YTTRIUM¹
(Data in metric tons of yttrium oxide (Y₂O₃) content, unless otherwise noted)

Domestic Production and Use: The rare-earth element, yttrium, was mined 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 at Mountain Pass, CA. 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 abrasives, 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 were components in microwave radar to control high frequency signals. Yttrium was an important component in yttrium-aluminum garnet 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 1997 by end use was as follows: lamp and cathode ray tube phosphors, 41%; oxygen sensors, laser crystals, and miscellaneous, 38%, ceramics, 21%.

Production, mine W — — — —
Imports for consumption: In monazite (yttrium oxide content) — 0.44 1.11 0.22 —
Yttrium compounds greater than 19% to less than 85% oxide equivalent (gross weight) NA NA 42.2 48.4 130
Exports, in ore and concentrate NA NA NA NA NA
Consumption, estimated 344 365 207 292 450
Price, dollars: Monazite concentrate, per metric ton³ 233-272 222-259 244-285 400-400 400-400
Yttrium oxide, per kilogram, 99.0% to 99.99% purity⁴ 20-116 17-110 17-85 17-85 22-85
Yttrium metal, per kilogram, 99.0% to 99.9% purity⁴ 135-350 150-200 95-200 80-100 80-100
Stocks, processor, yearend NA NA NA NA NA
Net import reliance as a percent of apparent consumption 100 100 100 100 100

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

Import Sources (1997): Yttrium compounds: China, 35%; France, 35%; United Kingdom, 23%; Belgium, 3%; and other, 4%.

Tariff: Item Number Normal Trade Relations (NTR) Non-NTR
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% Y₂O₃ 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 demand increased in 1997 and continued strong in 1998 as prices increased. Yttrium markets continued to be competitive, although China was the source of most of the world’s supply. The U.S. economy showed a slowdown in the first half of 1998, although imports of yttrium increased. The increase in domestic yttrium demand is primarily the result of U.S. dollar strength and the recessionary Asian economies minimizing inflation and undercutting commodity prices. Yttrium was consumed primarily in the form of high-purity compounds, especially the oxide and nitrate.

World Mine Production, Reserves, and Reserve Base:

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<tbody>
<tr>
<td>United States</td>
<td>—</td>
<td>—</td>
<td>120,000</td>
<td>130,000</td>
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<tr>
<td>Australia</td>
<td>—</td>
<td>—</td>
<td>100,000</td>
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<tr>
<td>Brazil</td>
<td>15</td>
<td>15</td>
<td>400</td>
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<tr>
<td>Canada</td>
<td>—</td>
<td>—</td>
<td>3,300</td>
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<tr>
<td>China</td>
<td>2,200</td>
<td>2,200</td>
<td>220,000</td>
<td>240,000</td>
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<td>Congo (Kinshasa)</td>
<td>—</td>
<td>—</td>
<td>570</td>
<td>630</td>
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<tr>
<td>India</td>
<td>30</td>
<td>30</td>
<td>36,000</td>
<td>38,000</td>
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<tr>
<td>Malaysia</td>
<td>4</td>
<td>4</td>
<td>13,000</td>
<td>21,000</td>
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<tr>
<td>South Africa</td>
<td>—</td>
<td>—</td>
<td>4,400</td>
<td>5,000</td>
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<tr>
<td>Sri Lanka</td>
<td>2</td>
<td>2</td>
<td>240</td>
<td>260</td>
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<tr>
<td>Thailand</td>
<td>—</td>
<td>—</td>
<td>600</td>
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<tr>
<td>Former Soviet Union</td>
<td>120</td>
<td>120</td>
<td>9,000</td>
<td>10,000</td>
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<tr>
<td>World total (rounded)</td>
<td>2,370</td>
<td>2,370</td>
<td>510,000</td>
<td>560,000</td>
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World Resources: Large resources of yttrium in monazite and xenotime are available worldwide in ancient and recent placer deposits (monazite and xenotime), weathered clay deposits (ion-adsorption ore), 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, but is generally not as resilient.

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*Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.
1See also Rare Earths and Scandium.
2Essentially all yttrium consumed domestically was imported or refined from imported ores and concentrates.
4Yttrium oxide and metal prices from Elements—Rare Earths, Specialty Metals and Applied Technology (a TradeTech publication), Denver, CO, and Rhodia, Inc., Shelton, CT.
5Defined as imports - exports + adjustments for Government and industry stock changes.
6See Appendix B.
7Includes yttrium contained in rare-earth ores.
8See Appendix D for definitions.
9Formerly Zaire.
10As constituted before December 1991.