



2005 Minerals Yearbook

MOLYBDENUM

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Molybdenum is a refractory metallic element used principally as an alloying agent in cast iron, steel, and superalloys to enhance hardenability, strength, toughness, and wear- and corrosion- resistance. To achieve desired metallurgical properties, molybdenum, primarily in the form of molybdenic oxide (MoX) or ferromolybdenum (FeMo), is frequently used in combination with or added to chromium, columbium (niobium), manganese, nickel, tungsten, or other alloy metals. The versatility of molybdenum in enhancing a variety of alloy properties has ensured it a significant role in contemporary industrial technology, which increasingly requires materials that are serviceable under high stress, expanded temperature ranges, and highly corrosive environments. Moreover, molybdenum finds significant use as a refractory metal in numerous chemical applications, including catalysts, lubricants, and pigments. The variety of uses for molybdenum materials, few of which afford acceptable substitution, has resulted in an increase in Western molybdenum consumption to an estimated 160,000 metric tons per year (t/yr) [352 million pounds per year (Mlb/yr)] in 2005 (Adams, 2005) from about 68,000 t/yr (150 Mlb/yr) in 1983 (Adams, 2004).

Molybdenum reserves and production capacity were concentrated in a few countries of the world. World mine output was estimated to be 185,000 metric tons (t) (molybdenum contained in concentrate), of which, in descending order of production, the United States, Chile, China, Peru, Canada, and Mexico provided about 95% (table 11). Chile, China, and the United States also held about 85% of the estimated 19 million metric tons (Mt) of molybdenum in the world reserve base.

Production

Domestic production data for molybdenum were derived from three separate voluntary surveys by the U.S. Geological Survey. These surveys are “Molybdenum Ore and Concentrate” (annual), “Molybdenum Concentrate” (monthly), and “Molybdenum Products and Molybdenum Concentrates” (monthly). Surveys were sent to all eight operations that produce molybdenum ore and products, and all responded, representing 100% of the U.S. production listed in table 1.

In 2005, U.S. mine production of molybdenum concentrate was 58,000 t, about a 40% increase from 41,500 t in 2004. World mine production of molybdenum in 2005 increased to 185,000 t, about a 16% increase from 159,000 t (revised) in 2004. The U.S. share of world production was about 31% in 2005. Net production of molybdenum products increased to 29,800 t in 2005 from 24,300 t in 2004 (table 2).

Primary molybdenum production continued at the Henderson Mine in Colorado, the Questa Mine in New Mexico, and the Thompson Creek Mine in Idaho. The Climax Mine in Colorado

has been inactive since 1995. Molybdenum was produced as a byproduct of copper production at the Bagdad and Sierrita Mines in Arizona, the Continental Pit in Montana, the Chino Mine in New Mexico, and the Bingham Canyon Mine in Utah. Montana Resources’ Continental Pit in Montana resumed operation in November 2003 and made the first shipments of molybdenite concentrate in early 2004 (Platts Metals Week, 2003). The byproduct molybdenum recovery circuit at Phelps Dodge’s Chino Mine was restarted in the fourth quarter and produced a minor amount of concentrate in 2004.

With byproduct molybdenum recovery at a copper mine, all mining costs associated with producing the molybdenum concentrate are allocated to the primary metal (copper). Owing to this cost advantage, byproduct molybdenite recovery from copper circuits at selected porphyry copper mines was estimated to account for 56% of the United States and 63% of worldwide molybdenum supply in 2005. Kennecott Utah Copper increased byproduct molybdenum production by more than 240%, and Montana Resources increased production by about 27% as compared with that of 2004. Phelps Dodge Corp. byproduct production was about equal to that of 2004.

Primary molybdenum mines operate in a swing capacity and have a limited ability to change production rate to meet spikes in demand. Phelps Dodge Corp. increased primary molybdenum recovery by about 20% through development work at its Henderson Mine, and Thompson Creek increased production by about 90% in 2005, reaping the benefits of mine development done the previous year. The Questa Mine continued to operate its mine and mill separately at intervals of about 2 to 3 months. Phelps Dodge Corp. commissioned two 6-month studies to determine the economic feasibility of reopening its Climax Mine; however, resumption of mining would not take place before 2008. If reopened, the mine could produce between 4,500 to 9,000 t/yr (10- to 20-million pounds per year) (Ryan’s Notes, 2005f).

Golden Phoenix Minerals, Inc. received Notice of Final Decision on October 15, 2005, from the Nevada Division of Environmental Protection, related to its water pollution control and reclamation permits. The company began construction of a 100-standard-ton-per-day flotation mill in November and will process a 1,000-t bulk sample early in 2006 to prove process design and test market the molybdenum concentrates produced (Golden Phoenix Minerals Inc., 2005¹).

In May 2005, the board of directors of Quadra Mining Ltd. approved \$7.75 million for construction of a molybdenum recovery circuit at its Robinson Mine near Ely, Nevada. Quadra also equipped a lab at the mine to allow molybdenum assays to

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

be run onsite for mill feed and copper concentrates. Production was expected to be from 450 to 725 t of molybdenum in concentrate in 2006 at an estimated operating cost of \$2.50 per pound (Quadra Mining Ltd., 2006§).

Consumption

In 2005, reported consumption (roasting) of molybdenum concentrate was 46,600 t, an increase of about 7,900 t compared with that of 2004. The increase resulted from increased mine production and because domestic roasters were ramped up to full capacity in 2005. Domestic mine production of molybdenum concentrate was roasted, exported for conversion, or purified to lubricant-grade molybdenum disulfide. Technical-grade MoX consumption in 2005 was about 9.5% greater than that of 2004. Oxide was the chief form of molybdenum used by industry, particularly in making full alloy, stainless and tool steel, and superalloys; however, some of the oxide was converted to other molybdenum products, such as ammonium and sodium molybdates, FeMo, high-purity oxide, and metal powder (table 3).

Metallurgical applications continued to dominate molybdenum use in 2005, accounting for about 84% of total consumption (table 3). In 2005, ferromolybdenum accounted for about 41% of the molybdenum-bearing materials used to make steel, a 3% increase from that of 2004. Nonmetallurgical applications included catalysts, chemicals, lubricants, and pigments. The dominant nonmetallurgical use was in catalysts.

Stocks

At yearend, 2005 producer plus consumer industry stocks contained about 5,800 t of molybdenum, an increase of about 1,200 t compared with those at yearend 2004. Inventories of molybdenum in concentrate at mines and plants increased by about 1,000 t. Producer stocks of molybdenum in such products as FeMo, molybdates, MoX, metal powders, and other types increased by about 930 t compared with those of 2004. Total stocks of about 9,410 t represented about a 26-week supply. Supply was calculated as reported stocks divided by annual consumption (table 1).

Prices

Prices were reported in Platts Metals Week in dollars per kilogram (kg) of contained molybdenum. The annual time-average prices for 2005 were MoX, \$70.677 per kg and FeMo, \$81.539 per kg of contained molybdenum, which represented increases of 92% and 102%, respectively, compared with 2004 prices. Molybdenum prices rose slightly in January, relative to their December 2004 levels, to \$70.396 and \$81.433, respectively, but dropped to \$61.812 and \$76.059 in February. Prices rose steadily from March through May and reached their highest point in June at \$82.232 and \$91.712, respectively. Prices followed a generally downward trend the rest of the year to close at \$61.840 and \$70.989, respectively. The MoX monthly average price ranged from the low of \$61.812 per kg in February to a high of \$82.832 per kg in June, and the FeMo

monthly average price ranged from a low of \$70.989 per kg in December to the high of \$91.712 per kg in June.

Foreign Trade

In 2005, molybdenum-containing material exports collectively contained about 48,500 t of molybdenum and were valued at \$2.06 billion (table 6). Imports for consumption of molybdenum-containing materials (products) collectively were valued at \$1.2 billion (table 9).

World Industry Structure

Capacity.—As of December 31, 2004, U.S.-rated capacity, for mines and mills, was estimated to be about 75,000 t/yr of contained metal. Rated capacity was defined as the maximum quantity of product that can be produced in a period of time on a normally sustainable long-term operating rate based on the physical equipment of the plant and given acceptable routine operating procedures involving energy, labor, maintenance, and materials. Capacity included operating plants temporarily closed that, in the judgment of the author, can be brought into production within a short period of time with minimal capital expenditure.

Reserves.—The U.S. molybdenum reserve base was estimated to be about 5.4 Mt, about 28% of the world molybdenum reserve base. About 90% of U.S. reserves occur in large low-grade porphyry molybdenum deposits mined or anticipated to be mined primarily for molybdenum and as an associated metal sulfide in low-grade porphyry copper deposits. These deposits were in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah. Other molybdenum sources contribute insignificantly to U.S. reserves.

Most Canadian reserves of molybdenum were contained in porphyry molybdenum and porphyry copper-molybdenum deposits in British Columbia. Other Canadian reserves were associated with minor copper-molybdenum porphyry deposits in New Brunswick and Quebec.

Molybdenum reserves in Central America and South America were associated mainly with large copper porphyry deposits. Of several such deposits in Chile, the Chuquicamata and El Teniente deposits were among the world's largest and accounted for 85% of molybdenum reserves in Chile. Peru also had substantial reserves, and the La Caridad deposit in Mexico was a leading producer. Numerous other porphyry copper deposits that may contain recoverable quantities of molybdenum have been identified in Central America and South America. Many of these deposits were being actively explored and evaluated and could substantially add to reserves in the future. Reserves of molybdenum in China and the Commonwealth of Independent States were thought to be substantial, but definitive information about the current sources of supply or prospects for future development in these two areas was lacking.

World Review

European Union.—The European Confederation of Iron and Steel Industries (Eurofer) finalized a resolution in June

asking the European Union either to conduct an interim review of the antidumping tariff on Chinese origin FeMo imports or to temporarily suspend the duty. A 5-year sunset review of the duty would not take place until February 2007. A duty of 22.5% was placed on Chinese-origin FeMo by the European Commission in January 2002 after a finding that dumping of Chinese material had caused harm to the European FeMo industry. Specialty steelmakers continued to be adversely affected by the high prices and limited supply of molybdenum in 2005 (Ryan's Notes, 2005a).

Treibacher Industrie AG announced that it would continue to produce FeMo at full capacity, contrary to rumors that it intended to discontinue production. Treibacher intended to cease production of a specialty grade of FeMo called Molyquik as it found the product difficult to market. Treibacher began producing Molyquik in 2001 and was producing only 2,500 t/yr but had a capacity of 6,500 t/yr (Ryan's Notes, 2005b).

Armenia.—Zangezur Copper-Molybdenum CJSC expanded operations in the Karajan copper-molybdenum field, the largest molybdenum-bearing deposit in the former Soviet Union. All molybdenum concentrates produced by the Zangezur plant were processed in Armenia, primarily by Armenian Pure Iron Works (API) and Armenian Molybdenum Production CJSC (AMP). API produced about 3,000 t of FeMo, 58% more than that of 2004, and AMP produced about 1,500 t of FeMo, about 180% more than that of 2004. Germany's Cronimet Mining GmbH, which owns 60% of Zangezur and 51% of API, was the principal buyer of the finished molybdenum products (Metal Pages, 2005§).

Canada.—Molybdenum production was restarted at the Gibraltar Mine in British Columbia in February. After 4 months of preproduction mining and mill/plant refurbishment, Gibraltar restarted copper milling operations in October 2004. A \$1.5 million upgrade of the molybdenum circuit began in October, and the circuit was operational at the end of January 2005. The mine produced about 194 t (427,000 pounds) of molybdenum in concentrate in 2005, about 80% of planned production (Platts Metals Week, 2005f).

Chile.—Chile's major copper producers, led by state-owned Corporación Nacional del Cobre (Codelco), produced 47,748 t of molybdenum in 2005, up about 14% from that of 2004. Several of Chile's copper producers have altered mine plans in order to extract ores higher in molybdenum content and have focused on molybdenum extraction over copper. Codelco's Chuquicamata Mine in northern Chile expected to produce 27,000 t of molybdenum in 2005, according to a company representative. Codelco achieved production breakthroughs in 2004 and 2005 that increased production at Chuquicamata, but that output was not sustainable. Production was expected to fall to about 20,000 t of molybdenum in 2006 (Platts Metals Week, 2005d). Molybdenum production at Antofagasta's Los Pelambres Mine was 7,900 t in 2004, down from 8,700 t in 2003, and was expected to decline further to about 7,200 t in 2005 owing to lower ore grades and reduced recoveries (Platts Metals Week, 2005c).

Santiago-based Molibdenos y Metales S.A. (Molymet) planned to invest \$106 million by 2007 to increase roasting capacity by 50% at its plants in Chile and Belgium. Molymet

announced that a 5,400-t/yr expansion at its FeMo converter in Chile was completed by mid-year 2005, boosting FeMo capacity there to 13,600 t/yr. An additional 3,400 t/yr of FeMo capacity planned for Molymet's FeMo plant in Belgium was likely to take place in 2006. Molymet previously announced expansion of its molybdenum concentrate roasting capacity in Chile by about 18,000 t/yr (40 million pounds) by yearend 2007, with an additional 4,500 t/yr (10 million pounds) expansion in Belgium to follow in 2009 (Ryan's Notes, 2005d).

Canadian metals producer Falconbridge Ltd. (Toronto) modified a former copper roaster at its Altonorte Smelter near Antofagasta in northern Chile to roast molybdenum concentrates. The plant began MoX production in June 2005 and achieved its design production capacity of 32 metric tons per day in less than 2 weeks. The modified plant could produce 10,000 t/yr of molybdenum oxide. Falconbridge contracted with Codelco, Chile's national copper company, to roast molybdenum concentrates from Codelco's Chuquicamata Mine (Platts Metals Week, 2005b).

China.—Molybdenum mines in the Huludao Region of northeastern China closed on government orders, and renewed safety checks were ordered in the wake of fatal coal mine accidents in February. About one-half of China's domestic supply of ferromolybdenum was lost to the market in April after authorities stopped production at about 30 companies suspected of tax fraud. The companies in northeastern Liaoning Province produced a combined 1,200 to 1,500 metric tons per month (t/mo) of FeMo (Metal Bulletin, 2005a). Mines in the Huludao region accounted for one-fourth of China's molybdenum concentrate, and about one-half of the country's FeMo exports (Metal Bulletin, 2005b). Local authorities confirmed those mining licenses that were revoked for tax fraud or illegal mining activity were to be auctioned.

Market sources said that the Chinese government had imposed a new 13% tax on molybdenum concentrate imports and a 17% tax on FeMo that is produced from imported concentrates and reexported. Export figures show that total Chinese molybdenum exports increased by more than 1,000 t/mo in June as compared with those of May and that most of the exports for June were in the form of FeMo. This pattern was the same as in 2004, when exports were low for the first 5 months and then increased sharply for several months (Ryan's Notes, 2005c).

Chinese producers stopped importing Western molybdenum concentrates by December. It was unclear if that action was because of falling MoX prices, increased consumption of domestic concentrates, or the gradual drawdown of FeMo stocks produced previously from imported concentrates. Molybdenum mines in the Huludao area of Liaoning Province were expected to remain closed until June 2006 as the Central Government worked to consolidate many small mines into larger operations that would be easier to regulate. Even if Chinese producers do not resume importing Western concentrates, the ongoing bottleneck in Western roasting capacity would continue to restrict supplies of roasted molybdenum concentrates (Ryan's Notes, 2005e).

Kazakhstan.—Eureka Mining Plc. (London, UK) expected to produce molybdenum concentrates from its Shorskoye project in early 2006, following the signing of a joint-venture

agreement with KazAtomProm, the state uranium company of Kazakhstan. Under terms of the agreement, Eureka would use KazAtomProm's Stepnogorsk industrial facilities to process molybdenum concentrates from Shorskoye in exchange for a 50% interest in Ar-Man, Eureka's wholly owned subsidiary, which owns Shorskoye (Platts Metals Week, 2005e).

Outlook

Molybdenum supply continued to be constrained in 2005, even with increased concentrate production, owing to the continued bottleneck of insufficient Western roasting capacity. Surplus molybdenum concentrates exported to China for roasting were not reexported to the market owing to strong demand within China, coupled with reduced production from the Huludao Region owing to mine closures. Output of byproduct molybdenum was expected to rise in 2006 with the development of a 4,000-t/yr project at the Escondida Mine in Chile. In addition, the Chuquicamata Mine and the Los Pelambres Mine changed their mining plans to increase molybdenum production (Metal Bulletin Research, 2005).

Phelps Dodge expected to boost capacity at its Henderson Mine to about 18,000 t/yr (40 million pounds per year) by mid-2006 from its present capacity of about 14,500 t/yr (32 million pounds per year) (Ryan's Notes, 2005f). If Phelps Dodge Mining Company restarted its idled Climax Mine in 2008, or later, an additional 4,500 to 9,000 t/yr (10 to 20 million pounds per year) of molybdenum would probably be added to the market.

Increased production of low-cost byproduct molybdenum from South American copper mines during the next decade could adversely affect development of molybdenum deposits in North America. Because the cost of mining ore is charged against copper in a byproduct mine, byproduct molybdenum production costs are in the \$1 to \$2 per pound range as compared with \$3 to \$4 per pound for an operating molybdenum mine where molybdenum is the principal product. Many North American molybdenum deposits that would be profitable at molybdenum prices in the \$6 to \$8 per pound range, will probably not be developed. Increasing reliance on byproduct molybdenum could lead to greater fluctuations in molybdenum prices in the future as copper production varies according to copper market conditions.

Another factor in future molybdenum prices involves action by the Chinese Government. In an effort to restrict small-scale mining operations that do not comply with environmental or health and safety regulations, many small mines in the Huludao Region of China, which accounted for about 20% of Chinese molybdenum production in 2004, have been closed since February 2005. In addition, owing to energy shortages, environmental concerns, and government regulations, Chinese toll roasting of imported molybdenum concentrates will be restricted, further exacerbating the worldwide shortage in roasting capacity (Platts Metals Week, 2005a).

Because of abundant resources and adequate production capacity in Chile, China, the United States, and other countries, world producers expected to readily meet the future requirement

for molybdenum. The principal use for molybdenum will continue to be in chemicals and catalysts and as an additive in steel manufacturing in general, most importantly alloy and stainless steel.

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TABLE 1
SALIENT MOLYBDENUM STATISTICS¹

(Metric tons of contained molybdenum)

	2001	2002	2003	2004	2005
United States:					
Concentrate:					
Production	37,600	32,300	33,500	41,500	58,000
Shipments	37,000	32,300	33,600	42,000	57,900
Reported consumption ²	33,300	21,200	27,500	38,700	46,600
Imports for consumption	6,010	4,710	5,190	8,780	11,900
Stocks, December 31:					
Concentrate, mine and plant	4,210	3,870	2,520	2,610	3,610
Product producers ³	5,600	4,300	2,760	2,840	3,770
Consumers	898 ^r	1,800	1,900	2,040 ^r	2,030
Total	10,700	9,970	7,180	7,480	9,410
Primary products:					
Production	40,300	31,300	41,400	66,300	78,500
Shipments	32,600	27,500	30,100	39,300	46,700
Reported consumption	15,800	15,300	16,400	17,400	18,900
World, mine production	133,000 ^r	122,000 ^r	131,000 ^r	159,000 ^r	185,000 ^e

^eEstimated. ^rRevised.

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

²Molybdenum concentrates roasted to make molybdenum oxide.

³Includes ammonium, calcium, and sodium molybdate; briquets; ferromolybdenum; molybdenum hexacarbonyl; molybdenum metal molybdenum pentachloride; molybdic acid; pellets; phosphomolybdic disulfide; and technical and purified molybdic oxide.

TABLE 2
PRODUCTION, SHIPMENTS, AND STOCKS OF MOLYBDENUM PRODUCTS IN THE UNITED STATES¹

(Metric tons of contained Mo)

	Metal powder		Other ²		Total	
	2004	2005	2004	2005	2004	2005
Received from other producers	--	--	15,100	17,900	15,100	17,900
Gross production during year	4,210	4,700	62,000	73,800	66,300	78,500
Molybdenum products used to make other products	3,340	3,660	38,600	45,100	42,000	48,700
Net production	868	1,050	23,400	28,700	24,300	29,800
Shipments	889	1,050	38,500	45,700	39,300	46,700
Producer stocks, December 31	172	171	2,660	3,600	2,840	3,770

-- Zero.

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

²Includes ammonium, calcium, and sodium molybdate; ferromolybdenum; molybdenum disulfide; molybdenum hexacarbonyl; molybdenum metal; molybdenum pentachloride; molybdic acid; molybdic oxides; pellets; and phosphomolybdic acid.

TABLE 3
U.S. REPORTED CONSUMPTION, BY END USES, AND CONSUMER STOCKS OF MOLYBDENUM MATERIALS¹

(Kilograms of contained Mo)

End use	Molybdic oxides	Ferromolybdenum ²	Ammonium and sodium molybdate	Molybdenum scrap	Other	Total
2004:						
Steel:						
Carbon	362,000	378,000	--	--	W	740,000
High-strength low-alloy	426,000	168,000	--	--	W	594,000
Stainless and heat-resisting	2,630,000	836,000	--	22,700	117,000	3,610,000
Full alloy	1,760,000	2,200,000	--	--	18,100	3,980,000
Tool	603,000	W	--	442	--	604,000
Total	5,790,000	3,580,000	--	23,100	135,000	9,520,000
Cast irons (gray, malleable, ductile iron)	W	920,000	--	--	27,000	947,000
Superalloys	948,000	19,500	--	(3)	1,400,000	2,360,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	68,000	--	--	733	68,700
Other alloys	W	28,000	--	913	1,050	30,000
Mill products made from metal powder ⁴	--	--	--	--	1,420,000	1,420,000
Cemented carbides and related products ⁵	--	--	--	--	46	46
Chemical and ceramic uses:						
Pigments	W	--	207,000	--	--	207,000
Catalysts	1,010,000	--	W	--	179,000	1,190,000
Other	--	--	--	--	14,500	14,500
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	350,000	350,000
Other	131,000 ^r	89,300 ^r	889,000	--	187,000	1,300,000 ^r
Grand total	7,880,000 ^r	4,700,000 ^r	1,100,000	24,000	3,710,000	17,400,000
Stocks, December 31	464,000	656,000	16,800	17,200	880,000	2,030,000
2005:						
Steel:						
Carbon	350,000	333,000	--	--	W	683,000
High-strength low-alloy	386,000	185,000	--	--	W	571,000
Stainless and heat-resisting	1,930,000	766,000	--	33,700	78,100	2,800,000
Full alloy	1,990,000	2,590,000	--	--	18,100	4,600,000
Tool	722,000	W	--	442	--	723,000
Total	5,380,000	3,870,000	--	34,200	96,300	9,380,000
Cast irons (gray, malleable, ductile iron)	W	736,000	--	--	51,500	788,000
Superalloys	1,120,000	22,800	--	(3)	1,680,000	2,820,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	44,800	--	--	733	45,500
Other alloys	W	51,400	--	913	1,950	54,300
Mill products made from metal powder ⁴	994,000	--	90,000	--	1,750,000	2,830,000
Cemented carbides and related products ⁵	--	--	--	--	95	95
Chemical and ceramic uses:						
Pigments	W	--	178,000	--	--	178,000
Catalysts	1,010,000	--	W	--	179,000	1,190,000
Other	--	--	--	--	12,300	12,300
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	279,000	279,000
Other	130,000	91,500	885,000	--	191,000	1,300,000
Grand total	8,630,000	4,820,000	1,150,000	35,100	4,240,000	18,900,000
Stocks, December 31	512,000	604,000	14,200	36,100	866,000	2,030,000

^rRevised. W Withheld to avoid disclosing company proprietary data; included with "Other" of the "Miscellaneous and unspecified uses" category. -- Zero.

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

²Includes calcium molybdate.

³Included with "Superalloys, other alloys."

⁴Includes construction, mining, oil and gas, and metal working machinery.

⁵Includes ingot, wire, rod, and sheet.

TABLE 4
U.S. EXPORTS OF MOLYBDENUM PRODUCTS, BY PRODUCT AND COUNTRY¹

Product and country	HTS ² code	2004		2005	
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Brazil		(3)	\$3	--	--
Canada		2,340	23,100	3,380	\$34,700
Japan		661	12,500	1,130	32,700
Mexico		3	56	13	207
Other		2,280	44,700	10,000	307,000
Total		5,280	80,300	14,600	375,000
Molybdates all, gross weight:	2841.70.0000				
Australia		14	131	6	327
Brazil		6	117	17	272
Canada		845	5,800	499	11,400
Colombia		6	41	22	581
Japan		279	2,650	146	2,830
Korea, Republic of		3	43	2	26
Mexico		370	5,240	424	8,410
Netherlands		876	13,400	843	28,400
Taiwan		6	113	4	198
Other		278	955	189	2,080
Total		2,680	28,500	2,150	54,500
Ferromolybdenum, contained weight: ⁴	7202.70.0000				
Canada		870	18,700	1,930	38,500
Mexico		34	1,130	89	1,310
Netherlands		--	--	33	2,450
Other		21	1,400	34	1,140
Total		925	21,200	2,090	43,400
Molybdenum other, gross weight: ⁵	Various ⁶				
Australia		(3)	43	1	60
Brazil		89	3,680	92	6,840
Canada		77	2,850	127	4,690
France		42	1,770	56	5,110
Germany		100	3,970	155	13,200
Hungary		84	3,180	59	4,290
India		37	1,520	23	2,180
Italy		25	1,010	15	1,510
Japan		442	22,800	528	49,000
Mexico		13	1,270	18	1,800
Netherlands		24	1,760	25	2,250
Spain		14	717	12	1,050
Sweden		24	461	2	191
Taiwan		101	4,140	309	7,760
United Kingdom		246	7,690	399	25,100
Other		203	9,150	207	14,400
Total		1,520	66,000	2,030	139,000

-- Zero.

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

²Harmonized Tariff Schedule of the United States.

³Less than ½ unit.

⁴Ferromolybdenum contains about 60% to 65% molybdenum.

⁵Includes powder, unwrought, waste and scrap, wire, wrought, and other.

⁶Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.97.0000, 8102.96.0000, 8102.95.0000, and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 5
U.S. EXPORTS OF MOLYBDENUM ORE AND CONCENTRATES
(INCLUDING ROASTED AND OTHER CONCENTRATES), BY COUNTRY¹

Country	2004		2005	
	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Australia	30	\$322	110	\$1,740
Austria	1,310	6,460	3	96
Belgium	6,470	57,900	9,430	377,000
Brazil	31	462	67	1,180
Canada	1,370	14,700	3,840	80,700
Chile	1,380	23,100	177	5,610
China	36	98	4,390	164,000
Costa Rica	27	67	4	76
Finland	638	3,990	12	801
Germany	295	1,000	136	2,310
Japan	5,730	26,000	2,050	60,200
Korea, Republic of	95	890	12	269
Mexico	3,910	26,500	3,130	34,300
Netherlands	14,100	125,000	15,000	478,000
Slovenia	815	3,610	--	--
Spain	765	3,760	5	136
Sweden	38	650	--	--
United Kingdom	8,910	61,000	7,310	224,000
Other	279	1,760	694	16,800
Total	46,200	358,000	46,400	1,450,000

-- Zero.

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

Source: U.S. Census Bureau.

TABLE 6
U.S. EXPORTS OF MOLYBDENUM PRODUCTS¹

Item	HTS ² code	2004			2005		
		Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)	Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	NA	33,800	\$237,000	NA	26,100	\$739,000
Molybdenum ore and concentrates, other	2613.90.0000	NA	12,400	121,000	NA	20,300	708,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	5,280	NA	80,300	14,600	NA	375,000
Molybdates, all	2841.70.0000	2,680	NA	28,500	2,150	NA	54,500
Ferromolybdenum	7202.70.0000	1,540	925	21,200	3,480	2090	43,400
Molybdenum powders	8102.10.0000	478	NA	18,200	612	NA	40,700
Molybdenum unwrought, bars and rods	8102.94.0000	181	NA	3,510	71	NA	4,260
Molybdenum waste and scrap	8102.97.0000	216	NA	4,330	434	NA	16,700
Molybdenum wire	8102.96.0000	177	NA	8,540	218	NA	19,600
Molybdenum, other	Various ³	469	NA	31,400	693	NA	58,100
Total		11,000	47,100	554,000	22,200	48,500	2,060,000

NA Not available.

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

²Harmonized Tariff Schedule of the United States.

³Includes HTS codes 8102.95.0000 and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS OF MOLYBDENUM PRODUCTS, BY PRODUCT AND COUNTRY¹

Product and country	HTS ² code	2004		2005	
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Chile		231	\$6,270	773	\$27,300
China		216	3,600	18	274
Germany		106	2,750	99	2,840
Russia		36	499	--	--
Uzbekistan		191	2,190	342	11,900
Other		42	511	4	150
Total		822	15,800	1,240	42,500
Molybdates all, contained weight:	Various ³				
Belgium		--	--	2	202
Canada		2	33	6	100
Chile		850	11,400	1,060	22,400
China		425	5,770	1,480	29,000
Germany		140	2,120	93	1,090
Other		27	477	107	2,040
Total		1,440	19,800	2,750	54,800
Molybdenum orange, gross weight:	3206.20.0020				
Canada		945	4,520	702	4,040
Colombia		43	86	9	20
Korea, Republic of		--	--	(6)	3
Mexico		28	65	148	396
Other		17	89	125	321
Total		1,030	4,760	983	4,780
Ferromolybdenum, contained weight: ⁴	7202.70.0000				
Belgium		12	719	32	2,240
Canada		44	1,370	382	28,600
Chile		116	3,860	313	22,300
China		4,850	148,000	3,030	214,000
Korea, Republic of		12	560	36	2,510
United Kingdom		231	2,520	114	2,390
Other		35	811	140	5,930
Total		5,310	158,000	4,050	278,000
Other, gross weight:	Various ⁵				
Austria		268	14,200	312	31,100
Canada		33	852	4	180
China		265	7,250	316	22,200
Germany		32	2,580	109	8,830
Hong Kong		21	415	8	395
Japan		87	3,640	81	7,400
Korea, Republic of		(6)	8	(6)	7
Russia		90	2,600	12	1,270
United Kingdom		16	599	10	544
Other		84	2,240	28	944
Total		896	34,300	879	72,900

-- Zero.

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

²Harmonized Tariff Schedule of the United States.

³Includes HTS codes 2841.70.1000 and 2841.70.5000.

⁴Ferromolybdenum contains about 60% to 65% molybdenum.

⁵Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.95.3000, 8102.95.6000, 8102.96.0000, 8102.97.0000, and 8102.99.0000.

⁶Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS OF MOLYBDENUM ORE AND CONCENTRATES (INCLUDING
ROASTED AND OTHER CONCENTRATES), BY COUNTRY¹

Country	2004		2005	
	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Canada	2,680	\$76,900	2,900	\$188,000
Chile	3,570	110,000	4,930	356,000
China	18	608	47	2,850
Italy	5	38	--	--
Japan	5	38	--	--
Mexico	2,210	70,300	3,460	170,000
Netherlands	37	217	48	3,230
Other	258	9,300	475	26,200
Total	8,780	268,000	11,900	746,000

-- Zero.

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

Source: U.S. Census Bureau.

TABLE 9
U.S. IMPORTS FOR CONSUMPTION OF MOLYBDENUM PRODUCTS¹

Item	HTS ² code	2004			2005		
		Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)	Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	7,580	4,720	\$133,000	8,570	5,380	\$306,000
Molybdenum ore and concentrates, other	2613.90.0000	9,330	4,070	135,000	13,800	6,480	440,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	822	NA	15,800	1,240	NA	42,500
Molybdates, all	Various ³	2,200	1,440	19,800	4,320	2,750	54,800
Molybdenum orange	3206.20.0020	1,030	NA	4,760	983	NA	4,780
Ferromolybdenum	7202.70.0000	8,310	5,310	158,000	6,340	4,050	278,000
Molybdenum powders	8102.10.0000	139	95	4,930	93	78	7,740
Molybdenum unwrought, bars and rods	8102.94.0000	151	151	3,520	99	99	5,750
Molybdenum waste and scrap	8102.97.0000	454	415	10,200	503	480	35,600
Molybdenum wire	8102.96.0000	20	NA	2,010	21	NA	3,160
Molybdenum, other	Various ⁴	132	NA	13,700	163	NA	20,700
Total		30,200	16,200	501,000	36,200	19,300	1,200,000

NA Not available.

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

²Harmonized Tariff Schedule of the United States.

³Includes HTS codes 2841.70.1000 and 2841.70.5000.

⁴Includes HTS codes 8102.95.3000, 8102.95.6000, and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 10
MOLYBDENUM-PRODUCING MINES IN THE UNITED STATES IN 2005

State and mine	County	Operator	Source of molybdenum
Arizona:			
Bagdad	Yavapai	Phelps Dodge Corp.	Copper-molybdenum ore, concentrated.
Sierrita	Pima	do.	Do.
Colorado, Henderson	Clear Creek	do.	Molybdenum ore, concentrated.
Idaho, Thompson Creek	Custer	Thompson Creek Metals Co.	Do.
Montana, Continental Pit	Silver Bow	Montana Resources	Copper-molybdenum ore, concentrated.
New Mexico:			
Chino	Grant	Phelps Dodge Corp.	Do.
Questa	Taos	Molycorp, Inc.	Molybdenum ore, concentrated.
Utah, Bingham Canyon	Salt Lake	Kennecott Utah Copper Corp.	Copper-molybdenum ore, concentrated.

TABLE 11
MOLYBDENUM: WORLD MINE PRODUCTION, BY COUNTRY^{1,2}

(Metric tons of contained molybdenum)

Country ³	2001	2002	2003	2004	2005 ^e
Armenia	2,943	2,884	2,763	2,950 ^e	2,750
Canada	8,233 ^r	8,043 ^r	9,090 ^r	9,520 ^r	7,910
Chile	33,492	29,466 ^r	33,374 ^r	41,883 ^r	47,748
China ^e	28,200	29,300	31,000	38,500 ^r	40,000
Iran ^e	2,400 ^r	2,300 ^r	2,200 ^r	1,800 ^r	2,000
Kazakhstan	225	230	230	230 ^e	230
Kyrgyzstan ^e	250	250	250	250	250
Mexico	5,518	3,428	3,524	3,730	4,246
Mongolia	1,514	1,590	1,793	1,141 ^r	1,188
Peru	9,499	8,613	9,561	14,246 ^r	17,325
Russia ^e	2,600	2,900	2,900	2,900	3,000
United States	37,600	32,300	33,500	41,500	58,000
Uzbekistan ^e	500	500	500	500	500
Total	133,000 ^r	122,000 ^r	131,000 ^r	159,000 ^r	185,000

^eEstimated. ^rRevised.

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

²Table includes data available through July 13, 2006.

³In addition to the countries listed, North Korea, Romania, and Turkey are believed to produce molybdenum, but output is not reported quantitatively, and available general information is inadequate to make reliable estimates of output levels.

⁴Reported figure.