LEAD

By Gerald R. Smith

Domestic lead mine production increased for the fourth straight year, increasing by about 5% compared with that of 1996. Alaska and Missouri were the dominant producing States with a 92% share. Other appreciable lead mine production was in Colorado, Idaho, and Montana. Lead was produced at 16 mines employing about 1,200 people. The value of domestic mine production was about $460 million. Primary lead was processed at two smelter-refineries in Missouri and a smelter in Montana. *(See table 4.)*

Secondary lead, derived principally from scrapped lead-acid batteries, accounted for 76% of refined lead production in the United States. Nearly all the secondary lead was produced by 10 companies operating 17 smelters.

During 1997, one U.S. Government agency announced a proposed rule and issued a final rule on matters affecting the lead industries, including treatment standards for metal wastes and mineral processing wastes, and amended final rules for secondary lead smelter emissions. Three agencies also published notices of funding availability to support State and community-based lead-hazard control programs.

Lead was consumed in the manufacture of end-use products, including batteries, ammunition, covering for power and communication cable, building construction materials, and solders for motor vehicles, metal containers, and electrical and electronic components and accessories, in about 160 plants.

Lead-acid batteries, starting-lighting-ignition (SLI) and industrial-types, continued to be the overwhelmingly dominant use of lead, accounting for about 87% of reported lead consumption. The Battery Council International (BCI) reported SLI battery production of 95 million units. This total included original equipment and replacement automotive-type batteries. An estimated 1.00 million metric tons of lead was consumed in SLI batteries.

Monthly sales of lead from the National Defense Stockpile (NDS) continued during 1997. Sales totaled about 25,800 tons (28,400 short tons), leaving about 363,000 tons (400,000 short tons) in the NDS at yearend.

Lead prices exhibited a generally declining trend throughout the year. The average London Metal Exchange (LME) and North American Producer prices were down by $0.029 per pound and $0.023 per pound, respectively, in 1997, from the average prices of $0.312 and $0.488 per pound, respectively, in 1996.

Lead was mined in 44 countries, the top 5 of which accounted for 69% of the world's total production of 3.01 million tons. China was the largest producer, with 22% of the world total, followed by Australia, 18%; the United States, 15%; Peru, 8%; and Canada, 6%.

Worldwide reserves of lead contained in demonstrated resources from producing and nonproducing deposits at yearend were estimated to be 65 million tons by the U.S. Geological Survey (USGS). Reserves for the two largest producers in the world, Australia and China, were about 18 million and 6 million tons, respectively. The United States, the third largest producer in the world, had reserves of 7 million tons. The reserve base (reserves plus marginal economic deposits, measured and indicated) for Australia and China was 32 million and 10 million tons, respectively. The reserve base for the United States was 18 million tons. The total world reserve base at the end of 1997 was estimated to be 120 million tons.

Legislation and Government Programs

Monthly sales of lead from the NDS continued during 1997. Lead disposal from stockpile inventory as a result of these sales totaled about 25,800 tons (28,400 short tons). The Defense National Stockpile Center's Annual Materials Plan (AMP) approved by the U.S Congress for fiscal year 1997 (October 1, 1996-September 30, 1997) included a maximum disposal authority for lead of 54,400 tons (60,000 short tons). Under this authority, disposal of lead from NDS inventory during the first 9 months of calendar year 1997 was 15,200 tons (16,800 short tons). The AMP approved by the U.S. Congress for fiscal year 1998 (October 1, 1997-September 30, 1998) also included a maximum disposal authority for lead of 54,400 tons (60,000 short tons). Under the fiscal year 1998 authority, disposal of lead from NDS inventory during the last 3 months of 1997 amounted to 10,600 tons (11,600 short tons), leaving about 363,000 tons (400,000 short tons) of lead at yearend. The Defense National Stockpile Center issued two solicitations in late 1997 for the sale of lead from the NDS in negotiated long-term contracts. The solicitations totaled approximately 20,000 tons.

During 1997, the U.S. Environmental Protection Agency (EPA) announced proposed rules or issued final rules on several matters affecting the lead industries. In May, a supplemental proposal on treatment standards for metal wastes and mineral-processing wastes was issued by EPA under Phase IV—Land Disposal Restrictions. Land disposal of hazardous wastes is largely prohibited by statute, unless the wastes are treated before land disposal in a manner that satisfies the treatment standards established by EPA. The agency proposed to revise the universal treatment standards (UTS) for 12 metals, including lead, in nonwaste-water forms of toxicity characteristic (TC) metal wastes and other non-TC wastes. TC metal wastes are determined according to a standard test procedure that measures the possibility that a particular waste may leach toxic metals above a designated concentration level. For lead and seven other metals, EPA proposed to modify the treatment standards by making them higher (less stringent) than the current UTS. In the case of lead, however, the proposed increase would lower the de facto existing standard (more stringent) for this particular metal waste because these wastes were subject to the TC level rather than to UTS prior to EPA's rule on waste-treatment standards. The current UTS is 0.37 milligram per liter, and the standard for TC metal wastes is

5.00 milligrams per liter. EPA's proposed rule would revise the UTS or lead from 0.37 to 0.75 milligram per liter, making the lead standard less stringent for non-TC wastes such as corrosives, but would make the lead standard more stringent for TC metal waste (U.S. Environmental Protection Agency, 1997d). In other subject matter covered under Land Disposal Restrictions—Phase IV and related treatment standards, EPA reaffirmed the classification of spent solder baths, which are solidified pieces of tin-lead solder used in the production of printed circuit boards. Prior to 1993, EPA had classified these solder baths as spent materials, which, without the scrap metal definition, would be fully regulated as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). In 1993, EPA issued a letter to the Lead Industries Association stating that spent solder baths met the definition of scrap metal, and were, therefore, exempt from RCRA regulation under the regulatory exemption for scrap metal that was to be recycled. This interpretation continues to be the agency's view (U.S. Environmental Protection Agency, 1997c).

In June, EPA issued a direct final rule amending national emission standards for hazardous air pollutants (NESHAP) from secondary lead smelting. This final rule, as amended, establishes standards to limit hazardous air pollutant (HAP) emissions from smelting furnaces, refining kettles, agglomerating furnaces, dryers, and fugitive dust sources at major and area source secondary lead smelters. Owners and operators of all lead smelting furnace types must limit lead compound emissions, which is a surrogate for all metal HAP at secondary lead smelters, to no more than 2.0 milligrams per dry standard cubic meter. Some changes were made to the NESHAP to address comments sent to EPA following promulgation of the final rule on June 23, 1995. Aspects of the final rule affected by these changes included applicability of the total hydrocarbon limit for collocated blast and reverberatory furnaces, minimum baghouse standard operating procedure requirements, and bag leak detection system specifications and requirements (U.S. Environmental Protection Agency, 1997f).

During the year, three separate agencies published notices of funding availability (NOFA) for lead-related programs. In February, the Centers for Disease Control and Prevention of the U.S. Department of Health and Human Services (HHS) issued a NOFA for fiscal year 1997 totaling $8 million to support State and community-based childhood lead poisoning programs and the surveillance of blood lead levels in children (U.S. Department of Health and Human Services, 1997b). In June, the U.S. Department of Housing and Urban Development (HUD) announced the availability of nearly $46 million for State and local governments to undertake lead-based paint hazard control programs in eligible privately owned housing units in fiscal year 1997. An additional $4 million was made available to State and local governments for assistance in conducting lead-based paint hazard control programs in eligible privately-owned housing units on or near Superfund or brownfield sites (U.S. Department of Housing and Urban Development, 1997). Also in June, EPA issued a NOFA for grants to be directed toward lead poisoning prevention and lead hazard awareness public education and outreach. In fiscal year 1997, $450,000 was to be available for this new EPA grant program (U.S. Environmental Protection Agency, 1997g). In November, EPA entered into an interagency agreement with HUD to administer the remaining funds authorized under Title X of the Housing and Community Development Act of 1992. Subsequent to this agreement, EPA, under authority stated in the Toxic Substances Control Act (TSCA), announced the availability of nearly $3.6 million to provide financial assistance to States for the purpose of establishing training, accreditation, and certification programs for professionals engaged in lead-based paint activities listed under TSCA (U.S. Environmental Protection Agency, 1997b).

The EPA continued to solicit public comments from involved parties regarding the agency's development of training and certification requirements and work practice standards for individuals and firms conducting lead-based paint activities in public buildings (except child-occupied facilities), commercial buildings, and steel structures. Issues of particular concern in the development of such requirements and standards were (1) further clarification of the term "lead-based paint activities" to resolve whether maintenance activities involving incidental disturbance of lead-coated surfaces should be included, (2) determination of the interface with the U.S. Occupational Safety and Health Administration regulations to minimize duplication and overlap of Federal regulatory programs, (3) differentiation of the various types of buildings and structures so as to define clearly the terms "commercial" and "public" buildings in the context of manufacturing, industrial, and service-related activities, and (4) consideration of preexisting or developing State, tribal, or local regulations governing lead-based paint activities to maximize the use of available regulations (U.S. Environmental Protection Agency, 1997e).

In November, EPA revised its lead-air-monitoring regulations to shift its monitoring focus away from emissions emanating from mobile sources and toward those existing at stationary point sources. The revisions were made in response to the fact that peak lead-in-air values being recorded at mobile-source monitors across the United States were significantly less than that required by National Ambient Air Quality Standards. According to historical data, lead-air pollution levels measured near the Nation's roadways decreased by 97% between 1976 and 1995 as a result of the elimination of lead in gasoline used by on-road vehicles. EPA's new direct final rule revising the lead-monitoring regulations could eliminate about 70% of the current monitoring stations, thus making more resources available to State and local agencies to deploy lead-air-quality monitors around heretofore unmonitored stationary sources of lead. The effective date of EPA's revised regulations was scheduled to be December 22, 1997, unless adverse or critical comments were received by December 5, 1997 (U.S. Environmental Protection Agency, 1997a).

The U.S. Food and Drug Administration, a unit of HHS, amended the food additive regulations in December to provide for the safe use of a source of radiation to treat refrigerated or frozen uncooked meat, meat byproducts, and certain meat food products to control food-borne pathogens and to extend product shelf life (U.S. Department of Health and Human Services, 1997a). As a result of this amendment, manufacturers of fabricated lead products noted the possibility of an expanded market for lead in the field of radiation shielding. Should the meat industry elect to use the irradiation procedure extensively, a significant quantity of radiation shielding to protect employees at the processing plants

would be needed, as well as additional lead containers to transport radiation material to the users of the irradiation technology. A spokesperson for a lead-fabricating company stated that the shielding installed in slaughterhouses and meat packing plants would resemble the type used in security scanners, because the meat irradiation procedure would also use a low-intensity form of radiation (American Metal Market, 1997c).

Production

Primary.—In 1997, domestic mine production of lead increased for the fourth straight year and was up by about 22,000 tons, or 5%, compared with that of 1996. Increases in production were reported at several of the major mines in Alaska and Missouri. The share of the U.S. mine output of lead derived from production in Alaska and Missouri was about 92%. Lead mine production was appreciable in Colorado, Idaho, and Montana. Domestic mine production data were collected from a voluntary survey on lode-mine production of gold, silver, copper, lead, and zinc by the USGS. All the major lead-producing mines responded to this survey. *(See tables 1-3.)*

ASARCO Incorporated, New York, operated four mines, two of which, Sweetwater and West Fork in southern Missouri, provided about 90% of the concentrate feed for its nearby smelter and refinery at Glover; the balance came from purchased lead concentrates. Zinc is an important coproduct of Asarco's mining business. Compared with recent years, production of mined lead and zinc declined in 1997 owing to lower ore grades. In 1997, the company completed its modernization project at the Glover smelter and refinery. With the completion of this project, the Glover facility met all Federal ambient air standards for 1997 and increased refined lead production by 4.5% compared with that of 1996. Asarco's custom lead business consists of its East Helena, MT, smelter. As a result of the permanent closure of the Omaha, NE, lead refinery, the company sells the lead bullion produced at East Helena to refineries located outside the United States. The custom lead business depends on the availability of precious-metal-bearing lead concentrates, primarily from mines in the United States and Latin America. During the year, Asarco completed a modernization project at East Helena, which met all Federal ambient air standards for 1997. Asarco also owned the Leadville Mine in Colorado, where the company produced zinc, lead, and silver. In January 1997, the mine was reopened after a brief period of interrupted production. Low metal prices kept the mine from being profitable in 1997.

Total production of lead in concentrates from Asarco's U.S. mining operations was about 105,000 tons in 1997, up about 6% from that of 1996. At yearend, Asarco reported total lead reserves of 15.5 million tons, with 10.6 million tons at a grade of 4.28% lead at its Sweetwater Mine, 5.0 million tons at a grade of 5.00% lead at its West Fork Mine, and 0.4 million tons at a grade of 2.72% at its Leadville Mine (ASARCO Incorporated, 1997).

The Doe Run Co., St. Louis, MO, operated five lead mines and four mills, centered in southeastern Missouri, that supply concentrates to its smelter and refinery at Herculaneum, MO. Doe Run is owned by The Renco Group, a New York-based, privately held company with investments in natural resources and industrial operations.

Cominco Alaska Incorporated, a wholly owned subsidiary of Cominco Ltd., Toronto, Canada, operated the Red Dog zinc-lead mine in northwestern Alaska under a leasing agreement with NANA Regional Corp., owner of 100% interest in the property. NANA is a corporation organized under the provisions of the Alaska Native Claims Settlement Act. The recovery of lead from ore to concentrate continued to improve during 1997 owing to increased efficiency and process changes. Lead recoveries rose to 62%, up from 57% in 1996. As a result of the increased mill recovery efficiencies, production of lead in concentrate increased by 2.3%, to about 63,500 tons, in 1997. Approximately 100,000 tons of lead concentrate was shipped to markets in Canada, Europe, Japan, and the Republic of Korea. The construction program, intended to increase production at the Red Dog Mine, continued during 1997 and was expected to be completed in the third quarter of 1998. In its first full year of operation in 1999 at the expanded rate, the Red Dog Mine is projected to yield 160,000 tons of lead concentrate for shipment to new and existing customers, currently committed under long-term contracts. Red Dog's exploration drilling program in 1997 extended the new Paalaaq deposit, adjacent to the recently discovered Aqqaluk deposit. The estimate of resource at the Paalaaq deposit is 13 million tons, but the grade of lead has not been determined. The 1998 drilling program will continue to outline the mineralization. Cominco Ltd. continued the development of the Pend Oreille zinc-lead mine near Metaline Falls, WA, which had been purchased from Resource Finance Corp., Toronto, Canada, in 1996. During the year, surface and underground drilling were performed to locate new mineralization zones and to define better and extend the 6-million-ton Yellowhead zone, estimated to contain 7% zinc and 1% lead. Drilling to the north located a low-grade extension. In addition, a new zone lying several hundred meters east of the Yellowhead zone was intersected. More drilling and engineering studies were planned for 1998 (Cominco Ltd., 1997).

Hecla Mining Company, Coeur d'Alene, ID, operated the Lucky Friday Mine in Mullan, ID, throughout 1997. Ore was processed at the rate of about 760 tons per day to produce silver-lead concentrate and zinc concentrate. About 96% of the lead was economically recovered by using conventional flotation methods. Production of lead in concentrates totaled about 17,000 tons in 1997. In mine development activities during the year, Hecla continued to focus on expanding its mining operations into the adjacent Gold Hunter silver-lead ore zone, about 1 mile northwest of the Lucky Friday Mine. An exploratory drilling program begun in mid-1996 was continued in 1997, and a final feasibility study was completed, resulting in the approval of a $16 million development plan. Initial production from the Gold Hunter project was achieved in 1997, and full production was expected to begin upon completion of the preproduction phase in the second quarter of 1998. Ore reserves at the Lucky Friday and the Gold Hunter deposits total about 1.3 million tons at a grade of 10.2% lead.

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 Company, the manager of the mine and a wholly owned subsidiary of Kennecott Minerals Corp. At Greens Creek, current plans are to mine 1,320 tons per day of ore from the underground Southwest ore zone. Improvements to the milling operation and ancillary project work, including expansion of the tailings

disposal facility and upgrading of the power-generating capacity, will allow the mine to be operated at increased efficiency, thereby increasing metal production. A land exchange agreement with the U.S. Government, signed into law in April 1996, will allow Greens Creek to gain access to 7,500 acres of land with additional resources surrounding the existing mine. The agreement is subject to the joint venture securing private property equal to a value of $1.0 million and transferring title to the U.S. Department of Agriculture's Forest Service. Exploration efforts at Greens Creek in 1997 revealed an extension to the Southwest ore zone. Definition drilling on the extension is planned for 1998, with the goal of bringing this resource into the proven and probable reserve categories by the end of 1998. Estimated reserves at the Greens Creek Mine are 7.6 million tons at a grade of 4.5% lead (Hecla Mining Company, 1997).

Pegasus Gold Inc., Spokane, WA, mined and processed 4.23 million tons of gold-silver-lead-zinc ore at its Montana Tunnels Mine in central Montana; this output was about 6% lower than that for 1996. About 91% of the lead was recovered from the ore. At yearend, proven and probable reserves totaled 16.0 million tons at a grade of 0.55 gram per ton gold, 10.6 grams per ton silver, 0.20% lead, and 0.60% zinc, sufficient for a remaining mine life of about 2.5 years (Pegasus Gold Inc., 1997).

Teck Corp., Vancouver, Canada, and Sumitomo Metal Mining, Tokyo, Japan, reached a basic agreement in June to continue exploration for lead-zinc deposits in the Stone Boy region near Fairbanks, AK. Sumitomo Metal Mining Arizona (SMMA), the owner of Stone Boy, Inc., and Teck Corp. continued to work out final details of the agreement that would permit the joint venture to explore the 16,000-square-kilometer Stone Boy survey area during the period from 1997 to 2000. A Sumitomo official indicated that SMMA had been conducting exploration work at Stone Boy since 1991 but that more drilling and field survey work would be required before any estimates of ore reserves could be obtained (Metal Bulletin, 1997l).

Ventures Resource Corp., an international exploration company, reported the discovery of significant sulfide mineralization containing lead, zinc, and silver on its Lead Creek property in east-central Alaska. Initial drilling results revealed massive sulfide deposits at grades ranging from 2.1% to 7.2% lead, 0.2% to 1.5% zinc, and 89 to 109 grams per ton silver. Additional mineralization was revealed in silicified limestone at grades up to 8.6% lead, 4% zinc, and 195 grams per ton silver (Mining Journal, 1997e).

Secondary.—Domestic secondary production increased by about 3% in 1997. Secondary lead accounted for 76% of domestic lead refinery production compared with 77% in 1996. Lead recovered from scrap lead-acid batteries continued at a high level and accounted for 90% 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 respondents. Of the 23 companies producing secondary lead, exclusive of that produced from copper-based scrap, to which a survey request was sent, 22 responded, representing more than 99% of the total production of secondary lead. Of the total lead recycled in 1997, about 98% was produced by 10 companies operating 17 plants in Alabama, California, Florida, Georgia, Indiana, Louisiana, Minnesota, Missouri, New York, Pennsylvania, Tennessee, and Texas. Production and consumption for the nonrespondents were estimated using prior-year levels as a basis. *(See tables 1, 5-9.)*

GNB Technologies Inc., Atlanta, GA, reported engineering design difficulties at its new secondary smelter in Columbus, GA, opened in mid-1995. The difficulties prevented the company from achieving the 90,000-ton-per-year production capacity for which the plant was designed. The company planned to continue to evaluate the progress toward alleviating the problems and was expected to make a decision in 1998 on the status of the plant. The new facility had replaced a 35-year-old smelter at Columbus that produced about 20,000 tons per year of recycled lead (American Metal Market, 1997d).

Consumption

Reported consumption of lead increased by about 4% owing to an increase in the use of lead in storage batteries. The demand for lead declined in a number of other end uses, including bearing metals, brass and bronze, casting metals, and sheet lead. Consumption of lead in SLI-type and industrial-type lead-acid storage batteries represented 87% of the total reported consumption of lead. Industrial-type batteries include stationary batteries, such as those used in uninterruptible power-supply equipment for hospitals, computer and telecommunications networks, and load-leveling equipment for commercial electrical power systems, as well as traction batteries, such as those used in industrial forklifts, airline ground equipment, and mining vehicles. Of the 128 consuming companies to which a survey request was sent, 114 responded, representing about 96% of the total reported U.S. lead consumption.

BCI reported an SLI-type battery production of 95 million units in 1997 compared with 100 million units in 1996 and 93 million units in 1995. The totals include original equipment and replacement automotive-type batteries. By using an estimate of 10.6 kilograms (23.3 pounds) per unit, the SLI offtake for 1997 was about 1.0 million tons of lead. SLI batteries include those used for automobiles, buses, trucks, tractors, motorcycles, and marine craft. *(See tables 6-13.)*

World Review

World production of refined lead increased to 5.76 million tons from 5.69 million tons in 1996. Other statistics for 1997, as reported by the International Lead and Zinc Study Group (1997) are as follows: World consumption remained at about 6.03 million tons. Commercial stocks of refined lead in industrialized countries were 0.58 million tons, or 4 weeks of consumption, at yearend 1997 compared with 0.56 million tons, or 4 weeks of consumption, at yearend 1996 and 0.61 million tons, or 5 weeks of consumption, at yearend 1995. Significant exports of refined lead to industrialized countries from developing Asian countries, notably China, continued during 1997, although decreasing by about 14% from the 1996 level of 286 thousand tons.

Lead prices exhibited a generally declining trend throughout the year. The average LME and North American producer prices were down by $0.029 per pound and $0.023 per pound, respectively, in 1997, from the average prices of $0.312 and $0.488 per pound, respectively, in 1996.

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, and modernizing of existing facilities. *(See tables 14 and 15.)*

New Mines, Plants, Properties, Resources.—Western Metals, Perth, Australia, approved development of the Kapok deposit near its Cadjebut Mine in the Kimberley region of Western Australia in early 1997. The timing of the development and the production levels to be used at Kapok were to be dependent upon the reserve status of the Cadjebut Mine. Mine production at Kapok was intended to replace production at the Cadjebut Mine as reserves at the latter mine became depleted. The recent discovery of additional reserves at Cadjebut, however, was expected to extend the life of the mine by as much as 4 years (Mining Journal, 1997b).

In August, Western Metals gave its final approval to the development of the Blendevale (renamed Pillara) zinc-lead mining project, in the Kimberley region, Lennard Shelf area of Western Australia. Construction began in August, and full commissioning of the mine was expected in about 11 months. Production at Pillara was projected to be about 200,000 tons per year of concentrate, yielding 102,000 tons of zinc and 28,000 tons of lead. Pillara has estimated reserves of 10.6 million tons of ore at a grade of 8.1% zinc and 2.5% lead. Concentrates are to be trucked to a new port facility to be constructed at Derby, about 260 kilometers from the mine. This new port facility is to have the capability to move up to 400,000 tons per year of concentrate, allowing it also to handle concentrates from other Western Metals operations in the Lennard Shelf area (Mining Journal, 1997g).

In early May, Australia's RTZ-CRA, recently renamed Rio Tinto Ltd., reached agreement with all aboriginal Native Title claimants and the local Government on the development of the Century zinc-lead mine in Queensland. The agreement allowed for the sale of the mining project to Pasminco Mining Ltd., Melbourne, Australia, to proceed as planned. RTZ-CRA had sold the project to Pasminco in January, contingent upon the issuance of the relevant mining leases by the Queensland State Government, which, in turn, depended upon a settlement with the Native Title claimants. The Queensland State Government also agreed in May to reinstate its A$30 million compensation package to the Native Title claimants. The compensation package had been withdrawn when negotiations between RTZ-CRA and the claimants were halted in February. Subsequently, Century mining project officials proceeded to secure titles to the mine site, port facilities, and the 300-kilometer pipeline corridor that will carry the concentrates from Century to the port of Karumba in the Gulf of Carpenteria (Metal Bulletin, 1997d; Mining Journal, 1997a). In September, the Queensland, Australia, State Parliament passed the Century Zinc Project Bill, providing final clearance for completion of the sale of the project by Rio Tinto to Pasminco Mining Ltd., and for construction to begin at the Century Mine in north Queensland during the last quarter of 1997. The Century Mine is expected to yield 780,000 tons per year of zinc-silver concentrate and 70,000 tons per year of lead concentrate (Platt's Metals Week, 1997c).

Ireland's Ivernia West and Minorco Lisheen, joint developers of the Lisheen zinc-lead mine in County Tipperary, Ireland, announced plans for construction at the mine following the receipt of final planning permission from the Tipperary County Council in June. In mid-October, the Lisheen joint-venture partners were granted a state mining lease by Ireland's Department of Marine and Natural Resources. Receipt of the mining lease permitted more-expeditious completion of financing and initiation of construction at the mine. The construction program was expected to be completed in time for production to start on schedule in mid-1999. Ivernia and Minorco each hold a 50% share in the project with Minorco acting as the operator. At full production, the Lisheen mining operation was expected to yield 300,000 and 40,000 tons per year of zinc and lead concentrates, respectively, during a 13-year life span. Reserves at Lisheen reportedly total about 19 million tons at a grade of 12.75% zinc and 2.2% lead (Metal Bulletin, 1997h; Mining Journal, 1997f).

China National Nonferrous Metals Co. reported completion of a feasibility study and initiation of construction for the mining of the zinc-lead deposit in Lanping County, western Yunnan Province. Ore reserves at Lanping are estimated to be 14 million tons. Although the grades of the deposit were not available, Lanping was reported to be the largest zinc-lead deposit in China. Construction at the mine is expected to take about 3 years to complete (Mining Journal, 1997c).

China's Shuikoushan Mining Authority, Hunan Province, reported that it intended to construct a new primary lead smelter with a production capacity of from 80,000 to 100,000 tons per year. Construction was scheduled to begin on the project in early 1998. The state-owned company had earlier expanded lead production capacity at its existing facilities by 15,000 tons per year to a level of 45,000 tons per year (Platt's Metals Week, 1997j).

Indian Lead Pvt. Ltd. announced plans to build an additional secondary lead refinery at Wada, near its existing refinery at Thane, Maharashtra. The Thane plant has a lead-production capacity of 25,000 tons per year, and the Wada plant will have a capacity of 20,000 tons per year. Construction at Wada was expected to be completed in two stages, the first by the end of 1997 and the second by the end of 1998. Indian Lead also planned to shift its existing plant from Thane to Wada with the combined operations of both plants being located in one facility by 1999 (Metal Bulletin, 1997g).

Farallon Resources Ltd., Vancouver, Canada, reported the discovery of three additional polymetallic sulfide deposits at its Campo Morado project in Mexico's Guerrero State. The new deposits—Largo, Rey and La Suriana—bring to five the number of polymetallic deposits at various stages of delineation on the Campo Morado property. The Largo and the Rey deposits are west of the Naranjo and Reforma deposits, and the La Suriana deposit is south of the latter deposits. Assay results for the new deposits from Farallon's drill-delineation program showed ore contents of up to 7.9% combined lead and zinc and significant quantities of copper, gold, and silver (Northern Miner, 1997a).

In late 1997, BHP Minerals, Melbourne, Australia, reported that it expected to begin shipments of concentrate in January 1998 from the new Cannington lead-zinc-silver mine in Queensland. At full production, BHP intends to treat 1.5 million tons per year of ore to produce 150,000 tons per year of lead and 60,000 tons per year of zinc in concentrate. Reserves at Cannington reportedly total 47 million tons at a grade of 10.7% lead, 4.6% zinc, and 470 grams per ton silver (Metal Bulletin, 1997b).

Malaysia's Metal Reclamation (Industries) Sdn. Bhd. (MRSIB) reported in October that it had designed a new secondary lead smelter to be built at Pulau Indah in West Port Industrial Estate near Klang. The plant will be capable of producing 75,000 tons per year of lead and lead alloys, thus enabling the country to meet the increasing domestic demand for lead, which is growing at about 8% per year. MRSIB produces 37,000 tons per year of lead at its battery breaking, smelting, and refining works in Taman Selayang Baru, Selangor. Because Malaysia has no lead mines, the recycling of spent lead-acid batteries is its only internal source of lead (Metal Bulletin, 1997i).

In December, European-based mining company Navan Resources plc and Ireland's Tara Mines Ltd., a wholly owned subsidiary of Finland's Outokumpu, signed a new joint-venture agreement to explore for zinc-lead deposits in Ireland. The main target area for exploration will be the geological sequence known as the Palc Beds, which hosts the zinc-lead Navan deposit. According to a Navan spokesperson, the deposit has yielded 46 million tons of ore at a grade of 8.5% zinc and 2.1% lead during the past 20 years. An estimated 30 million tons of ore is reported to remain at the Navan deposit (Platt's Metals Week, 1997i).

In December, Boliden Ltd., Toronto, Canada, reported that the design production rate had been reached at its newly opened Los Frailes Mine near Seville, Spain. The mine, located adjacent to the recently depleted Aznalcollar Mine, will be operated by using most of the existing infrastructure from Aznalcollar. The capacity of the concentrator was expanded to 4 million tons per year, an increase from 2.3 million tons. In addition, significant modifications, including the introduction of fully autogenous grinding and the installation of larger flotation cells were made to the mill. Production at Los Frailes is expected to be 125,000 and 47,000 tons per year of zinc and lead, respectively, and 93 thousand kilograms per year of silver in concentrates (Platt's Metals Week, 1997g).

Closings, Curtailments.—China reportedly planned to decrease lead production at its smelter-refinery in Zhuzhou, Hunan Province, by about 20%, to 70,000 tons, in 1997. Zinc production was to be increased by 50%, to 210,000 tons, at the facility. A company official cited declining lead prices and rising zinc prices as the principal reasons for the adjustment in production. Zhuzhou officials were expected to continue to review the market to determine whether further production adjustments would be necessary in 1998. The company continued to consider construction of a new lead smelter-refinery with the capacity to produce 70,000 tons per year of electrolytic lead and was seeking investment partners for this venture (Platt's Metals Week, 1997d).

Australia's Aberfoyle Ltd. reported late in the year that it planned to close its Hellyer base metal mine in Tasmania by mid-year 2000. According to a company spokesperson, reserves were being depleted, and, although exploration was continuing, there was no indication that mining could be extended beyond 2000. The Hellyer facility treats about 1.4 million tons per year of ore, yielding 140,000 tons of zinc and 49,000 tons of lead in concentrates, as well as significant quantities of copper and silver (Metal Bulletin, 1997a).

Reopenings and Expansions.—Grupo Imsa SA, Colonia Roma, Mexico, announced in March that the company will increase production of lead-acid batteries from 45,000 to 150,000 units per month at its operations in Argentina and from 60,000 to 100,000 units per month at its operations in Venezuela. The plant expansions, a result of the company's significant new investment in these facilities during 1996, were expected to be completed by the middle of 1998 (Metal Bulletin, 1997j).

India's state-owned Hindustan Zinc Ltd. (HZL) announced intentions to increase the supply of lead concentrate to its primary refinery through joint-venture agreements. According to a Government official, this action would be necessary in order to meet the anticipated increase in demand for lead during the next 5 years. HZL has the capacity to produce 65,000 tons per year of lead but will require an additional supply of concentrate to raise its production rate to this capacity. In a further move to meet the expected increase in demand, Indian Lead Ltd., the country's principal producer of secondary lead, intended to increase the production capacity of its smelter from the current 24,000 tons per year to the level of 40,000 tons per year. Indian consumption of lead last year was about 79,000 tons. By 2002, the projected consumption of lead will be about 120,000 tons per year (American Metal Market, 1997b).

In August, Anvil Range Mining Corp., Toronto, Canada, secured a loan from Cominco Ltd., Vancouver, Canada, to initiate a 3-month stripping operation at its Grum ore body, part of the Faro lead-zinc mining complex, Yukon, Canada. Anvil also indicated that it was pursuing additional funding to make modifications to the mill at Faro and restart it. Operations at the Faro Mine and mill had been temporarily suspended at the end of 1996. The mill has a capacity of 40,000 tons per month of lead and zinc concentrates, yielding 180,000 and 120,000 tons per year of zinc and lead, respectively (Platt's Metals Week, 1997b). In November, Anvil Range resumed shipment of lead-zinc concentrate from the Faro Mine. Anvil reportedly had arranged with Cominco and Switzerland's Glencore Ltd. for sufficient short-term working capital to keep the mine open through March 15, 1998. The arrangement gave Glencore the right to become the exclusive buyer of Faro concentrate through the end of March 1998 (American Metal Market, 1997a; Platt's Metals Week, 1997a).

Cominco announced in mid-August that tender calls would be issued on behalf of the Sä Dena Hes joint venture to facilitate a possible reopening of the zinc-lead mine in Yukon Territory, Canada. The actual reopening of the mine, which was dependent on conditions in the zinc market, was under review. The earliest possible start-up of the mine was expected to be in the second quarter of 1998. Sä Dena Hes is owned jointly by Korea Zinc Co., Ltd. (50%), Cominco (25%), and Teck Corp. (25%). Cominco serves as the operator of the mine in this joint venture (Cominco News, 1997). The mine was purchased by this joint-venture group in late 1993 from Canada's Curragh Inc. and Hillsborough Resources, which had started production at the mine in August 1991. During the following 14-month period, 807,000 tons of zinc and lead concentrates, containing 374,000 tons of zinc and 290,000 tons of lead, were produced. Measured and indicated reserves at Sä Dena Hes are 1.4 million tons grading 10.2% zinc and 2.5% lead (Northern Miner, 1997c). By yearend 1997, no decision had been made to reopen the mine (Metal Bulletin, 1997e).

Transfers of Ownership, Sales Offerings, Mergers.—The Government of Kazakstan announced in January that it planned to merge the lead-zinc primary smelter-refinery operations at Ust-

Kamenogorsk, the smelter-refinery works and polymetal mining combine at Leninogorsk, and the mining and ore-dressing combine at Zyryanovsk into one new company called AO Kaztsink. According to Kazakstan's Ministry of Trade and Industry, the union of the three operations will include a program for extensive modernization and repair of the current facilities. Kazakstan's total lead production was said to be about 88,000 tons in 1995 and 1996. Lead-production capacity at the Ust-Kamenogorsk smelter-refinery alone is reported to be more than 100,000 tons per year. The newly formed company will also hold mining rights in the Maleyevsk, the Ridder-Sokol, and the Tishinsk mineral deposits in eastern Kazakstan (Mining Journal, 1997d).

In September, Breakwater Resources, Toronto, Canada, acquired all the assets of Société Minière de Bougrine, including the Bougrine zinc-lead mine in Tunisia and the associated concentrator and infrastructure. Bougrine began production at the mine in June 1994, but operations were suspended in October 1996 as a result of financial constraints. Breakwater expects to produce 42,000 tons per year of zinc and 7,000 tons per year of lead in concentrate when it begins production early in 1998. Reserves at Bougrine reportedly total 4 million tons at a grade of 10.8% zinc and 2.4% lead (Metal Bulletin, 1997c).

Anvil Range announced in late January that it had arranged for Cominco to purchase 4 million of its common shares, representing a 28% share in the company. Anvil Range owns and operates the Faro lead-zinc mine. Mining operations were suspended temporarily at Faro near the end of 1996 as a result of adverse market conditions and mine production below budgeted levels. A spokesperson for Cominco, Anvil Range's exclusive marketing agent in Europe, reported that the purchase agreement was aimed at providing long-term support to Anvil Range's concentrate customers in Europe (Platt's Metals Week, 1997e).

In March, Metaleurop SA, Paris, France, made a bid to purchase Enirisorse's Porto Vesme lead-zinc smelter in Sardinia, Italy. According to a company official, Metaleurop expected the smelter operation to be a joint project with Switzerland's Glencore, Ltd., which holds a 25.4% interest in Metaleurop. Metaleurop acted as an industrial advisor to Glencore in connection with the bid. The Porto Vesme smelter has a production capacity of 120,000 tons per year of lead and 180,000 tons per year of zinc (Platt's Metals Week, 1997h).

Australia's Western Metals acquired the remaining 40.1% interest in the Pillara lead-zinc mining project in the Kimberley region of Western Australia from Acacia Resources Ltd., its joint venture partner in the project. Western had been managing the project throughout the joint venture (Metal Bulletin, 1997m). Further development of the Pillara deposit, as well as the recent opening of the Goongewa Mine, is expected to double the company's production to 120,000 tons per year of zinc and 50,000 tons per year of lead in concentrates by 1999 (Metal Bulletin, 1997n).

In August, Doe Run purchased a 100% interest in the La Oroya smelting and refining complex owned by Peru's Empresa Minera del Centro del Perú (CENTROMIN). Doe Run was given the opportunity to purchase the complex after Mexico's Grupo Industrias Peñoles, the highest bidder at the auction of La Oroya in April, decided to withdraw its offer in mid-July. According to CENTROMIN, Doe Run offered to purchase a 51% stake in the complex and to invest additional capital in the complex to acquire the remaining 49%. Doe Run also agreed to honor the right of the workers to buy up to 10% of the complex. Under its new ownership, the complex will be renamed Metal Oroya. In 1995, the La Oroya complex was operated near its capacity, producing about 90,000 tons of lead, 68,000 tons of zinc, 66,000 tons of copper, and significant quantities of gold and silver (Metal Bulletin, 1997f). Doe Run reportedly will increase by 10% the installed smelting and refining capacity in the lead circuit at Metal Oroya, effectively expanding the capacity to a level of 110,000 tons per year by mid-1998. This expansion in capacity was to be accomplished through installation of new instrument technology and automatic controls in the blast furnace phase of the smelter operation. In its continuing program to improve environmental conditions at the facilities, Doe Run also planned to build a sulfuric acid plant to reduce sulfur dioxide emissions (Platt's Metals Week, 1997f).

Ownership of the Rosh Pinah lead-zinc mine, in southwestern Namibia, reportedly was settled in October after more than 2 years of negotiations between the concerned parties. An agreement in principle was reached between South Africa's Iron and Steel Corp. (Iscor) and Namibia's PE Minerals. Under a memorandum of understanding, the assets of the mine (owned by Iscor subsidiary Iscor Tin) and the mineral rights (held by PE) will be transferred to a new operating company. This new company, consisting of Iscor Tin and New Mining Ventures, a sister company of PE, will each hold 50% of the equity in the new company, which has yet to be named. Despite the prolonged uncertainty regarding ownership of Rosh Pinah, about 70,000 tons of zinc concentrate and 28,000 tons of lead concentrate were produced in 1996. The lead concentrate was shipped to the Tsumeb smelter-refinery in northern Namibia (Mining Journal, 1997h). The Tsumeb facility was closed in August 1997 to correct lingering technical problems but was expected to reopen in February 1998. Production capacity at Tsumeb is currently about 30,000 tons per year of refined lead (Platt's Metals Week, 1997k).

Outlook

On the basis of overall economic growth in the industrialized countries, world lead consumption is expected to continue to increase steadily during the next 5 years, reaching approximately 500,000 tons above the current level by the end of 2002. Similarly, production of lead in the industrialized countries is expected to increase by 450,000 tons during the same period; lead recycling will account for 60% of the increase. Taking into consideration some modest cyclical slowdown, there is expected to be steady replacement battery demand, increased worldwide vehicle production, and stronger demand for industrial batteries (Metal Bulletin, 1998).

Strong economic growth in Southeast Asia in the past two decades has fueled an increase in demand for lead in all end-use sectors. A significant portion of this demand has come from the SLI battery sector as a result of considerable growth in automobile ownership in the region. With continued economic growth and further investment in automotive capacity, vehicle production and sales are expected to continue to grow beyond 2000, but at a slower rate than in the past two decades. The growth in lead consumption, estimated to be about 4% per year, is anticipated to

continue to exceed the growth in lead production. As a result of this deficit, Southeast Asia's dependence on imports for its supply of lead will increase. Most of these imports are likely to continue to come from China (Metal Bulletin, 1997k). The availability of lead from China will depend, to some degree, on China's investment in its mining sector. Reportedly, during the next 5 years, the Chinese Government plans significant investment in mineral exploration with specific emphasis directed toward the midwestern area of the country and is seeking foreign investment capital for this venture (Northern Miner, 1997b).

Mine production in the United States should increase by about 4% in 1998 as a result of continued higher production at some of the larger facilities. Total metal production from primary and secondary refineries in 1998 is expected to remain at about the level of 1997.

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TABLE 1
SALIENT LEAD STATISTICS 1/

(Metric tons, unless otherwise specified)

		1993	1994	1995	1996	1997
United States:						
Production:						
Mine, recoverable lead content 2/		355,000	363,000	386,000	426,000	448,000
Value	thousands	$249,000	$298,000	$359,000	$459,000	$460,000
Primary lead (refined):						
Domestic ores and base bullion		310,000	328,000	374,000	326,000	343,000
Foreign ores and base bullion		24,900	23,400	W	W	W
Secondary lead (lead content)		893,000	931,000	1,020,000	1,070,000 r/	1,110,000
Exports (lead content):						
Lead ore and concentrates		41,800	38,700	65,500	59,700	42,200
Lead materials, excluding scrap		60,300	74,200	65,300	121,000	104,000
Imports for consumption:						
Lead in ore and concentrates		483	473	2,600	6,570	17,800
Lead in base bullion		18	577	31	5	25
Lead in pigs, bars, and reclaimed scrap		196,000	231,000	264,000	268,000	265,000
Stocks, Dec. 31:						
Primary lead 3/		14,300	9,270	14,200	8,140 r/	11,900
At consumers and secondary smelters		80,500	68,800	79,400	72,100 r/	88,700
Consumption of metal, primary and secondary		1,290,000	1,450,000	1,560,000	1,540,000 r/	1,600,000
Price: North American Producer average, delivered, cents per pound 4/		31.74	37.17	42.28	48.83	46.54
World:						
Production:						
Mine	thousand metric tons	2,680 r/	2,790	2,820 r/	3,090 r/	3,010 e/
Refinery 5/	do.	3,130 r/	2,980 r/	2,890 r/	2,900 r/	2,900 e/
Secondary refinery	do.	2,290 r/	2,410 r/	2,710 r/	2,790 r/	2,860 e/
Price: London Metal Exchange, pure lead, cash average, cents per pound 4/		18.42	24.83	28.08 r/	31.22 r/	28.29

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Domestic ores and base bullion."

1/ Data are rounded to three significant digits, except prices.

2/ Lead recoverable after smelting and refining. Number in table 14 represents lead in concentrate.

3/ American Bureau of Metal Statistics Inc.

4/ Platt's Metals Week.

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

TABLE 2
MINE PRODUCTION OF RECOVERABLE LEAD IN
THE UNITED STATES, BY STATE 1/

(Metric tons)

State	1996	1997
Missouri 2/	397,000	412,000
Montana	7,970	9,230
Other States 3/	21,200	26,600
Total	426,000	448,000

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

2/ Includes Alaska.

3/ Includes Colorado, Idaho, Illinois, New York, and Tennessee.

TABLE 3
LEAD-PRODUCING MINES IN
THE UNITED STATES IN 1997, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of lead
1	Red Dog	Northwest Arctic, AK	Cominco Alaska Incorporated	Zinc ore.
2	Buick	Iron, MO	The Doe Run Company	Lead-zinc ore.
3	Casteel 1/	do.	do.	Do.
4	Fletcher	Reynolds, MO	do.	Do.
5	Sweetwater	do.	ASARCO Incorporated	Do.
6	West Fork	do.	do.	Do.
7	Greens Creek	Southeastern, AK	Kennecott Corporation	Zinc ore.
8	Lucky Friday	Shoshone, ID	Hecla Mining Company	Lead-zinc ore.
9	Viburnum No. 29	Washington, MO	The Doe Run Company	Do.
10	Viburnum No. 28	Iron, MO	do.	Do.
11	Montana Tunnels	Jefferson, MT	Pegasus Gold Corp.	Zinc ore.
12	Leadville Unit	Lake, CO	ASARCO Incorporated	Do.
13	Sunshine	Shoshone, ID	Sunshine Mining Company	Silver ore.
14	Balmat	St. Lawrence, NY	Zinc Corporation of America	Lead-zinc ore.
15	Pierrepont	do.	do.	Do.
16	Coy	Jefferson, TN	ASARCO Incorporated	Zinc ore.

1/ Includes Brushy Creek Mill.

TABLE 4
REFINED LEAD PRODUCED AT PRIMARY REFINERIES
IN THE UNITED STATES, BY SOURCE MATERIAL 1/ 2/

(Metric tons, unless otherwise specified)

Source material		1996	1997
Refined lead:			
Domestic ores and base bullion		326,000	343,000
Foreign ores and base bullion		W	W
Total		326,000	343,000
Calculated value of primary refined lead 3/	thousands	$351,000	$352,000

W Withheld to avoid disclosing company proprietary data; included with "Domestic ores and base bullion."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Total refined lead, American Bureau of Metal Statistics Inc.; domestic and foreign ores, U.S. Geological Survey calculations.
3/ Value based on average quoted price.

TABLE 5
LEAD RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES,
BY KIND OF SCRAP AND FORM OF RECOVERY 1/

(Metric tons)

		1996 r/	1997
Kind of scrap:			
New scrap:			
Lead-base		37,500	54,000
Copper-base		8,850	9,650
Tin-base		--	--
Total		46,400	63,700
Old scrap:			
Battery-lead		961,000	991,000
All other lead-base		56,400	43,100
Copper-base		7,850	7,840
Tin-base		--	--
Total		1,030,000	1,040,000
Grand total		1,070,000	1,110,000
Form of recovery:			
As soft lead		625,000	663,000
In antimonial lead		420,000	411,000
In other lead alloys		9,230	14,200
In copper-base alloys		16,700	17,500
In tin-base alloys		(2/)	--
Total		1,070,000	1,110,000
Value 3/	thousands	$1,150,000	$1,130,000

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Revised to zero.
3/ Value based on average quoted price of common lead.

TABLE 6
U.S. CONSUMPTION OF LEAD, BY PRODUCT 1/

(Metric tons)

SIC code	Product	1996	1997
	Metal products:		
3482	Ammunition, shot and bullets	52,100	55,300
	Bearing metals:		
35	Machinery except electrical	W	W
36	Electrical and electronic equipment	W	W
371	Motor vehicles and equipment 2/	3,620	1,850
37	Other transportation equipment	W	W
	Total bearing metals	4,350	2,490
3351	Brass and bronze, billets and ingots	5,460	4,410
36	Cable covering, power and communication	W	4,930
15	Calking lead, building construction	767	1,390
	Casting metals:		
36	Electrical machinery and equipment	W	W
371	Motor vehicles and equipment	W	W
37	Other transportation equipment	4,590	4,240
3443	Nuclear radiation shielding	1,240 r/	1,750
	Total casting metals	18,900 r/	18,300
	Pipes, traps, other extruded products:		
15	Building construction	1,810	1,860
3443	Storage tanks, process vessels, etc.	(3/)	(3/)
	Total pipes, traps, other extruded products	1,810	1,860
	Sheet lead:		
15	Building construction	14,000	14,000
3443	Storage tanks, process vessels, etc.	(3/)	(3/)
3693	Medical radiation shielding	5,400	5,020
	Total sheet lead	19,400	19,100
	Solder:		
15	Building construction	1,650	1,890
	Motor vehicles, equipment, metal cans and shipping containers	4,580	W
367	Electronic components and accessories	2,350	1,890
36	Other electrical machinery and equipment	445	W
	Total solder	9,020	9,580
	Storage batteries:		
3691	Storage battery grids, post, etc.	635,000 r/	634,000
3691	Storage battery oxides	706,000 r/	761,000
	Total storage batteries	1,340,000 r/	1,390,000
371	Terne metal, motor vehicles and equipment	(4/)	(4/)
27	Type metal, printing and allied industries	(5/)	(5/)
34	Other metal products 6/	5,220 r/	7,570
	Total metal products	1,460,000 r/	1,520,000
	Other oxides:		
285	Paint	W	W
32	Glass and ceramics products	W	W
28	Other pigments and chemicals	9,890 r/	10,600
	Total other oxides	62,100	67,000
	Miscellaneous uses	13,900	8,470
	Grand total	1,540,000 r/	1,600,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in appropriate totals.

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

2/ Includes "Terne metal, motor vehicles and equipment."

3/ Included with "Building construction" to avoid disclosing company proprietary data.

4/ Included with "Bearing metals, motor vehicles and equipment."

5/ Included with "Other metal products" to avoid disclosing company proprietary data.

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

TABLE 7
U.S. CONSUMPTION OF LEAD IN 1997, BY STATE 1/ 2/

(Metric tons)

State	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
California, Oregon, Washington	20,700	23,300	2,620	--	46,700
Florida and Georgia	17,100	15,900	--	--	33,000
Illinois	15,500	26,800	11,500	544	54,400
Iowa, Michigan, Missouri	43,600	28,700	34,800	--	107,000
Ohio and Pennsylvania	127,000	41,900	54,900	1,280	225,000
Arkansas and Texas	44,600	2,630	7,950	--	55,200
Alabama, Louisiana, Mississippi, Oklahoma	7,000	99	--	--	7,100
Colorado, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Tennessee, Wisconsin	368,000	87,500	62,800	523	518,000
Connecticut, Delaware, Maine, Maryland, Massachusetts, Montana, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Vermont	63,500	15,300	24,200	--	103,000
Various States	239,000	146,000	60,300	--	445,000
Total	946,000	388,000	259,000	2,350	1,600,000

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes lead that went directly from scrap to fabricated products.

TABLE 8
U.S. CONSUMPTION OF LEAD IN 1997, BY CLASS OF PRODUCT 1/ 2/

(Metric tons)

Product	Soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
Metal products	49,000	64,300	9,170	2,350	125,000
Storage batteries	817,000	323,000	246,000	--	1,390,000
Other oxides	W	--	--	--	W
Miscellaneous	80,000	545	3,940	--	84,500
Total	946,000	388,000	259,000	2,350	1,600,000

W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes lead that went directly from scrap to fabricated products.

TABLE 9
STOCKS OF LEAD AT CONSUMERS AND SECONDARY SMELTERS
IN THE UNITED STATES, DECEMBER 31 1/

(Metric tons, lead content)

Year	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
1996	33,400 r/	31,700	6,860	123	72,100 r/
1997	48,700	30,100	9,720	111	88,700

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

TABLE 10
PRODUCTION AND SHIPMENTS OF LEAD PIGMENTS AND OXIDES IN THE UNITED STATES 1/ 2/

(Metric tons unless otherwise specified)

	1996				1997			
	Production		Shipments		Production		Shipments	
Product	Gross weight r/	Lead content r/	Quantity	Value 3/	Gross weight	Lead content	Quantity	Value 3/
Litharge, red lead and white lead, dry	7,870	7,120	17,100 r/	$17,000,000 r/	1,910	1,570	22,600	$22,200,000
Leady oxide	655,000	623,000	NA	NA	712,000	677,000	NA	NA
Total	663,000	630,000	NA	NA	714,000	678,000	NA	NA

r/ Revised. NA Not available.

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

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

3/ At plant, exclusive of container.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF LEAD PIGMENTS
AND COMPOUNDS, BY KIND 1/

Kind	Quantity (metric tons)	Value (thousands)
1996:		
White lead carbonate	12	49
Red and orange lead	18	102
Chrome yellow and molybdenum orange pigments and lead-zinc chromates	8,970	23,500
Litharge	17,900	15,000
Leady litharge	119	113
Glass frits (undifferentiated)	16,800	17,800
Total	43,800	56,600
1997:		
White lead carbonate	(2/)	3
Red and orange lead	30	193
Chrome yellow and molybdenum orange pigments and lead-zinc chromates	8,880	26,600
Litharge	17,300	13,600
Leady litharge	23	22
Glass frits (undifferentiated)	15,500	19,600
Total	41,800	60,100

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

2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 12
U.S. EXPORTS OF LEAD, BY COUNTRY 1/

(Lead content, unless otherwise specified)

Country	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Ore and concentrates:				
Belgium	20,300	$5,750	25,900	$10,000
Canada	24,200	7,250	5,810	2,380
India	302	88	--	--
Japan	11,600	3,290	9,720	3,840
Netherlands	2,920	826	108	63
Trinidad and Tobago	144	64	--	--
United Kingdom	--	--	561	259
Venezuela	72	22	129	59
Other	188 r/	61 r/	19	6
Total	59,700	17,400	42,200	16,600
Ash and residues:				
Belgium	7,720	4,690	7,770	3,310
Canada	10,800	5,090	8,850	4,180
Hong Kong	29	33	--	--
India	79	58	--	--
United Arab Emirates	727	38	192	85
Other	15 r/	21 r/	15	29
Total	19,400	9,930	16,800	7,600
Base bullion:				
Belgium	228	667	113	702
Canada	16,600	36,200	24,300	76,400
Mexico	24,400	27,400	9,620	10,800
Other	9	10	--	--
Total	41,200	64,300	34,100	87,900
Unwrought lead and lead alloys:				
Australia	38	43	19	21
Belgium	7 r/	4 r/	2,420	6,030
Canada	9,210 r/	7,850 r/	9,190	6,730
China	324	280	14	40
Germany	58	204	19	264
Indonesia	2	4	41	30
Israel	1,350	1,220	830	681
Japan	2,040	1,610	910	609
Korea, Republic of	19,800	16,800	9,400	7,120
Malaysia	1	22	5,430	3,430
Mexico	474 r/	762 r/	301	653
Philippines	45	42	12	19
Singapore	99	107	12	39
Taiwan	10,000	9,650	2,170	1,670
Thailand	2	4	41	33
United Arab Emirates	40	35	17	22
United Kingdom	45	94	6,460	4,390
Other	458 r/	939 r/	158	341
Total	44,000 r/	39,600 r/	37,400	32,100
Wrought lead and lead alloys:				
Australia	160	161	58	360
Belgium	8	37	189	202
Brazil	2	23	645	1,030
Canada	3,090	3,690	3,110	4,130
Chile	339	606	167	810
China	78	149	39	336
Costa Rica	29	73	33	54
Dominican Republic	14	29	2,470	1,740
Ecuador	102	72	37	48
France	129	514	55	355
Hong Kong	581	1,830	1,670	3,770
India	353	475	472	559
Israel	26	51	5	47

See footnotes at end of table.

TABLE 12--Continued
U.S. EXPORTS OF LEAD, BY COUNTRY 1/

(Lead content, unless otherwise specified)

Country	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Wrought lead and lead alloys-Continued:				
Japan	98	$292	225	$620
Korea, Republic of	307	938	314	1,060
Kuwait	89	1,210	107	1,880
Malaysia	65	498	108	363
Mexico	4,250	15,000	2,290	10,700
Netherlands	130	$268	129	$412
New Zealand	55	127	43	140
Nicaragua	125	159	113	140
Panama	4	18	57	210
Saudi Arabia	289	4,950	448	8,810
Singapore	831	977	1,180	1,800
Sweden	48	986	42	716
Switzerland	52	208	13	166
Taiwan	86	482	139	1,640
Thailand	30	160	10	41
United Arab Emirates	21	389	42	376
United Kingdom	5,080	5,200	1,350	1,540
Other	280 r/	1,020 r/	303	1,770
Total	16,700	40,600	15,900	45,800
Scrap (gross weight):				
Canada	76,800 2/	10,100	83,900	12,200
China	47 2/	86	163	99
El Salvador	--	--	108	24
Germany	14 2/	204	29	209
Hong Kong	82 2/	60	884	289
India	633 2/	174	552	285
Italy	--	--	99	21
Japan	58 2/	71	--	--
Korea, Republic of	5,620 2/	6,070	1,160	746
Mexico	201 2/	44	--	--
Netherlands	--	--	47	54
Pakistan	--	--	327	70
Philippines	--	--	93	87
Singapore	--	--	33	125
Taiwan	20 2/	53	147	173
Thailand	--	--	26	170
United Arab Emirates	--	--	384	256
Venezuela	728	871	353	100
Other	1,090 2/	601	170	693
Total	85,300 2/	18,400	88,400	15,600

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes nonbattery scrap data only.

Source: Bureau of the Census.

TABLE 13
U.S. IMPORTS FOR CONSUMPTION OF LEAD, BY COUNTRY 1/

(Lead content, unless otherwise specified)

Country	1996 Quantity (metric tons)	1996 Value (thousands)	1997 Quantity (metric tons)	1997 Value (thousands)
Ore and concentrates (lead content): 2/				
Australia	--	--	6,670	$2,280
Canada	4,370	$941	753	679
China	122	85	--	--
Mexico	2,080	1,480	558	385
Peru	--	--	3,370	1,190
South Africa	--	--	4,550	1,570
Tunisia	--	--	1,910	716
Other	--	--	16	15
Total	6,570	2,500	17,800	6,830
Base bullion (lead content):				
Mexico	5	2	5	3
Other	(3/)	(3/)	20	13
Total	5	2	25	16
Pigs and bars (lead content):				
Belgium	11	32	47	126
Canada	192,000	156,000	187,000	131,000
Colombia	239	146	238	123
Germany	338	672	401	618
India	607	360	766	374
Mexico	56,900	42,200	70,400	42,000
Peru	17,100	13,700	6,420	4,100
United Arab Emirates	160	831	72	223
United Kingdom	19	31	--	3
Other	--	--	94	73
Total	268,000	214,000	265,000	179,000
Reclaimed scrap, including ash and residues (lead content): 4/				
Canada	106	63	48	8
Mexico	65	13	20	5
Other	21	28	--	--
Total	192	104	68	13
Grand total	274,000	217,000	283,000	186,000
Wrought lead, all forms, including wire and powders (gross weight):				
Argentina	18	14	63	116
Belgium	--	7	38	74
Canada	2,260	4,080	2,440	3,870
China	67	482	119	696
Colombia	176	95	61	33
Dominican Republic	370	292	161	106
France	71	334	372	1,010
Germany	200	1,250	305	1,470
Hong Kong	137	430	159	483
India	1,620	986	556	272
Italy	25	159	7	19
Japan	49	1,310	33	389
Malaysia	22	75	61	297
Mexico	2,630	1,740	1,150	1,400
Netherlands	132	713	95	297
New Zealand	88	710	60	640
Peru	939	742	20	16
Philippines	641	540	281	186
Taiwan	340	1,100	365	1,070
United Kingdom	111	878	230	984
Other	143 r/	589 r/	728	988
Total	10,000	16,500	7,310	14,400

r/ Revised.

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

2/ Also includes other lead-bearing materials containing more than 5 troy ounces of gold per short ton, or more than 100 troy ounces of total precious metals per short ton.

3/ Revised to zero.

4/ Also includes other lead-bearing materials containing more than 10% by weight of copper, lead, or zinc (any one).

Source: Bureau of the Census.

TABLE 14
LEAD: WORLD MINE PRODUCTION OF LEAD IN CONCENTRATES, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1993	1994	1995	1996	1997 e/
Algeria	1,538 r/	1,100 r/	1,383 r/	1,016 r/	1,000
Argentina	11,826	9,981	10,521	11,272 r/	11,300
Australia	519,000	537,000	455,000	522,000	531,000 4/
Austria	1,340	--	--	--	--
Bolivia	21,220	19,679	20,387	16,538 r/	16,600
Bosnia and Herzegovina e/	200	200	200	200	200
Brazil	117	1,329 r/	11,611 r/	--	--
Bulgaria e/	34,000 r/	32,000 r/	33,000 r/	28,000 r/ e/	28,000
Burma e/	2,200	2,300	2,400	2,200 r/	2,800
Canada	182,234	167,584	210,826 r/	257,253 r/	186,180 4/
Chile	344	1,008	944 r/	1,374 r/	800
China e/	338,000	462,000	520,000	643,000 r/	650,000
Colombia	447	290	300 r/ e/	300 r/ e/	300
Czech Republic e/	1,000	500	--	--	--
Ecuador e/	200	200	200	200	200
Georgia e/	500	400	300	200	200
Greece	28,800 r/	28,400 r/	20,400	8,400 r/	19,300 4/
Honduras	3,551	2,810	2,619	3,367	3,400
India	26,000	30,500	34,000 r/	35,000 r/	32,000 4/
Iran 5/	14,700	18,300	15,900	15,700 e/	15,500
Ireland	48,300	53,700	69,067 r/	45,344	45,149 4/
Italy	7,404	13,902	13,600 r/	11,100 r/	10,000
Japan	16,470	9,946	9,659	7,753	5,227 4/
Kazakstan	95,000 r/ e/	57,000	40,000	35,000 r/ e/	35,000
Kenya	396	350	4	--	--
Korea, North e/	80,000	80,000	80,000	80,000	80,000
Korea, Republic of	7,409	2,173	4,064	5,131	3,632 4/
Macedonia e/	8,000 r/	15,000	15,000	15,000	15,000
Mexico	154,000	170,322	164,348	173,831	174,661 4/
Morocco	81,684	73,164	67,708 r/	71,667 r/	77,056 4/
Namibia	11,600	13,917	16,084	15,519 r/	10,100 4/
Nigeria e/	-- r/	-- r/	-- r/	-- r/	--
Norway	1,698	3,096	1,462	2,083 r/	3,000
Peru	224,695	233,510	237,597	248,787	258,189 4/
Poland	49,100	54,700	58,100	58,700 r/	59,000
Romania	16,929	23,838	23,194	18,712	19,000
Russia	34,000 r/	25,000 r/	23,000 r/	18,000 r/	19,500
Serbia and Montenegro	3,510 r/	2,667 r/	3,342 r/	5,000 r/ e/	5,000
Slovakia e/	1,800	1,800	1,800	1,000	1,000
South Africa	100,171	95,824	88,449	88,613	83,614 4/
Spain	25,503	23,753	30,077 r/	23,826 r/	23,900 4/
Sweden	111,709	112,787	100,070	136,200 r/	100,000
Tajikistan e/	1,600	1,200	1,000	800	800
Thailand	6,050	7,950	9,680	21,000 r/	5,100
Tunisia	863 r/	2,856	6,601 r/	4,764 r/	1,424 4/
Turkey	11,448	11,158	10,376	10,000 e/	10,000
United Kingdom e/	1,000	2,000 4/	1,600	1,800	1,800
United States	362,000	370,000 r/	394,000	436,000	459,000 4/
Uzbekistan e/	25,000	15,000	10,000	10,000	2,000
Zambia 6/	7,027	--	--	--	--
Total	2,680,000 r/	2,790,000	2,820,000 r/	3,090,000 r/	3,010,000

e/ Estimated. r/ Revised.

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

2/ Table includes data available through July 1, 1998.

3/ In addition to the countries listed, Uganda may produce lead, but available information is inadequate to make reliable estimates of output levels.

4/ Reported figure.

5/ Year beginning March 21 of that stated.

6/ Pb content of ore milled in year beginning April 1 of that stated. Mine closed in June 1994.

TABLE 15
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1993	1994	1995	1996	1997 e/
Algeria:					
Primary e/	1,500	1,000	800	900	900
Secondary e/	7,100	8,000	7,800	7,700	7,100
Total	8,600	9,000	8,600	8,600	8,000
Argentina:					
Primary	12,473	7,785	2,430	396 r/	400
Secondary	16,000 e/	17,600 e/	26,298	27,705 r/	27,800
Total	28,473	25,385	28,728	28,101 r/	28,200
Australia:					
Primary	221,000	212,000	215,000	204,000	204,000 3/
Secondary	22,000	25,000 r/	26,000 r/	24,000 r/	34,000 3/
Total	243,000	237,000 r/	241,000 r/	228,000 r/	238,000 3/
Austria:					
Primary	4,779	410	-- e/	-- e/	--
Secondary	17,857	17,165	21,919	22,000 e/	22,000
Total	22,636	17,575	21,919	22,000 e/	22,000
Belgium:					
Primary	105,712	97,200	95,300	94,400	84,400
Secondary	25,400	26,300	26,400	31,000 r/	26,400
Total	131,112	123,500	121,700	125,400 r/	111,000
Brazil:					
Primary	27,663	24,000 r/	13,958	-- r/	--
Secondary	47,027	60,000 r/	65,000 r/	104,000 r/	105,000
Total	74,690	84,000 r/	78,958 r/	104,000 r/	105,000
Bulgaria:					
Primary e/	47,000	52,000	62,200	64,600 r/	60,000
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total	56,994	61,950	72,150	74,550 r/	70,000
Burma: Primary	1,561	1,797	1,753	1,984 r/	2,000
Canada:					
Primary	147,907	153,035	178,019	194,031	162,000
Secondary	69,107	98,605	103,372	115,348	113,000 3/
Total	217,014	251,640	281,391	309,379	275,000 3/
China: e/					
Primary	372,000	408,000	432,000	562,000 r/	506,000
Secondary	40,000	59,900	176,000	144,000 r/	140,000
Total	412,000	468,000	608,000	706,000 r/	646,000
Colombia: Secondary e/	3,600	3,500	3,500	3,500	3,500
Czech Republic: Secondary e/	15,000	15,000	15,000	15,000	15,000
France:					
Primary	112,300	105,250	133,580	141,000 r/ e/	115,000
Secondary e/	146,000	155,000	156,000	153,000 r/ e/	168,000 3/
Total	258,700	259,950	290,050	293,850 r/	282,788 3/
Germany:					
Primary	174,595	189,435	146,750 r/	88,700 r/	90,000
Secondary	159,561	142,249	164,400 r/	149,400 r/	150,000
Total	334,156	331,684	311,150 r/	238,100 r/	240,000
Hungary: Secondary e/	100	100	--	--	--
India: e/					
Primary	60,000 r/	60,000 r/	62,000 r/	67,000 r/	69,000
Secondary	18,200	21,700	28,000	27,000	24,000
Total	78,200 r/	81,700 r/	90,000 r/	94,000 r/	93,000
Iran:					
Primary e/	14,600	10,100	4,000	5,700	5,000
Secondary e/	37,400	41,200	41,200	41,200	41,000
Total	52,000	51,300	45,200	46,900	46,000
Ireland: Secondary e/	12,000	10,000	10,400	10,000	10,000

See footnotes at end of table.

TABLE 15--Continued
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1993	1994	1995	1996	1997 e/
Italy:					
Primary	89,900	91,700	84,900	113,800 r/	115,000
Secondary	92,900	114,200	95,500	96,000 e/	95,000
Total	182,800	205,900	180,400	209,800 r/	210,000
Jamaica: Secondary e/	800	800	800	800	800
Japan:					
Primary	212,145	181,707 r/	148,117 r/	140,531	142,326 3/
Secondary	97,307	110,512 r/	139,461 r/	146,842	154,433 3/
Total	309,452	292,219 r/	287,578 r/	287,373	296,759 3/
Kazakstan: e/					
Primary	200,000 r/	110,000 r/	70,000 r/	65,000 r/	65,000
Secondary	55,000 r/	28,000 r/	18,000 r/	13,900 r/	15,000
Total	255,000 r/	138,000 r/	88,000 r/	78,900	80,000
Korea, North: e/					
Primary	75,000	75,000	75,000	75,000	75,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	80,000	80,000	80,000	80,000	80,000
Korea, Republic of: e/					
Primary	88,000	86,457 3/	129,744 3/	88,556 3/	121,296 3/
Secondary	10,000	10,000	10,000	10,000	10,000
Total	98,000	96,500	140,000	98,600	131,000
Macedonia:					
Primary	34,080 r/	28,464 r/	28,000 r/	28,000 r/	25,000
Secondary e/	2,000	2,000	2,000	2,000	2,000
Total e/	36,100 r/	30,500 r/	30,000 r/	30,000 r/	27,000
Malaysia: Secondary e/	29,000	33,200	33,600	36,000 r/	36,000
Mexico:					
Primary 4/	178,419	160,734 r/	165,868 r/	150,395 r/	168,164 3/
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	188,000	171,000 r/	176,000 r/	160,000 r/	178,000
Morocco:					
Primary e/	69,100 r/	60,700 r/	60,400	59,700	64,200
Secondary e/	2,000	2,000	2,000	2,000	2,000
Total	71,110 r/	62,740 r/	62,363	61,749	66,202 3/
Namibia: Primary 5/	31,236	23,813	26,752	8,588 r/	505
Netherlands: Secondary e/	24,200 3/	25,000	25,000	25,000	25,000
New Zealand: Secondary e/	3,000	6,000	6,000	6,000	6,000
Pakistan: Secondary e/	3,000	3,000	2,500	2,000	2,000
Peru:					
Primary	87,197	88,071	89,696	94,324 r/	86,015 3/
Secondary	5,000 e/	5,000 e/	--	--	--
Total	92,200 e/	93,100 e/	89,696	94,324 r/	86,015 3/
Philippines: Secondary	24,300	17,200	17,200 e/	17,200 e/	17,000
Poland:					
Primary e/	47,300	46,300	51,400	51,000	50,000
Secondary e/	15,000	15,000	15,000	15,000	15,000
Total	62,300	61,300	66,400	66,000 e/	65,000
Portugal: Secondary e/	8,300	12,000	12,000	12,000	12,000
Romania:					
Primary	11,800	10,000 r/	14,000 r/	16,000 r/	20,000
Secondary e/	5,610 3/	5,000 r/	4,000	3,000 r/	5,000
Total e/	17,410 3/	15,000 r/	18,000 r/	19,000 r/	25,000
Russia: e/					
Primary	34,000 r/	25,000 r/	20,000 r/	20,000 r/	32,000
Secondary	11,000 r/	9,000 r/	10,000 r/	10,000 r/	20,000
Total	45,000 r/	34,000 r/	30,000 r/	30,000 r/	52,000
Serbia and Montenegro: Primary	6,393	4,458	11,468	30,317 r/	23,632 3/

See footnotes at end of table.

TABLE 15--Continued
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1993	1994	1995	1996	1997 e/
Slovenia: e/					
Primary	1,000	1,000	--	--	--
Secondary	3,000	5,424 3/	7,425 3/	7,000	7,000
Total	4,000	6,424 3/	7,425 3/	7,000	7,000
South Africa: Secondary	31,800	31,900	32,100	32,000 r/	42,000 3/
Spain: e/					
Primary	62,400	70,400	-- r/	-- r/	--
Secondary	61,000	69,600	80,000	86,000 r/	88,000
Total	123,000	140,000	80,000 r/	86,000 r/	88,000
Sweden: e/					
Primary	46,752 3/	46,600	39,700 r/	33,000 r/	50,000
Secondary	37,764 3/	36,000	51,500 r/	52,000 r/	45,000
Total	84,516 3/	82,600	91,200 r/	85,000 r/	95,000
Switzerland: Secondary	6,000	6,350	6,400 e/	6,400	6,000
Thailand: Secondary	17,060	16,904	19,070	17,711 r/	18,000
Trinidad and Tobago: Secondary e/	1,700	1,600	1,600	1,600	1,600
Tunisia:					
Primary e/	-- r/	-- r/	-- r/	-- r/	--
Secondary	-- r/	-- r/	-- r/	-- r/	--
Total e/	-- r/	-- r/	-- r/	-- r/	--
Turkey: e/					
Primary	3,000	4,000	4,000 r/	4,000 r/	4,000
Secondary	2,000	2,100	2,000	5,000	5,000
Total	5,000	6,100	6,000 r/	9,000 r/	9,000
Ukraine: Secondary e/	17,000	9,000 r/	14,000	21,000 r/	18,000
United Kingdom:					
Primary	209,560	191,036	149,706	168,108	215,243 3/
Secondary	154,193 r/	161,430	170,998	177,466	175,783 3/
Total	363,753 r/	352,466	320,704	345,574	391,026 3/
United States:					
Primary	335,000	351,000	374,000	326,000	343,000 3/
Secondary	893,000	931,000	1,020,000	1,070,000 r/	1,110,000 3/
Total	1,230,000	1,280,000	1,390,000	1,400,000 r/	1,450,000 3/
Venezuela: Secondary e/	14,000 3/	15,000 3/	16,000 r/	16,000	16,000
Zambia: Primary 6/	2,002	--	--	--	--
Grand total	5,420,000 r/	5,390,000 r/	5,600,000 r/	5,690,000 r/	5,760,000
Of which:					
Primary	3,130,000 r/	2,980,000 r/	2,890,000 r/	2,900,000 r/	2,900,000
Secondary	2,290,000 r/	2,410,000 r/	2,710,000 r/	2,790,000 r/	2,860,000

e/ Estimated. r/ Revised.

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

2/ Table includes data available through July 1, 1998. 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.

3/ Reported figure.

4/ Includes lead content in antimonial lead.

5/ Includes products of imported concentrate.

6/ Data are for fiscal year beginning April 1 of that stated. Smelter operation closed March 1993. Production in 1993 includes secondary output and may all simply be remelt.