

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 1997 producer price, was approximately \$30 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 1997. 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, worldwide, were fiber-optic systems, 40%; polymerization catalysts, 20%; infrared optics, 10%; electrical/solar applications, 20%; and other uses (phosphors, metallurgy, and chemotherapy), 10%.

Salient Statistics—United States:

| | 1993 | 1994 | 1995 | 1996 | 1997^e |
|---|-------------|-------------|-------------|-------------|-------------------------|
| Production, refinery ^e | 10,000 | 10,000 | 10,000 | 18,000 | 20,000 |
| Total imports ¹ | 15,000 | 15,000 | 16,000 | 27,000 | 17,000 |
| Exports | NA | NA | NA | NA | NA |
| Consumption ^e | 29,000 | 25,000 | 27,000 | 25,000 | 30,000 |
| Price, producer, yearend, dollars per kilogram: | | | | | |
| Zone refined | 1,060 | 1,060 | 1,375 | 2,000 | 1,475 |
| Dioxide, electronic grade | 660 | 660 | 880 | 1,300 | 950 |
| Stocks, producer, yearend | NA | NA | NA | NA | NA |
| Employment, plant, ² number ^e | 100 | 100 | 110 | 120 | 115 |
| 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. As a result of the low unit use of germanium in microelectronic devices, little germanium returns as old scrap.

Import Sources (1993-96):⁴ Russia, 30%; the United Kingdom, 16%; China, 15%; Belgium, 14%; and other, 25%.

| Tariff: Item | Number | Most favored nation (MFN) 12/31/97 | Non-MFN⁵ 12/31/97 |
|---------------------|---------------|---|---|
| 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:

| Material | Stockpile Status—9-30-97⁶ | | | | |
|-----------------|---|----------------------------|--------------------------------|------------------------------|--------------------------|
| | Uncommitted inventory | Committed inventory | Authorized for disposal | Disposal plan FY 1997 | Disposals FY 1997 |
| Germanium | 63,623 | 1,044 | 35,441 | 6,000 | 4,566 |

GERMANIUM

Events, Trends, and Issues: World demand for germanium remained higher than world production. The tight supply situation encouraged recycling and sales from stocks. As a result, germanium prices fell dramatically from the 1996 high, as sales from the Russian, Ukrainian, and U.S. national stockpiles began. Japan was reluctant to purchase, owing to the weakness of the yen and to current economic reverses. The fiber optic sector has grown slowly in Japan, as compared to its growth in other industrialized countries. But worldwide, fiber optics was expected to continue to be the main growth sector for germanium.

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>1996</u> | <u>1997^e</u> | | |
| United States | 18,000 | 20,000 | 450,000 | 500,000 |
| Other countries | <u>35,000</u> | <u>43,000</u> | <u>NA</u> | <u>NA</u> |
| World total | 53,000 | 63,000 | 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 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.

^eEstimated. NA Not available.

¹Does 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 1993-96 imports.

⁵See Appendix B.

⁶See Appendix C for definitions.

⁷See Appendix D for definitions.