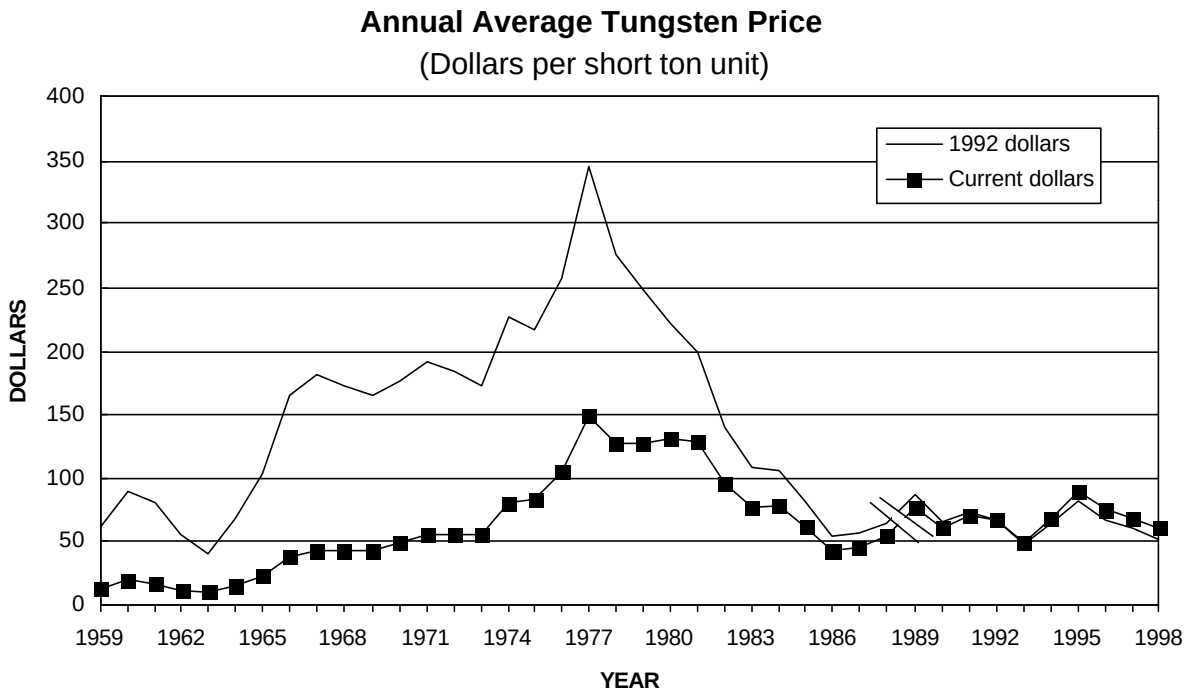
Tungsten

by Kim B. Shedd



Significant events affecting tungsten prices since 1958

1963	Sudden decrease in exports from China, North Korea, and Russia
1965-89	Disposal of tungsten concentrates from the U.S. Government stockpiles
1979-93	Increasing dominance of China in the world market
1981-82	Sharp recession
1991	U.S. antidumping duty imposed on Chinese concentrates and dissolution of the Soviet Union
1992-98	Exports of tungsten from Russia and other countries of the former Soviet Union to the world market

Tungsten has a wide range of industrial uses. The largest use is as tungsten carbide in cemented carbides. Cemented carbides (also called hardmetals) are wear-resistant materials used by the metalworking, mining, and construction industries. Tungsten metal wires, electrodes, and/or contacts are used in lighting, electronic, electrical, heating, and welding applications. Tungsten is also used to make tool steels, wear-resistant alloy parts and coatings, superalloys for turbine blades, and heavy metal alloys for armaments, heat sinks, and high-density applications, such as weights and counterweights. Chemical uses of tungsten include catalysts, inorganic pigments, and high-temperature lubricants.

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

Until recently, the main reference price for tungsten was the price of tungsten concentrates. In the early 1990's, the trade in tungsten concentrates decreased, and the market shifted towards the price of the intermediate product ammonium paratungstate as a reference price (International Tungsten Industry Association, 1997, p. 32). Prices of tungsten concentrates and ammonium paratungstate generally

follow similar trends. One would expect the price of ammonium paratungstate to exceed that of concentrate by an amount equivalent to the processing costs to convert concentrate to ammonium paratungstate. In 1992, however, the Metal Bulletin price for ammonium paratungstate actually fell below that for concentrate. At that time, the normal premium for ammonium paratungstate was estimated to be between $23 and $32 per short ton unit. The following were cited as possible explanations for this unusual pricing situation: the availability of very inexpensive feedstock for Chinese ammonium paratungstate plants or Government subsidies for those plants (Maby, 1993).

The main forms of tungsten used by downstream consuming industries are tungsten carbide powder, tungsten metal powder, ferrotungsten, and various tungsten chemical compounds. With the exceptions of ferrotungsten and ammonium paratungstate, prices for these products are no longer published on a regular basis.

Historically, tungsten prices have fluctuated widely as the market alternated between periods of scarcity and oversupply. In addition to general economic conditions and industrial activity, the following factors have affected the tungsten market over time: China's position as the world's largest producer; changes in availability from Communist or formerly Communist countries; purchases for or sales from various Government stockpiles; trade controls; buildup of or reduction in inventories held by industry; fluctuations in production by a large number of widely dispersed small producers; differing political, social, and economic objectives of producing countries; industry fragmentation in that most countries that produce tungsten are not large consumers; rapid shifts in demand; and increases in demand in support of military activity (Engineering and Mining Journal, 1967; Burrows, 1971, p. 1-7 and 36-37; Rawlings, 1974; Lincoln, 1986).

From the late 1950's to early 1960's, the tungsten market was characterized by oversupply and low prices. This was a result of several factors. Following the Korean conflict, high prices combined with U.S. Government programs to stockpile tungsten and to encourage domestic production by purchasing tungsten concentrates from U.S. mines at a fixed price led to an increase in production (Geehan, 1952; Grainger, 1960). This was followed by reduced demand when the U.S. Government's tungsten acquisition program was completed and increased supply as a result of the disposal of stockpiled ore from the United Kingdom, the resumption of shipments from Korea, and increased offers of tungsten from China and Russia (Grainger, 1960, 1962).

In late 1963, exports of tungsten from China, North Korea, and Russia suddenly decreased significantly from those of previous years. The apparent withdrawal of these countries from the world market combined with an increase in demand from Eastern Europe resulted in a supply squeeze and a significant increase in prices by late 1964. The high prices led to an increase in mine production from non-Communist countries and increased recycling of tungsten-bearing scrap. In 1965, the U.S. Government began a long-term sales program of tungsten concentrates from Defense Production Act inventories. The increase in supply from these sources was not enough to balance the loss of tungsten from Communist countries during a period of strong worldwide demand (Grainger, 1965; Engineering and Mining Journal, 1967). As a result, the annual average U.S. price of tungsten concentrate in 1966 was more than four times greater than that of 1963.

Prices remained relatively high during the late 1960's owing to strong demand and only limited exports of tungsten from China. U.S. tungsten consumption was strong, at least in part, in support of the war in Vietnam and for increased production of tungsten carbide balls for ballpoint pens and studs for automobile snow tires. Sales of tungsten concentrates from the U.S. Government at fixed prices contributed to the stabilization of the U.S. market (Stevens, 1969). Between March 1966 and December 1973, the U.S. Government's General Services Administration (GSA) "off the shelf" fixed prices for tungsten concentrates were quoted as the price of concentrates in the U.S. market. Between October 1969 and February 1970, European prices for tungsten concentrates quoted in Metal Bulletin increased from approximately $46 per short ton unit to a high of approximately $80 per short ton unit (Ratzker, 1971). The increase in European prices was reported to be primarily the result of a continued high level of industrial activity in combination with the absence of significant quantities of tungsten shipments from China. In 1969, as a result of stable fixed prices in the United States, increasing market prices in Europe, and the availability of tungsten from the U.S. Defense Production Act inventories, the United States became a net exporter of tungsten concentrates for the first time in history (Stevens, 1970).

A worldwide economic slowdown in 1971 caused reduced demand for tungsten, particularly from the steel and machine tool industries (Mining Journal, 1972). During 1972 and 1973, economic conditions improved, and demand for tungsten increased. U.S. prices were quoted at the GSA "off the shelf" fixed price of $55 per short ton unit. European prices decreased to a low of approximately $30 per short ton unit by late 1972. The downward trend in European prices during a period of increasing demand was attributed to substantial inventories overhanging the market. By late 1972/early 1973, the rate of consumption had increased enough to cause a significant reduction in inventory levels, and European prices began to increase (Rawlings, 1974).

Toward the end of 1973, the GSA discontinued its "off the shelf" fixed-price sales of tungsten concentrates in favor of monthly sales on a sealed-bid basis (Stevens, 1973). From 1974 through 1976, awards of tungsten concentrates from U.S. Government stockpiles were at unit values close to the prevailing European prices quoted in Metal Bulletin. In 1974, high levels of tungsten consumption in the United States and Europe and the lack of large inventories resulted in an

increase in the Metal Bulletin price to more than $100 per short ton unit (Rawlings, 1975). The Metal Bulletin price decreased in 1975 as a result of recessionary economic conditions in Western markets and a corresponding decrease in tungsten demand. During the next 2 years, tungsten prices increased sharply to record highs as a result of worldwide inflation, strong buying by Eastern European countries, a recovery in Western demand, and reports of decreased quantities of tungsten offered by China (Ho, 1977). Metals Week began publishing U.S. spot prices for tungsten concentrates in January 1977 after a hiatus of more than 10 years. By March 1977, this price exceeded $160 per short ton unit.

By late 1977-early 1978, the price of tungsten concentrates began to decline. Although Western mine production had steadily increased, exports of tungsten from China and releases from U.S. Government stockpiles balanced a shortfall between production and consumption. The decline in prices during 1978 was attributed to the following factors: an increase in Western tungsten inventories during 1977; reduced demand in Western Europe, particularly for ferrotungsten; increased Western mine production; and the absence of Eastern European buyers as a significant influence in the Western market (Thurber, 1979).

Between late February 1979 and late October 1981, the average of Metals Week prices for tungsten concentrate was relatively stable in the $120- to $140-per-short-ton-unit range. By late 1981, the worldwide recession began to affect tungsten demand. In addition, China was exporting steadily increasing amounts of tungsten concentrates and intermediate products to Western markets (Thurber, 1982; Ho, 1986). In the mid-1980's, the availability of low-priced intermediate products from China contributed to the downward trend in the price of tungsten concentrates. There was a marked change from concentrate prices governing the price of intermediate products to intermediate product prices governing concentrate prices (Ho, 1986). The price of concentrate trended downward to a low of $28 per short ton unit by late 1986, and then fluctuated between $30 and $65 per short ton unit during the next 2 years. From September 1988 to late 1990, the price steadily decreased to $31 per short ton unit. The decrease in price during a 3-year period of strong Western consumption was attributed to continued oversupply of Chinese tungsten (Bunting, 1991).

In mid-1991, the concentrate price increased to $67 per short ton unit following the imposition of a 151% antidumping duty against Chinese concentrates in the U.S. market. During the next 2 years, the price steadily fell to $28 per short ton unit. This price decline was attributed to continued exports of tungsten materials from China during a period of reduced demand as a result of the worldwide economic recession, a decrease in imports by former Soviet countries following the breakup of the Soviet Union in 1991, and destocking by consumers (Maby, 1993). By 1993, imports of Chinese tungsten concentrates and intermediate products had grown to 75% of Market Economy Countries' supply of primary tungsten (Bunting, 1994). Added to the increasing supply from China were exports of tungsten materials from Russia and other countries of the former Soviet Union.

By 1994, almost all of the tungsten mines in Market Economy Countries had ceased production, and Chinese mine production was also at a low level as a result of the persistent low prices of tungsten concentrates (Bunting, 1997). In 1994, the world economy and industrial activity improved, demand for tungsten increased, and prices began to rise (Maby, 1995). By mid-1995, the concentrate price rose to $70 per short ton unit. This led to large releases of tungsten from Government stockpiles in China, Kazakhstan, and Russia; releases of inventories from Russian mines; and an increase in mine production, particularly in China. By early 1996, an oversupply situation had developed. As a result, prices decreased and mine production was reduced. By late 1996, most of the inventories that had been overhanging the market had been drawn down (Bunting, 1997). In 1997, demand for tungsten increased, but supply was plentiful, and prices continued to decrease. Prices decreased again during 1998. Demand was strong during the first half of the year, but weakened during the second half. At yearend, the Metals Week price for tungsten concentrate was between $40 and $45 per short ton unit.

References Cited

Bunting, R.M., 1991, Tungsten—A strong year—But: Engineering and Mining Journal, v. 192, no. 3, March, p. 27-29.

———1994, Presentation to I.T.I.A. AGM—11/3/94, *in* International Tungsten Industry Association annual general meeting, 7th, Huntsville, AL, November 2-4, 1994, Proceedings: London, International Tungsten Industry Association, 16 p.

———1997, Tungsten—Can the industry meet future demand?: Engineering and Mining Journal, v. 198, no. 3, March, p. 37-41.

Burrows, J.C., 1971, Tungsten—An industry analysis: Lexington, MA, D.C. Heath and Co., 287 p.

Engineering and Mining Journal, 1967, Tungsten: Engineering and Mining Journal, v. 168, no. 2, February, p. 165-167.

Geehan, R.W., 1952, Tungsten, *in* Minerals Yearbook 1952, v. I: U.S. Bureau of Mines, p. 1066-1082.

Grainger, P.E., 1960, Tungsten, *in* Annual review 1960: Mining Journal, p. 41.

———1962, Tungsten, *in* Annual review 1962: Mining Journal, p. 41.

———1965, Tungsten, *in* Mining annual review 1965: Mining Journal, p. 48-49.

Ho, Eric, 1977, Tungsten, *in* Mining annual review 1977: Mining Journal, p. 82-83.

———1986, Tungsten, *in* Mining annual review 1986: Mining Journal, p. 73.

Lincoln, G.M., Jr., 1986, Tungsten—Bleak market environment:

Engineering and Mining Journal, v. 187, no. 3, March, p. 59-61.
International Tungsten Industry Association, 1997, Tungsten: London, International Tungsten Industry Association, 33 p.
Maby, Michael, 1993, Tungsten, *in* Metals and minerals annual review 1993: Mining Journal, p. 72-73.
———1995, Tungsten, *in* Metals and minerals annual review 1995: Mining Journal, p. 63-64.
Mining Journal, 1972, Tungsten, *in* Mining annual review 1972: Mining Journal, p. 80-83.
Ratzker, Menno, 1971, Tungsten: Engineering and Mining Journal, v. 172, no. 3, March, p. 149-150.
Rawlings, J.W., 1974, Tungsten—'73 market firmed, but GSA remains pricing key: Engineering and Mining Journal, v. 175, no. 3, March, p. 130-131.
———1975, Tungsten—Prices take off in '74 on good demand and lack of surplus inventories: Engineering and Mining Journal, v. 176, no. 3, March, p. 133-134.
Stevens, R.F., Jr., 1969, Tungsten: Engineering and Mining Journal, v. 170, no. 3, March, p. 130-133.
———1970, Tungsten: Engineering and Mining Journal, v. 171, no. 3, March, p. 106-109.
———1973, Tungsten, *in* Minerals Yearbook 1973, v. I: U.S. Bureau of Mines, p. 1245-1261.
Thurber, W.C., 1979, Tungsten—U.S. consumption at highest level since 1974: Engineering and Mining Journal, v. 180, no. 3, March, p. 139-143.
———1982, Tungsten—Production and consumption drop as economies weaken: Engineering and Mining Journal, v. 183, no. 3, March, p. 98-100.

Annual Average Tungsten Price

(Dollars per short ton unit[1])

Year	Price	Year	Price	Year	Price	Year	Price
1959	13	1969	43	1979	128	1989	76
1960	19	1970	49	1980	130	1990	61
1961	17	1971	55	1981	129	1991	71
1962	12	1972	55	1982	97	1992	67
1963	9	1973	55	1983	77	1993	49
1964	15	1974	80	1984	78	1994	68
1965	23	1975	83	1985	62	1995	89
1966	38	1976	104	1986	42	1996	75
1967	43	1977	149	1987	46	1997	69
1968	43	1978	128	1988	54	1998	60

[1] To convert to dollars per metric ton unit, multiply by 1.10231. To convert to dollars per kilogram contained tungsten, multiply by 0.139.

Note: Annual average prices were derived from price changes reported in the following sources:
1959-66, tungsten ore (wolframite) in New York, "ordinary quality," excluding duty, *in* American Metal Market.
1967-73, tungsten ore, domestic quote reflecting the U.S. Government's General Services Administration price, *in* American Metal Market's Metal Statistics 1972 and Metal Statistics 1974.
1974-76, tungsten ore, minimum 65% tungsten trioxide, European market, excluding duty, *in* U.S. Bureau of Mines Minerals Yearbook, converted from pounds sterling per metric ton unit as reported in Metal Bulletin.
1977-88, tungsten ore, minimum 65% tungsten trioxide, U.S. spot price, c.i.f., excluding duty, *in* Metals Week.
1989-98, ammonium paratungstate, U.S. free market, *in* Metal Bulletin.