

FLUORSPAR

(Data in thousand metric tons unless otherwise noted)

Domestic Production and Use: In 2017, minimal fluorspar (calcium fluoride, CaF₂) was produced in the United States. One company sold fluorspar 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 fluorspar mine in Kentucky. Synthetic fluorspar 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 44,400 tons of fluorosilicic acid (FSA), equivalent to about 72,200 tons of fluorspar grading 100%, was recovered from five phosphoric acid plants processing phosphate rock. FSA was used primarily in water fluoridation.

U.S. fluorspar consumption was satisfied by imports and small quantities of byproduct synthetic fluorspar. Domestically, production of hydrofluoric acid (HF) in Louisiana and Texas was by far the leading use for acid-grade fluorspar. HF 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. Fluorspar 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:	2013	2014	2015	2016	2017^e
Production:					
Finished, all grades	NA	NA	NA	NA	NA
Fluorspar equivalent from phosphate rock	121	114	105	72	72
Imports for consumption:					
Acid grade	512	291	328	328	390
Metallurgical grade	131	123	48	55	71
Total fluorspar imports	643	414	376	383	460
Hydrofluoric acid	119	125	120	126	130
Aluminum fluoride	43	38	32	20	23
Cryolite	19	16	19	16	10
Exports	16	13	14	12	11
Consumption:					
Apparent ¹	548	518	411	371	450
Reported	441	W	W	W	W
Price, ² acid grade, yearend, dollars per ton:					
Filtercake	350	290–330	260–280	260–280	260–280
Arsenic <5 parts per million	540–550	370–420	280–310	280–310	280–310
Stocks, yearend, consumer and dealer ³	313	195	^e 146	^e 147	W
Employment, mine, number ^e	6	6	5	4	5
Net import reliance ⁴ as a percentage of apparent consumption	100	100	100	100	100

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

Import Sources (2013–16): Mexico, 71%; China, 8%; South Africa, 8%; Vietnam, 5%; and other, 8%.

Tariff: Item	Number	Normal Trade Relations 12-31-17
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: The Kigali amendment to the Montreal protocol, aimed at reducing emissions from fluorinated greenhouse gases, has affected the fluorochemical market globally. It has resulted in new legislation in many countries, which reduces the production and consumption of hydrofluorocarbons. A new refrigerant, hydrofluoroolefin HFO-1234yf, with a low global-warming potential, has been developed as an alternative. A new facility opened in Geismar, LA, specifically for its production.

Prolonged adverse market conditions have affected numerous mining projects. In the past several years, mines in Bulgaria, Kenya, Namibia, and Russia have been put on care-and-maintenance status or permanently closed. However, a mine in Canada officially opened with production expected to begin in late 2017. Additionally, in South Africa, construction began on a mine with production expected to begin in early 2019.

World Mine Production and Reserves: Production estimates for individual countries were made using country or company-specific data whenever available; other estimates were made based on general knowledge of end-use markets. Reserves were updated with data from Government sources for Brazil and China, from Government sources and company-reported information for the United Kingdom, and from company-reported information for Vietnam.

	Mine production		Reserves^{5, 6}
	2016	2017^e	
United States	NA	NA	4,000
Argentina	39	39	NA
Brazil	24	24	640
China	3,800	3,800	41,000
Germany	50	50	NA
Iran	40	40	3,400
Kazakhstan	110	110	NA
Kenya	43	43	5,000
Mexico	988	990	32,000
Mongolia	202	200	22,000
Morocco	70	70	580
South Africa	165	200	41,000
Spain	130	130	6,000
Thailand	42	40	NA
United Kingdom	17	13	4,000
Vietnam	175	200	5,000
Other countries	33	33	<u>110,000</u>
World total (rounded)	5,930	6,000	270,000

World Resources: Identified world fluorspar resources were approximately 500 million tons of contained fluorspar. Additionally, 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% fluorspar 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% fluorspar equivalent.

Substitutes: FSA is used to produce aluminum fluoride (AlF_3), but because of differing physical properties, AlF_3 produced from FSA is not readily substituted for AlF_3 produced from fluorspar. FSA has been used to produce HF, but this practice has not been widely adopted. Synthetic fluorspar 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 fluorspar. Aluminum smelting dross, borax, calcium chloride, iron oxides, manganese ore, silica sand, and titanium dioxide have been used as substitutes for fluorspar fluxes.

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

¹Defined as imports – exports + adjustments for industry stock changes for fluorspar only. Adjustments for stocks changes are included for 2013–16 but were no longer available for 2017 and are not included. Excludes fluorspar production withheld to avoid disclosing company proprietary data and fluorspar equivalent of FSA, HF, AlF_3 , and cryolite.

²Free on board, Tampico, Mexico. Source: Industrial Minerals.

³Industry stocks for leading consumers and fluorspar distributors.

⁴Defined as imports – exports + adjustments for industry stock changes for fluorspar only. Adjustments for stocks changes are included for 2013–16 but were no longer available for 2017 and are not included.

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

⁶Measured as 100% calcium fluoride.