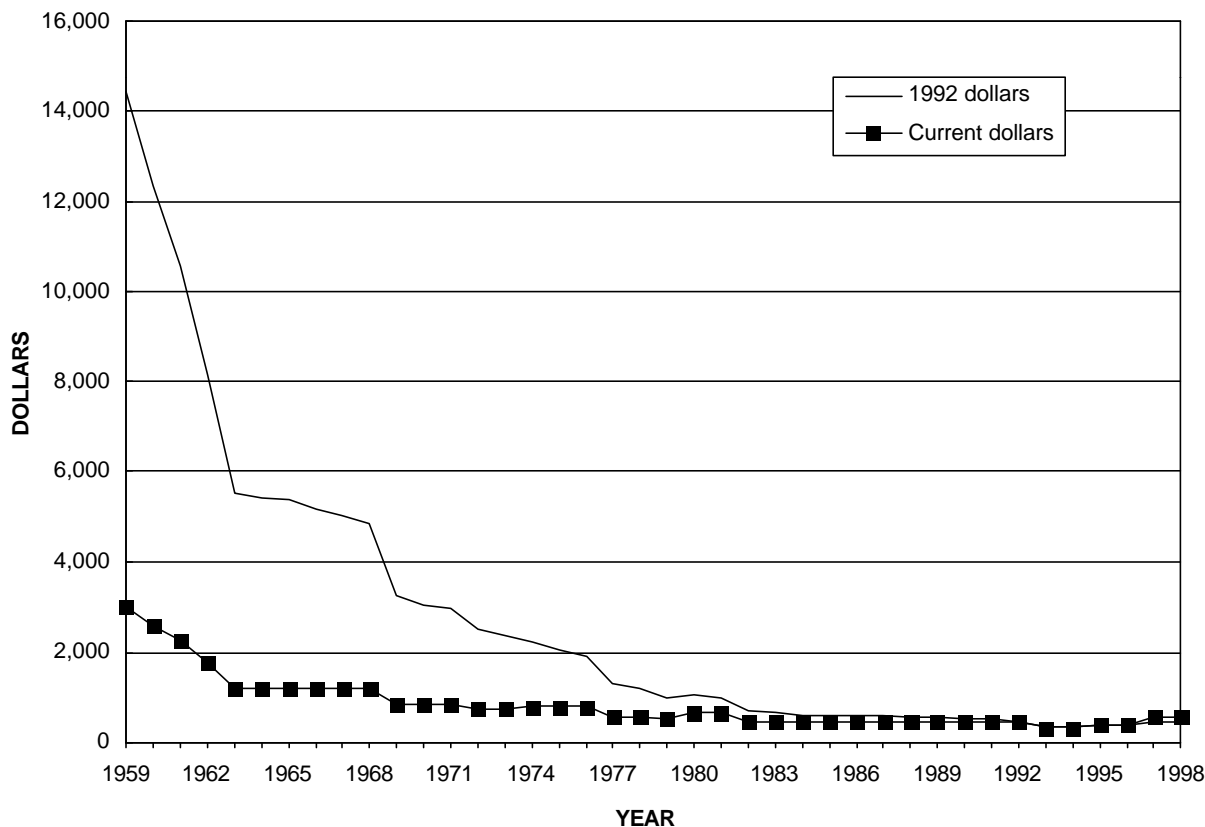


**Annual Average Gallium Price**  
(Dollars per kilogram)



### Significant events affecting gallium prices since 1958

- |         |  |
|---------|--|
| 1960-63 | Technologic improvements in gallium recovery and purification techniques                               |
| 1966-73 | U.S. gallium demand increases significantly because of widespread use of light-emitting diodes (LED's) |

Prices shown in the above graph are for gallium of 99.9999% purity. This grade has been used since the 1960's in gallium-arsenide-based optoelectronic devices, including LED's, laser diodes, and solar cells. From 1936 to 1960, prices for 99.9%-pure gallium were quoted at \$3,000 per kilogram; this grade of metal, however, had very limited uses in commercial applications. Most of its consumption was for experimental purposes; small quantities were used as a specialized mirror coating, in high-temperature thermometers, and in low-melting-point alloys. Consequently, there was little relation between prices prior to 1960 and those after that time when commercial applications were developed.

Gallium is recovered primarily as a byproduct from the

refining of bauxite to alumina. As a byproduct metal, price trends for gallium are not significantly influenced by macroeconomic factors; rather, they are driven by gallium supply and demand relations. The large drop in prices in the early 1960's was principally because of technologic improvements in gallium recovery and purification processes. Commercial gallium extraction techniques were introduced in the late 1950's (Beja, 1951; de la Breteque, 1957). As these processes were improved, the availability of gallium became greater, but the demand did not increase.

Introduction of the gallium-arsenide-based LED changed the consumption pattern of gallium from that of a laboratory curiosity to a metal with some consumer applications. LED's,

used in consumer applications, such as displays in digital watches and hand-held calculators, were responsible for large annual increases in demand from 1966 to 1973. To capture the LED market, gallium prices continued to drop throughout this period.

Research and development of gallium arsenide's semi-conducting properties, which were begun in the mid-1960's, has continued through 1998 as potential applications for the material continue to be evaluated (Brodsky, 1990). Gallium-arsenide-based integrated circuits have been developed and have made inroads into low-volume applications, such as sophisticated military warfare systems and supercomputers. Because these are low-volume applications and the quantity of gallium used per unit produced is small, gallium's raw material cost is not a significant factor in the item's final cost. The demand for gallium, therefore, has not increased to a level that cannot be met by existing supplies, and there has been no incentive to increase gallium's price. Although

gallium prices have decreased as its uses have grown, it is still used in small quantities compared with many other metals and only in specialized applications where its properties are crucial.

Most gallium prices are directly negotiated between the producer and consumer, with larger volume consumers able to negotiate lower prices. Producer-quoted prices, therefore, may not represent actual selling prices; in most cases, they provide an indication of the trend of gallium prices.

### References Cited

Beja, Maurice, 1951, Method of extracting gallium oxide from aluminous substances: U.S. Patent 2,574,008, 5 p.  
 Brodsky, M.H., 1990, Progress in gallium arsenide semi-conductors: Scientific American, v. 262, no. 2, p. 68-75.  
 de la Breteque, Pierre, 1957, Method of recovering gallium from an alkali aluminate lye: U.S. Patent 2,793,179, 6 p.

**Annual Average Gallium Price<sup>1</sup>**  
(Dollars per kilogram)

Year	Price	Year	Price	Year	Price	Year	Price
1959	3,000	1969	850	1979	510	1989	475
1960	2,600	1970	850	1980	630	1990	475
1961	2,250	1971	850	1981	630	1991	475
1962	1,750	1972	750	1982	470	1992	475
1963	1,200	1973	750	1983	470	1993	330
1964	1,200	1974	775	1984	445	1994	325
1965	1,200	1975	775	1985	475	1995	390
1966	1,200	1976	775	1986	475	1996	390
1967	1,200	1977	550	1987	475	1997	550
1968	1,200	1978	550	1988	475	1998	550

<sup>1</sup> 99.9999%-pure gallium metal.

Source: American Metal Market.