

## STRONTIUM

(Data in metric tons of strontium content unless otherwise noted)

**Domestic Production and Use:** Although deposits of strontium minerals occur widely throughout the United States, none have been mined in the United States since 1959. Domestic production of strontium carbonate, the principal strontium compound, ceased in 2006. It is thought that virtually all of the strontium mineral celestite consumed in the United States since 2006 has been used as an additive in drilling fluids for oil and natural gas wells.

A few domestic companies produce small quantities of downstream strontium chemicals from imported strontium carbonate. The estimated end-use distribution for strontium compounds in the United States was pyrotechnics and signals, 30%; ceramic ferrite magnets, 30%; and master alloys, pigments and fillers, electrolytic production of zinc, and other applications, including glass, 10% each.

<b><u>Salient Statistics—United States:</u></b>	<b><u>2013</u></b>	<b><u>2014</u></b>	<b><u>2015</u></b>	<b><u>2016</u></b>	<b><u>2017<sup>e</sup></u></b>
Production	—	—	—	—	—
Imports for consumption:					
Celestite <sup>1</sup>	21,900	24,200	24,500	4,420	10,800
Strontium compounds <sup>2</sup>	7,190	7,600	7,100	6,420	6,390
Exports, strontium compounds	37	104	86	91	49
Consumption, apparent:					
Celestite	21,900	24,200	24,500	4,420	10,800
Strontium compounds	7,160	7,500	7,020	6,330	6,340
Total	29,000	31,700	31,500	10,800	17,200
Price, average value of celestite imports at port of exportation, dollars per ton	50	50	51	78	73
Net import reliance <sup>3</sup> as a percentage of apparent consumption	100	100	100	100	100

**Recycling:** None.

**Import Sources (2013–16):** Celestite: Mexico, 100%. Strontium compounds: Mexico, 54%; Germany, 39%; China, 6%; and other, 1%. Total imports: Mexico, 87%; Germany, 11%; and China, 2%.

<b><u>Tariff:</u></b>	<b><u>Item</u></b>	<b><u>Number</u></b>	<b><u>Normal Trade Relations</u></b>
			<b><u>12–31–17</u></b>
	Celestite	2530.90.8010	Free.
	Strontium compounds:		
	Strontium metal	2805.19.1000	3.7% ad val.
	Strontium oxide, hydroxide, peroxide	2816.40.1000	4.2% ad val.
	Strontium nitrate	2834.29.2000	4.2% ad val.
	Strontium carbonate	2836.92.0000	4.2% ad val.

**Depletion Allowance:** 22% (Domestic), 14% (Foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** After increasing for 6 consecutive years, imports of celestite, the most commonly used strontium mineral, decreased by about 82% in 2016 before increasing again in 2017, although still below levels from 2013 through 2015. The decrease in 2016 was likely the result of decreased natural gas- and oil-drilling activity owing to low gas and oil prices in 2014 and 2015. The imports of celestite mirrored the rebounding oil prices in 2016 and 2017. All of the celestite is imported from Mexico and is thought to be used exclusively as an additive in drilling fluids for oil and natural gas exploration and production. For these applications, celestite is ground but undergoes no chemical processing. Outside the United States, celestite is the raw material used for production of strontium compounds.

Strontium carbonate is sintered with iron oxide to produce permanent ceramic ferrite magnets. Strontium nitrate contributes a brilliant red color to fireworks and signal flares. Approximately equal quantities of strontium compounds were thought to be used in these end uses. Smaller quantities of strontium compounds were consumed in several other applications, including glass production, electrolytic production of zinc, master alloys, and pigments and fillers. Strontium may be ingested by humans as a dietary supplement, as an active ingredient in toothpastes, and as a pain reliever for some types of cancer. Although specific information is not available, these uses likely consume very small quantities of strontium compounds, but the compounds must be extremely pure and, thus, are of high unit value.

With improvements to global economic conditions, consumption of strontium compounds and, thus, celestite would be expected to increase. Little information is available about the potential for celestite consumption in drilling fluids, but if oil and gas drilling increases, celestite consumption in that end use may increase as well.

### World Mine Production and Reserves:<sup>4</sup>

	Mine production		Reserves <sup>5</sup>
	2016	2017 <sup>e</sup>	
United States	—	—	—
Argentina	5,000	5,000	All other:
China	50,000	50,000	6,800,000
Mexico	56,500	57,000	
Spain	90,000	90,000	
World total (rounded)	202,000	202,000	6,800,000

**World Resources:** World resources of strontium are thought to exceed 1 billion tons.

**Substitutes:** Barium can be substituted for strontium in ferrite ceramic magnets; however, the resulting barium composite will have reduced maximum operating temperature when compared with that of strontium composites. Substituting for strontium in pyrotechnics is hindered by difficulty in obtaining the desired brilliance and visibility imparted by strontium and its compounds. In drilling mud, barite is the preferred material, but celestite may substitute for some barite, especially when barite prices are high.

<sup>e</sup>Estimated. — Zero.

<sup>1</sup>The strontium content of celestite is 43.88%, assuming an ore grade of 92%, which was used to convert units of celestite to strontium content.

<sup>2</sup>Strontium compounds, with their respective strontium contents, in descending order, include metal (100.00%); oxide, hydroxide, and peroxide (70.00%); carbonate (59.35%); and nitrate (41.40%). These factors were used to convert gross weight of strontium compounds to strontium content.

<sup>3</sup>Defined as imports – exports.

<sup>4</sup>Gross weight of celestite in tons.

<sup>5</sup>See [Appendix C](#) for resource and reserve definitions and information concerning data sources.