



# 2014 Minerals Yearbook

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## MOLYBDENUM [ADVANCE RELEASE]

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# MOLYBDENUM

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In the United States, mine production of molybdenum concentrate increased by 12% to 68,200 metric tons (t) in 2014 compared with the revised 61,000 t in 2013. Primary molybdenum production continued at three U.S. operations, accounting for 49% of total U.S. molybdenum production. Byproduct molybdenum was produced at 10 U.S. operations, accounting for 51% of total U.S. molybdenum production. World mine production of molybdenum was estimated at 281,000 t in 2014 compared with the revised 258,000 t in 2013 (table 1). The U.S. share of world production was 24% in 2014. Reported U.S. consumption of primary molybdenum products, not including molybdenum concentrates, increased by 5% in 2014 compared with that of 2013 (table 3).

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 molybdc oxide ( $\text{MoO}_3$ , called MoX) or ferromolybdenum ( $\text{FeMo}$ ), is commonly used in combination with or added to chromium, manganese, nickel, niobium (columbium), 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 can sustain high stress, expanded temperature ranges, and highly corrosive environments. Significant uses of molybdenum are as a refractory metal and in numerous chemical applications, including catalysts, lubricants, and pigments. Molybdenum has become increasingly important in green technology, particularly in the manufacture of biofuels, catalysts, ethanol, solar panels, and wind turbines.

U.S. molybdenum reserves were estimated to have been about 2.7 million metric tons (Mt), about 31% of world molybdenum reserves. About 90% of U.S. reserves occur in large, low-grade porphyry molybdenum deposits mined or anticipated to be mined primarily for molybdenum and in low-grade porphyry copper deposits as an associated metal sulfide. These deposits are in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah.

## Production

Domestic primary and byproduct molybdenum mine production data 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 13 U.S. operations that currently produce molybdenum concentrates and products from ore, and all responded, representing 100% of U.S. production reported in table 1.

As of December 31, 2014, U.S. rated capacity for mines and mills was estimated to be about 99,300 metric tons per year (t/yr) of contained metal. Rated capacity is 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 plants that were temporarily closed but could be brought into production within a short period of time with minimal capital expenditure.

Primary molybdenum production continued at the Climax Mine and the Henderson Mine in Colorado and the Thompson Creek Mine in Idaho. The Ashdown Mine in Nevada and the Questa Mine in New Mexico remained closed. Freeport-McMoRan Copper & Gold Inc. (FCX) operated the Henderson underground mine and the Climax open pit mine. Both mines produced high-purity, chemical-grade molybdenum concentrates, which were further processed into value-added molybdenum chemical products. Production from both mines in 2014 totaled 23,130 t of molybdenum, compared with 22,230 t in 2013 (Freeport-McMoRan Copper & Gold Inc., 2015a, p. 53). The Climax Mine began commercial operations in May 2012 and included a 25,000-metric-ton-per-day (t/d) mill facility. Molybdenum production from Climax totaled 9,525 t in 2014 (Freeport-McMoRan Copper & Gold Inc., 2015b, p. 13). The Henderson operation consisted of a large underground mining complex that fed a 32,000-t/d concentrator. Henderson had the capacity to produce 18,140 t/yr of molybdenum concentrate (Freeport-McMoRan Copper & Gold Inc., 2015b, p. 13). The majority of the molybdenum concentrate produced at Henderson was shipped to FCX’s Fort Madison, IA, processing facility.

Thompson Creek Metals Co. Inc. (TCMC) announced that it produced a total of 11,900 t of molybdenum in 2014 at both its Endako Mine (British Columbia, Canada) and Thompson Creek Mine compared with 13,600 t produced at both mines in 2013. TCMC owned a 75% joint-venture interest in the Endako open pit mine, mill, and roasting facility in northern British Columbia, Canada. The Thompson Creek Mine consists of an open pit primary molybdenum mine and mill near Challis, ID (Thompson Creek Metals Co. Inc., 2015). In October 2014, TCMC announced that mining operations ceased at its Thompson Creek Mine. The company announced that the remaining stockpiles of ore would continue to be processed through December. Thereafter, the mine was expected to be placed on care-and-maintenance status (Thompson Creek Metals Co. Inc. 2014a, c).

The molybdenum concentrate produced at the Thompson Creek Mine was transported to TCMC’s Langeloth, PA, metallurgical roasting facility, which produced ferromolybdenum products, molybdc oxide, and other

specialty products. The Langeloth facility also processed nonmolybdenum catalysts for various customers, primarily in the food industry. TCMC had two high-grade underground molybdenum deposits—the Davidson deposit near Smithers, British Columbia, Canada, and the Mount Emmons deposit near Crested Butte, CO (Thompson Creek Metals Co. Inc., 2013, p. 11).

Molybdenum was produced as a byproduct of copper production at the Bagdad, Mineral Park, Mission, Morenci, Pinto Valley, and Sierrita Mines in Arizona; the Continental Pit Mine in Montana; the Robinson Mine in Nevada; the Chino Mine in New Mexico; and the Bingham Canyon Mine in Utah (table 2). American Smelting and Refining Company LLC (ASARCO) restarted molybdenum production at its Mission Mine in early 2014. Capstone Mining Corp. restarted molybdenum production at its Pinto Valley Mine in early 2014 as well. In the case of byproduct molybdenum recovery at a copper mine, all mining costs associated with molybdenum concentrate production are allocated to the primary metal (copper). In 2014, byproduct molybdenite recovery accounted for approximately 51% of the U.S. molybdenum supply.

The Bagdad operation of FCX included a 75,000-t/d concentrator that produced copper and molybdenum concentrates, as well as a pressure-leach plant that processed molybdenum concentrate. Bagdad produced approximately 4,080 t of molybdenum concentrate in 2014, a 12% increase compared with 3,630 t of molybdenum concentrate produced in 2013 (Freeport-McMoRan Copper & Gold Inc., 2015b, p. 9).

The Morenci operation of FCX consisted of two concentrators capable of milling 115,000 t/d of ore to produce copper and molybdenum concentrates. Morenci underwent a mill expansion project, which commenced in May 2014. Construction of the expanded facility was almost complete by yearend 2014. The completion of the molybdenum circuit, which according to the company would add capacity of approximately 9,000 t/yr of molybdenum concentrate, was expected to be completed in 2015 (Freeport-McMoRan Copper & Gold Inc., 2015a, p. 44).

The Sierrita operation of FCX included a 102,000-t/d concentrator that produced copper and molybdenum concentrates. It also had molybdenum facilities consisting of a leaching circuit, two molybdenum roasters, and a packaging facility. The molybdenum facilities processed concentrate from Sierrita, other FCX mines, and third-party sources. Molybdenum concentrate production at Sierrita in 2014 was 10,900 t, a 20% increase compared with 9,070 t of molybdenum concentrate produced in 2013 (Freeport-McMoRan Copper & Gold Inc., 2015b, p. 10).

FCX's Chino Mine is an open pit copper-mining complex located in southwestern New Mexico's Grant County. The Chino operation included a 39,000-t/d concentrator that produced copper and molybdenum concentrates. Chino produced approximately 450 t of molybdenum concentrate in 2014 (Freeport-McMoRan Copper & Gold Inc., 2015b, p. 12).

Rio Tinto plc (London, United Kingdom) reported that molybdenum concentrate production at its Bingham Canyon Mine (operated by its subsidiary Kennecott Utah Copper Corp.) was 11,500 t of molybdenum compared with 5,700 t

of molybdenum in 2013. This more than double increase in production was partially attributed to low production in 2013 owing to a landslide that the mine experienced in April 2013 (Rio Tinto plc, 2015).

Mineral Park Inc., a subsidiary of Mercator Minerals Ltd. (Vancouver, British Columbia, Canada) announced that it was placing its mill and Mineral Park Mine near Kingman, AZ, on care-and-maintenance status as of December 29, 2014 (Metal Bulletin, 2015).

## Consumption

Statistics on consumption of molybdenum in end-use applications by U.S. metal consumers were developed from the voluntary "Consolidated Consumers Survey." For this survey, molybdenum consumers were canvassed on a monthly or annual basis. Reported consumption and stocks data in tables 1 and 3 include estimates to account for nonrespondents.

In 2014, U.S. reported consumption of molybdenum contained in concentrate for roasting increased compared with that of 2013. Domestic mine production of molybdenum concentrate was roasted, exported for conversion, or purified to lubricant-grade molybdenum disulfide ( $\text{MoS}_2$ ). MoX was the leading form of molybdenum used by industry, particularly in making stainless steel. Superalloy industry consumption decreased slightly in 2014 compared with that of 2013 (table 3).

Metallurgical applications dominated reported molybdenum use in 2014, accounting for approximately 88% of 2014 total reported consumption. In 2014, FeMo accounted for 41% of the molybdenum-bearing materials used to make steel (not including tool steel) (table 3). Nonmetallurgical applications included catalysts, chemicals, lubricants, and pigments. The dominant nonmetallurgical use was in catalysts, principally catalysts related to petroleum refining.

According to the International Molybdenum Association (IMOA), molybdenum compounds continued to play an important role in sustainable and environmentally safe pigments. Greater awareness of toxicity and environmental impact was generating a push to replace older, sometimes toxic, pigments. A new class of complex, inorganic, high-performance color pigments was created from oxides containing two or more metals. These complex oxides used chromium, cobalt, copper, iron, manganese, nickel, and vanadium to form their basic oxide structure and color. Adding molybdenum modified the color of the pigment. These pigments were some of the most stable and durable type of colorants commercially available. Molybdenum-containing pigments were expected to play an increasing role in environmentally friendly pigments in the future (International Molybdenum Association, 2014, p. 10).

## Stocks

At yearend 2014, producer plus consumer industry stocks increased compared with yearend 2013 stocks. Inventories of molybdenum in concentrate at mines and plants increased (table 1). Stocks of molybdenum in FeMo, MoX, metal powders, and other products increased compared with stocks of 2013 (table 3).

## Prices

In 2014, the average monthly price for domestic FeMo, as published by Ryan's Notes, ranged from \$11.389 to \$19.063 per pound of molybdenum content, compared with \$11.067 to \$12.838 per pound reported in 2013. The average monthly price for domestic MoX ranged from \$9.538 to \$14.747 per pound in 2014, compared with \$9.350 to \$11.810 per pound in 2013 (fig. 1).

## Foreign Trade

In 2014, molybdenum-containing exports (excluding molybdenum ore and concentrates) collectively totaled approximately 5,480 t (gross quantity) valued at \$172 million (table 6). Imports for consumption of all molybdenum-containing products collectively totaled approximately 42,300 t (gross quantity) valued at \$697 million (table 9).

## World Review

World molybdenum reserves and production capacity were concentrated in a few countries. In 2014, world mine output was estimated to have been 281,000 t (molybdenum contained in concentrate), of which, in descending order of production, China, the United States, Chile, Peru, Mexico, and Canada provided about 93% (table 10).

Most reserves of molybdenum in Canada were contained in porphyry molybdenum and porphyry copper-molybdenum deposits in British Columbia. Other reserves in Canada were associated with minor porphyry copper-molybdenum deposits in New Brunswick and Quebec. The La Caridad porphyry copper-molybdenum deposit in Mexico was a leading producer. Molybdenum reserves in Central America and South America were associated mainly with large porphyry copper deposits. Of several such deposits in Chile, the Chuquicamata and El Teniente deposits were among the largest in the world and accounted for 85% of molybdenum reserves in Chile. Peru also had substantial reserves. Reserves of molybdenum in China and the Commonwealth of Independent States (CIS) were thought to be substantial, but definitive information about the current sources of supply or prospects for future development in these two regions was lacking.

According to the IMO, global molybdenum consumption was a record high of 253,600 t in 2014 compared with 243,900 t in 2013. The leading consumer of molybdenum in 2014 continued to be China, where consumption increased to 91,600 t in 2014 from 89,000 t in 2013. The European Union had the second largest share with 65,000 t in 2014 compared with 63,700 t in 2013 (International Molybdenum Association, 2015).

**Armenia.**—The Zangezur Copper-Molybdenum Combine was expected to increase its total ore production to 22 million metric tons per year by 2016 at its Kajaran Mine. Ore production at the mine was 18.1 Mt in 2013 and 18.7 Mt in 2014. The company's shareholders are Croniment Mining AG (60%), Pure Iron Plant OJSC (15%), Armenian Molybdenum Production Ltd. (12.5%), and Zangezur Mining Ltd. (12.5%) (Arka News Agency, 2014).

**Canada.**—Thompson Creek Metals Co. Inc., along with joint-venture partner, Sojitz Moly Resources Inc., placed the

Endako molybdenum mine on temporary suspension, effective December 31, 2014. Approximately 50% of salaried employees at the mine were expected to be terminated (Thompson Creek Metals Co. Inc., 2014b).

At its Gibraltar Mine in south-central British Columbia, Taseko Mines Ltd. produced 1,057 t of molybdenum in 2014, a 61% increase from the 658 t of molybdenum produced in 2013. The company attributed the large increase to full-year operation of their new molybdenum separation facility in 2014 (Taseko Mines Ltd., 2015).

Alloycorp Mining Inc. (Toronto, Ontario), formerly Avanti Mining Inc., announced that targeted production at its Avanti Kitsault molybdenum mine would begin in the fourth quarter of 2017. In late 2014, the mine was at the pre-construction stage and was expected to move to full construction at the end of 2015 (Alloycorp Mining Inc., 2015). In June 2014, road construction work and upgrades to facilities had commenced. The mine was expected to produce approximately 163,000 t of molybdenum over a 14-year mine life (Alloycorp Mining Inc., 2014, p. 1, 7).

**Chile.**—Amerigo Resources Ltd. produced 263 t of molybdenum in 2014, compared with 366 t in 2012, at its Minera Valle Central (MVC) processing facility. Amerigo processed tailings from El Teniente's Colihues tailings pond as well as fresh tailings from the mine's concentrator. The plant extracted copper from tailings discharged from Corporación Nacional del Cobre de Chile's (CODELCO) El Teniente concentrators. The tailings were then returned to El Teniente's tailings disposal system. The MVC facility has a capacity of 175,000 t/d and processed 58 Mt of tailings in 2014 (Amerigo Resources Ltd., 2015, p. 12–13).

Antofagasta plc (London, United Kingdom) announced that 2014 molybdenum production at its Los Pelambres Mine was 7,900 t, a 12% decrease compared with 9,000 t of molybdenum produced in 2013. The company attributed the decrease to lower ore grades. Antofagasta anticipated 2015 molybdenum production to be approximately 8,000 t. Los Pelambres is in Chile's Coquimbo Region, 240 kilometers (km) northeast of Santiago (Antofagasta plc, 2015, p. 1, 7).

CODELCO, the state-controlled copper and molybdenum producer, announced that it produced 30,600 t of molybdenum in 2014 compared with 23,000 t in 2013. CODELCO attributed the 33% increase in molybdenum production mostly to higher molybdenum grades in the Chuquicamata Division. The Chuquicamata open pit mine produced 14,620 t of molybdenum in 2014, a 111% increase compared with the 6,923 t molybdenum produced in 2013. CODELCO also announced that in December 2014, its Board of Directors approved the investment of \$3,306 million to be added to the existing investment of \$894 million in order to start construction to transform the Chuquicamata open pit mine to a large underground operation. This transformation was expected to extend the mine life by 40 years, and, once completed, the Chuquicamata underground mine would produce approximately 15,000 t/yr of molybdenum (Corporación Nacional del Cobre de Chile, 2015, p. 99, 325–326).

CODELCO, through its subsidiary MOLYB Ltd., continued building its molybdenum concentrate treatment plant, located in Mejillones, Antofagasta Region. The plant was scheduled

to begin operations in 2016 and was expected to produce 16,000 t/yr of molybdenic oxide and 32,000 t of sulfuric acid. It was also expected to produce rhenium as a byproduct (Corporación Nacional del Cobre de Chile, 2015, p. 143).

The Sierra Gorda project, in the Antofagasta Region in northern Chile, was a joint venture among KGHM International Ltd., Sumitomo Metal Mining Co., Ltd., and Sumitomo Corp. under the company Sierra Gorda SCM. The open pit mine was still under construction at yearend and was expected to begin production in 2015. Estimated production from current reserves was approximately 11,000 t/yr of molybdenum (KGHM Polska Miedź S.A., 2015, p. 153, 163)

**China.**—China's Zhongxi Mining Co. Ltd. announced that its molybdenum concentrate processing plant upgrade project in Zhuozi County, Nei Mongol Autonomous Region, launched in August of 2014, was expected to be complete in early 2015. Once construction was complete, the processing plant would be able to process approximately 12,000 t/yr of molybdenum concentrate (Metal-Pages, 2014).

Jinduicheng Molybdenum Co. Ltd. (JDC) announced that it planned to increase its molybdenum concentrate production in 2015 to approximately 45,000 t. In 2014, JDC produced 39,200 t of molybdenum concentrate, a slight increase from the 39,000 t of molybdenum concentrate produced in 2013. JDC operated the Jinduicheng open pit molybdenum mine, two concentrators, one smelter, and two processing plants in Jinduicheng, Hua County, in northwest Shaanxi Province (Argus Media Ltd., 2015).

**Mexico.**—Southern Copper Corp. reported that its La Caridad Mine produced 10,800 t of molybdenum in 2014 compared with 11,700 t of molybdenum in 2013. The La Caridad complex is located in northeastern Sonora (Southern Copper Corp., undated).

**Peru.**—The Cerro Verde Mine of FCX is an open pit copper and molybdenum mining complex, 16 km southwest of Arequipa. Cerro Verde continued construction of its large-scale expansion project, which would expand its concentrator facilities from 120,000 t/d to 360,000 t/d of ore and would have the capacity to produce 6,800 t/yr of molybdenum beginning in 2016. In 2014, molybdenum production at Cerro Verde was approximately 5,000 t of molybdenum, a 15% decrease compared with 5,900 t of molybdenum produced in 2013 (Freeport-McMoRan Copper & Gold Inc., 2015b, p. 15).

## Outlook

The principal uses for molybdenum are expected to continue to be in catalysts and chemicals and as an additive in steel manufacturing, most importantly alloy and stainless steel. Molybdenum plays a vital role in the energy industry, and it may become an increasingly important factor in environmental technology, where it is used in high-strength steels for automobiles to reduce weight and improve fuel economy and safety. Molybdenum-based catalysts have a number of important applications in the petroleum and plastics industries. A major use is in the hydrodesulfurization of petroleum, petrochemicals, and coal-derived liquids. Production of ultra-low-sulfur diesel fuels was expected to more than double the amount of molybdenum used in oil refineries (Roskill Information Services Ltd., 2012, p. 305). Molybdenum not

only allows for economical fuel refining, it also contributes to a safer environment through lower sulfur emissions. Analysts expect global demand for molybdenum as a catalyst to continue to increase as there are no practical alternatives in many of its catalytic applications. The need for companies to reduce carbon dioxide emissions from coal-fired power stations will require plants to run at higher temperatures, resulting in greater demand for higher grade molybdenum-bearing steels.

Molybdenum consumption is also expected to continue to increase, owing to increases in China's industrial growth. The acceleration in molybdenum use in China is being fueled by the increasing intensity of use by Chinese steel manufacturers who are looking to produce higher grade steel products for domestic consumption in support of urbanization and infrastructure development and also as a means to improve the competitiveness of their steel exports (General Moly Inc., 2015, p. 7). In addition, China's State Reserve Bureau (SRB) emphasized molybdenum's importance by purchasing approximately 5,000 t of MoX for its stockpile in 2014. The SRB was expected to continue purchasing MoX in 2015 for its stockpile (Metal-Pages, 2015).

In 2014, global consumption of molybdenum increased by 4% from the previous year with approximately 4% of annual growth expected over the next 10 years (International Molybdenum Association, 2015; CPM Group, 2015). The principal areas of molybdenum growth are expected to continue to be in the use of stainless and other steels containing molybdenum in aero engine components, chemical and petrochemical processing plants, power and desalination plants, motor vehicle components, nuclear powerplants, and in wind power generation components.

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TABLE 1  
SALIENT MOLYBDENUM STATISTICS<sup>1</sup>

(Metric tons of contained molybdenum)

	2010	2011	2012	2013	2014
United States:					
Concentrate:					
Production	59,400	63,700	61,500	61,000 <sup>r</sup>	68,200
Shipments	59,400	62,800	61,600	68,100 <sup>r</sup>	71,400
Reported consumption <sup>2</sup>	W	W	W	W	W
Imports for consumption	12,900	14,600	12,000	13,100	15,800
Stocks, December 31:					
Concentrate, mine and plant	2,200	3,520	W	W	W
Product producers <sup>3</sup>	W	W	W	W	W
Consumers	1,630	1,810	1,770	1,820	2,010
Total	3,820	5,330	1,770	1,820	2,010
Primary products:					
Production	68,600	W	W	W	W
Shipments	51,100	W	W	W	W
Reported consumption	19,200	19,100	19,400	18,600	19,500
Imports for consumption	6,780	6,450	7,830	7,190	9,510
World, mine production	246,000 <sup>r</sup>	266,000 <sup>r</sup>	256,000 <sup>r</sup>	258,000	281,000 <sup>c</sup>

<sup>c</sup>Estimated. <sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Molybdenum concentrates roasted to make molybdenum oxide.

<sup>3</sup>Includes 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  
MOLYBDENUM-PRODUCING MINES IN THE UNITED STATES IN 2014

State and mine	County	Operator	Source of molybdenum
Arizona:			
Bagdad	Yavapai	Freeport-McMoRan Copper & Gold Inc.	Copper-molybdenum ore, concentrated.
Mineral Park	Mohave	Mineral Park Inc. <sup>1</sup>	Do.
Mission	Pima	ASARCO LLC <sup>2</sup>	Do.
Morenci	Greenlee	Freeport-McMoRan Copper & Gold Inc.	Do.
Pinto Valley	Gila	Capstone Mining Corp.	Do.
Sierrita	Pima	Freeport-McMoRan Copper & Gold Inc.	Do.
Colorado:			
Climax	Lake	do.	Molybdenum ore, concentrated.
Henderson	Clear Creek	do.	Do.
Idaho, Thompson Creek	Custer	Thompson Creek Metals Co. Inc.	Do.
Montana, Continental Pit	Silver Bow	Montana Resources	Copper-molybdenum ore, concentrated.
Nevada, Robinson	White Pine	Robinson Nevada Mining Company <sup>3</sup>	Do.
New Mexico, Chino	Grant	Freeport-McMoRan Copper & Gold Inc.	Do.
Utah, Bingham Canyon	Salt Lake	Kennecott Utah Copper Corp. <sup>4</sup>	Do.

Do., do. Ditto.

<sup>1</sup>Wholly owned subsidiary of Mercator Minerals Ltd.

<sup>2</sup>Wholly owned subsidiary of Grupo México, S.A.B. de C.V.

<sup>3</sup>Wholly owned subsidiary of KGHM International Ltd.

<sup>4</sup>Wholly owned subsidiary of Rio Tinto plc.

TABLE 3  
U.S. REPORTED CONSUMPTION, BY END USES, AND CONSUMER STOCKS OF MOLYBDENUM MATERIALS<sup>1</sup>

(Kilograms of contained molybdenum)

End use	Molybdic oxides	Ferromolybdenum <sup>2</sup>	Ammonium and sodium molybdate	Molybdenum scrap	Other	Total
2013:						
Steel:						
Carbon	454,000	173,000	--	--	W	628,000
High-strength low-alloy	W	112,000	--	--	--	112,000
Stainless and heat-resisting	2,020,000	680,000	--	(3)	131,000	2,830,000
Full alloy	3,260,000	2,790,000	--	--	W	6,050,000
Tool	607,000	W	--	(3)	--	607,000
Total	6,340,000	3,760,000	--	--	131,000	10,200,000
Cast irons (gray, malleable, ductile iron)	W	358,000	--	--	W	358,000
Superalloys	646,000	W	--	(3)	1,080,000	1,730,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	41,500	--	--	W	41,500
Other alloys	2,500 <sup>r</sup>	90,800	--	--	W	93,300 <sup>r</sup>
Mill products made from metal powder <sup>4</sup>	W	--	--	--	W	W
Cemented carbides and related products <sup>5</sup>	--	--	--	--	77	77
Chemical and ceramic uses:						
Pigments	W	--	11,100	--	--	11,100
Catalysts	937,000	--	(3)	--	W	937,000
Other	--	--	--	--	W	W
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	196,000	196,000
Other	591,000	121,000	(3)	--	4,300,000	5,020,000
Grand total	8,520,000	4,370,000	11,100	--	5,710,000	18,600,000
Stocks, December 31	554,000 <sup>r</sup>	330,000 <sup>r</sup>	7,390 <sup>r</sup>	(6)	(6)	1,820,000
2014:						
Steel:						
Carbon	W	192,000	--	--	W	192,000
High-strength low-alloy	W	110,000	--	--	--	110,000
Stainless and heat-resisting	2,190,000	715,000	--	(3)	131,000	3,030,000
Full alloy	3,590,000	3,160,000	--	--	W	6,750,000
Tool	607,000	W	--	(3)	--	607,000
Total	6,380,000	4,180,000	--	--	131,000	10,700,000
Cast irons (gray, malleable, ductile iron)	W	346,000	--	--	W	346,000
Superalloys	668,000	W	--	(3)	1,040,000	1,710,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	41,500	--	--	W	41,500
Other alloys	2,600	70,900	--	--	33,000	107,000
Mill products made from metal powder <sup>4</sup>	W	--	--	--	W	W
Cemented carbides and related products <sup>5</sup>	--	--	--	--	77	77
Chemical and ceramic uses:						
Pigments	W	--	8,220	--	--	8,220
Catalysts	937,000	--	(3)	--	W	937,000
Other	--	--	--	--	W	W
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	176,000	176,000
Other	1,080,000	110,000	(3)	(3)	4,270,000	5,460,000
Grand total	9,070,000	4,750,000	8,220	--	5,660,000	19,500,000
Stocks, December 31	644,000	374,000	3,950	(6)	(6)	2,010,000

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous and unspecified uses: Other." -- Zero.

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

<sup>2</sup>Includes calcium molybdate.

<sup>3</sup>Withheld to avoid disclosing company proprietary data; included in "Miscellaneous and unspecified uses: Other" under "Other."

<sup>4</sup>Includes ingot, wire, rod, and sheet.

<sup>5</sup>Includes construction, mining, oil and gas, and metal working machinery.

<sup>6</sup>Withheld to avoid disclosing company proprietary data; included in "Total."



TABLE 4  
U.S. EXPORTS OF MOLYBDENUM PRODUCTS, BY PRODUCT AND COUNTRY<sup>1</sup>

Product and country	HTS <sup>2</sup> code	2013		2014	
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Oxides and hydroxides, gross weight: <sup>3</sup>	2825.70.0000				
Brazil		22	\$432	161	\$3,250
Canada		55	789	283	3,440
Germany		7	91	2	54
Japan		683	16,700	612	12,700
Korea, Republic of		12	193	18	368
Kuwait		106	1,280	98	2,170
Mexico		170	2,970	129	2,430
Netherlands		127	913	270	5,930
Turkey		52	1,050	140	2,490
United Kingdom		--	--	24	581
Other (11 countries)		90 <sup>r</sup>	2,020 <sup>r</sup>	4	82
Total		1,320	26,400	1,740	33,500
Molybdates, all, gross weight: <sup>4</sup>	2841.70.0000				
Canada		390	5,110	381	5,210
Colombia		45	526	41	482
Japan		53	985	64	962
Mexico		174	2,950	407	5,790
Netherlands		684	15,100	526	6,180
Other (28 countries)		391 <sup>r</sup>	6,610 <sup>r</sup>	177	3,260
Total		1,740	31,200	1,600	21,900
Ferromolybdenum, contained weight: <sup>4,5</sup>	7202.70.0000				
Canada		635	16,400	542	17,600
Colombia		(6)	9	(6)	18
Denmark		1	37	(6)	26
Mexico		156	4,500	27	686
Vietnam		--	--	(6)	6
Other (6 countries)		70 <sup>r</sup>	1,930 <sup>r</sup>	--	--
Total		862	22,900	569	18,400
Molybdenum, other, gross weight: <sup>3,7</sup>	Various <sup>8</sup>				
Austria		28	1,320	174	19,300
Canada		58	2,990	105	4,610
China		73	4,460	95	7,310
Germany		93	4,690	80	4,140
Israel		67	5,220	63	4,910
Japan		91	5,740	102	5,160
Korea, Republic of		158	25,800	162	24,100
South Africa		66	1,420	45	582
Taiwan		75	4,530	74	3,260
United Kingdom		164	8,630	202	9,430
Other (52 countries)		188 <sup>r</sup>	14,000 <sup>r</sup>	222	15,200
Total		1,060	78,700	1,320	98,000

<sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Harmonized Tariff Schedule (HTS) of the United States.

<sup>3</sup>Presentation of annual data is based on the quantities (gross weight or contained weight) of the ten leading countries in 2014.

<sup>4</sup>Presentation of annual data is based on the quantities (gross weight or contained weight) of the five leading countries in 2014.

<sup>5</sup>Ferromolybdenum contains about 60% to 65% molybdenum.

<sup>6</sup>Less than ½ unit.

<sup>7</sup>Includes powder, unwrought, waste and scrap, wire, wrought, and other.

<sup>8</sup>Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.95.0000, 8102.96.0000, 8102.97.0000, 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 COUNTRY<sup>1,2</sup>

Country	2013		2014	
	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Belgium	3,770	\$75,200	11,000	\$199,000
Canada	2,070	43,300	2,210	51,600
Chile	--	--	1,580	26,700
China	1,530	34,900	1,430	24,200
India	1,310	27,300	498	12,400
Japan	4,900	112,000	6,480	146,000
Korea, Republic of	898	21,700	1,320	27,200
Mexico	9,160	169,000	7,060	185,000
Netherlands	21,100	462,000	17,300	343,000
United Kingdom	2,380	55,300	11,200	215,000
Other (15 countries)	1,460 <sup>r</sup>	33,000 <sup>r</sup>	469	12,300
Total	48,600	1,030,000	60,500	1,240,000

<sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Presentation of annual data is based on the quantities (gross weight or contained weight) of the 10 leading countries in 2014.

Source: U.S. Census Bureau.

TABLE 6  
U.S. EXPORTS OF MOLYBDENUM PRODUCTS<sup>1</sup>

Item	HTS <sup>2</sup> code	2013			2014		
		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	22,200	\$498,000	NA	27,600	\$565,000
Molybdenum ore and concentrates, other	2613.90.0000	NA	26,400	534,000	NA	32,900	677,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	1,320	NA	26,400	1,740	NA	33,500
Molybdates, all	2841.70.0000	1,740	NA	31,200	1,600	NA	21,900
Ferromolybdenum	7202.70.0000	1,240	862	22,900	815	569	18,400
Molybdenum powders	8102.10.0000	250	NA	11,100	269	NA	11,900
Molybdenum unwrought, bars and rods	8102.94.0000	70	NA	2,620	41	NA	1,880
Molybdenum waste and scrap	8102.97.0000	149	NA	3,100	182	NA	3,960
Molybdenum wire	8102.96.0000	55	NA	5,210	34	NA	4,030
Molybdenum, other	Various <sup>3</sup>	537	NA	56,700	798	NA	76,200
Total		XX	XX	1,190,000	XX	XX	1,410,000

NA Not available. XX Not applicable.

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

<sup>2</sup>Harmonized Tariff Schedule (HTS) of the United States.

<sup>3</sup>Includes 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 COUNTRY<sup>1</sup>

Product and country	HTS <sup>2</sup> code	2013		2014	
		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Chile		80	\$1,430	225	\$4,260
China		200	3,910	95	2,000
Germany		--	--	2	39
Mexico		--	--	126	2,110
Romania		2	34	--	--
Sweden		2	18	--	--
Total		284	5,390	448	8,410
Molybdates, all, contained weight: <sup>3</sup>	Various <sup>4</sup>				
Chile		204	5,670	518	15,900
China		405	11,200	138	4,290
India		1	40	1	69
Japan		(5) <sup>5</sup>	7	2	103
United Kingdom		1	19	9	244
Other (6 countries)		(5) <sup>r</sup>	150 <sup>r</sup>	2	120
Total		611 <sup>r</sup>	17,100 <sup>r</sup>	670	20,700
Molybdenum orange, gross weight:	3206.20.0020				
Canada		181	1,890	224	1,840
China		6	49	1	7
Colombia		64	375	191	1,110
Germany		20	100	10	26
India		2	14	1	7
Mexico		-- <sup>r</sup>	-- <sup>r</sup>	4	23
Total		273	2,430	431	3,010
Ferromolybdenum, contained weight: <sup>3,6</sup>	7202.70.0000				
Canada		468	11,900	424	11,800
Chile		3,510	91,900	4,110	117,000
China		--	--	217	7,030
Korea, Republic of		--	--	153	4,430
United Kingdom		87	2,520	90	2,380
Other (5 countries)		29 <sup>r</sup>	1,570 <sup>r</sup>	117	4,290
Total		4,090	108,000	5,110	147,000
Other, gross weight: <sup>7</sup>	Various <sup>8</sup>				
Austria		318	17,200	575	25,700
Canada		398	10,300	597	15,500
Chile		--	--	12	271
China		1,200	41,800	1,500	52,500
Germany		130	6,670	220	8,700
Hong Kong		41	1,350	200	6,670
Japan		59	1,710	54	2,090
Russia		8	951	22	2,590
Taiwan		51	1,050	31	679
United Kingdom		24	825	87	2,620
Other (18 countries)		43 <sup>r</sup>	2,410 <sup>r</sup>	28	1,740
Total		2,270	84,300	3,330	119,000

<sup>1</sup>Revised. -- Zero.

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

<sup>2</sup>Harmonized Tariff Schedule (HTS) of the United States.

<sup>3</sup>Presentation of annual data based on the quantities (gross weight or contained weight) of the five leading countries in 2014.

<sup>4</sup>Includes HTS codes 2841.70.1000 and 2841.70.5000.

<sup>5</sup>Less than ½ unit.

<sup>6</sup>Ferromolybdenum contains about 60% to 65% molybdenum.

<sup>7</sup>Presentation of annual data based on the quantities (gross weight or contained weight) of the ten leading countries in 2014.

<sup>8</sup>Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.95.3000, 8102.95.6000, 8102.96.0000, 8102.97.0000, and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 8  
U.S. IMPORTS OF MOLYBDENUM ORE AND CONCENTRATES (INCLUDING  
ROASTED AND OTHER CONCENTRATES), BY COUNTRY<sup>1</sup>

Country	2013		2014	
	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Belgium	--	--	24	\$511
Canada	5,830	\$138,000 <sup>r</sup>	6,040	152,000
Chile	608	14,400	2,050	46,500
China	--	--	24	616
Japan	--	--	(2)	6
Mexico	3,700	35,200	3,630	85,100
Mongolia	--	--	38	845
Netherlands	--	--	24	703
Peru	2,890	109,000	3,940	113,000
Sweden	19	410	--	--
Vietnam	12	311	--	--
Total	13,100	297,000 <sup>r</sup>	15,800	399,000

<sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9  
U.S. IMPORTS FOR CONSUMPTION OF MOLYBDENUM PRODUCTS<sup>1</sup>

Item	HTS <sup>2</sup> code	2013			2014		
		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	6,870	4,160	\$47,100	8,180	4,970	\$117,000
Molybdenum ore and concentrates, other	2613.90.0000	18,100	8,890	250,000	21,100	10,800	282,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	283	NA	5,390	448	NA	8,410
Molybdates, all	Various <sup>3</sup>	1,080	612	17,200	1,200	671	20,700
Molybdenum orange	3206.20.0020	274	NA	2,430	431	NA	3,010
Ferromolybdenum	7202.70.0000	6,120	4,090	108,000	7,650	5,110	147,000
Molybdenum powders	8102.10.0000	448	433	16,000	536	513	19,800
Molybdenum unwrought, bars and rods	8102.94.0000	762	747	22,100	1,140	1,120	32,800
Molybdenum waste and scrap	8102.97.0000	739	690	21,900	1,240	1,220	37,100
Molybdenum wire	8102.96.0000	23	NA	3,490	15	NA	2,240
Molybdenum, other	Various <sup>4</sup>	298	NA	20,800	392	NA	27,100
Total		35,000	XX	514,000	42,300	XX	697,000

NA Not available. XX Not applicable.

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

<sup>2</sup>Harmonized Tariff Schedule (HTS) of the United States.

<sup>3</sup>Includes HTS codes 2841.70.1000 and 2841.70.5000.

<sup>4</sup>Includes HTS codes 8102.95.3000, 8102.95.6000, and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 10  
MOLYBDENUM: WORLD MINE PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons of contained molybdenum)

Country <sup>3</sup>	2010	2011	2012	2013	2014 <sup>e</sup>
Armenia	4,335	4,817	6,500	6,700	7,100
Canada	8,524 <sup>r</sup>	8,543 <sup>r</sup>	8,936 <sup>r</sup>	7,956 <sup>r</sup>	9,698 <sup>4</sup>
Chile	37,186	40,889	35,090	38,715	48,770 <sup>4</sup>
China <sup>e</sup>	96,600	103,000	105,000	101,000	103,000
Iran <sup>e</sup>	3,900	3,400	3,900	4,000	4,000
Mexico	10,849	10,787	11,366	12,562 <sup>r</sup>	14,370
Mongolia	2,198	1,960	1,903	1,815 <sup>r</sup>	1,999 <sup>4</sup>
Peru	16,963	19,141	16,790	18,140	17,018 <sup>4</sup>
Russia	5,777 <sup>r</sup>	6,014 <sup>r</sup>	4,939 <sup>r</sup>	4,753 <sup>r</sup>	4,800
Turkey	--	2,848	-- <sup>r</sup>	1,240 <sup>r</sup>	1,300
United States	59,400	63,700	61,500	61,000 <sup>r</sup>	68,200
Uzbekistan <sup>e</sup>	500	557 <sup>4</sup>	522 <sup>4</sup>	530	530
Total	246,000 <sup>r</sup>	266,000 <sup>r</sup>	256,000 <sup>r</sup>	258,000	281,000

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Includes data available through July 20, 2015.

<sup>3</sup>In addition to the countries listed, the Republic of Korea, Kyrgyzstan, and Romania are thought to produce molybdenum, but output is not reported quantitatively, and available general information is inadequate to make reliable estimates of output levels.

<sup>4</sup>Reported figure.

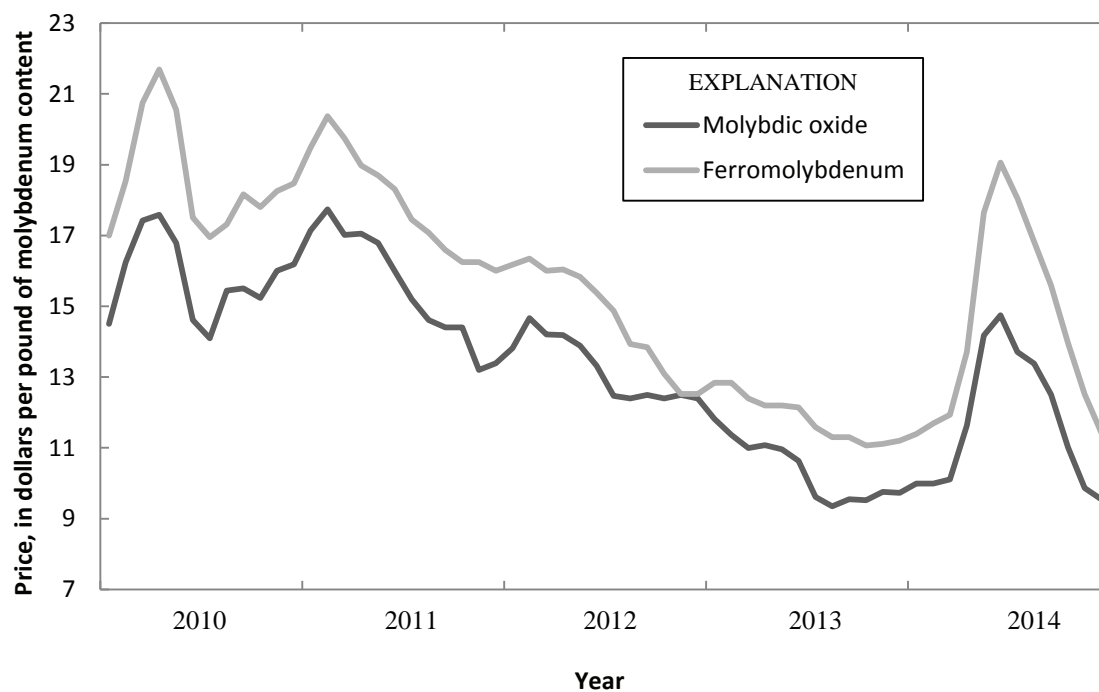


Figure 1. U.S. average monthly prices for molybdc oxide and ferromolybdenum from 2010 through 2014. Source: CRU Ryan's Notes.