

## GERMANIUM

(Data in kilograms of germanium content, unless otherwise noted)

**Domestic Production and Use:** The value of domestic refinery production of germanium, based on the 1996 producer price, was approximately \$36 million. Industry-generated scrap, imported concentrates, and processed residues from certain domestic base metal ores were the feed materials for the production of refined germanium in 1996. The domestic industry consisted of three germanium refineries, one each in New York, Oklahoma, and Pennsylvania, and two base metal mining operations, one in Tennessee and another in Alaska. Both of these mining companies supplied domestic and export markets with germanium-bearing materials generated from the mining of zinc ores. The major end uses for germanium were fiber-optic systems, 40%; polymerization catalysts, 25%; infrared optics, 15%; electrical/solar applications, 15%; and other uses (phosphors, metallurgy, and chemotherapy), 5%.

<b>Salient Statistics—United States:</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996<sup>e</sup></b>
Production, refinery <sup>e</sup>	13,000	10,000	10,000	10,000	18,000
Total imports <sup>1</sup>	13,000	15,000	15,000	16,000	25,000
Exports	NA	NA	NA	NA	NA
Consumption <sup>e</sup>	33,000	29,000	25,000	27,000	25,000
Price, producer, yearend, dollars per kilogram:					
Zone refined	1,060	1,060	1,060	1,375	2,000
Dioxide, electronic grade	660	660	660	880	1,300
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, plant, <sup>e 2</sup> number	100	100	100	110	120
Net import reliance <sup>3</sup> as a percent of apparent consumption	NA	NA	NA	NA	NA

**Recycling:** More than half of the metal used during the manufacture of most electronic and optical devices is routinely recycled as new scrap. As a result of the low unit use of germanium in microelectronic devices, little germanium returns as old scrap.

**Import Sources (1992-95):<sup>4</sup>** China, 18%; United Kingdom, 15%; Ukraine, 14%; Russia, 14%; Belgium, 12%; and other, 27%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Most favored nation (MFN) 12/31/96</b>	<b>Non-MFN<sup>5</sup> 12/31/96</b>
Germanium oxides	2825.60.0000	3.7% ad val.	25% ad val.
Waste and scrap	8112.30.3000	Free	Free.
Metal, unwrought	8112.30.6000	3.3% ad val.	25% ad val.
Other	8112.30.9000	5.1% ad val.	45% ad val.

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

### **Government Stockpile:**

#### Stockpile Status—9-30-96

<b>Material</b>	<b>Uncommitted inventory</b>	<b>Committed inventory</b>	<b>Authorized for disposal</b>	<b>Disposals Jan.-Sept. 96</b>
Germanium	68,207	—	40,007	—

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**Events, Trends, and Issues:** Monthly average free market prices for minimum 99.99% germanium dioxide, published by Metal Bulletin (London), increased rapidly throughout 1996 and reached the \$1,400 to \$1,445 per kilogram range by midyear. Later in the year, prices stabilized owing to the reported sale of 6.5 metric tons of germanium metal from the Ukrainian stockpile, the overhang of near-term sales from the Russian stockpile, and the signed authority for sales by the U.S. Defense Logistics Agency. As in 1995, a shortage of production and increased demand for virgin germanium led to a very tight world supply of germanium materials in 1996. In the near term, it is once again expected that this shortfall in supply will be moderated by increased production from North American sources, releases from various national stockpile holdings, and increased shipments from China. It is currently projected that fiber optics will provide the principal market for germanium well into the next century.

Germanium has little or no effect upon the environment because it usually occurs only as a trace element in ores and carbonaceous materials, and is used in very small quantities in commercial applications.

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

	<b>Refinery production</b>		<b>Reserves<sup>6</sup></b>	<b>Reserve base<sup>6</sup></b>
	<b><u>1995</u></b>	<b><u>1996<sup>e</sup></u></b>		
United States	10,000	18,000	450,000	500,000
Other countries	<u>35,000</u>	<u>35,000</u>	<u>NA</u>	<u>NA</u>
World total	45,000	53,000	NA	NA

**World Resources:** The available resources of germanium are associated with some zinc and lead-zinc-copper sulfide ores. Worldwide germanium resources would increase substantially if germanium were to be recovered from ash and flue dusts resulting from burning certain coals for power generation.

**Substitutes:** Less expensive silicon can be substituted for germanium in certain electronic applications. Certain bimetallic compounds of gallium, indium, selenium, and tellurium can also be substituted for germanium. Germanium is more reliable in some high-frequency and high-power applications and more economical as a substrate for some light-emitting diode applications. In infrared guidance systems, zinc selenide or germanium glass substitute for germanium metal but at the expense of performance.

<sup>e</sup>Estimated. NA Not available.

<sup>1</sup>Does not include imports of germanium dioxide and other germanium compounds for which data are not available.

<sup>2</sup>Employment related to primary germanium refining is indirectly related to zinc refining.

<sup>3</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>4</sup>Total imports from republics of the former Soviet Union (Estonia, Lithuania, Russia, and Ukraine) account for 32% of the 1992-95 imports.

<sup>5</sup>See Appendix B.

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