YTTRIUM[1]

(Data in metric tons of yttrium oxide (Y_2O_3) content, unless noted)

Domestic Production and Use: The rare-earth element, yttrium, was mined by one company as a constituent of the mineral bastnasite, but was not recovered as a separate element during processing. Bastnasite, a rare-earth fluocarbonate mineral, was mined as a primary product in California by surface methods. Bastnasite's yttrium content is very small and represents a potential minor source of the element. Yttrium used by the domestic industry was imported primarily as compounds.

Yttrium was used in many applications. Principal uses were in phosphors used in color televisions and computer monitors, trichromatic fluorescent lights, temperature sensors, and X-ray intensifying screens. As a stabilizer in zirconia, yttrium was used in wear-resistant and corrosion-resistant cutting tools, seals and bearings, high-temperature refractories for continuous casting nozzles, jet engine coatings, oxygen sensors in automobile engines, and simulant gemstones. In electronics, yttrium-iron-garnets (YIG) were components in microwave radar to control high frequency signals. Yttrium was an important component in yttrium-aluminum garnets (YAG) laser crystals used in industrial cutting and welding, medical and dental surgical procedures, temperature and distance sensing, photoluminescence, photochemistry, digital communications, and nonlinear optics. Yttrium was also used in heating element alloys, superalloys, and high-temperature superconductors. The approximate distribution in 1995 by end use was as follows: lamp and cathode ray tube phosphors, 68%; structural ceramics and components, 29%; oxygen sensors, laser crystals, and miscellaneous, 3%.

Salient Statistics—United States:	1991	1992	1993	1994	1995[e]
Production, mine	W	W	W	W	—
Imports for consumption:					
In monazite	—	—	—	—	—
In xenotime and yttrium concentrate[2]	NA	NA	NA	NA	NA
Exports, in ore and concentrate	NA	NA	NA	NA	NA
Consumption, estimated	NA	NA	NA	344	350
Price, dollars:[3]					
Monazite concentrate, per metric ton	494-532	207-241	204-238	233-272	229-267
Yttrium concentrate, per kilogram, 60% REO	32-33	32-33	NA	NA	NA
Yttrium oxide, per kilogram, 99.0% to 99.99% purity	116	15-116	16-116	20-116	17-110
Yttrium metal, per kilogram, 99.0% to 99.9% purity	550	140-550	135-350	135-350	150-200
Stocks, processor, yearend	NA	NA	NA	NA	NA
Employment[4]	411	372	352	350	280
Net import reliance[e 5]	100	100	100	100	100

Recycling: Small quantities, primarily from laser crystals and synthetic garnets.

Import Sources (1994):[e] Yttrium compounds: China 63%; United Kingdom, 29%; Hong Kong, 5%; Japan, 2%; and France, 1%.

Tariff: Item	Number	Most favored nation (MFN) 12/31/95	Non-MFN[6] 12/31/95
Thorium ores and concentrates (monazite)	2612.20.0000	Free	Free.
Rare-earth metals, scandium and yttrium, whether or not intermixed or interalloyed	2805.30.0000	5.0% ad val.	31.3% ad val.
Yttrium bearing materials and compounds containing by weight >19% but < 85% Y_2O_3	2846.90.4000	Free	25% ad val.
Rare-earth compounds, including yttrium oxide, yttrium nitrate, and other individual compounds	2846.90.8000	3.7% ad val.	25% ad val.

Depletion Allowance: Percentage method: Monazite: 22% on thorium content and 14% on yttrium and rare-earth content (Domestic), 14% (Foreign). Xenotime: 14% (Domestic and Foreign).

Government Stockpile: None.

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YTTRIUM

Events, Trends, and Issues: Yttrium prices firmed during the year as China restricted the number of exporters. Despite the slightly higher prices, yttrium markets continued to be competitive. The U.S. economy showed strong growth in 1995 while demand for yttrium in most uses increased.

Yttrium was consumed primarily in the form of high-purity compounds, especially the oxide and nitrate. Yttrium-bearing deposits are being evaluated in several countries.

World Mine Production, Reserves, and Reserve Base:

	Mine production[7]		Reserves[8]	Reserve base[8]
	1994	1995[e]		
United States	W	—	120,000	130,000
Australia	60	60	100,000	110,000
Brazil	15	15	400	1,500
Canada	—	—	3,300	4,000
China	500	500	220,000	240,000
India	50	50	36,000	38,000
Malaysia	5	5	13,000	21,000
South Africa	14	14	4,400	5,000
Sri Lanka	2	2	240	260
Thailand	9	10	600	600
Former Soviet Union[9]	75	75	9,000	10,000
Zaire	1	1	570	630
World total (rounded)	[10]730	[10]730	510,000	560,000

World Resources: Large resources of yttrium in monazite and xenotime are available worldwide in ancient and recent placer deposits, weathered clay deposits, carbonatites, and uranium ores. Additional large subeconomic resources of yttrium occur in other monazite-bearing deposits, apatite-magnetite rocks, sedimentary phosphate deposits, deposits of columbium-tantalum minerals, and certain uranium ores, especially those of the Blind River District in Canada. It is probable that the world's resources are very large relative to expected demand.

Substitutes: Substitutes for yttrium are available for some applications, but generally are much less effective. In most uses, especially in phosphors, electronics, and lasers, yttrium is not subject to substitution by other elements. As a stabilizer in zirconia ceramics, yttria may be substituted with calcia or magnesia.

[e]Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]See also Rare-Earths and Scandium.

[2]This import category typically includes yttrium concentrates.

[3]Monazite concentrate price derived from Metals Bulletin; yttrium concentrate prices from Industrial Minerals (London); yttrium oxide and metal prices from Elements (a TradeTech publication), Molycorp Inc., and Rhône-Poulenc Basic Chemicals Co.

[4]Total employment at a rare-earth mine in California and at heavy-mineral sands operations in Florida and New Jersey. Employees were not assigned to specific commodities in calculating employment.

[5]Essentially all yttrium consumed domestically was imported or refined from imported ores and concentrates.

[6]See Appendix B.

[7]Includes yttrium contained in rare-earth ores.

[8]See Appendix C for definitions.

[9]As constituted before Dec. 1991.

[10]Excludes U.S. mine production.