

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 1998 producer price, was more than \$37 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 1998. 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 the mining companies supplied domestic and export markets with germanium-bearing materials generated from the mining of zinc ores. The major end uses for germanium, worldwide, were fiber-optic systems, 44%; polymerization catalysts, 22%; infrared optics, 11%; electronics/solar electrical applications, 17%; and other uses (phosphors, metallurgy, and chemotherapy), 6%.

Salient Statistics—United States:

	1994	1995	1996	1997	1998^e
Production, refinery ^e	10,000	10,000	18,000	20,000	22,000
Total imports ¹	14,700	16,200	27,500	23,700	20,000
Exports	NA	NA	NA	NA	NA
Consumption ^e	25,000	27,000	25,000	28,000	28,000
Price, producer, yearend, dollars per kilogram:					
Zone refined	1,060	1,375	2,000	1,475	1,700
Dioxide, electronic grade	660	880	1,300	950	1,100
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, plant, number ^{e,2}	100	110	120	115	100
Net import reliance ³ 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. Worldwide, about 25% of the total germanium consumed was produced from recycled materials. As a result of the low unit use of germanium in various devices, little germanium returns as old scrap.

Import Sources (1994-97):⁴ Russia, 35%; Belgium, 19%; United Kingdom, 15%; China, 14%; and other, 17%.

<u>Tariff: Item</u>	Number	Normal Trade Relations (NTR) 12/31/98	Non-NTR⁵ 12/31/98
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	2.8% ad val.	25% ad val.
Other	8112.30.9000	4.6% ad val.	45% ad val.

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

Government Stockpile:

Material	Stockpile Status—9-30-98⁶				
	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposal plan FY 1998	Disposals FY 1998
Germanium	55,500	1,990	27,300	8,000	8,010

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Events, Trends, and Issues: Zinc ore, and associated germanium, is mined in 46 countries and smelted and refined in 34 countries. Germanium-bearing material generated from zinc processing is refined in only nine countries. World refinery production of germanium decreased in 1998, with smaller amounts brought to market by Canada, China, and Russia. However, total supply increased owing to increases in scrap recycling and metal released from government stockpiles in the United States, Russia, and Ukraine. Slight decreases in world demand for optical fibers and polyethylene terephthalate (PET), resulted in a world oversupply. It is expected that fiber optics will continue to be the main growth sector for germanium in spite of sluggish demand in the sector for 1998. The use of germanium in solar cells is also expected to increase.

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:

	Refinery production		Reserves⁷	Reserve base⁷
	<u>1997</u>	<u>1998^e</u>		
United States	20,000	22,000	450,000	500,000
Other countries	<u>43,000</u>	<u>34,000</u>	<u>NA</u>	<u>NA</u>
World total	63,000	56,000	NA	NA

World Resources: The available resources of germanium are associated with certain zinc and lead-zinc-copper sulfide ores. Worldwide germanium resources would increase substantially if germanium were to be recovered from ash and flue dust generated in the burning of 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 than competing materials in some high-frequency and high-power electronics 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.

^eEstimated. NA Not available.

¹Gross weight of unwrought germanium, and waste and scrap. Does not include imports of germanium dioxide and other germanium compounds for which data are not available.

²Employment related to primary germanium refining is indirectly related to zinc refining.

³Defined as imports - exports + adjustments for Government and industry stock changes.

⁴Total imports from republics of the Former Soviet Union (Estonia, Lithuania, Russia, and Ukraine) account for 44% of the 1994-97 imports.

⁵See Appendix B.

⁶See Appendix C for definitions.

⁷See Appendix D for definitions.