LEAD

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Domestic lead mine production increased by1% compared with that of 2000. Alaska and Missouri were the dominant producing States with a 93% share. Other appreciable lead mine production was in Idaho and Montana. Lead was produced at 12 U.S. mines employing about 1,100 people. The value of domestic mine production was about $440 million. A significant portion of 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 79% of refined lead production in the United States. Nearly all the secondary lead was produced by 7 companies operating 15 smelters.

During 2001, U.S. Government agencies issued several proposed and final rules on matters affecting the lead industry. The rules included the announcement of lower threshold requirements for reporting lead and lead compounds released to the environment; the establishment of agency notification procedures for certified lead abatement professionals conducting lead-based paint abatement and training activities; the addition of new definitions to the criteria for classification of solid waste disposal facilities and practices; and the approval of new, nontoxic forms of ammunition for hunting water fowl. In addition, an advance notice of initial rulemaking proceedings was issued that would ban certain candles with wicks containing lead. A notice of funding availability also was announced to conduct lead hazard awareness programs for Native American children and to assess the existing exposure of these children to lead.

Lead was consumed in about 130 U.S. 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. SLI battery shipments in North America totaled 106 million units in 2001. This total included original equipment and replacement automotive-type batteries. An estimated 1.12 million metric tons (Mt) of lead was contained in SLI batteries shipped during the year.

Monthly sales of lead from the National Defense Stockpile (NDS) continued during 2001. Sales totaled about 41,000 metric tons (t) (45,600 short tons), leaving about 178,000 t (196,000 short tons) in the NDS at yearend.

Lead prices rose slightly during the year. The average London Metal Exchange (LME) and North American Producer prices were up by $0.010 per pound and $0.001 per pound, respectively, in 2001, from the average prices of $0.206 per pound and $0.436 per pound, respectively, in 2000.

Of the 43 countries in which lead was mined, the top five accounted for 71% of the world's total production of 3.1 Mt. Australia was the largest producer, with 23% of the world total, followed by China, 19%; the United States, 15%; Peru, 9%; and Canada, 5%.

Worldwide reserves of lead contained in demonstrated resources in producing and nonproducing deposits at yearend were estimated to be 64 Mt by the U.S. Geological Survey (USGS). Reserves for the three largest producers in the world, Australia, China, and the United States, were about 15 Mt, 9 Mt, and 8.7 Mt of contained lead, respectively. The reserve base (reserves plus measured and indicated resources that are marginally economic and some of those that are currently subeconomic) for Australia and China was 28 Mt and 30 Mt, respectively. The reserve base for the United States was 20 Mt. The total world reserve base at the end of 2000 was estimated to be 130 Mt.

Legislation and Government Programs

Monthly sales of lead from the NDS continued during 2001. As a result of these sales and the delivery of previously committed inventory, lead disposal from stockpile inventory during 2001 totaled about 41,400 t (45,600 short tons). The Defense National Stockpile Center's (DNSC) Annual Materials Plan (AMP) approved by the U.S. Congress for fiscal year 2001 (October 1, 2000 to September 30, 2001) included a maximum sales authority for lead of 54,400 t (60,000 short tons). Under this authority, disposal of lead from NDS inventory during the first 9 months of calendar year 2001 was 22,600 t (24,900 short tons). The AMP approved by the U.S. Congress for fiscal year 2002 (October 1, 2001 to September 30, 2002) also included a maximum sales authority for lead of 54,400 t. Under the fiscal year 2002 authority, disposal of lead from NDS inventory during the final 3 months of calendar year 2001 amounted to 18,800 t (20,700 short tons), leaving about 178,000 t (196,000 short tons) of lead at yearend. Solicitations were issued by the DNSC in February 2001 and August 2001 for the sale of lead from the NDS in negotiated long-term contracts extending for a contract period of 360 calendar days. The solicitations included several grades of lead totaling about 8,400 t (9,260 short tons).

During 2001, U.S. Government agencies issued several proposed and final rules, announced funding availability, awarded grants, and requested specific information and comments from the public on matters affecting the lead industry. In a final rule issued in mid-January, the U.S. Environmental Protection Agency (EPA) announced that the threshold for reporting lead and lead compounds released to the environment would be lowered to 100 pounds per year.

Previously, facilities were required to report lead releases only if they manufactured or processed more than 25,000 pounds or consumed more than 10,000 pounds of lead per year. The new rule identifies lead and lead compounds as persistent bioaccumulative toxic (PBT) chemicals. As such, the lead and lead compounds are subject to enhanced Toxic Release Inventory (TRI) reporting requirements 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. Under EPCRA, the U.S. Congress set the initial parameters of the TRI, but also provided the EPA with the authority to change the toxic chemicals subject to reporting, the facilities required to report, and the threshold quantities that trigger reporting (U.S. Environmental Protection Agency, 2001f). In mid-April, a consortium of metals industry interests issued a court challenge to the rule identifying lead as a PBT chemical, citing primarily the scientific invalidity of the PBT classification. The challenge was filed in the U.S. District Court for the District of Columbia (American Metal Market, 2001c; Fialka and VandeHei, 2001). In late September, the EPA held a public meeting to discuss a guidance document on community right-to-know TRI chemical release reporting for lead and lead compounds. The EPA requested public comments on the draft version of this document, as well as participation by interested parties on a workgroup to assist in the preparation of the final guidance document (U.S. Environmental Protection Agency, 2001i).

The U.S. Department of the Interior's Fish and Wildlife Service issued a final rule in January approving shot formulated of 50% tungsten, 35% nickel, and 15% iron as a nontoxic form of ammunition for hunting waterfowl. Under authority contained in the Migratory Bird Treaty Act of 1918, the Fish and Wildlife Service controls the hunting of migratory game birds and, since the mid-1970s, has sought to identify shot that does not pose a significant toxicity hazard to migratory birds or other wildlife. Currently steel, bismuth-tin, tungsten-iron, tungsten polymer, and tungsten-matrix shot are approved for permanent use as a nontoxic form of shot (U.S. Department of the Interior, 2001).

In July, the U.S. Department of Health and Human Services (HHS) issued a request for public comment on 16 agents, substances, mixtures, and exposure circumstances proposed for listing in its Report on Carcinogens (RoC), 11th edition, scheduled for publication in 2004. Included in the proposed list is the occupational exposure to lead or lead compounds in smelting-refining, battery manufacturing, steel welding and cutting, construction, and use of firearms on firing ranges. The proposed list will be reviewed under HHS's National Toxicology Program. The RoC is a congressionally mandated listing of known human carcinogens and reasonably anticipated human carcinogens (U.S. Department of Health and Human Services, 2001).

In September, the EPA issued a direct final rule approving the Pennsylvania Department of Environmental Protection's (PADEP) request for delegation of authority to implement and enforce its hazardous air pollutant regulations for several industrial operations, including secondary lead smelting. The regulations were adopted from the requirements set forth in the Code of Federal Regulations. EPA's approval also will automatically delegate to the PADEP the authority to implement and enforce future amendments to the regulations (U.S. Environmental Protection Agency, 2001a).

In further action, the EPA issued a notice of final determination approving an application from the State of California for revisions to the State's hazardous waste management program. The program is authorized under the Resource Conservation and Recovery Act (RCRA). Among the revisions requested by the State was the exclusion of secondary lead smelter furnaces from the boilers and industrial furnaces conditional exemption outlined in the Code of Federal Regulations. Under RCRA, State programs must be consistent with Federal programs and other authorized State programs, but the program requirements are permitted to be more stringent than the Federal RCRA requirements (U.S. Environmental Protection Agency, 2001c).

In late January, the EPA issued a proposed rule to establish notification procedures for certified lead abatement professionals conducting lead-based paint activities and accredited training programs providing lead-based paint activities courses. Specifically, the proposal seeks to establish procedures for required notification of EPA prior to the commencement of lead-based paint abatement activities. It also seeks to establish provisions for requiring accredited training programs to notify the EPA prior to and following training courses conducted under the programs. The proposed rule was issued under the authority of Section 407 of the Toxic Substances Control Act, as amended by the Residential Lead-based Paint Hazard Reduction Act of 1992 (U.S. Environmental Protection Agency, 2001h).

The U.S. Consumer Product Safety Commission (CPSC) issued an advance notice initiating rulemaking proceedings that could result in a ban on certain candle wicks containing lead. In March 2000, the CPSC, under authority of the Federal Hazardous Substances Act, had accepted petitions from public citizens, the National Apartment Association, and the National Multi-housing Council requesting that the CPSC ban candles and candle wicks containing lead. The concern of these petitioners and the CPSC was that lead emissions to the air during candle burning could represent a potential health hazard under some use conditions. Certain candle wicks contain a metallic core to provide structural rigidity of the wick during candle production and subsequent burning of the wick. The metallic core may be primarily lead or may consist of a zinc-lead or tin-lead alloy.

Under the CPSC's advance notice of this proposed rulemaking, the commission solicited written comments that discuss the risks of illness associated with burning candle wicks containing lead, the regulatory alternatives for addressing such risks, and the economic impact of the various regulatory alternatives (U.S. Consumer Product Safety Commission, 2001).

The U.S. Department of Housing and Urban Development (HUD) announced, in April, the solicitation of comments on its proposed information collection for the First National Survey of Environmental Hazards in Child Care Centers. The survey is intended to estimate existing levels of environmental contaminants in the Nation's child care centers. The contaminant levels to be considered will include lead in dust, soil, and paint (U.S. Department of Housing and Urban Development, 2001d).

In other actions by HUD, the agency's Office of Healthy Homes and Lead Hazard Control announced, in April, the awarding of a grant totaling about $3 million to the National Center for Lead Safe Housing. The grant will be distributed by the Center in the form of subgrants to national public interest groups and State and local agencies to administer appropriate training for lead-based paint abatement (U.S. Department of Housing and Urban Development, 2001b). In June, HUD announced an award of grants totaling $780,000 to three institutions for the purpose of conducting research under HUD's fiscal year 2000 Lead Hazard Control Research Program. The program provides funds to improve methods for detecting and controlling residential lead-based paint hazards (U.S. Department of Housing and Urban Development, 2001a). In July, HUD announced an award of grants totaling $60 million to 25 recipients for the purpose of undertaking comprehensive programs to identify and control lead-based paint hazards. The programs will be directed toward eligible privately owned housing that is either rented or owner occupied. They will be conducted in partnership with appropriate organizations within States, Indian Tribes, and local governments. HUD'S Lead Hazard Control Program was issued pursuant to section 1011 of the Residential Lead-based Paint Hazard Reduction Act of 1992—Title X of the Housing and Community Development Act of 1992 (U.S. Department of Housing and Urban Development, 2001c).

In other funding actions, the EPA announced, in August, the availability of funds to conduct activities related to lead hazard awareness and to the assessment of the existing exposure of Native American children to lead (U.S. Environmental Protection Agency, 2001b, g). An announcement also was made by the EPA of its intent to enter into cooperative agreements with States, Territories, eligible Indian Tribes and Intertribal Consortia, and the District of Columbia to provide financial assistance for the purpose of developing and conducting EPA-authorized lead-based paint programs. These programs are authorized under section 404 (g) of the Toxic Substance Control Act (U.S. Environmental Protection Agency, 2001e).

In October, the EPA issued a direct final rule adding new definitions to "residential lead-based paint waste" and "construction and demolition landfill" as these terms apply to the criteria for classification of solid waste disposal facilities and practices. The rule will expressly allow residential lead-based paint waste to be disposed of in construction and demolition landfills by clearly stating that a construction and demolition landfill accepting residential lead-based paint waste, and no other household waste, is not classified as a municipal solid waste landfill unit. The action by the EPA does not, however, prevent a municipal solid waste unit from continuing to receive residential lead-based paint waste. Rather, it is intended to offer an option for disposal of residential lead-based paint waste that may be less expensive than disposal in a municipal solid waste unit in certain areas of the United States (U.S. Environmental Protection Agency, 2001d).

Production

Primary.—In 2001, domestic mine production of lead increased by about 5,000 t, or 1%, compared with that of 2000. The major share of the U.S. mine output of lead continued to be derived from production in Alaska and Missouri. Appreciable lead mine production also was reported in Idaho and Montana. Domestic mine production data were collected from a base metal voluntary survey on lode-mine production of copper, lead, and zinc by the USGS. All 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 four Doe Run mills that were supplied with ore mined from six production shafts along the Viburnum Trend in southeastern Missouri. In addition, concentrate for the smelter-refineries was purchased in the open market. As of October 31, 2001, the company's proven and probable U.S. ore reserves were about 50 Mt, containing 2.93 Mt lead, 0.67 Mt zinc, and 0.13 Mt copper. In fiscal year 2001, ending October 31, 2001, Doe Run shipped about 490,000 t 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 are indirectly owned by The Renco Group, Inc., a New York-based, privately held company with investments in natural resources and industrial operations. During 2001, the company continued surface and underground exploration drilling in and adjacent to its operating mines for the purpose of discovering new ore reserves, as well as further delineating the ore reserves from previous exploration drilling in the Viburnum Trend region. Pre-development work also was conducted at a company-owned tract containing a lead-zinc-cobalt deposit, 80 kilometers (50 miles) east of the Viburnum Trend (Doe Run Resources Corp., 2002, p. 1-7).

ASARCO Incorporated (a wholly owned subsidiary of Grupo Mexico, S.A. de C.V.) suspended operations indefinitely at its East Helena, MT, lead smelter, at the beginning of April, citing increased production costs. The suspension of operations continued throughout the remainder of the year as officials from Grupo Mexico cited poor market conditions and a decrease in the supply of lead concentrate feed for the smelter. The smelter was constructed in 1888 to process the output of mines located in the northwestern United States. As the number of mines and domestic primary refining capacity declined, the smelter relied to an increasingly greater extent, in recent years, on imported concentrate feed material and also exported its lead bullion product for refining. At full operating capacity, about 250,000 tons per year (t/yr) of raw material can be processed at East Helena, yielding about 75,000 t/yr of lead bullion (ASARCO Incorporated, 2001; Platts Metals Week, 2001e).

Cominco Alaska Inc. (a wholly owned subsidiary of Cominco Ltd., Vancouver, Canada) operated the Red Dog zinc-lead mine in northwestern Alaska under a leasing agreement with NANA Regional Corp., the sole owner of the property. NANA is a corporation organized under the provisions of the Alaska Native Claims Settlement Act. Cominco Ltd. merged with Teck Corporation, Vancouver, Bristish Columbia, Canada, in the third quarter, to form a new company, Teck Cominco Ltd. Production of lead in concentrate at Red Dog increased by 15% to 95,300 t compared with 83,100 t in 2000. The average mill recovery of lead at Red Dog was 59% in 2001, compared with

58% in 2000. A mill optimization project was completed in the fourth quarter that will effectively increase output by 15% and further improve product quality. Proven ore reserves at Red Dog, as of December 31, 2001, were estimated to be 38.4 Mt grading 19.2% zinc and 5.3% lead. Probable reserves at the nearby Aqqaluk deposit, as of December 31, 2001, were estimated to be 56.1 Mt grading 16.5% zinc and 4.1% lead (Teck Cominco Ltd., 2002). Further drilling was carried out at the underground Anarraaq deposit about 10 kilometers northwest of the Red Dog Mine. Drilling results from a large gravity anomaly at Anarraaq revealed zinc and lead concentrations ranging from trace quantities up to 45.8% and 4.0%, respectively. Following its discovery in 1999, drilling at Anarraaq in 2000 had established an inferred resource of 17.2 Mt grading 15.8% zinc and 4.8% lead (Teck Cominco Ltd., 2001).

Teck Cominco delayed the reopening of its Pend Oreille zinc-lead mine near Metaline Falls, WA, by 6 months to the first quarter of 2004, citing low metal prices as a principal reason for the delay. Significant reconstruction of the Pend Oreille facility was begun in October 2000. Work in 2002 will be limited to the completion of the construction of the internal mine shaft. Reconstruction of the surface processing facility and the tailings disposal facility are expected to be completed in 2003. Upon its reopening, Pend Oreille is expected to produce about 50,000 t/yr of zinc in concentrate and 7,000 t/yr of lead in concentrate. The concentrates likely will be processed at Teck Cominco's nearby Trail smelter in Canada. Ore reserves at Pend Oreille, as of December 31, 2001, were estimated to be 5.5 Mt grading 7.3% zinc and 1.4% lead (CRU International Ltd., 2002b; Teck Cominco Ltd., 2002).

Hecla Mining Company, Coeur d'Alene, ID, operated the Lucky Friday Mine in Mullan, ID, throughout 2001. Lucky Friday is an underground silver-lead mine 100% owned by Hecla that has been a producing mine for Hecla since 1958. In July, Hecla announced that operations at Lucky Friday would be reduced as a result of low metal prices. Commencing in the fourth quarter, production at the mine was decreased to approximately 30% of full production. Total lead production was about 19,000 t in 2001, down 34%, compared with that of 2000. It was estimated that the currently developed areas of the mine would be sufficient to sustain this lower production level for up to 24 months. Hecla anticipated that the decreased level of production would continue until metal prices increased, and the cost of operating remained less than the cost of placing the property on care-and-maintenance status. Ore was processed during the year in a conventional flotation mill with a capacity of about 1,000 metric tons per day (t/d). In 2001, ore was processed at a rate of about 855 t/d. Both silver-lead concentrates and zinc concentrates were produced at the mill, with 94% of the silver, 92% of the lead, and 45% of the zinc being economically recovered. Silver-lead concentrates from the Lucky Friday operations, normally sent to Asarco's East Helena, MT, smelter, were diverted to smelters in Canada, Europe, and Mexico following the suspension of operations at East Helena in April. These concentrates are expected to be shipped to Teck Cominco's Trail smelter in Canada during 2002. Total proven and probable ore reserves at Lucky Friday were about 1.1 Mt grading 9.4% lead at yearend 2001 compared with 1.2 Mt grading 10.7% lead at yearend 2000. Several factors contributed to the decline in the estimated ore reserves, including: The removal of ore by mining during 2001, the reassessment of metal grades and content in the veins, and the decrease in the metal price from original forecasts.

Hecla Mining also held a 29.7% interest in the Greens Creek Mine on Admiralty Island, near Juneau, AK, through a joint-venture arrangement with Kennecott Greens Creek Mining Co., the manager of the mine, and Kennecott Juneau Mining Company; both are wholly owned subsidiaries of Kennecott Corporation. Greens Creek lies within the Admiralty Island Monument area and includes 17 patented lode claims and one patented millsite claim. In addition, it includes property leased from the U.S. Forest Service and has title to mineral rights on 7,500 acres of Federal land adjacent to the mine properties. The mineral rights were acquired pursuant to a 1996 land exchange agreement whereby the Greens Creek joint venture transferred private property equal to a value of $1.0 million to the U.S. Forest Service in exchange for access to the potential resources within the acquired Federal land. At Greens Creek, about 1,800 t/d of ore was mined from the underground 200 South, Southwest, and West ore zones in 2001, 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 22,600 t in 2001, compared with about 22,800 t in 2000. Estimated reserves at the Greens Creek Mine at yearend 2001 were 7.6 Mt grading 4.6% lead compared with 9.1 Mt grading 4.4% lead in 2000. The changes in the reserve estimate were due to production in 2001, lower than expected lead prices, and a reassessment of reserves based upon new drilling results and a new mining plan for the Central West ore body (Hecla Mining Company, 2002, p. 6-12).

The U.S. Department of Agriculture, Forest Service (USFS) issued a notice of intent in March to prepare an environmental impact statement (EIS) regarding proposed changes to the Greens Creek Mine tailings disposal site. In its notice, the USFS proposed to approve an amendment to the General Plan of Operations for Greens Creek authorizing the construction of additional dry tailings storage beginning in 2002. The additional disposal area would be designed to provide tailings storage for the estimated remaining 14-year life of the mine, including the development of potential new reserves. The original EIS for operation of the Greens Creek Mine was completed and a Record of Decision was signed in January 1983 (U.S. Department of Agriculture, 2001).

Ventures Resource Corp., Morristown, NJ, reported initial results from its drilling program at the Lead Creek prospect, part of Ventures' Champion silver-lead-zinc property in eastern Alaska. Some of the more high-grade drill results showed metal levels between 5.1% and 8.5% lead, and between 0.2% and 1.4% zinc. The company reportedly is seeking a joint-venture partner to help continue the exploration program during 2002 (Mining Journal, 2001i).

Secondary.—Domestic secondary production decreased about 3% in 2001. Secondary lead accounted for 79% of domestic lead refinery production, compared with 77% in 2000. Lead-acid batteries continued to be the dominant source of recoverable lead scrap, accounting 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 17 companies producing secondary lead, exclusive of that produced from copper-based scrap, were surveyed; 13 responded, representing 99% of the total production of secondary lead. Of the total lead recycled in 2001, about 99% was produced by 7 companies operating 15 plants in Alabama, California, Florida, 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).

A report issued by the Chicago-based Battery Council International (BCI) indicated that the U.S. battery industry recycled 93.3% of the available lead scrap from spent lead-acid batteries during the period 1995 through 1999. The report, "BCI 1995-1999 National Recycling Rate Study" tracks the lead recycling rate from spent automotive, truck, motorcycle, marine, garden tractor, and other lead-acid batteries. According to a BCI official, the high recycling rate is the result of a successful collaboration among members of the battery industry, retailers, and consumers. Laws are now in place in 42 States that prohibit the disposal of spent lead-acid batteries and require that these batteries be collected through a customer return procedure when a replacement battery is purchased (Advanced Battery Technology, 2001d).

Consumption

Reported consumption of lead decreased by 8% in 2001 as the demand for lead slowed in all end-use sectors. Slower growth in the demand for industrial-type sealed lead-acid batteries in backup power systems was evident as telecommunications companies scaled down investment plans significantly. In addition, a decline in typical seasonally related automotive battery failures also was evident, effectively slowing the rate of demand for replacement batteries. 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 86 consuming companies to which a USGS survey request was sent, 61 responded, representing about 80% of the total reported U.S. lead consumption.

The BCI discontinued the reporting of SLI-type battery shipments by the United States as a separate statistic in 2001, subsequently reporting these shipments as a total North American quantity (i.e., Canada, Mexico, and the United States). Total North American SLI battery shipments were 106 million units in 2001 (Amistadi, 2002). The total included 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 2001 accounted for about 1.12 Mt of lead. SLI batteries included those used for automobiles, buses, trucks, tractors, motorcycles, marine craft, golf cars, and general utility vehicles (tables 6-13).

World Review

World production of refined lead decreased to 6.47 Mt in 2001 from 6.55 Mt in 2000. Other statistics for 2001, as reported by the International Lead and Zinc Study Group, are as follows: World consumption decreased to 6.41 Mt from 6.49 Mt in 2000; commercial stocks of refined lead in industrialized countries were 441,000 t, or 4 weeks of consumption, at yearend 2001 compared with 444,000 t at yearend 2000 and 472,000 t at yearend 1999; and significant exports of refined lead to industrialized countries from developing Asian countries, notably China, continued during 2001, increasing by about 1%, to 630,000 t, compared with those of 2000 (International Lead and Zinc Study Group, 2002a, p. 6-21).

Lead prices rose slightly, following four consecutive years of decline. The average LME and North American Producer prices were up by $0.010 per pound and $0.001 per pound, respectively, in 2001, from the average prices of $0.206 per pound and $0.436 per pound, respectively, in 2000.

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.—Arizona-based Silver Eagle Resources Ltd. reported that its joint-venture partner, Boliden Ltd.'s Mexican subsidiary, had completed a drilling program at the joint-venture San Felipe polymetallic property in Mexico. Results from drilling at the main La Ventana site at San Felipe revealed grades ranging from 12.14% to 12.95% zinc, and 6.45% to 10.74% lead (Mining Journal, 2001c).

Canada's Expatriate Resources Ltd. halted a 2-year effort, in September, to advance development of the Kudz Ze Kayah deposit at its Finlayson base-metal project in the Yukon Territory. Expatriate had sought to overcome metallurgical problems associated with its joint-venture Wolverine deposit adjacent to Kudz Ze Kayah by blending ores from the two deposits to yield concentrates of acceptable quality. The Wolverine deposit contains a resource of 5.4 Mt grading 13.1% zinc, and 1.6% lead, and appreciable quantities of copper, gold, and silver. Kudz Ze Kayah hosts an indicated resource of 11.3 Mt grading 5.9% zinc, and 1.5% lead, and also contains appreciable quantities of copper, gold, and silver. Expatriate reportedly planned to explore for a new deposit in this area, its goal continuing to be the blending of ores from such a deposit with that of the Wolverine deposit to yield concentrates with a lower level of contaminants, particularly selenium (Northern Miner, 2001b). The Kudz Ze Kayah deposit is owned by Expatriate under a purchase agreement with Cominco Ltd., and the Wolverine deposit is owned jointly by Expatriate (60%) and Atna Resources Ltd. (40%). Atna, however, elected, in April, not to continue participation in the development of the Kudz Ze Kayah deposit, but had retained the right to contribute at a later date (Northern Miner, 2001c).

In Australia, the final feasibility study was completed on the Magellan Lead project, majority owned (91.6%) by Ireland's Ivernia West plc. Magellan, located in the East Murchison Mineral Field, Western Australia, has estimated reserves totaling 8.5 Mt at a grade of 7.12% lead. A construction period

of 1 year was anticipated before production could begin at Magellan. It is estimated that 1 million t/yr of lead ore will be recovered from the Magellan Mine. The ore will be processed and refined onsite to yield about 55,000 t/yr of refined lead (Platts Metals Week, 2001g).

Results from the 2001 drill program at the Prairie Creek base-metal property in Canada's Northwest Territories revealed significant levels of lead and zinc. Canadian Zinc Corp., owner of the property, reported concentrations ranging from 8.0% to 14.8% lead and 8.9% to 10.1% zinc from the vein intercepts. Concentrations ranging from 3.2% to 4.1% lead and 6.9% to 12.3% zinc were reported from the strata-bound intercepts. Resources at Prairie Creek are estimated at 11.8 Mt grading 12.5% zinc and 10.1% lead. The measured and indicated portion of the resource is estimated at 3.6 Mt, grading 11.8% zinc and 9.7% lead. According to a company spokesperson, some drilling will continue at Prairie Creek to raise the confidence level in the resource toward reserve status, and will include extraction of a bulk sample for pilot-plant evaluation. Canadian Zinc reportedly has set a goal for making the project acceptable for financing by the end of 2002, with production projected to begin in 2003 (Northern Miner, 2001a). As part of the development of the Prairie Creek property, Canadian Zinc intends to operate a pilot plant within the existing mill structure at the property. A mine and mill infrastructure was constructed at Prairie Creek in 1982 by a previous owner but was never placed in operation (Mining Journal, 2001d).

Australia's Perth-based Kagara Zinc Ltd. reported drilling results from its King Vol polymetallic property in northern Queensland. Intersected mineralization ranged from 3.2% to 26.5% zinc and 0.1% to 8.8% lead. King Vol is located near Kagara's Mount Garnet project, and both projects are near the Townsville smelter. Ore from King Vol is expected to be processed at a facility proposed for construction at Mount Garnet. Kagara is continuing with its drilling program at King Vol (Mining Journal, 2001g, h).

Brisbane-based Union Capital Ltd. reported the intersection of wide intervals of base-metal mineralization in the Black Hill area of the Mehdiabad property in Iran. Drilling results showed compositions ranging from 2.1% to 11.4% zinc and 1.2% to 4.8% lead. Union Capital has a 25% share in Mehdiabad, under the terms of an agreement signed in late 1999. Union's partners are Itok GmbH of Austria (25%) and the Iranian Government (50%). A significant portion of the overall drilling program planned for Mehdiabad was completed in 2001 (Mining Journal, 2001k).

Compass Resources NL reported that feasibility studies completed at the Browns polymetallic project in Australia's Northern Territory indicate 82 Mt of mineral resources at an average grade of 2.28% lead and appreciable quantities of cobalt, copper, and nickel. Favorable metal recovery results were obtained from tests conducted with 380 t ore samples, confirming the proposed flowsheet design. Compass was assisted by the Doe Run Resources Corp., St. Louis, MO, in conducting these tests. Doe Run announced plans to acquire a 5% interest in Compass with an option to increase its interest in Compass to 20%. Doe Run is entitled to exercise this option until June 30, 2002. According to a Compass spokesperson, Doe Run also planned to enhance its current technological assistance to the Compass project (Metal Bulletin, 2001b). The Browns project is situated on property covered by mine leases that do not require renewal until 2022. Acceptance of an environmental impact statement by the Government of the Northern Territory will be required before mining can begin (Mining Journal, 2001e). Further commitment to the development of the Browns polymetallic project was demonstrated by Ausmelt Ltd., an Australian metallurgical engineering company. Ausmelt purchased $A1 million worth of shares in Compass Resources NL, and as part of the purchase agreement, planned to expand its technical support to the project. In return, Compass agreed to use only Ausmelt technology where top submerged lancing (TSL) is preferred. According to an Ausmelt spokesperson, pilot scale tests of TSL have efficiently separated lead from a high-grade copper, cobalt, and nickel matte. The Ausmelt technology, in combination with other technologies planned for the Browns project, represents a significant breakthrough in the treatment of polymetallic ores (Mining Journal, 2001a).

Ireland's Lisheen lead-zinc mine in County Tipperary, Ireland, reached 86% of its designed production capacity in the first quarter of 2001. The owners of the mine projected that Lisheen would be operating at full production capacity during the last half of 2001, yielding 300,000 t/yr of zinc concentrate and 40,000 t/yr of lead concentrate. Lisheen is expected to have a mine life of 14 years. The Lisheen mining operation is a 50-50 joint venture between Ivernia West plc. and Anglo American plc., and is operated by Anglo American's subsidiary, Anglo Base Metals Ltd. (Northern Miner, 2001d).

Closings and Curtailments.—Teck Cominco Ltd. ceased production of lead and zinc at its Trail, British Columbia, smelter during the third quarter of 2001 in order to sell its production of electric power normally used for the operation of the smelter. Metal production was resumed in October but production of lead was delayed until early November in order to complete maintenance work that was interrupted when contract workers were found to have been exposed to high concentrations of thallium in the furnace boiler (Teck Cominco Ltd., 2002).

Teck Cominco closed permanently its Sullivan Mine in Kimberley, British Columbia, as a result of depleted ore reserves. Mining officially ended on December 7, and the last ore was milled on December 21. Concentrate from the mill was traditionally processed at the Trail smelter. Production of lead in concentrate at Sullivan reached 24,900 t in 2001 prior to being closed (CRU International Limited, 2002a).

In Japan, Mitsui Mining & Smelting Co. reported the permanent closure of its lead-zinc mine in Kamiokain, Gifu Prefecture, in June. The mine, operated by wholly owned subsidiary Kamioka Mining & Smelting Co., has yielded 75 Mt of ore during its 130 years of operation. According to a company spokesperson, about 4,700 t/d of ore were produced at the Kamioka Mine during the peak years of operation, but had declined to 1,000 t/d recently. The closure of the Kamioka Mine will leave only one active lead-zinc mine in Japan. Nippon Mining & Metals Co. currently operates the Toyoha Mine on the northern island of Hokkaido (American Metal Market, 2001d).

In China, severe flooding in mid-May forced the closure of 28 lead-zinc mines in Guangxi Zhuang Autonomous Region. The mines were forced to close temporarily as a result of concerns

regarding leakage of mine materials that could cause environmental problems. Total ore processing capacity of the 28 mines affected was about 6,500 t/d. Antaike, the information center of China National Nonferrous Metals Industry, estimated that the shutdown effectively reduced Guangxi's lead-zinc concentrate supply by about 50,000 t in 2001 (Platts Metals Week, 2001d).

Exide Technologies delayed the start of production of industrial-type lead-acid batteries at its Maple, Ontario, manufacturing facility until the first quarter of 2002. The company had closed the plant, originally used to manufacture automotive-type lead-acid batteries, after Exide's acquisition of GNB Technologies, Inc. in September 2000. Full production at the Maple facility had been anticipated by October 2001. According to a company spokesperson, the delay was prompted by a decline in the demand for industrial-type batteries, particularly in the telecommunications sector (Metal Bulletin, 2001c).

Boliden Apirsa S.L., the Spanish mining division of Boliden Ltd., closed its Los Frailes lead-zinc mine near Seville in early October. According to a company spokesperson, it was not likely that the mine would be reopened. Investment in the mine had been ruled out by Boliden in October 2000 as a result of increasing financial losses (American Metal Market, 2001a). Los Frailes had been forced to close in April 1998 when a tailings dam failed, flooding a significant portion of the neighboring land. The mine was restarted in June 1999 after its milling license was restored by the local administration, along with a permit to dump tailings in the adjacent Aznalcollar open pit mine (Metal Bulletin, 2000).

Reopenings and Expansions.—Indian metals producer, Binani Industries, revealed plans to construct a 25,000 ton-per-year lead recycling plant in Maharashtra State. This is to be followed by the building of a 125,000 ton-per-year primary lead smelter. Production at the recycling plant began in mid-2001, but a starting date for production at the primary smelter was not set. The new facilities are expected to fill the widening gap between lead supply and demand in India. Lead demand presently is about 170,000 to 180,000 t/yr, whereas domestic production is only 70,000 t/yr (Mining Journal, 2001b).

Official reports from Kazakhstan in 2001 indicated that production of refined lead had doubled since 1998 to a level of 208,000 t in 2000. About 75% of Kazakhstan's lead production was exported in 2000. Significant increases in lead production were reported at most of the refineries, including Kaztsink, Leninogorsk, and Chimkent, the latter following its reorganization into Yuzhpolimetall. Domestic concentrate production increased by 19.8% in 2000, mainly as a result of increased output at the Zyryanovsk facility, which processed ore from the expanded Maleevsk Mine. Despite the increase, Kazakhstan remained chronically short of lead concentrates and continued to depend on scrap and imported concentrates for most of its feed to the smelters (CRU International Ltd., 2001).

In China, Yubei Metal Smelter added 60,000 t/yr of refined lead production capacity to its facility in Henan Province. The expansion effectively doubled Yubei's capacity to 120,000 t/yr. According to a Yubei official, the company expected to maintain its exports near the 2000 level of 4,000 tons per month (Platts Metal Week, 2001a).

China's Yuguang Gold and Lead Group completed an expansion project that added 50,000 t/yr of lead refining capacity to its operations, giving the company a total lead production capacity of 130,000 t/yr. As a result of the expansion, exports of refined lead were expected to reach 35,000 t in 2001 compared with 20,000 t in 2000. Total production of lead in 2001 was about 100,000 t (Metal Bulletin, 2001a).

Also, in China, the Chunxing Group continued the expansion of its lead recycling production line in Jiangsu Province and expected to complete the project by July 2002. Upon completion of the expansion project, the company's production capacity will be increased to 150,000 t/yr from the current level of 50,000 t/yr. The Chunxing Group expects to produce about 100,000 t of lead in 2002. Both imported and domestic lead scrap are processed at Chunxing's facility. In order to accommodate the increased output of lead, the company plans to increase its lead scrap imports to 50,000 t in 2002, compared with imports of 10,000 t in 2001 (Platts Metals Week, 2001b).

China's Wanyang Lead Group reported the beginning of an expansion project to increase its electrolytic lead production capacity to 60,000 t/yr by the end of 2002 from the current capacity of 35,000 t/yr. The Wanyang Group produced an estimated 25,000 t of lead in 2001 and expected to produce 40,000 t in 2002. About 80% of Wanyang Lead Group's refined lead product is sold in the domestic market. The remaining 20% is exported to countries in Southeast Asia (Platts Metals Week, 2001h).

Transfers of Ownership, Sales Offerings, and Mergers.—Finland's Outokumpu Oy, through its Irish subsidiary, Tara Mines Ltd., signed a contract to acquire the Bula zinc-lead ore body from the receiver of Bula Ltd. The Bula property lies adjacent to the northeastern boundary of Tara's mining operations in Navan, County Meath, Ireland, and hosts the upper extension of the Navan ore body. Tara officials estimate that the Bula deposit contains resources exceeding 8 Mt grading 10% zinc and 2% lead. Bula Ltd. had brought an unsuccessful court action against Tara Mines in the late 1990s, claiming that it was being prevented from independently developing the Bula ore body (Mining Journal, 2001j).

Exide Technologies completed the sale of its lead-acid battery recycling facility in Pont-Saint-Maxence, France, to STCM Holdings, effective at the end of May. STCM is a subsidiary of United Kingdom-based Eco-Bat Technologies, owned by Dallas-based Quexco Inc. The Pont-Saint-Maxence plant has a lead production capacity of 45,000 t/yr. Plastics and sulfuric acid also are reclaimed from the spent batteries for use in new batteries and other products (Platts Metal Week, 2001c).
In September, Australia's Pasminco Ltd. appointed administrators to keep its lead and zinc businesses operating, while buyers were found for the company's mines and smelters. The administration did not, however, apply to Pasminco's overseas subsidiaries, including the Budel smelter in Netherlands and the smelter and mines in Clarksville, TN. According to an administrator spokesperson, business would be conducted as usual after it had secured an additional $A300 million in funding from Pasminco's major creditor banks. The sales of Pasminco's Century Mine and Broken Hill Mine were expected to proceed as planned, contingent upon "a sale price that was within the administrators' expectations" (Metal Bulletin, 2001d).

The Indian Government was unsuccessful in its attempt to attract private investment in Hindustan Zinc Ltd., the country's largest lead and zinc producer, through the sale of a 26% interest in the company. The bidding process had attracted the attention of five companies, but only one had submitted a formal bid. That bid was rejected when it failed to meet the minimum desired price level. As a result, the Indian Government planned to call for new bids, due by February 2002. Hindustan Zinc, 75.92% owned by the Indian Government, owns six lead-zinc mines with a combined capacity of 3.5 million metric tons per year of ore. In addition, the company owns four lead-zinc smelters with a combined capacity of 169,000 t/yr of zinc and 43,000 t/yr of lead. The attempted sale of Hindustan Zinc is part of a prolonged privatization program by the Indian Government to sell companies in the mining sector as well as in other industry sectors (Mining Journal, 2001f; Platts Metals Week, 2001f).

Current Research and Technology

The European constituent of the Advanced Lead Acid Battery Consortium initiated its third project relating to valve-regulated lead-acid (VRLA) battery performance in hybrid-electric vehicle (HEV) systems. This initiative, termed the Reliable, Highly Optimized Lead Acid Battery (RHOLAB) project, is being conducted in the United Kingdom and is funded in part by the Department of Trade and Industry and the Engineering and Physical Sciences Research Council. It will focus on the development of a new spiral-wound VRLA system designed specifically for HEVs. The European project will involve removing the nickel-metal hydride battery pack currently used in the Honda Insight HEV, replacing it with the new RHOLAB system, and evaluating its longevity and reliability in HEV applications. VRLA battery systems have been successfully used in larger HEVs, such as hybrid-electric buses, but have not been tested in smaller, commercially available HEVs, such as the Honda Insight or the Toyota Prius, where the use of VRLAs could lower the cost of such vehicles (Advanced Battery Technology, 2001b).

The Advanced Lead Acid Battery Consortium reported that four of the world's major battery manufacturers displayed their first 36/42 volt (36-volt battery, 42-volt alternator) lead-acid systems for automotive use. The systems were displayed at the first Advanced Automotive Battery Conference held at Las Vegas, NV, in February 2001. Their VRLA batteries, expected to be marketed in the near future, will supply sufficient power for such automotive features as idle stop and regenerative power recovery, and a host of in-car luxuries, such as electrically conductive oxide coatings for heating windshields, and electrically driven power steering. The VRLA batteries will operate at temperatures down to minus 20° C. They also have shown the potential for use in so-called "mild" hybrid vehicles—automobiles capable of operating in an "electric assist" mode, thereby achieving exceptional fuel economy. The innovation of the starter-alternator system has made it possible for the vehicle to derive some of its motive power from the vehicle's electrical system (Advanced Battery Technology, 2001c).

Delphi Automotive Systems Corp., Detroit, MI, announced that the company planned to provide the advanced Absorbent Glass Mat (AGM) lead-acid battery as its entry into the 36/42-volt automotive electrical systems market. The market for higher voltage batteries is expected to grow significantly during the next few years in order to handle the greater automotive electrical demands. The AGM battery uses a quantity of lead similar to that of a conventional lead-acid battery and is designed to last about twice as long as a conventional battery. Its sealed design permits the battery to be placed in a variety of positions without danger of electrolyte spillage, and also permits the recombination of hydrogen and oxygen gases to form water, resulting in a maintenance-free battery (American Metal Market, 2001b).

Exide Technologies signed an agreement to be the sole lead-acid battery supplier for the Revolutionary Electric Vehicle Alternative (REVA) project in Bangalore, India. Exide's batteries will be manufactured in India and distributed under the company's Chloride Motive Power brand for use in the four-passenger, REVA vehicle. REVA is a joint venture between AEVT, a California-based electric vehicle technology company, and the Maini Group, an automotive component company headquartered in Bangalore. The REVA is India's first electric-powered vehicle and will be equipped with eight Exide batteries (Advanced Battery Technology, 2001a).

Outlook

Total world demand for refined lead is expected to remain in balance with supply in 2002. A forecast rise in Asian consumption of 2.7% is expected to be balanced by an anticipated decline of 4.3% in the United States, resulting in a global demand for refined lead in 2002 similar to that of 2001. Lead mine output is likely to decrease by 7.2% worldwide and by 9.7% in the Western industrialized countries, principally due to further reductions in output in the United States and mine closures in Canada, Morocco, Spain, and Sweden. Production of refined lead is expected to decline in China, Europe, and the United States, but is anticipated to be largely offset by increases in Australia, Canada, the Republic of Korea, Malaysia, and Morocco. Overall, production of refined lead in 2002 is expected to be 0.8% lower globally compared with 2001. Net export of refined lead from China to the industrialized countries in the Western World is expected to be constrained in 2002 by the restricted availability of feedstock (International Lead and Zinc Study Group, 2002b).

Lead-acid batteries will continue to dominate the demand for lead for the foreseeable future. In 2002, North American shipments of SLI lead-acid batteries are expected to decline by 3% to 19.8 million units in the automotive original equipment sector, and by 5% to 81.4 million units in the automotive replacement battery sector (Amistadi, 2002). Demand for industrial-type lead-acid batteries is expected to decline by 2% in the motive power sector and by 5% in the stationary power sector, the latter principally the result of an 8% to 10% decline in the telecommunications market. The U.S. industrial battery market had grown steadily over a 10-year period prior to posting a 15% drop in demand in 2001. Beginning in 2003, it is anticipated that as the U.S. economy improves and the telecommunications sector begins to increase spending on its infrastructure, the demand for industrial batteries will begin to

grow again, possibly at the rate of 6% to 8% per year through 2006 (Cullen, 2002).

Mine production in the United States should decline slightly in 2002 as a result of additional temporary production cutbacks at several of the larger facilities. Refined lead production from primary refineries also will decline as a result of temporary production cutbacks (Ryan's Notes, 2001). Secondary production of lead is expected to remain at a level comparable with that of 2001, but could rise slightly should weather-related temperature extremes increase the demand for replacement automotive-type batteries.

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TABLE 1
SALIENT LEAD STATISTICS 1/

(Metric tons, unless otherwise specified)

		1997	1998	1999	2000	2001
United States:						
Production:						
Mine, recoverable lead content 2/		448,000	481,000	503,000	449,000 r/	454,000
Value	thousands	$460,000	$480,000	$485,000	$431,000 r/	$437,000
Primary lead (refined):						
Domestic ores and base bullion		343,000 3/	337,000	350,000	341,000	290,000
Foreign ores and base bullion		W	W	W	W	W
Secondary lead (lead content)		1,110,000	1,120,000	1,110,000	1,130,000	1,100,000
Exports (lead content):						
Lead ore and concentrates		42,200	72,400	93,500	117,000	181,000
Lead materials, excluding scrap		104,000	100,000	103,000	92,000	52,400
Imports for consumption:						
Lead in ore and concentrates		17,800	32,700	12,300	31,200	2,240
Lead in base bullion		25	464	90	65	--
Lead in pigs, bars, and reclaimed scrap		265,000	267,000	311,000	356,000	271,000
Stocks, December 31:						
Primary lead		11,900 3/	10,900	12,300	18,600	W 4/
At consumers and secondary smelters		89,100	77,900	78,700	106,000 r/	100,000
Consumption of metal, primary and secondary		1,620,000	1,630,000	1,680,000	1,720,000 r/	1,590,000
Price, North American Producer average, delivered, cents per pound 5/		46.54	45.27	43.72	43.57	43.64
World:						
Production:						
Mine	thousand metric tons	3,100 r/	3,060 r/	3,080 r/	3,200 r/	3,080 e/
Refinery 6/	do.	3,050 r/	3,100	3,310 r/	3,590 r/	3,680 e/
Secondary refinery	do.	2,840	2,850 r/	2,850 r/	2,960 r/	2,790 e/
Price, London Metal Exchange, pure lead, cash average, cents per pound 5/		28.29	23.96	22.78	20.57	21.58

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

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/ Included with stocks at consumers and secondary smelters.

5/ Platts Metals Week.

6/ 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	2000 r/	2001
Alaska and Missouri	410,000	423,000
Other States 2/	38,700	30,900
Total	449,000	454,000

r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Idaho, Montana, Nevada, and New York.

TABLE 3
LEADING LEAD-PRODUCING MINES IN THE UNITED STATES IN 2001, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of lead
1	Red Dog	Northwest Arctic, AK	Teck Cominco Alaska Inc.	Lead-zinc ore.
2	Fletcher	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
3	Brushy Creek	do.	do.	Do.
4	Buick	Iron, MO	do.	Do.
5	Sweetwater	Reynolds, MO	do.	Do.
6	Greens Creek 1/	Juneau, AK	Kennecott Greens Creek Mining Co.	Zinc ore.
7	Lucky Friday	Shoshone, ID	Hecla Mining Company	Silver ore.
8	Viburnum #28	Iron, MO	Doe Run Resources Corp.	Lead ore.
9	Casteel	do.	do.	Do.
10	Montana Tunnels	Jefferson, MT	Montana Tunnels Mining, Inc.	Zinc ore.
11	McCoy/Cove	Lander, NV	Echo Bay Mines Limited	Gold ore.
12	Viburnum #29	Washington, MO	Doe Run Resources Corp.	Lead ore.

1/ Updated to reflect locality name change.

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

(Metric tons, unless otherwise specified)

Source material		2000	2001
Refined lead:			
Domestic ores and base bullion		341,000	290,000
Foreign ores and base bullion		W	W
Total		341,000	290,000
Calculated value of primary refined lead 2/	thousands	$328,000	$279,000

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)

		2000	2001
Kind of scrap:			
New scrap:			
Lead-base		35,500	47,300
Copper-base		11,400	7,850
Total		46,900	55,100
Old scrap:			
Battery-lead		1,020,000	1,000,000
All other lead-base		59,300	35,200
Copper-base		4,730	6,560
Total		1,080,000	1,050,000
Grand total		1,130,000	1,100,000
Form of recovery:			
As soft lead		651,000	652,000
In antimonial lead		428,000	360,000
In other lead alloys		36,800	74,200
In copper-base alloys		16,100	14,400
Total		1,130,000	1,100,000
Value 2/	thousand	$1,090,000	$1,060,000

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	2000	2001
	Metal products:		
3482	Ammunition, shot and bullets	63,700 r/	53,600
	Bearing metals:		
35	Machinery except electrical	W	W
36	Electrical and electronic equipment	W	W
371	Motor vehicles and equipment 2/	1,110 r/	498
37	Other transportation equipment	W	W
	Total	1,490 r/	837
3351	Brass and bronze, billets and ingots	3,670	2,590
36	Cable covering, power and communication	W	W
15	Calking lead, building construction	1,140	901
	Casting metals:		
36	Electrical machinery and equipment	W	W
371	Motor vehicles and equipment	28,400	24,100
37	Other transportation equipment	W	W
3443	Nuclear radiation shielding	1,270	2,340
	Total	35,100	31,700
	Pipes, traps, other extruded products:		
15	Building construction	2,010	2,340
3443	Storage tanks, process vessels, etc.	(3/)	(3/)
	Total	2,010	2,340
	Sheet lead:		
15	Building construction	17,600	16,100
3443	Storage tanks, process vessels, etc.	(3/)	(3/)
3693	Medical radiation shielding	6,190	5,870
	Total	23,800	21,900
	Solder:		
15	Building construction	1,440	1,190
	Metal cans and shipping containers	W	W
367	Electronic components, accessories, and other electrical equipment	5,430	3,690
371	Motor vehicles and equipment	W	W
	Total	11,500	6,120
	Storage batteries:		
3691	Storage battery grids, post, etc.	796,000	764,000
3691	Storage battery oxides	690,000	629,000
	Total storage batteries	1,490,000	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/	25,800 r/	17,100
	Total	1,660,000 r/	1,530,000
	Other oxides:		
285	Paint	W	W
32	Glass and ceramics products	W	W
28	Other pigments and chemicals	W	W
	Total	52,400	43,900
	Miscellaneous uses	14,000	14,100
	Grand total	1,720,000 r/	1,590,000

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 2001, 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	25,600	28,300	4,520	--	58,400
Florida and Georgia	6,100	1,600	15,300	--	23,000
Illinois	15,000	28,700	14,400	--	58,000
Iowa, Michigan, Missouri	31,800	22,800	15,500	--	70,100
Ohio and Pennsylvania	98,200	42,500	69,900	1,000	212,000
Arkansas and Texas	37,100	16,400	12,500	--	65,900
Alabama, Louisiana, Mississippi, Oklahoma	9,940	2,180	--	--	12,100
Colorado, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Tennessee, Wisconsin	390,000	96,800	81,800	152	568,000
Connecticut, Delaware, Maine, Maryland, Massachusetts, Montana, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Vermont	30,600	14,300	35,300	--	80,200
Various States	241,000	143,000	58,800	--	443,000
Total	886,000	396,000	308,000	1,150	1,590,000

-- 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 2001, 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	50,400	73,400	15,100	1,150	140,000
Storage batteries	784,000	322,000	287,000	--	1,390,000
Other oxides	W	--	--	--	W
Miscellaneous	51,400	964	5,510	--	57,900
Total	886,000	396,000	308,000	1,150	1,590,000

W Withheld to avoid disclosing company proprietary data; included with "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
2000	59,600 r/	30,500 r/	15,400	94	106,000 r/
2001	58,500	27,500	14,100	131	100,000

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)

	2000				2001			
	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	1,770	1,450	21,000	$10,800,000	992	819	21,500	$15,000,000
Leady oxide	724,000	687,000	NA	NA	659,000	626,000	NA	NA
Total	725,000	689,000	NA	NA	660,000	627,000	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)
2000:		
White lead carbonate	--	--
Red and orange lead	104	$594
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	8,900	26,400
Litharge	18,000	10,600
Glass frits (undifferentiated)	13,300	20,100
Total	40,300	57,600
2001:		
White lead carbonate	1	13
Red and orange lead	33	244
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	7,120	21,600
Litharge	9,090	5,250
Glass frits (undifferentiated)	18,300	18,800
Total	34,500	45,900

-- Zero.
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	2000 Quantity (metric tons)	2000 Value (thousands)	2001 Quantity (metric tons)	2001 Value (thousands)
Ore and concentrates:				
Belgium	49,300	$12,000	33,900	$7,750
Canada	11,100	9,190	18,300	14,500
Japan	32,200	7,530	45,000	10,200
Korea, Republic of	5,380	3,400	16,700	12,000
Mexico	17,500	9,230	40,800	23,400
Netherlands	--	--	11,700	2,510
United Kingdom	629	409	9,080	2,350
Other	425	885	5,580	4,560
Total	117,000	42,600	181,000	77,400
Ash and residues:				
Belgium	536	116	13,500	1,750
Canada	695	1,890	687	888
Japan	9,820	16,200	--	--
United Arab Emirates	206	122	--	--
Other	64	75	--	--
Total	11,300	18,400	14,200	2,640
Base bullion:				
Belgium	638	922	18	233
Canada	7,840	24,600	462	1,140
Mexico	23,600	49,800	2,790	7,420
Other	12	15	199	525
Total	32,100	75,300	3,470	9,320
Unwrought lead and lead alloys:				
Canada	9,070	6,150	1,250	880
Germany	68	99	59	194
Hong Kong	33	173	--	10
India	116	208	297	248
Israel	353	766	105	635
Japan	46	333	18	36
Korea, Republic of	3,190	2,060	726	508
Mexico	8,150	13,400	14,400	9,450
Thailand	47	33	--	--
United Kingdom	65	80	32	132
Other	241 r/	535 r/	157	784
Total	21,400	23,900 r/	17,000	12,900
Wrought lead and lead alloys:				
Australia	45	82	80	129
Belgium	136	1,660	225	2,420
Canada	5,260	4,790	5,310	4,870
China	1,320	928	728	486
Colombia	23	71	75	172
France	77	148	351	357
Germany	143	1,780	3,640	2,120
Hong Kong	528	2,470	167	878
Israel	165	456	94	477
Korea, Republic of	245	6,740	153	2,700
Kuwait	66	861	34	461
Mexico	15,900	22,100	4,480	6,920

See footnotes at end of table.

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

(Lead content, unless otherwise specified)

Country	2000 Quantity (metric tons)	2000 Value (thousands)	2001 Quantity (metric tons)	2001 Value (thousands)
Wrought lead and lead alloys--Continued:				
Netherlands	143	$260	120	$271
Saudi Arabia	787	6,270	370	4,210
Singapore	1,000	1,240	501	741
South Africa	84	188	43	81
Spain	26	530	13	227
Taiwan	211	1,400	102	271
United Arab Emirates	3	41	52	51
United Kingdom	166	974	664	1,110
Other	848 r/	4,620 r/	465	2,320
Total	27,200	57,600	17,700	31,300
Scrap (gross weight):				
Argentina	253	418	73	1,290
Canada	65,500	9,850	54,900	7,830
China	2,770	1,140	47,500	13,100
Dominican Republic	20	29	117	118
France	131	188	--	--
Haiti	113	66	14	6
Hong Kong	127	76	193	165
India	239	237	1,050	890
Japan	73	55	1	3
Korea, Republic of	328	72	473	99
Mexico	1,640	599	1,610	548
Spain	--	--	1,900	418
Taiwan	141	134	9	103
United Kingdom	75	187	3	7
Venezuela	74	9	--	--
Other	80 r/	154 r/	129	246
Total	71,600	13,200	108,000	24,900

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

Source: U.S. Census Bureau.

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

(Lead content, unless otherwise specified)

Country	2000 Quantity (metric tons)	2000 Value (thousands)	2001 Quantity (metric tons)	2001 Value (thousands)
Ore and concentrates (lead content): 2/				
Australia	--	--	--	--
Brazil	9,990	$2,280	--	--
Canada	(3/)	25	--	--
Mexico	12,600	3,900	--	--
Peru	1,720	306	--	--
Poland	4,530	805	2,240	$449
South Africa	2,310	491	--	--
Total	31,200	7,810	2,240	449
Base bullion (lead content):				
Colombia	65	30	--	--
Pigs and bars (lead content):				
Australia	36,000	15,700	18,600	8,790
Belgium	65	172	--	--
Canada	216,000	123,000	167,000	93,200
China	72,100	34,800	56,300	27,700
Colombia	189	78	276	109
Germany	537	1,600	120	299
Kazakhstan	4,160	1,990	4,240	2,060
Mexico	18,400	7,270	12,400	5,330
Peru	1,790	1,040	2,330	1,260
United Arab Emirates	30	137	--	--
Other	7,250	3,720	10,000	4,680
Total	356,000	190,000	271,000	143,000
Reclaimed scrap, including ash and residues (lead content)				
United Kingdom 4/	25	5	--	--
Netherlands	--	--	203	93
Grand total	388,000	198,000	274,000	144,000
Wrought lead, all forms, including wire and powders (gross weight):				
Australia	28	129	23	99
Belgium	75	178	6	68
Canada	2,870	4,960	3,270	4,860
China	519	1,130	5,360	3,530
El Salvador	803	568	177	146
France	66	292	2	37
Germany	895	2,440	1,000	2,840
Guatemala	125	86	(3/)	2
Hong Kong	118	412	15	65
Italy	12	71	29	135
Japan	117	943	74	518
Mexico	415	814	131	527
Netherlands	858	2,890	770	1,940
New Zealand	56	487	54	347
Peru	437	276	181	116
Philippines	10	42	--	--
Taiwan	1,130	1,340	470	1,090
United Kingdom	476	1,380	640	1,560
Other	186	855	315	1,150
Total	9,200	19,300	12,500	19,000

-- 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 3/	1997	1998	1999	2000	2001 e/
Algeria	845	730 r/	1,215 r/	818 r/	900
Argentina	13,760	15,004	15,256 r/	14,115 r/	14,000
Australia	526,000 r/	618,000	681,000	739,000 r/	714,000 4/
Bolivia	18,608	13,848	10,153	9,523 r/	9,600
Bosnia and Herzegovina e/	200	200	200	200	200
Brazil	8,729 r/	7,567 r/	10,281 r/	8,832 r/	8,830
Bulgaria	27,000 r/	24,200 r/	17,000 r/	10,500 r/	11,000
Burma e/	1,900	2,200	1,800 r/	1,200 r/	1,300
Canada	186,234	189,752	162,180 r/	152,765 r/	149,400 4/
Chile	1,264	337	606 r/	784 r/	790
China e/	712,000	580,000	549,000	660,000 r/	600,000
Colombia	311 r/	272 r/	166 r/	226 r/	225
Ecuador e/	200	200	200	200	200
Georgia e/	200	200	200	200	200
Greece e/	19,300	18,000	16,000	18,235 r/ 4/	27,700
Honduras	5,900	4,329	3,764 r/	4,805 r/	6,750 4/
India	32,000	39,300	32,100	28,900	27,000 4/
Iran 5/	18,200	11,000	11,000 e/	15,000 e/	15,000
Ireland	45,149	36,528 r/	43,831 r/	57,825 r/	44,500
Italy	11,792	6,800	6,000 e/	2,000 e/	1,000
Japan	5,227	6,198	6,074	8,835	4,997 4/
Kazakhstan e/	31,000	30,000 4/	34,100	40,000	37,700 4/
Kenya	-- r/	--	--	-- e/	--
Korea, North e/	75,000	70,000	70,000	70,000	70,000
Korea, Republic of	3,632	3,558	1,822	2,724 r/	2,500
Macedonia e/	28,000	26,000	26,000 4/	25,000	25,000
Mexico	174,661	166,060	125,656	137,975 r/	135,000
Morocco	77,056	79,300	79,900 r/	82,300 r/	83,000
Namibia	13,577	13,568	9,885 r/	12,115 r/	12,000
Norway	2,000	--	--	--	--
Peru	262,466 r/	257,713 r/	271,782	270,576	271,000
Poland	54,800 r/	59,600 r/	68,400 r/	60,000 e/	60,000
Romania	19,447 r/	15,128 r/	17,489 r/	18,744 r/	20,000
Russia	16,000	13,000	13,000	13,300 e/	12,300
Serbia and Montenegro	11,000	12,000	3,200	9,000	15,000
South Africa	83,114	84,128	80,191	75,262	50,771 4/
Spain	23,900	21,900 r/	41,800 r/	40,300 r/	49,500
Sweden	108,600	114,430	116,300	106,500 r/	94,900 4/
Tajikistan e/	800	800	800	800	800
Thailand	5,400	6,700	11,900	15,600 r/	12,900 4/
Tunisia	1,424	4,274	6,599	6,602	6,450 4/
Turkey	13,113	13,500 e/	14,225 r/	17,270 r/	18,000
United Kingdom e/	1,800	1,600	1,000	1,000	1,000
United States	459,000	493,000	520,000	465,000 r/	466,000 4/
Vietnam e/	1,000	1,000	1,000	1,000	1,000
Total	3,100,000 r/	3,060,000 r/	3,080,000 r/	3,200,000 r/	3,080,000

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

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

2/ Table includes data available through July 1, 2002.

3/ In addition to the countries listed, lead is also produced in Nigeria, but information is inadequate to estimate output.

4/ Reported figure.

5/ Year beginning March 21 of that stated.

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

(Metric tons, gross weight)

Country 3/	1997	1998	1999	2000	2001 e/
Algeria: e/					
Primary	900	900	900	900	900
Secondary	7,100 4/	6,100 4/	6,100	6,100	6,100
Total	8,000	7,000	7,000	7,000	7,000
Argentina:					
Primary	3,282	300 e/	495 e/	8,665 r/	8,500
Secondary	28,834	30,057	25,195 r/	21,000	20,000
Total	32,116	30,357	25,690 r/	29,665 r/	28,500
Australia:					
Primary	204,000	173,000	240,000	223,366	270,000 4/
Secondary	34,000	33,000	32,828	28,430	33,000 4/
Total	238,000	206,000	272,828	251,796	303,000 4/
Austria, secondary	22,700	23,100	24,000 e/	24,000 e/	22,000
Belgium:					
Primary e/ 5/	84,400	74,300	82,900	98,000	76,000
Secondary	26,400	17,200	20,300	20,000 e/	20,000
Total	110,800	91,500	103,200	118,000 e/	96,000
Brazil, secondary	44,500	48,000 r/ 6/	52,000 r/ 6/	50,000 r/ 6/	47,000 4/ 6/
Bulgaria:					
Primary	64,690 r/	62,975	60,000 e/	71,600 r/ e/	70,000
Secondary e/	10,000	10,000	11,000 r/	10,000	10,000
Total	74,690 r/	72,975	71,000 r/	81,600 r/ e/	80,000
Burma, primary	1,760	1,936	1,666	1,054 r/	1,200
Canada:					
Primary	139,736	129,750	137,172 r/	145,640 r/	146,000
Secondary	131,659	135,737	129,243 r/	137,212 r/	137,000
Total	271,395	265,487	266,415 r/	282,852	283,000
China: e/					
Primary	584,000	665,000	821,000	998,000 r/	1,080,000
Secondary	123,000	92,000	97,000	102,000 r/	100,000
Total	707,000	757,000	918,000	1,100,000 r/	1,180,000
Colombia, secondary	10,000	12,000	12,000 e/	12,000 e/	12,000
Czech Republic, secondary e/	15,000	15,000	15,000	15,000	15,000
France:					
Primary	131,480	146,000	124,000	100,000 e/	96,000
Secondary	170,820	172,000	155,000	158,000 e/	142,000
Total	302,300	318,000	279,000	258,000 e/	238,000
Germany:					
Primary	164,800	176,800	169,557	210,000 e/	232,000
Secondary	164,400	203,400	204,000	205,000 e/	142,000
Total	329,200	380,200	373,557	415,000 e/	374,000
India: e/					
Primary	69,000	70,000	72,000	70,000	74,000
Secondary	24,000	25,000	20,000	26,000	20,000
Total	93,000	95,000	92,000	96,000	94,000
Iran:					
Primary e/	8,400	9,000	9,000	9,000	12,000
Secondary	41,000	38,000	38,000 e/	38,000 e/	38,000
Total	49,400	47,000	47,000 e/	47,000 e/	50,000
Ireland, secondary e/	10,000	11,000	12,000	12,000	13,000
Israel, secondary	12,000	12,000	13,000	13,000	20,000 4/
Italy:					
Primary	65,700	57,400	66,954	75,000 e/	82,000
Secondary	145,900	141,900	148,354	160,000 e/	121,000
Total	211,600	199,300	215,308	235,000 e/	203,000
Jamaica, secondary	800 e/	800 e/	-- r/	-- r/	--
Japan:					
Primary	142,326	144,542	125,514	129,469 r/	127,358 4/
Secondary	154,438	157,555	167,915	182,209 r/	175,029 4/
Total	296,764	302,097	293,429	311,678 r/	302,387 4/
Kazakhstan, primary and secondary	81,974	118,632	160,000 e/	185,800 r/	158,800 4/
Kenya, secondary	1,000	1,000	1,000	1,000	1,000 4/

See footnotes at end of table.

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

(Metric tons, gross weight)

Country 3/	1997	1998	1999	2000	2001 e/
Korea, North: e/					
Primary	75,000	75,000	70,000	70,000	70,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	80,000	80,000	75,000	75,000	75,000
Korea, Republic of:					
Primary	121,296	133,066	140,317	170,704	171,000
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	131,000	143,000	150,000	181,000	181,000
Macedonia:					
Primary	24,046	26,000	19,000 e/	19,000 e/	19,000
Secondary e/	2,000	2,415 4/	738	1,000	1,000
Total	26,046 r/	28,415	19,738 r/	20,000 e/	20,000
Malaysia, secondary e/	42,000	35,000	33,000 r/	35,300 r/	42,000
Mexico:					
Primary 7/	168,164	163,206	111,136	143,223 r/	140,000
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	178,000	173,000	121,000	153,000 r/	150,000
Morocco:					
Primary	64,202	60,929 r/	65,209 r/	66,812 r/	67,000
Secondary	3,000	3,000	3,000	3,000	3,000
Total	67,202	63,929 r/	68,209 r/	69,812 r/	70,000
Namibia, primary 8/	1,530	236	--	--	--
Netherlands, secondary	19,500 e/	13,200	19,900	20,000 e/	24,000
New Zealand, secondary e/	6,000	6,000	6,000	10,000	10,000
Nigeria, secondary e/	4,000	5,000	5,000	5,000	5,000
Pakistan, secondary e/	2,000	2,000	2,000	2,000	3,000
Peru, primary	97,882	109,492	121,090 r/	116,412	116,000
Philippines, secondary	17,000 e/	17,000 e/	12,389	16,218	24,000
Poland:					
Primary e/	49,900	49,300	50,000	35,412 4/	35,000
Secondary e/	15,000	15,000	13,985 4/	10,000	10,000
Total	64,900	64,300	63,985 r/	45,412 r/	45,000
Portugal, secondary e/	6,000	6,000	6,000	6,000	6,000
Romania: e/					
Primary	18,000	20,000	18,000 r/	27,000 r/	25,000
Secondary	4,000	4,000	3,000 r/	3,000 r/	3,000
Total	22,000	24,000	21,000 r/	30,000 r/	28,000
Russia, primary and secondary e/	52,000	36,000	62,000	59,000	67,500
Serbia and Montenegro, primary	23,632	23,756	3,690	1,242	--
Slovenia, secondary e/	14,500 4/	14,000	14,000	15,300	15,000
South Africa, secondary	41,500	39,200	40,000	53,000 r/	50,000
Spain, secondary e/	74,900	90,000	96,000 4/	120,000	98,000
Sweden:					
Primary	34,700	40,600	38,000 e/	37,800 e/	36,800
Secondary	51,500	52,000	48,000 e/	45,000 e/	45,000
Total	86,200	92,600	86,000 e/	82,800 e/	81,800
Switzerland, secondary e/	6,000	7,600	7,000	8,000	9,000
Thailand:					
Primary	4,112	3,219	3,025	3,390	3,300
Secondary	14,968	18,906	23,741	23,803 r/	23,200
Total	19,080	22,125	26,766	27,193 r/	26,500
Trinidad and Tobago, secondary e/	1,600	1,600	1,600	1,600	1,600
Turkey: e/					
Primary	7,000	8,000	4,000	4,000	4,000
Secondary	2,000	4,000	4,000	2,000	2,000
Total	9,000	12,000	8,000	6,000	6,000
Ukraine, secondary	11,000 e/	9,000 e/	9,902	15,034	12,000
United Kingdom:					
Primary	215,243	186,212	185,422	166,411	203,000
Secondary	175,783	162,651	162,651	170,740	163,000
Total	391,026	348,863	348,073	337,151	366,000

See footnotes at end of table.

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

(Metric tons, gross weight)

Country 3/	1997	1998	1999	2000	2001 e/
United States:					
Primary	343,000	337,000	350,000	341,000	290,000 4/
Secondary	1,110,000	1,120,000	1,110,000	1,130,000	1,100,000 4/
Total	1,450,000	1,450,000	1,460,000	1,470,000	1,390,000 4/
Venezuela, secondary e/	25,000	25,000	25,000	30,000	30,000
Grand total:	5,880,000	5,950,000 r/	6,160,000 r/	6,550,000 r/	6,470,000
Of which:					
Primary	2,910,000	2,950,000 r/	3,090,000 r/	3,340,000 r/	3,460,000
Secondary	2,840,000	2,850,000 r/	2,850,000 r/	2,960,000 r/	2,790,000
Undifferentiated	134,000	155,000	222,000	245,000 r/	226,000

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

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

2/ Table includes data available through July 1, 2002. 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/ In adddition to the countries listed, Egypt produced secondary lead, but output is not officially reported; available general information is inadequate for the formulation of reliable estimates of output levels.

4/ Reported figure.

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

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

7/ Includes lead content in antimonial lead.

8/ Includes products of imported concentrate.