

## COBALT

(Data in metric tons, cobalt content, unless otherwise specified)

**Domestic Production and Use:** In 2023, the Eagle Mine, a nickel-copper mine in Michigan, produced cobalt-bearing nickel concentrate. In Missouri, a company produced nickel-copper-cobalt concentrate from historic mine tailings and was building a hydrometallurgical processing plant near the mine site. Ore extraction commenced at a cobalt-copper-gold mine in Idaho, but commissioning was suspended in March owing to low cobalt prices. This mine and one in Morocco were the only mines in the world where cobalt was the principal product. Most U.S. cobalt supply consisted of imports and secondary (scrap) materials. About six companies in the United States produced cobalt chemicals. An estimated 50% of cobalt consumed in the United States was used in superalloys, mainly aircraft gas turbine engines; 25% in a variety of chemical applications; 15% in various other metallic applications; and 10% in cemented carbides for cutting and wear-resistant applications. The total estimated value of cobalt consumed in 2023 was \$270 million.

<b>Salient Statistics—United States:</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023<sup>e</sup></b>
Production: <sup>e</sup>					
Mine	500	600	650	500	500
Secondary <sup>1</sup>	2,750	2,010	1,800	1,900	2,100
Imports for consumption	13,900	9,740	9,790	10,500	9,600
Exports	4,080	3,430	4,930	5,360	5,300
Consumption (includes secondary):					
Estimated <sup>2</sup>	9,050	7,260	7,270	7,700	8,300
Apparent <sup>e, 3</sup>	12,500	8,480	6,650	7,090	6,400
Price, average, dollars per pound:					
U.S. spot, cathode <sup>4</sup>	16.95	15.70	24.21	30.78	17
London Metal Exchange (LME), cash	14.88	14.21	23.17	28.83	16
Stocks, yearend:					
Industry <sup>e, 2, 5</sup>	1,090	952	1,010	1,000	1,000
LME, U.S. warehouse	102	82	50	34	34
Net import reliance <sup>6</sup> as a percentage of apparent consumption	78	76	73	73	67

**Recycling:** In 2023, cobalt content of purchased scrap represented an estimated 25% of estimated cobalt consumption.

**Import Sources (2019–22):** Metal, oxide, and salts: Norway, 25%; Canada, 15%; Finland, 13%; Japan, 12%; and other, 35%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12-31-23</b>
	Cobalt ores and concentrates	2605.00.0000	Free.
	Chemical compounds:		
	Cobalt oxides and hydroxides	2822.00.0000	0.1% ad valorem.
	Cobalt chlorides	2827.39.6000	4.2% ad valorem.
	Cobalt sulfates	2833.29.1000	1.4% ad valorem.
	Cobalt carbonates	2836.99.1000	4.2% ad valorem.
	Cobalt acetates	2915.29.3000	4.2% ad valorem.
	Unwrought cobalt, alloys	8105.20.3000	4.4% ad valorem.
	Unwrought cobalt, other	8105.20.6000	Free.
	Cobalt mattes and other intermediate products; cobalt powders	8105.20.9000	Free.
	Cobalt waste and scrap	8105.30.0000	Free.
	Wrought cobalt and cobalt articles	8105.90.0000	3.7% ad valorem.

**Depletion Allowance:** 22% (domestic), 14% (foreign).

**Government Stockpile:<sup>7</sup>**

	<b>FY 2023</b>		<b>FY 2024</b>	
<b>Material</b>	<b>Potential acquisitions</b>	<b>Potential disposals</b>	<b>Potential acquisitions</b>	<b>Potential disposals</b>
Cobalt	—	—	—	—
Cobalt alloys, gross weight <sup>8</sup>	—	—	200	—

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**Events, Trends, and Issues:** Global cobalt mine and refinery production were estimated to have increased to record highs in 2023. The increase in mine production was mainly in Congo (Kinshasa), the world's leading source of mined cobalt accounting for 74% of world cobalt mine production, and in Indonesia, accounting for 7%. China was the world's leading producer of refined cobalt, most of which was produced from partially refined cobalt imported from Congo (Kinshasa). China was the world's leading consumer of cobalt, with nearly 87% of its consumption used by the lithium-ion battery industry. In 2023, numerous projects were underway globally to recover cobalt from lithium-ion battery scrap. A number of projects progressed in the United States for cobalt processing, refining, or recycling, spurred by incentives from the Bipartisan Infrastructure Law of 2021 and the Inflation Reduction Act of 2022.

**World Mine Production and Reserves:** Reserves for Australia, Canada, Congo (Kinshasa), Indonesia, Papua New Guinea, Turkey, and "Other countries" were revised based on company and Government reports.

	Mine production <sup>e</sup>		Reserves <sup>9</sup>
	2022	2023	
United States	500	500	69,000
Australia	5,790	4,600	<sup>10</sup> 1,700,000
Canada	3,060	2,100	230,000
Congo (Kinshasa)	144,000	170,000	6,000,000
Cuba	3,700	3,200	500,000
Indonesia	9,600	17,000	500,000
Madagascar	3,500	4,000	100,000
New Caledonia <sup>11</sup>	2,000	3,000	NA
Papua New Guinea	2,990	2,900	49,000
Philippines	3,900	3,800	260,000
Russia	9,200	8,800	250,000
Turkey	2,100	2,800	91,000
Other countries	6,600	6,600	780,000
World total (rounded)	197,000	230,000	11,000,000

**World Resources:**<sup>9</sup> Identified cobalt resources of the United States are estimated to be about 1 million tons. Most of these resources are in Minnesota. Other important occurrences are in Alaska, California, Idaho, Michigan, Missouri, Montana, Oregon, and Pennsylvania. Identified world terrestrial cobalt resources are about 25 million tons. The vast majority are in sediment-hosted stratiform copper deposits in Congo (Kinshasa) and Zambia; nickel-bearing laterite deposits in Australia and nearby island countries and Cuba; and magmatic nickel-copper sulfide deposits of mafic and ultramafic rocks in Australia, Canada, Russia, and the United States. More than 120 million tons of cobalt resources have been identified in polymetallic nodules and crusts on the floor of the Atlantic, Indian, and Pacific Oceans.

**Substitutes:** Depending on the application, substitution for cobalt could result in a loss in product performance or increase cost. The cobalt contents of lithium-ion batteries, the leading global use for cobalt, are being reduced; cobalt-free substitutes that use iron and phosphorus held significant market share in China. Potential substitutes in other applications include barium or strontium ferrites, neodymium-iron-boron alloys, or nickel-iron alloys in magnets; cerium, iron, lead, manganese, or vanadium in paints; cobalt-iron-copper or iron-copper in diamond tools; copper-iron-manganese for curing unsaturated polyester resins; iron, iron-cobalt-nickel, nickel, ceramic-metallic composites (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; and titanium-base alloys in prosthetics.

<sup>e</sup>Estimated. NA Not available. — Zero.

<sup>1</sup>Estimated from consumption of purchased scrap.

<sup>2</sup>Includes reported data and U.S. Geological Survey estimates.

<sup>3</sup>Defined for 2019–22 as secondary production + imports – exports ± adjustments for Government and industry stock changes for refined cobalt. Beginning in 2023, Government stock changes no longer included.

<sup>4</sup>Source: S&P Global Platts Metals Week. Cobalt cathode is refined cobalt metal produced by an electrolytic process.

<sup>5</sup>Stocks held by consumers and processors; excludes stocks held by trading companies and held for investment purposes.

<sup>6</sup>Defined for 2019–22 as imports – exports ± adjustments for Government and industry stock changes for refined cobalt. Beginning in 2023, Government stock changes no longer included.

<sup>7</sup>See Appendix B for definitions.

<sup>8</sup>Samarium-cobalt alloy; excludes potential disposals of aerospace alloys.

<sup>9</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>10</sup>For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 610,000 tons.

<sup>11</sup>Overseas territory of France.