# COLUMBIUM (NIOBIUM)

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

**Domestic Production and Use:** No significant U.S. columbium mine production has been reported since 1959. Domestic columbium resources are of low grade, some mineralogically complex, and most are not commercially recoverable. Five companies produced ferrocolumbium and columbium compounds, metal, and other alloys from imported columbium minerals, oxides, and ferrocolumbium. Consumption was mainly as ferrocolumbium by the steel industry and as columbium alloys and metal by the aerospace industry. Major end-use distribution of reported columbium consumption was as follows: carbon steels, 30%; high-strength low-alloy steels, 22%; superalloys, 20%; alloy steels, 14%; stainless and heat-resisting steels, 13%; and other, 1%. The estimated value of reported columbium consumption, in the form of ferrocolumbium and nickel-columbium alloy, in 2005, was $110 million.

| Salient Statistics—United States:[1] | 2001 | 2002 | 2003 | 2004 | 2005[e] |
|---|---|---|---|---|---|
| Production, mine | — | — | — | — | — |
| Imports for consumption: | | | | | |
| Mineral concentrates[e] | 277 | 273 | 181 | 167 | 157 |
| Columbium metal and alloys[e] | 1,050 | 673 | 743 | 940 | 1,370 |
| Columbium oxide[e] | 1,360 | 654 | 585 | 633 | 770 |
| Ferrocolumbium[e] | 4,480 | 4,030 | 4,080 | 5,180 | 5,130 |
| Exports, concentrate, metal, alloys[e] | 83 | 111 | 143 | 196 | 303 |
| Government stockpile releases[e, 2] | 57 | 19 | 182 | 112 | 64 |
| Consumption, reported, ferrocolumbium[e, 3] | 4,230 | 3,150 | 3,650 | 3,940 | 3,640 |
| Consumption, apparent | 7,140 | 5,540 | 5,630 | 6,830 | 7,180 |
| Price: | | | | | |
| Columbite, dollars per pound[4] | NA | NA | NA | NA | NA |
| Ferrocolumbium, dollars per pound[5] | 6.88 | 6.60 | 6.58 | 6.56 | 6.58 |
| Net import reliance[6] as a percentage of apparent consumption | 100 | 100 | 100 | 100 | 100 |

**Recycling:** Columbium was recycled when columbium-bearing steels and superalloys were recycled; scrap recovery specifically for columbium content was negligible. The amount of columbium recycled is not available but may be as much as 20% of apparent consumption.

**Import Sources (2001-04):** Brazil, 77%; Canada, 10%; Estonia, 4%; China, 3%; and other, 6%.

| Tariff: Item | Number | Normal Trade Relations 12-31-05 |
|---|---|---|
| Columbium ores and concentrates | 2615.90.6030 | Free. |
| Columbium oxide | 2825.90.1500 | 3.7% ad val. |
| Ferrocolumbium: | | |
| Less than 0.02% of P or S, or less than 0.4% of Si | 7202.93.4000 | 5.0% ad val. |
| Other | 7202.93.8000 | 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 2005, the Defense National Stockpile Center (DNSC), Defense Logistics Agency, disposed of 55 tons of columbium contained in columbium-tantalum mineral concentrates (no columbium value was obtained, as the columbium was contained within tantalum minerals) and about 9 tons of vacuum grade columbium metal valued at about $304,000 from the Defense National Stockpile. The DNSC's ferrocolumbium inventory was exhausted in fiscal year 2001, and its columbium carbide inventory was exhausted in fiscal year 2002. The DNSC announced maximum disposal limits for fiscal year 2006 of about 254 tons[7] of columbium contained in columbium concentrates and about 9 tons[7] of columbium metal ingots.

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**Stockpile Status—9-30-05[8]**

| Material | Uncommitted inventory | Committed inventory | Authorized for disposal | Disposal plan FY 2005 | Disposals FY 2005 |
|---|---|---|---|---|---|
| Columbium: | | | | | |
| Carbide powder | — | — | — | — | — |
| Concentrates | 190 | — | 190 | 254 | — |
| Ferrocolumbium | — | — | — | — | — |
| Metal | 19 | 3 | 19 | 9 | 9 |

**Events, Trends, and Issues:** Columbium ferroalloys domestic demand in steelmaking remained strong, columbium demand in superalloys (mostly for aircraft engine components) increased compared with that of 2004, and overall apparent consumption rose about 4%. Columbium imports increased about 7% compared with those of 2004; Brazil accounted for about 84% of the quantity and about 79% of the value. Overall exports rose substantially owing to a more than doubling of ferrocolumbium exports to Canada, from about 140 tons in 2004 to about 330 tons in 2005. The published price for standard-grade (steelmaking-grade) ferrocolumbium was quoted at a range of $6.45 to $6.70 per pound of columbium content. Public information on current prices for other columbium products was not available. According to industry sources, the price for columbium oxide, columbium metal, other columbium chemicals, and various columbium alloys is variable and depends on product specifications, volume, and processing considerations. Pricing is normally established by negotiation between buyer and seller.

**World Mine Production, Reserves, and Reserve Base:**

| | Mine production | | Reserves[9] | Reserve base[9] |
|---|---|---|---|---|
| | 2004 | 2005[e] | | |
| United States | — | — | — | Negligible |
| Australia | 200 | 200 | 29,000 | NA |
| Brazil | 29,900 | 29,900 | 4,300,000 | 5,200,000 |
| Canada | 3,450 | 3,400 | 110,000 | NA |
| Congo (Kinshasa) | 52 | 52 | NA | NA |
| Ethiopia | 6 | 6 | NA | NA |
| Mozambique | 130 | 110 | NA | NA |
| Namibia | 1 | 1 | NA | NA |
| Nigeria | 170 | 170 | NA | NA |
| Rwanda | 63 | 63 | NA | NA |
| Uganda | 8 | 2 | NA | NA |
| Other countries[10] | NA | NA | NA | NA |
| World total (rounded) | 34,000 | 33,900 | 4,400,000 | 5,200,000 |

**World Resources:** World resources are more than adequate to supply projected needs. Most of the world's identified resources of columbium occur mainly as pyrochlore in carbonatite deposits and are outside the United States. The United States has approximately 150,000 tons of columbium resources in identified deposits, all of which were considered uneconomic at 2005 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.

[e]Estimated. NA Not available. — Zero.

[1]Revisions principally based on reevaluation of import and export data.

[2]Net quantity (uncommitted inventory).

[3]Includes nickel columbium.

[4]Average of yearend trade journal reported prices, per pound of contained pentoxides for material having a $Nb_2O_5$ to $Ta_2O_5$ ratio of 10 to 1.

[5]Average of yearend trade journal reported prices, per pound of contained columbium, standard (steelmaking) grade.

[6]Defined as imports – exports + adjustments for Government and industry stock changes.

[7]Actual quantity limited to remaining sales authority; additional legislative authority is required.

[8]See Appendix B for definitions.

[9]See Appendix C for definitions.

[10]Bolivia, Burundi, China, Russia, Zambia, and Zimbabwe also produce (or are believed to produce) columbium mineral concentrates, but available information is inadequate to make reliable estimates of output levels.