



# 2011 Minerals Yearbook

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**LEAD**

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# LEAD

By David E. Guberman

**Domestic survey data and tables were prepared by Elsie D. Isaac, statistical assistant, and the world production tables were prepared by Glenn J. Wallace, international data coordinator.**

In 2011, domestic lead mine production of recoverable lead was 334,000 metric tons (t), a 6% decrease compared with that of 2010. Alaska and Missouri were the dominant producing States with significantly more than one-half of total domestic mine production.

Lead was produced at 9 U.S. mines that employed about 1,500 people. The value of domestic mine production (based on the North American Producer Price) was about \$895 million, a 5% increase from the value of domestic mine production in 2010, despite a decline in production owing to an increase in the average price of lead in 2011. Primary lead metal was produced at a smelter-refinery in Missouri.

Secondary lead, derived principally from scrapped lead-acid batteries, accounted for 91% of refined lead production in the United States in 2011. Nearly all the secondary lead was produced by 7 companies operating 14 smelters. Domestic secondary lead production declined slightly from that of 2010.

Lead was consumed in about 76 U.S. plants to manufacture such products as ammunition; building-construction materials; covering for power and communication cable; lead oxides in ceramics, chemicals, glass, and pigments; lead sheet; solders for construction, electrical-electronic components and accessories, metal containers, and motor vehicles; and storage batteries.

World mine production of lead increased by 13%, to 4.70 million metric tons (Mt) from 4.15 Mt in 2010. The United States accounted for about 7% of global lead mine production compared with 9% in 2010 and was ranked third in the world. China and Australia were the two leading world lead producers in 2011 accounting for 50% and 13%, respectively, of global lead mine production. China's share of global lead mine production has increased substantially during the last several years. World production of refined lead (primary and secondary) increased by 6%, to 10.2 Mt in 2011 from 9.61 Mt in 2010. The United States was the second leading producer of refined lead in the world and accounted for 12% of global refined lead production. China produced about 46% of global refined lead production and was the leading producer of refined lead in 2011.

According to the International Lead and Zinc Study Group (ILZSG), global consumption of refined lead increased by 7% to 10.49 Mt in 2011 from 9.85 Mt in 2010. The leading refined-lead-consuming countries in 2011 were China, 44%; the United States, 15%; and Germany, India, and the Republic of Korea, 4% each. ILZSG data indicated that global refined lead production exceeded consumption by about 153,000 t in 2011 compared with 8,000 t in 2010 (International Lead and Zinc Study Group, 2012b, p. 10–11, 16).

Lead-acid batteries, including starting-lighting-ignition (SLI) and industrial types, continued to be the dominant use of lead, accounting for about 89% of U.S. reported lead consumption. SLI battery shipments in North America were 122.6 million

units in 2011, a 3% increase from those of 2010. This total included original equipment (OE) and replacement automotive-type batteries (Battery Council International, 2012, p. 23–24).

The 2011 annual average LME cash price was \$1.09 per pound, an increase of 12% from that of 2010, and the North American Producer price (the weighted average, based on 1993 production figures, of the list prices of those North American primary and secondary producers quoting list prices, in addition to those producers who have switched to LME pricing) increased by about 12% from that of 2010, to \$1.22 per pound from \$1.09 per pound.

## Legislation and Government Programs

In April, the U.S. Environmental Protection Agency (EPA) proposed updates to the air toxics standards that covered secondary lead smelters. The amendments would strengthen the current standards that were issued by the EPA in 1997. The amendments were proposed after the EPA evaluated the 1997 standards to determine if new or improved emission control approaches, practices, or processes had become available, and if additional emission reductions were needed to protect health. The EPA estimated that the proposed changes would reduce lead and arsenic emissions from secondary smelters by about 68% when compared to current levels. The amendments would allow facilities to choose the most practical and cost-effective emissions control technology or techniques to reduce lead and arsenic emissions in order to achieve compliance with the new emissions limit. The new limit for allowable emissions of lead would be one-tenth the current limit. The EPA initially planned to accept public comments for 45 days after the proposal was published in the Federal Register and was under court order to issue a final rule by yearend 2011. The comment period was extended to August owing to the number of comments from both the public and members of the U.S. Congress. An association that represented lead-acid battery recyclers and secondary smelters filed comments with the EPA stating opposition to the new regulations. After reviewing the comments it received, in December, the EPA announced the final amendments to the air toxics standards. Key changes to the standards included a requirement that facilities fully enclose all operations within a building and vent emissions through a controlled stack to reduce arsenic and lead emissions. The EPA lowered the allowable emissions for lead to 0.2 milligram (mg) per dry standard cubic meter from 2.0 mg per dry standard cubic meter. The EPA estimated that the total estimated capital cost for new controls to achieve these emissions reductions would be about \$50 million and an additional \$13 million annual operating cost for all secondary lead smelting facilities, and the changes would yield substantial public health benefits (U.S. Environmental Protection Agency, 2011a, b).

## Production

**Mine.**—In 2011, domestic mine production of recoverable lead was 334,000 t, a 6% decline compared with that of 2010. Lead mine production in the United States has declined by about 26% during the past 10 years owing to shutdowns and curtailments at zinc and lead mines, with no new significant domestic lead mines opening. In 2011, there were 9 lead-producing mines operating in the United States compared with 19 lead-producing mines in 2000.

Alaska and Missouri contributed the major share of the U.S. mine output of lead. Lead mine production also was reported in Idaho. Domestic mine production data were collected by the U.S. Geological Survey (USGS) from a precious-metal and base-metal voluntary survey of lode-mine production (tables 1–2).

Teck Alaska Inc. (a wholly owned subsidiary of Teck Resources Ltd., Vancouver, British Columbia, Canada) operated the Red Dog zinc-lead mine in northwestern Alaska under a royalty agreement with NANA Regional Corp., the sole owner of the property. NANA is a corporation organized under the provisions of the Alaska Native Claims Settlement Act. During 2011, Teck reported that production of lead in concentrate at Red Dog decreased by about 24% to 84,000 t compared with 110,000 t of lead in concentrate in 2010 owing to lower ore grades and recovery rates of near-surface weathered Aqqaluk ore. The average lead grade of ore milled in 2011 was 5.0% compared to 5.4% during the 2010. Lead grade of ore milled during the fourth quarter of 2011 was 5.5%, reflecting improvement compared with the same quarter of 2010. The Aqqaluk deposit was expected to provide sufficient ore to enable zinc and lead mining operations at Red Dog to continue until 2030. Total proven and probable ore reserves at yearend 2011 totaled 50.7 Mt at 4% lead. Teck expected to produce 70,000 t of lead in concentrate in 2012 with the majority of mill feed coming from the Aqqaluk deposit and the balance coming from the Main Pit that was expected to be exhausted during the first quarter of 2012 (Teck Resources Ltd., 2012a, p. 33–35; b, p. 31–32, 41).

In 2011, Teck's Pend Oreille zinc-lead mine in northeastern Washington remained on care-and-maintenance status owing to reduced metal demand and weakened zinc prices. A core group of employees remained at Pend Oreille after the shutdown to facilitate a possible restart in the future and to assure that all regulatory and environmental requirements were being met (Teck Resources Ltd., 2012a, p. 35).

Hecla Mining Co. (Coeur d'Alene, ID) continued to operate two lead-producing mines, the Greens Creek gold, lead, silver, and zinc mine near Juneau, AK, and the Lucky Friday lead, silver, and zinc mine in the Coeur d'Alene Mining District in northern Idaho. Hecla's total production of lead in concentrate in 2011 decreased by 17% to 35,500 t from 42,600 t in 2010. The Lucky Friday mine was temporarily shut down in late 2011 because of an accident in November that killed two miners and a rock burst in December that injured 11. An order was issued by the Mine Safety and Health Administration (MSHA) to remove loose material from the Silver Shaft, requiring all operations at the mine to cease production. In response, Hecla submitted a plan to MSHA and received approval to remove

loose material and unused utilities and to install a metal brattice wall that would improve shaft functionality. Production was expected to resume in early 2013 after the maintenance work is completed. As of December 31, 2011, total proven and probable lead reserves at the two mines were 535,000 t compared with 505,000 t at yearend 2010 (Hecla Mining Co., 2012, p. 7–16).

**Primary.**—Doe Run produced primary lead at a smelter-refinery facility in Herculaneum, MO. Concentrates for the smelter-refinery were provided mainly from four Doe Run mills that were supplied with ore mined from six production shafts along the Viburnum Trend in southeastern Missouri. In 2011, domestic primary lead metal production was 118,000 t, a slight increase compared with 115,000 t in 2010. The company has operated the smelter with a single furnace since 2008. In late 2010, Doe Run announced that it would be shutting down the primary lead smelter in Herculaneum in 2013 as part of an agreement with Federal and State regulatory agencies and limiting annual refined lead production to about 118,000 t until it was closed. In 2011, the company did not indicate if it planned to proceed with construction of a new commercial-scale primary lead electrowinning plant based on a new lead processing technology that it had unveiled in 2010 (U.S. Environmental Protection Agency, 2010).

**Secondary.**—Domestic secondary production of refined lead in 2011 decreased slightly to 1.13 Mt from 1.14 Mt in 2010. Reports during the year indicated that several secondary lead smelters lost production for time periods ranging from days to several weeks owing to planned and unplanned maintenance shutdowns, contributing to the slight decline in production in 2011. Secondary lead accounted for 91% of domestic lead refinery production, unchanged from that in 2010. Lead-acid batteries continued to be the dominant source of recoverable lead scrap, accounting for 95% of all lead recovered 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. In 2011, 12 companies producing secondary lead, exclusive of that produced from copper-based scrap, were surveyed; 11 responded, representing about 99% of the total production of secondary lead. Of the total lead recycled in 2011, the majority was produced by 7 companies operating 14 plants in Alabama, California, Florida, Indiana, 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, 3).

In January, Johnson Controls Inc. (JCI) broke ground on its new secondary lead smelter in Florence, SC. Construction of the \$150 million Florence Recycling Center was expected to be completed by yearend 2012. The Florence plant was the first lead smelter to receive the necessary air permit to operate in the United States in about 20 years. When fully operational, the plant was expected to produce 120,000 to 132,000 metric tons per year (t/yr) of refined lead from used lead-acid batteries (Johnson Controls Inc., 2011b).

In early September, EnviroFocus Technologies (Tampa, FL) was expected to start its new reverberatory and blast furnace at its secondary lead smelter in Tampa. The company had already started a new battery-breaking operation for recycling lead-acid

batteries. EnviroFocus was expanding secondary refined lead production capacity at the plant to 100,000 t/yr from about 24,000 t/yr by early 2012 (Ryan's Notes, 2011a).

## Consumption

Reported U.S. consumption of refined lead increased slightly in 2011 compared with that of 2010. Increases in lead used for ammunition and in other metal products offset slight declines in, casting metals, solder, and storage batteries end-use sectors. Consumption of lead in SLI and industrial type lead-acid storage batteries represented about 89% of the total reported consumption of lead (tables 4–6). Demand for lead is heavily reliant on the lead-acid battery industry and, in turn, the automotive sector. The Battery Council International (BCI) reported that North American shipments of SLI automotive batteries in 2011 were 122.6 million units, a 3% increase from those in 2010. Shipments of replacement SLI batteries in 2011 totaled 107.1 million units, slightly greater than those in 2010. Replacement batteries represented 87% of all North American battery shipments in 2011. North American shipments of OE SLI batteries were 15.5 million units in 2011, an increase of 12% from those of 2010. The increase in shipments of OE batteries was attributed to increased production of new vehicles during 2011 compared with production in 2010. Total domestic vehicle production (passenger cars and light commercial vehicles) in 2011 was about 8.4 million units compared with 7.6 million units produced in 2010. In 2011, an estimated 244 million vehicles were in operation in the United States, and the average age of the vehicle fleet on the road in the United States increased to 10.6 years, the highest level in history. Maintenance requirements of the aging fleet kept the replacement battery market stable while consumption of OE batteries increased compared with those of 2010. During the economic downturn that began in late 2008, consumers delayed preventative vehicle maintenance, such as exchanging older batteries for new units, opting instead to wait until batteries failed before replacing them (Battery Council International, 2012, p. 23–24; CRU International Ltd., 2012b, p. 165).

Lead-acid batteries used in vehicles incorporating traditional internal combustion engines remained the backbone of global lead consumption in 2011. Many of the leading lead-acid battery producers were investing capital to research and develop battery technologies for the next generation of vehicles (partially driven by European Union regulations aimed at substantially reducing carbon dioxide emissions in new vehicles by 2012). Battery technologies such as absorbed glass mat (AGM) were considered feasible options for use in some hybrid-electric vehicles. In AGM batteries, the electrolyte in the battery is immobilized with a highly porous and absorbent microfiber glass mat. AGM batteries typically deliver considerably longer lifespans than traditional flooded lead-acid batteries, and their design makes them a preferred battery choice for use in vehicles that have start-stop technology. Vehicles equipped with start-stop technology (sometimes called microhybrids) use automatic stop-start functionality to cut power to the engine when the vehicle idles, reducing fuel consumption and emissions by as much as 12%. This technology is attractive to automobile manufacturers because it is relatively inexpensive

to add to existing vehicle designs. Battery producers were installing capacity to produce appropriate lead-acid batteries, like AGM, for the introduction of vehicles equipped with start-stop technology in the United States by 2012. Lead-acid battery manufacturer, JCI, announced that it planned to invest \$138.5 million to convert its battery plant in Toledo, OH, into the company's first AGM plant in the United States. The plant was expected to produce 6 million AGM batteries per year by 2013. The company forecast that the global start-stop market would increase to 35 million batteries by 2015 (Platts Metals Week, 2011).

The BCI reported that the sales value of industrial-type lead-acid batteries in North America increased by about 20% (\$288 million) in 2011 compared with that of 2010. A 32% sales increase in motive power lead-acid batteries was attributed to a price increase for lead and an increase in quantity of units sold. About 93% of these batteries were used in material handling equipment like forklifts, and increased sales were linked to a recovery in the manufacturing industry since the economic downturn in late 2008. Overall, 2011 shipments of industrial-type lead-acid batteries were valued at about \$1.74 billion compared with \$1.45 billion in 2010. Stationary power batteries accounted for 49% of all industrial-type battery sales, and the remaining 51% was motive power batteries (Purdy, 2012).

Metalico Inc. (Cranford, NJ) was a leading domestic producer of nonbattery lead-based products in 2011. Metalico's lead-fabricating segment produced lead sheet, shot, strips, and various extruded products at four fabricating facilities. In 2011, sales of fabricated lead products were valued at \$72.6 million, an 11% increase compared with lead fabrication sales in 2010. Similar to the situation in 2010, the increase was attributed to a greater average sales price of fabricated lead products in 2011 compared with that of 2010, offsetting a decline in volume sold during that time period (Metalico Inc., 2012, p. 38).

## Prices

The LME average cash price for lead began 2011 at \$2,601 per metric ton in January. Lead prices peaked at \$2,741 per ton in April, and ended 2011 at \$2,019 per ton. LME price increases during the first half of the year were attributed to investor optimism about global economic growth, a weaker U.S. dollar, and a potential increase in lead consumption after the earthquake and tsunami in Japan. Prices declined during the second half of the year as investor optimism for global economic growth faded and Chinese lead-acid battery plants were closed by the Federal and provincial government owing to environmental concerns. On an annual average basis, the North American Producer and the LME cash prices in 2011 were up by \$0.128 per pound (12%) and \$0.115 per pound (12%) respectively, from the 2010 average prices of \$1.09 per pound and \$0.974 per pound, respectively (CRU International Ltd, 2012a, p. 47–49).

## Foreign Trade

In 2011, imports of unwrought (refined) lead metal in pigs and bars for consumption totaled 313,000 t, a 15% increase from those of 2010. The leading source was Canada, accounting for



80% of unwrought lead metal imports. Unwrought lead metal imports from Mexico increased by 90% from that in 2010 to 56,000 t.

Total domestic exports of unwrought lead in 2011 were 40,100 t, 48% less from that in 2010. Belgium was the leading destination for the unwrought lead exported in 2011, accounting for about 53% of the total. Exports to Mexico, the leading destination in 2010, declined by 73% in 2011 compared with that in 2010.

Domestic exports of lead in concentrate were 223,000 t, a 25% decrease from those of 2010. Nearly 65% of the lead in concentrate produced domestically was exported in 2011, and the majority of lead in concentrate exports went to Belgium, Canada, China, Japan, and the Republic of Korea (tables 10–11).

A substantial quantity of lead contained in new and spent lead-acid batteries is traded annually. In 2011, the United States imported about 20.0 million SLI lead-acid batteries for consumption, a 15% decrease from those of 2010. Mexico was the leading provider of SLI batteries, accounting for 63% of the SLI batteries imported in 2011. SLI batteries were also imported primarily from China, Columbia, Germany, Philippines, the Republic of Korea, Spain, and Taiwan. The United States exported about 25.9 million spent SLI lead-acid batteries in 2011, 63% more than those of 2010. The majority of those units were shipped to Mexico (76%) and Canada (22%) for recycling. Much of the lead recovered from the exported batteries was reused to manufacture lead-acid batteries at plants in Canada and Mexico that were exported to the United States.

## World Review

World mine production of lead increased by 13% to 4.70 Mt in 2011. China was the leading producer accounting for about 50% of the world total, followed by Australia, with 13%; the United States, 7%; and Peru and Mexico, 5% each (table 12). This increase in mine production was primarily owing to increased production in Bolivia, China, India, and Mexico offsetting decreases in Peru and the United States. In 2011, seven lead-producing mines were opened, adding 128,000 t/yr to global lead mine production capacity. Nearly one-half of the additional mine capacity was in India, and the remainder was added in Australia, Canada, Tajikistan, and Uzbekistan. The only substantial mine closure in 2011 was an 80,000-t/yr mine in Australia.

World production of refined lead (primary and secondary) increased by 6%, to 10.18 Mt in 2011 from 9.61 Mt in 2010. China was the leading producer of refined lead, accounting for 46% of world production, followed by the United States, with 12%; and Germany and India, 4% each (table 13). Refined lead production increases, most substantially in China, but also in Germany, India, Poland, and Thailand offset small declines in other countries. Secondary (recycled) lead has accounted for an increasing portion of the total global lead supply during the past 12 years. Secondary lead production represented about 52% of total refined lead production worldwide in 2011 compared with 47% in 1999. Secondary production for the world, except for China (China produces substantially more primary than secondary lead), represented 69% of total refined lead production in 2011. In 2011, nine new lead smelters added about

780,000 t/yr of lead smelting capacity, and about 70% of this capacity was in China. The remainder of the new capacity was added in India and Mexico. There were no substantial single plant closures in 2011 but there were multiple closures of small, older smelters in China (International Lead and Zinc Study Group, 2012c, p. 5–6, 21–26).

According to ILZSG, consumption of refined lead increased by 7% to 10.49 Mt in 2011 from 9.85 Mt in 2010, following a similar increase in global lead consumption in 2010 from that in 2009. The leading refined-lead-consuming countries in 2011 were China, 44%; the United States, 15%; and Germany, India, and the Republic of Korea, 4% each. Chinese consumption continued to drive global demand growth, increasing by 10% in 2011 from that in 2010. Chinese consumption was fueled by increased use in automotive and stationary batteries used in backup power supply systems, telecommunication networks, and renewal energy storage applications. ILZSG data indicated that global refined lead production exceeded consumption by about 153,000 t in 2011 compared with 8,000 t in 2010 (International Lead and Zinc Study Group, 2012b, p. 10–11).

**European Union.**—Recylex S.A. (Paris, France), a leading lead producer in Europe, reported that in 2011 its two facilities in France and subsidiary in Germany processed 149,000 t of spent lead-acid batteries, unchanged from 149,000 t in 2010. The lead-bearing materials produced by these plants were sent to the company's two smelters in Belgium and Germany. Total refined lead production from the company's smelters in 2011 was 126,000 t, a 3% increase compared with 122,000 t in 2010. In 2010, operating performance of the company's main smelter in Nordenham, Germany, was affected by a temporary shutdown (Recylex S.A., 2012, p. 10).

**Australia.**—On December 31, 2010, Magellan Metals Pty. Ltd. [a wholly owned subsidiary of Ivernia Inc., (Toronto, Ontario, Canada)] announced that it had received an order from the Acting Minister for Environment of Western Australia to stop the transportation of lead concentrate from its Magellan Mine in Western Australia. Magellan was one of the leading lead carbonate mines in the world. Magellan Metals stopped mining and processing operations at the Magellan Mine until February 23, 2011, when the stop order was lifted. Following the lifting of the order, Magellan commenced ramp-up operations to resume mining. On April 5, Magellan announced that it had voluntarily ceased transportation and operations as a result of the detection of a small amount of lead-bearing mud on the outside of one of its shipping containers at the Port of Fremantle. On April 7, the company placed the Magellan Mine on care-and-maintenance status indefinitely. In 2011, the company produced approximately 12,700 dry metric tonnes of lead carbonate concentrate containing approximately 8,100 t of lead in concentrate. The mine remained closed at yearend, and it was unclear when and under what conditions the mine would resume operations (Ivernia Inc., 2012, p. 9–12).

In July, Xstrata plc (Zug, Switzerland) began construction to develop the high-grade, zinc-lead-silver Lady Loretta deposit in northwest Queensland. The company was going to develop the decline, surface infrastructure, and underground services at the \$239 million project. The mine was 140 kilometers northwest of Xstrata's Mount Isa operations, and the company planned to

start operations at Lady Loretta by yearend 2013. Lady Loretta was expected to produce 1 million metric tons per year (Mt/yr) of zinc-lead-silver-ore yielding an average of 126,000 t/yr and 40,000 t/yr of zinc and lead in concentrate, respectively, during its 10-year mine life. Ore was expected to be treated at Xstrata's Mount Isa's processing facilities. The company was also expanding its Handlebar Hill open pit zinc-lead mine near Mount Isa to extend the mine's life to 2013 (Xstrata plc, 2011).

**Canada.**—Xstrata's Brunswick underground zinc-lead mine near Bathurst, New Brunswick, was the leading producer of lead in concentrate in Canada. The mine and mill had production capacity to process 3.1 Mt/yr of ore containing copper, lead, silver, and zinc. In 2011, Brunswick Mine produced 57,000 t of lead in concentrate, down from 60,000 t in 2010. The Brunswick smelter produced 76,500 t of refined lead compared with 85,000 t in 2010 owing to lower lead content in feed ore. In 2010, Xstrata increased reserves at Brunswick Mine to extend the mine life to 2013, beyond its previously anticipated closure in early 2010. Brunswick was expected to close no later than March 2013 (Xstrata plc, 2012, p. 70–71, 81).

In 2011, Selwyn Resources Ltd. (Vancouver, British Columbia) and joint-venture partner, Yunnan Chihong Zinc and Germanium Co. Ltd. (Yunnan Province, China), continued an exploration, permitting, engineering, and development program at the Selwyn Project in the eastern Yukon Territory (also known as the Howard's Pass District). Selwyn Chihong Mining Ltd. was formed as a joint-venture company to advance the Selwyn project through the development stages to production. In 2010 and 2011, the company spent about \$80 million on programs at the project. In 2011, Selwyn Chihong engaged in definition drilling of the XY Central and Don deposits, converting the mineral resources into the indicated categories for use as the basis of the mine development plan. Drilling on the XY West deposit, adjacent to the XY Central deposit, confirmed and expanded the mineral resource at XY West. The Selwyn project was one of the largest undeveloped resources of lead and zinc in the world according to the company. The latest (August 2011) resource estimates for the project were 180.6 Mt of indicated mineral resources, grading 1.83% lead. Selwyn's revised development schedule provided for initial ore production to begin in 2015 at rates that would produce about 65,000 t/yr of lead in concentrate (Selwyn Resources Ltd., 2012, p. 3, 11, 15–19).

Teck announced that 2011 refined lead production at its metallurgical complex at Trail was 85,600 t, a 20% increase from that of 2010 owing to the KIVCET furnace operating at greater feed rates and no substantial shutdowns during the year. Teck expected to produce 85,000 t of refined lead at Trail in 2012. In September, Teck announced plans to invest \$211 million to significantly increase capacity to recycle end-of-life electronics at Trail. This project included construction of a new slag-fuming furnace and a settling furnace that would integrate into the existing lead smelting process. Teck recycled 13,000 t of electronic waste at Trail in 2010, and this project will triple capacity. Typical electronic waste consists of crushed glass from computer and television screens that contains 8% to 10% lead and other components that contain aluminum, copper, and steel. Construction was scheduled to begin in 2012 and be completed

in 2014 (Ryan's Notes, 2011b; Teck Resources Ltd., 2012b, p. 34–35).

**China.**—China continued to be the leading global producer and consumer of lead in 2011. China was also the leading producer of lead-acid batteries in the world. Between 1999 and 2011, China's surging consumption of lead contained in lead-acid batteries was caused by tremendous growth in the production of automobiles, electric bicycles (e-bikes), and motorcycles. The number of e-bikes in China had grown to more than an estimated 120 million in 2011. Each e-bike typically needed at least one lead-acid battery per year, containing about 10 kilograms of lead, to operate, which translated to more than 1 Mt of lead consumed for this use in 2011. Consumption of lead in China has increased by an average of about 19% per year from 2000 to 2011 and was estimated to have increased by 10% to 4.63 Mt in 2011 from 4.21 Mt in 2010. Lead in concentrate production in 2011 was 2.35 Mt, a 27% increase from the 1.85 Mt produced in 2010. Refined lead production in 2011 was 4.65 Mt, an 11% increase from the 4.20 Mt produced in 2010. In 2011, secondary lead production accounted for 31% of total refined lead production in China, compared with 32% in 2010 (International Lead and Zinc Study Group, 2012b, p. 1–14).

In 2011, the Chinese National and Provincial governments continued to eliminate smaller lead mines and smelters in an attempt to consolidate production and shutter lead-acid battery manufacturers that violated environmental regulations. In August, the Ministry of Industry, Information, and Technology (MIIT) released a draft proposal that would permanently close all secondary lead smelters with refined lead capacity less than 30,000 t/yr by 2013. New plants and expansions at existing plants would need to have the capacity to produce at least 50,000 t/yr of refined lead. Any new capacity additions would have to achieve a lead recovery rate of 98%, and existing plants would be required to achieve recovery rates of at least 96%. The Government ultimately wanted to close the smaller smelters that were considered heavier polluters and keep larger, more technologically advanced smelters that would comply with environmental regulations. It was estimated that the plans could affect 66% of the secondary lead smelters operating in China. In December, the MIIT issued a circular to Provinces and regions listing 3.60 Mt/yr of outdated nonferrous metals production capacity that was targeted to be closed or phased out during the 12th 5-year plan period (2011–15). An estimated 1.30 Mt/yr of lead smelting capacity was targeted for elimination during this period. The Government wanted recycling to account for 40% of total refined lead production by 2015 (CRU International Ltd., 2011, p. 167).

In 2011, about 1,600 lead-acid battery manufacturing plants out of 1,930 inspected were permanently or temporarily closed from April to July as a result of a national environmental crackdown. In response to multiple lead pollution and lead poisoning incidents near lead-acid battery plants, inspections were conducted to eliminate plants that were potential hazards to the community and public health. By yearend about 66% of the more than 3,000 total lead-acid battery plants operating in China would be permanently closed. Many of these plants were smaller facilities that operated outside of the government's regulatory control. Despite the shutdowns, applications for new lead-acid battery plants in 2011 increased from the previous

year, and larger companies appeared to be preparing to replace lost capacity with new plants (Metal Bulletin, 2011a, b).

**India.**—In support of its emerging industrial economy and automotive sector, mine and refined lead consumption and production increased in 2011 compared with that in 2010. Lead-acid batteries account for about 90% of total lead consumed in India. Hindustan Zinc Ltd. (HZL) (Udaipar), India's leading integrated zinc and lead producer, produced 607,000 t of mined zinc and lead in concentrate at its four active mines during the 9-month period that ended December 31, 2011, a slight decrease compared with production in the same period of 2010. HZL continued an aggressive plan to expand its mines and smelters to satisfy increased domestic lead consumption. In 2011, HZL commissioned a new zinc and lead smelter in Dariba with capacity to produce 100,000 t/yr of primary lead and increased the company's total refined lead production capacity to 185,000 t/yr. HZL was also expanding production capacities at its Kayar, Rampura Agucha, and Sindesar Khurd zinc-lead mines for progressive commissioning from 2011 to 2012. HZL's expanded production capacity could help satisfy some of the increased demand for lead in India, which has become reliant on imported lead during the past several years (Hindustan Zinc Ltd., 2012).

**Mexico.**—In August, JCI announced plans to invest more than \$70 million in its secondary lead smelter in Nuevo Leon to replace existing rotary furnaces with larger, more efficient rotary furnaces. New environmental controls were expected to be added during the furnace upgrade to comply with Mexican air emission standards. It was unclear how much additional refined lead production capacity, if any, the 132,000-t/yr secondary smelter would have after the upgrade. The upgrade was part of JCI's strategy to increase lead recycling capacity in North America (Johnson Controls, Inc, 2011a).

## Outlook

At its April 2012 meeting in Lisbon, Portugal, ILZSG forecast global increases in lead mine and refinery production as well as in lead consumption. Global lead mine production was expected to increase to 4.88 Mt in 2012, 5% more than that in 2011, owing to greater output in China. About 300,000 t/yr of new lead mine capacity was expected to be commissioned from 2012 to 2014 with the largest additions in Australia and Russia. Global refined lead metal production in 2012 was expected to increase by 4% (10.9 Mt), owing to production increases in Belgium, Canada, China, India, Japan, Kazakhstan, the Republic of Korea, Sweden, the United Kingdom, and the United States. Twelve new plants were expected to open in 2012—four primary and eight secondary plants (International Lead and Zinc Study Group, 2012a, 2012c, p. 5–6).

The availability of lead scrap, primarily in the form of used lead-acid batteries, has become an issue of concern for many domestic secondary producers. The combination of increased exports of spent lead-acid batteries to other countries during the past few years and substantial additions to domestic secondary lead production capacity expected during the next 2 to 3 years could cause the market for lead scrap to tighten. It is unclear if there will be enough scrap available for all existing secondary smelters to operate at full capacity or if some will be

forced to scale-back operations or close. Impending regulatory requirements that might require some smelters to invest additional capital and increase annual production costs to remain in compliance could also factor into which plants will be able to operate profitably in the long-term.

Global consumption of refined lead in 2012 was forecast to be 10.8 Mt, a 5% increase from that of 2011, according to ILZSG. The global increase in consumption was attributed to a 7% increase in use of refined lead in China owing to growth in the automotive, e-bike, and industrial battery sectors. Lead-acid battery production in China was expected to recover from the closure of many small plants in 2011 owing to environmental regulations. Consumption in India, Japan, Poland, the Republic of Korea, Russia, Thailand, and Vietnam were expected to be greater in 2012 than in 2011. In North America, the BCI forecast that total shipments of SLI lead-acid batteries would increase slightly in 2012 from those in 2011. Provided that the majority of vehicles in the current fleet continue to be operated on a regular basis, the replacement SLI battery market was expected to remain stable in the near future. Shipments of OE batteries were expected to be heavily reliant on production of new automobiles in North America which were expected to increase from 2011 to 2016. The BCI forecast that OE battery shipments would increase by about 6% per year from 2011 to 2016. Sales of industrial-type lead-acid batteries in North America were expected to increase by 8% in 2012 compared with sales in 2011 owing to increased demand for motive power and standby batteries from the business sector. Overall, ILZSG expected that production of refined lead would exceed consumption, and the lead market would remain in surplus of about 114,000 t by yearend 2012 (International Lead and Zinc Study Group, 2012a; Purdy, 2012).

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TABLE 1  
SALIENT LEAD STATISTICS<sup>1</sup>

		2007	2008	2009	2010	2011
United States:						
Production:						
Mine, recoverable lead content: <sup>2</sup>						
Quantity	metric tons	434,000	399,000	395,000	356,000	334,000
Value	thousands	\$1,180,000	\$1,060,000	\$757,000	\$854,000	\$895,000
Primary lead, refined content, domestic ores and base bullion	metric tons	123,000	135,000	103,000	115,000	118,000
Secondary lead, lead content	do.	1,180,000	1,140,000	1,110,000	1,140,000	1,130,000
Exports, lead content:						
Lead ore and concentrates	do.	300,000	277,000	287,000	299,000	223,000
Lead materials, excluding scrap	do.	56,500	74,800	82,000	83,500	47,200
Imports for consumption, lead content:						
Lead in base bullion	do.	1,990	2,740	844	602	434
Lead in pigs and bars	do.	263,000	309,000	251,000	271,000	313,000
Stocks, December 31, lead content:						
Primary lead	do.	W	W	W	W	W
At consumers and secondary smelters	do.	51,600	72,500	63,300	64,800 <sup>r</sup>	46,600
Consumption of metal, primary and secondary, lead content	do.	1,570,000	1,440,000	1,290,000	1,430,000	1,440,000
Price:						
North American Producer average, delivered <sup>3</sup>	cents per pound	123.84	120.33	86.87	108.91	121.70
London Metal Exchange, pure lead, cash average <sup>3</sup>	do.	117.00	94.79	77.95	97.42	108.92
World:						
Production, gross weight:						
Mine	metric tons	3,710,000 <sup>r</sup>	3,880,000 <sup>r</sup>	3,870,000 <sup>r</sup>	4,160,000 <sup>r</sup>	4,700,000
Primary refinery	do.	3,660,000	3,980,000	3,860,000	4,240,000 <sup>r</sup>	4,690,000
Secondary refinery	do.	4,440,000 <sup>r</sup>	4,620,000 <sup>r</sup>	4,910,000 <sup>r</sup>	5,170,000 <sup>r</sup>	5,270,000
Undifferentiated		222,000	196,000	164,000	202,000	216,000

<sup>r</sup>Revised. do. Ditto. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Data are rounded to no more than three significant digits, except prices.

<sup>2</sup>Lead recoverable after smelting and refining. Data in table 12 represent lead in concentrate.

<sup>3</sup>Platts Metals Week.

TABLE 2  
LEADING LEAD-PRODUCING MINES IN THE UNITED STATES IN 2011, IN ORDER OF OUTPUT<sup>1</sup>

Rank	Mine	County and State	Operator	Source of lead
1	Red Dog	Northwest Arctic, AK	Teck Alaska Inc.	Zinc-lead ore.
2	Fletcher	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
3	Buick	Iron, MO	do.	Do.
4	Brushy Creek	Reynolds, MO	do.	Do.
5	Viburnum (#29 and #35)	Washington and Iron, MO	do.	Do.
6	Greens Creek	Juneau, AK	Hecla Mining Co.	Zinc-silver ore.
7	Lucky Friday	Shoshone, ID	do.	Silver ore.
8	Sweetwater	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
9	Galena	Shoshone, ID	U.S. Silver Corp.	Silver ore.

Do., do. Ditto.

<sup>1</sup>The mines on this list accounted for 100% of the U.S. mine production in 2011.

TABLE 3  
LEAD RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES,  
BY KIND OF SCRAP AND FORM OF RECOVERY<sup>1</sup>

(Metric tons, lead content, unless otherwise specified)

	2010	2011
<b>Kind of scrap:</b>		
New scrap:		
Lead-base	22,600	20,100
Copper-base	--	--
Tin-base	1,530	1,530
Total	<u>24,100</u>	<u>21,600</u>
Old scrap:		
Battery-lead	1,070,000	1,070,000
All other lead-base	42,900	40,100
Copper-base	--	--
Total	<u>1,120,000<sup>r</sup></u>	<u>1,110,000</u>
Grand total	<u>1,140,000</u>	<u>1,130,000</u>
<b>Form of recovery:</b>		
As soft lead	968,000	966,000
In antimonial lead	174,000 <sup>r</sup>	167,000
In other lead alloys	(2)	(2)
In copper-base alloys	--	--
Total:		
Quantity	1,140,000	1,130,000
Value <sup>3</sup>	thousands \$2,740,000 <sup>r</sup>	\$3,040,000

<sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Included with "Other lead alloys."

<sup>3</sup>Value based on average quoted price of common lead.

TABLE 4  
U.S. CONSUMPTION OF LEAD, BY PRODUCT<sup>1</sup>

(Metric tons, lead content)

SIC <sup>2</sup> code	Product	2010	2011
	Metal products:		
3482	Ammunition, shot and bullets	65,700	69,200
	Bearing metals:		
35	Machinery except electrical	W	W
371	Motor vehicles and equipment	W	W
37	Other transportation equipment	W	W
	Total	1,230	1,150
3351	Brass and bronze, billets and ingots	1,410	1,620
36	Cable covering, power and communication	(3)	(3)
15	Calking lead, building construction	(3)	(3)
	Casting metals:		
36	Electrical machinery and equipment	W	W
371	Motor vehicles and equipment	W	W
37	Other transportation equipment	W	W
3443	Nuclear radiation shielding	W	W
	Total	16,400	11,100
	Pipes, traps, other extruded products:		
15	Building construction	990	859
3443	Storage tanks, process vessels, etc.	(4)	(4)
	Total	990	859
	Sheet lead:		
15	Building construction	16,000	15,800
3443	Storage tanks, process vessels, etc.	W	W
3693	Medical radiation shielding	W	W
	Total	23,400	24,200
	Solder:		
15	Building construction	W	W
	Metal cans and shipping containers	W	W
367	Electronic components, accessories and other electrical equipment	6,130	6,120
371	Motor vehicles and equipment	W	W
	Total	6,420	6,370
	Storage batteries:		
3691	Storage battery grids, post, etc.	478,000	440,000
3691	Storage battery oxides	806,000	833,000
	Total storage batteries	1,280,000	1,270,000
27	Type metal, printing and allied industries	(3)	(3)
34	Other metal products <sup>3</sup>	8,800	24,000
	Grand total	1,410,000	1,410,000
	Other oxides:		
285	Paint	W	W
32	Glass and ceramics products	W	W
28	Other pigments and chemicals	W	W
	Total	9,760	9,760
	Miscellaneous uses	13,700	14,300
	Grand total	1,430,000	1,440,000

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

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

<sup>2</sup>SIC Standard Industrial Classification.

<sup>3</sup>Included with "Metal products: Other metal products."

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

<sup>5</sup>Includes lead consumed in foil, collapsible tubes, annealing, galvanizing, plating, electrowinning, and fishing weights.

TABLE 5  
U.S. CONSUMPTION OF LEAD IN 2011, BY STATE<sup>1,2</sup>

(Metric tons, lead content)

State	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
California and Washington	25,100	1,050	3,020	--	29,200
Illinois	23,600	19,400	--	--	43,000
Iowa, Michigan, Missouri	23,700	41,400	W	--	65,100
Ohio and Pennsylvania	95,200	92,300	32,600	W	220,000
Arkansas and Texas	56,500	19,700	--	--	76,200
Alabama, Georgia, Oklahoma	29,700	6,770	W	--	36,500
Indiana, Kansas, Kentucky, Minnesota, Nebraska, Tennessee, Wisconsin	122,000	134,000	28,800	W	285,000
Connecticut, Maryland, New Jersey, New York, North Carolina, South Carolina	22,700	14,800	2,110	--	39,600
Other States	516,000	73,900	49,900	626	640,000
Total	914,000	404,000	116,000	626	1,440,000

W Withheld to avoid disclosing company proprietary data; included in "Other States." -- Zero.

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

<sup>2</sup>Includes lead that went directly from scrap to fabricated products.

TABLE 6  
U.S. CONSUMPTION OF LEAD IN 2011, BY CLASS OF PRODUCT<sup>1,2</sup>

(Metric tons, lead content)

Product	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
Metal products	65,700	65,900	W	W	139,000
Storage batteries	825,000	338,000	W	W	1,270,000
Miscellaneous <sup>3</sup>	24,000	(4)	W	W	24,100
Total	914,000	404,000	116,000	626	1,440,000

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

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

<sup>2</sup>Includes lead that went directly from scrap to fabricated products.

<sup>3</sup>Included in "Miscellaneous" are other oxides and gasoline additives.

<sup>4</sup>Withheld to avoid disclosing proprietary data; included in "Storage batteries."



TABLE 7  
STOCKS OF LEAD AT CONSUMERS AND SECONDARY SMELTERS  
IN THE UNITED STATES, DECEMBER 31<sup>1,2</sup>

(Metric tons, lead content)

Year	Refined soft lead	Lead in		Lead in alloys	Lead in copper-base scrap	Total
		antimonial lead	lead			
2010	29,000	25,100 <sup>r</sup>		W	W	64,800 <sup>r</sup>
2011	28,400	15,400		W	W	46,600

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."

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

<sup>2</sup>Includes stocks at primary refineries.

TABLE 8  
PRODUCTION AND SHIPMENTS OF LEAD PIGMENTS AND OXIDES IN THE UNITED STATES<sup>1,2</sup>

(Metric tons and dollars)

Product	2010				2011			
	Production		Shipments <sup>e</sup>		Production		Shipments <sup>e</sup>	
	Gross weight	Lead content	Quantity (lead content)	Value <sup>3</sup>	Gross weight	Lead content	Quantity (lead content)	Value <sup>3</sup>
Litharge, red lead and white lead, dry	--	--	3,450	7,000,000	--	--	3,590	8,600,000
Leady oxide	820,000 <sup>r</sup>	779,000 <sup>r</sup>	NA	NA	827,000	786,000	NA	NA
Total	820,000 <sup>r</sup>	779,000 <sup>r</sup>	NA	NA	827,000	786,000	NA	NA

<sup>e</sup>Estimated. <sup>r</sup>Revised. NA Not available. -- Zero.

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

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

<sup>3</sup>At plant, exclusive of container.

TABLE 9  
U.S. IMPORTS FOR CONSUMPTION OF LEAD PIGMENTS AND COMPOUNDS, BY KIND<sup>1</sup>

Kind	Quantity	Value
	(metric tons, lead content)	(thousands)
2010:		
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	1,900	\$9,760
Litharge	1,470	5,440
Glass frits (undifferentiated)	25,300	45,900
Total	28,600	61,000
2011:		
Chrome yellow, molybdenum orange pigments, lead-zinc chromates	2,320	11,800
Litharge	1,360	5,160
Glass frits (undifferentiated)	22,800	45,600
Total	26,400	62,500

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

Source: U.S. Census Bureau.

TABLE 10  
U.S. EXPORTS OF LEAD, BY COUNTRY<sup>1</sup>

Country	2010		2011	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
<b>Ore and concentrates, lead content:</b>				
Belgium	4,320	\$4,830	14,700	\$18,400
Canada	32,200	58,700	33,300	72,100
China	173,000	243,000	129,000	222,000
Japan	55,000	119,000	27,600	64,600
Korea, Republic of	26,300	37,600	17,700	46,200
Mexico	7,490	7,800	464	1,120
Other	274	140	240	423
Total	299,000	472,000	223,000	425,000
<b>Base bullion, lead content:</b>				
China	100	387	1	9
Korea, Republic of	--	--	55	718
Mexico	99	371	--	--
Other	--	--	14	16
Total	199	758 <sup>†</sup>	70	743
<b>Unwrought lead and lead alloys, lead content:</b>				
Belgium	18,200	16,400	21,300	19,900
Canada	6,670	10,400	2,830	3,420
Chile	336	277	763	797
China	1,290	1,980	34	108
India	34	30	104	101
Japan	515	1,930	904	1,840
Korea, Republic of	13	10	641	999
Mexico	49,900	51,800	13,300	26,600
Other	803 <sup>†</sup>	1,190 <sup>†</sup>	323	360
Total	77,700	84,100	40,100	54,100
<b>Wrought lead and lead alloys, lead content:</b>				
Canada	1,540	3,520	1,590	4,550
Chile	34	115	288	514
China	200	192	133	167
Germany	257	278	398	557
Haiti	113	107	196	182
India	824	1,060	1,600	2,400
Mexico	947	1,160	915	1,030
United Kingdom	607	630	192	397
Venezuela	67	69	651	1,690
Other	1,000 <sup>†</sup>	2,050 <sup>†</sup>	1,070	2,040
Total	5,590	9,170	7,030	13,500
<b>Scrap, gross weight:</b>				
Canada	8,060	8,770	5,010	8,530
Chile	--	--	325	118
China	1,810	989	1,510	1,270
Honduras	327	98	142	42
India	2,290	3,540	8,420	9,610
Japan	1,730	613	92	169
Korea, Republic of	20,700	15,500	10,900	13,200
Mexico	643	1,310	829	1,170
Netherlands	--	--	2,620	1,220
Spain	--	--	224	336
Taiwan	5,270	1,600	--	--
United Kingdom	19	32	94	161
Other	2,710 <sup>†</sup>	1,350 <sup>†</sup>	1,010	986
Total	43,500	33,800	31,100	36,800

<sup>†</sup>Revised. -- Zero.

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

Source: U.S. Census Bureau.

TABLE 11  
U.S. IMPORTS FOR CONSUMPTION OF LEAD, BY COUNTRY<sup>1</sup>

Country	2010		2011	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
<b>Base bullion:</b>				
Canada	404	\$817	35	\$86
Mexico	159	806	199	1,350
Poland	38	94	--	--
Venezuela	--	--	200	506
Total	602	1,720	434	1,940
<b>Pigs and bars, lead content:</b>				
Canada	237,000	522,000	250,000	627,000
Colombia	97	159	--	--
Ecuador	--	--	299	688
France	730	2,210	629	1,940
Guatemala	330	651	436	1,010
Italy	240	96	--	--
Mexico	29,400	25,800	56,000	53,700
Morocco	--	--	496	1,160
Peru	--	--	121	346
Russia	3,380	7,150	3,270	8,530
South Africa	49	128	246	144
United Kingdom	--	--	1,560	3,630
Other	52 <sup>r</sup>	94 <sup>r</sup>	540	1,380
Total	271,000	559,000	313,000	700,000
<b>Reclaimed scrap, including ash and residues, lead content:</b>				
Canada	621	1,500	481	1,310
Chile	83	136	153	272
China	21	5	--	--
Colombia	1,560	3,950	374	1,120
Mexico	402	732	987	1,600
Russia	--	--	--	--
United Kingdom	27	12	96	227
Venezuela	616	1,580	207	618
Other	405 <sup>r</sup>	967 <sup>r</sup>	97	225
Total	3,730	8,880	2,400	5,380
<b>Wrought lead, all forms, including wire and powders, gross weight:</b>				
Argentina	165	423	219	589
Canada	133	426	197	426
Czech Republic	7	143	794	2,840
Egypt	100	301	40	131
Germany	744	4,130	717	4,330
India	7	55	144	487
United Kingdom	95	322	193	1,260
Other	39 <sup>r</sup>	472 <sup>r</sup>	148	1,010
Total	1,290	6,270	2,450	11,100

<sup>r</sup>Revised. -- Zero.

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

Source: U.S. Census Bureau.

TABLE 12  
LEAD: WORLD MINE PRODUCTION OF LEAD IN CONCENTRATE, BY COUNTRY<sup>1,2</sup>

(Metric tons, lead content)

Country <sup>3</sup>	2007	2008	2009	2010	2011
Argentina	17,045	20,788	24,753	22,000	25,000
Australia	641,000	645,000	566,000	625,000	621,000
Bolivia	22,798	81,602	84,538 <sup>r</sup>	72,803	100,051
Bosnia and Herzegovina <sup>c</sup>	2,600	3,300	2,100	3,200 <sup>r</sup>	3,200
Brazil	24,574	25,286 <sup>r</sup>	15,890 <sup>r</sup>	19,650 <sup>r</sup>	19,700 <sup>p</sup>
Bulgaria <sup>c</sup>	15,000	15,000	12,000	12,000	12,000
Burma <sup>c</sup>	2,000	3,000	7,500	7,000	7,000
Canada	75,135	98,974	68,761	64,859	59,445 <sup>p</sup>
Chile	1,305	3,985	1,511	695 <sup>r</sup>	841
China <sup>e</sup>	1,410,000	1,500,000	1,600,000	1,850,000	2,350,000
Georgia <sup>e</sup>	400	400	400	400	400
Greece <sup>c</sup>	15,000	16,000	16,000	18,000	18,000
Guatemala	165	53	--	--	--
Honduras	10,215	12,545	14,471	13,000	13,000 <sup>c</sup>
India	77,500	87,300	92,000	97,000 <sup>r</sup>	115,000
Iran <sup>c,4</sup>	25,000	26,905 <sup>5</sup>	20,000 <sup>r</sup>	35,000 <sup>r</sup>	35,000
Ireland <sup>c</sup>	54,100	50,200	43,000	45,000	45,000
Italy <sup>c</sup>	800	800	800	800	800
Kazakhstan	40,200	39,000	39,400	36,100	34,600
Korea, North <sup>c</sup>	13,000	13,000	13,000	13,000	26,000
Korea, Republic of	12	449	2,064	1,168 <sup>r</sup>	1,000 <sup>c</sup>
Macedonia	29,000 <sup>r</sup>	35,000 <sup>r,c</sup>	38,000 <sup>r</sup>	40,000 <sup>r</sup>	40,000 <sup>c</sup>
Mexico	120,000	100,725	143,838	192,062 <sup>r</sup>	220,000 <sup>c</sup>
Morocco	44,800	40,000	40,000 <sup>c</sup>	35,000	42,000 <sup>c</sup>
Namibia	10,543	14,062	10,129 <sup>r</sup>	10,140 <sup>r</sup>	10,000 <sup>c</sup>
Peru	329,154	345,109	302,459	261,990 <sup>r</sup>	230,019
Poland	79,400	87,700	80,400	63,800 <sup>r</sup>	60,000 <sup>c</sup>
Romania <sup>c</sup>	1,000 <sup>5</sup>	--	--	--	--
Russia <sup>c</sup>	50,000	60,000	70,000	97,000	105,000
Serbia <sup>c</sup>	1,600	1,600	1,800	2,000	1,800
South Africa	41,857	46,440	49,149	49,715	55,000 <sup>c</sup>
Sweden <sup>c</sup>	62,100 <sup>5</sup>	60,000 <sup>5</sup>	69,000 <sup>r</sup>	68,000 <sup>r</sup>	62,000
Tajikistan <sup>c</sup>	800	800	800	800	6,000
Turkey <sup>c</sup>	32,000	25,000	26,000	27,000	27,000
United Kingdom <sup>c</sup>	500	500	500	500	500
United States	444,000 <sup>r</sup>	410,000 <sup>r</sup>	406,000 <sup>r</sup>	369,000 <sup>r</sup>	342,000
Uzbekistan	--	--	--	--	6,000
Vietnam	19,200	14,200	7,700	7,400 <sup>r,c</sup>	7,400 <sup>c</sup>
Total	3,710,000 <sup>r</sup>	3,880,000 <sup>r</sup>	3,870,000 <sup>r</sup>	4,160,000 <sup>r</sup>	4,700,000

<sup>c</sup>Estimated. <sup>p</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Table includes data available through July 7, 2012.

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

<sup>4</sup>Year beginning March 21 of that stated.

<sup>5</sup>Reported figure.



TABLE 13  
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2007	2008	2009	2010	2011
Algeria, secondary <sup>c</sup>	5,000	5,000	5,000	11,000 <sup>r</sup>	9,000
Argentina:					
Primary	11,588	13,482	12,558	14,245 <sup>r</sup>	14,000 <sup>e</sup>
Secondary	49,000	59,000	70,000 <sup>e</sup>	63,000 <sup>r</sup>	63,000 <sup>e</sup>
Total	60,588	72,482	82,558	77,245 <sup>r</sup>	77,000 <sup>e</sup>
Australia:					
Primary	202,000	221,000	204,000	178,000	187,000
Secondary <sup>c</sup>	27,000	27,000	25,000	26,000	26,000
Total	229,000	248,000	229,000	204,000	213,000
Austria, secondary	28,564	26,902	22,197 <sup>r</sup>	25,499 <sup>r</sup>	25,000 <sup>e</sup>
Belgium, secondary	117,200	109,000	109,000	121,000 <sup>e</sup>	121,000 <sup>e</sup>
Bolivia	301	473	418 <sup>r</sup>	310 <sup>r,4</sup>	269 <sup>4</sup>
Brazil, secondary	130,963	95,704	104,160 <sup>r</sup>	114,887 <sup>r</sup>	115,000 <sup>p</sup>
Bulgaria: <sup>c</sup>					
Primary	73,000 <sup>5</sup>	73,000	70,000	68,000	67,000
Secondary	14,000 <sup>5</sup>	14,000	13,000	13,000	12,000
Total	87,000 <sup>5</sup>	87,000	83,000	81,000	79,000
Burma, primary	165	202	200 <sup>e</sup>	--	--
Canada:					
Primary	95,577	105,526	101,484	105,836	112,531 <sup>p</sup>
Secondary	141,111	153,549	157,370	167,042	169,849 <sup>p</sup>
Total	236,688	259,075	258,854	272,878	282,380 <sup>p</sup>
China: <sup>c</sup>					
Primary	2,140,000	2,350,000	2,480,000	2,840,000	3,220,000
Secondary	650,000	850,000	1,230,000	1,360,000	1,430,000
Total	2,790,000	3,200,000	3,710,000	4,200,000	4,650,000
Czech Republic, secondary <sup>c</sup>	34,000	36,000	29,000	30,000	30,000
Estonia, secondary <sup>c</sup>	10,000 <sup>5</sup>	10,000	10,000	10,000	10,000
France, secondary <sup>c</sup>	100,200 <sup>5</sup>	88,000 <sup>5</sup>	88,000	88,000	88,000
Germany:					
Primary	110,934	113,200	104,900	125,000 <sup>e</sup>	135,000 <sup>e</sup>
Secondary	294,147	301,900	285,700	280,400 <sup>r</sup>	303,000 <sup>e</sup>
Total	405,081	415,100	390,600	405,400 <sup>r</sup>	438,000 <sup>e</sup>
Greece, secondary <sup>c</sup>	5,000	5,000	4,000	4,000	4,000
India:					
Primary	53,800	62,000	62,000 <sup>r</sup>	75,000 <sup>r</sup>	120,000
Secondary	204,000 <sup>r</sup>	232,000 <sup>r</sup>	275,000 <sup>r</sup>	305,000 <sup>r</sup>	306,000
Total	257,800 <sup>r</sup>	294,000 <sup>r</sup>	337,000 <sup>r</sup>	380,000 <sup>r</sup>	426,000
Indonesia, secondary	18,500	18,500	18,000	18,000	17,000
Iran: <sup>c</sup>					
Primary	25,000	20,000	20,000	20,000	20,000
Secondary	50,000	55,000	55,000	55,000	55,000
Total	75,000	75,000	75,000	75,000	75,000
Ireland, secondary <sup>c</sup>	22,500	22,500	19,000	20,000	20,000
Israel, secondary <sup>c</sup>	25,000	27,000	26,000 <sup>r</sup>	27,000 <sup>r</sup>	27,000
Italy: <sup>c</sup>					
Primary	45,000 <sup>5</sup>	47,800 <sup>5</sup>	15,000	15,000	15,000
Secondary	165,000 <sup>5</sup>	164,000 <sup>5</sup>	134,000	134,000	134,000
Total	210,000 <sup>5</sup>	211,800 <sup>5</sup>	149,000	149,000	149,000
Japan:					
Primary	104,527	107,005	96,974	101,610 <sup>r</sup>	100,078
Secondary	171,795	172,454	150,871	165,613 <sup>r</sup>	148,524
Total	276,322	279,459	247,845	267,223 <sup>r</sup>	248,602

See footnotes at end of table.

TABLE 13—Continued  
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2007	2008	2009	2010	2011
Kazakhstan, primary and secondary	117,641	105,766	80,994	103,110	111,249
Kenya, secondary <sup>c</sup>	1,000	1,000	500	250 <sup>r</sup>	250
Korea, North, primary and secondary <sup>c</sup>	9,000	9,000	9,000	9,000	9,000
Korea, Republic of:					
Primary	195,022	244,137	216,918 <sup>r</sup>	197,900 <sup>r</sup>	200,000
Secondary <sup>c</sup>	60,000	60,000	60,000	60,000	60,000
Total	255,022	304,137	276,918 <sup>r</sup>	257,900 <sup>r</sup>	260,000
Malaysia, secondary <sup>c,6</sup>	73,000	73,000	70,000	71,000	70,000
Mexico:					
Primary <sup>7</sup>	102,000 <sup>c</sup>	89,838	100,361	110,980 <sup>r</sup>	111,000 <sup>c</sup>
Secondary <sup>c</sup>	110,000	110,000	110,000	110,000	110,000
Total	212,000 <sup>c</sup>	199,838	210,361	220,980 <sup>r</sup>	221,000 <sup>c</sup>
Morocco: <sup>c</sup>					
Primary	45,000	45,000	45,000	45,000	45,000
Secondary	3,000	3,000	3,000	2,500	2,500
Total	48,000	48,000	48,000	47,500	47,500
Netherlands, secondary <sup>c</sup>	17,000	17,000	17,000	17,000	17,000
New Zealand, secondary <sup>c</sup>	7,000	9,000	13,000	9,000	9,000
Nigeria, secondary <sup>c</sup>	5,000	5,000	5,000	5,000	5,000
Pakistan, secondary <sup>c</sup>	3,000	3,000	2,900	2,900	2,900
Peru, primary	116,774	114,259	26,599 <sup>r</sup>	-- <sup>r</sup>	--
Philippines, secondary <sup>c</sup>	34,000	34,000	40,000	40,000	40,000
Poland: <sup>c</sup>					
Primary	37,200	38,000	30,000	40,000 <sup>r</sup>	45,000
Secondary	67,000	70,200	70,400	80,000 <sup>r</sup>	85,000
Total	104,000	108,000	100,000	120,000 <sup>r</sup>	130,000
Portugal, secondary <sup>c</sup>	3,000	3,000	3,000	3,000	3,000
Romania: <sup>c</sup>					
Primary	34,368 <sup>5</sup>	34,000	9,000	8,000	8,000
Secondary	5,000	5,000	5,000	3,000	3,000
Total	39,400	39,000	14,000	11,000	11,000
Russia, primary and secondary <sup>c</sup>	94,000	80,000	73,000	89,000	94,000
Saudi Arabia, secondary <sup>c</sup>	38,000	38,000	38,000	38,000	38,000
Serbia, primary and secondary <sup>c</sup>	1,273 <sup>5</sup>	929 <sup>5</sup>	1,000 <sup>r</sup>	1,000 <sup>r</sup>	1,000 <sup>r</sup>
Slovenia, secondary <sup>c</sup>	15,000	15,000	14,000	14,000	14,000
South Africa, secondary	59,000	62,000	58,000 <sup>r</sup>	58,000	60,000 <sup>c</sup>
Spain, secondary	128,000	125,000	125,000	165,000 <sup>r,c</sup>	172,000 <sup>c</sup>
Sweden: <sup>c</sup>					
Primary	26,000	26,000	26,000	26,000	26,000
Secondary	40,000	40,000	40,000	35,000	35,000
Total	66,000	66,000	66,000	61,000	61,000
Switzerland, secondary <sup>c</sup>	9,000	8,000	8,000	-- <sup>r</sup>	--
Taiwan, secondary	55,000	55,000	40,000	35,000	35,000
Thailand, secondary	73,159	73,303	55,504	55,000 <sup>r</sup>	71,000 <sup>c</sup>
Turkey, secondary <sup>c</sup>	6,000	6,000	6,000	6,000	6,000
Ukraine, secondary <sup>c</sup>	7,000	7,000	7,000	7,000	7,000
United Arab Emirates, secondary <sup>c</sup>	2,000	2,000	2,000	2,000	2,000
United Kingdom:					
Primary	119,000	139,000	135,000	150,000	150,000 <sup>c</sup>
Secondary	144,000	144,000	144,000	144,000	144,000 <sup>c</sup>
Total	263,000	283,000	279,000	294,000	294,000 <sup>c</sup>

See footnotes at end of table.

TABLE 13—Continued  
LEAD: WORLD REFINERY PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2007	2008	2009	2010	2011
United States:					
Primary	123,000	135,000	103,000	115,000	118,000
Secondary	1,180,000	1,140,000	1,110,000	1,140,000	1,130,000
Total	1,300,000	1,280,000	1,210,000	1,260,000 <sup>r</sup>	1,250,000
Venezuela, secondary <sup>c</sup>	30,000	30,000	30,000	30,000	30,000
Zambia, secondary <sup>c</sup>	1,000	1,000	1,000	1,000	1,000
Grand total:	8,320,000 <sup>r</sup>	8,790,000 <sup>r</sup>	8,930,000 <sup>r</sup>	9,610,000 <sup>r</sup>	10,200,000
Of which:					
Primary	3,660,000	3,980,000	3,860,000	4,240,000 <sup>r</sup>	4,690,000
Secondary	4,440,000 <sup>r</sup>	4,620,000 <sup>r</sup>	4,910,000 <sup>r</sup>	5,170,000 <sup>r</sup>	5,270,000
Undifferentiated	222,000	196,000	164,000	202,000	216,000

<sup>c</sup>Estimated. <sup>p</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Table includes data available through July 7, 2012. 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.

<sup>3</sup>In addition to the countries listed, Colombia, Egypt, El Salvador, Iraq, and Trinidad and Tobago produced secondary lead, but output is not officially reported; available general information is inadequate for the formation of reliable estimates of output levels.

<sup>4</sup>Gross weight of primary metal alloys is believed to contain lead.

<sup>5</sup>Reported figure.

<sup>6</sup>Metal Reclamation Industries' secondary lead smelter is receiving some primary mine concentrates from the Magellan Mine (Australia). The ore minerals are lead oxides and can be smelted at a secondary smelter.

<sup>7</sup>Includes lead content in antimonial lead.