

FLUORSPAR

(Data in thousand metric tons unless otherwise noted)

Domestic Production and Use: In 2018, minimal fluor spar (calcium fluoride, CaF₂) was produced in the United States. One company sold fluor spar from stockpiles produced as a byproduct of its limestone quarrying operation in Cave-in-Rock, IL. The same company also continued development work and stockpiling of ore for future processing at the Klondike II fluor spar mine in Kentucky. Synthetic fluor spar may have been recovered as a byproduct of petroleum alkylation, stainless steel pickling, or uranium processing, but no data were collected from any of these operations. An estimated 40,000 tons of fluorosilicic acid (FSA), equivalent to about 64,000 tons of fluor spar grading 100%, was recovered from five phosphoric acid plants processing phosphate rock. Fluorosilicic acid was used primarily in water fluoridation.

U.S. fluor spar consumption was satisfied by imports and small quantities of byproduct synthetic fluor spar. Domestically, production of hydrofluoric acid (HF) in Louisiana and Texas was by far the leading use for acid-grade fluor spar. Hydrofluoric acid is the primary feedstock for the manufacture of virtually all fluorine-bearing chemicals and is also a key ingredient in the processing of aluminum and uranium. Fluor spar was also used in cement production, in enamels, as a flux in steelmaking, in glass manufacture, in iron and steel casting, and in welding rod coatings.

Salient Statistics—United States:	2014	2015	2016	2017	2018^e
Production:					
Finished, metallurgical grade	NA	NA	NA	NA	NA
Fluor spar equivalent from phosphate rock	114	105	72	64	64
Imports for consumption:					
Acid grade	291	328	328	331	350
Metallurgical grade	123	48	55	70	60
Total fluor spar imports	414	376	383	401	420
Hydrofluoric acid	125	120	126	123	130
Aluminum fluoride	38	32	20	21	23
Cryolite	16	19	16	10	14
Exports	13	14	12	11	10
Consumption:					
Apparent ¹	518	411	371	390	410
Reported	W	W	W	W	W
Price, average value of acid grade imports					
Cost, insurance, and freight, dollars per ton	254	284	267	262	270
Stocks, yearend, consumer and dealer ²	195	^e 146	^e 147	NA	NA
Employment, mine, number ^e	6	5	4	4	3
Net import reliance ³ as a percentage of apparent consumption	100	100	100	100	100

Recycling: Synthetic fluor spar may be produced from neutralization of waste in the enrichment of uranium, petroleum alkylation, and stainless steel pickling; however, undesirable impurities constrain use. Primary aluminum producers recycle HF and fluorides from smelting operations.

Import Sources (2014–17): Mexico, 69%; Vietnam, 10%; South Africa, 8%; China, 6%; and other, 7%.

Tariff: Item	Number	Normal Trade Relations 12–31–18
Metallurgical grade (less than 97% CaF ₂)	2529.21.0000	Free.
Acid grade (97% or more CaF ₂)	2529.22.0000	Free.
Natural cryolite	2530.90.1000	Free.
Hydrogen fluoride (hydrofluoric acid)	2811.11.0000	Free.
Aluminum fluoride	2826.12.0000	Free.
Synthetic cryolite	2826.30.0000	Free.

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

Government Stockpile: None.

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Events, Trends, and Issues: In May 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 critical minerals (83 FR 23295), including fluor spar. This list was developed to serve as an initial focus, pursuant to Executive Order 13817, “A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals” (82 FR 60835).

A new mine in Canada that began operation in late 2017 reportedly sent its first shipment of 4,700 tons of fluor spar to the United States. According to U.S. Census Bureau trade statistics, these imports were received by the Houston-Galveston Customs District. Another new mine in South Africa was under construction and production was expected to begin in early 2019.

World Mine Production and Reserves: Reserves for Brazil, China, and Thailand were revised based on updated data from Government sources, and reserves for Mexico and Morocco were revised based on company-reported information.

	Mine production		Reserves ^{4, 5}
	<u>2017</u>	<u>2018^e</u>	
United States	NA	NA	4,000
Argentina	14	14	NA
Brazil	24	24	1,500
China	3,500	3,500	42,000
Germany	55	55	NA
Iran	70	70	3,400
Mexico	1,020	1,100	68,000
Mongolia	220	220	22,000
Morocco	78	78	460
South Africa	257	260	41,000
Spain	142	170	6,000
Thailand	31	30	3,600
United Kingdom	12	12	4,000
Vietnam	236	220	5,000
Other countries	<u>26</u>	<u>29</u>	<u>110,000</u>
World total (rounded)	5,680	5,800	310,000

World Resources: No known systematic assessment of either U.S. or global resources has been conducted since the 1980s. Enormous quantities of fluorine are present in phosphate rock. Current U.S. reserves of phosphate rock are estimated to be 1 billion tons, containing about 72 million tons of 100% fluor spar equivalent assuming an average fluorine content of 3.5% in the phosphate rock. World reserves of phosphate rock are estimated to be 70 billion tons, equivalent to about 5 billion tons of 100% fluor spar equivalent.

Substitutes: Fluorosilicic acid is used to produce aluminum fluoride (AlF₃), but because of differing physical properties, AlF₃ produced from FSA is not readily substituted for AlF₃ produced from fluor spar. Fluorosilicic acid has been used to produce HF, but this practice has not been widely adopted. Synthetic fluor spar could potentially be recovered by the Department of Energy’s two depleted uranium hexafluoride conversion plants in Paducah, KY, and Portsmouth, OH. However, the preferred product is currently aqueous HF rather than fluor spar. Aluminum smelting dross, borax, calcium chloride, iron oxides, manganese ore, silica sand, and titanium dioxide have been used as substitutes for fluor spar fluxes.

^eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Defined as imports – exports + adjustments for industry stock changes for fluor spar only. Adjustments for stocks changes are included for 2014–16 but were no longer available for 2017 and 2018 and are not included. Excludes fluor spar equivalent of FSA, HF, AlF₃, and cryolite.

²Industry stocks for leading consumers and fluor spar distributors.

³Defined as imports – exports + adjustments for industry stock changes for fluor spar only. Adjustments for stocks changes are included for 2014–16 but were no longer available for 2017 and 2018 and are not included.

⁴See Appendix C for resource and reserve definitions and information concerning data sources.

⁵Measured as 100% calcium fluoride.