

CESIUM

(Data in kilograms of cesium content unless otherwise noted)

Domestic Production and Use: Pollucite, the ore mineral of cesium with the most commercial importance, may be found in zoned pegmatites worldwide, with the largest deposit at Bernic Lake in Canada. Canada is the leading producer and supplier of pollucite concentrate, which is imported for processing by one company in the United States. Occurrences of cesium-bearing pollucite in pegmatites have been discovered in Maine and South Dakota; however, these occurrences are not being mined. The most widespread end use of cesium is in cesium formate brines, a high-density, low-viscosity fluid used for high-pressure/high-temperature (HPHT) oil and gas drilling. Cesium formate possesses anti-oxidant and water-structuring properties that protect drilling polymers from thermal degradation and has the required density needed to maintain well control.

Cesium is used as an atomic resonance frequency standard in atomic clocks, playing a vital role in global positioning satellite, Internet, and cell phone transmissions and aircraft guidance systems. Owing to the high accuracy of the cesium atomic clock, which only loses or gains a second in 60 million years, the international definition of a second is based on the cesium atom. The U.S. primary time and frequency standard is based on a cesium fountain clock at the National Institute of Standards and Technology in Boulder, CO.

Other applications of cesium include biomedical research, infrared detectors, night vision devices, photoelectric cells, and traffic controls. Cesium-131 and cesium-137, isotopes of cesium produced by the nuclear fission of uranium-235, are used primarily to treat cancer. Cesium-131 is used in the treatment of prostate cancer and cesium-137 is used in brachytherapy, where the radioactive source is placed within the cancerous area. Cesium-137 is also widely used in industrial gauges, in mining and geophysical instruments, and for sterilization of food, sewage, and surgical equipment. Radioactive cesium chloride is used in self-contained irradiators at hospitals and universities for blood irradiation and in biomedical and radiation research, as well as for industrial uses. Nonradioactive cesium chloride is used in electrically conductive glass.

Salient Statistics—United States: Mine production, consumption, import, and export data for cesium have not been available since the late 1980s. There is no trading of cesium, and therefore no market price is available. Consumption of cesium in the United States is estimated to only be a few thousand kilograms per year. In 2009, one company offered 1-gram ampoules of 99.8% (metals basis) cesium for \$50.70 each and 99.98% (metals basis) cesium for \$62.80, an increase of 14.2% and 7.5% from that of 2008, respectively. The price for 50 grams of 99.8% (metals basis) cesium was \$629.00, and 100 grams of 99.98% (metals basis) cesium was priced at \$1,725.00, an increase of 7.9% and 7.6% from that of 2008, respectively.

Recycling: Cesium formate brines are normally used by oil and gas exploration clients on a rental basis, and after completion of the well, the used cesium formate is returned and reprocessed for subsequent drilling operations. Approximately 15% of the cesium formate may be lost in the well. There are no data available on the amounts used or recovered.

Import Sources (2005-08): Canada is the chief source of pollucite concentrate imported by the United States, and the United States is 100% import reliant.

Tariff: Item	Number	Normal Trade Relations 12-31-09
Alkali metals, other	2805.19.9000	5.5% ad val.
Chlorides, other	2827.39.9000	3.7% ad val.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

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Events, Trends, and Issues: Domestic cesium occurrences will remain uneconomic unless market conditions change, such as the discovery of new end uses or increased consumption for existing end uses. Commercially useful quantities of inexpensive cesium are available as a byproduct of the production of lithium. There are no known human health issues associated with cesium, and its use has minimal environmental impact.

Cesium's cost and reactivity limit its viability in many applications; however, its use in cesium formate brines and nuclear medicine is showing steady growth. Cesium formate drilling operations are being undertaken in the Thar Desert in Pakistan, in the North Sea off the coast of Norway, and in Argentina. Aside from its use in drilling fluid, cesium formate brine is used as a fast-acting liquid pill for releasing drill pipes differentially stuck in oil-based mud (OBM) filter cakes. The pill of formate brine rapidly destroys the OBM filter cake and allows the pipe to be jarred free. In February 2009, the U.S. Food and Drug Administration expanded the clearance for cesium-131 brachytherapy seeds, allowing products to be commercially distributed to treat head, neck, and lung tumors.

The International Atomic Energy Agency has indicated that cesium-137 is one of several radioactive materials that may be used in radiological dispersion devices or "dirty bombs." As of February 2008, the National Research Council mandated that the U.S. Government take steps to promote the replacement of cesium-137 with lower risk alternatives. In April 2009, the U.S. Nuclear Regulatory Commission (NRC) agreed to encourage research into finding and implementing alternatives, but deemed that a near-term replacement was not practical and would be detrimental to current emergency medical capabilities. In August 2009, the NRC announced plans to monitor devices containing cesium-137, requiring material holders to obtain specific licenses for these devices. The new regulations are expected to take effect sometime in late 2010.

World Mine Production and Reserves: Pollucite, a hydrated aluminosilicate mineral, mainly formed in association with lithium-rich, lepidolite-bearing or petalite-bearing zoned granite pegmatites, is a significant cesium ore. Cesium reserves are therefore estimated based on the occurrence of pollucite, which is mined as a byproduct of the lithium mineral lepidolite. Concentrates of pollucite may contain about 20% cesium by weight. Data on cesium resources and mine production are either limited or not available. The deposit at Bernic Lake in Canada contains approximately 300,000 metric tons of pollucite with an average Cs₂O content of 24% and also contains lithium and tantalum. The next largest occurrence that may become economic is in Zimbabwe.

	Reserves¹
Canada	70,000,000
Other countries	NA
World total (rounded)	70,000,000

World Resources: World resources of cesium have not been estimated. Cesium may be associated with lithium-bearing pegmatites worldwide, and cesium resources have been identified in Namibia and Zimbabwe. Cesium occurrences are also known in brines in Chile and China and in geothermal systems in Germany, India, and Tibet.

Substitutes: Because cesium and rubidium have similar physical properties and atomic radii, they may be used interchangeably in many applications.

NA Not available.

¹See [Appendix C for definitions](#). Reserve base estimates were discontinued in 2009; see [Introduction](#).