	21	182
Mexico	109	126	1,110	937
Netherlands	319	1,160	321	1,570
New Zealand	34	350	33	364
Peru	16	17	6	3
Taiwan	197	679	182	675
United Kingdom	659	1,410	1,050	2,280
Other	308 ^r	1,190 ^r	755	2,280
Total	7,780	17,800	11,000	25,200

^rRevised. -- Zero.

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

Source: U.S. Census Bureau.

TABLE 15
LEAD: WORLD MINE PRODUCTION OF LEAD IN CONCENTRATE, BY COUNTRY^{1,2}

(Metric tons, gross weight)

Country ³	2000	2001	2002	2003	2004 ^c
Algeria	818	991	1,105	-- ^r	-- ⁴
Argentina	14,115	12,334	12,011	12,079	9,551 ^p
Australia	739,000	714,000	658,000 ^r	648,000 ^r	642,000 ⁴
Bolivia	9,523	8,857	9,893	9,740	9,740
Bosnia and Herzegovina ^c	200	200	200	200	200
Brazil	8,832	10,725 ^r	9,253	10,652 ^r	7,000
Bulgaria	10,500	18,500	21,800 ^r	17,000 ^{r,e}	13,000
Burma ^c	1,200	900 ^r	900 ^r	500 ^r	500
Canada	148,765	153,932	101,330 ^r	81,264 ^r	76,727 ⁴
Chile	785	1,193	-- ^r	-- ^r	--
China ^c	660,000	676,000	641,000	955,000 ^r	950,000
Colombia ^c	226 ⁴	220 ^r	220 ^r	220 ^r	220
Ecuador ^c	200	200	200	200	220
Georgia ^c	200	200 ^r	400	400	400
Greece ^c	18,235 ⁴	27,700	29,300	2,000	--
Honduras	4,805	6,750	8,128	8,000 ^{r,e}	8,000
India	28,900	32,000 ^r	34,000 ^r	44,000 ^r	51,000
Iran ^{e,5}	15,000	12,000	9,000	16,000 ^r	16,000
Ireland ^c	57,825 ⁴	44,500	32,000	50,000	65,000
Italy ^c	2,000	4,000 ^r	4,000 ^r	5,000 ^r	6,000
Japan	8,835	4,997	5,723	5,660	5,572 ⁴
Kazakhstan	40,000	37,700	40,000 ^e	44,000 ^{r,e}	44,000
Korea, North ^c	60,000	60,000	60,000	60,000	60,000
Korea, Republic of	2,724	988	28	--	--
Macedonia	16,200	9,700	3,500	5,000 ^r	--
Mexico	137,975	139,000 ^r	138,707	139,348 ^r	139,000
Morocco	81,208	76,747	75,000 ^r	38,000 ^e	46,000 ^p
Namibia	11,114	13,025	13,190	18,782	16,100
Peru	270,576	289,546	297,704	307,755	306,211 ⁴
Poland	51,200	52,600	56,600	42,000 ^r	40,000
Romania	18,750	19,676	15,136 ^r	18,102 ^r	18,000
Russia ^c	13,300 ⁴	12,300	19,000 ^r	24,000 ^r	22,000
Saudi Arabia ^c	50	60	60	60	30
Serbia and Montenegro	10,500	7,500	-- ^r	400 ^r	--
South Africa	75,262	50,771	49,444	39,941	37,485 ⁴
Spain	40,300	36,000	6,000	2,000 ^e	--
Sweden	106,584	85,975	43,000 ^e	51,000 ^{r,e}	55,000 ⁴
Tajikistan ^c	800	800	800	800	800
Thailand	15,600	500	3,200	--	--
Tunisia	6,602	6,820	5,081	5,000 ^e	3,000
Turkey	17,270	17,923	17,352	14,000 ^{r,e}	12,000
United Kingdom ^c	1,000	1,000	1,000	--	--
United States	465,000	466,000	451,000	460,000	445,000 ⁴
Vietnam ^c	1,000	1,000	1,000	1,000	1,000
Total	3,170,000	3,120,000 ^r	2,870,000 ^r	3,140,000 ^r	3,110,000

^cEstimated. ^pPreliminary. ^rRevised. -- Zero.

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

²Table includes data available through June 24, 2005.

³In addition to the countries listed, lead is also produced in Nigeria, but information is inadequate to formulate reliable estimates of output levels.

⁴Reported figure.

⁵Year beginning March 21 of that stated.

TABLE 16
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY^{1, 2}

(Metric tons, gross weight)

Country ³	2000	2001	2002	2003	2004 ^c
Algeria: ^e					
Primary	900	900	1,100	1,100	--
Secondary	5,200	5,100	5,000	5,000	5,000
Total	6,100	6,000	6,100	6,100	5,000
Argentina:					
Primary	8,665	9,473	10,567	11,011	10,000
Secondary	27,000	25,960	33,000	30,300	33,000
Total	35,665	35,433	43,567	41,311	43,000
Australia:					
Primary	223,366	270,000	181,000	310,000	233,000 ⁴
Secondary	28,430	33,000	30,000 ^e	40,000	40,000
Total	251,796	303,000	211,000 ^e	350,000	273,000
Austria, secondary ^e	24,000	22,000	21,000	18,000 ^f	20,000
Belgium: ^c					
Primary ⁵	98,000	76,000	68,000	45,000	43,000
Secondary	20,000	20,000	20,000	20,000	20,000
Total	118,000	96,000	88,000	65,000	63,000
Bolivia	--	--	--	1	1
Brazil, secondary	50,000 ⁶	50,000 ⁶	50,000 ^{e, 6}	50,000 ^e	38,000
Bulgaria:					
Primary ^e	74,100	75,000	57,000 ^f	60,000	54,000
Secondary ^e	10,000	13,600	9,000 ^f	9,000 ^f	9,000
Total	84,100	88,600	66,000 ^f	69,000 ^{f, e}	63,000
Burma, primary	1,054	1,005	-- ^f	888 ^f	--
Canada:					
Primary	159,192	127,007	133,815	118,506 ^f	131,015 ⁴
Secondary	125,641	103,921	117,449	104,527 ^f	110,382 ⁴
Total	284,833	230,928	251,264	223,033 ^f	241,397 ⁴
China: ^c					
Primary	998,000	984,000	1,100,000	1,290,000 ^f	1,500,000
Secondary	102,000	211,000	230,000	290,000 ^f	300,000
Total	1,100,000	1,200,000	1,330,000	1,580,000	1,800,000
Colombia, secondary ^e	12,000	12,000	12,000	12,000	12,000
Czech Republic, secondary ^e	15,000	15,000	15,000	15,000	15,000
France: ^c					
Primary	100,000	96,000	76,000	14,000 ^f	--
Secondary	158,000	142,000	128,000	80,000	104,000
Total	258,000	238,000	204,000	94,000 ^f	104,000
Germany:					
Primary	210,515 ^f	153,743 ^f	141,084 ^f	133,417 ^f	134,000
Secondary	204,000 ^{f, e}	219,640 ^f	238,700 ^f	221,229 ^f	269,000
Total	414,515 ^f	373,383 ^f	379,784 ^f	354,646 ^f	403,000
India: ^e					
Primary	57,400	74,400	64,200	77,500 ^f	41,700
Secondary	20,500	22,000	25,000	41,000 ^f	25,000
Total	77,900	96,400	89,200	119,000 ^f	66,700
Iran: ^c					
Primary	15,000	12,000	12,000	12,000	12,000
Secondary	38,000	38,000	38,000	38,000	38,000
Total	53,000	50,000	50,000	50,000	50,000
Ireland, secondary ^e	12,000	13,000	7,000	9,000 ^f	21,000
Israel, secondary	13,000	20,000	22,000	25,000	27,000 ⁴

See footnotes at end of table.

TABLE 16—Continued
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY^{1, 2}

(Metric tons, gross weight)

Country ³	2000	2001	2002	2003	2004 ^c
Italy: ^e					
Primary	75,000	82,000	75,000	48,000 ^r	45,000
Secondary	160,000	121,000	130,000	166,000 ^r	165,000
Total	235,000	203,000	205,000	214,000	210,000
Japan:					
Primary	129,469	127,358	107,744	105,462	91,200 ⁴
Secondary	182,209	175,088	178,016	189,831	185,500 ⁴
Total	311,678	302,446	285,760	295,293	276,700 ⁴
Kazakhstan, primary and secondary	185,800	158,700	161,800	133,200 ^r	157,000
Kenya, secondary	1,000	1,000	1,000	1,000	1,000 ⁴
Korea, North, primary and secondary ^e	75,000	75,000	75,000	75,000	75,000
Korea, Republic of:					
Primary	170,704	161,000	178,722	167,575 ^r	168,994 ⁴
Secondary ^c	10,000	10,000	63,900 ^r	60,000 ^r	60,000 ⁴
Total	180,704	171,000	242,622 ^r	227,575 ^r	228,994 ⁴
Macedonia: ^e					
Primary	19,000	19,000	19,000	6,000 ^r	--
Secondary	1,000	1,000	1,000	400 ^r	--
Total	20,000	20,000	20,000	6,400 ^r	--
Malaysia, secondary ^e	35,300	42,000	40,000	57,000 ^r	54,000
Mexico:					
Primary ⁷	143,223	143,523	128,241	137,482 ^r	137,000
Secondary ^c	110,000	110,000	110,000	110,000	110,000
Total	253,223	253,523	238,241	247,482 ^r	247,000
Morocco:					
Primary	66,812	58,178	71,840	61,473	21,500 ^p
Secondary ^c	3,000	3,000	3,000	3,000	3,500 ^p
Total	69,812	61,178	74,840	64,473	25,000 ^p
Netherlands, secondary ^e	20,000	24,000	25,000	17,000 ^r	17,000
New Zealand, secondary ^e	10,000	10,000	10,000	10,000	10,000
Nigeria, secondary ^e	5,000	5,000	5,000	5,000	5,000
Pakistan, secondary ^e	2,000	3,000	2,000	3,000	3,000
Peru, primary	116,412	121,181	119,588	112,289	118,570 ⁴
Philippines, secondary ^c	16,218 ⁴	24,000	24,000	27,000 ^r	29,000
Poland: ^e					
Primary	35,412 ⁴	45,000	30,000 ^r	28,000 ^r	30,000
Secondary	20,000	20,000	35,800 ^r	40,000	40,000
Total	55,412 ⁴	65,000	65,800 ^r	68,000 ^r	70,000
Portugal, secondary ^c	6,000	6,000	4,000	4,000	4,000
Romania: ^e					
Primary	25,000	24,000	26,000	23,100 ^r	25,000
Secondary	3,000	3,000	3,000	5,000 ^r	3,000
Total	28,000	27,000	29,000	28,100 ^r	28,000
Russia, primary and secondary ^e	59,000	67,500	60,350 ⁴	66,000 ^r	66,000
Serbia and Montenegro, primary ^c	1,242 ⁴	--	170	--	--
Slovenia, secondary ^c	15,300	15,000	15,000	15,000	15,000
South Africa, secondary	46,000	55,000	61,000	64,900 ^r	61,500
Spain, secondary ^c	120,000	98,000	116,000	102,000	105,000
Sweden:					
Primary	30,604	31,322	30,000 ^e	24,200 ^e	28,000
Secondary	47,255	44,056	39,700 ^e	52,000 ^e	44,000
Total	77,859	75,378	69,700 ^e	76,200 ^e	72,000
Switzerland, secondary ^c	8,000	9,000	9,000	8,000	9,000

See footnotes at end of table.

TABLE 16—Continued
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY^{1,2}

(Metric tons, gross weight)

Country ³	2000	2001	2002	2003	2004 ^c
Thailand:					
Primary	3,390	3,500 ^r	2,000 ^r	2,000 ^r	3,000
Secondary	23,803	23,000 ^r	28,000 ^r	45,000 ^r	55,000
Total	27,193	26,500 ^r	30,000 ^r	47,000 ^r	58,000
Trinidad and Tobago, secondary ^c	1,600	1,600	1,600	1,600	1,600
Turkey: ^c					
Primary	4,000	4,000	4,000	4,000	4,000
Secondary	2,000	2,000	2,000	2,000	2,000
Total	6,000	6,000	6,000	6,000	6,000
Ukraine, secondary ^c	15,034 ⁴	12,000	12,000	7,000 ^r	7,000
United Kingdom: ^c					
Primary	166,411 ⁴	203,000	205,000	162,000 ^r	123,000
Secondary	170,740 ⁴	163,000	165,000	158,000 ^r	120,000
Total	337,151 ⁴	366,000	370,000	320,000 ^r	243,000
United States:					
Primary	341,000	290,000	262,000	245,000	148,000 ⁴
Secondary	1,130,000	1,100,000	1,120,000	1,140,000 ^r	1,110,000 ⁴
Total	1,470,000	1,390,000	1,380,000	1,380,000 ^r	1,260,000 ⁴
Venezuela, secondary ^c	30,000	30,000	30,000	30,000	30,000
Grand total:	6,650,000 ^r	6,570,000 ^r	6,630,000 ^r	6,800,000 ^r	6,740,000
Of which					
Primary	3,270,000	3,190,000 ^r	3,100,000 ^r	3,200,000 ^r	3,100,000
Secondary	3,060,000	3,080,000 ^r	3,230,000 ^r	3,330,000 ^r	3,340,000
Undifferentiated	320,000	301,000	297,000	274,000 ^r	298,000

^cEstimated. ^pPreliminary. ^rRevised. -- Zero.

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

²Table includes data available through June 24, 2005. Data included represent the total output of refined lead by each country, whether derived from ores and concentrates (primary) or scrap (secondary), and include the lead content of antimonial lead but exclude, to the extent possible, simple remelting of scrap.

³In addition to the countries listed, Egypt and Iraq produced secondary lead, but output is not officially reported; available general information is inadequate for the formulation of reliable estimates of output levels.

⁴Reported figure.

⁵Derived by calculating reported total lead output plus exports of lead bullion minus imports of lead bullion.

⁶Source: Lead and Zinc Statistics, Monthly Bulletin of the International Lead and Zinc Study Group, v. 42, no. 6, June 2002.

⁷Includes lead content in antimonial lead.