LEAD

By Gerald R. Smith

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Domestic lead mine production increased for the sixth straight year, increasing by about 5% compared with that of 1998. Alaska and Missouri were the dominant producing States with a 92% share. Other appreciable lead mine production was in Idaho and Montana. Lead was produced at 19 mines employing about 1,100 people. The value of domestic mine production was about $480 million. The lead concentrates produced from the mined ore were processed into primary metal at two smelter-refineries in Missouri and a smelter in Montana.

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 8 companies operating 16 smelters.

During 1999, U.S. Government agencies issued several proposed and final rules on matters affecting the lead industry. The rules included national emission standards for hazardous air pollutants at primary lead smelters, requirements for notification, evaluation, and reduction of lead-based paint hazards in Federally owned residential property, housing receiving Federal assistance, and recommendations for new regulations that would effectively lower the reporting threshold for lead and lead compounds. Several extensions of time for public comment on proposed rules were issued by one agency. In addition, notices of funding awards and funding availability were provided for technical studies on lead-based paint hazard control.

Lead was consumed in about 150 plants to manufacture end-use products, including batteries, ammunition, covering for power and communication cable, building-construction materials, and solders for motor vehicles, metal containers, and electrical/electronic components and accessories.

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. The Battery Council International reported SLI battery shipments of 100 million units (Fowler, 2000, p. 8-14). This total included original equipment and replacement automotive-type batteries. An estimated 1.06 million metric tons of lead was contained in SLI batteries shipped in 1999.

Monthly sales of lead from the National Defense Stockpile (NDS) continued during 1999. Sales totaled about 60,800 metric tons (67,100 short tons), leaving about 252,000 tons (277,000 short tons) in the NDS at yearend.

Lead prices continued to decline throughout the year. The average London Metal Exchange (LME) and North American Producer prices were down by $0.012 per pound and $0.016 per pound, respectively, in 1999, from the average prices of $0.239 per pound and $0.452 per pound, respectively, in 1998.

Of the 42 countries in which lead was mined, the top 5 accounted for 71% of the world's total production of 3.02 million tons. Australia was the largest producer, with 23% of the world total, followed by the United States, 17%; China, 17%; Peru, 9%; and Canada, 5%.

Worldwide reserves of lead contained in demonstrated resources from producing and nonproducing deposits at yearend were estimated to be 64 million tons by the U.S. Geological Survey (USGS). Reserves for the three largest producers in the world, Australia, the United States, and China, were about 17 million, 6.5 million, and 9 million tons, respectively. The reserve base (reserves plus measured and indicated resources in marginal economic deposits) for Australia and China was 36 million and 30 million tons, respectively. The reserve base for the United States was 20 million tons. The total world reserve base at the end of 1999 was estimated to be 143 million tons.

Legislation and Government Programs

Monthly sales of lead from the NDS continued during 1999. As a result of these sales and delivery of previously committed inventory, lead disposal from stockpile inventory during 1999 totaled about 60,800 tons (67,100 short tons). The Defense National Stockpile Center's (DNSC) Annual Materials Plan (AMP) approved by the U.S. Congress for fiscal year 1999 (October 1, 1998-September 30, 1999) included a maximum sales 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 1999 was 48,600 tons (53,600 short tons). The AMP approved by the U.S. Congress for fiscal year 2000 (October 1, 1999-September 30, 2000) also included a maximum sales authority for lead of 54,400 tons (60,000 short tons). Under the fiscal year 2000 authority, disposal of lead from NDS inventory during the last 3 months of 1999 amounted to 12,200 tons (13,500 short tons), leaving about 252,000 tons (277,000 short tons) of lead at yearend. A solicitation was issued by the DNSC in late 1999 for the sale of lead from the NDS in negotiated long-term contracts. This solicitation included several grades of lead totaling about 10,600 tons (11,700 short tons).

During 1999, U.S. Government agencies issued several proposed and final rules, announced funding awards and funding availability, and requested specific information and comments from the public on matters affecting the lead industry. In January, the U.S. Environmental Protection Agency (EPA) reopened the comment period on a proposed

regulation to establish standards for identification of lead-based paint hazards, lead-contaminated dust, and lead-contaminated soil in residences and child-occupied facilities (U.S. Environmental Protection Agency, 1999h). The EPA's proposed regulation is in accordance with section 403 of the Toxic Substances Control Act, as amended by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as Title X. The proposed regulation was first introduced by the EPA in June 1998 and was followed by two extension periods for further receipt of public comment in October and November 1998. The additional comment period in January 1999 also was followed by a public meeting on the proposed regulation. This meeting was intended to provide further opportunity for comments from various parties pertaining to environmental justice issues affected by the regulation (U.S. Environmental Protection Agency, 1999g). By yearend 1999, no final rule had been issued by the EPA on the proposed regulation.

In January, the EPA proposed a rule to lower the reporting thresholds for certain persistent bioaccumulative toxic (PBT) chemicals that are subject to reporting under section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and section 6607 of the Pollution Prevention Act of 1990. In the proposal, EPA had requested the separate reporting of the alkyl lead compounds tetraethyl lead and tetramethyl lead and sought public comment on this particular provision. For the initial rulemaking on PBT chemicals, EPA reviewed the persistence and bioaccumulation data for tetraethyl and tetramethyl lead but did not review the available data for elemental lead or other lead compounds. The EPA's intent was to review available data on elemental lead and other lead compounds to determine whether they also should be considered as PBT chemicals, and whether it would be appropriate to establish lower reporting thresholds for these chemicals. Any such determinations by EPA were to be made part of an additional rulemaking activity on PBT chemicals (U.S. Environmental Protection Agency, 1999l). As a result of the EPA's further review, the Agency issued a proposed rule in August that would reduce the reporting threshold for lead and lead compounds currently subject to reporting under Section 313 of EPCRA and section 6607 of the Pollution Prevention Act of 1990. The EPA believed that lead and lead compounds are PBT chemicals that warrant lower reporting thresholds than those currently established under EPCRA section 313. The proposal also included a limitation on the reporting of lead when contained in certain alloys, as well as modifications to certain reporting exemptions and requirements for lead and lead compounds (U.S. Environmental Protection Agency, 1999d). After issuance of the initial proposal on lead and lead compounds, the EPA extended the original 45-day comment period by an additional 90 days for further receipt of and consideration of public concerns and questions regarding the Agency's proposed rule (U.S. Environmental Protection Agency, 1999c). In conjunction with these extensions, the EPA also held public meetings in Los Angeles, CA, Chicago, IL, and Washington, DC, in December to obtain further comments on the proposed rule on lead and lead compounds (U.S. Environmental Protection Agency, 1999e). As part of the proposed rulemaking process, the EPA addressed the issue of reporting thresholds for PBT chemicals, as it pertained to the alkyl lead compounds tetraethyl lead and tetramethyl lead. Specifically, the EPA had issued its final rule on the reporting thresholds for certain other PBT chemicals in October and had excluded any final action on the alkyl lead compounds in this final rule (U.S. Environmental Protection Agency, 1999k).

In another action taken by the EPA, a final rule was issued on national emission standards for hazardous air pollutants for new and existing primary lead smelters. The action was pursuant to section 112 of the Clean Air Act as amended in November 1990. The effective date for implementation of the final rule was June 4, 1999 (U.S. Environmental Protection Agency, 1999i).

The EPA also issued a final rule in June to establish fees for the accreditation of training programs and certification of contractors engaged in lead-based paint activities, pursuant to section 402 (a) (3) of the Toxic Substances Control Act. The fees are established to recover, for the U.S. Treasury, EPA's cost of administering and enforcing the standards and requirements applicable to such activities (U.S. Environmental Protection Agency, 1999f). The EPA had withdrawn its final rule on this matter in October 1998, pending review of public comments on the rule.

In August, the EPA issued a notice requesting information from interested parties, particularly the U.S. regulated community, concerning transfrontier movement of wastes, including certain lead metal wastes, to recycling operations within the member countries of the Organization for Economic Cooperation and Development (OECD). The information will be used by the EPA and other Federal agencies in developing U.S. positions, with respect to potential harmonization of OECD Council decisions on the transfrontier movement issue with those of the Basel Convention (U.S. Environmental Protection Agency, 1999m).

In November, the EPA announced its solicitation of pre-application grant proposals for technical studies to minimize lead hazards to occupants engaged in home improvement, repainting, renovation, and remodeling projects. The EPA anticipated that about $700,000 would be available in fiscal year 2000, with individual grants and cooperative agreements awarded in the range of $60,000 to $100,000. Eligible recipients included, but were not limited to, nonprofit organizations, institutions of higher learning, state and local associations, States, Federally recognized Indian Tribes and tribal organizations, for-profit organizations, trade and professional associations, and labor unions and joint labor/management trust funds. The applicant's proposed period of technical studies was to be scheduled to begin on October 1, 2000, and to last for a duration of up to 2 years. Decisions on the awarding of the grant funds were to be made based on the evaluation of the pre-application grant proposals, at which time the successful applicants then would be requested to submit other documents to complete the application process (U.S. Environmental Protection Agency, 1999j).

In April, the EPA and the U.S. Department of Housing and Urban Development (HUD) solicited public comment on changes to the renewal application for its Information Collection Request (ICR) pertaining to residential lead-based

paint hazard disclosure requirements. After revisions, based upon written comments received by the agencies, the amended ICR was submitted to the U.S. Office of Management and Budget (OMB) for its review and approval. Subsequently, the OMB extended approval of the requested information collection activity in May and November, with the latter approval extending through the end of February 2000. The original ICR, in effect through April 1999, had been approved in 1996, and, thus, required revision to the estimates of burden and cost expended in order for persons to generate, maintain, retain, disclose, or provide information to or for EPA and HUD. The lead-based paint disclosure information is collected in accordance with section 1018 of the Residential Lead-Based Paint Hazard Reduction Act of 1992. This section of the act requires that sellers and lessors of most residential housing built before 1978 disclose information on the presence of lead-based hazards in such dwellings, and provide an EPA-approved pamphlet to purchasers and renters before selling or leasing the housing (U.S. Environmental Protection Agency and U.S. Department of Housing and Urban Development, 1999; U.S. Environmental Protection Agency, 1999a, b). HUD also issued a request for public comment on its proposed information collection requirements as authorized under section 1012 (Federal assistance housing) and section 1013 (federally owned housing) of the Residential Lead-Based Paint Hazard Reduction Act. As with section 1018, sections 1012 and 1013 also require that a pamphlet on lead poisoning prevention be distributed to tenants and purchasers, as well as a notice to occupants on the results of the hazard evaluation and the actions taken to reduce lead hazards. In addition, sections 1012 and 1013 require that a designated party (i.e., residential property owner or housing agency) submit to the appropriate public health department information on any child, residing in such Federal housing, who has been identified as having a blood lead level that would necessitate additional housing evaluation and hazard reduction activities (U.S. Department of Housing and Urban Development, 1999c).

In September, HUD issued its final rule on the requirements for notification, evaluation, and reduction of lead-based paint hazards in federally owned residential property and housing receiving Federal assistance. The rule implements Sections 1012 and 1013 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, which is Title X of the Housing and Community Development Act of 1992. The requirements of this final rule are based on the practical experience of cities and States as well as others who have been controlling lead-based paint hazards in low-income, privately owned housing and public housing through HUD assistance. As a result of this ruling, all of HUD's Federal programs concerning lead-based paint requirements now are consolidated into a component of Title 24 of the Code of Federal Regulations (U.S. Department of Housing and Urban Development, 1999e).

In other actions by HUD, the Department published a request in May for public comment on proposed information collection requirements pertaining to a review of currently available lead-based paint encapsulants and use patterns in the control of residential lead-based paint hazards (U.S. Department of Housing and Urban Development, 1999b). Public comment was also requested by HUD on proposed information collection requirements for the formulation of training materials and guidance on interpreting lead-based paint inspection and risk assessment reports (U.S. Department of Housing and Urban Development, 1999d).

In March, HUD's Office of Lead Hazard Control, in accordance with section 102 (a) (4) (c) of HUD's Reform Act of 1989, announced the recipients of funding for lead hazard control for fiscal year 1998. Twenty-one applicants received a total of $50 million for lead-based paint hazard control in low income private housing. Seven applicants received $3.2 million for lead hazard control research, and 18 applicants received approximately $3.1 million for local and national lead hazard control awareness campaigns (U.S. Department of Housing and Urban Development, 1999a).

In April, the U.S. Department of the Interior, Fish and Wildlife Service, announced its intention to promulgate regulations that would prohibit the use of fishing sinkers and jigs made of lead and lead alloys on certain units of the National Wildlife Refuge System. The prohibition would be enforced in units where mortality of common loons from ingestion of lead sinkers had occurred or where concerns existed because habitat use by loons and significant fishing activity overlapped. Refuges that met this criteria would be designated as "lead-free fishing areas." The affected refuges were identified in a component of the Agency's proposed rule on refuge-specific public use regulations issued in June 1999 (U.S. Department of the Interior, 1999).

Production

Primary.—In 1999, domestic mine production of lead increased for the sixth straight year and was up by about 22,000 tons, or 5%, compared with that of 1998. Increases in production were reported at several mines in Alaska, Idaho, and Missouri. The major share of the U.S. mine output of lead was derived from production in Alaska and Missouri. Appreciable lead mine production also was reported in 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 major lead-producing mines responded to this survey. The lead concentrates produced from the mined ore were processed into primary metal at two smelter-refineries in Missouri and a smelter in Montana (tables 1-4).

The Doe Run Resources Corp., St. Louis, MO, produced primary lead at two smelter-refinery facilities in Missouri. Concentrates for the smelter-refineries were provided from six Doe Run mills that were supplied with ore mined from eight production shafts along the Viburnum Trend in southeastern Missouri. As of October 31, 1999, the company's proven and probable U.S. ore reserves were about 65 million tons, grading 5.62% lead, 1.13% zinc, and 0.22% copper. In fiscal year 1999, ending October 31, 1999, Doe Run shipped about 516,000 tons of refined lead and lead alloy products, including recycled lead produced at its secondary smelter in southeastern Missouri. Doe Run's issued and outstanding stock is indirectly owned by The Renco Group, Inc., a New York-based, privately

held company with investments in natural resources and industrial operations. During 1999, the company continued exploration drilling in the vicinity of all eight of its mines in the Viburnum Trend region. Exploration activity was carried out both at the surface and underground, with a view toward delineating additional ore reserves (The Doe Run Resources Corp., 1999, p. 1-3).

ASARCO Incorporated, New York, announced in July that it would close permanently its Black Cloud lead-zinc-silver mine in Leadville, CO. The mine had been placed on care-and-maintenance status in late January 1999, after which time an exploration drilling program was conducted in an attempt to find new lead reserves; the exploration program proved to be unsuccessful. The Black Cloud Mine was first opened in 1971 and, according to a mine official, was operated significantly longer than its originally projected life span (Platt's Metals Week, 1999a).

In November, all outstanding shares of Asarco were purchased by Grupo Mexico, S.A. de C.V., including Asarco's custom primary lead smelter in East Helena, MT (Grupo Mexico, S.A. de C.V., 1999b). Asarco continued to operate the smelter during the year, producing lead bullion at the plant capacity level of about 75,000 tons per year. All of the bullion product from the East Helena facility was exported for further refining (Grupo Mexico, S.A. de C.V., 1999a).

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. After completion of the concentrator expansion program in late 1998, attention at Red Dog during 1999 was focused on optimizing mill operations to improve recovery, concentrate quality, and overall mill output. Several incremental capital projects were identified that will effectively increase mill capacity. A significant component among these projects will be the installation of additional flotation capacity to match the current grinding capacity. All of the mill improvement projects were expected to be completed in the second half of 2001. The average mill recovery of lead at Red Dog increased to 59% in 1999 from 57% in 1998, and overall production of lead concentrate increased by nearly 24% to 152,000 tons at an average concentrate grade of 58.5% lead. Proven and probable ore reserves at Red Dog in 1999 were estimated to be 101 million tons at a grade of 19.0% zinc and 5.2% lead. The four deposits at Red Dog's mineralized center (Main, Hilltop, Aqqaluk, and Paalaaq Zones) were estimated to contain total resources of 142 million tons of ore grading 15.8% zinc and 4.3% lead. In addition, a second mineralized center, the Su Lik deposit, about 19 kilometers north of Red Dog, contained an estimated 34 million tons of mineral resources grading about 8% zinc and 2% lead. Further exploration in 1999 resulted in the discovery of a third mineralized center, Anarraaq, about 10 kilometers north of Red Dog. Preliminary drilling results suggested that ore grades at the Anarraaq center may be slightly higher than the average grade of Red Dog's currently delineated total mineral resources. In other developmental activities during the year, Cominco, in cooperation with the U.S. Army Corps of Engineers, began funding a 2-year study to determine the viability of upgrading Red Dog's existing shipping facility into a deep-water port. The study will address the feasibility of dredging a deep channel through the shallow coastal waters to the shoreline in order to accommodate ocean-going vessels. Under the present shipping system, concentrate is loaded onto barges and is transferred to large-capacity vessels anchored 5 kilometers offshore.

In 1999, Cominco also continued the development of the Pend Oreille zinc-lead mine near Metaline Falls, WA. Engineering design for the service shaft and associated electrical services commenced in the last quarter, and a full feasibility study was scheduled for completion in 2000. Based on preliminary economics, a hoist was purchased for an internal production shaft to allow an early 2002 startup of the mine. The permitting process was expected to be completed in time to make a decision on mine production by mid-2000. A limited diamond drilling and geophysical program were conducted during the year that established several areas with the potential for adding to Pend Oreille's reserve base. Based upon current reserves, Pend Oreille's mine life is about 8 years (Cominco Ltd., 1999, p. 12-20).

Hecla Mining Company, Coeur d'Alene, ID, operated the Lucky Friday Mine in Mullan, ID, throughout 1999. After completion of the "Lucky Friday Expansion Project" (i.e, the adjacent Gold Hunter ore body) in mid-1998,the first full year of production at the Gold Hunter property in 1999 resulted in increased output at the Lucky Friday Mine. Ore was processed during the year in a conventional flotation mill at a full-capacity rate of about 1,000 tons per day. Both silver-lead concentrates and zinc concentrates were produced at the mill, with 94% of the silver, 93% of the lead, and 41% of the zinc being economically recovered. Production of lead in concentrates from Lucky Friday was about 25,000 tons in 1999, essentially equivalent to that of 1998. Adjustments in ore tonnage and metal grade were made in 1999 after additional diamond drilling data were included with the statistical and traditional calculation of estimated reserves. Total proven and probable ore reserves at the Lucky Friday and the Gold Hunter deposits were about 1.5 million tons grading 9.6% lead at yearend 1999 compared with 1.1 million tons grading 10.5% lead at yearend 1998.

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 a wholly owned subsidiary of Kennecott Minerals Corp. At Greens Creek, about 1,500 tons per day of ore was mined from the underground South, Southwest, and West ore zones and milled on-site to yield lead, zinc, and bulk concentrates, as well as a gold-silver doré. Total production of lead in concentrate was about 23,000 tons in 1999 compared with about 20,000 tons in 1998. Estimated reserves at the Greens Creek Mine at yearend 1999 were 9.1 million tons grading 4.5% lead, compared with 8.8 million tons grading 4.5% lead at yearend 1998 (Hecla Mining Company, 1999, p. 4-12).

Canada's Atna Resources Ltd. and Grayd Resources Corp.

signed a letter of agreement in midyear whereby Atna would have an option to earn a 51% interest in Grayd's wholly owned Dry Creek and Anderson Mountain properties in the Bonnifield District, south of Fairbanks, AK. Exploratory drilling in the early 1980's at Dry Creek reportedly had outlined about 3 million tons of resource, at a grade of 6% zinc, 2.5% lead, and significant quantities of gold and silver (Mining Record, 1999a). Grayd began exploratory drilling at the properties in July and initial drilling results revealed mineralization grades ranging from 0.34% to 2.5% lead and 1.4% to 6.0% zinc. However, the drill program failed to meet Atna's required objectives for outlining a large deposit, and Atna ended its involvement in the Dry Creek and Anderson Mountain development project in October (Northern Miner, 1999a). Grayd continued its exploration activity in the project and in December reported the discovery of a possible new zone of massive sulfides at the Dry Creek property. The new zone is located to the west of Grayd's Fosters Creek Zone where results of drilling in 1999 revealed mineralization containing up to 5.3% zinc and 2.0% lead. Preliminary drilling results at the new zone showed the intersection of massive sulfides averaging 7.9% zinc and 4.0% lead (Mining Record, 1999b).

In other activity by Grayd Resources Corp. during the year, an agreement in principle was negotiated with its joint-venture partner, American Copper and Nickel, Inc., a wholly owned subsidiary of Inco United States, Inc., whereby Grayd would obtain a 100% interest in the Delta and Rumble Creek properties near Tok, AK. An inferred resource of 17.3 million tons, at a grade of 4.7% zinc and 2.0% lead was estimated for the Delta property. At the Rumble Creek property, massive sulfide type deposits were outlined, assaying up to 15% combined lead and zinc (Mining Record, 1999c).

Argentina-based Plata Mining Ltd., reportedly signed a letter of intent with Placer Mining Corp., a privately owned U.S. company, to purchase an interest in Placer's dormant Bunker Hill Mine near Kellogg, ID. As part of the agreement, Plata would have an exclusive option to buy a 100% stake in Bunker Hill, which historically was one of the largest underground lead-zinc mines in North America prior to its closure in 1991. The companies anticipated completing the sales agreement by the end of the year. According to spokespersons for the two companies, ore was expected to be processed at the rate of 400 tons per day when operations were resumed. Historically, the grade of ore recovered from the Bunker Hill Mine averaged about 8.5% lead and 3.5% zinc (Mining Record, 1999e).

Chief Consolidated Mining Co., holder of a controlling interest in the lead-zinc-silver Burgin Mine in the Tintic District of Utah, through its 75% interest in Tintic Utah Metals LLC, continued its efforts to reopen the mine. Korea Zinc Co. Ltd. holds the remaining 25% interest in the Burgin property. The mine was operated by Kennecott Copper Corp. from 1967 to 1978, but Kennecott then discontinued operations as a result of poor ground conditions and the presence of geothermal brines at the mine. Chief Consolidated took action during 1999 to alleviate the latter problem, offering to appropriate the brine from the State of Utah and to desalinate it. The treated water would then be used commercially, and the recovered salt would be sold. In this regard, Chief Consolidated commissioned U.S. Filter Co. to begin a feasibility study for development and construction of a water treatment plant, contingent upon approval of the application for appropriation of the brine. Chief Consolidated had spent much of 1998 and 1999 exploring for reserves at the property, with efforts in 1999 focused on mineralization above the geothermal brine table. Reserves at Burgin reportedly are about 1 million tons, at a grade of 21% lead, 6.7% zinc, and 16.5 ounces per short ton (566 grams per metric ton) silver. The company also began refurbishing the concentrator at the Burgin mill, an effort that by midyear was about two-thirds complete (Northern Miner, 1999b).

Canada's Camnor Resources Ltd. and Oromin Exploration Ltd. announced that a drilling program completed at the Cirque property in Alaska had intersected high-grade volcanogenic massive sulfide mineralization. Drill results from the Discovery and Dol Zones revealed up to 11.5% combined lead, zinc, and copper. The Cirque property is located in the Bonnifield District, 130 kilometers south of Fairbanks, AK. Camnor and Oromin have an option to acquire the property from Great American Exploration Inc., subject to a 3% net smelter return royalty (Mining Record, 1999d).

Secondary.—Domestic secondary production remained essentially unchanged in 1999. Secondary lead accounted for 76% of domestic lead refinery production compared with 77% in 1998. Lead recovered from scrap lead-acid batteries continued at a high level and accounted for 91% 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 of the 21 companies producing secondary lead, exclusive of that produced from copper-based scrap, were surveyed; 18 responded, representing more than 99% of the total production of secondary lead. Of the total lead recycled in 1999, about 98% was produced by 8 companies operating 16 plants in Alabama, California, Florida, Georgia, Indiana, Louisiana, Minnesota, Missouri, New York, Pennsylvania, Tennessee, and Texas. Production and consumption for the nonrespondents were estimated by using prior-year levels as a basis (tables 1, 5-9).

Metalico, Inc., Cranford, NJ, purchased Gulf Coast Recycling, Inc's. secondary lead smelter in Tampa, FL, in March 1999. The smelter was reported to have a production capacity of about 64 tons per day of lead (Ryan's Notes, 1999b). Metalico also owns a secondary smelter in College Grove, TN, that the company acquired from General Smelting and Refining, Inc. in December 1997.

Negotiations were terminated in July between Quexco Inc., the Texas-based holding company (whose assets include RSR Corp., Dallas, TX, a secondary lead producer) and GNB Technologies, Inc., a secondary lead and lead-acid battery producer, ending Quexco's 18-month effort to purchase GNB's lead operations. According to a Quexco spokesperson, the company was unable to reach agreement with GNB's Australian-based parent company, Pacific Dunlop Ltd., regarding certain contractual terms (Metal Bulletin, 1999g).

GNB Technologies, Inc., Atlanta, GA, closed for an indefinite period its secondary lead smelter in Columbus, GA,

at the end of October. The new facility had been in operation for about 4 years, but failed to reach its full production capacity of about 82,000 tons per year. According to a GNB official, the low price of lead, and the cost of producing recycled lead at the Columbus plant prevented the plant from being competitive. However, reopening of the facility remained a possibility, should there be a sufficient rise in lead prices. The company also noted that there were no existing plans to sell the smelter (Metal Bulletin, 1999a).

Sanders Lead Co., Inc., Troy, AL, a major producer of secondary lead, announced late in the year that the company was in the process of obtaining the required permits to add two smelting furnaces to its existing four-furnace facility. The additional furnaces would increase plant production capacity to about 145,000 tons per year from the current 110,000 tons per year (Ryan's Notes, 1999a).

Consumption

Reported consumption of lead increased by about 3.1% as the demand for lead in storage batteries continued to increase. The demand for lead declined in a number of other end uses, including bearing metals, cable covering, and construction materials, such as caulking lead, pipes, traps, and other extruded products. 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 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 117 consuming companies to which a USGS survey request was sent, 83 responded, representing about 94% of the total reported U.S. lead consumption.

The Battery Council International reported SLI-type battery shipments of 100 million units in 1999 compared with 98 million units in 1998 (Fowler, 2000, p. 8-14). The totals include original equipment and replacement automotive-type batteries. By using an estimate of 10.6 kilograms (23.3 pounds) of lead per unit, the SLI shipments in 1999 accounted for about 1.06 million tons of lead. SLI batteries included those used for automobiles, buses, trucks, tractors, motorcycles, and marine craft. (tables 6-13).

World Review

World production of refined lead increased to 6.01 million tons in 1999 from 5.92 million tons in 1998. Other statistics for 1999, as reported by the International Lead and Zinc Study Group, are as follows: world consumption increased to about 6.2 million tons from about 6.0 million tons in 1998; commercial stocks of refined lead in industrialized countries were 603,000 tons, or 5 weeks of consumption, at yearend 1999 compared with 557,000 tons at yearend 1998 and 598,000 tons at yearend 1997; and significant exports of refined lead to industrialized countries from developing Asian countries, notably China, continued during 1999, increasing by about 70%, to 557 thousand tons, compared with those of 1998.

Lead prices exhibited a declining trend for the third consecutive year. The average LME and North American Producer prices were down by $0.012 per pound and $0.016 per pound, respectively, in 1999, from the average prices of $0.239 per pound and $0.452 per pound, respectively, in 1998.

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 (tables 14-15).

New Mines, Plants, Properties, Resources.—In February, Ireland's Navan Resources plc. began mining at its wholly owned Aguas Teñidas polymetallic mine in southern Spain. Production at Aguas Teñidas was expected to be about 160,000 tons of ore in 1999, increasing to 400,000 tons in 2000. The estimate of resources at the mine was reported to be 12.7 million tons at an average grade of 6.2% zinc and 1.9% lead. The deposit also contains appreciable quantities of copper and silver. Navan anticipated that greater resource potential existed at Aguas Teñidas, based upon preliminary drill results obtained in the region immediately west of the existing ore body (Mining Journal, 1999c).

Anglo American plc. reported that the first concentrates from the Lisheen zinc-lead mine in County Tipperary, Ireland, had been shipped in mid-December. Anglo American's subsidiary, Anglo Base Metals Ltd., operates the mine in a joint venture with Ivernia West plc. The Lisheen Mine has a capacity of 330,000 tons per year of zinc concentrate and 40,000 tons per year of lead concentrate. Production from Lisheen is allocated 70% to sales contracts and 30% for sale on the spot market (Mining Journal, 1999d).

Australia's Western Metals Ltd. revealed an exploration plan in September to extend the life of its Hellyer mining operation in Tasmania. The existing Hellyer ore body potentially will be depleted by mid-2000, but its modern processing facilities are valuable to Western Metals and suitable to be used advantageously beyond the life of the Hellyer Mine. Thus, Western signed an agreement with Oceania Tasmania Pty, Ltd. to conduct a drilling program at the Comstock project, 70 kilometers from the Hellyer Mine, late in the year. Upon evaluation of the drilling results, Western Metals Ltd. will have the option of acquiring 70% of Comstock through a cash payment to Oceania. A spokesperson for Western hoped that the exploration would lead to at least a 2-year mine life for Comstock that would provide an extended source of ore for the Hellyer processing facilities (Platt's Metals Week, 1999e).

EuroZinc Mining Corp., Vancouver, Canada, released new resource estimates for its Aljustrel zinc-lead mining project in Portugal, as part of a final feasibility study. According to data derived from extensive diamond drilling and underground channel sampling, the combined Feitas and Moinho deposits were calculated to contain about 141 million tons of mineralization at a grade of 2.79% zinc and 0.97% lead. EuroZinc planned to begin mining in 2000 at Feitas, where most of the initial drilling had been focused. Aljustrel had been operated in the early 1990's by a Portuguese State-owned

mining company but inefficient mining and milling methods, combined with low metal prices, forced its closure. After EuroZinc's final feasibility study is completed and project financing arranged, EuroZinc will have acquired a 75% interest in the Aljustrel project from the State-owned mining company (Northern Miner, 1999c).

In December, High Marsh Holdings Ltd., an exploration company based in the United Kingdom, was awarded an additional three exploration licenses in northern Tunisia. In July, the company had optioned five other licenses it had acquired in this region to Canada's Aurora Gold Corp. All of the licensed properties are located within or near the Zone des Domes metallogenic belt in Tunisia. The geology that is characteristic of this belt reportedly has been host to nearly all past zinc-lead producers in Tunisia, and currently includes Breakwater Resources Ltd.'s Bougrine zinc-lead mine. One of the three new licenses awarded to High Marsh is contiguous with the Fez Ledoun zinc-lead mine. According to a High Marsh spokesperson, this particular license will be the subject of a joint venture with Vancouver-based Consolidated Global Minerals Ltd. (Mining Journal, 1999b).

Closings and Curtailments.—Sources in Bulgaria's Ministry of Finance reported early in 1999 that three Government-owned lead-zinc mines were at risk of being closed because of accumulating operating losses. The mines at Zlatograd, Madan, and Rudozem had been significantly affected by low metal prices and high production costs, the latter reflecting a declining grade of ore at the mines. During the year, the Bulgarian Government continued its efforts to restructure and privatize the mines. The mines provide employment for several thousand people, and mindful of the consequences of closure, the Government was reported to be considering management buyouts for those parts of the operations that are profitable (Mining Journal, 1999a).

China reportedly planned to restructure its secondary lead industry, eliminating small-scale enterprises that are presenting environmental difficulties. According to an official of Hubei Jinyang Metallurgical Company, China planned to reduce the number of lead recycling facilities to 100, a 60% decrease, by 2002. Of the currently operating secondary plants, only three were said to have an output capacity of 10,000 tons per year or more (Platt's Metals Week, 1999c).

In India, recyclers of lead battery scrap were optimistic that a report submitted in midyear by a special committee studying the effects of the partial ban on imports of lead-acid battery scrap and zinc ash would recommend that the ban be lifted. The ban, as it existed in 1999, allowed only five companies to import these materials. Battery scrap processors were hopeful that the committee report would recommend that an open general license (OGL) scheme should be instituted, whereby companies with certified environmentally sound processing facilities could import lead-acid battery scrap. Should an OGL approach be approved, the battery scrap processors were said to be preparing to increase India's annual production of secondary lead by 40,000 tons per year. Simultaneous with the special committee study, the Indian Ministry of Environment formed a group to suggest methods to improve the collection of spent batteries by approved battery scrap processors. In addition, a program to attract the spent batteries to environmentally friendly processing units through legislative means was under discussion, but details on such a program are expected to take considerable time to prepare (Metal Bulletin, 1999c). By yearend, the partial ban on imports of lead-acid battery scrap had not been lifted, and, according to a report given by representatives of the Indian Bureau of Mines, the gap between supply and demand for lead in India had been increasing. Consequently, the Government reportedly was giving serious consideration to lifting the ban. Additional domestic lead capacity that might help to balance India's lead supply and demand was not expected in the near future. Therefore, a further increase in imports of lead was anticipated should the ban fail to be lifted. In a related action, the Indian Government was in the process of instituting new legislation that will require battery sellers to collect a spent lead-acid battery for each new battery that is sold. The new law places the responsibility for collecting spent batteries on battery producers, importers, assemblers, and reconditioners (Metal Bulletin, 1999b).

Reopenings and Expansions.—In July, milling operations were resumed at the Los Frailes Mine near Seville, Spain. The mine and mill had not been in operation since April 1998 when a tailings dam failed, flooding a significant portion of the neighboring land and forcing its indefinite closure. The owner of the mine, Boliden Apirsa S.L., a subsidiary of Canada's Boliden Ltd., reported that initial milling was conducted at about 70% of plant capacity, but that full capacity was expected to be reached rather quickly. Mining at Los Frailes had been restarted in April 1999 after a mining license had been received, and a permit had been issued to dump tailings from the Los Frailes operations at the adjacent Aznalcollar mine site (Metal Bulletin, 1999f).

In China, plans to increase lead production and exports were reported by several companies. Yuguang Gold and Lead Group in Henan Province expected to produce 60,000 tons of refined lead in 1999, up 11% from the previous year, and to raise exports to 50% of production from the current 40%. The company further planned to increase production capacity to 100,000 tons by 2001. In Yunnan Province, Kunming Smelter revised its 1999 lead production target to 65,000 tons, 5,000 tons more than it had originally forecast. The higher production was partly attributed to the completion of a renovation project in 1999 that increased lead production capacity to 6,400 tons per month from the previous 3,800 tons per month. Kunming expected to export 3,000 tons of lead per month, three times its original projection. Hanjiang Smelter in Hubei Province anticipated that it would produce 45,000 tons of lead in 1999, up 15,000 tons from 1998. Exports to southeast Asian countries increased by 20% in 1998. Production capacity at Hanjiang was increased to 50,000 tons per year, up from its previous 30,000 tons per year, upon completion of an expansion project in mid-1999. Shikoushan Mining Administration in Hunan Province planned to produce 45,000 tons of lead in 1999, up 5,000 tons from 1998, and expected to raise capacity an additional 5,000 tons per year by 2000. In northern China's Hebei Province, the first phase of an expansion program was completed at Baoding Feng Fan Lead

Factory, increasing the plant capacity by 8,000 tons from the previous 10,000 tons per year. Another 2,000 tons of capacity were to be added in a second expansion phase, but a timetable had not been set for completion of this phase. The majority of Baoding Feng Fan's lead is consumed by its Chinese subsidiaries in the production of lead-acid batteries (Platt's Metals Week, 1999c). China's Xitieshan Mining Administration increased its refined lead production capacity by 20,000 tons per year to a level of 50,000 tons per year, as a result of the opening of its expanded production facility in early August. The company planned to add another 20,000 tons of capacity by 2002, but expected to maintain exports at 50,000 tons per year, and use the additional production as a supply to domestic fabricators and lead alloy producers (Platt's Metals Week, 1999b).

The St. Louis-based Doe Run Resources Corp. reported in September that its 10-year modernization plan for the La Oroya smelting and refining complex in Peru was proceeding on schedule, resulting in higher metal production. Doe Run purchased the complex from Peru's State-owned Empresa Minera del Centro del Perú in August 1997. According to a Doe Run spokesperson, throughput at the facilities has been increased by 15% for lead, and 10% to 15% for zinc (American Metal Market, 1999).

Production of refined lead in Kazakhstan has been increasing, reaching nearly 43,000 tons in the third quarter of 1999, up 83% from the same quarter of 1998. Lead production for the first 9 months of the year totaled about 113,000 tons, a 66% increase compared with production in the same period of 1998. Kazakhstan accounted for an estimated 80% of the regional production of refined lead in the first 3 quarters of 1999. Reportedly, the recent installation of new smelting furnaces at both the Ust-Kamenogorsk and Chimkent (renamed Yuzhpolimetall) smelters could further increase Kazakhstan's refined lead production (CRU International Ltd., 1999).

Transfers of Ownership, Sales Offerings, Mergers.—In April, Bulgaria's Privatization Agency selected a preferential buyer for 57% of the state's interest in the Karjali lead and zinc complex. Terms of the preliminary contract were being negotiated between the agency and two Bulgarian joint-stock holding companies, one a consortium of Karjali management and employees and the other a private investment firm, Karjali Invest. The Bulgarian government was unable to attract any bids for Karjali in its previous attempt to sell the complex in November 1998, when it was tendered at a higher price (Metal Bulletin, 1999e).

The Bulgarian Privatization Agency reportedly also was close to reaching a decision on an offer from an undisclosed Turkish metals company to purchase Kombinat za Czvetni Metali (KCM), Bulgaria's largest lead and zinc smelter, located near Plovdiv. The Turkish offer was the lone bid received for KCM by the mid-May deadline. Bulgarian Government officials were said to be considering the bidder's investment plan for KCM in conjunction with the results of a special advisory study before making a final decision on the sale. KCM officials indicated that the smelter is currently being operated at or near its production capacity of 55,000 tons per year of zinc and 40,000 tons per year of lead (Metal Bulletin, 1999h).

Ireland's Ivernia West was reported to be interested in purchasing a 20% stake in the Magellan lead project in Western Australia. Upon completion of an ongoing feasibility study, Ivernia will have the option of increasing its stake in the project by an additional 40%. Results of prefeasibility studies on the Magellan deposit indicated a mineable resource of 8.2 million tons of ore at an average grade of 7.75% lead, sufficient for 9 years of mining at the projected annual mining rate of 930,000 tons per year (Metal Bulletin, 1999d).

Italy's Enirisorse SpA signed a contract in June with Ammizinc, a unit of the Swiss-based trading group Glencore International AG, for the sale of Enirisorse's Porto Vesme primary lead-zinc complex in Sardinia that includes the San Gavino refinery. The deal with Glencore completed a sales process that had continued for nearly 3 years. Annual production capacity at Porto Vesme is 181,000 tons of zinc and 135,000 tons of lead (Platt's Metals Week, 1999d).

Union Itok International AG (UII), a joint-venture company consisting of Australia's Union Mining Ltd. and Iran's Itok Engineering and Technology Company, announced that it will further explore and develop the Mehdiabad zinc-lead-silver deposit in central Iran, under an agreement signed in midyear. The joint-venture agreement was subject to the approval of the Iranian Ministry of Mines. UII compares the potential of the Mehdiabad deposit to that of Australia's Century and McArthur River Mines. Mehdiabad is estimated to contain nearly 97 million tons of total resources, at a grade of 10.1% zinc and 2.5% lead (Metal Bulletin, 1999j). By yearend, a security of tenure agreement had been signed as an initial step in the potential development of the Mehdiabad deposit. A prefeasibility study was being undertaken by an independent consultant to determine the processing and mining options at Mehdiabad. Development of the deposit as a large open pit mine and economic processing of the complex ore in an integrated facility was believed to be feasible. Pending the results of the full-feasibility study, the project was expected to be ready for development in about 2 years (Metal Bulletin, 1999i).

Outlook

Total world demand for refined lead is expected to rise in 2000 by 1.8% to 6.3 million tons; in the industrialized countries alone, demand is expected to increase by 1.5% to 5.5 million tons. Demand is expected to continue to grow in Asia, rising by 3.2%, and to recover in Europe, increasing by 2.5%. Lead mine output in 2000 is predicted to rise by 4.1% worldwide to 3.1 million tons, and by 5.2% in the industrialized countries to 2.4 million tons. Australian production will benefit from the first year of production at the Century Mine. There also will be an appreciable increase in mine output in Ireland as a result of the commissioning of the Lisheen Mine, and in Spain as a result of the reopening of the Los Frailes Mine. Production of refined lead is likely to recover to earlier levels in Mexico, and to increase in Australia, Belgium, Germany, Italy, Romania, and the United States, resulting in a 2.4% increase in world production to 6.3 million tons, including a 2.9% rise in industrialized country output to

5.1 million tons (International Lead and Zinc Study Group, 1999).

Lead-acid batteries will continue to dominate the demand for lead. The Chicago-based Battery Council International, anticipates significant growth in lead-acid battery usage during the next 5 years. As a result of the increased use of fiber optics, broadband communications systems, computer networks, and their basic need for backup power systems, industrial lead-acid battery demand is projected to double by 2005. By then, the backup battery power systems are expected to represent about 65% of the industrial battery market. Contributing to the increase in demand will be the development and installation of new data networks that will be carrying a significantly greater volume of traffic. Demand for lead-acid batteries in the automotive sector also is expected to increase appreciably during this period. Automotive manufacturers are producing vehicles with increased electrical demands. As a result, the automotive manufacturers now are working with the lead-acid battery industry to produce dual-battery systems as well as higher voltage batteries to replace the 12-volt-size battery now being used (Battery Council International, September 13, 1999, Lead-acid batteries behind some of the most significant developments of the century, accessed November 16, 1999, at URL http://www.batterycouncil.org/news-anniv.html).

Mine production in the United States should remain constant or decline slightly in 2000 as a result of temporary production cutbacks at several of the larger facilities (Metal Bulletin, 2000). Total metal production from primary and secondary refineries is expected to increase marginally in 2000, but could rise by 2% to 3% should weather-related temperature extremes significantly increase the demand for replacement automotive-type batteries.

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TABLE 1
SALIENT LEAD STATISTICS 1/

(Metric tons, unless otherwise specified)

		1995	1996	1997	1998	1999
United States:						
Production:						
Mine, recoverable lead content 2/		386,000	426,000	448,000	481,000	503,000
Value	thousands	$359,000	$459,000	$460,000	$480,000	$485,000
Primary lead (refined):						
Domestic ores and base bullion		374,000 3/	326,000 3/	343,000 3/	337,000	350,000
Foreign ores and base bullion		W	W	W	W	W
Secondary lead (lead content)		1,020,000	1,070,000	1,110,000	1,120,000	1,110,000
Exports (lead content):						
Lead ore and concentrates		65,500	59,700	42,200	72,400	93,500
Lead materials, excluding scrap		65,300	121,000	104,000	100,000	103,000
Imports for consumption:						
Lead in ore and concentrates		2,600	6,570	17,800	32,700	12,300
Lead in base bullion		31	5	25	464	90
Lead in pigs, bars, and reclaimed scrap		264,000	268,000	265,000	267,000	311,000
Stocks, December 31:						
Primary lead		14,200 3/	8,140 3/	11,900 3/	10,900	12,300
At consumers and secondary smelters		79,400	72,100	89,100	77,900 r/	79,500
Consumption of metal, primary and secondary		1,560,000	1,540,000	1,620,000	1,630,000	1,680,000
Price, North American Producer average, delivered, cents per pound 4/		42.28	48.83	46.54	45.27	43.72
World:						
Production:						
Mine	thousand metric tons	2,830 r/	3,090 r/	3,110 r/	3,080 r/	3,020 e/
Refinery 5/	do.	2,910	2,880 r/	3,030 r/	3,040 r/	3,200 e/
Secondary refinery	do.	2,670 r/	2,740 r/	2,800 r/	2,880 r/	2,810 e/
Price, London Metal Exchange, pure lead, cash average, cents per pound 4/		28.60	35.10	28.29	23.96	22.78

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

1/ Data are rounded to no more than 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	1998	1999
Alaska and Missouri	439,000	464,000
Montana	7,310	7,950
Other States 2/	35,100	31,200
Total	481,000	503,000

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

2/ Includes Colorado, Idaho, New York, and Tennessee.

TABLE 3
LEADING LEAD-PRODUCING MINES IN
THE UNITED STATES IN 1999, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of lead
1	Red Dog	Northwest Arctic, AK	Cominco Alaska Inc.	Lead-zinc ore.
2	Casteel 1/	Iron, MO	Doe Run Resources Corp.	Lead ore.
3	Buick	do.	do.	Do.
4	Sweetwater	Reynolds, MO	do.	Do.
5	Fletcher	do.	do.	Do.
6	West Fork	do.	do.	Do.
7	Lucky Friday	Shoshone, ID	Hecla Mining Company	Silver ore.
8	Greens Creek	Admiralty Island, AK	Kennecott Greens Creek Mining Co.	Zinc ore.
9	Viburnum #29	Washington, MO	Doe Run Resources Corp.	Lead ore.
10	Viburnum #28	Iron, MO	do.	Do.
11	Montana Tunnels	Jefferson, MT	Apollo Gold Co.	Zinc ore.
12	Sunshine	Shoshone, ID	Sunshine Mining Company	Silver ore.
13	Galena	do.	Silver Valley Resources Corp.	Do.
14	Balmat	St. Lawrence, NY	Zinc Corporation of America	Zinc ore.
15	Leadville Unit	Lake, CO	ASARCO Incorporated	Lead-zinc ore.
16	Coy	Jefferson, TN	do.	Zinc ore.
17	Young	do.	do.	Do.
18	Pierrepont	St. Lawrence, NY	Zinc Corporation of America	Do.

1/ Includes Brushy Creek Mill.

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

(Metric tons, unless otherwise specified)

Source material		1998	1999
Refined lead:			
Domestic ores and base bullion		337,000	350,000
Foreign ores and base bullion		W	W
Total		337,000	350,000
Calculated value of primary refined lead 2/	thousands	$336,000	$337,000

W Withheld to avoid disclosing company proprietary data; included with "Domestic ores and base bullion."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ 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, unless otherwise specified)

		1998	1999
Kind of scrap:			
New scrap:			
Lead-base		45,800	42,700
Copper-base		9,440	10,100
Tin-base		--	--
Total		55,200	52,800
Old scrap:			
Battery-lead		1,010,000	1,020,000
All other lead-base		46,600	37,100
Copper-base		7,360	7,210
Tin-base		--	--
Total		1,060,000	1,060,000
Grand total		1,120,000	1,110,000
Form of recovery:			
As soft lead		667,000	635,000
In antimonial lead		417,000	444,000
In other lead alloys		16,100	18,100
In copper-base alloys		16,800	17,300
In tin-base alloys		--	--
Total		1,120,000	1,110,000
Value 2/	thousands	$1,110,000	$1,070,000

-- Zero.

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

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

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

(Metric tons)

SIC code	Product	1998	1999
	Metal products:		
3482	Ammunition, shot and bullets	52,800	58,300
	Bearing metals:		
35	Machinery except electrical	W	W
36	Electrical and electronic equipment	W	W
371	Motor vehicles and equipment 2/	1,700	1,120
37	Other transportation equipment	W	W
	Total	2,210	1,570
3351	Brass and bronze, billets and ingots	3,460	3,940
36	Cable covering, power and communication	4,630	2,410
15	Calking lead, building construction	1,350	971
	Casting metals:		
36	Electrical machinery and equipment	W	W
371	Motor vehicles and equipment	W	W
37	Other transportation equipment	3,420	4,950
3443	Nuclear radiation shielding	1,570	1,770
	Total	32,600	34,300
	Pipes, traps, other extruded products:		
15	Building construction	3,130	2,020
3443	Storage tanks, process vessels, etc.	(3/)	(3/)
	Total	3,130	2,020
	Sheet lead:		
15	Building construction	11,700	11,600
3443	Storage tanks, process vessels, etc.	(3/)	(3/)
3693	Medical radiation shielding	3,860	3,890
	Total	15,500	15,400
	Solder:		
15	Building construction	1,700	2,450
	Motor vehicles, equipment, metal cans and shipping containers	W	W
367	Electronic components and accessories	3,180	3,040
36	Other electrical machinery and equipment	W	W
	Total	10,900	13,100
	Storage batteries:		
3691	Storage battery grids, post, etc.	685,000	728,000
3691	Storage battery oxides	742,000 r/	744,000
	Total	1,430,000	1,470,000
371	Terne metal, motor vehicles and equipment	(4/)	(4/)
27	Type metal, printing and allied industries	(5/)	(5/)
34	Other metal products 6/	8,160 r/	7,130
	Total	1,560,000	1,610,000
	Other oxides:		
285	Paint	W	W
32	Glass and ceramics products	W	W
28	Other pigments and chemicals	W	W
	Total	53,400	58,200
	Miscellaneous uses	15,500	15,100
	Grand total	1,630,000	1,680,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in appropriate totals.
1/ Data are rounded to no more than 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 1999, 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	22,600	26,500	1,940	--	51,100
Florida and Georgia	5,350	2,170	12,200	--	19,700
Illinois	15,200	25,800	12,800	--	53,900
Iowa, Michigan, Missouri	43,800	39,200	19,500	--	103,000
Ohio and Pennsylvania	111,000	44,700	64,100	1,260	221,000
Arkansas and Texas	36,500	18,300	11,100	--	65,900
Alabama, Louisiana, Mississippi, Oklahoma	5,610	2,270	--	--	7,880
Colorado, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Tennessee, Wisconsin	426,000	108,000	89,800	452	625,000
Connecticut, Delaware, Maine, Maryland, Massachusetts, Montana, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Vermont	45,100	20,100	21,400	--	86,500
Various States	240,000	143,000	68,500	--	451,000
Total	952,000	430,000	301,000	1,710	1,680,000

-- Zero.
1/ Data are rounded to no more than 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 1999, 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	46,300	80,700	10,500	1,710	139,000
Storage batteries	838,000	347,000	286,000	--	1,470,000
Other oxides	W	--	--	--	W
Miscellaneous	66,700	1,880	4,600	--	73,200
Total	952,000	430,000	301,000	1,710	1,680,000

W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous." -- Zero.
1/ Data are rounded to no more than 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
1998	31,500 r/	37,100 r/	9,200 r/	116	77,900 r/
1999	35,800	24,600	19,100	135	79,500

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

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

(Metric tons, unless otherwise specified)

	1998				1999			
	Production		Shipments		Production		Shipments	
Product	Gross weight	Lead content	Quantity	Value 3/	Gross weight	Lead content	Quantity	Value 3/
Litharge, red lead and white lead, dry	1,830	1,520	18,700	$15,900,000	1,750	1,430	20,800	$17,400,000
Leady oxide	736,000	699,000	NA	NA	728,000	692,000	NA	NA
Total	738,000	701,000	NA	NA	730,000	693,000	NA	NA

NA Not available.

1/ Data are rounded to no more than 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)
1998:		
White lead carbonate	5	$38
Red and orange lead	35	248
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	8,610	26,600
Litharge	17,400	11,600
Glass frits (undifferentiated)	14,500	19,900
Total	40,600	58,300
1999:		
White lead carbonate	1	11
Red and orange lead	86	664
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	8,470	25,900
Litharge	15,700	9,580
Glass frits (undifferentiated)	13,400	20,000
Total	37,700	56,100

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

Source: U.S. Census Bureau.

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

(Lead content, unless otherwise specified)

Country	1998 Quantity (metric tons)	1998 Value (thousands)	1999 Quantity (metric tons)	1999 Value (thousands)
Ore and concentrates:				
Belgium	17,400	$3,820	31,800	$7,430
Canada	5,300	3,150	12,600	10,000
China	5,770	2,130	--	--
Italy	2,020	1,190	--	--
Japan	18,500	4,340	39,400	9,240
Mexico	15,600	10,600	7,600	5,670
Netherlands	5,770	1,260	63	41
United Kingdom	2,050	1,100	2	5
Other	34	20	2,010	962
Total	72,400	27,600	93,500	33,400
Ash and residues:				
Belgium	4,650	701	280	68
Canada	2,910	5,130	709	1,640
Sweden	619	693	--	--
United Arab Emirates	789	278	321	232
Other	69	66	122	62
Total	9,030	6,870	1,430	2,000
Base bullion:				
Belgium	--	--	422	475
Canada	12,900	34,300	1,870	6,160
Mexico	38,600	43,400	61,800	69,500
Other	26	26	19	33
Total	51,600	77,800	64,100	76,200
Unwrought lead and lead alloys:				
Brazil	161	183	4	47
Canada	10,100	6,920	9,880	6,360
Costa Rica	29	377	1	12
France	(2/)	6	36	267
Germany	54	147	14	73
Hong Kong	86	84	55	276
India	45	69	69	121
Israel	909	729	43	155
Japan	545	1,270	55	371
Korea, Republic of	8,960	6,550	5,140	3,240
Mexico	282	296	7,580	5,580
Singapore	115	337	2	132
Taiwan	2,140	2,640	19	22
United Arab Emirates	63	266	146	205
United Kingdom	561	133	56	221
Other	83 r/	577 r/	316	610
Total	24,100	20,600	23,400	17,700
Wrought lead and lead alloys:				
Argentina	4	89	133	502
Aruba	234	1,990	3	29
Belgium	170	740	183	2,190
Brazil	452	483	18	37
Canada	5,650	4,600	5,660	4,230
Chile	210	1,120	17	61
China	103	319	131	380
Colombia	200	228	27	67
France	28	187	32	396
Germany	45	676	70	1,250
Hong Kong	490	2,010	833	2,500
Japan	79	493	182	891
Korea, Republic of	58	312	139	409
Kuwait	73	930	59	751
Lebanon	4	15	106	425
Malaysia	165	1,010	26	709
Mexico	3,240	12,100	2,580	13,300

See footnotes at end of table.

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

(Lead content, unless otherwise specified)

Country	1998 Quantity (metric tons)	1998 Value (thousands)	1999 Quantity (metric tons)	1999 Value (thousands)
Wrought lead and lead alloys continued:				
Netherlands	64	$233	234	$388
Saudi Arabia	901	7,220	434	3,810
Singapore	2,330	2,980	2,080	2,600
South Africa	19	107	65	144
Taiwan	65	503	195	541
Thailand	16	23	33	35
United Arab Emirates	57	448	34	251
United Kingdom	256	537	355	1,100
Other	499 r/	2,000 r/	238	1,500
Total	15,400	41,300	13,900	38,500
Scrap (gross weight):				
Australia	55	30	17	9
Canada	92,900	15,100	110,000	17,000
China	1,960	738	3,160	1,070
El Salvador	214	60	14	40
France	31	301	9	89
Guatemala	147	46	40	45
Hong Kong	749	322	186	116
India	717	619	1,200	700
Japan	457	757	258	426
Korea, Republic of	313	380	625	649
Mexico	340	103	146	81
Saudi Arabia	102	192	88	144
Spain	57	87	59	55
Taiwan	549	456	1,610	918
Thailand	85	19	16	46
Trinidad and Tobago	9	14	33	40
United Arab Emirates	6	5	99	127
United Kingdom	74	105	53	123
Venezuela	154	59	1	9
Other	281 r/	430 r/	188	311
Total	99,200	19,900	117,000	22,000

r/ Revised. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

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

(Lead content, unless otherwise specified)

Country	1998 Quantity (metric tons)	1998 Value (thousands)	1999 Quantity (metric tons)	1999 Value (thousands)
Ore and concentrates (lead content): 2/				
Argentina	2,390	$581	--	--
Australia	2,240	770	87	$81
Brazil	--	--	5,710	907
Canada	6,540	1,300	(3/)	5
Mexico	--	--	1,580	726
Peru	18,500	3,210	193	60
South Africa	2,630	585	--	--
Other	409	105	4,750	1,320
Total	32,700	6,560	12,300	3,100
Base bullion (lead content):				
Colombia	--	--	88	38
Dominican Republic	464	293	--	--
Other	--	--	2	20
Total	464	293	90	58
Pigs and bars (lead content):				
Australia	--	--	21,900	11,100
Belgium	30	24	218	505
Canada	181,000	119,000	198,000	119,000
China	8,010	6,420	47,700	23,700
Colombia	1,260	525	1,960	782
Germany	135	63	1,000	876
Mexico	63,600	32,400	27,200	13,100
Peru	11,400	6,460	6,930	3,590
United Arab Emirates	59	242	46	182
Other	808	461	6,230	2,960
Total	267,000	166,000	311,000	175,000
Reclaimed scrap, including ash and residues (lead content), Canada 4/	(3/)	3	--	--
Grand total	300,000	173,000	324,000	179,000
Wrought lead, all forms, including wire and powders (gross weight):				
Australia	29	142	3,070	1,610
Canada	2,330	4,060	2,690	4,460
China	442	1,450	295	963
Colombia	41	24	--	--
El Salvador	1,150	776	814	536
France	238	687	32	63
Germany	415	2,260	501	2,340
Hong Kong	206	554	173	570
India	16	28	10	39
Italy	87	158	260	299
Japan	24	322	79	555
Korea, Republic of	11	67	3	25
Malaysia	10	45	23	56
Mexico	1,350	1,480	1,110	1,370
Netherlands	337	1,690	320	1,220
New Zealand	72	736	53	495
Peru	200	160	330	257
Philippines	264	710	51	215
Taiwan	710	1,720	1,300	1,450
United Kingdom	479	1,450	441	1,220
Other	72 r/	451 r/	280	579
Total	8,480	19,000	11,800	18,300

r/ Revised. -- Zero.

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

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

3/ Less than 1/2 unit.

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

Source: U.S. Census Bureau.

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

(metric tons)

Country	1995	1996	1997	1998	1999 e/
Algeria	1,383	1,016	1,000 e/	1,000 e/	1,000
Argentina	10,521	11,272	13,760	15,004	15,600
Australia	455,000	522,000	531,000	618,000	681,000 3/
Bolivia	20,387	16,538	18,608	13,848 r/	12,000
Bosnia and Herzegovina e/	200	200	200	200	200
Brazil	11,611	13,157	14,258	14,300 e/	14,300
Bulgaria	33,000	28,000	32,000 r/	25,000	18,000 3/
Burma e/	2,400	2,200	1,900	2,200	2,000
Canada	210,826	257,253	186,234	189,752 r/	160,913 p/
Chile	944	1,374	1,264	337	170 3/
China e/	520,000	643,000	712,000	580,000 r/	501,000
Colombia e/	300	300	300	300	300
Ecuador e/	200	200	200	200	200
Georgia e/	300	200	200	200	200
Greece	20,400	8,400	19,300	18,000 e/	16,000
Honduras	2,619	4,700	5,900	4,329 r/	5,226 3/
India	34,000	35,000	32,000	39,300	40,000
Iran 4/	15,900	15,700 e/	18,200	13,000 r/	14,000
Ireland	69,067	45,344	45,149	46,000 e/	45,000
Italy	13,600	11,100	11,792	6,800 r/ e/	6,000
Japan	9,659	7,753	5,227	6,198	6,074 3/
Kazakhstan	40,000	35,000 e/	31,000 e/	30,000	34,100
Kenya e/	4 4/	5	5	--	--
Korea, North e/	80,000	80,000	75,000 r/	70,000 r/	70,000
Korea, Republic of	4,064	5,131	3,632	7,117 r/	3,644 3/
Macedonia	25,000 r/	27,000 r/	28,000 r/	26,000 r/	26,000
Mexico	164,348	173,831	174,661	166,060 r/	120,000
Morocco	67,708	71,667	77,056	80,000 r/	87,000
Namibia	16,084	15,349	13,577	13,300 r/	10,000
Norway	1,462	2,083	2,000 r/ e/	1,000 r/ e/	--
Peru	237,597	248,787	258,188	259,710	272,647 p/
Poland	58,100	58,700	55,000 r/	60,000	61,000 3/
Romania	23,194	18,712	17,000 r/	15,000 r/	20,484 3/
Russia	23,000	23,000 r/	16,000 r/	13,000 r/	13,000
Serbia and Montenegro	3,342	10,000	11,000	12,000 e/	3,000
Slovakia e/	1,800	-- r/	-- r/	-- r/	--
South Africa	88,449	88,613	83,114	84,128 r/	80,191 3/
Spain	30,077	23,826	23,900	18,800 r/	18,000
Sweden	100,070	98,800 r/	108,600 r/	114,430 r/	115,000
Tajikistan e/	1,000	800	800	800	800
Thailand	9,680	21,000	5,280	6,430 r/	6,000
Tunisia	6,601	4,764	1,424	4,274	6,000
Turkey	10,376	10,971	13,113 r/	13,500 r/ e/	12,000
United Kingdom e/	1,600	1,800	1,800	1,600	1,000
United States	394,000	436,000	459,000	493,000	520,000 3/
Uzbekistan e/	10,000	10,000	-- 5/	-- 5/	-- 5/
Total	2,830,000 r/	3,090,000 r/	3,110,000 r/	3,080,000 r/	3,020,000

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

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

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

3/ Reported figure.

4/ Year beginning March 21 of that stated.

5/ Mining operations appear to have been sharply curtailed or to have ceased.

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

(Metric tons, gross weight)

Country	1995	1996	1997	1998	1999 e/
Algeria:					
Primary e/	800	900	900	900 r/	900
Secondary	7,500	7,700	7,100 r/	6,100 r/	6,100
Total	8,300	8,600	8,000 r/	7,000 r/	7,000
Argentina:					
Primary	2,430	396	3,282	300 e/	400
Secondary	26,298	27,705	28,834	30,057	32,000
Total	28,728	28,101	32,116	30,357	32,400
Australia:					
Primary	215,000	204,000	204,000	173,000 r/	240,000 3/
Secondary	26,000	24,000	34,000	27,000 r/	35,000
Total	241,000	228,000	238,000	200,000 r/	275,000
Austria: Secondary e/	21,919 3/	22,000	22,000	22,000	24,000
Belgium: e/					
Primary	95,300	94,400	84,400 3/	93,000	90,000
Secondary	26,400	31,000	26,400 3/	27,000	20,000
Total	122,000	125,000	110,800 3/	120,000	110,000
Brazil:					
Primary	13,958	--	--	--	--
Secondary	65,000	45,000	44,500	45,000 e/	45,000
Total	78,958	45,000	44,500	45,000 e/	45,000
Bulgaria:					
Primary e/	62,200 r/	64,700	62,600 r/	63,000 r/	60,000
Secondary e/	10,000	10,000	10,000	10,000	13,000
Total	72,150	74,670	72,580	72,975 r/	73,000
Burma: Primary	1,753	1,984	1,760	1,936	1,666 3/
Canada:					
Primary	178,019	194,031	139,736	129,750 r/	145,889 3/
Secondary	103,372	115,348	131,659	135,737 r/	117,023 3/
Total	281,391	309,379	271,395	265,487 r/	262,912 3/
China: e/					
Primary	432,000	562,000	584,000	665,000 r/	730,000
Secondary	176,000	144,000	123,000	92,000 r/	129,000
Total	608,000	706,000	707,000	757,000 r/	859,000
Colombia: Secondary	8,000	10,000	10,000	12,000	12,000
Czech Republic: Secondary e/	15,000	15,000	15,000	15,000	15,000
France:					
Primary	128,708	140,750	131,480	91,000 e/	119,000
Secondary	168,000	162,000	170,820	215,000 e/	150,000
Total	296,708	302,750	302,300	306,000 e/	269,000
Germany:					
Primary	146,750	88,700	164,800	140,000 e/	174,000
Secondary	164,400	149,400	164,400	194,000 e/	200,000
Total	311,150	238,100	329,200	335,000 e/	374,000
India: e/					
Primary	62,000	67,000	69,000	70,000	72,000
Secondary	28,000	27,000	24,000	25,000	20,000
Total	90,000	94,000	93,000	95,000	92,000
Iran:					
Primary e/	4,000	7,000	8,400 r/	9,000	9,000
Secondary	41,200 r/	39,900 r/	41,000 r/	38,000 r/	38,000
Total	45,200 r/	46,900 r/	49,400 r/	47,000 r/	47,000
Ireland: Secondary e/	10,400	10,000	10,000	11,000 r/	12,000
Italy:					
Primary	84,900	65,900	65,700	71,000 e/	75,000
Secondary	95,500	143,900	145,900	177,000 e/	140,000
Total	180,400	209,800	211,600	248,000 e/	215,000
Jamaica: Secondary e/	800	800	800	800	800
Japan:					
Primary	148,117	140,531	142,326	144,542	125,514 3/
Secondary	139,461	146,842	154,438	157,555 r/	168,013 3/
Total	287,578	287,373	296,764	302,097 r/	293,527 3/

See footnotes at end of table.

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

(Metric tons, gross weight)

Country	1995	1996	1997	1998	1999 e/
Kazakhstan: Primary and secondary	88,500	70,000 e/	81,974 r/	118,632 r/	160,000
Korea, North: e/					
Primary	75,000	75,000	75,000	75,000	70,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	80,000	80,000	80,000	80,000	75,000
Korea, Republic of:					
Primary	129,744	88,556	121,296	133,066 r/	140,317 3/
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	140,000	98,600	131,000	143,000 r/	150,000
Macedonia:					
Primary	28,000	28,000	25,000 e/	30,000 r/	30,000
Secondary e/	2,000	2,000	2,000	5,500 r/	5,000
Total e/	30,000	30,000	27,000	35,500 r/	35,000
Malaysia: Secondary e/	33,600	36,000	42,000	29,000 r/ 3/	26,200 3/
Mexico:					
Primary 4/	165,868	150,395	168,164	163,206 r/	120,000
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	176,000	160,000	178,000	173,000 r/	130,000
Morocco:					
Primary	60,363	59,749	64,202	59,000 r/	57,000
Secondary	2,600	3,100	3,000	3,000 r/	3,000
Total	62,963	62,849	67,202	62,000 r/	60,000
Namibia: Primary 5/	26,752	8,588	1,530 r/	236 r/	--
Netherlands: Secondary	25,000	22,000	19,500	13,200	16,000
New Zealand: Secondary e/	6,000	6,000	6,000	6,000	6,000
Pakistan: Secondary e/	2,500	2,000	2,000	2,000	2,000
Peru: Primary	89,577 r/	94,324 r/	86,015 r/	109,492 r/	111,276 p/
Philippines: Secondary e/	17,200	17,200	17,000	17,000	17,000
Poland:					
Primary e/	51,400	51,000	49,900 r/	49,300 r/	50,000
Secondary e/	15,000	15,000	15,000	15,000	15,000
Total	66,400	66,000	64,900 r/ e/	64,300 r/ e/	65,000
Portugal: Secondary e/	7,700	5,900	6,000	6,000	5,000
Romania:					
Primary	14,000	20,000 r/	18,000 r/ e/	20,000 e/	2,000
Secondary e/	4,000	4,000 r/	4,000 r/	4,000 r/	3,000
Total e/	18,000	24,000 r/	22,000 r/	24,000 r/	5,000
Russia: Primary and secondary e/	30,000	30,000	52,000	36,000 r/	30,000
Serbia and Montenegro: Primary	11,468	30,317	23,632	23,000 r/	8,000
Slovenia: Secondary	7,425	7,237 r/	6,160 r/	7,000 e/	7,000
South Africa: Secondary	32,100	32,200	41,500	39,200 r/	40,000
Spain: Secondary e/	80,000	86,000	74,900	87,000	85,000
Sweden:					
Primary	39,700	42,200	34,700	40,600 e/	35,000
Secondary	51,500	41,900	51,500	52,000 e/	52,000
Total	91,200	84,100	86,200	92,600 e/	87,000
Switzerland: Secondary e/	6,400	6,200	6,000	7,600	7,000
Thailand: Secondary	11,150	12,789	14,968 r/	18,906 r/	23,741 3/
Trinidad and Tobago: Secondary e/	1,600	1,600	1,600	1,600	1,600
Turkey: e/					
Primary	4,000	4,000	7,000	8,000 r/	4,000
Secondary	2,000	2,000	2,000	4,000 r/	4,000
Total	6,000	6,000	9,000	12,000 r/	8,000
Ukraine: Secondary e/	10,000	21,000	11,000	9,000	9,000
United Kingdom:					
Primary	149,706	168,108	215,243	185,000 e/	185,000
Secondary	170,998	177,466	175,783	165,000 e/	163,000
Total	320,704	345,574	391,026	350,000 e/	348,000
United States:					
Primary	374,000	326,000	343,000	337,000	350,000 3/
Secondary	1,020,000	1,070,000	1,110,000	1,120,000	1,110,000 3/
Total	1,390,000	1,400,000	1,450,000	1,450,000	1,460,000 3/

See footnotes at end of table.

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

(Metric tons, gross weight)

Country	1995	1996	1997	1998	1999 e/
Venezuela: Secondary e/	16,000	16,000	16,000	16,000	16,000
Grand total:	5,590,000 r/	5,610,000 r/	5,830,000 r/	5,920,000 r/	6,010,000
Of which:					
Primary	2,790,000 r/	2,780,000	2,890,000 r/	2,890,000 r/	3,010,000
Secondary	2,670,000 r/	2,740,000 r/	2,800,000 r/	2,880,000 r/	2,810,000
Undifferentiated	119,000	100,000	134,000 r/	155,000 r/	190,000

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

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

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