

# 2005 Minerals Yearbook

**ZINC** 

### ZINC

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In 2005, domestic zinc mine production, expressed in zinc content of ore, increased slightly compared with that of 2004, according to the U.S. Geological Survey (USGS). Based on recoverable content of concentrate and annual average U.S. price, the value of zinc mine production was estimated to be about \$1.07 billion, 29% greater than that of 2004. By yearend 2005, only seven mines in four States were operating in the United States. Mine closures in the past 3 years solidified Alaska's position as the leading producer of zinc concentrate, followed by Missouri, Washington, and Montana in descending order. In 2005, as in every year since the opening of Alaska's Red Dog Mine in 1989, U.S. mine production greatly exceeded smelter capacity. Zinc mine production data were obtained by the USGS from a voluntary survey of domestic mining operations. The "Lode Mine Production" survey was sent to 20 zinc mining operations, all of whom responded to the request for production data shown in tables 1 and 2.

Concentrates were exported and refined zinc metal imported (tables 1, 6). Most of the zinc concentrate (73%) was exported to four countries—Canada, the Republic of Korea, Japan, and Spain, in descending order (table 14). Zinc metal production in the United States, which was provided by 2 primary smelters and 12 large- and medium-size secondary smelters, increased by about 2% in 2005 (table 1, 4). Zinc metal imports (zinc metal, all grades; unalloyed and unwrought) were primarily from Canada and Mexico.

Apparent domestic consumption of refined zinc metal decreased 19% to about 939,000 metric tons (t). About one-half of metal consumed in the United States was used for galvanizing, followed by use in zinc-base alloys and brass and bronze (table 11). The agriculture, chemical, paint, and rubber industries were the primary users of zinc compounds and dust.

The average U.S. producer price for Special High Grade zinc in 2005, which was based on the London Metal Exchange (LME) daily cash price plus premium, increased by about 28% to \$1.48 per kilogram (67.11 cents per pound) (table 1).

Worldwide shortages of zinc-in-concentrate further restricted the supply of refined zinc. Chinese apparent consumption of zinc was 14% higher than that of 2004, whereas U.S. consumption of zinc metal was 17% lower. Countries in Europe and North and South America account for less than one-half of global zinc output. Chinese output of zinc metal increased by 6% in the first 11 months of 2005, topping 2.7 million metric tons (Mt) for the year, and China continued to be a net importer of zinc metal. Estimated shortfall of production as compared with consumption was expected to be almost 200,000 t for 2005 (Metal-Pages, 2006b§¹).

#### **Legislation and Government Programs**

A stockpile of zinc for national defense purposes has been maintained for more than 60 years. In 1992, Public Law 102-484 was signed, which authorized the disposal of the entire inventory of zinc from the National Defense Stockpile (NDS). The basic ordering agreement (BOA) under which zinc is currently sold from the NDS was established in May 2002. In April 2004, the BOA was amended to establish a minimum quote for an award of 20 t unless a smaller quantity was all that was available. Additionally, the Government changed its right to vary the quantity or weight delivered from that in the original bid to 5% from 2% on deliveries with a contract price adjustment to be made on the actual delivered zinc.

The Defense Logistics Agency (DLA), which maintains the NDS, was authorized to sell 45,000 t of zinc in fiscal year 2005 (October 1, 2004, to September 30, 2005). The stockpile inventory on December 31, 2004, was 68,000 t, while the inventory at yearend 2005 was 47,500 t, all of which was authorized for disposal (U.S. Department of Defense, 2005, p. 9).

#### **Production**

Mine.—HudBay Minerals Inc., formerly OntZinc Corporation, announced plans to reopen the Balmat Mine in upstate New York. It had been closed since May 2001 owing to low zinc prices. HudBay expected production to commence during the second quarter of 2006, and the mine to be in full production in 2008. Its estimated output of 60,000 metric tons per year (t/yr) of zinc in concentrate would be processed at the Canadian Electrolytic Refinery in Valleyfield, Quebec, Canada, and treated at HudBay's Zochem plant in Brampton, Ontario. Estimated mineral ore reserves amounted to 1,709,000 t grading 11.1% zinc, with focus on mining higher grade ore with a mine life of 7 years. In addition, underground exploration at this mine will likely extend the estimated mine life (Hudbay Minerals Inc., 2006, p. 4, 13).

In 2005, mine production from the Red Dog Mine, AK, increased by about 3% to 568,000 t of zinc compared with 554,000 t produced in 2004. Projected 2006 production of zinc for the Red Dog Mine was 574,000 t. Teck Cominco Ltd.'s Pend Oreille Mine in northeastern Washington State began commercial production in August and by yearend had produced 45,000 t of zinc in concentrates. Pend Oreille's ore reserves were 4.7 Mt grading 7.0% zinc and 1.2% lead and an additional 2.3 Mt of ore containing 6.7% zinc and 1.3% lead was inferred at yearend. Estimated production of zinc for 2006 will probably remain steady (Teck Cominco Limited, 2006, p. 8-9). Zinc sales were 18% lower than 2004, however, operating profit increased

<sup>&</sup>lt;sup>1</sup>References that include a section mark (§) are found in the Internet References Cited section.

by \$118 million in 2005 owing to higher zinc and lead prices (Teck Cominco Limited, 2006§).

In Missouri, the Doe Run Company maintained the West Fork Mill, reportedly on care-and-maintenance status in 2005, and the Sweetwater lead-zinc mine along with five other active production shafts. Products are shipped by trucks over public roads. As of October 31, 2005, the Doe Run Company reported total (proven and probable) reserves decreased to 34,283 t from 47,686 t in 2003. Higher operating costs accounted for the 28% decline of reserves. The estimated average metallurgical recovery for zinc was 83.0% (Doe Run Company, The, 2006b, p. 21).

Greens Creek Mine in Juneau, AK, operated by Kennecott Greens Creek Mining Co. (a subsidiary of Kennecott Minerals Company) produced concentrates containing gold, lead, silver, and zinc. In 2005, mill production rate was reported to be 1,966 metric tons per day and by yearend, 58,300 t of zinc had been produced. The estimated recoverable zinc in proven and probable reserves was 605,500 t with a projected mine life beyond 10 years (Kennecott Minerals Company, 2006).

In September 2004, CalEnergy Minerals LLC (a subsidiary of MidAmerican Energy Holdings Company) ceased zinc recovery operations at its Salton Sea plant in southern California. Despite recent increases in refined zinc prices, the company reportedly ran up large losses since it began operations in December 2002 (Salton Sea Funding Corporation, 2005, p. 20).

Smelter.—In 2004, a strike at Big River Zinc's Sauget, IL, refinery was averted when a majority of the 220 unionized workers agreed to a 1-year extension to the existing labor agreement, which had been due to expire in May. Big River Zinc (a subsidiary of Korea Zinc Co. Ltd.), was the second largest smelter in the United States that produced about 90,000 t/yr of zinc as refined zinc metal, zinc alloys, zinc powders, zinc sulfate, and zinc oxide. The company also produces electrolytic or commercial grade sulfuric acid and high-purity cadmium oxide (Metal-Pages, 2004§). Big River Zinc's closure was announced by Korea Zinc in December 2005 as the company sought a buyer for the plant (ZincOx Resources plc, 2006, p. 8-9).

#### **Prices**

The average LME slab zinc price increased by 32% to \$1,381.37 per metric ton from that of 2004 and rose dramatically during the final quarter of the year. Demand between January to November was almost 1% higher than that of the similar period of 2004, which was enough to push the supply demand balance into supply deficit. Inventories held by the LME at yearend 2005 decreased by 37% to 393,550 t from 628,625 t at yearend 2004 (London Metal Exchange Ltd., 2006). Case settlement prices on the LME averaged \$1,821.44 per ton in December, making December the highest monthly level for zinc prices since September 2000.

#### **World Review**

In 2005, world mine production of zinc was 9.8 Mt about 3.6% more than that in 2004; China, Australia, and Peru, in

descending order, accounted for more than one-half of total world mine production. World refined production of zinc was 10.7 Mt, an increase by 2% compared with that in 2004. The leading producing countries, in descending order, were China, Canada, the Republic of Korea, and Japan, accounting for about 47% of total world refined production. According to data compiled by the International Lead and Zinc Study Group, world consumption of refined zinc decreased slightly in 2005 to 10.6 Mt from 10.7 Mt in 2004. China, the United States, Japan, and the Republic of Korea, in decreasing order of metal used, accounted for nearly one-half of the world's zinc consumption. The main end use for zinc, galvanizing (a coating for iron and steel products to increase resistance to rust and corrosion), accounted for about 48% of worldwide zinc use. The most commonly galvanized products were steel sheet and strip, tube and pipe, and wire and wire rope. Worldwide, the automobile industry was the largest user of galvanized steel (International Lead and Zinc Study Group, 2006, p. 40-41).

Australia.—In February, Zinifex Limited (Melbourne) declared a force majeure on zinc concentrate shipments from its open pit Century Mine in northwest Queensland, the world's second leading zinc mine after the Red Dog Mine in Alaska. An electrical fault at the semiautogeneous grinding mill forced closure of the concentration circuit (Mining Journal, 2005). During the 11-day closure, Zinifex lost 17,700 t of contained zinc production and 1,400 t of contained lead production (Metal Bulletin Daily, 2005).

In 2005, annual production at Zinifex's Century Mine declined to 501,000 t from 517,000 t in 2004, and at its underground Rosebery Mine in western Tasmania, production declined to 88,000 t from 92,000 t in 2004. Zinc production for its Hobart Smelter in southern Tasmania was 252,716 t, a significant portion of which was converted into diecast alloy and primarily sold in China; its Port Pirie Smelter in South Australia, mainly a lead smelter, produced 37,068 t of zinc metal (Zinifex Limited, 2006, p. 12).

In May, Terramin Australia Limited (Strathalbyn, Australia) announced that Sempra Metals & Concentrates Corp. (San Diego, CA) and Macquarie Bank Limited (Sydney, Australia) would invest up to \$17 million in its Angas Project, which it thought to be South Australia's largest zinc deposit. The funds were to be allocated to drilling, project design and costing, and early capital expenditures, if and when the decision to mine was made. Terramin identified approximately 2.8 Mt of ore resources grading 14.1% zinc equivalent, including 2.1 Mt indicated resources and 0.7 Mt inferred resources (Terramin Australia Limited, 2005a). The company also announced that it had concluded a joint-partnership agreement with Zinifex. Under the agreement, Zinifex would invest up to \$A8 million in the Mennennie Dam project for exploration and development and earn up to a 70% share in the joint venture. The project encompasses the largest known lead-zinc and silver deposit in South Australia with almost equal proportions of lead and zinc (Terramin Australia Limited, 2005b).

At Xstrata plc's (Zug, Switzerland) Mount Isa operation in northwest Queensland, production of zinc-in-concentrate increased to 457,122 t in 2005 by 23% from that in 2004, and lead-in-concentrate production increased by 29% to 277,753 t,

owing to improved operational and maintenance practices and increased ore feed. The Mount Isa Mine had reserves to support a mine life of approximately 11 years. Ore throughput at the Mount Isa zinc concentrator increased to 4.4 Mt, up by 37% from that in 2004. The George Fisher Mine produced 2.6 Mt of ore, 7% more than in 2004. Production increased in the second half of 2005 as a result of better mine planning, updated mining equipment, and improved geotechnical control of stoping. Ore production was expected to increase further in 2006 following improvements in the ore hoisting capacity. In 2004, Xstrata approved the development of the Black Star Mine, to be a zinclead open pit operation. The mine was expected to supply an additional 1.5 million metric tons per year (Mt/yr) of ore to supplement current production output from the George Fisher Mine, and from the Mount Isa Mine, with the objective of fully utilizing the capacity of the Mount Isa zinc-lead concentrator (Xstrata plc, 2006b, p. 70-74).

In August 2005, Xstrata plc announced its intention to convert the McArthur River zinc-lead mine in the Northern Territory from an underground to an open pit operation. The open pit conversion would increase ore throughput to 1.8 Mt/yr from 1.6 Mt/yr in order to maintain current levels of concentrate production from declining ore grades and will extend the mine's life by at least 25 years (Xstrata plc., 2005). In August, Xstrata also filed an environmental impact statement (EIS) with the Northern Territory Government, and in December, submitted a supplementary EIS, in response to submissions received as part of the consultation process. In February 2006, the Northern Territory Minister for the Environment and Heritage declined to recommend the approval of Xstrata's proposal (Xstrata plc, 2006b, p. 74). In April 2006, following a review by the Federal Government, Xstrata received approval from the Northern Territory Government to mine the stage B test pit, which would allow Xstrata to remain operational and continue at current production levels until March 2007 while the environmental review process for the full open pit development proceeded (Xstrata plc, 2006a).

Burkina Faso.—Alternative Investment Market (AIM) Resources Limited (Sidney, Australia) planned to develop the first zinc mine in Burkina Faso, West Africa. In December, a bankable feasibility study was released by Snowden Mining Industry Consultants announcing positive results for the high grade Perkoa Zinc Project. AIM was expected to start production by yearend 2007, with ore production of about 6.3 Mt, dry concentrate production of 1.6 Mt, and zinc metal production of 848,390 t. The zinc mine reportedly has reserves to support a mine life of approximately 14 years (AIM Resources Limited, 2005).

Canada.—The United States is the leading customer for Canadian refined zinc, receiving about 462,000 t (88%) of refined zinc (International Lead and Zinc Study Group, 2006, p. 66). In 2005, Noranda Income Fund produced 272,418 t of zinc at its Salaberry-de-Valleyfield, Quebec, zinc refinery, about 2% less than the 277,283 t produced in 2004. In 2005, some domestic mines closed and refining operations began to treat a different mix of concentrates having higher iron and lower zinc content, reducing production in the second half of the year (Noranda Income Fund, 2006).

Teck Cominco Ltd.'s metallurgical operation at Trail, in British Columbia, was one of the world's largest fully integrated zinc and lead smelting and refining complexes. Refined zinc production of 223,200 t was 25% lower than in 2004 as a result of an interruption caused by a 79-day strike by workers represented by the United Steelworkers of America that began on July 19. The strike ended on October 5, when the unions ratified the terms of a new collective agreement covering the 3-year period from June 1, 2005, to May 31, 2008. Following the restart in October, refined zinc production averaged 26,000 metric tons per month in November and December (Teck Cominco Limited, 2006, p. 27).

China.—According to China's General Administration of Customs, China's most notable drop in export volume during 2005 was that of refined zinc, which declined by 45% to 123,252 t compared with exports in 2004. Significant cuts in shipments to major consumers in Hong Kong, the Republic of Korea, and Taiwan more than offset increases elsewhere. Exports of zinc alloy decreased by 39.4% to 23,600 t in 2005 (Metal-Pages, 2006a§). China's concentrate imports decreased by 7.8% to 567,800 t, compared with that in 2004, with declines in deliveries from Australia, India, and Iran offsetting increases from Myanmar, North Korea, and Vietnam. Refined zinc imports increased by 63.8%, to 392,000 t, with most of the increase coming from Australia. Zinc alloy imports rose by 3.9%, to 229,000 t (Metal-Pages, 2006c§).

China's National Bureau of Statistics reported production of 1.8 Mt of zinc-in-concentrate, an increase of 13% compared with 1.6 Mt in 2004. In September, the Bairendaba Silver Polymetallic Mine, located in Hexigten Banner, Chifeng City, Mongolia, was commissioned. The mine was one of the largest nonferrous metal mines in North China, with resources of 1.05 Mt of zinc (Antaike, 2006a). In September, the construction of Tsairt Minerals' Tumurtiin Ovoo Mine near the town of Sukhe Bator, Suhbaatar Province, Mongolia, was completed. The mine was jointly owned by China Nonferrous Metal Industry Engineering Co. Ltd. (51%) and Mentalimpex of Mongolia (49%). The mine had 7.5 Mt of ore reserves with an average grade of 13.67% zinc. The open pit mine was designed to process 300,000 t of ore and will probably produce 66,000 t/yr of zinc in concentrate containing 32,700 t/yr of zinc. The company projected a 25-year open pit operation followed by 10 years of underground mining (Metals Economics Group, 2006,

Hunan Zhuye Torch Metal Co., Ltd., the leading zinc smelter in China, produced 326,778 t of zinc in 2005, an increase of 8% compared with that in 2004. In December, Shenzhen Zhongjin Lingnan Nonfemet Co. Ltd., China's third leading zinc producer, was forced to close its Shaoguan Smelter following a toxic spill into the Beijing River. The smelter had the capacity to produce 160,000 to 170,000 t/yr of zinc. After renovating the waste treatment systems and passing an inspection for compliance with government environmental standards, it was to be reopened in early 2006 (Antaike, 2006b; Metal-Pages, 2006d§).

To address the existing problems in China's lead and zinc industry, such as lack of raw materials, outdated technology and equipment, small plant size, and environmental pollution, the National Development and Reform Commission conducted an

investigation and released a Catalogue for Guidance of Industry Structure Adjustment 2005. According to the catalogue, construction of zinc smelters with capacity less than 100,000 t/yr of zinc, lead smelters with capacity less than 50,000 t/yr of primary lead, and secondary lead smelters with capacity less than 10,000 t/yr of secondary lead will be restricted, and projects adopting backward technologies will be eliminated (Antaike, 2006a, b).

India.—Vedanta Resources plc (London, United Kingdom), managed by Hindustan Zinc Limited (HZL) (Udaipur, India), India's only integrated zinc company, supplied nearly 75% of India's zinc requirements. The production capacity for galvanized steel in India was increasing significantly in response to the high demand for the product in infrastructure and construction work. HZL's zinc operations included three lead-zinc mining complexes, one-lead-zinc smelter, and three smelters. Its total zinc metal output during 2005 was 284,000 t, an increase of 34% compared with that in 2004. HZL's total mine production of zinc-in-concentrate increased by 33% to 472,000 t in 2005, principally owing to increased output from the Rampura Agucha Mine. The mine located in the northern State of Rajasthan was the leading producer (owned 65% by Vedanta and 35% by the Government of India). In May, Vedanta completed a \$360 million expansion at the Rampura Agucha Mine and the nearby Chanderiya Smelter. The expansion would increase the production capacity to about 400,000 t/yr from 170,000 t/yr of refined zinc (Vedanta Resources plc, 2006, p. 11-12).

*Ireland.*—In April, Vancouver-based Lundin Mining Company acquired ARCON International Resources plc (County Kilkenny, Ireland), which owned the Galmoy zinclead mine. Combined with its other zinc assets in Sweden, the Zinkgruvan and Storliden Mines, Lundin Mining increased its estimated zinc production to almost 152,000 t/yr. Lundin also announced that it would soon start an aggressive exploration program in County Kilkenny, Ireland (Platts Metals Week, 2005).

*Kazakhstan.*—In December, the Kazakhstan Government auctioned off a 22.65% stake in Kazzinc JSC (Ust-Kamenogorsk, Republic of Kazakhstan); previously, it sold a 5% stake for \$26.3 million to an undisclosed buyer. It was established in 1997 through the merger of three main nonferrous metals companies in eastern Kazakhstan: Ust-Kamenogorsk Lead and Zinc Combinate Smelter, Leninogorsk Polymetallic Combinate Smelter, and Zyrianovsk Lead Combinate Smelter. All three producers were majority owned by the Government of Kazakhstan. Kazzinc produced 287,198 t of refined zinc in 2005, an increase of 17% since 2000 and 66% since 1997, and accounted for about 90% of Central Asia's output of refined zinc (CRU Monitor, 2005a; Kazzinc, 2006§).

*Peru.*—According to Peru's Ministry of Energy and Mines, production of zinc-in-concentrates in 2005 decreased slightly to 1,201,671 t from 1,209,006 t in 2004, and was down about 12% compared with production in 2003. The Volcan Compañia Minera S.A.A. operated four mineral centers located in the regions of Pasco and Junín, in central Peru, where it produced zinc and lead-silver concentrates. It was the leading zinc producer in Peru in 2005, producing 237,288 t of zinc-in-

concentrate. Compañia Minera Antamina S.A. a joint venture between Teck Cominco Ltd. (22.5%), BHP Billiton Ltd. (33.75%), Falconbridge Ltd. (33.75%), and Mitsubishi Ltd. (10%), was Peru's second leading producer, located in the north central Peruvian Andes. Antamina produced 218,265 t of zinc-in-concentrates in 2005, 4% lower than in 2004. Output at the mine is expected to decline by 30% during 2006 because of changes in ore characteristics and grade (CRU Monitor, 2006a). Empresa Minera Los Quenuales S.A., Peru's third leading zinc producer, increased mine production to 191,291 t of zinc, 2% more than in 2004 (Ministerio de Energía y Minas, 2005§).

Peruvian refined zinc production was 163,603 t in 2005, nearly a 16% decrease compared with that in 2004. Sociedad Minera Refinería de Zinc Cajamarquilla S.A. (Group Votorantim Metais S.A., 99%, and employees, 1%) produced 122,424 t, about three-quarters of the Peruvian refined zinc in 2005; the remaining 41,179 t was produced by the Doe Run Peru S.R. Ltd. in La Oroya, Junín (Ministerio de Energía y Minas, 2005§). Expansion plans aimed at doubling current refined production at Cajamarquilla were delayed until at least 2008 owing to the tight zinc concentrates market (CRU Monitor, 2006b). At La Oroya lead-zinc-copper smelter, Doe Run Peru expected to complete eight of the nine projects required by the Environmental Adjustment and Management Program (PAMA) by yearend 2009. The final project includes the construction of three sulfuric acid plants. The acid plant for the zinc circuit was expected to be completed by yearend 2006; the lead circuit by 2008; and the copper circuit by yearend 2009. The company was seeking more time to complete an additional project at the metals processing facility. The company's investment in PAMA mandated projects was expected to be \$200 million (Doe Run Company, The, 2006a).

Peru exported an estimated 989,000 t of zinc-in-concentrate in 2005, 57,000 t (6%) more than in 2004. This increase did not reflect an increase in the mine production level, which remained essentially the same, but rather displaced concentrate from La Oroya smelter, which had reduced its operating rates to 45,000 t/yr from 80,000 t/yr in December 2004 in order to reduce emissions of sulfur dioxide (CRU Monitor, 2006b).

#### **Current Research and Technology**

ZincOx Resources' Big River Zinc (BRZ) project replaces the Mid-West Recycling Project which was previously planned for the company's recycling strategy in North America. Treatment of electronic arc furnace dust (EAFD) at BRZ will require construction of a new leach and purification plant. The company entered into a strategic alliance with Envirosafe Services of Ohio, Inc. (ESOI), a specialist hazardous waste disposal company, to recover zinc from EAFD. Under the agreement, ESOI will be responsible for properly managing the delivery of EAFD to BRZ, the stabilization of residue, removal from site, and final disposal. A cost estimate and feasibility study was expected to be completed during the third quarter of 2006 (ZincOx Resources plc, 2006, p. 3, 9).

The Japan Science and Technology Agency along with researchers from the Tokyo Institute of Technology developed a transistor made from an oxide of indium, gallium, and zinc allowing for flexible displays. The compound oxide is applied as a thin film on plastic allowing the transistor to be transparent and flexible (Metal-Pages, 2005a§).

An inexpensive blue light-emitting diode (LED) containing zinc oxide instead of indium gallium nitride or silicon carbide was developed by a research team at the Institute for Materials Research in Japan. The main use of blue LEDs is for back light in electronic devices such as mobile telephones and lasers in digital video disc (DVD) players. The zinc oxide containing LEDs are high-quality, undoped p-type zinc oxide films, which were expected to lower manufacturing costs for blue LEDs and promote developments in high-quality DVDs (Metals-Pages, 2005b§).

#### Outlook

According to the International Lead and Zinc Study Group (2006§), world consumption for refined zinc metal was expected to rise by about 4.8% to 11.2 Mt in 2006. World mine output was expected to be 4.5% higher than that of 2005 as European output would benefit from production increases in Greece, Ireland, Kazakhstan, Russia, and Sweden, all of which were expected to rise by 8%. World refined zinc metal output was expected to be about 10.7 Mt in 2006. Production increases in Australia, Belgium, Canada, China, India, Kazakhstan, the Republic of Korea, and Netherlands were expected to fuel this 4.3% rise. Overall, a supply deficit of 437,000 t of refined zinc was expected in 2006. This imbalance could result in continued zinc price increases.

#### **References Cited**

- AIM Resources Limited, 2005, Perkoa Zinc—Highly positive bankable feasibility study results: Sidney, Australia, AIM Resources Limited news release, December 22, 1 p.
- Antaike, 2006a, Market commentary: Antaike Lead & Zinc & Tin Monthly, no. 110, January, 12 p.
- Antaike, 2006b, Market commentary: Antaike Lead & Zinc & Tin Monthly, no. 111, February, 12 p.
- CRU Monitor, 2005a, Company news—Zinc: CRU Monitor, November, 12 p. CRU Monitor, 2005b, Industry news—Lead and zinc concentrates: CRU Monitor, December, 12 p.
- CRU Monitor, 2006a, Industry news—Lead and zinc concentrates: CRU Monitor, February, 12 p.
- CRU Monitor, 2006b, Industry news—Lead and zinc concentrates: CRU Monitor, March, 12 p.
- Doe Run Company, The, 2006a, Doe Run Peru responds to government comments on La Oroya metals facility: Saint Louis, MO, Doe Run Peru news release, March 21, 1 p.
- Doe Run Company, The, 2006b, Form 10-K—2005: Securities and Exchange Commission, 132 p.
- Hudbay Minerals Inc., 2006, Annual report 2005: Winnipeg, Manitobia, Canada, Hudbay Minerals Inc., 82 p.
- International Lead and Zinc Study Group, 2006, Lead and zinc statistics, monthly bulletin of the International Lead and Zinc Study Group: London, United Kingdom, International Lead and Zinc Study Group, v. 46, no. 5, 68 p.
- Kennecott Minerals Company, 2006, 2005 sustainable development review: Salt Lake City, UT, 31 p.
- London Metal Exchange Ltd., 2006, Zinc stocks: London, United Kingdom, London Metal Exchange Ltd., December 31, 3 p.
- Metal Bulletin Daily, 2005, Century closure costs Zinifex \$A14 million: Metal Bulletin Daily, no. 8887.4, April 1, 2 p.
- Metals Economic Group, 2006, Strategic report, the outlook for zinc: Halifax, Nova Scotia, Canada, Metals Economic Group, March/April, 26 p.

- Mining Journal, 2005, Zinifex declares force majeure at Century: Mining Journal, March 24, 3 p.
- Noranda Income Fund, 2006, Noranda Income Fund reports 2005 earnings of \$32.8 million: Valleyfield, Quebec, Canada, Noranda Income Fund news release, February 6, 1 p.
- Platts Metals Week, 2005, Lundin, ARCON to merge in 123-mil deal: Platts Metals Week, v. 76, no. 16, April 18, 15 p.
- Salton Sea Funding Corporation, 2005, Form 10-K—2004: Securities and Exchange Commission, 106 p.
- Teck Cominco Limited, 2006, Annual report—2005: Vancouver, British Columbia, Canada, Teck Cominco Limited, 96 p.
- Terramin Australia Limited, 2005a, Sempra metals takes strategic stake in Terramin's Australian lead and zinc project: South Australia, Australia, ASX press release, May 9, 2 p.
- Terramin Australia Limited, 2005b, South Australia's largest zinc deposit to be fast-tracked under new Terramin-Zinifex JV: South Australia, Australia, ASX press release, May 16, 2 p.
- U.S. Department of Defense, 2005, Strategic and critical materials report to the Congress: Washington, DC, U.S. Department of Defense, April 1, 64 p.
- Vedanta Resources plc, 2006, Vedanta Resources plc preliminary results for the year ended 31 March 2006: London, United Kingdom, Vedanta Resource plc news release, June 1, 45 p.
- Xstrata plc, 2005, McArthur River Mine to move to open cut: Darwin, Northern Territory, Australia, Xstrata plc news release, August 3, 3 p.
- Xstrata plc, 2006a, MRM extension approved: Darwin, Northern Territories, Australia, Xstrata plc news release, April 20, 1 p.
- Xstrata plc, 2006b, Xstrata plc annual report—2005: Zug, Switzerland, Xstrata plc, 120 p.
- ZincOx Resources plc, 2006, Annual report—2005: Bagshot, United Kingdom, ZincOx Resources plc, 35 p.
- Zinifex Limited, 2006, Zinifex Limited annual report—2005: Melbourne, Victoria, Australia, Zinifex Limited, October 24, 96 p.

#### **Internet References Cited**

- Defense Logistics Agency, 2005, Stock accepts germanium bids, News release, accessed May 20, 2006, via URL https://www.dnsc.dla.mil.
- International Lead and Zinc Study Group, 2006 (April 26), ILZSG spring 2006 meetings/forecasts, accessed July 25, 2006, via URL http://www.ilzsg.org.
- Kazzinc, 2006, Company profile, accessed June 16, 2006, via URL http://www.kazzinc.com.
- Metal-Pages, 2004 (March 25), Big River gets extension, accessed June 15, 2004, via URL http://www.metal-pages.com.
- Metal-Pages, 2005a (January 5), Gallium indium and zinc provide clear way for flexible displays, accessed August 3, 2006, via URL http://www.metal-pages.
- Metal-Pages, 2005b (April 11), ZnO may replace InGaN in blue diodes, accessed August 3, 2006, via URL http://www.metal-pages.com.
- Metal-Pages, 2006a (January 23), Zinc on the move, accessed August 3, 2006, via URL http://www.metal-pages.com.
- Metal-Pages, 2006b (January 25), Base metal export drop for China, accessed April 26, 2006, via URL http://www.metal-pages.com.
- Metal-Pages, 2006c (January 26), China hikes base metal imports, accessed April 26, 2006, via URL http://www.metal-pages.com.
- Metal-Pages, 2006d (February 23), Shaoguan smelter starts-up, accessed April 26, 2006, via URL http://metal-pages.com.
- Ministerio de Energía y Minas, 2005, Producción Anual 2005: Lima, Peru, accessed June 13, 2006, at URL http://www.minem.gob.pe/mineria/estad\_anual2005.asp.
- Teck Cominco Limited, 2006 (March 14), Year in review—2005, accessed September 25, 2006, at URL http://www.teckcominco.com/operations/reddog/review.htm.

#### GENERAL SOURCES OF INFORMATION

#### U.S. Geological Survey Publications

Zinc. Ch. in Mineral Commodity Summaries, annual.Zinc. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

#### **Other Sources**

Jolly, J.H., 1997, U.S. Zinc Industry—A History, Statistics, and Glossary: Baltimore, MD, American Literary Press, Inc.

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

		2001	2002	2003	2004	2005
United States:						
Production:						
Domestic ores, contained zinc	metric tons	842,000	780,000	768,000	739,000	748,000
Domestic ores, recoverable zinc	do.	799,000	701,000	738,000	715,000	720,000
Value, recoverable zinc	thousands	\$774,000	\$664,000	\$661,000	\$827,000	\$1,070,000
Refined zinc:	_					
From domestic ores	metric tons	169,000	151,000	155,000	156,000	159,000
From foreign ores	do.	34,000	30,800	31,900	32,200	32,100
From scrap	do.	108,000	113,000	116,000	117,000	118,000
Total	do.	311,000	294,000	303,000	305,000	310,000
Secondary zinc <sup>2</sup>	do.	267,000	253,000	265,000	241,000	231,000
Exports:						
Ores and concentrates, zinc content	do.	696,000	822,000	841,000	745,000	786,000
Slab zinc	do.	1,180	1,160	1,680	3,300	785
Rolled zinc	do.	5,700	7,200	9,430	9,770	8,760
Imports for consumption:						
Ores and concentrates, zinc content	do.	84,000	122,000	164,000	231,000	156,000
Refined (slab) zinc	do.	813,000	874,000	758,000	812,000	668,000
Rolled zinc	do.	7,240	1,640	1,790	2,500	3,630
Stocks of slab zinc, December 31:						
Producer	do.	7,380	8,550	7,660	6,430	5,670
Consumer	do.	57,100	59,100	55,300	56,300	55,100
Merchant	do.	10,300	9,970	10,300	10,200	10,200
Total	do.	74,700	77,600	73,300	73,000	71,000
Government stockpile	do.	120,000	109,000	95,200	66,400	46,000
Consumption, refined zinc:						
Reported	do.	543,000	496,000	506,000	510,000	499,000
Apparent <sup>3</sup>	do.	1,150,000	1,170,000	1,080,000	1,160,000	939,000
All classes <sup>4</sup>	do.	1,420,000	1,420,000	1,340,000	1,400,000	1,170,000
	its per pound	43.96	38.64	40.63	52.47	67.11
World:						
Production:						
Mine thousand	d metric tons	8,930 °	8,550 <sup>r</sup>	9,470 <sup>r</sup>	9,460 <sup>r</sup>	9,800
Smelter	do.	9,320 <sup>r</sup>	9,720 <sup>r</sup>	9,900 <sup>r</sup>	10,400 <sup>r</sup>	10,700
Price, London Metal Exchange cer	its per pound	40.16	35.31	37.53	47.51	62.66

<sup>&</sup>lt;sup>e</sup>Estimated. <sup>r</sup>Revised.

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

<sup>&</sup>lt;sup>2</sup>Zinc in metal products and compounds derived directly from scrap; refined secondary zinc is listed separately in the table.

<sup>&</sup>lt;sup>3</sup>Domestic production plus net imports, plus or minus stock changes.

<sup>&</sup>lt;sup>4</sup>Apparent consumption of refined zinc plus reported consumption of zinc in metal products and compounds derived directly from ore, concentrate, or scrap.

## TABLE 2 $\label{eq:mine_production} \mbox{ MINE PRODUCTION OF RECOVERABLE ZINC } \mbox{ IN THE UNITED STATES, BY STATE}^1$

#### (Metric tons)

State	2004	2005
Alaska <sup>2</sup>	630,000	628,000
Missouri	40,400	34,200
Montana	14,800	12,500
Other <sup>3</sup>	29,400	45,300
Total	715,000	720,000

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

 ${\it TABLE~3}$  Leading zinc-producing mines in the united states in 2005, in order of output

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

 $\label{eq:table 4} \textbf{REFINED ZINC PRODUCED IN THE UNITED STATES}^1$ 

#### (Metric tons)

	2004	2005
Primary:		
From domestic ores	156,000	159,000
From foreign ores	32,200	32,100
Total	189,000	191,000
Secondary	117,000	118,000
Grand total <sup>2</sup>	305,000	310,000
1		

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

<sup>&</sup>lt;sup>2</sup>Data based, in part, on publicly available information.

<sup>&</sup>lt;sup>3</sup>Includes production from Idaho, Tennessee, and Washington.

<sup>&</sup>lt;sup>2</sup>Excludes zinc recovered by remelting.

TABLE 5  $\mbox{REFINED ZINC PRODUCED IN THE UNITED STATES}, \\ \mbox{BY GRADE}^1$ 

#### (Metric tons)

Grade	2004	2005
Special high	94,600	94,800
Continuous galvanizing	108,000	110,000
Other <sup>2</sup>	102,000	105,000
Total	305,000	310,000

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

TABLE 6 SLAB ZINC CAPACITY OF PRIMARY ZINC PLANTS IN THE UNITED STATES, BY TYPE OF PLANT AND COMPANY

#### (Metric tons)

Type of plant and company	2004	2005
Electrolytic:		
Big River Zinc Corp., Sauget, IL	100,000	100,000
Pasminco Ltd., Clarksville, TN	115,000	115,000
Electrothermic, Zinc Corporation of America, Monaca, PA		
Total	215,000	215,000
7		

<sup>--</sup> Zero.

TABLE 7 STOCKS AND CONSUMPTION OF NEW AND OLD ZINC SCRAP IN THE UNITED STATES IN 2005, BY TYPE OF SCRAP  $^{\rm I}$ 

#### (Metric tons, zinc content)

		Consumption				
	Stocks,		New	Old		Stocks,
Type of scrap	January 1	Receipts	scrap	scrap	Total	December 31
Diecastings	W	W		W	W	185
Flue dust	341	69,000	34,500	34,500	69,000	341
Galvanizer's dross	2,830	41,000	41,000		41,000	2,830
Old zinc <sup>2</sup>	102	253		276	276	79
Remelt die-cast slab	W	W		W	W	53
Remelt zinc <sup>3</sup>	1,240	47,300	47,300		47,300	1,240
Skimmings and ashes <sup>4</sup>	W	22,600	22,300		22,300	739
Other <sup>5</sup>	882	15,500	8,530	7,020	15,500	199
Total	5,390 <sup>r</sup>	196,000	154,000	41,800	195,000	5,660

<sup>&</sup>lt;sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included with "Other." -- Zero.

<sup>&</sup>lt;sup>2</sup>Includes controlled lead, high, and prime western grades.

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

<sup>&</sup>lt;sup>2</sup>Includes engraver's plates and rod and die scrap.

<sup>&</sup>lt;sup>3</sup>Includes new clippings.

<sup>&</sup>lt;sup>4</sup>Includes slab and die-cast skimmings.

<sup>&</sup>lt;sup>5</sup>Includes chemical residues and solutions, electrogalvanizing anodes, fragmentized diecastings, and steelmaking dust.

## $\label{eq:table 8} {\it PRODUCTION~OF~ZINC~PRODUCTS~FROM}$ ${\it ZINC-BASE~SCRAP~IN~THE~UNITED~STATES}^1$

#### (Metric tons)

Products	2004	2005
Redistilled slab zinc	117,000	120,000
Other zinc metal products <sup>2</sup>	6,930	7,070
Zinc in chemical products	27,500	27,200
Zinc dust	5,020	5,020

<sup>&</sup>lt;sup>1</sup>Data are rounded to no more than three significant digits.

 $\label{thm:covered} TABLE~9$  ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF SCRAP AND FORM OF RECOVERY  $^1$ 

#### (Metric tons)

149,000 152,000 548 ° 302,000 40,100 2,060
152,000 548 ° 302,000 40,100 2,060
152,000 548 ° 302,000 40,100 2,060
302,000 40,100 2,060
302,000 40,100 2,060
40,100 2,060
2,060
2,060
548 <sup>e</sup>
338 <sup>e</sup>
43,100
345,000
120,000
5,020
125,000
168,000
15,600
23,100
8,880
216,000

<sup>&</sup>lt;sup>e</sup>Estimated. <sup>r</sup>Revised.

<sup>&</sup>lt;sup>2</sup>Includes electrogalvanizing anodes, remelt die-cast slab, and other metal alloys.

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

<sup>&</sup>lt;sup>2</sup>Includes chlorine, electrogalvanizing anodes, and zinc content of slab made from remelt die-cast slab.

### $\label{eq:table 10} \text{U.S. CONSUMPTION OF ZINC}^1$

#### (Metric tons)

	2004	2005
Refined zinc, apparent	1,160,000	939,000
Ores and concentrates, zinc content	617	617
Secondary, zinc content <sup>2</sup>	241,000	231,000
Total	1,400,000	1,170,000

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

 ${\it TABLE~11} \\ {\it U.S.~REPORTED~CONSUMPTION~OF~ZINC~IN~2005,~BY~INDUSTRY~USE~AND~GRADE}^{I} \\$ 

#### (Metric tons)

	Special			Remelt	
	high	High	Prime	and other	
Industry use	grade	grade	western	grades	Total
Galvanizing	111,000	22,200	64,700	40,300	238,000
Zinc-base alloys	W	W	W	W	W
Brass and bronze	42,300	W	W	W	83,900
Other	163,000	39,900	3,270		XX
Total	316,000	62,100	68,000	40,300	486,000

W Withheld to avoid disclosing company proprietary data. XX Not applicable. -- Zero.

TABLE 12 ZINC CONTAINED IN PIGMENTS AND COMPOUNDS PRODUCED AND SHIPPED IN THE UNITED STATES  $^{\rm 1,\,2}$ 

#### (Metric tons)

	20	004	20	05
	Production	Shipments	Production	Shipments
Zinc oxide	29,500	28,400	29,500	29,500
Zinc sulfate	24,300	24,200	24,000	24,000

<sup>&</sup>lt;sup>1</sup>Excludes leaded zinc oxide, lithopone, and zinc chloride.

<sup>&</sup>lt;sup>2</sup>Excludes secondary slab zinc and remelt zinc.

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

<sup>&</sup>lt;sup>2</sup>Data are rounded to no more than three significant digits.

## TABLE 13 $\label{eq:table_table}$ REPORTED SHIPMENTS OF ZINC CONTAINED $\label{eq:table_table} \mbox{IN ZINC OXIDE, BY INDUSTRY}^{1,\,2}$

#### (Metric tons)

	2004	2005
Ceramics	383	418
Chemicals	5,000	5,320
Paints	1,820	1,840
Rubber	20,300	21,000
Other <sup>3</sup>	895	975
Total	28,400	29,500

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

 $\label{eq:table 14} \text{U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY}^1$ 

	200	4	200	15
	Quantity		Quantity	
	(metric tons,	Value	(metric tons,	Value
	zinc content)	(thousands)	zinc content)	(thousands)
Australia	37,300	\$21,600	48,800	\$31,400
Belgium	74,000	36,100	35,900	23,600
Brazil	287	167		
Bulgaria	32,400	18,800	21,300	13,700
Canada	152,000	119,000	178,000	142,000
China	865	187	19	12
Finland	33,400	19,400	33,500	21,600
Gambia, The	12,200	7,080	15,200	9,800
Germany	20,300	11,800	17,700	11,400
Italy	8	17	38,400	24,700
Japan	111,000	40,000	136,000	48,600
Korea, Republic of	184,000	90,000	177,000	97,900
Netherlands				
Spain	86,900	47,900	84,000	51,800
Other	217	378	921	685
Total	745,000	413,000	786,000	477,000

<sup>--</sup> Zero.

Source: U.S. Census Bureau.

<sup>&</sup>lt;sup>2</sup>In addition, zinc contained in zinc oxide was imported as follows: 2004—103,089 and 2005—109,247; distribution cannot be distinguished by industry.

<sup>&</sup>lt;sup>3</sup>Includes agriculture and photocopying.

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

 $\label{eq:table 15} \text{U.S. EXPORTS OF ZINC COMPOUNDS}^1$ 

	200	)4	2005		
	Quantity		Quantity		
	(metric tons,	Value	(metric tons,	Value	
	gross weight)	(thousands)	gross weight)	(thousands)	
Zinc chloride	1,870	\$2,200	1,860	\$2,310	
Zinc compounds, n.s.p.f. <sup>2</sup>	7,840	14,300	10,400	19,400	
Zinc oxide	14,400	19,800	14,600	23,600	
Zinc sulfate	3,060	1,860	2,820	1,870	

<sup>&</sup>lt;sup>1</sup>Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

 $\label{eq:table 16} \text{U.s. IMPORTS FOR CONSUMPTION OF ZINC COMPOUNDS}^1$ 

	200	14	2005			
	Quantity		Quantity			
	(metric tons,	Value	(metric tons,	Value		
	gross weight)	(thousands)	gross weight)	(thousands)		
Lithopone	3,950	\$2,600	6,390	\$4,930		
Zinc chloride	705	863	723	1,250		
Zinc compounds, n.s.p.f. <sup>2</sup>	16	29	11	28		
Zinc hydrosulfite	102	300	177	309		
Zinc oxide	103,000	89,000	109,000	127,000		
Zinc sulfate	29,100	14,000	31,100	16,600		

<sup>&</sup>lt;sup>1</sup>Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

<sup>&</sup>lt;sup>2</sup>Not specifically provided for.

<sup>&</sup>lt;sup>2</sup>Not specifically provided for.

 ${\it TABLE~17}$  ZINC: WORLD MINE PRODUCTION (ZINC CONTENT OF CONCENTRATE AND DIRECT SHIPPING ORE UNLESS NOTED), BY COUNTRY  $^{\rm I,~2}$ 

(Metric tons, zinc content of concentrate and direct shipping ore, unless otherwise specified)

Country	2001	2002	2003	2004	2005 <sup>e</sup>
Algeria	10,693	8,576	2,796 <sup>r</sup>	231 г	4,463 <sup>3</sup>
Argentina	39,703	37,325	29,839 <sup>r</sup>	27,220 <sup>r</sup>	28,000
Australia	1,519,000	1,144,000 <sup>r</sup>	1,447,000 <sup>r</sup>	1,298,000 <sup>r</sup>	1,329,000 <sup>3</sup>
Bolivia	145,306	141,558	144,985	145,906 <sup>r</sup>	158,582 <sup>3</sup>
Bosnia and Herzegovina <sup>e</sup>	300	300	300	300	300
Brazil	111,432	136,339	152,822 <sup>r</sup>	158,962 <sup>r</sup>	160,000
Bulgaria <sup>e</sup>	12,100	14,900	12,000	11,000	11,000
Burma	467	138 r, 4	127 r, 4	196 <sup>r, 4</sup>	200
Canada	1,012,048	923,930 <sup>r</sup>	757,307 <sup>r</sup>	735,698 <sup>r</sup>	755,000
Chile	32,762	36,161	33,051	27,635 <sup>r</sup>	28,000
China	1,700,000	1,550,000	2,030,000	2,390,000 <sup>r</sup>	2,450,000
Congo (Kinshasa)	1,014	r	r		
Ecuador <sup>e</sup>	100	100	100	r	
Finland	36,253	35,000 <sup>r</sup>	39,000 <sup>r</sup>	37,000 <sup>r</sup>	41,000 <sup>3</sup>
Georgia <sup>e</sup>	200	400	400	400	400
Greece	31,700	33,000	3,000		
Honduras	48,485	46,339	43,766 <sup>r</sup>	41,413 <sup>r</sup>	42,698 3
India <sup>e</sup>	146,000	234,300 <sup>r</sup>	306,400 r	341,000	446,000 <sup>3</sup>
ran <sup>e</sup>	120,000	120,000	110,000 r	121,000 <sup>r</sup>	125,000
reland	225,135	252,700	419,000	438,000	429,000
apan	44,519	42,851	44,574	47,781 <sup>r</sup>	41,452 3
Kazakhstan	344,300	390,000	395,000	360,000	400,000
Korea, North <sup>e</sup>	60,000	60,000	60,000	62,000 <sup>r</sup>	67,000
Korea, Republic of	5,129	99	e		
Macedonia	6,300	10,000 <sup>r</sup>	4,000 r		
Mexico	428,828	446,104	413,991 <sup>r</sup>	426,330 <sup>r</sup>	470,000
Morocco	89,339	90,487 <sup>r</sup>	69,200 <sup>r</sup>	74,600 <sup>r</sup>	75,000
Namibia	37,622	42,685	60,500 r, 5	66,028 r, 4,	70,000
Peru	1,056,629	1,221,830	1,372,790	1,209,006	1,201,671 3
Poland	152,700	152,200	153,900 r	140,300 <sup>r</sup>	117,200 <sup>3</sup>
Romania	29,786	21,200	22,081 <sup>r</sup>	18,604 <sup>r</sup>	25,000
Russia <sup>e</sup>	124,000	130,000 <sup>3</sup>	159,000	179,000	180,000
Saudi Arabia <sup>e</sup>	3,300 <sup>3</sup>	3,000	3,000	1,500	1,500
Serbia and Montenegro	5,988	6,900			
South Africa	61,560 <sup>r</sup>	64,580 <sup>r</sup>	41,400 <sup>r</sup>	32,310 <sup>r</sup>	32,112 <sup>p</sup>
Spain	164,900	69,900	15,000	52,510	52,112
Sweden	156,334	148,600	188,000 <sup>r</sup>	199,000 <sup>r</sup>	216,000 <sup>3</sup>
Fhailand	15,300	31,000 <sup>r</sup>	43,400 <sup>r</sup>	29,900 <sup>r</sup>	42,570 <sup>3</sup>
Tunisia	37,900 e	35,692	38,000 e	31,000	19,000
Turkey	37,900	43,000	40,000	39,000	48,000 <sup>3</sup>
United States	842,114	780,026	767,597	738,876	748,000 <sup>3</sup>
Vietnam <sup>e</sup>	32,000 <sup>r</sup>	42,000 <sup>r</sup>	45,000 <sup>r</sup>	30,000 <sup>r</sup>	32,000
Vietnam Total	8,928,246 <sup>r</sup>	8,547,220 <sup>r</sup>	9,468,326 <sup>r</sup>	9,459,196 <sup>r</sup>	9,795,148
1 Otal	8,928,246	8,347,220	9,408,320	9,439,190	9,793,148

 $<sup>^{\</sup>mathrm{e}}$ Estimated.  $^{\mathrm{p}}$ Preliminary.  $^{\mathrm{r}}$ Revised. -- Zero.

<sup>&</sup>lt;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>&</sup>lt;sup>2</sup>Table includes data available through July 1, 2006.

<sup>&</sup>lt;sup>3</sup>Reported figure.

<sup>&</sup>lt;sup>4</sup>Data are for fiscal year ending March 31 of the following year.

<sup>&</sup>lt;sup>5</sup>Anglo American plc's Skorpion solvent extraction-electrowinning plant started production in 2003.

 $\label{eq:table 18} \textbf{ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY}^{1,\,2}$ 

#### (Metric tons)

Country <sup>3</sup>	2001	2002	2003	2004	2005 <sup>e</sup>
Algeria, primary and secondary	26,000 r	33,900 <sup>r</sup>	34,900 <sup>r</sup>	36,800 <sup>r</sup>	32,000
Argentina:					
Primary	39,727	38,699	39,221 <sup>r</sup>	35,300 <sup>r</sup>	35,000
Secondary	3,180	3,098	3,139 <sup>r</sup>	3,000 <sup>r</sup>	3,000
Total	42,907	41,797	42,360 <sup>r</sup>	38,300 <sup>r</sup>	38,000
Australia:					
Primary <sup>5</sup>	554,000	567,000	553,000	473,000	503,300
Secondary <sup>e</sup>	4,500	4,500	4,500	4,500	4,500
Total	558,500	571,500	557,500	477,500	507,800
Belgium, primary and secondary <sup>e</sup>	259,300 4	260,000	244,000	263,000	257,000
Brazil:					
Primary	193,061	247,692 <sup>r</sup>	257,530 <sup>r</sup>	265,987 <sup>r</sup>	270,000
Secondary <sup>e</sup>	7,000	7,000	7,000	7,000	7,000
Total	200,061	254,692 <sup>r</sup>	264,530 °	272,987 <sup>r</sup>	277,000
Bulgaria, primary and secondary	88,600	83,000	86,800	102,000 <sup>r</sup>	95,000
Canada, primary	661,172	793,410 <sup>r</sup>	761,199	804,219 <sup>r</sup>	805,000
China, primary and secondary e	2,040,000	2,100,000	2,320,000	2,720,000 <sup>r</sup>	2,800,000
Czech Republic, secondary <sup>e</sup>	250	200	250	250	250
Finland, primary	247,179	235,300	265,900	284,500 <sup>r</sup>	292,000
France, primary and secondary <sup>e</sup>	347,000	350,000	253,000	260,000	268,000
Germany, primary and secondary	358,341 <sup>r</sup>	378,561 <sup>r</sup>	388,131 <sup>r</sup>	382,020 <sup>r</sup>	380,000
India:					
Primary	207,000 <sup>e</sup>	231,400	253,900	238,400	270,000
Secondary <sup>e</sup>	25,000	24,000	24,000	24,000	23,000
Total	232,000	255,400	277,900	262,400	293,000
Iran	73,000 <sup>e</sup>	82,571 <sup>r</sup>	78,428 <sup>r</sup>	109,400 <sup>r</sup>	140,000
Italy, primary and secondary	177,800	176,000	123,000 <sup>e</sup>	130,000	121,000
Japan:					
Primary	541,277	547,183	532,704	534,830	536,768
Secondary	142,777	126,723	153,411	132,417	138,453
Total	684,054	673,906	686,115	667,247	675,221
Kazakhstan, primary and secondary	277,100	286,300	279,000	316,500	356,907
Korea, North, primary and secondary e	65,000 <sup>r</sup>	65,000 r	65,000 <sup>r</sup>	67,000 <sup>r</sup>	72,000
Korea, Republic of, primary	503,315 <sup>r</sup>	605,990 <sup>r</sup>	644,218 <sup>r</sup>	668,666 <sup>r</sup>	644,828
Laos	28,745	1,345	3,069	2,000	87,379
Macedonia, primary and secondary e	52,000	56,000	28,000	25,000 r	25,000
Mexico, primary	303,810	302,122	320,364	325,220 <sup>r</sup>	360,000
Mongolia					22,800
Namibia <sup>6</sup>	<del></del>	35	47,436	119,200	132,800
Netherlands, primary <sup>e, 7</sup>	204,800 4	203,000	223,000	225,000	228,000
Norway, primary	129,300 <sup>r</sup>	145,000	142,000	139,000 <sup>r</sup>	148,000
Peru, primary	204,646	172,688	202,076	195,692	163,603
Poland, primary and secondary	174,700	158,900	153,300	153,000	155,000
Portugal, secondary <sup>e</sup>	3,600	3,600	3,500	1,500	3,000
Romania, primary and secondary	47,200	51,600	52,000	55,000 <sup>r</sup>	57,000
Russia, primary and secondary e	237,000	244,000	253,000	240,000	220,000
Serbia and Montenegro, primary and secondary	13,467	1,478	62	100	100
Slovakia, secondary <sup>e</sup>	1,000	1,000	1,000	1,000	1,000
South Africa, primary	109,000	111,000 <sup>r</sup>	113,000 <sup>r</sup>	104,000	102,000
G C	102,000	111,000	112,000	10.,000	102,000

See footnotes at end of table.

### $\label{eq:continued} \textbf{ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY}^{1,\,2}$

	(Metric tons)				
Country <sup>3</sup>	2001	2002	2003	2004	2005 <sup>e</sup>
Spain, primary and secondary	418,000	488,000	519,000	525,000	546,000
Thailand, primary	104,797 <sup>r</sup>	105,148 <sup>r</sup>	113,686 <sup>r</sup>	115,100 °	101,186 4
United Kingdom, primary and secondary	100,000 r	99,600 <sup>r</sup>	16,600 <sup>r</sup>		
United States:					
Primary	203,000	182,000	187,000	189,000	191,000 4
Secondary	108,000	113,000	116,000	117,000	118,000 4
Uzbekistan, primary <sup>e</sup>	35,000	30,000	30,000	30,000	30,000
Grand total	9,320,000 <sup>r</sup>	9,720,000 <sup>r</sup>	9,900,000 <sup>r</sup>	10,400,000 <sup>r</sup>	10,700,000
Of which:					
Primary	4,240,000 <sup>r</sup>	4,520,000 <sup>r</sup>	4,640,000 r	4,630,000 r	4,680,000
Secondary	295,000	283,000	313,000 <sup>r</sup>	290,000	298,000
Undifferentiated	4,780,000 <sup>r</sup>	4,920,000 <sup>r</sup>	4,940,000 <sup>r</sup>	5,510,000 <sup>r</sup>	5,770,000

<sup>&</sup>lt;sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

<sup>&</sup>lt;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>&</sup>lt;sup>2</sup>Wherever possible, detailed information on raw material source of output (primary--directly from ores, and secondary--from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undifferentiated (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output. Table includes data available through July 1, 2006.

<sup>&</sup>lt;sup>3</sup>In addition to the countries listed, Israel also produces small amounts of secondary zinc, but available information is inadequate to make reliable estimates of output levels.

<sup>&</sup>lt;sup>4</sup>Reported figure.

<sup>&</sup>lt;sup>5</sup>Excludes zinc dust.

<sup>&</sup>lt;sup>6</sup>Special high-grade electrowon cathodes from Anglo American plc's Skorpian solvent extraction-electrowinning plant.

<sup>&</sup>lt;sup>7</sup>Sales.