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, and construction industries. 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 composites are used as a substitute for lead in bullets and shot. Tungsten chemicals are used in catalysts, inorganic pigments, and high-temperature lubricants.

U.S. apparent consumption of all tungsten materials in 2001 remained approximately equal to that of 2000. U.S. reported consumption of tungsten to make end-use products decreased slightly as compared with that of 2000. No tungsten was mined in the United States in 2001. U.S. supply of tungsten raw materials comprised imports, tungsten-bearing scrap, releases from industry stocks, and sales of excess materials from the National Defense Stockpile. China continued to be the world's leading producer of tungsten concentrates and the largest supplier of imported tungsten materials to the United States. Over the course of the year, tungsten prices increased, leveled off, and then decreased. Salient U.S. and world tungsten statistics for 2001 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 National Defense Stockpile. Four bid offerings were held during calendar year 2001, one for each of the tungsten materials in the stockpile—ores and concentrates, ferrotungsten, tungsten carbide powder, and tungsten metal powder. DNSC's offering of ores and concentrates, which was held on January 11, was under a new multiyear format. The entire amount of ores and concentrates available for sale during fiscal year 2001 (October 1, 2000, through September 30, 2001) was offered, along with options on the entire amounts available for fiscal years 2002 through 2005. The multiyear contract was awarded to trading firm Comsup Commodities, Inc., of Fort Lee, NJ. Comsup received approximately 1,810 metric tons (t) of tungsten in ores and concentrates for fiscal year 2001, with an option for an additional 7,260 t over the next 4 years (Defense National Stockpile Center, 2000, 2001).

The sale of tungsten carbide powder in September depleted the entire amount of that material from the stockpile. As shown in table 2, 2,510 t of tungsten contained in ores and concentrates, ferrotungsten, tungsten metal powder, and tungsten carbide powder was sold during the calendar year.

During fiscal year 2001 (October 1, 2000, through September 30, 2001), 2,580 t of contained tungsten was sold. Of the tungsten materials sold, the following quantities, in metric tons of contained tungsten, had not been shipped by the end of the 2001 fiscal year: tungsten ores and concentrates, 1,980; tungsten carbide powder, 151; tungsten metal powder, 65; and ferrotungsten, 36 (U.S. Department of Defense, 2002, p. 57-58). Estimates of 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 2001 is listed in table 2. The AMP for fiscal year 2002 (October 1, 2001, through September 30, 2002) set the maximum quantities of tungsten materials that could be sold, in metric tons of contained tungsten, at the following levels: tungsten ores and concentrates, 1,810; ferrotungsten, 136; and tungsten metal powder, 136 (U.S. Department of Defense, 2002, p. 11).

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 was mined in the United States in 2001. At the end of March, Avocet Tungsten, Inc. (a U.S. subsidiary of Avocet Mining PLC of London, England), completed the sale of the land and other residual assets associated with its tungsten processing plant in Bishop, CA. By September, the nearby Pine Creek Mine had been closed and tailings reclamation activities were completed, with the exception of final approvals and post-closure monitoring and

maintenance (Avocet Mining PLC, 2001a, b).

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. The USGS received responses from 9 of the 10 processing operations on the survey; estimates were made for the nonresponding operation. Major U.S. processors of tungsten materials operating in 2001 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; OM Group, Inc. (OMG), Midland, MI, and St. George, UT; and Osram Sylvania, Inc., Towanda, PA.

In 2001, U.S. processors consumed significantly less tungsten concentrate, slightly more tungsten-bearing scrap, and 3% more ammonium paratungstate than they did in 2000. Domestic production of ammonium paratungstate was lower than that of 2000. Total net production of all primary tungsten products (hydrogen-reduced metal powder, all tungsten carbide powders, and tungsten chemicals) decreased by 7% in 2001 compared with that of 2000.

n.v. Umicore s.a. (formerly named n.v. Union Minière s.a.) of Brussels, Belgium, discontinued production of nanocrystalline tungsten carbide powders at its Nanodyne Inc. plant in Laurinburg, NC (n.v. Umicore s.a., 2002, p. 20).

In April, Air Products and Chemicals, Inc., announced that it had begun construction on a second tungsten hexafluoride plant at its Hometown, PA, manufacturing site. Air Products planned to complete phase one of the new plant by early 2002. The capacity of phase one would be 45 metric tons per year (t/yr), gross weight, of tungsten hexafluoride. The company would then be able to add an additional capacity of 91 t/yr, gross weight, when needed. The new plant would complement Air Products' existing tungsten hexafluoride plant at Hometown, which was expanded in 1999 to a capacity of 136 t/yr, gross weight. Tungsten hexafluoride is used by the electronics industry as a source of tungsten metal, which connects the aluminum in the layers within semiconductor devices (Air Products and Chemicals, Inc., 2001).

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 14,600 t in 2001, approximately the same as the apparent consumption of 14,400 t in 2000. In 2001, increases in imports, shipments of tungsten materials from the NDS, and consumption of tungsten scrap were nearly equal to an increase in exports and a decrease in industry stock releases.

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, more than 70 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 decreased slightly in 2001 compared with that of 2000. Producers of cemented carbides, mill products for lighting and other industries, steels, and chemical products used less tungsten in 2001 than in 2000; producers of superalloys and other alloys used more tungsten in 2001 than in 2000. As compared with 2000, in 2001, U.S. industry consumed less ferrotungsten, tungsten carbide powder, and tungsten chemicals, and more tungsten metal powder and tungsten 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. During the early months of 2001, the trend in the number of rigs that operated in the United States continued the increase that began in April 1999. The rig count increased from 1,107 the first week of January to 1,262 in late May and then remained relatively stable until early August, when it began to decrease. The highest count during 2001 was 1,293 in mid-July and the lowest count was 882 in late December. In 2001, the average number of operating rigs in the United States was 1,156; 26% higher than the average of 918 operating rigs in 2000 (Baker Hughes Inc., undated§[1]).

In 2001, total consumption of tungsten scrap by U.S. processors and consumers was 5,390 t of contained tungsten, which was a 3% increase from the 5,210 t revised scrap consumption in 2000.

Prices

Because ammonium paratungstate is the most widely traded primary tungsten material, 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). During the early months of 2001, published prices for ammonium paratungstate in the U.S. market increased as a result of continued efforts by China, the world's largest tungsten supplier, to control its industry (covered under the World Review section below). By midyear, ammonium paratungstate prices had nearly doubled as compared with those of mid-2000. The U.S. ammonium paratungstate price reported by Platts Metals Week stabilized at a high of $93 to $98 per short ton unit [$103 to $108 per metric ton unit (mtu)] in late April through May. The U.S. ammonium paratungstate price reported by Metal Bulletin was highest during early May through early July at $95 to $98 per short ton unit ($105 to $108 per mtu).

During the latter part of the year, U.S. ammonium paratungstate prices decreased and by yearend 2001 had returned to the levels reported in late 2000. The decrease in prices was attributed to a severe reduction in demand for tungsten end products resulting from a slowing of the world economy, which was compounded by the terrorist attacks in the United States on September 11; an increase in smuggling of nonlicensed primary tungsten materials, including tungsten concentrates, from China; and the buildup of inventories by consumers and traders (Avocet Mining PLC, 2001a; North American Tungsten Corp. Ltd., 2002b; Ross, 2001, p. 5, 13).

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

Annual average prices of ammonium paratungstate are listed in table 1.

Prices of tungsten concentrates are listed in tables 1 and 5. The U.S. spot tungsten ore concentrate price reported by Platts Metals Week reached a high of $60 to $70 per short ton unit ($66 to $77 per mtu) during late March through late September. The concentrate price reported by Metal Bulletin was highest during mid-February through early August at $67 to $74 per mtu.

Foreign Trade

The total tungsten content of U.S. exports was 5,080 t; 77% higher than the 2,870 t exported in 2000. As shown in tables 6 through 10, with the exception of ferrotungsten, exports of all tungsten materials increased as compared with those of 2000.

The total tungsten content of U.S. imports was 6% higher than that of 2000. China, which continued to be the largest supplier of imported tungsten to the United States, provided 61% of all tungsten imports in 2001. The total tungsten content of imports from China increased by 34% in 2001 to 6,570 t, from 4,910 t in 2000. Of the imports from China, 35% was ammonium paratungstate; 21%, tungsten oxides; 19%, ores and concentrates; 8%, tungsten metal powders; 6%, tungsten waste and scrap; 5%, ferrotungsten; 3%, tungsten carbide powder; and the remainder, calcium tungstate, other tungstates, other tungsten compounds, unwrought tungsten, and wrought tungsten.

Other significant suppliers of tungsten materials were as follows: Bolivia, with 6% of the total tungsten imports to the United States; Germany and Portugal, with 5% each; Canada and Russia, with 4% each; and Hong Kong, with 3%. Total imports from Russia, which in recent years had been the second largest supplier of imported tungsten materials to the United States, decreased by 73% in 2001 to 466 t of contained tungsten, as compared with 1,710 t in 2000. In 2001, Russian imports were mainly tungsten oxide (55%), ammonium paratungstate (34%), and tungsten waste and scrap (11%).

As shown in table 11, U.S. imports of tungsten ores and concentrates increased by 13% in 2001 compared with those of 2000. Imports of ores and concentrates from China increased by 81% as compared with those of 2000. In contrast, no ores or concentrates were imported from Kazakhstan and Russia, two countries which formerly supplied significant quantities of these materials. In 2001, 96% of U.S. imports of ores and concentrates was from six countries—China (47%), Bolivia (23%), Portugal (18%), Hong Kong (4%), and Mongolia and Peru (2% each).

U.S. imports of ammonium paratungstate increased 20% as compared with those of 2000 (table 12). China continued to be the dominant supplier, providing 83% of U.S. ammonium paratungstate imports.

In 2001, imports of calcium tungstate, other tungstates, other tungsten compounds, tungsten metal powders, and tungsten waste and scrap increased compared with those of 2000, but those of ferrotungsten, tungsten carbide powder, tungsten oxides, unwrought tungsten, and wrought tungsten decreased (tables 13-14).

Net import reliance as a percent 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 2001, net import reliance as a percent of apparent consumption was 63%. Because there was no U.S. mine production in 2001, about 63% of U.S. tungsten supply was from imports and stock releases and 37% was from scrap materials generated in the United States.

World Review

As shown in table 15, estimated world production of tungsten concentrates was essentially the same as that of 2000. China remained the leading world producer of tungsten concentrates. In addition to mine production and tungsten recovered from scrap, tungsten materials from stockpiles in 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 2000, an estimated 44,000 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. During the past few years, however, the quantity of tungsten exported from the CIS has been decreasing (Kerr, 2001, p. 18-19; Maby, 2001, p. 3, 13; Ross, 2001, p. 11-12).

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. In late 2001, Wolfram Bergbau signed a contract to purchase tungsten concentrates from Spain (discussed under Spain below).

Bolivia.—Early in the year, high prices for tungsten prompted Bolivian producers to increase their mine output. Empresa Minera Urania S.A. increased its production by adding to its labor force and by reinvesting revenues to improve infrastructure and to open new areas at its underground mine. Urania also confirmed plans to recommission two nearby mines, which had been dormant. International Mining Co. began to raise financing to expand ore production at its tungsten-tin operation at La Chojilla by 50%. In March, North American Tungsten Corp. Ltd. announced that it had signed a letter of intent with Empresa Minera Himalaya Ltda. to study the feasibility of developing a tungsten-tin deposit in Murillo and Sadyumyai Provinces. North American Tungsten chose to allow the letter to expire, however, in order to focus its efforts on the CanTung Mine in Canada (Metal Bulletin, 2001a; North American Tungsten Corp. Ltd., 2001a, b).

Brazil.—Verena Minerals Corp. of Toronto, Canada, began a pre-feasibility study on its 100%-owned Bonfim property in Rio Grande do Norte State in northeastern Brazil. The study confirmed that the deposit, which was a gold-tungsten-bismuth skarn, might contain total resources of more than 1 million

ounces of gold and 30,000 t of WO_3. Metallurgical testwork on samples from the deposit indicated that more than 90% of the gold could be recovered by using cyanide leaching and that a high-grade scheelite concentrate could be produced by using standard shaking tables. In early 2002, Verena Minerals purchased the property immediately north of Bonfim, where tungsten had been mined from 1969 until 1981. Verena Minerals planned to continue fieldwork on the expanded property and to build a pilot plant for metallurgical testwork (Verena Minerals Corp., 2002, p. 2, 5-6, 9).

Canada.—In March, North American Tungsten signed a letter of intent with Osram Sylvania Products Inc. and AB Sandvik Coromant of Stockholm, Sweden. In the letter, and in formal agreements signed in May, Osram and Sandvik agreed to purchase all of the tungsten concentrates to be produced from North American Tungsten's Cantung Mine in Northwest Territories. The agreement provided for the guaranteed purchase of the concentrates and included minimum floor prices for the various grades of concentrates to be produced, and a sliding scale discount from published tungsten prices above the floor prices. Osram and Sandvik would provide a cash advance to be used for the startup and retrofitting of the mine and would have an exclusive option for future participation in North American Tungsten's other tungsten projects, specifically the Mactung deposit 160 kilometers (km) northwest of the mine.

The Cantung Mine first opened in 1962 and was operated almost continuously until 1986, when it was placed on care and maintenance pending improved market conditions. Ore mined from the underground operation was expected to produce three grades of scheelite concentrates—a roasted primary gravity concentrate grading 75% WO_3, a gravity concentrate grading 35% WO_3, and a flotation concentrate grading 25% WO_3. Osram was to process Sandvik's share of the concentrates purchased from the mine. The purchase agreement covered existing reserves containing an estimated 900,000 mtu (approximately 7,140 t of tungsten), which were expected to be mined over a 3-year period, and potential additional concentrates that might be produced from underground or open pit operations at Cantung.

By yearend, North American Tungsten had rehabilitated the plant, mine, and mill infrastructure; entered into an access road maintenance agreement with the Yukon Government; and signed the necessary supply and service contracts. In December, the company assumed all operating and maintenance activities at the mine and in January 2002 it began pre-production activities. The first concentrates were shipped from the mine in February (North American Tungsten Corp. Ltd., 2002a, p. 19, 21, 24, 36, 52-53, 64).

In July, Copper Ridge Explorations Inc. announced that it had reached an agreement to acquire the Kalzas property in central Yukon Territory. The property contained a stockwork and sheeted vein complex of tungsten, tantalum, and tin mineralization, which had the potential to be developed into an open pit mine. Assays on samples collected from trenches across a mineralized zone previously identified by Union Carbide Corp. confirmed earlier geochemical results. Copper Ridge planned to undertake a program of shallow core drilling on the property (Copper Ridge Explorations Inc., 2001a, b, c, 2002).

China.—The Chinese Government continued with its efforts to make full use of its tungsten resources and to try to stabilize world tungsten prices. In 2001, the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) set the quota for exports of tungsten materials from China at 17,000 t of contained tungsten, a slight decrease from the quota of 17,400 t in 2000. When granting export licenses, priority was given to the larger processors, producers, and traders. The Government evaluated mines and processing plants on the basis of their production scale, equipment level, product quality, environmental protection, International Standards Organization qualification, and market share. Those that did not meet the established qualifications were to be closed. For example, in June, the Ministry of Land and Natural Resources announced that it planned to close small privately owned mines that were operating without licenses and small ore-processing plants established after January 15, 1991, that did not have their own mines. Another aspect of the Government's efforts to develop the Chinese tungsten industry was the emphasis on increasing the proportion of value-added downstream tungsten products produced and exported. Export statistics show that over the period of 1996 through June 2001, the proportion of downstream products has increased relative to that of tungsten concentrates and ammonium paratungstate (China Metal Market, 2001, p. 5; Guang, 2001).

Portugal.—Beralt Tin & Wolfram S.A. (a subsidiary of Avocet Mining PLC), began an investment program to improve production efficiencies, reduce production costs, and expand capacity at the Panasqueira Mine in east central Portugal. To accomplish these goals, Beralt planned to extend underground mine development to delineate a larger reserve base and more production areas and to refurbish mine infrastructure and equipment. Production was to be increased to an interim level of 109,000 mtu (864 t of tungsten) per year, after which work would begin towards expanding production by an additional 40% (Avocet Mining PLC, 2001b, c, 2001a§). Production was brought up to 42,900 mtu (340 t of tungsten) during the 6-month period of April through September 2001. However, because of decreasing prices for tungsten concentrates during the latter part of the year, Avocet Mining decided to defer further investment in the expansion program until market conditions improved. By early 2002, the average price of tungsten concentrates had fallen below the cost of production at the Panasqueira Mine, and Beralt limited its production to that for customers with long-term contracts with minimum floor prices above the mine's cash cost of production (Avocet Mining PLC, 2002, 2001b§).

Russia.—According to the State Statistics Committee, Russian production of tungsten concentrates was 1.5% higher than that of 2000, and production of metallic tungsten was 0.4% lower than that of 2000 (Interfax International Ltd., 2002b). Russia's Chelyabinsk Electrometallurgical Plant has reportedly been mothballed, leaving China as the only significant producer of ferrotungsten in the world (Kerr, 2001, p. 3-4).

The Primorsky tungsten mine and mill complex in Primorskiy Kray completed a $2 million modernization program. Credit for the upgrade was provided by trading firm Comsup Commodities Inc. and Japanese tungsten processor Japan New Metals Co.,

Ltd. The upgrade was expected to improve production efficiency rather than volume. Because of a reduced demand for tungsten concentrates, the complex was reportedly operating at about 50% capacity in October and began a 1-month shutdown at the end of January 2002. Approximately one-half of Primorsky's tungsten concentrates was exported to Japan, Europe, and the United States, and the remainder was sold primarily to the A/O Gidrometallurg processing plant in Nalchik. In addition, a small volume of concentrates was sold to the Uzbek Refractory and High-Temperature Metals Plant in Chirchik, Uzbekistan (Metal Bulletin, 2001b, 2002a).

During the year, Avocet Mining conducted a strategic review of its investment in the Lermontov Mine in Primorskiy Kray. Avocet Mining held a 10.6% interest in the mine, which reportedly was operating at low levels in 2001 (Metal Bulletin, 2002a; Avocet Mining PLC, 2001a§).

The Tyrnyauzsky GOK mining and beneficiation plant in the Republic of Kabardino-Balkaria reportedly produced 20% less tungsten concentrate in 2001 than it did in 2000. The decrease was attributed to "mountain torrents" during the second half of the year, which damaged the facilities and interfered with mining operations. Concentrates from Tyrnyauz were converted to tungsten anhydride at the Gidrometallurg plant (Interfax International Ltd., 2002c).

Spain.—Wolfram Bergbau of Austria signed a contract for the purchase of tungsten concentrates from the Castilia y Leon region in Spain. The concentrates would be produced from scheelite ore reserves. Mining was to begin as an open pit operation, which would later be developed into an underground operation. The mine was expected to produce approximately 800 t/yr of tungsten in concentrates for 4 years. Wolfram Bergbau would be the sole buyer of the concentrates. The first delivery to Wolfram Bergbau's plant in Austria was scheduled for late 2002 (Metal Bulletin, 2001c).

Uzbekistan.—Uzbek Refractory and High-Temperature Metals Plant in Chirchik, Tashkent region, processed tungsten concentrates from Russia and produced 260 t of tungsten as metal powders, hard alloys, and fabricated products, an increase of 36% from the 191.7 t produced in 2000. The plant has been running at less than one-third capacity in recent years because of reduced demand and a shortage of working capital (Interfax International Ltd., 2002d).

Metek Metal Technology Ltd. of Beer-Sheva, Israel, reportedly signed an agreement in October to form a joint venture with Uzbek companies to develop tungsten deposits in Uzbekistan. Metek is a producer of tungsten alloys, carbide powder, metal powder, and oxide from secondary (scrap) feeds (Radio Free Europe/Radio Liberty, 2001§; Ramat Hovav Local Industrial Council, undated§).

Vietnam.—Tiberon Minerals Ltd. of Calgary, Alberta, Canada, continued to explore the Nui Phao deposit 80 km north-northwest of Hanoi. The deposit is a polymetallic skarn and greisen containing tungsten-, gold-, copper-, bismuth-, and fluorine-bearing minerals, which could be mined by open pit methods. At yearend, Tiberon reported that the deposit's limits had not yet been defined, but that the current overall resource (including measured, indicated, and inferred resources) was estimated at 24.4 million metric tons (Mt) grading 0.39% WO_3, 0.34 grams per metric ton gold, 0.28% copper, 0.13% bismuth, and 10.6% fluorite. The tungsten resources were estimated as follows: measured, 5.73 Mt grading 0.42% WO_3; indicated, 11.47 Mt grading 0.36% WO_3; and inferred, 7.23 Mt grading 0.42% WO_3. Initial results from metallurgical testwork conducted on ores from Nui Phao indicated that 80% of the tungsten and 75% of the copper was recoverable by using a combination of conventional gravity and flotation beneficiation methods. Tiberon held a 70% interest in the project, with two Vietnamese companies holding the remaining 30% (Tiberon Minerals Ltd., 2002, p. 2-5).

Outlook

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Demand for tungsten tends to follow general economic conditions and is expected to increase when the world's economies improve. 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; semiconductor manufacturing, where cemented carbide microdrills are used; and other manufacturing. Some recent developments in uses for tungsten include the shift from lead to tungsten for military and recreational ammunition and the use of tungsten by the sporting goods industry to make golf clubs and golf ball cores. The consumption of tungsten to produce 5.56 millimeter "green ammunition" for the military was forecast to grow from nearly zero in 2000 to between 450 t and 800 t of tungsten in 2005 (Middleton, 2000, p. 22).

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. Higher prices during the second half of 2000 and the first half of 2001 encouraged an increase in the production of tungsten concentrates outside China. For example, North American Tungsten reopened the Cantung Mine in Canada. The decrease in prices that began during the second half of 2001 and extended into the first half of 2002, however, caused some producers to cut back their output (Avocet Mining PLC, 2002; Interfax International Ltd., 2002a; Metal Bulletin, 2002a, b).

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TABLE 1
SALIENT TUNGSTEN STATISTICS 1/

(Metric tons, tungsten content, unless otherwise specified)

	1997	1998	1999	2000	2001
United States:					
Concentrates:					
Consumption	6,590	3,210 2/	2,100 2/	W	W
Exports	12	10	26	70	220
Imports for consumption	4,850	4,750	2,870	2,370	2,680
Stocks, December 31:					
Consumer	658	514	W	W	W
U.S. Government 3/	34,600	34,600	34,600	33,400	31,100 e/
Price, per metric ton unit:					
U.S. spot quotation 4/	$64	$52	$47	$47	$64
European 5/	$47	$44	$40	$45	$65
Ammonium paratungstate:					
Production	5,380 6/	838 7/	7,050	W	W
Consumption	9,300	10,000	7,490	8,980	9,240
Stocks, December 31, producer and consumer	W	603	376	W	W
Price, per metric ton unit:					
U.S. free market 8/	$77	$66	$56	$66	$99
U.S. market 4/	$83	$65	$57	$64	$97
Primary products:					
Net production 9/	8,300	9,630	8,500	9,780 r/	9,520
Consumption 10/	8,800 r/	9,520 r/	8,730 r/	9,280 r/	9,090
Stocks, December 31:					
Producer 11/	1,210	1,340	1,070	1,160	699
Consumer 10/	610	524	534	522 r/	729
U.S. Government 3/	2,700	2,700	2,700	2,110	1,120 e/
World, production of concentrate	33,200	37,400	37,900 r/	44,200 r/	44,200 e/

e/ Estimated. r/ Revised. 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/ Excludes 4 months of "Withheld" data.
7/ Excludes 11 months of "Withheld" data.
8/ Annual average calculated from annual average high and low prices reported by Metal Bulletin.
9/ Includes only tungsten metal powder and tungsten carbide powder made from metal powder.
10/ Includes scrap.
11/ Data for 1997-98 exclude cast and crystalline tungsten carbide powder. Data for 1999-2001 exclude cast and crystalline tungsten carbide powder and chemicals.

TABLE 2
U.S. GOVERNMENT NATIONAL DEFENSE STOCKPILE TUNGSTEN STATISTICS IN 2001 1/ 2/

(Metric tons, tungsten content)

	Inventory, yearend 3/		Annual Materials Plan,	Sales		Inventory decrease 4/	
Material	Fiscal year 5/	Calendar year e/	fiscal year 5/	Fiscal year 5/	Calendar year	Fiscal year 5/	Calendar year e/
Ores and concentrates	32,100	31,100	1,810	1,870	1,870	1,440	2,290
Ferrotungsten	580	487	136	200	200	235	288
Tungsten metal powder	679	612	136	136	65	78	145
Tungsten carbide powder	151	25	454	377	377	529	552
Total	33,500	32,200	2,540	2,580	2,510	2,280	3,280

e/ Estimated.
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, 2001.

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:			
2000	5,290 r/	4,490	9,780 r/
2001	5,190	4,330	9,520
Producer stocks:			
December 31, 2000	621	538	1,160
December 31, 2001	367	332	699

r/ Revised.
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)

	2000	2001
Consumption by end use:		
Steels	408	389
Superalloys	498 r/	599
Other alloys 4/	W	W
Cemented carbides 5/	5,960	5,650
Mill products made from metal powder	W	W
Chemical uses	89	80
Total	9,280 r/	9,090
Consumption by form:		
Ferrotungsten	388	343
Tungsten metal powder	2,270	2,360
Tungsten carbide powder	5,980	5,680
Tungsten scrap	554 r/	618
Other tungsten materials 6/	89	80
Total	9,280 r/	9,090
Consumer stocks, December 31:		
Ferrotungsten	33	37
Tungsten metal powder	29	34
Tungsten carbide powder	381	596
Tungsten scrap	62 r/	43
Other tungsten materials 6/	17	19
Total	522 r/	729

r/ Revised. 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 2001

	Metal Bulletin (London), European market, 65% WO_3 basis, 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	55	73	64	58	40	45	43	47
February	66	74	70	64	40	45	43	47
March	67	74	71	64	40	70	55	61
April	67	74	71	64	60	70	65	72
May	67	74	71	64	60	70	65	72
June	67	74	71	64	60	70	65	72
July	67	74	71	64	60	70	65	72
August	65	74	70	63	60	70	65	72
September	58	70	64	58	60	70	65	72
October	54	65	60	54	55	65	60	66
November	49	62	56	50	55	65	60	66
December	40	57	49	44	50	65	58	63

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 $65 in 2001. The average equivalent price per short ton unit of WO_3 was $59 in 2001.

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 $58 in 2001. The average equivalent price per metric ton unit of WO_3 was $64 in 2001.

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

	2000			2001		
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	--	--	--
Austria	--	--	--	18	9	$181
Belgium	--	--	--	2	1	41
China	5	2	71	9	4	158
France	1	1	23	--	--	--
Germany	(3/)	(3/)	3	36	19	1,180
Hong Kong	--	--	--	(3/)	(3/)	5
Hungary	1	1	20	--	--	--
Italy	2	1	31	4	2	62
Japan	10	5	148	9	4	159
Korea, Republic of	15	8	190	4	2	59
Luxembourg	1	1	13	--	--	--
Netherlands	54	28	832	83	43	815
Russia	16	8	250	164	85	1,300
Singapore	--	--	--	(3/)	(3/)	8
Slovakia	(3/)	(3/)	4	--	--	--
South Africa	(3/)	(3/)	9	--	--	--
Sweden	(3/)	(3/)	7	30	16	517
Switzerland	--	--	--	(3/)	(3/)	3
Taiwan	1	(3/)	10	(3/)	(3/)	4
United Kingdom	28	15	439	66	34	1,050
Total	135	70	2,050	426	220	5,550

-- 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/

Country of destination	2000 Tungsten content (metric tons)	2000 Value (thousands)	2001 Tungsten content (metric tons)	2001 Value (thousands)
Belgium	2	$17	--	--
Czech Republic	25	204	50	$367
Denmark	14	143	--	--
France	1	13	--	--
Germany	10	87	137	1,030
Hungary	--	--	2	13
Korea, Republic of	--	--	2	22
Mexico	(2/)	4	1	9
Netherlands	--	--	63	525
Singapore	1	4	--	--
Spain	1	17	1	20
Venezuela	--	--	1	7
Total	53	489	257	2,000

-- 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.

Collected By Chinatungsten Online

TABLE 8
U.S. EXPORTS OF TUNGSTEN METAL POWDERS, BY COUNTRY 1/ 2/

Country of destination	2000 Gross weight (metric tons)	2000 Tungsten content 3/ (metric tons)	2000 Value (thousands)	2001 Gross weight (metric tons)	2001 Tungsten content 3/ (metric tons)	2001 Value (thousands)
Australia	5	4	$162	14	11	$437
Belgium	--	--	--	8	6	123
Brazil	16	13	428	22	17	610
Canada	66	53	1,880	60	48	1,910
Chile	1	1	34	1	1	38
China	2	2	85	10	8	126
Egypt	8	6	124	--	--	--
France	8	6	523	11	9	645
Germany	264	212	7,780	380	304	13,200
Hong Kong	4	3	133	2	1	126
India	1	(4/)	35	4	4	175
Israel	11	9	128	22	18	377
Italy	13	10	582	6	5	376
Japan	26	21	776	15	12	741
Korea, Republic of	2	2	119	2	2	122
Mexico	8	7	138	10	8	133
Netherlands	15	12	135	13	10	161
Peru	1	1	32	1	1	48
Saudi Arabia	6	4	72	3	2	53
Singapore	4	3	249	7	5	486
South Africa	2	1	69	(4/)	(4/)	22
Spain	2	2	101	2	2	100
Sweden	25	20	206	18	15	105
Switzerland	1	1	43	3	2	130
Taiwan	28	22	747	20	16	509
Turkey	4	3	74	2	2	86
United Kingdom	60	48	2,220	72	57	2,810
Other	3	2 r/	149 r/	4	4	151
Total	583	467	17,000	712	569	23,800

r/ Revised. -- Zero.
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/

	2000		2001	
Country of destination	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Australia	6	$158	17	$541
Austria	6	61	--	--
Belgium	3	94	8	254
Brazil	2	106	6	170
Canada	181	4,460	158	4,090
China	3	50	3	105
Denmark	(2/)	10	1	14
France	10	196	141	1,990
Germany	162	3,370	304	5,980
Hong Kong	(2/)	3	(2/)	13
India	2	41	4	109
Ireland	1	117	5	233
Israel	16	193	1	87
Italy	64	1,650	6	199
Japan	13	686	46	1,720
Korea, Republic of	3	99	16	323
Malaysia	3	127	--	--
Mexico	12	294	1	49
Netherlands	11	314	32	373
Singapore	1	143	2	99
South Africa	18	254	17	276
Sweden	137	1,950	381	10,400
Switzerland	(2/)	7	9	294
Taiwan	5	118	2	30
Thailand	--	--	1	41
United Kingdom	306	4,370	783	20,000
Venezuela	2	66	1	33
Other	1 r/	70 r/	1	96
Total	969	19,000	1,950	47,400

r/ Revised. -- 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	2000		2001	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Ferrotungsten and ferrosilicon tungsten:				
Canada	(2/)	$6	(2/)	$4
Japan	3	44	--	--
Mexico	1	12	1	7
Total	4	62	1	11
Unwrought tungsten and waste and scrap: 3/ 4/ 5/				
Australia	4	30	12	69
Belgium	44	181	10	38
Brazil	1	7	6	62
Canada	48	338	27	241
China	58	329	26	105
France	3	47	--	--
Germany	395	1,640	374	1,880
Hong Kong	2	10	51	702
Ireland	--	--	11	61
Israel	21	128	20	122
Italy	17	98	17	102
Japan	15	87	3	41
Korea, Republic of	12	71	9	54
Malaysia	3	21	(2/)	14
Mexico	10	99	24	203
Netherlands	32	180	(2/)	3
Norway	2	13	--	--
Philippines	20	112	16	91
Singapore	20	127	2	10
Sweden	6	33	4	29
Taiwan	82	598	69	500
United Kingdom	26	148	290	2,030
Other	6	59	1	19
Total	827	4,350	972	6,370
Wrought tungsten wire: 3/ 4/				
Belgium	12	573	1	148
Brazil	10	647	6	333
Canada	11	481	11	403
China	1	200	3	467
France	16	939	7	909
Germany	7	710	29	882
Hong Kong	2	48	4	85
Hungary	24	1,750	8	691
India	15	912	16	833
Indonesia	10	476	3	150
Italy	9	465	3	260
Japan	17	1,920	15	1,550
Korea, Republic of	1	80	(2/)	61
Mexico	27	2,170	43	4,670
Netherlands	3	165	10	577
Philippines	1	41	3	202
Singapore	1	196	1	63
Spain	15	1,420	19	1,350
Sweden	2	109	26	971
United Kingdom	2	318	3	476
Other	1	428	1	1,630
Total	187	14,000	214	16,700

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	2000 Tungsten content (metric tons)	2000 Value (thousands)	2001 Tungsten content (metric tons)	2001 Value (thousands)
Wrought tungsten, excluding wire: 3/ 4/				
Canada	22	$954	25	$1,020
China	1	49	(2/)	31
France	2	237	(2/)	105
Germany	158	3,220	177	4,330
India	4	232	1	91
Italy	2	155	1	151
Japan	6	818	6	664
Korea, Republic of	1	89	1	99
Mexico	5	545	6	377
Qatar	1	15	(2/)	12
Spain	2	176	2	102
Sweden	1	114	10	311
Taiwan	(2/)	25	2	126
United Arab Emirates	(2/)	29	1	48
United Kingdom	3	250	1	119
Other	1	379 r/	2	466
Total	210	7,290	236	8,050
Other tungsten metal: 3/ 4/				
Australia	2	318	3	302
Brazil	1	116	2	3,230
Canada	15	857	13	686
Colombia	(2/)	5	7	6,030
Ecuador	--	--	5	11,500
France	2	358	2	336
Germany	6	1,020	1	908
Hungary	3	245	7	6,860
Indonesia	--	--	1	1,860
Israel	1	353	1	218
Japan	6	1,890	5	2,880
Korea, Republic of	(2/)	71	1	1,450
Mexico	8	807	9	5,370
Netherlands	1	221	2	508
Singapore	3	639	1	282
Taiwan	3	654	2	416
United Kingdom	12	1,250	6	764
Other	6 r/	824 r/	5	2,370
Total	68	9,630	72	45,900
Tungsten compounds: 6/				
Canada	13	31	12	26
Denmark	--	--	3	39
France	--	--	(2/)	3
Mexico	(2/)	14	--	--
Netherlands	--	--	579	2,130
United Kingdom	--	--	(2/)	9
Total	13	45	594	2,210

r/ Revised. -- 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 obtained by sintering.
6/ Includes only other tungstates.

Source: U.S. Census Bureau.

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

	2000		2001	
Country of origin	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Bolivia	449	$2,310	610	$4,290
China	699	3,470	1,260	9,160
Czech Republic	--	--	7	22
Germany	--	--	4	12
Hong Kong	--	--	96	574
Israel	--	--	3	54
Japan	--	--	7	50
Kazakhstan	31	119	--	--
Mexico	--	--	2	8
Mongolia	67	261	62	372
Peru	107	460	48	456
Portugal	499	2,770	488	3,930
Russia	395	1,350	--	--
Rwanda	100	300	12	33
Thailand	12	49	39	214
Uganda	12	59	39	286
United Kingdom	--	--	5	46
Total	2,370	11,100	2,680	19,500

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

Source: U.S. Census Bureau.

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

	2000		2001	
Country of origin	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Austria	18	$126	--	--
China	1,760	10,200	2,270	$20,700
Germany	131	844	124	1,170
Hong Kong	95	644	159	1,250
Japan	--	--	15	147
Russia	265	1,600	157	1,240
Total	2,270	13,400	2,720	24,500

-- 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/

	2000		2001	
Country of origin	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
China	395	$2,160	335	$2,080
Germany	--	--	2	7
India	--	--	15	82
Russia	30	182	--	--
United Kingdom	45	255	--	--
Total	470	2,600	352	2,170

-- 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/

	2000		2001	
Product and country of origin	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Tungsten metal powders: 2/				
Belgium	3	$138	8	$109
Canada	6	53	3	28
China	267	2,790	514	5,760
Germany	70	1,580	100	2,030
Hong Kong	--	--	4	52
Israel	50	584	57	994
Japan	17	1,340	33	1,720
Korea, Republic of	8	133	48	711
Netherlands	(3/)	9	3	53
Pakistan	--	--	14	89
Russia	26	213	--	--
United Kingdom	138	1,330	160	1,980
Other	8	30 r/	1	36
Total	593	8,190	947	13,600
Tungsten carbide powder:				
Austria	16	431	41	761
Belgium	(3/)	40	2	41
Canada	540	8,180	414	3,030
China	167	2,200	215	3,100
France	5	333	7	567
Germany	123	2,390	95	2,060
Hong Kong	8	102	8	143
Israel	86	1,300	112	2,060
Japan	7	471	3	214
Korea, Republic of	13	194	14	247
Luxembourg	13	252	16	393
Netherlands	8	124	--	--
Russia	11	126	2	12
Sweden	--	--	2	58
United Kingdom	1	42	(3/)	21
Other	2	108 r/	1	69
Total	1,000	16,300	932	12,800
Unwrought tungsten: 2/ 4/ 5/				
Austria	7	109	(3/)	3
Canada	21	33	6	25
China	1	21	5	110
Germany	2	135	1	53
United Kingdom	2	148	(3/)	15
Other	(3/) r/	7 r/	(3/)	40
Total	32	452	12	245

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	2000		2001	
	Tungsten content (metric tons)	Value (thousands)	Tungsten content (metric tons)	Value (thousands)
Waste and scrap:				
Austria	11	89	22	195
Canada	24	109	25	147
China	253	2,200	399	3,560
Czech Republic	--	--	3	41
Estonia	19	122	--	--
France	3	12	(3/)	12
Germany	79	404	150	658
Hong Kong	--	--	45	453
India	9	41	19	88
Ireland	25	115	--	--
Israel	9	97	47	210
Japan	64	310	113	695
Korea, Republic of	146	420	2	22
Malaysia	--	--	2	12
Mexico	2	11	3	8
Netherlands	35	179	21	145
Russia	151	995	49	294
Singapore	9	49	35	157
South Africa	60	322	87	483
Taiwan	--	--	8	54
United Kingdom	30	179	47	219
Uzbekistan	55	497	--	--
Other	8	72	--	--
Total	993	6,230	1,080	7,460
Wrought tungsten wire, plate, sheet, strip, foil, other: 2/ 4/				
Austria	39	4,490	43	6,170
Belgium	1	113	2	86
Brazil	(3/)	9	6	97
China	59	3,030	62	4,890
Estonia	8	77	--	--
France	5	586	4	507
Germany	92	5,880	75	4,430
Hong Kong	1	89	6	232
Hungary	6	483	6	347
India	1	52	1	156
Israel	13	968	19	1,570
Italy	1	76	(3/)	13
Japan	22	7,600	16	5,020
Korea, Republic of	2	203	(3/)	47
Netherlands	1	249	(3/)	247
Russia	(3/)	12	2	127
Singapore	1	95	1	147
Switzerland	3	433	1	280
Taiwan	(3/)	26	1	98
United Kingdom	4	525	3	355
Other	1	625 r/	2	685
Total	260	25,600	251	25,500
Tungsten oxides:				
Australia	36	188	--	--
China	1,220	6,730	1,380	13,300
Germany	(3/)	9	3	45
Japan	--	--	57	285
Russia	836	4,900	256	3,370
Other	--	--	(3/)	13
Total	2,090	11,800	1,700	17,000
Calcium tungstate:				
China	97	317	104	666
Japan	(3/)	9	(3/)	28
United Kingdom	--	--	13	73
Total	97	326	117	766

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	2000 Tungsten content (metric tons)	2000 Value (thousands)	2001 Tungsten content (metric tons)	2001 Value (thousands)
Other tungstates:				
China	2	$12	(3/)	$8
Germany	(3/)	30	17	153
Total	2	42	17	160
Other tungsten compounds: 6/				
Belgium	(3/)	2	(3/)	8
China	--	--	20	319
Germany	(3/)	34	(3/)	53
Ireland	(3/)	4	--	--
Japan	1	159	(3/)	78
Netherlands	1	7	--	--
Total	3	205	21	458

r/ Revised. -- 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 obtained by sintering; excludes powders and waste and scrap.
6/ Includes tungsten chlorides.

Source: U.S. Census Bureau.

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

(Metric tons, tungsten content)

Country	1997	1998	1999	2000	2001
Austria	1,400 e/	1,423	1,610	1,600 e/	1,600 e/
Bolivia	513	497	334	382 r/	360 e/
Brazil	40	--	13	14	14 e/
Burma 3/	272	178	87	74 r/	71
Burundi e/	16	-- r/	-- r/	-- r/	--
China e/	25,000	30,000	31,100 r/	37,000 r/	37,000
India	1	--	--	--	--
Korea, North e/	900	800	700	700	700
Mexico	179	130	11 r/	--	--
Mongolia e/	26	35	27 r/	52 r/	63
Peru	280	76	--	--	--
Portugal	1,036	831	434	743 r/	750 e/
Russia e/	3,000	3,000	3,500	3,500	3,500
Rwanda	33	149	67 r/	114 r/	100 e/
Thailand e/	30	35	30	30	30
Uganda	--	--	(4/)	--	17
Uzbekistan e/	250	200	-- r/	-- r/	--
Vietnam	210	--	--	--	--
Total	33,200	37,400	37,900 r/	44,200 r/	44,200

e/ Estimated. r/ Revised. -- 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 Kyrgyzstan and Nigeria, but information is inadequate for making production estimates. Table includes data available through May 30, 2002.
3/ Includes tungsten content of tin-tungsten concentrate produced by state-owned mining enterprises under the Ministry of Mines.
4/ Less than 1/2 unit.