

COBALT

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

Domestic Production and Use: With the exception of negligible amounts of byproduct cobalt produced as intermediate products from some mining operations, the United States did not mine or refine cobalt in 1998. U.S. supply was comprised of imports, stock releases, and secondary sources such as superalloy scrap, cemented carbide scrap, and spent catalysts. There were two domestic producers of extra-fine cobalt powder: One produced powder from imported primary metal, and another produced powder from recycled materials. In addition to the powder producers, six companies were known to be active in the production of cobalt compounds. More than 100 industrial consumers were surveyed on a monthly or annual basis. About 82% of U.S. consumption of cobalt was in five major end uses. Superalloys, used mainly in aircraft gas turbine engines, accounted for about 48% of U.S. demand; catalysts, cemented carbides, and magnetic alloys each accounted for about 9%; paint driers, about 7%; and other, 18%. The total estimated value of cobalt consumed in 1998 was \$450 million.

Salient Statistics—United States:	1994	1995	1996	1997	1998^e
Production: Mine	—	—	—	—	—
Secondary	1,660	1,640	2,000	2,530	2,500
Imports for consumption	6,780	6,440	6,710	8,430	8,000
Exports	1,360	1,300	1,660	1,570	1,600
Shipments from Government stockpile excesses	1,500	1,550	2,050	1,620	2,000
Consumption:					
Reported (includes secondary)	7,110	7,140	7,470	8,400	8,400
Apparent (includes secondary)	8,560	8,740	9,130	11,000	10,800
Price, average annual spot for cathodes, dollars per pound	24.66	29.21	25.50	23.34	22.50
Stocks, industry, yearend	1,490	1,080	1,050	1,060	1,160
Net import reliance ¹ as a percent of apparent consumption	81	81	78	77	77

Recycling: About 2,500 tons of cobalt was recycled from purchased scrap in 1998. This represented about 30% of estimated reported consumption for the year.

Import Sources (1994-97): Cobalt contained in metal, oxide, and salts: Norway, 22%; Finland, 18%; Zambia, 15%; Canada, 13%; and other, 32%. Since 1991, imports from Congo (Kinshasa) and Zambia have decreased, while imports from Finland, Norway, and Russia have increased.

Tariff: Item	Number	Normal Trade Relations (NTR)² 12/31/98	Non-NTR³ 12/31/98
Unwrought cobalt, alloys	8105.10.3000	4.6% ad val.	45% ad val.
Unwrought cobalt, other	8105.10.6000	Free	Free.
Cobalt matte, waste, and scrap	8105.10.9000	Free	Free.
Wrought cobalt and cobalt articles	8105.90.0000	4.1% ad val.	45% ad val.
Chemical compounds:			
Cobalt oxides and hydroxides	2822.00.0000	0.1% ad val.	1.7% ad val.
Cobalt sulfates	2833.29.1000	1.4% ad val.	6.5% ad val.
Cobalt chlorides	2827.34.0000	4.2% ad val.	30% ad val.
Cobalt carbonates	2836.99.1000	4.2% ad val.	30% ad val.
Cobalt acetates	2915.23.0000	4.2% ad val.	30% ad val.
Cobalt ores and concentrates	2605.00.0000	Free	Free.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Government Stockpile: Sales of National Defense Stockpile cobalt began in March 1993. The Department of Defense's Annual Materials Plan includes a cobalt disposal limit of 2,720 tons (6.0 million pounds) during fiscal year 1999.

Stockpile Status—9-30-98⁴

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposal plan FY 1998	Disposals FY 1998
Cobalt	14,700	199	14,700	2,720	2,510

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Events, Trends, and Issues: World cobalt production is expected to continue to increase during the next 5 years with the opening of new nickel-cobalt, copper-cobalt, and primary cobalt mines, and the startup of projects to recover cobalt from stockpiled tailings, slags, and concentrates. Cobalt supply during this period will also include cobalt in recycled scrap and sales from the U.S. Government's National Defense Stockpile.

Demand for cobalt in any given year will depend on world economic conditions. In the near to medium term, various industry sectors are expected to increase their consumption of cobalt. In particular, increases from the superalloy industry, which consumes the most cobalt of any industry sector, and the rechargeable battery industry, which has been using cobalt at a rapidly increasing rate in recent years, are anticipated to contribute to an overall growth in cobalt demand of 3% to 6% per year.

In the medium to long term, cobalt supply is expected to grow faster than demand. The general trend in cobalt prices would be downward in response to a growing market surplus. In 1998, the free market price for cobalt cathode experienced a nearly steady decrease from approximately \$26 per pound in January to \$20 per pound in September. In early October, the price rapidly dropped to \$17 to \$18 per pound. Market analysts attributed this rapid decrease in price to various factors, ranging from supply-demand fundamentals to an intentional effort to lower prices.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ⁵	Reserve base ⁵
	<u>1997</u>	<u>1998^e</u>		
United States	—	—	—	860,000
Australia	3,000	3,400	430,000	840,000
Canada	5,700	6,200	45,000	260,000
Congo (Kinshasa)	3,500	5,000	2,000,000	2,500,000
Cuba	2,080	2,100	1,000,000	1,800,000
New Caledonia ⁶	800	800	230,000	860,000
Philippines	—	—	—	400,000
Russia	3,300	2,800	140,000	230,000
Zambia	6,100	7,500	360,000	540,000
Other countries	<u>2,490</u>	<u>2,500</u>	<u>90,000</u>	<u>1,200,000</u>
World total (may be rounded)	<u>27,000</u>	<u>30,300</u>	<u>4,300,000</u>	<u>9,500,000</u>

World Resources: The cobalt resources of the United States are estimated to be about 1.3 million tons. Most of these resources are in Minnesota, but other important occurrences are in Alaska, California, Idaho, Missouri, Montana, and Oregon. Although large, most domestic resources are in subeconomic concentrations that will not be economical in the foreseeable future. In addition, with the exception of Idaho, any cobalt production from these deposits would be as a byproduct of another metal. The identified world cobalt resources are about 11 million tons. The vast majority of these resources are in nickel-bearing laterite deposits, with most of the rest occurring in nickel-copper sulfide deposits hosted in mafic and ultramafic rocks in Australia, Canada, and Russia, and in the sedimentary copper deposits of Congo (Kinshasa) and Zambia. In addition, millions of tons of hypothetical and speculative cobalt resources exist in manganese nodules and crusts on the ocean floor.

Substitutes: Periods of high prices and concern about availability have resulted in various efforts to conserve, reduce, or substitute for cobalt. In many applications, further substitution of cobalt would result in a loss in product performance. Potential substitutes include barium or strontium ferrites, neodymium-iron-boron, or nickel-iron alloys in magnets; nickel, cermets, or ceramics in cutting and wear-resistant materials; nickel base alloys or ceramics in jet engines; nickel in petroleum catalysts; rhodium in hydroformylation catalysts; nickel or manganese in batteries; and manganese, iron, cerium, or zirconium in paints.

^eEstimated.

¹ Defined as imports - exports + adjustments for Government and industry stock changes.

² No tariff for Canada or Mexico.

³ See Appendix B.

⁴ See Appendix C for definitions.

⁵ See Appendix D for definitions.

⁶ Overseas territory of France.