GERMANIUM

(Data in kilograms of germanium content, unless noted)

<u>Domestic Production and Use</u>: The value of domestic refinery production of germanium, based on the 1995 producer price, was approximately \$13.8 million. Industry generated scrap, imported concentrates, and some processed residues from certain domestic ores were the feed materials for refined germanium production in 1995. The domestic industry consisted of three germanium refineries, one each in New York, Oklahoma, and Pennsylvania, and a mining operation in Tennessee. The company in Tennessee exported germanium-bearing residues generated from the production of zinc metal. The major end uses for germanium were fiber-optic systems, 40%; infrared optics, 15%; detectors, 10%; semiconductors (including transistors, diodes, and rectifiers), 5%; and other applications (catalysts, phosphors, metallurgy, and chemotherapy), 30%.

| Salient Statistics—United States: | <u> 1991</u> | <u> 1992</u> | <u>1993</u> | <u> 1994</u> | <u>1995</u> ° |
|--|--------------|--------------|-------------|--------------|---------------|
| Production, refinery ^e | 15,000 | 13,000 | 10,000 | 10,000 | 10,000 |
| Total imports ¹ | 27,000 | 13,000 | 15,000 | 15,000 | 13,000 |
| Exports | NA | NA | NA | NA | NA |
| Consumption ^e | 33,000 | 33,000 | 29,000 | 25,000 | 25,000 |
| Price, producer, yearend, dollars per kilogram: | | | | | |
| Zone refined | 1,060 | 1,060 | 1,060 | 1,060 | 1,375 |
| Dioxide, electronic grade | 660 | 660 | 660 | 660 | 880 |
| Stocks, producer, yearend | NA | NA | NA | NA | NA |
| Employment, plant ^{e 2} | 100 | 100 | 100 | 100 | 110 |
| Net import reliance ³ as a percent of | | | | | |
| apparent consumption | NA | NA | NA | NA | NA |

Recycling: More than 50% 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 (1991-94): United Kingdom, 16%; Belgium, 15%; Germany, 14%; China, 13%; and other, 42%.

| Tariff: Item | Number | Most favored nation (MFN) 12/31/95 | Non-MFN⁵ 12/31/95 | |
|------------------|--------------|---------------------------------------|----------------------|--|
| 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 | 3.5% ad val. | 25% ad val. | |
| Other | 8112.30.9000 | 5.3% ad val. | 45% ad val. | |

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

Government Stockpile:

Stockpile Status—9-30-95

| | Uncommitted | Committed | Authorized | Disposals |
|-----------|-------------|-----------|--------------|-------------|
| Material | inventory | inventory | for disposal | JanSept. 95 |
| Germanium | 68.207 | _ | 7 | |

GERMANIUM

Events, Trends, and Issues: The monthly average free market price for minimum 99.99% germanium dioxide, published by Metal Bulletin (London), began to increase rapidly in February 1995 and reached the range of \$850 to \$950 per kilogram in August; it began to soften somewhat in September. Improved worldwide demand for the fiber optics sector and continued concern over supplies from the republics of the Former Soviet Union led to a very tight world supply of germanium materials in 1995. In the near term, it is expected that this shortfall in supply will be moderated by increased production from North American sources 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:

| | Refinery production | | Reserves ⁶ | Reserve base ⁶ | |
|-----------------|---------------------|--------|-----------------------|---------------------------|--|
| | 1994 | 1995° | | | |
| United States | 10,000 | 10,000 | 450,000 | 500,000 | |
| Other countries | 40,000 | 35,000 | NA | NA | |
| World total | 50,000 | 45,000 | NA | NA | |

<u>World Resources</u>: The available resources of germanium are associated with some zinc and lead-zinc-copper sulfide ores. Potential 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.

<u>Substitutes</u>: 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, Russia, and Ukraine) account for 23% of the 1991-94 imports.

 $^{^5\}mbox{See}$ Appendix B.

⁶See Appendix C for definitions.