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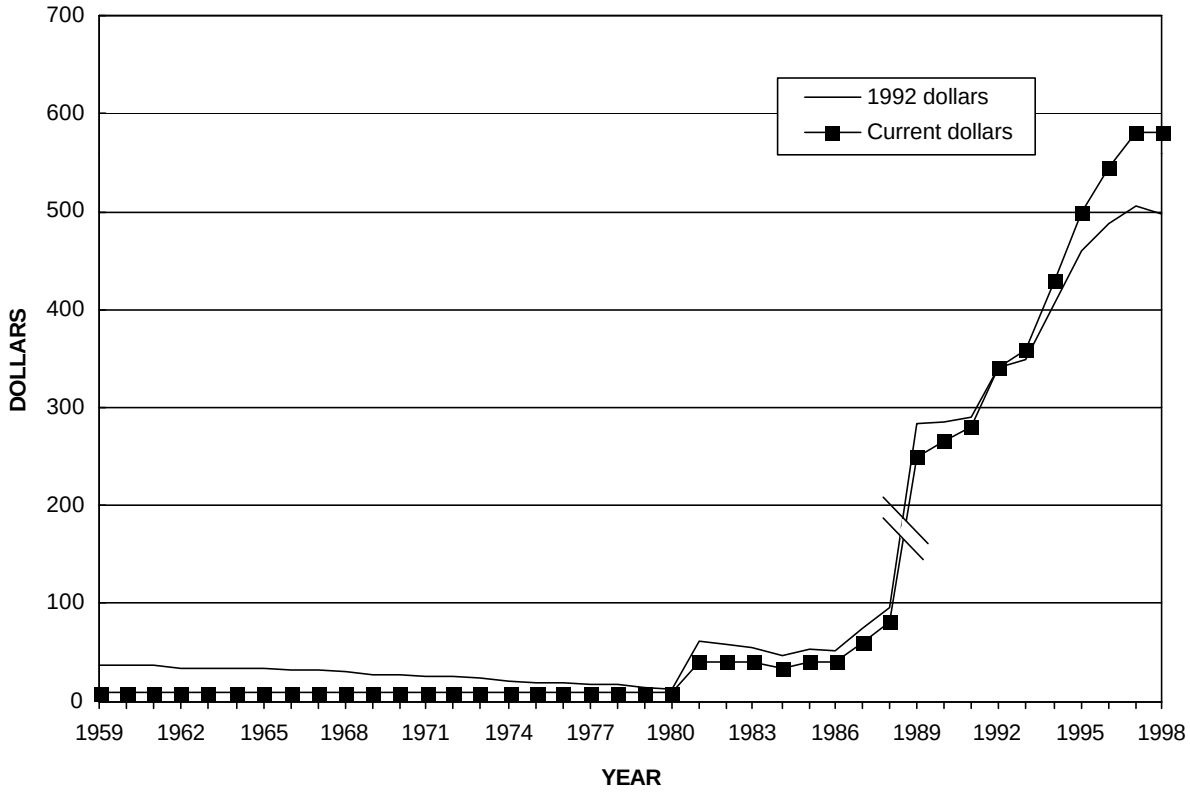
Thallium

by Gerald R. Smith

Annual Average Thallium Price
(Dollars per pound)



Significant events affecting thallium prices since 1958

1959-73	Continued use for rodenticides and insecticides
1981	Domestic production was terminated; dependence on imports
1989-98	Used in superconductivity research and new medical applications; traditional uses continued

Thallium, a soft, bluish-gray, malleable heavy metal, was discovered by Sir William Crookes in 1861 while he was making spectroscopic determinations for tellurium on residues from a sulfuric acid plant. Although the metal is reasonably abundant in the Earth's crust at a concentration estimated to be about 0.7 part per million, it exists mostly in association with potassium minerals in clays, soils, and granites and, thus, is generally considered to be commercially unavailable in this form. Several thallium minerals, containing 16% to 60% thallium, occur in nature as sulfide or selenide complexes with antimony, arsenic, copper, lead, and silver but are rare and have no commercial importance as sources of this element. The major source of commercial thallium is the trace amounts found in copper, lead, zinc, and other sulfide ores. Thallium is recovered as a byproduct from the flue dust and residues generated during the roasting and smelting steps in the processing of these ores.

From 1912 to 1930, thallium compounds were used extensively for medicinal purposes; for example, in the treatment of ringworm, dysentery, and tuberculosis. The narrow margin between toxicity and therapeutic benefit, however, eventually eliminated the practical use of these

compounds. The use of thallium salts as poison for rodents and later as insecticide led to increased use of thallium from 1925 to 1965; significant quantities of the rodenticide were used by the U.S. military to control rat infestation in World War II operations (Lee, 1971; Smith and Carson, 1977).

The postwar price of thallium metal reached $18.00 per pound after the wartime allocation and price control system imposed on thallium chemicals was lifted by the War Production Board in 1946. In 1965, the U.S. Government issued regulations prohibiting the household use of thallium-containing rodent poisons and insecticides because of their extreme toxicity to humans, resulting in a significant decline in thallium consumption. By 1973, all retail sales of these chemicals had been banned in the United States. Although thallium consumption declined sharply as a result of the loss of these markets, the decline was offset to some extent by increases in the uses of thallium in electronic applications, chemical synthesis, and such minor uses as components for solders, low-melting alloys, low-temperature thermometers, and optical glasses. During this period of transition in the end-use sectors, the published domestic producer price remained at $7.50 per pound through 1980. In 1981, ASARCO Incorporated, the only domestic producer of thallium and thallium compounds, stopped production. From 1981 through 1988, the price of thallium metal was based upon information obtained from import dealers. By 1988, thallium prices had risen to $80.00 per pound.

In the 1990's, consumption of thallium metal and compounds has continued in most of the established end uses; for example, semiconductor material for selenium rectifiers, an activator in gamma radiation detection equipment, an electrical resistance component in infrared radiation detection and transmission equipment, a crystalline filter for light diffraction in acousto-optical measuring devices, an alloy with mercury for low-temperature measurements, an addition to glass to increase its refractive index and density, a catalyst or intermediate in the synthesis of organic compounds, and a high-density liquid for sink-float separation of minerals. In addition, research activity has been ongoing to develop high-temperature superconducting materials for such applications as magnetic resonance imaging, storage of magnetic energy, magnetic propulsion, and electric power generation and transmission. Since 1989, numerous patents have been issued for and reports have been published on the preparation of high-temperature superconductor compounds containing thallium. In 1993, one U.S. company joined the International Superconductivity Technology Research Center, a 46-member superconductivity consortium based in Japan. As a member of this consortium, the company now sends two scientists to the Center to conduct research on its newly discovered thallium compounds that superconduct at high temperatures. The use of radioactive thallium compounds for medical purposes in cardiovascular imaging to detect heart disease has also increased steadily since the early 1980's.

With the advent of these newer and potential safe uses for thallium, the demand for higher purity thallium metal, either in research or practical application, has increased. Consistent with the greater need for high-purity thallium and the lack of published or otherwise available producer or dealer quotations for thallium metal of any purity since 1988, the price of thallium metal has been based upon the metal price listed in retail supplier catalogues. The price of 99.999%-pure thallium granules has risen steadily from $250.00 per pound in 1989 to $580.00 per pound in 1998. This price increase, an average of about 15% per year, reflects an increase in the retail price, but this increase is higher than the rate of inflation. To some extent, the price increase is probably the result of a greater demand for high-purity thallium.

References Cited

Lee, A.G., 1971, The chemistry of thallium: Amsterdam, Elsevier, p. 1-4.

Smith, I.C., and Carson, B.L., 1977, Thallium, v. 1 *of* Trace metals in the environment: Ann Arbor, MI, Ann Arbor Science, p. 9-16.

Annual Average Thallium Price

(Dollars per pound[1])

Year	Price	Year	Price	Year	Price	Year	Price
1942	10.00	1957	12.50	1972	7.50	1987	60.00
1943	10.00	1958	7.50	1973	7.50	1988	80.00
1944	11.00	1959	7.50	1974	7.50	1989	250.00
1945	12.50	1960	7.50	1975	7.50	1990	265.00
1946	14.00	1961	7.50	1976	7.50	1991	280.00
1947	18.00	1962	7.50	1977	7.50	1992	340.00
1948	15.00	1963	7.50	1978	7.50	1993	360.00
1949	14.00	1964	7.50	1979	7.50	1994	430.00
1950	12.50	1965	7.50	1980	7.50	1995	500.00
1951	12.50	1966	7.50	1981	40.00	1996	545.00
1952	12.50	1967	7.50	1982	40.00	1997	580.00
1953	12.50	1968	7.50	1983	40.00	1998	580.00
1954	12.50	1969	7.50	1984	35.00		
1955	12.50	1970	7.50	1985	40.00		
1956	12.50	1971	7.50	1986	40.00		

[1] To convert to dollars per kilogram, multiply by 2.20462.

Note:
1942-66, U.S. producer price (99.90% pure thallium), *in* E&MJ Metal and Mineral Markets.
1967-80, U.S. producer price (99.90% pure thallium), *in* Metals Week.
1981-88, Imported dealer price (99.90% pure thallium), private communications with suppliers.
1989-98, Retail supplier price (99.9990% pure thallium granules), *in* Aldrich and Alfa Aesar chemicals catalogues.