

## MOLYBDENUM

(Data in metric tons of molybdenum content, unless otherwise noted)

**Domestic Production and Use:** In 2003, molybdenum, valued at about \$342 million (based on average oxide price), was produced by six mines. Molybdenum ore was produced at three primary molybdenum mines, one each in Colorado, Idaho, and New Mexico; whereas three copper mines in Arizona and Utah recovered molybdenum as a byproduct. Two roasting plants converted molybdenite (MoS<sub>2</sub>) concentrate to molybdic oxide, from which intermediate products, such as ferromolybdenum, metal powder, and various chemicals, were produced. Iron and steel, cast and wrought alloy, and superalloy producers accounted for about 75% of the molybdenum consumed.

<b>Salient Statistics—United States:</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003<sup>e</sup></b>
Production, mine	42,400	40,900	37,600	32,600	34,100
Imports for consumption	14,000	15,000	13,400	11,500	11,800
Exports	32,700	27,900	31,500	23,600	32,300
Consumption:					
Reported	18,700	18,300	15,800	14,400	14,900
Apparent	28,000	28,600	20,100	21,200	13,900
Price, average value, dollars per kilogram <sup>1</sup>	5.90	5.64	5.20	8.27	11.57
Stocks, mine and plant concentrates, product, and consumer materials	12,000	11,400	10,700	10,000	9,800
Employment, mine and plant, number	610	618	518	489	510
Net import reliance <sup>2</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Secondary molybdenum in the form of molybdenum metal or superalloys was recovered, but the amount was small. Although molybdenum is not recovered from scrap steel, recycling of steel alloys is significant, and some molybdenum content is reutilized. Quantities of molybdenum recycled from new and old scrap are estimated to be 30% of the apparent supply of molybdenum.

**Import Sources (1999-2002):** Ferromolybdenum: China, 78%; United Kingdom, 19%; and other, 3%. Molybdenum ores and concentrates: Mexico, 58%; Canada, 38%; Chile, 2%; and other, 2%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12/31/03</b>
Molybdenum ore and concentrates, roasted	2613.10.0000	12.8¢/kg + 1.8% ad val.
Molybdenum ore and concentrates, other	2613.90.0000	17.8¢/kg.
Molybdenum chemicals:		
Molybdenum oxides and hydroxides	2825.70.0000	3.2% ad val.
Molybdates of ammonium	2841.70.1000	4.3% ad val.
Molybdates, all others	2841.70.5000	3.7% ad val.
Molybdenum pigments:		
Molybdenum orange	3206.20.0020	3.7% ad val.
Ferroalloys:		
Ferromolybdenum	7202.70.0000	4.5% ad val.
Molybdenum metals:		
Powders	8102.10.0000	9.1¢/kg + 1.2% ad val.
Unwrought	8102.94.0000	13.9¢/kg + 1.9% ad val.
Wrought bars and rods	8102.95.3000	6.6% ad val.
Wrought plates, sheets, strips, etc.	8102.95.6000	6.6% ad val.
Wire	8102.96.0000	4.4% ad val.
Waste and scrap	8102.97.0000	Free.
Other	8102.99.0000	3.7% ad val.

**Depletion Allowance:** 22% (Domestic); 14% (Foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** U.S. mine output of molybdenum in 2003 increased about 5% from that of 2002. U.S. imports for consumption increased an estimated 3% from those of 2002, while the U.S. exports increased 37% from those of 2002. The increase in exports reflects the return to full year production levels in 2003 after reduced byproduct molybdenum production by the copper companies in the first half of 2002. U.S. reported consumption increased 3% from that of 2002. Mine capacity utilization was about 40%.

China continued its high level of steel production and consumption, thus providing a stable demand for molybdenum. In addition, copper production cutbacks of prior years stabilized copper prices and allowed some production capacity to come back online in 2003, thus increasing byproduct molybdenum production. The Continental Pit operation in Butte, MT, reopened and resumed mining activities in December. The operation is expected to produce about 3,200 tons (7 million pounds) of molybdenum in 2004. With the continuing high price of nickel-bearing stainless steel in 2003, consumers increasingly considered use of duplex stainless steel. If this trend holds, molybdenum consumption could be increased in the near future.

### **World Mine Production, Reserves, and Reserve Base:**

	Mine production		Reserves <sup>3</sup>	Reserve base <sup>3</sup>
	2002	2003 <sup>e</sup>	(thousand metric tons)	
United States	32,600	34,100	2,700	5,400
Armenia	3,500	4,000	200	400
Canada	7,500	7,500	450	910
Chile	29,500	31,400	1,100	2,500
China	29,300	30,000	3,300	8,300
Iran	1,700	1,700	50	140
Kazakhstan	230	225	130	200
Kyrgyzstan	250	250	100	180
Mexico	3,400	3,500	90	230
Mongolia	1,590	1,500	30	50
Peru	9,500	9,500	140	230
Russia <sup>e</sup>	2,900	2,900	240	360
Uzbekistan <sup>e</sup>	500	500	60	150
World total (rounded)	123,000	127,000	8,600	19,000

**World Resources:** Identified resources amount to about 5.4 million tons of molybdenum in the United States and about 13 million tons in the rest of the world. Molybdenum occurs as the principal metal sulfide in large low-grade porphyry molybdenum deposits and as an associated metal sulfide in low-grade porphyry copper deposits. Resources of molybdenum are adequate to supply world needs for the foreseeable future.

**Substitutes:** There is little substitution for molybdenum in its major application as an alloying element in steels and cast irons. In fact, because of the availability and versatility of the metal, industry has sought to develop new materials that benefit from the alloying properties of molybdenum. Potential substitutes for molybdenum include chromium, vanadium, columbium (niobium), and boron in alloy steels; tungsten in tool steels; graphite, tungsten, and tantalum for refractory materials in high-temperature electric furnaces; and chrome-orange, cadmium-red, and organic-orange pigments for molybdenum orange.

<sup>e</sup>Estimated. E Net exporter.

<sup>1</sup>Major producer price per kilogram of molybdenum contained in technical-grade molybdic oxide.

<sup>2</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>3</sup>See Appendix C for definitions.