TUNGSTEN

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Tungsten is a whitish-gray metal with many unique properties and a wide variety of commercial, industrial, and military applications. The largest use is as tungsten carbide in cemented carbides, which are wear-resistant materials used by the metalworking, mining, oil drilling, and construction industries. Tungsten alloy and pure tungsten metal wires, electrodes, and contacts are used in lighting, electronic, electrical, heating, and welding applications. Tungsten is also used to make heavy-metal alloys for armaments, heat sinks, radiation shielding, and weights and counterweights; superalloys for turbine blades; tool steels; and wear-resistant alloy parts and coatings. Tungsten alloys and composites are used as a substitute for lead in bullets and shot. Tungsten chemicals are used to make catalysts, corrosion-resistant coatings, dyes and pigments, fire-resistant compounds, lubricants, phosphors, and semiconductors.

U.S. apparent consumption of all tungsten materials in 2003 was 15% lower than apparent consumption in 2002, primarily because of lower shipments of ores and concentrates from the National Defense Stockpile (NDS) and increases in stocks held by U.S. industry. No U.S. tungsten mine production was reported in 2003. U.S. supply of tungsten raw materials comprised imports, tungsten-bearing scrap, releases from industry stocks, and sales of excess materials from the NDS. China continued to be the world's leading producer of tungsten concentrates and the largest supplier of imported tungsten materials to the United States. Prices of tungsten ore concentrates and ammonium paratungstate remained below the high levels reported in 2001. Salient U.S. tungsten statistics and world tungsten concentrate production for 2003 and the previous 4 years are listed in table 1.

Most data in this report have been rounded to three significant digits. Totals and percentages were calculated from unrounded numbers. Unless otherwise specified, all statistics in this report are in metric tons of contained tungsten.

Tungsten prices and many tungsten statistics from other sources are quoted in units of tungsten trioxide (WO_3). The short ton unit, which is used in the United States, is 1% of a short ton (20 pounds), and WO_3 is 79.3% tungsten. A short ton unit of WO_3, therefore, equals 20 pounds of WO_3 and contains 7.19 kilograms (kg) (15.86 pounds) of tungsten. The metric ton unit, which is used in most other countries, is 1% of a metric ton (10 kg). A metric ton unit of WO_3, therefore, equals 10 kg of WO_3 and contains 7.93 kg (17.48 pounds) of tungsten.

Legislation and Government Programs

The Defense National Stockpile Center (DNSC), U.S. Department of Defense, continued its negotiated sales of tungsten materials from the NDS. Two bid offerings were held during calendar year 2003—one for ferrotungsten in March, and one for tungsten metal powder in April. In June, DNSC announced that it would begin selling tungsten ores and concentrates under a Strategic Supply Alliance (SSA). Under this format, ores and concentrates available for sale were posted on DNSC's Web site (Defense National Stockpile Center, undated§[1]). Prequalified prospective purchasers could submit bids electronically via the Web site at any time, 24 hours per day and 7 days per week. No awards of tungsten ores and concentrates were made under the SSA format by the end of the calendar year (Defense National Stockpile Center, 2003, p. 6, 8).

As shown in table 2, during fiscal year 2003 (October 1, 2002, through September 30, 2003), 1,530 metric tons (t) of contained tungsten was sold. By the end of the fiscal year, 41 t of ferrotungsten and 728 t of tungsten ores and concentrates had been sold, but not shipped, from the stockpile (U.S. Department of Defense, 2004, p. 57).

During the calendar year, 167 t of tungsten contained in ferrotungsten and tungsten metal powder was sold. The quantities of tungsten materials remaining in the stockpile at the end of the calendar year, including those committed for sale and pending shipment, are listed in tables 1 and 2.

The Annual Materials Plan (AMP) for fiscal year 2003, which represented the maximum quantities of tungsten materials that could be sold, is listed in table 2. These quantities remained the same for fiscal year 2004 (October 1, 2003, through September 30, 2004) (U.S. Department of Defense, 2004, p. 10).

In January, the U.S. Fish and Wildlife Service (FWS) granted final approval to a tungsten-iron-nickel-tin shot product for hunting waterfowl and coots. Approval of this product, which contained 65% tungsten, brought the number of FWS-approved tungsten-based shot products to five. The other four products were tungsten-iron, tungsten matrix (which was a tungsten-polymer composite), tungsten-nickel-iron, and tungsten-polymer (U.S. Fish and Wildlife Service, 2003).

The effect of tungsten exposure on human health came under question during a Department of Health and Human Services (HHS) Centers for Disease Control and Prevention (CDC) study of a childhood leukemia cluster in Fallon, Churchill County, NV. The CDC study concluded that although residents of Churchill County had elevated levels of tungsten in their urine, exposure to tungsten in Churchill County did not appear to be unique when compared with other communities in Nevada. The CDC also concluded that not much was known about the potential health effects of tungsten exposure, and, as a result, the CDC nominated tungsten for toxicological studies under the National Toxicology Program. In addition, the Interagency Testing Committee, which was established under the Toxic Substances Control Act, recommended

[1]References that include a section mark (§) are found in the Internet References Cited section.

that 20 tungsten compounds be added to its Priority Testing List, and HHS's Agency for Toxic Substances and Disease Registry announced the availability of a draft toxicological profile on tungsten (Agency for Toxic Substances and Disease Registry, 2003; U.S. Public Health Service, 2003; U.S. Environmental Protection Agency, 2004; Centers for Disease Control and Prevention, 2003§).

Production

Domestic production statistics for tungsten are based on data collected by the U.S. Geological Survey (USGS) by means of two separate voluntary surveys. Statistics that result from these surveys are listed in tables 1 and 3.

The annual Tungsten Ore and Concentrate Survey covered the production, purchases, disposition, and stocks of tungsten ores and concentrates. No tungsten mine output was reported for the United States in 2003.

The monthly Tungsten Concentrate and Tungsten Products Survey canvassed companies that produced tungsten carbide powder, tungsten chemicals, and/or tungsten metal powder from ammonium paratungstate, tungsten-bearing scrap, and tungsten concentrate. Major U.S. processors of tungsten materials operating in 2003 included Allegheny Technologies Inc.'s Metalworking Products business, Huntsville, AL; Buffalo Tungsten Inc., Depew, NY; General Electric Co., Euclid, OH; Kennametal Inc., Latrobe, PA, and Fallon, NV; and Osram Sylvania, Inc., Towanda, PA.

In 2003, U.S. processors consumed more tungsten concentrates and ammonium paratungstate and less tungsten scrap than they did in 2002. Domestic production of ammonium paratungstate was higher than that of 2002. Net production of hydrogen-reduced tungsten metal powder and tungsten carbide powder produced from metal powder decreased by 25% in 2003 compared with that of 2002 (table 3).

At yearend, Philips Electronics North America Corp. sold the Philips Elmet plant in Lewiston, ME, to a former company executive. The new business, which was named Elmet Technologies, Inc., planned to continue manufacturing tungsten and molybdenum products in Lewiston. The company produced tungsten metal powder and tungsten products from metal powder including coils for cathodes in fluorescent lamps and filaments in incandescent lamps; electronic and semiconductor equipment components; furnace components; metallizing evaporation coils; pressed and sintered parts, such as semiconductor heat sinks; and wire, rod, and plate for various applications (MaineToday.com, 2003§; Elmet Technologies, Inc., undated§).

Consumption

U.S. apparent consumption of all tungsten materials, as calculated from net imports, primary and secondary production, and changes in Government and industry stock levels, was 10,100 t in 2003, which was 15% lower than the 2002 apparent consumption of 11,900 t. As compared with 2002, in 2003, the U.S. Government shipped lower levels of tungsten ores and concentrates from the NDS, and U.S. industry increased its inventories of tungsten materials.

Statistics on consumption of tungsten in end-use applications by U.S. metal consumers were developed from the voluntary Consolidated Consumers Survey. For this survey, approximately 65 tungsten consumers were canvassed on a monthly or annual basis. Reported consumption and stocks data in tables 1 and 4 include estimates to account for nonrespondents. Total U.S. reported consumption of tungsten materials to make end-use products in 2003 was approximately equal to that of 2002. Producers of cemented carbides used more tungsten in 2003 than in 2002; producers of chemical products, mill products for lighting and other industries, steels, superalloys, and other alloys used less tungsten in 2003 than in 2002. As compared with 2002, in 2003, U.S. industry consumed more ferrotungsten and tungsten carbide powder, and less tungsten chemicals, metal powder, and scrap.

Weekly reports of the number of operating drilling rigs give an indication of the demand for cemented carbide components used by industry to explore for or produce oil and natural gas. The number of rigs that operated in the United States steadily increased during 2003. During the first week in January, 837 rigs were operating and by the last week in December, 1,126 rigs were operating. In 2003, the average number of operating rigs in the United States was 1,032; 24% higher than the average of 830 operating rigs in 2002 (Baker Hughes Inc., undated§).

In 2003, total consumption of tungsten scrap by U.S. processors and consumers was 4,110 t of contained tungsten, which was a 6% decrease from the 4,380 t of scrap consumed in 2002.

Prices

Ammonium paratungstate is the most widely traded primary tungsten material, and as a result, its price has become a reference price for upstream materials such as tungsten ore concentrates and downstream materials such as tungsten metal powders and tungsten carbide powders (International Tungsten Industry Association, 1997, p. 32; Ross, 2001, p. 5).

Annual average prices for ammonium paratungstate and tungsten ore concentrates in the U.S. market were lower than those of 2002 (tables 1, 5). The U.S. ammonium paratungstate price reported by Platts Metals Week began the year at $58 to $62 per short ton unit [$64 to $68 per metric ton unit (mtu)] and then progressively increased to $65 to $70 per short ton unit ($72 to $77 per mtu) in late March, where it remained until October, when it dropped to $60 to $65 per short ton unit ($66 to $72 per mtu). In mid-November, it decreased to $55 to $60 per short ton unit ($61 to $66 per mtu) and in mid-December it returned to $65 to $70 per short ton unit ($72 to $77 per mtu). The U.S. ammonium paratungstate price reported by Metal Bulletin began the year at $58 to $62.50 per short ton unit ($64 to approximately $69 per mtu), and then increased to $60 to $66 per short ton unit ($66 to $73 per mtu) in late February, where it remained through yearend.

The U.S. spot tungsten ore concentrate price reported by Platts Metals Week, which began the year at $35 to $45 per short ton unit ($39 to $50 per mtu), was $40 to $50 per short ton unit ($44 to $55 per mtu) from late January to early May. It narrowed to $45 to $50 per short ton unit ($50 to $55 per mtu) in mid-May, where it remained until late September; it then decreased $40 to $45 per short ton unit ($44 to $50 per mtu) in early October, where it stayed until yearend.

Foreign Trade

The total tungsten content of U.S. exports was 5,090 t; 54% higher than the 3,310 t exported in 2002. With the exception of exports of ores and concentrates, other tungstates, and tungsten wire, exports of all tungsten materials increased as compared with those of 2002 (tables 6 through 10).

The total tungsten content of U.S. imports was 12,300 t; 16% higher than the 10,600 t imported in 2002. China, which continued to be the largest supplier of imported tungsten to the United States, provided 39% of all tungsten imports in 2003. The total tungsten content of imports from China increased by 9% in 2003 to 4,790 t, from 4,390 t in 2002. Of the imports from China, 50% was ammonium paratungstate; 16%, tungsten oxides; 11%, tungsten metal powders; 9%, tungsten carbide powders; 8%, ferrotungsten; 4%, tungsten waste and scrap; and the remainder was ores and concentrates, other tungstates, unwrought tungsten, and wrought tungsten. Other significant suppliers of tungsten materials were as follows: Canada, with 32% of the total tungsten imports to the United States; Israel and Portugal, with 5% each; Germany, 4%; and Bolivia, 3%.

As shown in table 11, U.S. imports of tungsten ores and concentrates increased by 15% in 2003 compared with those of 2002. Canada remained the largest supplier of tungsten ore concentrates. Imports of ores and concentrates from China decreased by 79% as compared with those of 2002. No ores or concentrates were imported from Kazakhstan and Russia, two countries that supplied significant quantities of these materials prior to 2001. In 2003, 94% of U.S. imports of ores and concentrates was from four countries—Canada (71%), Portugal (13%), Bolivia (7%), and Rwanda (3%).

U.S. imports of ammonium paratungstate increased by 10% as compared with those of 2002 (table 12). China continued to be the dominant supplier, providing 90% of U.S. ammonium paratungstate imports. In 2003, imports of calcium tungstate, tungsten carbide powders, tungsten metal powders, and tungsten waste and scrap increased compared with those of 2002, but those of ferrotungsten, other tungstates, tungsten oxides, other tungsten compounds, wrought tungsten, and unwrought tungsten decreased (tables 13, 14).

Net import reliance as a percentage of apparent consumption is used to measure the adequacy of current domestic production to meet U.S. demand. Net import reliance was defined as imports minus exports plus adjustments for Government and industry stock changes. Releases from stocks, including shipments from the NDS, were counted as part of import reliance, regardless of whether they were imported or produced in the United States. In 2003, net import reliance as a percentage of apparent consumption was 63%. Because there was no recorded U.S. mine production in 2003, about 63% of U.S. tungsten supply was from imports and stock releases and 37% was from scrap materials generated in the United States.

Structure of the World Industry

Estimated world tungsten mine production increased in 2003, primarily because of increases in production from Canada, China, and Russia. As shown in table 15, China remained the leading producer of tungsten concentrates. In addition to mine production and tungsten recovered from scrap, tungsten materials from stockpiles in the United States and Russia and other countries in the Commonwealth of Independent States (CIS) have been a significant component of world supply in recent years. Between 1992, when exports of tungsten from CIS countries first entered western markets, and the end of June 2003, an estimated 52,000 t of tungsten was exported from CIS countries. Information on the amount of tungsten that remained in CIS stockpiles and whether these materials would be released for export continued to be unavailable (Maby, 2003, p. 3).

World Review

Australia.—Australian Tungsten Pty. Ltd. considered several financial options for reopening the King Island scheelite mine. Past production from the mine, on King Island northwest of Tasmania, ceased in 1990, and Australian Tungsten purchased the mine from Rio Tinto Ltd. in 2001. Results from Australian Tungsten's prefeasibility study indicated that concentrates containing approximately 3 million metric ton units of WO_3 (approximately 23,800 t of tungsten) could be produced during an initial 9-year mine life. Australian Tungsten expected that mine life could be expanded to 20 years, based on scheelite occurrences outside the two main ore bodies (Gibson, 2003).

Austria.—Wolfram Bergbau und Hütten GmbH Nfg KG produced tungsten concentrates from the Mittersill scheelite mine in the Province of Salzburg. All these concentrates were converted to primary tungsten products at Wolfram Bergbau's Bergla tungsten processing plant in the Province of Steiermark.

Canada.—North American Tungsten Corp. Ltd. produced concentrates containing approximately 2,750 t of tungsten from its Cantung Mine in Northwest Territories, an 8% increase from the 2,550 t produced in 2002. In early January, North American Tungsten announced that it was required to scale back future production to meet the annualized sales quota in its supply agreement with Osram Sylvania Products Inc. and Sandvik AB of Stockholm, Sweden. North American Tungsten chose to operate the mine at maximum capacity, temporarily suspend operations for 5 weeks during March and April, and then avoid additional shutdowns by marketing excess concentrates to third parties. In early December, Osram and Sandvik notified North American Tungsten that they were terminating their purchase agreement and issuing a demand with respect to their loan obligation. Osram stated that although North American Tungsten demonstrated a strong production capability and successfully met startup and delivery targets from the mine, it was not able to overcome the challenges of low market prices, a tight investment market, and very unfavorable currency exchange rates. Osram planned to replace the shortfall from Cantung with supplies from other western sources. Directly after receiving the notices from Osram and Sandvik, North American Tungsten was forced to suspend operations, place the mine on care-and-maintenance status, and apply for protection under the Canadian Companies' Creditors Arrangement Act (Osram Sylvania, Inc., 2003; North American Tungsten Corp. Ltd., 2003a, b; 2004a).

China.—The Chinese Government continued with its efforts to make full use of its tungsten resources and to try to stabilize

world tungsten prices. The Ministry of Land and Natural Resources restricted total tungsten mine output to 43,380 t of concentrates containing 65% WO_3 from 118 mines, as compared with 43,730 t of concentrates from 123 mines in 2002. The breakdown of mine output by province or autonomous region was as follows: Jiangxi (60%), Hunan (20%), Yunnan (7%), Guangdong (6%), Guangxi and Inner Mongolia (2% each), Fujian and Zhejiang (1% each), and Anhui and Qinghai (0.1% each). The Ministry of Foreign Trade and Economic Cooperation (MOFTEC) reduced the annual quota for exports of tungsten materials from China to 16,300 t of contained tungsten, from 17,000 t in 2002 (Beijing Antaike Information Development Co., Ltd., 2002, p. 6; 2003, p. 5; Guang, 2002).

Some of the larger Chinese tungsten enterprises were consolidating into vertically integrated groups involved in the mining, processing, production of downstream products, and in some cases research and/or trade in tungsten materials and products. Cemented carbide producer Zhuzhou Cemented Carbide Group Corp. and mining company Hunan Shizhuyuan Nonferrous Metals Co. opened the joint-venture Chenzhou Diamond Tungsten Products Co. plant to produce ammonium paratungstate and tungsten oxide in Chenzhou, southern Hunan Province. The trading firm China National Metals and Minerals Import and Export Corp. (Minmetals) and the tungsten mining and processing group Jiangxi Rare Earth & Rare Metals Tungsten Group Corp. formed China Rare Earth & Rare Metals Tungsten Group Corp. Jiangxi was also a joint-venture partner with Ganzhou South Nonferrous Metals Plant in the Ganzhou Jiangwu Ferrotungsten Ltd. plant. Tungsten processor and products producer Xiamen Tungsten Co. Ltd. and Luanchuan Molybdenum Group were joint-venture partners in the Yulu tungsten mine in Henan Province (Metal Bulletin, 2003a, b; Platts Metals Week, 2003).

During the past decade, the growth in China's economy has resulted in a significant increase in consumption of tungsten materials to produce downstream products, such as cemented carbide tools, for the domestic market (Guang, 2003).

Peru.—Minera Malaga Santolalla owned tungsten mining and exploration interests in Peru, which included the Pasto Bueno Mine. Private handpicking by former miners resulted in approximately 50 t of tungsten in concentrates in 2001 (Walser, 2002, p. 4).

Portugal.—In April, Salish Ventures Inc. acquired Beralt Tin & Wolfram S.A., the Portugese company that owned the Panasqueira Mine in east central Portugal. Following the acquisition, Salish changed its name to Primary Metals Inc. and made plans to reduce production costs at the mine by replacing equipment that had exceeded its useful life, introducing low-profile mining equipment, and possibly increasing output. At yearend, Primary Metal's major concern was the need to renew long-term concentrate sales contracts for 2004 at prices that would permit operations to continue. Beralt was considering bankruptcy protection and close to suspending operations when the Government of Portugal provided a loan to cover employee payrolls for a period of 6 months (Primary Metals Inc., 2004).

Russia.—According to the State Statistics Committee, Russian production of tungsten concentrates was 14% higher than that of 2002, and production of tungsten metal was 2.1 times that of 2002. Primorsky GOK, Russia's largest tungsten concentrate producer, increased output from its Vostok-2 tungsten mine by 16.3%. The company planned to reequip the mine and mill complex in Primorskiy Kray and explore adjacent areas. During 2002, the company completed a third stage of its mine and began a project to upgrade its tailings dump. Late in the year, Lermontov Mining and Ore Co. reportedly declared itself bankrupt. The company operated the Lermontov Mine in Primorskiy Kray (Interfax International Ltd., 2003b; 2004a-c).

Several large plants in Russia produced ferrotungsten, some of which was used domestically for the production of various steel grades and some of which was exported. In an overview of the Russian tungsten industry, one analyst predicted that Russia would follow the same development pattern as China has in recent years—exports of tungsten concentrates would decrease, more concentrates would be processed domestically, and exports of higher value downstream materials and products would increase (Visser, 2002, p. 7-8).

Thailand.—SC Mining Co. Ltd. began producing high-grade ferberite concentrates from an open pit mine southwest of Chiang Mai in northern Thailand. The mine is fully funded and owned by the Som Chai family (Black, 2003).

Uganda.—In recent years, M/S Krone Uganda Ltd. has mined tungsten from the Nyamuliro deposit near Kabale. Production has been limited by outdated equipment, poor road conditions in the vicinity of the mine, and a lack of electricity, other than that provided by generators (Olaki, 2002§).

Uzbekistan.—Metek Metal Technology Ltd. of Beer-Sheva, Israel, completed a feasibility study on developing tungsten deposits in Uzbekistan. Production from the deposits, which was estimated to be 900 metric tons per year (t/yr) to 950 t/yr of tungsten, would be processed at the newly modernized facilities of the Uzbek Refractory and High-Temperature Metals Plant in Chirchik, Tashkent region (Visser, 2002, p. 6-7; Interfax International Ltd., 2003a).

Vietnam.—Tiberon Minerals Ltd. of Calgary, Alberta, Canada, began a bankable feasibility study on developing the Nui Phao deposit 80 kilometers north-northwest of Hanoi in Thai Nguyen Province. The deposit is a polymetallic skarn and greisen containing tungsten-, gold-, copper-, bismuth-, and fluorine-bearing minerals. As of November, measured and indicated resources totaled 60.5 million metric tons (Mt) grading 0.60% WO_3 equivalent and inferred resources were 27.4 Mt grading 0.50% WO_3 equivalent. A prefeasibility study indicated that the deposit could be mined by open pit methods and by using conventional gravity and mineral flotation methods, Tiberon could produce scheelite concentrates containing 6,000 t/yr of WO_3 (4,760 t/yr tungsten) and acid grade fluorspar, copper-gold, and bismuth concentrates. Tiberon planned to complete the feasibility study in 2004, after which it would finalize financing for construction. Tiberon hoped to begin production in 2006. The Nui Phao project was a joint venture among Tiberon (70%) and two Vietnamese companies, Thai Nguyen Mineral Co. (15%) and Export-Import Investment Co. Thai Nguyen (15%) (Tiberon Minerals Ltd., 2004, p. 1-7, 14).

Current Research and Technology

Researchers at the U.S. Department of Energy's Sandia National Laboratories showed that, when heated, filaments

made from microscopic tungsten lattices emitted more energy in certain bands of near-infrared wavelengths than solid tungsten filaments. The amount of energy emitted by the tungsten lattice filaments exceeded, by 4 to 10 times, that predicted by Planck's Law of Blackbody Cavity Radiation. The researchers concluded that the lattices apparently subjected energies passing through them to more complex photon-tungsten interactions than Planck imagined when he derived his system to predict the maximum emissions expected at any wavelength from simple heated solids (Sandia National Laboratories, 2003).

Outlook

Demand for tungsten tends to follow general economic conditions. Future consumption of tungsten in cemented carbides, which is the largest end-use sector, will depend on the performance of the following industries: automotive and aircraft production; construction; mining; oil and gas drilling; electronics manufacturing, where cemented carbide microdrills are used on circuit boards; large equipment manufacturing; and general manufacturing. Demand for tungsten is also influenced by changes in government spending for defense applications. In 2000, the consumption of tungsten to produce 5.56 millimeter "green ammunition" for the military was forecast to grow from nearly zero to between 450 t and 800 t of tungsten in 2005 (Middleton, 2000, p. 22). Since that forecast was made, defense spending has increased for the fight against global terrorism, which is expected to impact U.S. demand for tungsten during the next few years. The incremental increase in annual tungsten demand, based on approved military projects, including green ammunition, was forecast to reach 2,200 t to 2,700 t by the year 2006, depending on which ammunition type was produced. Other areas where tungsten is replacing lead in ammunition, such as commercial shot gun shell rounds and law enforcement bullet rounds, are expected to add another 170 t/yr to tungsten demand (Payne, 2002, p. 10-11).

World tungsten supply will continue to be dominated by Chinese production and exports. Future supply from China will be affected by the Chinese Government's success or failure in controlling the release of tungsten materials to the market. The Ministry of Land and Resources set the 2004 mine production quota at 52,000 t of concentrates containing 65% WO_3. Export licences for 2004 were reportedly limited to a total of 16,000 t of all tungsten products, a slight decrease from the 16,300 t allowed in calendar year 2003 (Platts Metals Week, 2004). During the first half of 2004, drought conditions in the tungsten mining regions of southern China resulted in severe shortages of electrical power, which affected the production of tungsten concentrates. Shortages of concentrates resulted in reduced output of ammonium paratungstate and ferrotungsten. This situation led to increases in the prices of tungsten concentrates, ammonium paratungstate, and ferrotungsten (Metal Bulletin, 2004a, b; Ryan's Notes, 2004).

In April 2004, North American Tungsten signed a settlement agreement with Osram and Sandvik. The company planned to pursue settlements with its unsecured creditors, obtain outside financing, and secure a customer for its concentrates so that it could resume production from the Cantung Mine (North American Tungsten Corp. Ltd., 2004b).

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TABLE 1
SALIENT TUNGSTEN STATISTICS[1]

(Metric tons, tungsten content, unless otherwise specified)

	1999	2000	2001	2002	2003
United States:					
Concentrates:					
Consumption	2,100 [2]	W	W	W	W
Exports	26	70	220	94	20
Imports for consumption	2,870	2,370	2,680	4,090	4,690
Stocks, December 31:					
Consumer	W	W	W	W	W
U.S. Government[3]	34,600	33,400	31,200 e	30,100	29,400
Price, per metric ton unit:					
U.S. spot quotation[4]	$47	$47	$64	$55	$50
European[5]	$40	$45	$65	$38	$45
Ammonium paratungstate:					
Production	7,050	W	W	W	W
Consumption[6]	7,490	8,980	9,240	8,860	9,410
Stocks, December 31, producer and consumer	376	W	W	68	W
Price, per metric ton unit:					
U.S. free market[7]	$56	$66	$99	$72	$69
U.S. market[4]	$57	$64	$97	$73	$72
European free market[7]	$51	$60	$89	$54	$62
Primary products:					
Net production[8]	8,500	9,780	9,520	12,000	9,030
Consumption[9]	8,730	9,280	9,090	9,490	9,590
Stocks, December 31:					
Producer[10]	1,070	1,160	699	666	807
Consumer[9]	534	522	729	394	423
U.S. Government[3]	2,700	2,110	1,120 e	947	765
World, production of concentrate	37,700	44,000	45,300	58,800 r	62,100 e

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Data are rounded to no more than three significant digits.

[2]Excludes 6 months of "Withheld" data.

[3]Defense National Stockpile Center. Includes material committed for sale pending shipment.

[4]Annual average calculated from weekly prices reported by Platts Metals Week.

[5]Annual average calculated from semiweekly prices reported by Metal Bulletin.

[6]Reported by tungsten processors.

[7]Annual average calculated from annual average high and low prices reported by Metal Bulletin.

[8]Includes only tungsten metal powder and tungsten carbide powder made from metal powder.

[9]Includes ammonium paratungstate, other tungsten chemicals, and scrap.

[10]Data exclude cast and crystalline tungsten carbide powder and chemicals.

TABLE 2
U.S. GOVERNMENT NATIONAL DEFENSE STOCKPILE TUNGSTEN STATISTICS IN 2003[1, 2]

(Metric tons, tungsten content)

Material	Inventory, yearend[3]		Annual Materials Plan,	Sales		Inventory decrease[4]	
	Fiscal year[5]	Calendar year	fiscal year[5]	Fiscal year[5]	Calendar year	Fiscal year[5]	Calendar year
Ores and concentrates	29,500	29,400	1,810	1,370	--	655	710
Ferrotungsten	305	303	136	141	141	183	165
Tungsten metal powder	463	463	136	28	27	28	16
Tungsten carbide powder	--	--	XX	--	--	4	--
Total	30,200	30,100	2,090	1,530	167	869	891

XX Not applicable. -- Zero.

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

[2]Includes stockpile- and nonstockpile-grade materials.

[3]Includes material committed for sale pending shipment.

[4]From previous year.

[5]Twelve-month period ending September 30, 2003.

Source: Defense National Stockpile Center.

TABLE 3
U.S. NET PRODUCTION AND STOCKS OF TUNGSTEN PRODUCTS[1, 2, 3]

(Metric tons, tungsten content)

	Hydrogen reduced metal powder	Tungsten carbide powder made from metal powder	Total
Net production:			
2002	7,970	4,070	12,000
2003	5,350	3,680	9,030
Producer stocks:			
December 31, 2002	427	239	666
December 31, 2003	544	263	807

[1]Net production equals gross production less quantity used to make other products in table.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Data for cast and crystalline tungsten carbide powder and tungsten chemicals are withheld to avoid disclosing company proprietary data; not included in "Total."

TABLE 4
U.S. REPORTED CONSUMPTION AND STOCKS OF TUNGSTEN PRODUCTS[1, 2, 3]

(Metric tons, tungsten content)

	2002	2003
Consumption by end use:		
Steels	313	312
Superalloys	426	W
Other alloys[4]	W	W
Cemented carbides[5]	4,820	5,210
Mill products made from metal powder	W	W
Chemical uses	133	129
Total	9,490	9,590

See footnotes at end of table.

TABLE 4--Continued
U.S. REPORTED CONSUMPTION AND STOCKS OF TUNGSTEN PRODUCTS[1, 2, 3]

(Metric tons, tungsten content)

	2002	2003
Consumption by form:		
Ferrotungsten	285	288
Tungsten metal powder	3,790	W
Tungsten carbide powder	4,840	5,300
Tungsten scrap	437	W
Other tungsten materials[6]	133	129
Total	9,490	9,590
Consumer stocks, December 31:		
Ferrotungsten	20	32
Tungsten metal powder	26	33
Tungsten carbide powder	293	301
Tungsten scrap	23	25
Other tungsten materials[6]	32	32
Total	394	423

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

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

[2]Does not include materials used in making primary tungsten products.

[3]Includes estimates.

[4]Includes welding and hard-facing rods and materials, wear- and corrosion-resistant alloys, and nonferrous alloys.

[5]Includes diamond tool matrices, cemented and sintered carbides, and cast carbide dies or parts.

[6]Includes tungsten chemicals.

TABLE 5
MONTHLY PRICE QUOTATIONS OF TUNGSTEN CONCENTRATES IN 2003

	Metal Bulletin (London), European market, 65% WO_3 basis, cost, insurance, and freight (c.i.f.)[1]				Platts Metals Week, U.S. spot quotations, 65% WO_3 basis, c.i.f. U.S. ports, including duty[2]			
	Dollars per metric ton unit			Dollars per short ton unit,	Dollars per short ton unit			Dollars per metric ton unit,
Month	Low	High	Average	average	Low	High	Average	average
January	32	47	40	36	35	50	43	47
February	37	47	42	38	40	50	45	50
March	37	48	43	39	40	50	45	50
April	40	50	45	41	40	50	45	50
May	42	50	46	42	40	50	45	50
June	42	50	46	42	45	50	48	52
July	42	50	46	42	45	50	48	52
August	42	50	46	42	45	50	48	52
September	42	50	46	42	45	50	48	52
October	42	50	46	42	40	45	43	47
November	42	50	46	42	40	45	43	47
December	42	50	46	42	40	45	43	47

[1]Combined wolframite and scheelite quotations. Low and high prices are reported semiweekly. Monthly averages are arithmetic averages of semiweekly low and high prices. The annual average price per metric ton unit of WO_3 of all semiweekly low and high prices was $45 in 2003. The average equivalent price per short ton unit of WO_3 was $41 in 2003.

[2]Low and high prices are reported weekly. Monthly averages are arithmetic averages of weekly low and high prices. The annual average price per short ton unit of WO_3 of all weekly low and high prices was $45 in 2003. The average equivalent price per metric ton unit of WO_3 was $50 in 2003.

TABLE 6
U.S. EXPORTS OF TUNGSTEN ORES AND CONCENTRATES, BY COUNTRY[1]

	2002			2003		
Country of destination	Gross weight (metric tons)	Tungsten content[2] (metric tons)	Value (thousands)	Gross weight (metric tons)	Tungsten content[2] (metric tons)	Value (thousands)
Argentina	--	--	--	(3)	(3)	$3
Australia	(3)	(3)	$4	--	--	--
Austria	4	2	59	--	--	--
Canada	--	--	--	1	1	15
China	2	1	28	--	--	--
Estonia	--	--	--	22	11	335
France	(3)	(3)	3	2	1	32
Germany	20	10	397	1	(3)	24
India	--	--	--	(3)	(3)	4
Indonesia	--	--	--	1	(3)	9
Ireland	1	(3)	9	2	1	32
Italy	--	--	--	1	(3)	11
Japan	3	1	42	1	(3)	17
Korea, Republic of	1	(3)	8	--	--	--
Mexico	1	1	26	(3)	(3)	10
Netherlands	11	6	168	4	2	62
Singapore	--	--	--	(3)	(3)	3
Sweden	--	--	--	(3)	(3)	7
Switzerland	(3)	(3)	4	--	--	--
Taiwan	(3)	(3)	5	2	1	25
Turkey	--	--	--	(3)	(3)	7
Ukraine	1	1	16	--	--	--
United Kingdom	138	71	2,230	1	1	25
Vietnam	--	--	--	1	(3)	10
Total	181	94	2,990	39	20	630

-- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Content estimated from reported gross weight.
[3]Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 7
U.S. EXPORTS OF AMMONIUM PARATUNGSTATE, BY COUNTRY[1]

	2002		2003	
Country of destination	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Germany	11	$101	63	$344
Japan	17	151	--	--
Netherlands	38	324	34	182
Spain	2	20	2	17
Total	69	596	99	543

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

Source: U.S. Census Bureau.

TABLE 8

U.S. EXPORTS OF TUNGSTEN METAL POWDERS, BY COUNTRY[1, 2]

	2002			2003		
Country of destination	Gross weight (metric tons)	Tungsten content[3] (metric tons)	Value (thousands)	Gross weight (metric tons)	Tungsten content[3] (metric tons)	Value (thousands)
Australia	14	11	$485	6	5	$229
Belgium	1	1	34	20	16	103
Brazil	20	16	572	12	10	455
Canada	39	31	1,070	36	29	1,160
Chile	1	1	36	2	1	52
China	(4)	(4)	12	1	1	62
Czech Republic	2	2	26	21	17	226
France	18	14	855	24	19	1,040
Germany	333	266	9,980	243	195	6,540
Hong Kong	1	1	50	2	1	92
India	2	2	67	493	395	4,020
Israel	52	42	553	123	99	1,100
Italy	13	10	516	36	29	1,520
Japan	16	13	727	18	14	804
Korea, Republic of	3	3	136	2	2	112
Mexico	6	5	142	17	13	432
Netherlands	1	1	40	4	3	104
Peru	2	2	64	1	1	23
Singapore	9	7	504	13	10	669
South Africa	3	2	89	1	1	21
Spain	3	2	109	4	3	167
Sweden	1	1	25	193	155	1,530
Switzerland	3	2	115	3	2	206
Taiwan	31	25	761	44	35	1,060
Thailand	2	2	42	(4)	(4)	8
Turkey	2	2	96	3	3	69
United Kingdom	38	30	1,750	90	72	2,180
Other	4	3	167	3	2	116
Total	620	496	19,000	1,420	1,130	24,100

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

[2]May include tungsten alloy powders.

[3]Content estimated from reported gross weight.

[4]Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 9
U.S. EXPORTS OF TUNGSTEN CARBIDE POWDER, BY COUNTRY[1]

	2002		2003	
Country of destination	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Argentina	1	$20	(2)	$13
Australia	4	116	5	67
Belgium	18	326	11	332
Brazil	4	73	4	80
Canada	103	2,460	60	1,540
Chile	(2)	4	2	41
China	18	283	1	20
Czech Republic	10	203	11	122
Finland	(2)	10	1	18
France	50	835	59	1,800
Germany	283	3,800	862	4,520
India	6	165	5	146
Ireland	12	815	9	420
Israel	15	66	--	--
Italy	14	412	7	165
Japan	20	724	20	484
Korea, Republic of	29	588	24	505
Luxembourg	5	91	9	172
Malaysia	(2)	3	1	12
Mexico	(2)	29	2	82
Netherlands	15	78	2	83
Peru	1	28	(2)	9
Singapore	3	144	1	101
South Africa	11	152	56	625
Spain	1	46	1	36
Sweden	199	2,760	64	989
Switzerland	6	233	6	141
Taiwan	14	216	1	21
Thailand	1	24	2	75
Turkey	1	28	--	--
United Kingdom	407	5,600	465	7,010
Other	1 r	97 r	2	54
Total	1,250	20,400	1,690	19,700

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

Source: U.S. Census Bureau.

TABLE 10
U.S. EXPORTS OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY[1]

Product and country of destination	2002 Tungsten content (metric tons)	2002 Value (thousands)	2003 Tungsten content (metric tons)	2003 Value (thousands)
Ferrotungsten and ferrosilicon tungsten:				
France	7	$16	--	--
Mexico	--	--	40	$95
Netherlands	--	--	18	110
United Kingdom	(2)	10	(2)	8
Total	7	26	59	214
Unwrought tungsten:[3, 4, 5]				
Australia	3	21	48	205
Belgium	1	4	17	76
Brazil	35	155	29	134
Canada	57	613	32	349
China	9	39	9	40
France	21	89	120	384
Germany	49	188	29	182
Hong Kong	10	46	5	22
Hungary	--	--	15	73
Ireland	--	--	4	15
Israel	20	97	25	107
Italy	4	20	36	153
Japan	53	240	95	866
Korea, Republic of	14	60	--	--
Macao	2	11	--	--
Malaysia	10	41	18	82
Mexico	129	550	190	843
Netherlands	2	7	56	240
New Zealand	4	33	2	21
Philippines	20	84	15	63
Singapore	4	31	4	23
Slovakia	--	--	4	18
Spain	1	5	7	30
Sweden	4	27	4	28
Switzerland	--	--	3	14
Taiwan	110	638	261	1,200
United Kingdom	121	631	24	133
Other	1	108	3	20
Total	682	3,740	1,060	5,330
Waste and scrap:[4]				
Armenia	--	--	16	94
Belgium	21	165	29	165
Brazil	5	37	7	112
Canada	4	60	9	63
China	61	470	288	1,660
France	3	69	--	--
Germany	45	357	81	396
Hong Kong	49	475	12	148
India	--	--	109	593
Ireland	1	3	2	9
Italy	--	--	2	10
Mexico	4	24	--	--
Netherlands	20	85	36	160
Panama	5	31	--	--
Singapore	2	9	8	57

See footnotes at end of table.

TABLE 10--Continued
U.S. EXPORTS OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY[1]

Product and country of destination	2002 Tungsten content (metric tons)	2002 Value (thousands)	2003 Tungsten content (metric tons)	2003 Value (thousands)
Waste and scrap--Continued:[4]				
Taiwan	17	$101	99	$446
Thailand	--	--	1	7
Turkey	1	5	--	--
United Kingdom	115	702	2	9
Total	353	2,590	702	3,930
Wrought tungsten:[3, 4, 6]				
Australia	2	140	(2)	49
Belgium	7	661	1	310
Brazil	1	249	3	356
Canada	63	2,720	53	2,390
China	2	353	12	1,110
Colombia	4	519	1	327
Czech Republic	(2)	4	2	237
Finland	3	92	--	--
France	7	1,100	6	898
Germany	52	2,040	88	3,610
Hong Kong	1	59	3	527
Hungary	5	713	(2)	233
India	16	804	20	885
Israel	2	555	1	511
Italy	6	539	5	488
Japan	37	2,300	38	3,520
Korea, Republic of	3	655	5	1,090
Mexico	32	3,450	22	2,440
Netherlands	2	248	(2)	59
Philippines	4	168	6	274
Poland	1	421	2	540
Singapore	2	357	1	312
Spain	13	524	18	806
Sweden	2	298	4	319
Taiwan	3	503	2	416
United Kingdom	14	1,440	11	1,600
Other	7	1,150	9	1,930
Total	292	22,000	314	25,200
Tungsten compounds:[7]				
Belgium	(2)	6	(2)	8
Canada	3	7	8	18
Czech Republic	--	--	1	11
Mexico	1	13	2	16
Netherlands	60	210	--	--
United Kingdom	1	6	--	--
Total	65	243	12	53

-- Zero.

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

[2]Less than 1/2 unit.

[3]May include alloys.

[4]Content estimated from reported gross weight.

[5]Includes bars and rods produced simply by sintering; excludes powders and waste and scrap.

[6]Includes bars and rods other than those produced simply by sintering, profiles, plates, sheets, strip, and foil; wire; and other wrought products.

[7]Includes only other tungstates.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF TUNGSTEN ORES AND CONCENTRATES, BY COUNTRY[1]

Country of origin	2002		2003	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Bolivia	513	$2,700	350	$1,770
Canada	2,510	14,400	3,340	17,500
China	285	1,550	59	289
Congo (Kinshasa)	--	--	28	96
Czech Republic	--	--	(2)	7
Hong Kong	61	308	--	--
India	22	108	--	--
Israel	4	77	--	--
Kenya	--	--	37	193
Mongolia	25	108	10	46
Peru	55	380	22	140
Portugal	550	4,520	589	5,010
Rwanda	34	157	127	595
Tanzania	--	--	11	55
Thailand	--	--	68	275
Uganda	30	185	8	43
United Kingdom	--	--	(2)	3
Vietnam	--	--	33	175
Total	4,090	24,500	4,690	26,200

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

Source: U.S. Census Bureau.

TABLE 12
U.S. IMPORTS FOR CONSUMPTION OF AMMONIUM PARATUNGSTATE, BY COUNTRY[1]

Country of origin	2002		2003	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
China	2,010	$13,500	2,380	$14,300
Germany	153	1,200	134	915
Hong Kong	33	223	--	--
Japan	90	860	77	658
Russia	42	173	36	207
United Kingdom	53	261	21	219
Vietnam	18	102	--	--
Total	2,400	16,300	2,640	16,300

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

Source: U.S. Census Bureau.

TABLE 13

U.S. IMPORTS FOR CONSUMPTION OF FERROTUNGSTEN AND FERROSILICON TUNGSTEN, BY COUNTRY[1]

Country of origin	2002		2003	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
China	422	$2,590	362	$2,310
Hong Kong	15	95	--	--
Russia	43	248	--	--
Taiwan	--	--	15	77
Total	480	2,930	377	2,380

-- Zero.

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

Source: U.S. Census Bureau.

TABLE 14

U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY[1]

Product and country of origin	2002		2003	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Tungsten metal powders:[2]				
Australia	--	--	10	$31
Austria	--	--	3	40
Belgium	3	$88	4	152
Canada	23	433	69	616
China	260	2,540	539	5,140
France	4	162	(3)	3
Germany	94	1,790	198	2,960
Israel	32	580	140	2,080
Japan	9	588	12	935
Korea, Republic of	98	1,480	94	1,600
Pakistan	10	57	--	--
Sweden	10	40	5	12
United Kingdom	100	1,100	21	212
Other	1	23	1	19
Total	642	8,870	1,090	13,800
Tungsten carbide powder:				
Armenia	8	138	--	--
Austria	22	438	23	436
Canada	345	4,470	460	6,820
China	192	2,480	432	4,400
France	5	383	3	369
Germany	99	1,880	64	1,240
Israel	173	2,650	319	4,370
Japan	1	66	12	215
Korea, Republic of	38	571	46	647
Luxembourg	14	270	7	96
Taiwan	2	18	--	--
Other	3 r	123 r	2	62
Total	901	13,500	1,370	18,700

See footnotes at end of table.

TABLE 14--Continued

U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY[1]

Product and country of origin	2002		2003	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Unwrought tungsten:[2, 4, 5]				
Canada	--	--	2	$8
China	56	$479	6	68
Germany	1	75	16	950
Japan	2	191	(3)	18
Pakistan	15	61	--	--
Singapore	21	295	8	50
Other	1	44	1	33
Total	97	1,140	33	1,130
Waste and scrap:				
Belgium	--	--	8	53
Brazil	--	--	16	80
Canada	30	130	34	184
China	250	2,070	201	1,560
Czech Republic	31	218	4	32
Estonia	--	--	10	42
Germany	141	717	79	513
Hong Kong	56	329	58	278
India	--	--	115	508
Israel	12	44	121	413
Japan	112	534	94	435
Korea, Republic of	17	43	123	189
Pakistan	53	241	16	77
Russia	17	90	16	83
Singapore	14	51	--	--
South Africa	56	272	60	358
Sweden	--	--	21	217
United Kingdom	94	494	132	641
Uzbekistan	18	162	--	--
Other	2 r	7 r	10	54
Total	903	5,400	1,120	5,720
Wrought tungsten:[2, 4, 6]				
Austria	21	2,570	25	2,300
Belgium	2	119	1	53
China	115	5,210	68	3,810
France	4	513	1	167
Germany	53	4,310	43	3,840
Hong Kong	6	450	7	486
Hungary	4	322	4	348
India	4	488	3	396
Israel	15	1,430	15	1,200
Japan	26	4,180	45	4,270
Netherlands	1	231	3	286
Russia	3	286	5	389
South Africa	4	40	(3)	3
United Kingdom	2	301	1	280
Other	6 r	884 r	4	783
Total	266	21,300	227	18,600
Tungsten oxides:				
China	781	5,450	743	5,050
France	(3)	8	--	--
Germany	4	77	7	174
Japan	13	36	--	--
United Kingdom	--	--	10	124
Total	799	5,570	760	5,350

See footnotes at end of table.

TABLE 14--Continued
U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY[1]

Product and country of origin	2002 Tungsten content (metric tons)	2002 Value (thousands)	2003 Tungsten content (metric tons)	2003 Value (thousands)
Calcium tungstate, Japan	(3)	$8	(3)	$25
Other tungstates:				
Australia	(3)	62	(3)	2
China	--	--	(3)	126
Germany	(3)	48	(3)	21
India	(3)	8	--	--
Japan	(3)	4	--	--
Total	1	122	(3)	149
Other tungsten compounds:[7]				
China	20	258	--	--
Germany	(3)	184	(3)	126
Japan	2	372	2	398
Korea, Republic of	(3)	10	--	--
United Kingdom	--	--	(3)	6
Ukraine	--	--	(3)	52
Total	23	824	3	582

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]May include alloys.
[3]Less than 1/2 unit.
[4]Content estimated from reported gross weight.
[5]Includes bars and rods produced simply by sintering; excludes powders and waste and scrap.
[6]Includes bars and rods other than those produced simply by sintering, profiles, plates, sheets, strip, and foil; wire; and other wrought products.
[7]Includes tungsten chlorides.

Source: U.S. Census Bureau.

TABLE 15
TUNGSTEN: WORLD CONCENTRATE PRODUCTION, BY COUNTRY[1, 2]

(Metric tons, tungsten content)

Country	1999	2000	2001	2002	2003e
Austria	1,610	1,600 e	1,237	1,400 e	1,400
Bolivia	334	382	533	400 r	442 [3]
Brazil	13	18 r	22 r	24 r	25
Burma[4]	87	74	48 r	30 r, e	30
Canada	--	--	--	2,550 e	2,750
China e	31,100	37,000	38,500	49,500	52,000
Korea, North e	500	500	500	600	600
Mexico	11	--	--	-- e	--
Mongolia e	27	52	63	35 r	40
Portugal	434	743	698 r	693 r	700
Russia e	3,500	3,500	3,500	3,400	3,900
Rwanda	41	108	142 r	153 r	150
Thailand e	30	30	53 r	30	30
Uganda	(5)	--	17	16 r	10
Total	37,700	44,000	45,300	58,800 r	62,100

eEstimated. rRevised. -- Zero.
[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Tungsten concentrates are believed to be produced in Nigeria, Peru, and Turkey and may be produced from tin-tungsten ores in Kyrgyzstan, but information is inadequate for making production estimates. Table includes data available through May 28, 2004.
[3]Reported figure.
[4]Includes tungsten content of tin-tungsten concentrate produced by state-owned mining enterprises under the Ministry of Mines.
[5]Less than 1/2 unit.