RUBIDIUM

(Data in metric tons of rubidium oxide unless otherwise noted)

Domestic Production and Use: Rubidium is not actively mined in the United States; however, occurrences are known in Alaska, Arizona, Idaho, Maine, South Dakota, and Utah. Rubidium is also associated with some evaporate mineral occurrences in other States. Rubidium is not a major constituent of any mineral; it is produced in small quantities as a byproduct of cesium, lithium, and strontium mining. Rubidium concentrate is produced as a byproduct of pollucite (cesium) and lepidolite (lithium) mining and is imported from other countries for processing in the United States. The source of the majority of U.S. pollucite imports is the largest known deposit in North America at Bernic Lake, Manitoba, Canada; however, mining ceased at that operation at the end of 2015.

Applications for rubidium and its compounds include biomedical research, electronics, specialty glass, and pyrotechnics. Specialty glasses are the leading market for rubidium; rubidium carbonate is used to reduce electrical conductivity, which improves stability and durability in fiber optic telecommunications networks. Biomedical applications include rubidium salts used in antishock agents and the treatment of epilepsy and thyroid disorder; rubidium-82, a radioactive isotope used as a blood-flow tracer in positron emission tomographic imaging; and rubidium chloride, used as an antidepressant. Rubidium atoms are used in academic research, including the development of quantum-mechanics-based computing devices, a future application with potential for relatively high consumption of rubidium. Quantum computing research uses ultracold rubidium atoms in a variety of applications. Quantum computers, which have the ability to perform more complex computational tasks than traditional computers by calculating in two quantum states simultaneously, were expected to be in prototype phase by 2025.

Rubidium's photoemissive properties make it ideal for electrical-signal generators in motion-sensor devices, night-vision devices, photoelectric cells (solar panels), and photomultiplier tubes. Rubidium is used as an atomic resonance-frequency-reference oscillator for telecommunications network synchronization, playing a vital role in global positioning systems. Rubidium-rich feldspars are used in ceramic applications for spark plugs and electrical insulators because of their high dielectric constant. Rubidium hydroxide is used in fireworks to oxidize mixtures of other elements and produce violet hues. The U.S. military frequency standard, the United States Naval Observatory (USNO) timescale, is based on 48 weighted atomic clocks, including 4 USNO rubidium fountain clocks.

Salient Statistics—United States: U.S. salient statistics, such as consumption, exports, and imports, are not available. Some concentrate, which was primarily from Canada, was exported to the United States for further processing. Industry information during the past decade suggests a domestic consumption rate of approximately 2,000 kilograms per year.

In 2016, one company offered 1-gram ampoules of 99.75%-grade rubidium (metals basis) for $83.13, a 4% increase from $80.30 in 2015, and 100 grams ampoules of the same material for $1,177.60, a 20% decrease from $1,472.00 in 2015. The price for 10-gram ampoules of 99.8% rubidium formate hydrate (metals basis) was $44.96, a 20% decrease from $56.20 in 2015. In 2016, the prices for 10 grams of 99.8% (metals basis) rubidium acetate, rubidium bromide, rubidium carbonate, rubidium chloride, and rubidium nitrate were $48.41, $63.86, $61.08, $57.23, and $47.28, respectively. In 2015, the prices for 10 grams of the same materials were $47.00, $62.00, $59.30, $55.10, and $45.90, respectively. The price for a rubidium-plasma standard solution (10,000 µg/ml) was $56.50 for 50 milliliters, the same as in 2015, and $67.49 for 100 milliliters, a 20% decrease from $84.20 in 2015.

Recycling: None.

Import Sources (2012–15): The United States is 100% import reliant on byproduct rubidium-concentrate imports, most of which were thought to be imported from Canada.

Tariff: Item	Number	Normal Trade Relations 12–31–16
Alkali metals, other	2805.19.9000	5.5% ad val.
Chlorides, other	2827.39.9000	3.7% ad val.
Bromides, other	2827.59.5100	3.6% ad val.
Nitrates, other	2834.29.5100	3.5% ad val.
Carbonates, other	2836.99.5000	3.7% ad val.

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RUBIDIUM

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: Domestic rubidium occurrences will remain uneconomic unless market conditions change, such as the development of new end uses or increased consumption for existing end uses, which in turn could lead to increased prices. No known human health issues are associated with exposure to naturally occurring rubidium, and its use has minimal environmental impact.

During 2016, several projects that were primarily aimed at developing lithium resources were at various stages of development in Manitoba, Canada. The projects were focused on pollucite and spodumene deposits, which primarily contain tantalum, lithium, or both, and possibly cesium and rubidium resources in minor quantities. One company updated its National Instrument 43-101 resource estimate in March 2016 to reflect more than 24,000 tons of measured and indicated rubidium oxide resources.

One pollucite operation at Bernic Lake, Manitoba, Canada, completed a development project in November 2015 after mine collapses in 2010 and 2013; however, the company ceased mining at the site. The company indicated that it had sufficient stocks of raw materials to supply cesium for its products for the foreseeable future. Rubidium concentrate is a byproduct from the processing of cesium ore from the mine; therefore, it is likely that as the company continues to process cesium for formate it will also continue to produce rubidium concentrate. The company also planned to continue exploring possibilities for accessing the mine's resources, as well as possibilities for alternative sources of supply for cesium as needed. The company report did not state whether it had or was considering options for a similar rubidium supply.

World Mine Production and Reserves: Production of pollucite ceased at the Bernic Lake operation in Manitoba, Canada; however, it was expected that rubidium concentrate would continue to be produced as a byproduct of processing from pollucite stocks. Lepidolite and pollucite, the principal rubidium-containing minerals in global rubidium reserves, can contain up to 3.5% and 1.5% rubidium oxide, respectively. Rubidium-bearing mineral resources are found in zoned pegmatites, which are exceptionally coarse-grained plutonic rocks that formed late in the crystallization of a silicic magma. Mineral resources exist globally, but extraction and concentration are cost prohibitive. Production is known to take place periodically in Canada, Namibia, and Zimbabwe, but production data are not available. Rubidium is thought to be mined in China, but information regarding reserves and production is unavailable. Reserves for Zimbabwe were revised based on updated information on the Bikita pegmatite deposit. Reserves for Canada were removed as mining operations ceased in 2015.

	Reserves[1]
Namibia	50,000
Zimbabwe	30,000
Other countries	10,000
World total	90,000

World Resources: In addition to several significant rubidium-bearing zoned pegmatites in Canada, similar pegmatite occurrences have been identified in Afghanistan, China, Denmark, Germany, Japan, Kazakhstan, Namibia, Peru, Russia, the United Kingdom, the United States, and Zambia. Minor amounts of rubidium are reported in brines in northern Chile and China and in evaporites in France, Germany, and the United States (New Mexico and Utah).

Substitutes: Rubidium and cesium can be used interchangeably in many applications because they have similar physical properties and atomic radii. Cesium, however, is more electropositive than rubidium, making it a preferred material for some applications.

[1]See Appendix C for resource and reserve definitions and information concerning data sources.