

ZINC

By Stephen M. Jasinski

Zinc was produced at 24 mines in the United States in 1994. Production increased 17% from 1993. For the fourth consecutive year, Alaska was the leading zinc-producing State, followed by Tennessee, New York, Missouri, Montana, and Colorado. U.S. mine production greatly exceeded smelter capacity, which resulted in a net export of 362,000 metric tons of zinc in concentrate. The value of zinc mine production, based on the average annual U.S. price, was \$619 million.

Three smelters produced primary zinc metal in 1994 from domestic and imported ore. Seven secondary smelters produced zinc metal using about 70% new scrap and 30% old scrap. A detailed discussion of the secondary zinc industry is contained in the annual Mineral Industry Survey "Recycling — Nonferrous Metals." Total zinc metal production was 356,000 tons; a 7% decrease from 1993, caused by the indefinite closure of one primary zinc smelter in September 1993.

Domestic apparent consumption of zinc in all forms increased 5%; imports of zinc metal grew by 10% to meet the demand. Apparent consumption of slab zinc grew 5% from 1993. The increase was greatest in the galvanizing and diecasting industries owing to strong growth by the U.S. automobile industry. Zinc use in brass and bronze products increased slightly. The use of zinc in the form of compounds, dust, and powder increased 14% over that of 1993.

U.S. producer prices, which are based on the London Metal Exchange (LME) price plus a premium, rebounded slightly at the end of the year after dropping below \$0.45 per pound in April. The average price for the year was \$0.4926 per pound, \$0.0311 higher than in 1993.

World mine production decreased 2%. Australia, Canada, China, Peru, and the United States were the top producers, in order of output, accounting for 60% of the world total. Production cuts initiated in several countries in late 1993 reduced output and greatly reduced the world surplus of zinc concentrates. World metal production, including secondary production, dropped slightly. China, Japan, Canada, Germany, and the United States were the top producers, in order of output, representing 42% of the world total. World zinc consumption increased 4%, as demand remained strong in North America and Asia

(except for Japan) and improved in Europe. Zinc exports from China, Kazakhstan, North Korea, and Russia remained high, according to the International Lead And Zinc Study Group (ILZSG); the exports helped LME stocks of refined zinc to reach a record high of 1,230,000 tons at the end of August. Stocks then gradually decreased to end the year at 1,190,000 tons. However, this was a 31% increase over 1993 yearend stocks. Total world stocks were 1,800,000 tons at yearend, which represented 15 weeks of consumption, compared with 1,620,000, or 14 weeks of consumption, in 1993.

Conventional identified world zinc resources were about 1.8 billion tons. The world reserve base was estimated at 330 million tons and reserves at 140 million tons. Canada had the largest reserves, 15% of the world total; however, Australia had the largest reserve base, 20%. The U.S. share was 11% and 15% respectively.

Legislation and Government Programs

A stockpile of zinc for national defense purposes has been maintained for more than 50 years. In 1992, the President signed Public Law 102-484, which authorized the disposal of the entire inventory of zinc from the National Defense Stockpile (NDS). The Defense Logistics Agency, which maintains the NDS, was authorized to sell 45,000 tons in fiscal year (FY) 1994 (October 1, 1993 to September 30, 1994), but sold only 29,000 tons from January to September. The FY 1995 authorization was for 45,000 tons, but sales were suspended at the beginning of FY 1995 (October 1, 1994) by Congress, in response to industry complaints that NDS sales were adversely affecting the market. The FY 1995 authorization also included a provision to prevent sales if the price falls more than 5% from the date of enactment. Sales were scheduled to resume in April 1995, pending Congressional approval, with 22,680 tons authorized for sale for the remainder of the FY 1995. The inventory on December 31, 1994, was 296,000 tons.

Production

Domestic mine production data were developed by the U.S. Bureau of Mines

(USBM) from a voluntary survey on Lode-Mine Production of Gold, Silver, Copper, Lead, and Zinc. All of the major zinc producing mines responded to this survey.

Mine Production.—U.S. zinc mine output increased 17% in 1994, because of increased production at the Red Dog Mine in Alaska and Asarco's mines in Missouri and Tennessee. The 15 leading mines accounted for 95% of production, with five leading mines accounting for 74%. For the fourth consecutive year, Alaska was the leading zinc-producing State, followed by Tennessee, New York, Missouri, and Colorado. The leading domestic producers were Asarco Incorporated Cominco Alaska Inc., Savage Zinc Inc., and Zinc Corp. of America (ZCA).

Savage Resources of Australia purchased the U.S. zinc operations of Union Minière of Belgium in February for \$200 million. Union Minière had owned five zinc mines and the Clarksville, TN, smelter. Savage did not make any major changes in the facilities.

In Tennessee, zinc was produced at eight underground mines, four owned by Asarco and four owned by Savage Zinc Inc. Asarco's production was 67,700 tons of zinc in concentrate, an increase of 17,700 tons from last year, according to the company's annual report. Reported ore reserves at yearend were 4.5 million tons averaging 3.27% zinc.

The Red Dog Mine in Northwestern Alaska accounted for all zinc production in the State. Red Dog, which began operations in late 1989, is owned by NANA Regional Corp. Inc. and leased to Cominco Alaska Inc., a subsidiary of Cominco, Ltd., which owns and operates the mining and processing facilities. NANA is paid a royalty that is scheduled to increase after the capital investment plus interest is recovered by Cominco.

At Red Dog, an expansion of the grinding circuit was completed in late 1994. Two ball mills, a tower mill, and a powerplant were installed, resulting an increased production of zinc concentrates, exceeding original design capacity. According to Cominco's annual report, zinc recovery was 75%, compared with 74% in 1993, and total ore milled was 2,120,000 tons, 422,000 tons more than in 1993. The average ore grade was 18.8% zinc, up slightly from last year. The production of zinc in concentrate was 298,000 tons in 1994,

62,500 tons more than in 1993. According to the company, ore reserves at yearend were 54.3 million tons averaging 18.3% zinc, 5.5% lead, and 93 grams per ton silver. An additional 14.1 million tons of lower grade ore, averaging 10% zinc and 2.7% lead was classified as inferred reserves.

The Greens Creek polymetallic mine on Admiralty Island near Juneau, AK, remained closed in 1994. The mine is a joint venture between RTZ Ltd., through its Kennecott subsidiary (70.3%), Greens Creek Mining Co. and Hecla Mining Co. (20.7%). Development and maintenance continued during the year. Exploration drilling defined a high grade ore body first identified in 1991. According to Hecla, the new ore body is richer than the previously mined section of the mine; proven and probable reserves are 2.35 million tons, grading 13.1% zinc and 4.7% lead. In 1995, the companies were expected to announce plans to reopen the mine in the near future.

In Missouri, zinc was produced as a coproduct of lead at eight underground lead mines along the Viburnum Trend by three companies, Asarco, The Doe Run Co., and Cominco American Inc., a subsidiary of Cominco Ltd. According to Asarco's annual report, production of zinc in concentrate at the West Fork and Sweetwater Mines was 18,800 tons, an increase of 2,900 tons. Ore reserves at yearend, according to the company, were 16.2 million tons, averaging 0.73% zinc. The Magmont Mine, a joint venture of Cominco American and Dresser Industries, closed permanently in May due to depletion of the ore reserve. According to Cominco's annual report, the Magmont mill processed 287,000 tons of ore grading 1.5% zinc, yielding 3,200 tons of zinc in 5,400 tons of concentrate.

In Colorado, zinc was produced only as a coproduct of gold-silver operations at the Leadville Unit, managed by Asarco, but owned jointly with the Resurrection Mining Co. As reported in Asarco's annual report, production of zinc in concentrate was 14,000 tons, and, at yearend, ore reserves were 900,000 tons, averaging 8.44% zinc.

In Montana, the Montana Tunnels Mining Co., a subsidiary of Pegasus Gold Inc., milled 4.7 million tons of ore in 1994, yielding 18,000 tons of zinc and 8,500 tons of lead in concentrates according to the company's 10-K report. Zinc recovery was 88%, with the mill feed averaging 0.56% zinc. At yearend, according to the company, proven and probable reserves were 26.6 million tons, grading 0.60% zinc and 0.21% lead.

In Idaho, zinc was produced by Hecla Mining Co., at its Lucky Friday Mine. According to the company's 10-K report, total

ore milled was 113,000 tons, yielding 2,200 tons of zinc and 12,000 tons of lead in concentrate. Production was down in 1994 because of an ore conveyance accident on August 30, 1994, which resulted in a suspension of operations for 3 months. According to the company, ore reserves were 408,000 tons averaging 2.9% zinc and 13.9% lead.

Smelter and Refinery Production.— Production of refined zinc was 356,000 tons, down from 382,000 in 1993. Primary slab zinc was produced at three smelter/refineries in 1994; Big River Zinc at Sauget, IL, Savage Zinc Inc. at Clarksville, TN, and ZCA at Monaca, PA. The ZCA smelter in Bartlesville, OK, had been closed indefinitely in late 1993. Secondary slab zinc was produced at seven plants from waste and scrap materials. The largest secondary producer was ZCA at its electrothermic smelter in Monaca, PA. A substantial part of the plant's feed material was crude zinc calcine recovered from steel mill electric arc furnace dust by its parent company, Horsehead Resource Development Co., Palmerton, PA. Other major producers of zinc metal at secondary plants were Huron Valley Steel Corp., Interamerican Zinc Co., and Gulf Metals Corp.

Zinc Oxide.—One company, Eagle Zinc Co., produced only American-process zinc oxide and four companies produced only French-process zinc oxide in 1994. Nearly 60% of U.S. production is from secondary materials. U.S. Zinc Corp., parent company of Midwest Zinc, purchased Asarco's Hillsboro, IL, zinc oxide plant in February. Midwest Zinc also operates plants in Chicago, IL, and Millington, TN. Other producers were North American Oxide, Inc. (NAO), Clarksville, TN, and ZCA, Monaca, PA. NAO began expansion of its 20,000-ton-per-year plant late in the year, with completion set for early 1995. Production was expected to be increased gradually, but the new capacity was not disclosed. NAO also purchased Purity Zinc Metals Co., Ltd., Stoney Creek, Ontario, Canada, the largest producer of high purity zinc dust in North America and the largest independent alloy producer in Canada.

U.S. production was 131,000 tons, a 4% increase over that of 1993. Some impure zinc oxide produced at secondary plants was sold directly for agricultural purposes.

Consumption

Domestic data for zinc were developed by the USBM from five separate, voluntary surveys of U.S. operations. Typical of these was the "Slab Zinc" consumption survey sent out monthly or annually, depending on

consumption quantities; small consumers are canvassed annually. Consumption for nonrespondents was estimated using prior-year consumption adjusted for industry trends.

Reported consumption of zinc metal, however, accounted for only 72% of apparent metal consumption, a reflection of a low current response rate for voluntary surveys.

Zinc is found in a great many manufactured products, but its role is not obvious to the public because it tends to lose its identity in the products. Zinc-containing products were used extensively in 1994 for construction, transportation, electrical, machinery, and chemical purposes. Zinc-coated steel sheet, structural shapes, fencing, storage tanks, fasteners, nails, and wire rope were widely used in all types of construction, including transmission and radar towers, industrial plants, culverts, roads, bridges, and airfields. Zinc sacrificial anodes were used to protect ship hulls, offshore oil drilling rigs, and submerged and buried steelwork, tanks, and pipes. Brass was used as shell casings in ammunition, and in tubes, valves, motors, pipes, refrigeration equipment, heat exchangers, communication units, and electronic devices. Zinc die-cast parts, such as handles, grilles, bezels, brackets, locks, hinges, gauges, pumps, mounts, and housings were used extensively in vehicles, heavy machinery, business machinery, appliances, household hardware, and scientific and electronic equipment. Zinc dust was used in primers and paints; in alkaline dry cell batteries; in the sherardizing process to protectively coat nuts, bolts, and small parts; for the precipitation of noble metals from solution; and in the zinc industry for the removal of impurities, such as copper, cadmium, and lead, before electrolysis. The metal casings of zinc-carbon dry cell batteries were made of rolled zinc. In 1994, 33,200 tons of Special High Grade (SHG) zinc was used by the U.S. Mint to produce 13.6 billion pennies.

The use of galvanized steel framing for residential construction continues to grow. It was used in about 5% of new homes built in the United States in 1994. The goal of the American Iron and Steel Institute is for galvanized steel frame construction to have a 25% share of new homes by 1999.

Zinc compounds were used in corrosion-inhibiting paint primers, chemical catalysts, welding and soldering fluxes, fungicides and pharmaceuticals, paints, rubber, phosphors for cathode ray tubes, ceramics, and additives for lubricating oils and greases. Zinc ferrites were used in electrical devices such as transformers, coils, amplifiers, and motors.

Domestic apparent consumption of slab zinc rose 50,000 tons to 1.19 million tons in 1994.

Hot dip galvanizing and electrogalvanizing, mainly for sheet and strip, continued to be the principal use of zinc metal, consuming an estimated 53%, followed by zinc-base die-cast alloys, 20%; brass alloys, 13%; and other uses 14%. SHG accounted for about 57% of the reported consumption, followed by Prime Western, 22%; High-Grade, 13%; and other grades, 8%. Overall, zinc metal accounted for over 83% of the total zinc in final products and zinc chemicals.

Consumption of zinc in the production of copper-base alloy for brass mills, ingotmakers, and foundries increased 35,200 tons from 1993 to 348,000 tons, according to the Copper Development Association Inc. (CDA). Consumption was evenly split between refined metal and zinc contained in brass and bronze scrap metal. According to the CDA, brass mills accounted for 89% of the total zinc consumed as metal and scrap in producing copper-base alloys.

Apparent consumption of zinc oxide was about 174,000 tons. Domestic production was 131,000 tons, whereas net imports were 33,000 tons. USBM information on zinc oxide consumption reflects only shipments as reported by the domestic producers; because reporting is incomplete, the data listed in table 10 account for only about 80% of the market. Of the reported amounts, the rubber and chemical industries continued to be the principal consumers.

Stocks

Industry stocks decreased slightly from 1993. Stock numbers in table 1 represent consumer, producer, and merchant stocks. The 1992 and 1993 zinc annual reports listed only consumer stocks.

Prices

Since 1991, U.S. zinc producers have used the LME as their price basis. For domestic metal, sellers generally charged either a premium of \$0.02-to-\$0.05 per pound over the LME spot price or an average of LME prices adjusted to account for delivery and/or importing costs. The price reported in table 1 was published by *Platt's Metals Week*, which based its price on the daily LME spot price for SHG plus a premium that reflected market conditions.

The domestic price was in the range of \$0.44 to \$0.48 per pound through August, when the price began to increase in response to declining LME stocks and to speculation. The December average was \$0.5726 per pound and the 1994 average price was \$0.4926 per pound.

Foreign Trade

The value of U.S. exports of basic zinc materials, including waste and scrap, was about \$224 million, a \$27 million increase over that of 1993, owing to more exports of slab zinc and higher zinc prices. Exports of zinc concentrates increased 25% in quantity and 34% in value, owing to increased output from the Red Dog Mine.

Imports of slab zinc increased 69,000 tons to meet growing domestic demand in 1994. Slab zinc accounted for about 88% of the total value of imports of basic zinc materials (excluding alloys). Canada was the largest supplier of slab zinc, accounting for 63% of imports for consumption of slab zinc. Mexico, Peru, and Spain were other significant suppliers.

World Review

World stocks of slab zinc increased 11%, owing to a 31% increase in LME stocks, to end the year at 1,800,000 tons. Continued high exports from Eastern Europe and China combined with increased Western smelter production, pushed LME stocks to over 1,240,000 tons in August. LME stocks gradually decreased from September to the end of the year. World mine production decreased, although production increased in Peru and the United States. Stockpiles of zinc concentrates were reduced significantly as a result of the lower production levels. In Australia, CRA Ltd., began bulk sampling at its Century project in Queensland. A bulk sample of concentrate was sent to several smelters in Europe for evaluation. CRA will decide in 1995 whether to proceed with full development of the mine, which they would have operating at full production in 1998. CRA said it had identified reserves of 118 million tons grading 10.2% zinc, 1.5% lead, and 36 grams per ton silver. Annual production at full capacity for the project would be 5 million tons of ore containing 500,000 tons of zinc in concentrate.

Construction began on the McArthur River Joint Venture polymetallic mine project in the Northern Territory of Australia. First production is expected in 1995. The mine has proven and probable reserves of 26 million tons grading 14% zinc, 6.3% lead, and 63 grams per ton silver. Projected annual metal output is 160,000 tons of zinc and 45,000 tons of lead in concentrates.

In Ireland, Arcon International Plc. received planning approval for its Galmoy zinc/lead mine in County Kilkenny and began construction late in the year. Arcon expects to begin production by June 1996. Projected annual production capacity is 66,000 tons of zinc in concentrate.

Proven and probable reserves, as reported by Arcon, are 6.18 million tons grading 11.10% zinc and 1.12% lead. In County Tipperary, Ivernia West Plc. won an Irish High Court decision allowing it to acquire the 52.5% interest of Chevron Minerals Ltd. in the Lisheen zinc/lead deposit. Ivernia began development of the mine and expects to begin production in early 1997, at an annual rate of 180,000 tons of zinc in concentrate. The company reports reserves at 22.3 million tons grading 11.9% zinc, 2.0% lead, and 27 grams per ton silver.

In Tunisia, the Bougrine lead/zinc mine commenced operations, producing 26,500 tons of zinc in concentrate, which was shipped to smelters in Europe. Annual production capacity was listed at 38,000 tons of zinc in concentrates. Inferred reserves are 5.3 million tons, grading 11.7% zinc and 2.6% lead.

World metal production dropped, primarily owing to reduced output in Europe and Japan caused by high zinc inventories, low prices, and shortages of concentrates. Metaleurop S.A. closed its Noyelles-Godault zinc smelter in France after an explosion destroyed a zinc refining column. The entire facility was closed as a precaution. Metaleurop exported output from its Imperial Smelting Furnace to Belgium and Germany for final refining. The plant was expected to reopen in 1995.

In March, Cominco, Ltd. announced it would proceed with the construction of a Kivcet lead smelter to replace the inoperative QSL smelter, and expand its zinc refining circuit at Trail, B.C. The annual zinc production capacity would increase from 290,000 tons to 320,000 tons over a 3-year period. To help finance the C\$17 million project, Cominco sold the rights to expand power production at two company-owned hydroelectric dams to the Province of British Columbia.

Current Research and Technology

The International Tin Research Institute has developed a 75% tin-25% zinc alloy that can be used as an environmentally friendly substitute for cadmium anticorrosion coatings on steel. The noncyanide based electrolyte, *Stanzec*, from which the coating is deposited, has been patented for rack or barrel plating and licensed to Asotec, a major U.S. plating company. Initially it will be used on automotive and aerospace parts.¹

Outlook

Domestic mine production is expected to increase 35,000 tons in 1995 and level off in 1996, owing to improvements at several mines

that will be completed by 1996. Metal production is expected to increase slightly over the next 2 years, mainly from secondary production. The primary smelters have been operating near full capacity and there are no expansions likely, which will keep the United States the largest importer of zinc metal and a net exporter of zinc concentrates. Demand for zinc metal is expected to rise 2% to 3% in each of the next 2 years. There are no major shifts anticipated in demand, with galvanizing remaining the largest use. The domestic automobile industry is one of the largest consumers of zinc metal, hence its production rate is a major factor contributing to shifts in the demand pattern. Auto production was predicted to increase 5.7% in 1995 and similarly in 1996. However, increased substitution of plastic and composite materials for die castings and greater use of electrogalvanized steel may reduce the amount of zinc required per vehicle over the next decade. Other uses of galvanized steel, such as framing for residential housing and commercial construction are anticipated to grow substantially in the next decade. Projected growth in demand will keep the United States the largest consumer of zinc in the world.

¹Carlin, J. F. USBM Tin MIS 1-31-95, p. 1

OTHER SOURCES OF INFORMATION

U.S. Bureau of Mines Publications

Zinc. Ch. in Mineral Commodity Summaries, annual

Zinc. Reported monthly in Mineral Industry Surveys.

Other Sources

ABMS Nonferrous Metal Data.

American Metal Market.

Engineering and Mining Journal.

Journal of Metals.

Lead and Zinc Statistics (monthly bulletin of ILZSG)

Metal Bulletin (London).

Metals Week.

Mining Journal (London).

The Northern Miner.

World Metal Statistics (WBMS).

TABLE 1
SALIENT ZINC STATISTICS 1/

(Metric tons unless otherwise specified)

	1990	1991	1992	1993	1994
United States:					
Production:					
Domestic ores, recoverable content	515,000	518,000	523,000	488,000	570,000
Value	\$847,000	\$602,000	\$674,000	\$497,000	\$619,000
Slab zinc:					
From domestic ores	230,000	218,000	227,000	214,000	201,000
From foreign ores	32,200	35,600	44,800	26,000	15,600
From scrap	95,700	122,000	128,000	141,000	139,000
Total	358,000	376,000	399,000	382,000	356,000
Secondary zinc 2/	246,000	W	W	W	W
Rolled zinc	47,900	41,800	48,200	60,300	53,500
Exports:					
Ores and concentrates (zinc content)	220,000	382,000	307,000	311,000	389,000
Slab zinc	1,240	1,250	565 r/	1,410 r/	6,310
Rolled zinc	11,900	10,400	5,430	6,600	6,680
Imports for consumption:					
Ores and concentrates (zinc content)	46,700	45,400	44,500	33,100	27,400
Slab zinc	632,000	549,000	644,000	724,000	793,000
Rolled zinc	929	537	171	135	475
Stocks of slab zinc, Dec. 31:					
Industry	87,400 r/	79,300 r/	74,900 r/	73,900 r/	71,000
Government stockpile	341,000	344,000	341,000	326,000	286,000
Consumption:					
Slab zinc:					
Reported	802,000	790,000	814,000	828,000 r/	859,000
Apparent 3/	992,000	933,000	1,040,000	1,140,000 r/	1,190,000
All classes 4/	1,240,000	1,170,000	1,280,000	1,350,000 r/	1,420,000
Price: Special High Grade, cents per pound (delivered)	74.59 5/	52.77	58.38	46.15	49.26
World:					
Production:					
Mine	7,150 r/	7,270 r/	7,260 r/	6,960 r/	6,810 e/
Smelter	7,180	7,310	7,230 r/	7,400 r/	7,360 e/
Price: London, cents per pound	66.46 5/	50.67	56.24	43.64	45.26

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits, except prices.

2/ Excludes secondary slab and remelt zinc.

3/ Domestic production plus net imports plus or minus stock changes.

4/ Based on apparent consumption of slab zinc plus zinc content of ores and concentrates and secondary materials.

5/ High grade.

TABLE 2
MINE PRODUCTION OF RECOVERABLE ZINC
IN THE UNITED STATES, BY STATE 1/
(Metric tons)

State	1993	1994
Kentucky	(2/)	--
Missouri	40,200	42,000
Montana	W	21,000
Oregon	--	118
Washington	W	--
Other 3/	448,000	507,000
Total	488,000	570,000

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

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Revised to zero.

3/ Includes production from Alaska, Colorado, Idaho, Illinois, New York, Tennessee, and States indicated by symbol "W."

TABLE 3
LEADING ZINC PRODUCING MINES IN THE UNITED STATES IN 1994, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of zinc
1	Red Dog	Northwest Arctic, AK	Cominco Alaska Inc.	Zinc ore.
2	Elmwood-Gordonsville	Smith, TN	Savage Zinc Inc.	Do.
3	Balmat	St. Lawrence, NY	Zinc Corporation of America	Do.
4	Young	Jefferson, TN	ASARCO Incorporated	Do.
5	Pierrepont	St. Lawrence, NY	Zinc Corporation of America	Do.
6	Montana Tunnels	Jefferson, MT	Montana Tunnels Mining Inc.	Do.
7	Immel	Knox, TN	ASARCO Incorporated	Do.
8	Leadville Unit	Lake, CO	do.	Do.
9	New Market	Jefferson, TN	do.	Do.
10	Cumberland	Smith, TN	Savage Zinc Inc.	Do.
11	West Fork	Reynolds, MO	ASARCO Incorporated	Lead-zinc ore.
12	Jefferson City	Jefferson, TN	Savage Zinc Inc.	Zinc ore.
13	Clinch Valley	Grainger, TN	do.	Do.
14	Coy	Jefferson, TN	ASARCO Incorporated	Do.
15	Sweetwater	Reynolds, MO	do.	Do.
16	Casteel 1/	Iron, MO	The Doe Run Co.	Lead ore.
17	Fletcher	Reynolds, MO	do.	Do.
18	Buick	Iron, MO	do.	Lead-zinc ore.
19	Rosiclare	Hardin and Pope, IL	Ozark-Mahoning Co.	Fluorspar.
20	Magmont	Iron, MO	Cominco American Inc.	Lead ore.
21	Viburnum No. 29	Washington, MO	The Doe Run Co.	Do.
22	Lucky Friday	Shoshone, ID	Hecla Mining Co.	Lead-zinc ore.
23	Silver Butte	Douglas, OR	Formosa Exploration Inc.	Copper ore.
24	Viburnum No. 28	Iron, MO	The Doe Run Co.	Lead ore.

1/ Includes Brushy Creek Mill.

TABLE 4
PRIMARY AND SECONDARY SLAB ZINC PRODUCED IN THE UNITED STATES 1/

(Metric tons)

	1993	1994
Primary:		
From domestic ores	214,000	201,000
From foreign ores	26,000	15,600
Total	240,000	217,000
Secondary:		
At primary smelters	99,300	99,900
At secondary smelters	42,200	39,200
Total	141,000	139,000
Grand total (excludes zinc recovered by remelting)	382,000	356,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

TABLE 5
DISTILLED AND ELECTROLYTIC ZINC, PRIMARY AND SECONDARY, PRODUCED IN
THE UNITED STATES, BY GRADE 1/

(Metric tons)

Grade	1993	1994
Special High	104,000	119,000
High	89,900	31,100
Continuous Galvanizing	65,400	62,000
Controlled Lead	7,570	2,670
Prime Western	115,000	141,000
Total	382,000	356,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to 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	Slab zinc capacity	
	1993	1994
Electrolytic:		
Big River Zinc Corp., Sauget, IL	82,000	82,000
Savage Zinc, Inc., Clarksville, TN	98,000	98,000
Zinc Corp. of America, Bartlesville, OK 1/	54,000	54,000
Electrothermic:		
Zinc Corp. of America, Monaca, PA 2/	146,000	146,000
Total available capacity	380,000	380,000
Total operating capacity	326,000	326,000

1/ Temporarily closed in Sept. 1993.

2/ Includes secondary capacity.

TABLE 7
U.S. CONSUMPTION OF ZINC 1/

(Metric tons)

	1993 r/	1994
Slab zinc, apparent	1,140,000	1,190,000
Ores and concentrates (zinc content) 2/	W	W
Secondary (zinc content) 3/	W	W
Total	1,350,000	1,420,000

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

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits.

2/ Includes ore used directly in galvanizing.

3/ Excludes secondary slab zinc.

TABLE 8
U.S. REPORTED CONSUMPTION OF SLAB ZINC IN 1994, BY INDUSTRY USE AND GRADE 1/

(Metric tons)

Industry use	Special High Grade	High Grade	Prime Western	Remelt and other grades	Total
Galvanizing	89,100	76,600	162,000	66,600	395,000
Zinc-base alloys	196,000	W	W	--	196,000
Brass and bronze	46,400	W	W	W	107,000
Zinc oxide	W	W	--	--	68,300
Other	W	W	W	W	92,400
Total	486,000	112,000	192,000	68,400	859,000

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

1/ Data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

TABLE 9
ZINC CONTENT OF PRODUCTION AND SHIPMENTS OF
ZINC PIGMENTS AND COMPOUNDS 1/ IN THE UNITED STATES 2/

(Metric tons)

	1993		1994	
	Production	Shipments	Production	Shipments
Zinc chloride 3/	4,240	4,240	9,170	9,170
Zinc oxide	102,000	102,000	106,000	105,000
Zinc sulfate	20,500	19,900	22,700	22,000

1/ Excludes leaded zinc oxide and lithopone.

2/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits.

3/ Includes zinc content of zinc ammonium chloride.

TABLE 10
 REPORTED DISTRIBUTION OF ZINC CONTAINED IN ZINC OXIDE
 SHIPMENTS, BY COUNTRY 1/ 2/

(Metric tons)

Industry	1993	1994
Agriculture	1,580	1,900
Ceramics	3,435	3,014
Chemicals	22,747	27,623
Paints	3,420	3,550
Photocopying	2,335	2,268
Rubber	65,300	65,600
Other	3,112	1,477
Total	102,000	105,000

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

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ In addition, zinc oxide was imported as follows: 1993--35,900; 1994--41,300; distribution cannot be distinguished by industry.

TABLE 11
 U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY 1/

(Zinc content)

	1993		1994	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Belgium	48,600	\$22,000	86,700	\$36,100
Canada	110,000	35,900	147,000	67,600
Finland	14,800	3,990	--	--
Germany	33,300	13,900	30,200	12,600
Japan	68,800	26,700	68,400	24,500
Korea, Republic of	6,160	2,560	11,700	4,850
Russia	9,950	1,990	9,990	2,200
Spain	7,930	2,100	9,660	2,210
United Kingdom	10,600	7,070	1	3
Other	911	953	26,000	6,550
Total	311,000	117,000	389,000	157,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 12
U.S. EXPORTS OF ZINC COMPOUNDS 1/

	1993		1994	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Lithopone	216	\$436	426	\$393
Zinc chloride	1,140	947	947	939
Zinc compounds, n.s.p.f.	5,490	31,100	8,530	13,300
Zinc oxide	5,460	7,250	8,200	7,190
Zinc sulfate	4,760	8,830	5,230	8,500
Zinc sulfide	219	1,840	2,000	792

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits.

Source: Bureau of the Census.

TABLE 13
U.S. IMPORTS FOR CONSUMPTION OF ZINC PIGMENTS AND COMPOUNDS 1/

	1993		1994	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Lithopone	1,140	\$696	1,110	\$857
Zinc chloride	3,580	3,300	3,360	2,960
Zinc compounds, n.s.p.f.	312	686	225	519
Zinc oxide	35,900	40,500	41,300	45,800
Zinc sulfate	5,620	3,110	7,200	4,000
Zinc sulfide	2,050	4,970	1,950	5,530

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits.

Source: Bureau of the Census.

TABLE 14
ZINC: WORLD MINE PRODUCTION (CONTENT OF CONCENTRATE AND DIRECT SHIPPING ORE UNLESS NOTED), BY COUNTRY 1/ 2/

(Metric tons)

Country	1990	1991	1992	1993	1994 e/
Algeria	4,160	2,610	7,500 r/ e/	6,800 r/ e/	6,800
Argentina	38,700	39,300	41,000	31,400 r/	33,000
Australia	940,000	1,020,000	1,030,000 r/	1,010,000 r/	995,000
Austria	16,700	14,800	13,500	5,400 e/	--
Bolivia	104,000	130,000	144,000	123,000	101,000
Bosnia and Herzegovina e/	XX	XX	3,000	600	600
Brazil	158,000	130,000	149,000 r/	172,000 r/	172,000
Bulgaria	34,700	29,100	29,000 e/	25,000 e/	25,000
Burma	1,580	996 r/	1,080 r/	850 r/	1,800
Canada	1,200,000	1,160,000	1,320,000	1,010,000	984,000 3/
Chile	25,100	31,000	29,700	29,400 r/	30,000
China e/	619,000	750,000	758,000 r/	775,000 r/	780,000
Colombia	356	266	277	279	275
Czech Republic e/	XX	XX	XX	1,500 r/	100 3/
Czechoslovakia e/ 4/	9,800	11,600	7,500	XX	XX
Ecuador e/	100	100	100	100	100
Finland	51,700 e/	55,500	30,800	22,000 r/	16,900 3/
France	23,900	27,100	16,500	13,800 r/	1,000
Georgia e/	XX	XX	2,000	1,500	1,000
Germany: Western states	58,200	54,000	14,300	--	--
Greece	26,700	30,000	26,000	22,000 r/	20,000
Greenland	47,900	--	--	--	--
Honduras	29,600	38,300	29,000 r/	18,300 r/	16,700 3/
India	74,000	105,000 r/	153,000 r/	156,000 r/	144,000 3/
Iran	29,000 e/	70,000 e/	66,000 r/	77,000 r/	75,000
Ireland	167,000	188,000	194,000 r/	194,000 r/	195,000
Italy	43,000	36,300	35,000	7,100 r/	6,000
Japan	127,000	133,000	135,000	119,000	101,000 3/
Kazakhstan e/	XX	XX	250,000	250,000	175,000
Korea, North e/	230,000	200,000	200,000	210,000	210,000
Korea, Republic of	22,800	22,000	21,900	27,600 r/	25,000
Macedonia e/	XX	XX	16,000	16,000	16,000
Mexico	307,000	317,000	294,000	370,000	382,000 3/
Morocco	18,800	24,300	22,600	65,400 r/	77,000
Namibia	37,700	33,200	36,100	28,400	33,400 3/
Norway	17,500	18,900	21,100	14,300 r/	15,600 3/
Peru	598,000 r/	638,000 r/	605,000 r/	664,000 r/	665,000
Philippines	53	--	--	--	--
Poland	153,000 r/	145,000 r/	152,000 r/	152,000 r/	151,000
Romania	36,000	26,900	25,000	28,000 e/	25,000
Russia e/	XX	XX	150,000	170,000	140,000
Saudi Arabia	2,470	2,480	2,480 e/	2,500 e/	2,500
Serbia and Montenegro e/	XX	XX	19,700 r/	9,700 r/	8,000
Slovakia e/	XX	XX	XX	3,100	3,000
Slovenia	XX	XX	1,550	--	--
South Africa, Republic of	74,800	64,400	71,900	77,100 r/	76,400 3/
Spain	258,000	261,000 e/	205,000 r/	170,000 r/	150,000 3/
Sweden	164,000	161,000	172,000 r/	169,000 r/	160,000 3/
Thailand	61,500	87,000	62,000 e/	70,000 e/	56,000
Tunisia	7,000	5,000	4,090	2,400 r/	26,500 3/
Turkey 5/	39,100	32,500	32,500 r/	32,500 e/	35,000
U.S.S.R. e/ 6/	550,000	475,000	XX	XX	XX
United Kingdom	6,670	1,080	--	--	--
United States	543,000	547,000	552,000	513,000	598,000 3/
Uzbekistan e/	XX	XX	60,000	60,000	55,000
Vietnam e/	10,000	15,000	15,000	15,000	15,000
Yugoslavia 7/	83,800	75,000 e/	XX	XX	XX
Zaire	61,800	42,400	22,300	6,500 e/	6,500
Zambia 8/	32,100	19,800	14,700 r/	16,700 r/	--
Total	7,150,000 r/	7,270,000 r/	7,260,000 r/	6,960,000 r/	6,810,000

e/ Estimated. r/ Revised. XX Not applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through July 5, 1995.

3/ Reported figure.

4/ Dissolved Dec. 31, 1992.

5/ Content in ore hoisted.

6/ Dissolved in Dec. 1991.

7/ Dissolved in Apr. 1992.

8/ Data are for years beginning Apr. 1 of that stated. Content of ore milled. Mine closed June 1994.

TABLE 15
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1990	1991	1992	1993	1994 e/
Algeria, primary	23,600	24,900	31,000 e/	31,000 e/	35,000
Argentina:					
Primary	31,500	35,800	34,500	35,000 e/	34,500
Secondary e/	2,700	2,800	2,800	2,800	2,700
Total	34,200	38,600	37,300	37,800 e/	37,200
Australia:					
Primary 3/	304,000	322,000	333,000 r/	316,000 r/	326,000
Secondary e/	4,500	4,500	4,500	4,500	4,500
Total e/	309,000	327,000	338,000 r/	321,000 r/	331,000
Austria, primary and secondary	26,900 r/	15,900 r/	5,540 r/	6,820 r/	--
Belgium, primary and secondary	357,000	385,000	311,000	300,000 r/	310,000
Brazil:					
Primary	150,000	157,000 r/	180,000 r/	188,000 r/	190,000
Secondary	4,600	5,540 r/	7,000 r/	7,200 r/	7,000
Total	154,000	163,000	187,000 r/	195,000 r/	197,000
Bulgaria, primary and secondary	75,500	58,700	47,000	47,000 e/	45,000
Canada, primary	592,000	661,000	672,000	662,000	693,000 6/
China, primary and secondary e/	550,000	612,000	719,000	857,000 r/	975,000
Czechoslovakia, secondary 4/ 5/	1,000	800	1,100	XX	XX
Finland, primary	175,000	170,000	171,000	171,000 r/	173,000
France, primary and secondary	263,000	300,000	319,000 r/ e/	310,000 r/ e/	310,000
Germany:					
Eastern states, primary and secondary	12,700	XX	XX	XX	XX
Western states:					
Primary	288,000 r/	XX	XX	XX	XX
Secondary	49,900 r/	XX	XX	XX	XX
Total	350,000	346,000	383,000	381,000 r/	360,000 6/
Hungary, secondary e/	1,300	1,300	1,000	1,000	1,000
India:					
Primary	79,100	85,800	128,000 r/	142,000 r/	143,000 6/
Secondary e/	200	200	200	200	500
Total e/	79,300	86,000	128,000 r/	142,000 r/	144,000
Italy, primary and secondary	264,000	264,000	253,000	254,000 r/ e/	260,000
Japan:					
Primary	606,000	641,000	645,000	609,000 r/	572,000 6/
Secondary	126,000	138,000	136,000	135,000 r/	141,000 6/
Total	732,000	779,000	781,000	745,000 r/	713,000 6/
Kazakhstan, primary e/	XX	XX	250,000	250,000	175,000
Korea, North, primary e/	200,000	175,000	175,000	200,000	200,000
Korea, Republic of, primary	248,000	254,000	253,000	272,000	250,000
Macedonia, primary and secondary e/	XX	XX	32,000	32,000	32,000
Mexico, primary	199,000	189,000	152,000	210,000	220,000
Netherlands, primary 7/	209,000	211,000	210,000	207,000	210,000
Norway, primary	125,000	125,000	128,000	129,000 r/	132,000 6/
Peru, primary	121,000	155,000	138,000 r/	165,000 r/	165,000
Poland, primary and secondary	132,000	126,000	135,000	150,000 r/	156,000
Portugal, primary e/	5,500	2,100	2,200 r/	2,800	3,000
Romania, primary and secondary e/	11,500	8,700	11,600	14,000 r/	18,500
Russia: e/					
Primary	XX	XX	140,000	140,000	115,000
Secondary	XX	XX	60,000	60,000	50,000
Total	XX	XX	200,000	200,000	165,000
Serbia and Montenegro, primary and secondary	XX	XX	14,200	17,000 r/	3,900 7/
Slovakia, secondary 5/	XX	XX	XX	1,000 e/	1,000
Slovenia, primary and secondary e/	XX	XX	2,500	2,500	2,500
South Africa, Republic of, primary	91,900	91,700	83,200	96,200 r/	93,900 6/
Spain, primary and secondary	253,000	262,000	366,000	328,000 r/	325,000
Thailand, primary	63,300	62,200	60,600 r/	65,000 r/ e/	68,000
Turkey, primary	20,100	17,400	18,800 r/	17,000 r/	18,500 6/

See footnotes at end of table.

TABLE 15--Continued
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1990	1991	1992	1993	1994 e/
Ukraine, secondary e/	XX	XX	15,000 r/	12,000	10,000
U.S.S.R.: e/ 8/					
Primary	780,000	700,000	XX	XX	XX
Secondary	110,000	100,000	XX	XX	XX
Total	890,000	800,000	XX	XX	XX
United Kingdom, primary and secondary	93,300	101,000	96,800	102,000 r/	96,800 6/
United States:					
Primary	263,000	253,000	272,000	240,000	217,000 6/
Secondary	95,700	123,000	128,000	142,000	139,000 6/
Total	358,000	376,000	400,000	382,000	356,000 6/
Uzbekistan, primary e/	XX	XX	65,000	65,000	60,000
Vietnam, primary and secondary e/	10,000	10,000	10,000	10,000	10,000
Yugoslavia, primary and secondary 9/	114,000	78,000	XX	XX	XX
Zaire, primary	38,200	28,300	18,800	4,000 e/	4,000
Zambia, primary 10/	9,720 r/	6,340 r/	7,290 r/	3,450 r/	-- 6/
Total primary	4,620,000	4,370,000	4,170,000 r/	4,220,000 r/	4,100,000
Total secondary	396,000 r/	376,000	355,000 r/	365,000 r/	357,000
Total undifferentiated	2,160,000	2,570,000	2,700,000 r/	2,810,000 r/	2,900,000
Grand total	7,180,000	7,310,000	7,230,000 r/	7,400,000 r/	7,360,000

e/ Estimated. r/ Revised. XX Not applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ 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 5, 1995.

3/ Excludes zinc dust.

4/ All production in Czechoslovakia from 1990-92 came from Slovakia.

5/ Dissolved Dec. 31, 1992.

6/ Reported figure.

7/ Sales.

8/ Dissolved in Dec. 1991.

9/ Dissolved in Apr. 1992.

10/ Data are for years beginning Apr. 1 of that stated. Imperial smelter production ceased in Mar. 1993. Electrolytic production was suspended Jan. 1991 to Mar. 1993 and ceased in Jan. 1994.