

## COLUMBIUM (NIOBIUM)

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

**Domestic Production and Use:** There has been no significant domestic columbium mining since 1959. Domestic columbium resources are of low grade, some mineralogically complex, and most are not commercially recoverable. Most metal, ferrocolumbium, other alloys, and compounds were produced by five companies. Feed for these plants included imported concentrates, columbium oxide, and ferrocolumbium. Consumption was mainly as ferrocolumbium by the steel industry and as columbium alloys and metal by the aerospace industry, with plants in the Eastern and Midwestern United States, California, and Washington. The estimated value of reported columbium consumption, in the form of ferrocolumbium and nickel columbium, in 2002, was about \$75 million. Major end-use distribution of reported columbium consumption was as follows: carbon steels, 27%; superalloys, 27%; high-strength low-alloy steels, 17%; stainless and heat-resisting steels, 15%; alloy steels, 13%; and other, 1%.

<b>Salient Statistics—United States:</b>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002<sup>e</sup></u>
Production, mine	—	—	—	—	—
Imports for consumption:					
Mineral concentrates <sup>e</sup>	200	140	300	290	290
Columbium metal and alloys <sup>e</sup>	563	468	607	1,050	700
Columbium oxide <sup>e</sup>	860	1,200	1,190	1,360	800
Ferrocolumbium <sup>e</sup>	4,900	4,450	4,400	4,480	4,900
Exports, concentrate, metal, alloys <sup>e</sup>	50	160	100	110	100
Government stockpile releases <sup>e1</sup>	145	280	217	(4)	10
Consumption, reported, ferrocolumbium <sup>e2</sup>	3,640	3,460	4,090	4,230	3,500
Consumption, apparent	4,150	4,100	4,300	4,400	4,300
Price:					
Columbite, dollars per pound <sup>3</sup>	3.00	3.00	6.25	NA	NA
Ferrocolumbium, dollars per pound <sup>4</sup>	6.88	6.88	6.88	6.88	6.60
Net import reliance <sup>5</sup> as a percentage of apparent consumption	100	100	100	100	100

**Recycling:** While columbium is not recovered from scrap steel and superalloys containing it, recycling of these alloys is significant, and their columbium content is reused. Detailed data on the quantities of columbium recycled in this manner are not available, but may comprise as much as 20% of apparent consumption.

**Import Sources (1998-2001):** Brazil, 74%; Canada, 9%; Germany, 4%; Estonia, 3%; and other, 10%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations <u>12/31/02</u></b>
Columbium ores and concentrates	2615.90.6030	Free.
Columbium oxide	2825.90.1500	3.7% ad val.
Ferrocolumbium	7202.93.0000	5.0% ad val.
Columbium, unwrought:		
Waste and scrap	8112.92.0500	Free.
Alloys, metal, powders	8112.92.4000	4.9% ad val.
Columbium, other	8112.99.0100	4.0% ad val.

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

**Government Stockpile:** For fiscal year 2002, the Defense National Stockpile Center (DNSC) sold about 10 tons of columbium contained in columbium carbide powder valued at about \$86,000 (which exhausted the DNSC's columbium carbide powder inventory) and about 9 tons of columbium metal ingots valued at about \$301,000 from the National Defense Stockpile (NDS). There were no sales of columbium concentrates in fiscal year 2002. The DNSC's ferrocolumbium inventory was exhausted in fiscal year 2001. The DNSC proposed maximum disposal limits in fiscal year 2003 of about 254 tons of columbium contained in columbium concentrates and about 9 tons of columbium metal ingots. The NDS uncommitted inventories shown below include about 244 tons of columbium contained in nonstockpile-grade columbium concentrates.

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### Stockpile Status—9-30-02<sup>6</sup>

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposal plan FY 2002	Disposals FY 2002
Columbium:					
Carbide powder	—	—	—	<sup>7</sup> 10	10
Concentrates	594	—	594	254	—
Ferrocolumbium	—	—	—	—	—
Metal	37	—	37	9	9

**Events, Trends, and Issues:** For the first half of 2002, domestic demand for columbium ferroalloys in steelmaking and demand for columbium in superalloys (mostly for aircraft engine components) were less than in the same period of 2001. For the same period, overall columbium imports decreased; Brazil accounted for more than 50% of quantity and value. Exports also decreased, with Canada, China, Mexico, and the United Kingdom receiving most of the columbium materials. There were no published price quotes for columbium-bearing columbite and pyrochlore concentrates. The published price for standard-grade (steelmaking-grade) ferrocolumbium was quoted at a range of \$6.50 to \$6.70 per pound of columbium content. The published price for high-purity ferrocolumbium was discontinued in February-March at a range of \$17.50 to \$18 per pound of columbium content. Industry sources indicated in December 1999 that nickel columbium sold at about \$18.50 per pound of columbium content, columbium metal products sold in the range of about \$24 to \$100 per pound in ingot and special shape forms, and columbium oxide for master alloy production sold for about \$8.80 per pound. Public information on current prices for these columbium products was not available.

**World Mine Production, Reserves, and Reserve Base:** The reserves estimate for Australia has been increased and the reserves estimate for Canada has been decreased based on updated company and/or official country information. Reliable information could not be found to estimate the reserves and reserve base for Nigeria and reserve base for Canada.

	Mine production		Reserves <sup>8</sup>	Reserve base <sup>8</sup>
	2001	2002 <sup>9</sup>		
United States	—	—	—	Negligible
Australia	230	300	29,000	NA
Brazil	22,000	22,000	4,300,000	5,200,000
Canada	3,200	3,200	87,000	NA
Congo (Kinshasa)	50	50	NA	NA
Ethiopia	8	8	NA	NA
Nigeria	30	30	NA	NA
Rwanda	120	120	NA	NA
Other countries <sup>9</sup>	—	—	NA	NA
World total (rounded)	25,600	25,700	4,400,000	5,200,000

**World Resources:** Most of the world's identified resources of columbium are outside the United States and occur mainly as pyrochlore in carbonatite deposits. On a worldwide basis, resources are more than adequate to supply projected needs. The United States has approximately 150,000 tons of columbium resources in identified deposits, all of which were considered uneconomic at 2002 prices for columbium.

**Substitutes:** The following materials can be substituted for columbium, but a performance or cost penalty may ensue: molybdenum and vanadium as alloying elements in high-strength low-alloy steels; tantalum and titanium as alloying elements in stainless and high-strength steels; and ceramics, molybdenum, tantalum, and tungsten in high-temperature applications.

<sup>6</sup>Estimated. NA Not available. — Zero.

<sup>1</sup>Net quantity (uncommitted inventory). Parentheses indicate negative number (increase in inventory).

<sup>2</sup>Includes nickel columbium.

<sup>3</sup>Yearend average value, contained pentoxides for material having a Nb<sub>2</sub>O<sub>5</sub> to Ta<sub>2</sub>O<sub>5</sub> ratio of 10 to 1.

<sup>4</sup>Yearend average value, contained columbium, standard (steelmaking) grade.

<sup>5</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>6</sup>See Appendix B for definitions.

<sup>7</sup>Actual quantity limited to remaining sales authority or inventory.

<sup>8</sup>See Appendix C for definitions.

<sup>9</sup>Bolivia, China, Russia, and Zambia also produce (or are thought to produce) columbium, but available information is inadequate to make reliable estimates of output levels.