

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 six 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 2001 was about \$85 million. Major end-use distribution of reported columbium consumption was as follows: carbon steels, 33%; superalloys, 23%; stainless and heat-resisting steels, 18%; high-strength low-alloy steels, 16%; alloy steels, 9%; and other, 1%.

Salient Statistics—United States:	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001^e</u>
Production, mine	—	—	—	—	—
Imports for consumption:					
Concentrates, tin slags, other ¹	NA	NA	NA	NA	NA
Ferrocolumbium ^e	4,260	4,900	4,450	4,400	4,100
Exports, concentrate, metal, alloys ^e	70	50	160	100	110
Government stockpile releases ^{e 2}	126	145	280	217	(14)
Consumption, reported, ferrocolumbium ^{e 3}	3,770	3,640	3,460	4,090	4,100
Consumption, apparent	4,030	4,150	4,100	4,300	4,300
Price:					
Columbite, dollars per pound ⁴	3.00	3.00	3.00	6.25	NA
Pyrochlore, dollars per pound ⁵	NA	NA	NA	NA	NA
Stocks, industry, processor and consumer, yearend	NA	NA	NA	NA	NA
Employment	NA	NA	NA	NA	NA
Net import reliance ⁶ 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 columbium content is reused. Data on the quantities of columbium recycled in this manner are not available.

Import Sources (1997-2000): Brazil, 75%; Canada, 9%; Germany, 4%; Russia, 2%; and other, 10%.

Tariff: Item	Number	Normal Trade Relations 12/31/01
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	8112.91.0500	Free.
Alloys, metal, powders	8112.91.4000	4.9% ad val.
Columbium, wrought	8112.99.0000	4.0% ad val.

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

Government Stockpile: For fiscal year 2001, ending September 30, 2001, the Defense National Stockpile Center (DNSC) sold about 48 tons of columbium contained in ferrocolumbium valued at about \$1.29 million and about 9 tons of columbium metal ingots valued at about \$323,000 from the National Defense Stockpile (NDS). The DNSC disposed of about 3 tons of columbium contained in tantalum minerals that were sold in fiscal year 2001; no value obtained as columbium was contained within the tantalum minerals. There were no sales of columbium carbide powder in fiscal year 2001. The DNSC also proposed maximum disposal limits in fiscal year 2002 of about 10 tons⁷ of columbium contained in columbium carbide powder, 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 concentrates.

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Stockpile Status—9-30-01⁸

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposal plan FY 2001	Disposals FY 2001
Columbium:					
Carbide powder	10	—	10	⁷ 10	—
Concentrates	594	—	594	254	⁹ 3
Ferrocolumbium	—	—	—	⁷ 68	48
Metal	46	—	46	9	9

Events, Trends, and Issues: For the first one-half year, domestic demand for columbium ferroalloys in steelmaking and demand for columbium in superalloys (mostly for aircraft engine components) increased slightly compared with the similar period of 2000. For the same period, overall columbium imports increased; Brazil accounted for more than 70% of quantity and about 65% of value. Exports increased, with Canada, Italy, Mexico, and the United Kingdom receiving most of the columbium materials. The published price for columbite ore was discontinued in October at a range of \$5.50 to \$7 per pound of pentoxide content. Unchanged since September 1997, the published price for steelmaking-grade ferrocolumbium was quoted at a range of \$6.75 to \$7 per pound of columbium content and high-purity ferrocolumbium was quoted 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 products was not available. No domestic columbium mine production is expected in 2002, and it is estimated that U.S. apparent consumption will be about 4,400 tons. Most of total U.S. demand will be met by columbium imports in upgraded forms.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ¹⁰	Reserve base ¹⁰
	<u>2000</u>	<u>2001^e</u>		
United States	—	—	—	Negligible
Australia	160	200	16,000	NA
Brazil	30,000	30,000	4,400,000	5,200,000
Canada	2,290	2,300	140,000	400,000
Ethiopia	7	5	NA	NA
Nigeria	35	30	60,000	90,000
Rwanda	28	25	NA	NA
Other countries ¹¹	—	—	NA	NA
World total (rounded)	<u>32,600</u>	<u>32,600</u>	<u>4,600,000</u>	<u>5,700,000</u>

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 2001 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.

^eEstimated. NA Not available. — Zero.

¹Metal, alloys, synthetic concentrates, and columbium oxide.

²Net quantity (uncommitted inventory). Parentheses indicate negative number (increase in inventory).

³Includes nickel columbium.

⁴Yearend average value, contained pentoxides for material having a Nb₂O₅ to Ta₂O₅ ratio of 10 to 1.

⁵Yearend average value, contained pentoxide.

⁶Defined as imports - exports + adjustments for Government and industry stock changes.

⁷Actual quantity limited to remaining sales authority or inventory.

⁸See Appendix B for definitions.

⁹Columbium units contained in the disposal of tantalum minerals.

¹⁰See Appendix C for definitions.

¹¹Bolivia, China, Congo (Kinshasa), Russia, and Zambia also produce (or are thought to produce) columbium, but available information is inadequate to make reliable estimates of output levels.