



2010 Minerals Yearbook

TUNGSTEN

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Domestic survey data and tables and the world production table were prepared by Lisa D. Miller, international data coordinator.

In 2010, one U.S. tungsten operation shipped ore concentrates. Most of the U.S. supply of tungsten raw materials comprised imports, scrap, and sales from the National Defense Stockpile (NDS). China continued to be the world's leading producer of tungsten concentrates and the leading supplier of tungsten imports to the United States. U.S. apparent consumption increased significantly in 2010, as compared with that of 2009. Salient U.S. tungsten statistics and world tungsten concentrate production for 2010 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 by weight. 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.

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

Legislation and Government Programs

The Defense Logistics Agency (DLA), U.S. Department of Defense, changed the name of the Defense National Stockpile Center to DLA Strategic Materials. DLA had two sales formats for NDS tungsten materials—negotiated sales and a strategic supply alliance (SSA). Under the SSA format, prequalified purchasers could submit bids for tungsten ores and concentrates via the DLA Web site at any time, 24 hours per day and 7 days per week. During fiscal year 2010 (October 1, 2009, through September 30, 2010), 2,670 metric tons (t) of contained tungsten

was sold. During the calendar year, 2,060 t of tungsten was sold. The quantities of uncommitted tungsten materials remaining in the stockpile at the end of the calendar year are listed in tables 1 and 2 (U.S. Department of Defense, 2011, p. 8).

The Annual Materials Plan (AMP) for fiscal year 2010, which represented the maximum quantities of tungsten materials that could be sold, is listed in table 2. The proposed AMP for fiscal year 2011 (October 1, 2010, through September 30, 2011), was to remain unchanged for tungsten. Sales of tungsten materials were curtailed in order to hold a goal quantity equivalent to 1 year's AMP (U.S. Department of Defense, 2011, p. 2, 6–7).

The Dodd-Frank Wall Street Reform and Consumer Protection Act (Public Law 111–203) was signed into law on July 21. Section 1502 of the law required annual reporting by companies that file reports with the U.S. Securities and Exchange Commission for whom conflict minerals were necessary to the functionality or manufacture of their products. Conflict minerals were defined as columbite-tantalite (coltan), cassiterite, gold, wolframite, or their derivatives, or any other mineral or its derivatives determined by the Secretary of State to be financing conflict in Congo (Kinshasa) or an adjoining country. Wolframite is one of two principal minerals mined for tungsten. Tungsten mine production from Congo (Kinshasa) and adjoining countries is typically less than 4% of world production (table 15).

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, purchase, disposition, and stocks of tungsten ores and concentrates. In 2010, Curtis Tungsten, Inc. (Upland, CA) produced and shipped scheelite concentrates from the Andrew Mine northeast of Los Angeles, CA.

EMC Metals Corp. (Vancouver, British Columbia, Canada) appointed an agent for the sale of its Springer complex in Pershing County, NV. The complex comprised an underground scheelite mine, a mill, and a processing plant designed to produce either ammonium paratungstate (APT) or calcium tungstate (also known as synthetic scheelite). The mine and mill had a rated output of 146,000 metric ton units per year [1,160 metric tons per year (t/yr) of contained tungsten]. Although on care-and-maintenance status since 1982, investments have been made to the facilities in recent years, and work to make the primary milling and flotation circuits fully operational was nearly complete. By yearend, EMC had expanded its options for Springer to include restarting operations, establishing a joint venture, or selling the assets (EMC Metals Corp., 2011a, p. 7; b, p. 7, 14).

The USGS monthly “Tungsten Concentrate and Tungsten Products Survey” canvassed companies that produced tungsten

carbide powder, tungsten chemicals, and (or) tungsten metal powder from APT, tungsten-bearing scrap, and tungsten concentrate. U.S. processors of tungsten materials operating in 2010 are listed in table 4.

In 2010, U.S. processors consumed more tungsten concentrates, APT, and scrap than they did in 2009. Domestic production of APT was higher than that of 2009. Total net production of tungsten metal powder and tungsten carbide powder increased by 57% in 2010 compared with that of 2009 (table 3).

Global Tungsten & Powders Corp. (GTP) announced that it planned to invest more than \$10 million in its Towanda, PA, plant. The investment reportedly would include new technology for tungsten metal powder production and would increase the plant's tungsten metal powder production capacity (Loewenstein, 2010).

Consumption

U.S. apparent consumption of all tungsten materials, as calculated from net imports, secondary production, and changes in Government and industry stock levels, was 15,600 t in 2010, 34% higher than the 2009 apparent consumption of 11,600 t. Primary U.S. production was not included in the calculation to avoid disclosing company proprietary data. The increase in apparent consumption in 2010 was the result of significantly higher net imports, scrap consumption, and NDS shipments compared with those of 2009.

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 50 tungsten consumers were canvassed on a monthly or annual basis. Reported consumption and stock data in tables 1 and 5 include estimates to account for nonrespondents.

Total U.S. reported consumption of tungsten materials to make end-use products in 2010 was 46% higher than that of 2009. With the exception of steelmakers and producers of other alloys, tungsten consumption by all industries (producers of cemented carbides, chemical products, mill products, and superalloys) was higher than that of 2009. Compared with consumption in 2009, U.S. end users consumed more tungsten chemicals, tungsten carbide powder, tungsten metal powder, and tungsten scrap, but less ferrotungsten.

Weekly reports of the number of operating drilling rigs give an indication of the demand for tungsten carbide in the form of cemented carbide components used by industry to explore for or produce oil and natural gas. The number of rigs operating each week in the United States trended upward during the year. In 2010, the average of weekly operating rigs was 1,546, 42% higher than the average of 1,089 operating rigs in 2009 (Baker Hughes Inc., undated).

In 2010, total consumption of tungsten scrap by U.S. processors and consumers was 5,880 t of contained tungsten, which was 66% more than the 3,550 t consumed in 2009.

Prices

APT is the most widely traded primary tungsten material, and as a result, its price has become a reference price for such

upstream materials as tungsten ore concentrates and such downstream materials as tungsten metal powder and tungsten carbide powder. Annual average APT prices increased from those of 2009 (table 1). The U.S. APT price reported by Platts Metals Week increased three times during the year and ranged from \$154 to \$220 per short ton unit (\$170 to \$243 per metric ton unit). U.S. APT prices reported by Metal Bulletin were fairly stable during the first 7 months of the year, decreased slightly in late July, increased four times between mid-August and late October, and then were stable throughout the remainder of the year. They ranged between \$160 and \$243 per short ton unit (\$176 to \$268 per metric ton unit).

The semiweekly tungsten ore price reported by Metal Bulletin has remained unchanged since late 2008 (table 1). The U.S. spot tungsten ore concentrate price reported by Platts Metals Week increased twice during the year and ranged from \$131 to \$175 per short ton unit (\$144 to \$193 per metric ton unit). The annual average of Platts' tungsten ore concentrate prices increased by 21% from that of 2009. Platts' annual average ferrotungsten price increased by 22% to \$34.30 per kilogram of contained tungsten in 2010 from \$28.08 per kilogram of contained tungsten in 2009. In 2010, the ferrotungsten price ranged between \$25.50 and \$52 per kilogram.

Foreign Trade

The tungsten content of U.S. exports was 4,620 t, 67% more than the 2,770 t exported in 2009. In 2010, the quantity of tungsten in every export category except for ferrotungsten and waste and scrap was higher than that of 2009 (tables 6–10).

The tungsten content of U.S. imports was 12,400 t, 24% more than the 10,000 t imported in 2009. China, which continued to be the leading supplier of imported tungsten to the United States, provided 49% of all tungsten imports in 2010. In 2010, the tungsten content of imports from China increased by 33% to 6,080 t from 4,580 t in 2009. The distribution of materials imported from China was as follows: APT, 40%; tungsten oxide, 18%; tungsten carbide powder, 16%; wrought tungsten, 9%; ferrotungsten and unwrought tungsten, 5% each; tungsten metal powders, 4%; and tungsten waste and scrap, other tungstates, and other tungsten compounds, minor amounts. Other significant suppliers of tungsten materials to the United States were as follows: Bolivia, 8%; Germany and Portugal, 5% each; and Israel, Peru, and the Republic of Korea, 4% each.

The tungsten contained in U.S. imports of ores and concentrates was 24% lower than that of 2009 (table 11). In 2010, the leading suppliers of U.S. imports of tungsten ores and concentrates were Bolivia (34%), Portugal (23%), Peru (19%), and Spain (8%).

U.S. imports of APT were slightly lower than those of 2009 (table 12). China continued to be the dominant supplier, providing 96% of U.S. APT imports. Imports of other tungsten materials are presented in tables 13–14.

In 2010, U.S. net import reliance for tungsten as a percentage of apparent consumption was 63%. 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. Because there was only limited U.S. mine production in 2010, 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

Estimated world tungsten mine production increased significantly from that of 2009, primarily because of an increase in production from China (table 15). In addition to mine production and tungsten recovered from scrap, tungsten materials from the NDS contributed to supply in 2010.

The European Commission reported the results of a study of 41 economically important minerals and metals. Tungsten was one of 14 raw materials identified as critical for European Union supply within a period of 10 years, based on their high economic importance and high risk of supply shortage relative to other materials in the study. For tungsten, the high risk of supply shortage was because a large share of worldwide production comes from China. Tungsten's criticality was increased by economic, performance, and environmental issues of potential substitutes (European Commission, 2010, p. 5–6, 23, 38).

Australia.—Tasmania Mines Ltd. (Sydney) produced a small amount of scheelite concentrate from its Kara open pit magnetite mine south of Burnie in Tasmania.

Hazelwood Resources Ltd. (Perth) studied the feasibility of developing the Big Hill scheelite deposit within its Cookes Creek project area in northwestern Western Australia. A prefeasibility study indicated that the mine could produce up to 200,000 metric ton units per year of concentrate (1,600 t/yr of tungsten) during a 12-year period beginning in 2012. The ore would be preconcentrated using ore-sorting methods, milled, and then processed by conventional gravity separation methods. Hazelwood planned to use the concentrate from Big Hill as feedstock for the Asia Tungsten Products Co. Ltd. ferrotungsten plant, which was under construction in Vietnam (Hazelwood Resources Ltd., 2010, p. 1, 5, 16).

Icon Resources Ltd. (Sydney) decided to focus solely on tungsten and planned a staged development of its Mt. Carbine tungsten mine west of Port Douglas in northern Queensland. The first stage of production would be from retreating tailings generated during past mining operations, the second stage would entail crushing, sorting, and milling low-grade stockpiled ore, and the final stage would be mining from open pit and underground operations. The company planned to begin construction of a tailings processing plant in 2011 (Icon Resources Ltd., 2011).

Hunan Nonferrous Metals Corp. Ltd. (Changsha, China) withdrew from the Dolphin Joint Venture with King Island Scheelite Ltd. (KIS, Sydney), which had been established to redevelop the former King Island Scheelite Mine at Grassy, King Island, northwest of Tasmania. At yearend, KIS was considering a base case for the Dolphin project that included underground mining from stopes and pillars left from previous mining operations and milling 300,000 t/yr of ore, which would be processed by flotation to produce more than 2,600 t/yr

of tungsten in concentrate. The company was investigating strategies to reduce project risk and increase project value before seeking funding to redevelop the mine (King Island Scheelite Ltd., 2011).

Planet Metals Ltd. (Brisbane) maintained its Wolfram Camp tungsten-molybdenum project west of Cairns, Queensland, on care-and-maintenance status. During 2010, the company made two unsuccessful attempts to sell the project, first to Tropical Metals Pty. Ltd. (Brisbane) and later to Hazelwood Resources (Planet Metals Ltd., 2011 a, b).

Austria.—Wolfram Bergbau und Hütten AG (owned by Sandvik AB, Sandviken, Sweden) operated the Mittersill scheelite mine and mill in the State of Salzburg, the Bergla tungsten processing plant, and a tungsten recycling unit near St. Martin in the State of Steiermark.

Brazil.—Largo Resources Ltd. (Toronto, Ontario, Canada) completed a preliminary economic assessment on the Currais Novos project, which would reprocess tailings generated by past production from the Barra Verde and Boca de Laje tungsten-molybdenum mines west-southwest of Natal, Rio Grande do Norte State. Largo was considering a 4-year operation, which would produce scheelite concentrate containing 62,000 metric ton units per year (approximately 500 t/yr of tungsten). The company planned to build the plant and begin producing concentrate in 2011 and had a preliminary agreement to sell the concentrate to GTP (Salari and others, 2011, p. 79–83).

Canada.—In October, North American Tungsten Corp. Ltd. (Vancouver) restarted operations at its Cantung Mine in the Northwest Territories. The mine had been placed on care-and-maintenance status in October 2009 in response to weak demand, low tungsten prices, and increasing inventories of tungsten concentrates and primary materials. Concentrate production during the restart was significantly below target levels, owing to a shortfall in the quantity of ore mined resulting from development delays and a shortage of underground equipment. In 2010, the company produced 420 t (53,000 metric ton units) of tungsten in scheelite concentrates, of which 334 t (42,100 metric ton units) was in gravity concentrate and 86 t (10,800 metric ton units) was in flotation concentrates. North American Tungsten continued to evaluate the development of its Mactung scheelite deposit in the Yukon. The company was considering an open pit mine in addition to the underground mine proposed in a 2009 feasibility study (North American Tungsten Corp. Ltd., 2011, p. 3–4).

Geodex Minerals Ltd. (Vancouver, British Columbia) formed a joint venture with Northcliff Exploration Ltd. (Vancouver, British Columbia) to develop the Sisson tungsten-molybdenum project in New Brunswick. Northcliff would acquire a 70% interest in the project by funding a feasibility study and beginning mine construction. A 2009 scoping study on the project proposed the development of an open pit mine and beneficiation plant to produce concentrates containing 470,000 metric ton units per year (approximately 3,700 t/yr of tungsten) and 1,600 t/yr of molybdenum for a period of 20 years (Geodex Minerals Ltd., 2011, p. 3, 15, 18).

H.C. Starck GmbH (Goslar, Germany) received an Advanced Manufacturing Investment Strategy loan from the Ontario

Provincial government to expand the company's tungsten plant in Sarnia, Ontario. The company had approval from the Ontario Ministry of the Environment for a manufacturing facility with a capacity to produce 4,500 t/yr of metal powder, including tungsten metal, tungsten carbide, and cast tungsten carbide powders, but suspended the expansion in 2009 owing to global economic conditions. H.C. Starck planned to transfer its expertise and manufacturing of high-tech powders for oil and gas drilling bits to Sarnia and complete the expansion project in 2010 (Ontario Ministry of the Environment, 2009; H.C. Starck GmbH, 2010).

China.—China's Government had a program to conserve its tungsten resources and to try to stabilize tungsten prices. In the mining sector, the Government regulated the production of tungsten concentrates by forbidding foreign investment in tungsten exploration and mining; closing mines that did not meet certain energy, environmental, production, and safety standards; imposing a resource tax on tungsten ores; not issuing new exploration and mining licenses; and setting production quotas. For 2010, the tungsten concentrate production quota was increased by 17% to 80,000 t (65% WO₃). Concentrates recovered from tailings were 17% of the quota, and combined production from mining and tailings recycling was to be distributed by province or autonomous region as follows: Jiangxi (44%), Hunan (25%), Henan (6%), Yunnan (5%), Guangdong and Guangxi (4% each), Fujian and Inner Mongolia (3% each), Anhui and Gansu (2% each), Heilongjiang (1%), Zhejiang (0.4%), Hubei and Xinjiang (0.3% each), and Hainan, Shaanxi, and Qinghai (0.2% each). Local entities, such as the Ganzhou City Government (Jiangxi Province) and the Ganzhou Tungsten Industry Association (GTIA), also regulated the production and marketing of tungsten, including GTIA's monthly recommended prices for tungsten concentrates, APT, and metal powder. In 2010, the Government reportedly considered tying the resource tax on tungsten ores to the tungsten price (Huang, 2008; Ganzhou Government Online, 2009; Huang, 2009; Asian Metal, 2010; China Metal Market—Precious & Minor Metals Monthly, 2010a, b; Fang, 2011, p. 4, 44, 48; Fang Jiyun, deputy general manager, Tungsten Department, China Minmetals Non-ferrous Metals Co., Ltd., written commun., October 9, 2011).

In the processing sector, the Government encouraged the recovery of tungsten from low-grade ores, mixed scheelite-wolframite concentrates, and scrap; banned tolling of tungsten concentrate; limited foreign investment in processing plants; and maintained requirements to limit the building or expansion of plants. These requirements included minimum capacities, the ability to secure reliable supplies of raw materials, the use of the company's own funds for 50% or more of the investment, and meeting environmental, energy, production, and safety standards (China Metal Market—Precious & Minor Metals Monthly, 2006; Fu, 2007; Zhang, 2007; Huang, 2008; Huang, 2009).

With respect to trade, the Government regulated tungsten exports by restricting the volumes and types of materials and products that could be sent out of the country, limiting the number of producers and traders authorized to export tungsten materials and products, and adjusting the export tax system.

Before 2010, two departments in the Ministry of Commerce issued export licenses—one for foreign trade and the other for foreign investment. The quota for foreign investment was typically 1,700 t/yr to 1,900 t/yr, and was not included in the quotas reported by trade journals prior to 2010. Beginning in 2010, all licenses were issued by one department and included the amounts for foreign investment. The 2010 export quota for tungsten materials was 16,000 t of contained tungsten, down from 16,300 t in 2009. To qualify for an export license, companies were required to have minimum production capacities and recycling rates. In mid-July, the Chinese Government canceled export tax rebates for certain materials, including tungsten articles (Ryan's Notes, 2007, 2010a; Huang, 2009; Fang, 2011, p. 24, 44, 46).

In spite of its position as the world's leading miner of tungsten, China has imported tungsten concentrates in recent years. In 2010, China imported 3,160 t of tungsten in concentrates, 33% less than it imported in 2009. The decrease in imports was attributed to a buildup of stocks during 2009, which were drawn down during 2010. In addition, China planned to add tungsten to its strategic stockpile (People's Daily Online, 2010; Ryan's Notes, 2010b; Fang, 2011, p. 31).

Congo (Kinshasa).—The President of Congo (Kinshasa) temporarily banned all artisanal mining in the eastern provinces of Maniema, Nord-Kivu, and Sud-Kivu. The ban, which was in effect for about 1 month, was intended to restrict illegal mining and trade in minerals that provided funding to rebel groups (Metal-Pages, 2010a).

Japan.—The Ministry of Economy, Trade and Industry (METI) planned to reduce Japan's dependence on China for its supply of tungsten raw materials. METI's strategy comprised providing assistance to develop new mine production in other countries, increasing recycling rates, promoting research to reduce consumption by increasing the life of tungsten products or developing substitutes, and making improvements to the stockpiling program (Japan Oil, Gas and Metals National Corp., 2011, p. 1–2).

Korea, Republic of.—The South Korean Government reportedly planned to invest in developing the country's rare-metals production industry and to secure a strategic stockpile of various metals, including tungsten, by 2016. The program was to include assistance with exploration, partnerships with countries having metal resources, and the development of metal processing technologies (Young-aah, 2010).

Woulfe Mining Corp. (Vancouver, British Columbia, Canada) commissioned Wardrop Engineering Inc. to prepare a feasibility study on reopening the Sangdong tungsten-molybdenum mine approximately 170 kilometers southeast of Seoul in Gangwon Province. The Sangdong Mine operated for more than 50 years before its closure in 1992 and had been a significant producer of tungsten. The feasibility study was to evaluate a 1.25-million-metric-ton-per-year (Mt/yr) underground mining operation, a beneficiation plant to produce tungsten and molybdenum concentrates, and an onsite processing plant with the capacity to produce 400,000 metric ton units per year of APT (approximately 3,200 t/yr of contained tungsten). The study would also consider the potential for doubling the mine capacity to 2.5 Mt/yr of ore. Late in the year, Woulfe entered into a

heads of agreement with Korea Zinc Co. Ltd. to help finance the project, which it hoped to have in commercial production by 2013 (Woulfe Mining Corp., 2011, p. 2–5).

Peru.—In the Ancash region, Malaga Inc. (Montreal, Quebec, Canada) produced tungsten concentrate from the Pasto Bueno mine and mill; the concentrate was sold to U.S. tungsten processor GTP under an offtake agreement. During the year, Malaga doubled its mill capacity to 500 metric tons per day (t/d) of ore, which was equivalent to concentrate production of more than 100,000 metric ton units per year (approximately 800 t/yr of tungsten). The company began an extensive exploration and development program to increase mine capacity to 500 t/d, and planned an additional increase in mill capacity to 600 t/d by yearend 2011 (Malaga Inc., 2011a, p. 9–10; b, p. 9, 13).

Portugal.—Sojitz Beralt Tin and Wolfram (Portugal) S.A. (Barroca Grande) produced wolframite concentrates from the Panasqueira Mine and beneficiation plant in central Portugal.

Russia.—In 2010, Russian production of tungsten concentrates and intermediates (APT, tungsten anhydride, and tungsten oxide) and consumption of scrap and primary tungsten products (chemicals, ferrotungsten, and metal powders) increased from the low levels seen in 2009. Five companies mined tungsten and produced concentrates. The companies, with the locations of their operations and listed in order of their share of 2010 production, were as follows: JSC A&IR Mining, which produced concentrates from ores mined by Primorsky GOK in Primorskiy Kray; Russkaya Gornorudnaya Kompaniya (RGRK, the Russian Ore Mining Company) managed JSC Novoorlovsky GOK in Zabaykal'sk Kray; prospectors' cooperative Artel Quartz Ltd. (Kvarz) in Zabaykal'sk Kray; Wolfram Company CJSC, which owned CJSC Buryat Wolfram in Zakamensk, Buryatiya Republic; and KGUP Primateploenergo, which won the exploration and mining license for the Lermontov Mine in Primorskiy Kray. In addition, OOO Sibinvest (Tomsk) reportedly planned to begin mining and processing ores from the Kalgutinskiy wolframite-molybdenite deposit in the Altay Republic (Metal-Pages, 2010b; Gorbachev, 2011, p. 6–8, 18).

Wolfram Company (Moscow) Hydrometallurg plant at Nalchik, Kabardino-Balkariya Republic, and Kirovgradskiy Zavod Tverdykh Splavov OAO's Kirovgrad Hard Alloys plant in Sverdlovsk Oblast produced APT, tungsten anhydride, and tungsten oxide. Russian production of these materials increased from the low levels produced in 2009. In addition to concentrates, Russian supply included about 450 t of tungsten scrap in 2010 (Gorbachev, 2011, p. 9, 11–16).

Wolfram also completed the first phase of a refractory metals plant in Unecha, Bryansk Oblast, which was expected to produce tungsten metal powders as its main product. The company planned to gain full control of the Tyrnyauz tungsten-molybdenum mining complex by purchasing the share held by the Kabardino-Balkariya Republic (Wolfram Company CJSC, undated a, b).

Rwanda.—In recent years, wolframite has been mined by privately owned companies, cooperatives, unlicensed artisanal miners, and the Government of Rwanda, listed in order of share of production volume (Transafrika Resources Ltd., 2010).

Spain.—Heemskirk Consolidated Ltd. (Melbourne, Australia) completed a project to increase mill throughput and tungsten

recovery at the Los Santos tungsten mine in Salamanca Province. The company aimed to increase its annual output to between 90,000 metric ton units and 100,000 metric ton units (between 714 t/yr of tungsten and 793 t/yr of tungsten). All of the scheelite concentrate produced through 2013 was committed to GTP under a 6-year offtake agreement. In December, Heemskirk announced that it had signed a letter of intent to sell the Los Santos operation to New York-based private equity firm Almonty Partners LLC (Heemskirk Consolidated Ltd., 2010a, p. 4–5, 58; b, p. 14).

Ormonde Mining plc (Dublin, Ireland) studied the feasibility of developing its Barruecopardo tungsten project in Salamanca Province and began the permitting process for a mining operation. Barruecopardo was the leading tungsten mine in Spain until its closure in the early 1980s. Ormonde was considering an open pit mine and beneficiation plant that would use gravity and flotation methods to produce scheelite concentrates containing 130,000 metric ton units per year (approximately 1,000 t/yr of tungsten). After the first 10 years of operation, mining would be moved underground. Ormonde hoped to begin production from Barruecopardo in late 2012 (Ormonde Mining plc, 2011, p. 4–6).

Sweden.—Sandvik AB (Sandviken), a global tool, material, and machinery manufacturer, worked to increase the use of secondary raw materials (scrap) to make its products. In 2010, nearly 60% of the tungsten used by the Sandvik Tooling business area, excluding Wolfram Bergbau, was derived from recycling cemented carbide products. The Sandvik Mining and Construction business area collected about 10% of its annual production of rock-drilling tools for recycling, which generated 80 t of tungsten-bearing powder (Sandvik AB, 2011, p. 103).

United Kingdom.—Wolf Minerals Ltd. (Subiaco, Australia) continued to study the feasibility of redeveloping the Hemerdon tungsten and tin mine northeast of Plymouth. The open pit mine and milling operation was expected to produce approximately 360,000 metric ton units per year (2,850 t/yr of tungsten) in wolframite concentrate and 500 t/yr of tin in concentrate for 12 years beginning in 2013. In early 2011, the Devon County Council and United Kingdom Secretary of State granted updated planning permission for mining at the project, and Wolf Minerals entered into a 6-year formal agreement with Traxys Europe S.A. to market offtake agreements for and deliver all of the tungsten concentrates produced (Wolf Minerals Ltd., 2011a, b).

Vietnam.—Vietnam Youngsun Tungsten Industry Co., Ltd. produced ferrotungsten in Halong City, Quang Ninh Province. Most of the production was from scheelite and wolframite ores purchased from Thienke Mine in Tuyen Quang Province and Philieng Mine in Lam Dong Province. The ferrotungsten was produced for export to Europe, Japan, the Republic of Korea, and the United States (Vietnam Youngsun Tungsten Industry Co., Ltd., 2009a, b).

Hazelwood Resources acquired a 60% interest in Asia Tungsten Products and established a joint venture for the construction and operation of a ferrotungsten plant in the Vihn Bao district near the port of Haiphong. The plant would produce ferrotungsten containing 80% tungsten and was to be built in two stages. Stage 1, with the capacity to produce 2,400 t/yr of

tungsten contained in ferrotungsten, was under construction and would be in production in 2011. Stage II, which would require additional permitting and approvals, would double the capacity. Feedstock for the plant initially would be purchased, and then later supplemented with concentrates from Hazelwood's Big Hill Mine in Australia. The plant was also licensed to produce sodium tungstate (Hazelwood Resources Ltd., 2010, p. 1, 5, 11).

Masan Group Corp. (Ho Chi Minh City) acquired control of Nui Phao Mining Joint Venture Company Ltd. from Tiberon Minerals Pte. Ltd., a company owned by Dragon Capital Group. By early 2011, Masan had 100% ownership of the Nui Phao project in Thai Nguyen Province. The project comprised an open pit mine and mill to produce tungsten, copper, and fluorspar concentrates and bismuth cement for more than 16 years. Masan forecast tungsten output during the first 5 years of full production to average 5,300 t/yr of contained tungsten and was considering the inclusion of a plant to produce APT. The company obtained an updated investment certificate and new mining license, completed more than 80% of the compensation and resettlement for land required for construction, and completed the first round of financing for the project. The company planned to begin production in 2013 (Heaton, 2011, p. 7–8, 33–35; Masan Group Corp., 2011).

Outlook

World tungsten supply will continue to be dominated by Chinese production and exports. The Chinese tungsten concentrate production quota for 2011 was increased by 9% to 87,000 t (65% WO₃). Export licenses for 2011 were limited to 15,700 t of all tungsten products, a decrease of 2% from the quota of 16,000 t in 2010 (Fang, 2011, p. 4, 24).

Tungsten use is strongly influenced by general economic conditions. Future consumption of tungsten in cemented carbides, which is the leading end-use sector, will depend on the performance of the following industries: automotive and aircraft production; construction; electronics manufacturing, where cemented carbide microdrills are used on circuit boards; general manufacturing; large equipment manufacturing; mining; and oil and gas drilling. Tungsten use is also influenced by Government spending for defense applications. During the first half of 2011, tight supplies of tungsten concentrates in China, combined with strong demand, resulted in significant increases in the prices of tungsten concentrates and downstream products such as ferrotungsten and APT (Ryan's Notes, 2011).

References Cited

- Asian Metal, 2010, Ganzhou Tungsten Industry Association announced September guiding prices: Beijing, China, Asian Metal, September 7. (Accessed October 5, 2011, at <http://www.asianmetal.com/news/viewNews.am?newsId=641226>.)
- Baker Hughes Inc., [undated], North American rotary rig count—Baker Hughes rigs running by week in the U.S. 1990–2011: Baker Hughes Inc. (Accessed August 8, 2011, via http://investor.shareholder.com/bhi/rig_counts/rc_index.cfm.)
- China Metal Market—Precious & Minor Metals Monthly, 2006, China bans toll trading for some metals from Nov 22: China Metal Market—Precious & Minor Metals Monthly, no. 82, December, p. 2–4.
- China Metal Market—Precious & Minor Metals Monthly, 2010a, China plans to reform resource taxes: China Metal Market—Precious & Minor Metals Monthly, no. 123, June, p. 1–2.
- China Metal Market—Precious & Minor Metals Monthly, 2010b, The comparison for mining quota for tungsten deposits between 2009 and 2010: China Metal Market—Precious & Minor Metals Monthly, no. 121, April, p. 4.
- EMC Metals Corp., 2011a, Annual information form for the fiscal year ended December 31, 2010: Vancouver, British Columbia, Canada, EMC Metals Corp., 33 p.
- EMC Metals Corp., 2011b, Corporate presentation: Vancouver, British Columbia, Canada, EMC Metals Corp., January, 19 p.
- European Commission, 2010, Critical raw materials for the EU—Report of the Ad-hoc working group on defining critical raw materials: Brussels, Belgium, European Commission, Enterprise and Industry Directorate General, July 30, 85 p.
- Fang, Jiyun, 2011, Update of China tungsten market and its forecast: International Tungsten Industry Association Annual General Meeting, 24th, Nice, France, September 20–22, 2011, Presentation, 54 p.
- Fu, Chenghao, 2007, New rules for smelters to improve efficiency: Shanghai, China, Shanghai Daily, January 9. (Accessed January 8, 2007, via <http://www.shanghaidaily.com/>.)
- Ganzhou Government Online, 2009, Tungsten capital of the world: Ganzhou, China, Ganzhou City Government, February 27. (Accessed May 5, 2010, at http://www.ganzhou.gov.cn/english/AboutGanzhou/TungstenCapital/200903/t20090317_76163.htm.)
- Geodex Minerals Ltd., 2011, Sisson Project—Tungsten-molybdenum: Vancouver, British Columbia, Canada, Geodex Minerals Ltd. corporate presentation, January, 27 p.
- Gorbachev, Denis, 2011, Update on the Russian tungsten industry: International Tungsten Industry Association Annual General Meeting, 24th, Nice, France, September 20–22, 2011, Presentation, 19 p.
- Hazelwood Resources Ltd., 2010, Pre-feasibility results provide strong case for Big Hill development: Perth, Australia, Hazelwood Resources Ltd. ASX announcement, May 5, 16 p.
- H.C. Starck GmbH, 2010, H.C. Starck investment supported by Ontario's AMIS program: Sarnia, Ontario, Canada, H.C. Starck GmbH news release, April 8, 2 p.
- Heaton, Dominic, 2011, Nui Phao project update: Vietnamese Industrial Minerals Conference, Hanoi, Vietnam, June 28–29, 2011, Presentation, 41 p.
- Heemskirk Consolidated Ltd., 2010a, Annual report 2010: Melbourne, Australia, Heemskirk Consolidated Ltd., 64 p.
- Heemskirk Consolidated Ltd., 2010b, Tungsten industry review & Los Santos operation: Melbourne, Australia, June, Presentation, 18 p.
- Huang, Changgeng, 2008, China's tungsten industry status and its future development trends: International Tungsten Industry Association Annual General Meeting, 21st, Xiamen, China, September 23–25, 2008, Presentation, 5 p.
- Huang, Guoping, 2009, The background and analysis of relevant policies and reforms to tungsten industry in China: International Tungsten Industry Association Annual General Meeting, 22d, Vancouver, British Columbia, Canada, September 16–17, 2009, Presentation, 5 p.
- Icon Resources Ltd., 2011, Icon advises the following updates on its activities: Sydney, Australia, Icon Resources Ltd. news release, January 7, 4 p.
- Japan Oil, Gas and Metals National Corp., 2011, Metals—JOGMEC's activities—Metal resources field: Tokyo, Japan, Japan Oil, Gas and Metals National Corp. brochure, May, 22 p.
- King Island Scheelite Ltd., 2011, Report for the quarter ended 31 December 2010: Sydney, Australia, King Island Scheelite Ltd., January 31, 2 p.
- Loewenstein, James, 2010, GTP to invest more than \$10 million at its Towanda plant: The Daily Review, July 30. (Accessed July 30, 2010, at <http://thedailyreview.com/news/gtp-to-invest-more-than-10-million-at-its-towanda-plant-1.910674>.)
- Malaga Inc., 2011a, Annual information form—Relating to the year ended December 31, 2010: Montreal, Quebec, Canada, Malaga Inc., March 29, 28 p.
- Malaga Inc., 2011b, Malaga—An investment of quality in tungsten: Montreal, Quebec, Canada, March, Presentation, 25 p.
- Masan Group Corp., 2011, Masan Group raises USD\$100 million from Mount Kellett—Investment in Nui Phao Mine underscores year of significant achievements: Ho Chi Minh City, Vietnam, Masan Group Corp. news release, January 24, 3 p.
- Metal-Pages, 2010a, DRC to lift mining ban this month—Government: Metal-Pages, October 4. (Accessed October 4, 2010, via <http://www.metal-pages.com/>.)
- Metal-Pages, 2010b, Russia tungsten-molybdenum plant to open: Metal-Pages, May 27. (Accessed June 29, 2011, via <http://www.metal-pages.com/>.)
- North American Tungsten Corp. Ltd., 2011, Management discussion and analysis for the quarter ended December 31, 2010: Vancouver, British Columbia, Canada, North American Tungsten Corp. Ltd., March 1, 21 p.

Ontario Ministry of the Environment, 2009, Amended certificate of approval: Toronto, Ontario, Canada, Ontario Ministry of the Environment, March 5, 8 p. (Accessed June 22, 2010, at <http://www.environet.ene.gov.on.ca/instruments/1124-7L2NLE-14.pdf>.)

Ormonde Mining plc, 2011, Annual report & accounts 2010: Dublin, Ireland, Ormonde Mining plc, 57 p.

People's Daily Online, 2010, China plans strategic reserves for rare metals: People's Daily Online, November 3. (Accessed November 3, 2010, at <http://english.peopledaily.com.cn/90001/90778/90860/7186937.html>.)

Planet Metals Ltd., 2011a, Quarterly activities report to 31 December 2010: Brisbane, Australia, Planet Metals Ltd., January 28, 4 p.

Planet Metals Ltd., 2011b, Wolfram Camp tungsten project—Purchase by Hazelwood not proceeding: Brisbane, Australia, Planet Metals Ltd. ASX release, February 3, 1 p.

Ryan's Notes, 2007, China approves 12,000 mt of W exports: Ryan's Notes, v. 13, no. 3, January 15, p. 3.

Ryan's Notes, 2010a, China's government eliminated the VAT rebate: Ryan's Notes, v. 16, no. 26, July 5, p. 3.

Ryan's Notes, 2010b, Chinese W ore price falls a bit: Ryan's Notes, v. 16, no. 48, December 13, p. 2–3.

Ryan's Notes, 2011, W shortfall leads to record prices: Ryan's Notes, v. 17, no. 15, April 11, p. 1.

Salari, D.J., Tallarico, F., and Rivera, M., 2011, A preliminary economic assessment of the Currais Novos tailings piles, Rio Grande do Norte, Brazil: Oakville, Ontario, Canada, D.E.N.M. Ltd., January 28, 144 p.

Sandvik AB, 2011, Annual report 2010: Sandviken, Sweden, Sandvik AB, 112 p.

Transafrika Resources Ltd., 2010, The Byumba concession—A first for Rwanda: Port Louis, Mauritius, Transafrika Resources Ltd., 10 p.

U.S. Department of Defense, 2011, Strategic and critical materials operations report to Congress—Operations under the Strategic and Critical Materials Stockpiling Act during the period October 2009 through September 2010: Washington, DC, U.S. Department of Defense, 69 p.

Vietnam Youngsun Tungsten Industry Co., Ltd., 2009a, Profile: Halong City, Vietnam, Vietnam Youngsun Tungsten Industry Co., Ltd. (Accessed October 7, 2009, at <http://www.youngsun-tungsten.com/>.)

Vietnam Youngsun Tungsten Industry Co., Ltd., 2009b, Raw material: Halong City, Vietnam, Vietnam Youngsun Tungsten Industry Co., Ltd. (Accessed October 7, 2009, at <http://www.youngsun-tungsten.com/rawmaterial.htm>.)

Wolf Minerals Ltd., 2011a, Investor update: Subiaco, Australia, Wolf Minerals Ltd., issue 5, February, 2 p.

Wolf Minerals Ltd., 2011b, Quarterly activities report—For the period ending 31st December 2010: Subiaco, Australia, Wolf Minerals Ltd., January 28, 8 p.

Wolfram Company CJSC, [undated]a, History: Moscow, Russia, Wolfram Company CJSC. (Accessed June 28, 2011, at http://www.wolframcompany.ru/wmc/en/en_about/historyeng.)

Wolfram Company CJSC, [undated]b, Mining: Moscow, Russia, Wolfram Company CJSC. (Accessed June 28, 2011, at http://www.wolframcompany.ru/wmc/en/en_about/mining.)

Woulfe Mining Corp., 2011, Management discussion and analysis for the six months ended December 31, 2010: Vancouver, British Columbia, Canada, Woulfe Mining Corp., February 28, 15 p.

Young-aah, Koh, 2010, Korea to further rare metal exploration: Seoul, Republic of Korea, The Korea Herald, October 15. (Accessed July 5, 2011, at <http://www.koreaherald.com/business/Detail.jsp?newsMLId=20101015000593>.)

Zhang, Shoulian, 2007, Update on the tungsten market and policy in China: International Tungsten Industry Association Annual General Meeting, 20th, Madrid, Spain, September 25–27, 2007, Presentation, 11 p.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.

Tungsten. Ch. in *Metal Prices in the United States Through 1998*, 1999.

Tungsten. Ch. in *Mineral Commodity Summaries*, annual.

Tungsten. Ch. in *United States Mineral Resources*, Professional Paper 820, 1973.

Tungsten. *International Strategic Mineral Issues Summary Report*, Circular 930–O, 1998.

Tungsten. *Mineral Industry Surveys*, monthly.

Tungsten Recycling in the United States in 2000. Circular 1196–R, 2011.

Other

China Metal Market—Precious & Minor Metals. Beijing Antaika Information Development Co., Ltd., monthly.

Company reports and media releases.

DATAWEB. U.S. International Trade Commission.

DLA Strategic Materials, Defense Logistics Agency.

Federal Register, daily.

International Tungsten Industry Association.

Materials Flow of Tungsten in the United States. U.S. Bureau of Mines Information Circular 9388, 1994.

Metal Bulletin, daily, weekly, and monthly.

Mining & Metals Report. Interfax International Ltd., weekly.

Mining Journal, weekly.

Platts Metals Week, weekly.

Roskill Information Services Ltd.

Ryan's Notes, weekly.

Strategic and Critical Materials Report to the Congress. U.S. Department of Defense.

Tungsten Industry of the U.S.S.R., The. U.S. Bureau of Mines Mineral Issues, 1988.

Tungsten. Ch. in *Mineral Facts and Problems*, U.S. Bureau of Mines Bulletin 675, 1985.

Tungsten. Mineral profile. British Geological Survey, 2011.

TABLE 1
SALIENT TUNGSTEN STATISTICS¹

(Metric tons of tungsten content and dollars per metric ton unit)

	2006	2007	2008	2009	2010
United States:					
Concentrates:					
Production	--	W	W	W	W
Consumption	W	W	W	W	4,840
Exports	130	109	496	38	276
Imports for consumption	2,290	3,880	3,990	3,590	2,740
Stocks, December 31:					
Consumer	W	W	W	W	W
U.S. Government ²	22,900	21,200	19,700	19,000	17,000
Price:					
U.S. spot quotation ³	200	189	184	151	183
European ⁴	166	165	164	150	150
Ammonium paratungstate:					
Production	W	W	W	W	W
Consumption ⁵	11,300	12,000	9,700	6,860	10,300
Stocks, December 31, producer and consumer	W	68	W	100	62
Price:					
U.S. free market ⁶	293	284	278	204	214
U.S. market ³	273	262	260	178	186
European free market ⁶	261	248	249	203	244
Primary products:					
Net production ⁷	8,050	8,360	8,950	5,300	8,310
Consumption ⁸	12,400 ^r	11,400 ^r	12,100 ^r	7,460 ^r	10,900
Stocks, December 31:					
Producer ⁹	827	825	707	682	669
Consumer ⁸	500 ^r	488 ^r	571 ^r	509 ^r	567
U.S. Government ²	266	235	183	171	171
World, production of concentrate	56,600 ^r	53,500 ^r	62,300 ^r	61,000 ^r	68,800 ^e

^eEstimated. ^rRevised. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

²Defense Logistics Agency, DLA Strategic Materials (formerly Defense National Stockpile Center). Data for 2006 include material committed for sale pending shipment; data for 2007–10 are uncommitted material only.

³Annual average calculated from weekly prices reported by Platts Metals Week.

⁴Annual average calculated from semiweekly prices reported by Metal Bulletin.

⁵Reported by tungsten processors.

⁶Annual average calculated from annual average high and low prices reported by Metal Bulletin for 2006 and from semiweekly prices reported by Metal Bulletin for 2007–10.

⁷Includes only tungsten metal powder and tungsten carbide powder.

⁸Includes ammonium paratungstate and other tungsten chemicals, ferrotungsten, tungsten metal powder, tungsten carbide powder, and tungsten scrap.

⁹Data exclude cast and crystalline tungsten carbide powder and chemicals.

TABLE 2
U.S. GOVERNMENT NATIONAL DEFENSE STOCKPILE TUNGSTEN STATISTICS IN 2010^{1,2}

(Metric tons of tungsten content)

Material	Inventory, yearend ³		Annual Materials Plan ⁵	Sales		Inventory decrease ⁴	
	Fiscal year ⁵	Calendar year		Fiscal year ⁵	Calendar year	Fiscal year ⁵	Calendar year
	Ores and concentrates	17,000	17,000	3,630	2,670	2,060	2,670
Tungsten metal powder	171	171	136	--	--	1	(6)
Total	17,200	17,200	3,760	2,670	2,060	2,670	2,060

-- Zero.

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

²Includes stockpile- and nonstockpile-grade materials.

³Uncommitted inventory only. Does not include material committed for sale pending shipment.

⁴From previous year. Based solely on uncommitted yearend inventories.

⁵Twelve-month period ending September 30, 2010.

⁶Less than ½ unit.

Source: Defense Logistics Agency, DLA Strategic Materials (formerly Defense National Stockpile Center).

TABLE 3
U.S. NET PRODUCTION AND STOCKS OF TUNGSTEN PRODUCTS^{1,2,3}

(Metric tons of tungsten content)

	Tungsten metal powder	Tungsten carbide powder	Total
Net production:			
2009	2,880	2,420	5,300
2010	4,100	4,210	8,310
Producer stocks:			
December 31, 2009	379	304	682
December 31, 2010	341	328	669

¹Net production equals receipts plus gross production less quantity used to make other products in table.

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

³Data 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. PROCESSORS OF TUNGSTEN IN 2010¹

Company	Plant location
ATI Alldyne ²	Huntsville, AL.
Buffalo Tungsten Inc.	Depew, NY.
Chem-Met Co., The	Clinton, MD.
Elmet Technologies, Inc.	Lewiston, ME.
General Electric Co.	Euclid, OH.
Global Tungsten & Powders Corp. ³	Towanda, PA.
Kennametal Inc.	Fallon, NV.
Do.	Latrobe, PA.
Tungsten Diversified Industries LLC ⁴	White Bear Lake, MN. ⁵
Do. Ditto.	

¹Consumers of ammonium paratungstate, tungsten-bearing scrap, tungsten concentrates, and (or) tungsten oxides.

²An Allegheny Technologies Inc. company.

³A division of Plansee Group; formerly owned by Osram Sylvania Inc.

⁴Joint venture of North American Tungsten Corp. Ltd., Tundra Particle Technologies LLC, and Queenwood Capital Partners LLC.

⁵Pilot-scale operation.

TABLE 5
U.S. REPORTED CONSUMPTION AND STOCKS OF TUNGSTEN PRODUCTS^{1, 2, 3}

(Metric tons of tungsten content)

	2009	2010
Consumption by end use:		
Steels	244	71
Superalloys	386 ^r	W
Other alloys ⁴	W	W
Cemented carbides ⁵	4,070	5,990
Mill products made from metal powder	W	W
Chemical uses	84	99
Total	7,460 ^r	10,900
Consumption by form:		
Ferrotungsten	246	129
Tungsten metal powder	2,610 ^r	W
Tungsten carbide powder	3,980	5,890
Tungsten scrap ⁶	535	W
Other tungsten materials ⁷	84	99
Total	7,460 ^r	10,900
Consumer stocks, December 31:		
Ferrotungsten	20 ^r	23
Tungsten metal powder	39 ^r	58
Tungsten carbide powder	387	414
Tungsten scrap ⁶	49 ^r	61
Other tungsten materials ⁷	13	11
Total	509 ^r	567

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

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

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

³Includes estimates.

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

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

⁶Includes tungsten bars.

⁷Includes tungsten chemicals.

TABLE 6
U.S. EXPORTS OF TUNGSTEN ORES AND CONCENTRATES, BY COUNTRY¹

Country of destination	2009			2010		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Tungsten content ² (metric tons)		Gross weight (metric tons)	Tungsten content ² (metric tons)	
Australia	(3)	(3)	\$10	--	--	--
Brazil	2	1	38	(3)	(3)	\$5
Canada	(3)	(3)	4	(3)	(3)	5
Chile	--	--	--	2	1	25
China	14	7	219	--	--	--
Colombia	--	--	--	1	(3)	10
Egypt	4	2	59	--	--	--
Germany	1	(3)	15	487	251	5,570
Guyana	--	--	--	(3)	(3)	5
India	--	--	--	11	5	116
Ireland	1	1	18	--	--	--
Israel	1	(3)	10	--	--	--
Italy	(3)	(3)	8	--	--	--
Korea, Republic of	(3)	(3)	6	--	--	--
Malaysia	8	4	168	9	5	254
Mexico	--	--	--	2	1	26
Peru	--	--	--	2	1	96
Singapore	--	--	--	1	(3)	23
Spain	18	9	176	--	--	--
United Arab Emirates	--	--	--	3	2	28
United Kingdom	(3)	(3)	10	4	2	60
Vietnam	24	12	340	15	7	225
Total	73	38	1,080	535	276	6,440

-- Zero.

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

²Content estimated from reported gross weight.

³Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
U.S. EXPORTS OF AMMONIUM PARATUNGSTATE, BY COUNTRY¹

Country of destination	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Austria	18	\$361	6	\$49
Brazil	--	--	2	20
Germany	350	5,560	432	7,750
Hungary	2	28	44	581
India	1	10	26	230
Italy	2	14	2	21
Mexico	2	16	4	35
Netherlands	--	--	1	11
Switzerland	--	--	20	137
Taiwan	1	5	(2)	4
United Kingdom	--	--	(2)	4
Total	375	5,990	538	8,840

-- Zero.

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

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8
U.S. EXPORTS OF TUNGSTEN METAL POWDERS, BY COUNTRY^{1,2}

Country of destination	2009			2010		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Tungsten content ³ (metric tons)		Gross weight (metric tons)	Tungsten content ³ (metric tons)	
Argentina	(4)	(4)	\$10	3	2	\$145
Australia	2	1	90	16	13	563
Austria	4	3	140	25	20	771
Belgium	--	--	--	8	6	193
Brazil	14	11	797	19	15	1,160
Canada	76	61	3,140	111	88	4,820
Chile	2	2	119	6	5	450
China	23	19	1,720	31	25	1,860
Czech Republic	(4)	(4)	3	20	16	637
Germany	155	124	9,010	558	446	17,600
Hungary	--	--	--	5	4	117
India	13	10	739	13	11	856
Ireland	4	3	187	4	3	172
Israel	3	2	268	1	1	124
Japan	10	8	922	17	14	1,140
Korea, Republic of	5	4	403	5	4	344
Mexico	14	12	629	28	22	878
Netherlands	25	20	765	43	34	941
Norway	--	--	--	1	1	33
Oman	1	1	47	1	1	82
Peru	2	2	133	5	4	238
Saudi Arabia	(4)	(4)	19	6	5	494
Singapore	18	14	1,610	18	14	1,680
South Africa	2	2	126	8	6	542
Switzerland	2	2	187	9	8	868
Taiwan	12	10	849	19	15	1,430
Thailand	(4)	(4)	12	2	2	86
Turkey	2	2	129	3	2	231
United Arab Emirates	3	2	248	2	2	149
United Kingdom	15	12	969	9	7	401
Venezuela	1	1	71	8	6	376
Other	41 ^r	33 ^r	2,180 ^r	3	2	172
Total	450	360	25,500	1,000	803	39,600

^rRevised. -- Zero.

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

²May include tungsten alloy powders.

³Content estimated from reported gross weight.

⁴Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9
U.S. EXPORTS OF TUNGSTEN CARBIDE POWDER, BY COUNTRY¹

Country of destination	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Argentina	3	\$56	1	\$30
Australia	18	404	15	379
Austria	42	1,010	119	2,900
Belgium	2	234	39	313
Brazil	12	456	17	543
Canada	62	2,930	124	5,380
Chile	(2)	17	1	44
China	3	241	27	1,600
Colombia	2	141	3	85
Czech Republic	(2)	7	14	422
Denmark	1	50	3	106
France	7	476	34	1,070
Germany	125	6,080	235	9,290
Hong Kong	2	181	15	606
India	4	142	7	282
Indonesia	(2)	6	3	279
Ireland	26	773	27	919
Italy	(2)	12	1	94
Japan	8	253	13	894
Korea, Republic of	3	160	5	274
Mexico	2	130	8	585
Peru	1	68	5	305
Poland	13	677 ^r	1	41
Saudi Arabia	2	50	47	547
Singapore	9	380	6	369
South Africa	30	1,070	77	2,360
Sweden	1	96	15	495
Switzerland	(2)	12	5	243
Taiwan	32	1,180	61	2,440
Thailand	1	61	1	162
United Kingdom	38	1,280	262	9,150
Venezuela	7	402	24	1,230
Other	13 ^r	614 ^r	2	175
Total	469	19,600	1,220	43,600

^rRevised.

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

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 10
U.S. EXPORTS OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY¹

Product and country of destination	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Ferrotungsten and ferrosilicon tungsten:				
Canada	1	\$24	(2)	\$3
Mexico	1	26	--	--
United Kingdom	(2)	4	(2)	8
Total	1	55	(2)	11
Unwrought tungsten:^{3,4,5}				
Belgium	--	--	103	467
Brazil	5	34	13	59
Canada	56	467	162	1,070
China	24	100	8	32
Colombia	--	--	4	17
Czech Republic	17	70	5	20
France	38	162	2	9
Germany	16	73	9	47
Hungary	18	85	15	66
Indonesia	2	7	19	84
Israel	1	3	4	19
Japan	(2)	12	8	38
Korea, Republic of	--	--	2	10
Malaysia	5	22	2	15
Mexico	6	25	44	191
Netherlands	--	--	12	176
New Zealand	(2)	6	3	15
Singapore	14	69	12	62
Switzerland	--	--	1	5
Taiwan	7	45	2	23
Thailand	1	3	1	3
United Kingdom	27	113	11	47
Other	42 ^r	240 ^r	(2)	4
Total	277	1,530	444	2,470
Waste and scrap:⁴				
Australia	--	--	7	58
Belgium	--	--	2	66
Brazil	--	--	11	378
Canada	29	341	92	947
China	181	3,290	132	2,860
Colombia	(2)	8	2	13
Czech Republic	--	--	5	141
Finland	61	1,500	306	3,800
France	--	--	3	94
Germany	190	3,080	218	4,340
Hong Kong	--	--	1	9
India	32	703	14	443
Ireland	--	--	1	6
Japan	19	159	11	93
Mexico	1	11	2	22
Netherlands	17	141	27	497
Singapore	1	8	6	51
Switzerland	(2)	3	3	24
Taiwan	31	558	8	69
United Arab Emirates	--	--	10	91

See footnotes at end of table.

TABLE 10—Continued
U.S. EXPORTS OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY¹

Product and country of destination	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Waste and scrap—Continued:⁴				
United Kingdom	181	\$1,570	55	\$740
Other	237 ^r	2,060 ^r	(2)	3
Total	981	13,400	915	14,700
Wrought tungsten:^{3,4,6}				
Australia	6	1,170	9	1,470
Belgium	1	68	6	599
Brazil	6	597	7	808
Canada	24	2,540	37	4,190
China	5	944	9	1,400
Colombia	2	369	2	545
Costa Rica	(2)	54	5	715
Czech Republic	16	2,240	27	3,450
Germany	35	5,070	82	7,570
Hungary	3	579	5	948
India	3	260	3	353
Indonesia	3	797	5	1,000
Italy	2	451	2	351
Japan	25	5,640	25	4,110
Mexico	17	3,090	17	3,190
Netherlands	3	787	4	926
Russia	2	232	2	164
Singapore	1	278	5	953
Spain	3	473	6	802
Sweden	7	1,860	9	2,240
United Kingdom	19	3,440	9	3,200
Other	16 ^r	2,100 ^r	13	2,320
Total	198	33,000	289	41,300
Tungsten compounds:⁷				
Canada	25	84	21	75
France	(2)	8	2	21
Germany	--	--	117	1,470
Malaysia	--	--	1	31
Other	42 ^r	458 ^r	1	14
Total	67	551	142	1,610

^rRevised. -- Zero.

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

²Less than ½ unit.

³May include alloys.

⁴Content estimated from reported gross weight.

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

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

⁷Includes only other tungstates.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF TUNGSTEN ORES AND CONCENTRATES,
BY COUNTRY¹

Country of origin	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Bolivia	891	\$16,800	939	\$18,500
Brazil	14	233	--	--
Canada	856	17,500	13	396
Germany	--	--	(2)	44
Guatemala	8	28	--	--
Kenya	20	356	--	--
Mexico	22	191	13	92
Mongolia	35	476	19	240
Peru	427	9,160	519	12,500
Portugal	756	18,100	635	15,900
Rwanda	216	3,470	79	1,290
Spain	196	4,250	215	5,510
Thailand	115	1,830	90	1,690
Uganda	12	245	94	1,810
United Kingdom	18	275	36	554
Vietnam	--	--	88	1,400
Total	3,590	72,900	2,740	60,000

-- Zero.

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

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 12
U.S. IMPORTS FOR CONSUMPTION OF AMMONIUM PARATUNGSTATE, BY COUNTRY¹

Country of origin	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
China	2,470	\$51,000	2,410	\$53,500
Germany	47	1,020	55	1,700
Hong Kong	--	--	3	56
United Kingdom	(2)	11	(2)	13
Vietnam	25	553	44	1,130
Total	2,540	52,600	2,510	56,400

-- Zero.

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

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 13
 U.S. IMPORTS FOR CONSUMPTION OF FERROTUNGSTEN AND
 FERROSILICON TUNGSTEN, BY COUNTRY¹

Country of origin	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Australia	--	--	4	\$110
China	23	\$624	304	9,320
France	--	--	(2)	4
Luxembourg	--	--	15	535
Netherlands	--	--	15	419
Vietnam	23	641	19	634
Total	46	1,260	357	11,000

-- Zero.

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

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 14
U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS,
BY COUNTRY¹

Product and country of origin	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Tungsten metal powders:²				
Austria	1	\$26	2	\$66
Canada	20	864	63	2,310
China	133	4,320	249	8,390
Germany	255	9,720	214	8,500
Israel	211	9,140	391	13,700
Japan	27	1,220	49	3,370
Korea, Republic of	187	6,960	374	13,500
Spain	(3)	44	2	129
Other	3 ^r	126 ^r	1	54
Total	837	32,400	1,340	50,000
Tungsten carbide powder:				
Austria	6	114	14	483
Belgium	5	304	44	2,010
Canada	26	1,250	116	5,920
China	536	16,500	961	34,100
Czech Republic	23	904	49	2,540
France	4	351	5	353
Germany	54	4,270	127	8,040
Hong Kong	8	183	16	595
India	3	85	3	148
Israel	43	1,680	156	5,600
Korea, Republic of	12	494	17	707
Luxembourg	--	--	5	226
Singapore	--	--	5	77
Sweden	32	1,130	42	1,360
Vietnam	--	--	47	2,120
Other	1	77	1	262
Total	753	27,400	1,610	64,500
Unwrought tungsten:^{2,4,5}				
Australia	--	--	3	48
China	475	12,000	310	9,170
Germany	3	229	2	210
Singapore	14	459	17	724
Other	(3)	71 ^r	4	234
Total	492	12,800	335	10,400
Waste and scrap:				
Austria	69	937	120	860
Brazil	--	--	3	39
Canada	14	194	20	485
Chile	1	16	12	286
China	252	6,250	142	4,020
Czech Republic	4	84	29	629
Germany	215	3,110	170	2,930
Hong Kong	9	197	37	1,010
India	8	47	47	974
Japan	19	377	32	702
Korea, Republic of	65	609	120	1,510
Luxembourg	--	--	318	4,970
Mexico	74	757	134	1,480
Pakistan	2	21	50	782

See footnotes at end of table.

TABLE 14—Continued
 U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS,
 BY COUNTRY¹

Product and country of origin	2009		2010	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Waste and scrap—Continued:				
Peru	2	\$70	4	\$164
Singapore	(3)	3	19	438
Switzerland	--	--	54	735
Taiwan	7	40	43	951
Thailand	8	97	60	946
United Kingdom	56	937	35	805
Other	73 ^r	946 ^r	2	43
Total	879	14,700	1,450	24,800
Wrought tungsten:^{2, 4, 6}				
Austria	29	4,670	61	11,100
Belgium	7	967	7	948
China	364	15,500	568	24,100
Czech Republic	8	6,050	5	3,370
France	6	1,260	3	662
Germany	5	938	9	1,550
Hong Kong	4	308	5	424
Hungary	3	648	8	1,550
Japan	16	4,090	21	6,190
Mexico	2	218	2	146
Netherlands	4	842	3	479
Russia	1	73	10	1,140
South Africa	3	81	43	1,050
Sweden	1	480	4	1,110
Other	10 ^r	1,390 ^r	8	2,030
Total	462	37,500	759	55,900
Tungsten oxides:				
China	329	8,170	1,090	25,100
Czech Republic	--	--	12	487
Germany	5	167	8	263
Hong Kong	--	--	32	782
Israel	--	--	5	106
Taiwan	--	--	16	420
Vietnam	5	85	48	1,560
Other	42 ^r	1,070 ^r	(3)	19
Total	380	9,490	1,210	28,700
Other tungstates:				
China	1	30	41	1,050
India	4	112	8	216
Ireland	5	23	62	173
Other	7 ^r	190 ^r	1	187
Total	17	356	111	1,630
Other tungsten compounds:⁷				
China	--	--	1	37
Germany	3	159	(3)	244
Japan	1	392	4	975
Total	5	550	5	1,260

^rRevised. -- Zero.

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

²May include alloys.

³Less than ½ unit.

TABLE 14—Continued
U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS,
BY COUNTRY¹

⁴Content estimated from reported gross weight.

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

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

⁷Includes tungsten chlorides.

Source: U.S. Census Bureau.

TABLE 15
TUNGSTEN: WORLD CONCENTRATE PRODUCTION, BY COUNTRY^{1,2}

(Metric tons, tungsten content)

Country ³	2006	2007	2008	2009	2010 ^e
Australia	15	7	28	33	16
Austria	1,153	1,117	1,122	887 ^r	1,000
Bolivia	868	1,107	1,148	1,023	1,204 ⁴
Brazil	525	537	408	208 ^{r,e}	500
Burma ⁵	197	183	136	87	90
Burundi	238	144	194	150 ^{r,e}	170
Canada	1,983	2,305	2,277	1,964	420 ⁴
China ^{e,6}	45,000	41,000	50,000	51,000	59,000
Congo (Kinshasa) ^{e,7}	500	560 ^r	370 ^r	360 ^r	360
Korea, North ^{e,8}	930	230	270	100	110
Mongolia	182	245	142	39	20
Peru ⁹	50	366	456	502	571 ⁴
Portugal	780	846	1,238 ^r	1,037 ^r	1,200
Russia ^e	2,800	3,400 ^r	3,000	2,300 ^r	2,800
Rwanda	1,000 ^r	920 ^r	670 ^r	450 ^r	440
Spain ^e	--	--	150	200 ^r	250
Thailand ^e	303	477	617	600	600
Uganda	75	86	50 ^e	20 ^e	25
United States	--	W	W	W	W
Total	56,600 ^r	53,500 ^r	62,300 ^r	61,000 ^r	68,800

^eEstimated. ^rRevised. W Withheld to avoid disclosing company proprietary data. -- Zero.

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through May 22, 2011.

³Tungsten concentrates are thought to be produced in Mexico, Nigeria, Turkey, and Vietnam, and may be produced from tin-tungsten ores in Kyrgyzstan, but information is inadequate to make reliable estimates of production. Illegal tungsten (wolfram) mining in the Phuoc Trung Commune of the Bac Ai District, Ninh Thuan Province in Southern Vietnam reportedly was halted by the District People's Committee in April 2008.

⁴Reported figure.

⁵Includes tungsten content of tin-tungsten concentrate produced by state-owned mining enterprises under the Ministry of Mines.

⁶Based upon data published in the Yearbook of Nonferrous Metals Industry of China.

⁷Production estimated based on reported exports from Nord-Kivu and Sud-Kivu Provinces.

⁸Production estimated based on Chinese imports.

⁹Data for 2007–10 based on production reported by Malaga Inc.