

STRONTIUM

(Data in metric tons of contained strontium 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. Virtually all the strontium mineral celestite consumed in the United States since 2006 is thought to have been used as an additive in drilling fluids for oil and natural-gas wells. A few domestic companies produced small quantities of downstream strontium chemicals from imported strontium carbonate.

Based on import data, the estimated end-use distribution in the United States for strontium, including celestite and strontium compounds, was drilling fluids, 65%; ceramic ferrite magnets and pyrotechnics and signals, 13% each; and other uses, including electrolytic production of zinc, master alloys, pigments and fillers, and other applications, including glass, accounted for the remaining 9%.

<u>Salient Statistics—United States:</u>	2018	2019	2020	2021	2022^e
Production	—	—	—	—	—
Imports for consumption:					
Celestite ¹	16,900	7,960	1,060	106	7,200
Strontium compounds ²	6,350	5,560	4,440	5,020	5,100
Exports, strontium compounds ³	32	20	32	6	13
Consumption, apparent: ⁴					
Celestite	16,900	7,960	1,060	106	7,200
Strontium compounds	<u>6,320</u>	<u>5,540</u>	<u>4,410</u>	<u>5,010</u>	<u>5,100</u>
Total	23,200	13,500	5,470	5,120	12,000
Price, average unit value of celestite imports at port of exportation, dollars per ton	78	82	89	209	140
Net import reliance ⁴ as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2018–21): Celestite: Mexico, 100%. Strontium compounds: Germany, 47%; Mexico, 45%; China, 4%; and other, 4%. Total imports: Mexico, 75%; Germany, 21%; China, 2%; and other, 2%.

<u>Tariff:</u>	Item	Number	Normal Trade Relations <u>12–31–22</u>
	Celestite	2530.90.8010	Free.
	Strontium compounds:		
	Strontium metal	2805.19.1000	3.7% ad valorem.
	Strontium oxide, hydroxide, peroxide	2816.40.1000	4.2% ad valorem.
	Strontium nitrate	2834.29.2000	4.2% ad valorem.
	Strontium carbonate	2836.92.0000	4.2% ad valorem.

Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile: None.

Events, Trends, and Issues: Apparent consumption of total strontium increased significantly in 2022. Apparent consumption of strontium compounds increased slightly, but apparent consumption of celestite increased to within 10% of that in 2019. The increase in 2022 was likely the result of improved economic conditions following the economic downturn attributed to the global coronavirus disease 2019 (COVID-19) pandemic in 2020, and the prolonged economic recovery period in 2021. World celestite production in 2022 was estimated to have remained essentially unchanged from that in 2021.

On February 24, 2022, a final U.S. critical minerals list was published in the Federal Register (87 FR 10381). The 2022 critical minerals list was an update of the list of critical minerals published in 2018 in the Federal Register (83 FR 23295). The 2022 critical minerals list contained 50 individual mineral commodities instead of 35 minerals and mineral groups. The changes in the 2022 list from the prior list were the addition of nickel and zinc and the removal of helium, potash, rhenium, strontium, and uranium. The list is to be updated every 3 years and revised as necessary consistent with available data.

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Imports of celestite increased significantly 2022, likely the result of increased use of celestite in natural-gas- and oil-well-drilling fluids. Drilling activity increased by nearly 60% in the first 8 months of 2022 compared with that in the same period in 2021, but still remained about 30% below that seen in the same period in 2019 before the pandemic. In recent years, nearly all celestite imports were from Mexico and were thought to be used as additives in drilling fluids for oil and natural gas exploration and production. For these applications, celestite is ground but undergoes no chemical processing. A small quantity of high-value celestite imports were reported; these were most likely mineral specimens. Although no strontium carbonate was produced in the United States, celestite is the raw material from which strontium carbonate and other strontium compounds are produced.

Strontium carbonate is the most commonly traded strontium compound and is used as the raw material from which other strontium compounds are derived. Strontium carbonate is sintered with iron oxide to produce permanent ceramic ferrite magnets. Strontium nitrate, the second most commonly traded strontium compound, contributes a brilliant red color to fireworks and signal flares. Smaller quantities of these and other strontium compounds and strontium metal were consumed in several other applications, including electrolytic production of zinc, glass production, master alloys, and pigments and fillers. Imports of strontium compounds were estimated to have increased slightly in 2022.

World Mine Production and Reserves:⁵ Reserves for China were revised based on Government reports.

	Mine production		Reserves⁶
	<u>2021</u>	<u>2022^e</u>	
United States	—	—	NA
Argentina	^e 700	700	NA
China	^e 80,000	80,000	16,000,000
Iran	^e 110,000	110,000	NA
Mexico	21,400	22,000	NA
Spain	<u>^e130,000</u>	<u>130,000</u>	<u>NA</u>
World total (rounded)	^e 340,000	340,000	Large

World Resources:⁶ World resources of strontium may exceed 1 billion tons.

Substitutes: Barium can be substituted for strontium in ferrite ceramic magnets; however, the resulting barium composite will have a 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.

^eEstimated. NA Not available. — Zero.

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

²Strontium compounds (with their respective strontium contents) 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.

³Calculated from Schedule B of the United States code 2836.92.0000 for strontium carbonate. Other strontium compounds exports are not included because these shipments likely consisted of materials misclassified as strontium compounds.

⁴Defined as imports – exports.

⁵Gross weight of celestite in metric tons.

⁶See Appendix C for resource and reserve definitions and information concerning data sources.