

FLUORSPAR

(Data in thousand metric tons unless otherwise noted)

Domestic Production and Use: In 2021, 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, and continued development of its fluor spar mine in Kentucky. In May, a second company, in Utah, began site preparations for the construction of a plant to produce metallurgical-grade fluor spar briquets. An estimated 22,000 tons of fluorosilicic acid (FSA), equivalent to about 36,000 tons of fluor spar grading 100% CaF₂, was recovered from three phosphoric acid plants processing phosphate rock and was primarily used in water fluoridation. A company in Aurora, NC, continued construction on a plant to produce hydrofluoric acid (HF) from FSA which was expected to begin operation in 2022. The U.S. Department of Energy continued to produce aqueous HF as a byproduct of the conversion of depleted uranium hexafluoride to depleted uranium oxide at plants in Paducah, KY, and Portsmouth, OH.

U.S. fluor spar consumption was satisfied by imports. Domestically, production of 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, particularly refrigerants and fluoropolymers, 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:	2017	2018	2019	2020	2021^e
Production:					
Finished, metallurgical grade	NA	NA	NA	NA	NA
Fluorosilicic acid from phosphate rock	40	33	29	22	22
Imports for consumption:					
Acid grade	331	381	346	414	430
Metallurgical grade	<u>70</u>	<u>78</u>	<u>59</u>	<u>65</u>	<u>40</u>
Total fluor spar imports	401	459	405	480	470
Hydrofluoric acid	123	122	124	103	110
Aluminum fluoride	21	26	38	21	20
Cryolite	10	17	21	26	46
Exports, fluor spar, all grades ¹	11	9	8	9	17
Consumption, apparent ²	390	450	398	470	450
Price, average unit value of imports, cost, insurance, and freight, dollars per ton:					
Acid grade	267	276	304	310	330
Metallurgical grade	237	258	292	149	160
Employment, mine, number ^e	19	16	14	14	14
Net import reliance ² 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 (2017–20):³ Mexico, 66%; Vietnam, 16%; South Africa, 7%; Canada, 4%; and other, 7%.

Tariff:	Item	Number	Normal Trade Relations
			<u>12–31–21</u>
	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.
	Sodium hexafluoroaluminate (synthetic cryolite)	2826.30.0000	Free.

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

Government Stockpile: None.

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Events, Trends, and Issues: Global mine production was estimated to have increased in 2021 primarily owing to the continued rampup of production at mines in Canada, Mongolia, and South Africa. Globally, several projects to produce HF from FSA also continued to progress.

Some countries continued to phase down production, consumption, and imports of non-feedstock hydrofluorocarbons (HFCs) used as aerosols, propellants, and refrigerants owing to HFCs' high global warming potential. Consumption of fluorospar in Europe decreased since the European Union's fluorinated greenhouse gas (also known as F-Gas) regulation went into effect in 2015 and several producers discontinued production of HFCs. Subsequent price increases and lack of availability have reportedly led to a resurgence in illegal imports and sales of these materials. Previous phasedowns of chlorofluorocarbons and hydrochlorofluorocarbons led to similar activity.

In response to the American Innovation and Manufacturing Act, in October, the U.S. Environmental Protection Agency established the Allowance Allocation and Trading Program as part of its final rule to phase down the production and consumption of non-feedstock HFCs by 85% over the next 15 years. The rule set baseline production and consumption levels from which reductions will be made and established a methodology for allocating and trading HFC allowances. In a related action, the White House established an interagency task force on illegal HFC trade.

The State Intellectual Property Office of China invalidated a U.S. company's patent on a manufacturing process used to produce hydrofluoroolefins (HFOs). HFOs have increasingly been adopted as low-global-warming-potential alternatives to HFCs.

World Mine Production and Reserves:

	Mine production		Reserves ⁴
	2020	2021 ^e	
United States	NA	NA	4,000
Canada	100	140	NA
China	55,400	55,400	42,000
Germany	80	80	NA
Iran	56	56	3,400
Kazakhstan	77	77	NA
Mexico	915	990	68,000
Mongolia	685	800	22,000
Morocco	82	80	210
Pakistan	55	70	NA
South Africa	330	420	41,000
Spain	131	130	10,000
Vietnam	220	220	5,000
Other countries	110	110	120,000
World total (rounded)	8,240	8,600	320,000

World Resources:^{4, 6} Large 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% fluorospar equivalent assuming an average fluorine content of 3.5% in the phosphate rock. World reserves of phosphate rock are estimated to be 71 billion tons, containing about 5 billion tons of 100% fluorospar equivalent.

Substitutes: FSA is used to produce aluminum fluoride (AlF₃) and HF. Because of differing physical properties, AlF₃ produced from FSA is not readily substituted for AlF₃ produced from fluorospar. Aluminum smelting dross, borax, calcium chloride, iron oxides, manganese ore, silica sand, and titanium dioxide have been used as substitutes for fluorospar fluxes.

^eEstimated. NA Not available.

¹Includes data for the following Schedule B codes: 2529.21.0000 and 2529.22.0000.

²Defined as total fluorospar imports – exports.

³Includes data for the following Harmonized Tariff Schedule of the United States codes: 2529.21.0000 and 2529.22.0000.

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

⁵As reported by China's Ministry of Natural Resources. Likely excludes production from operations that did not meet the Government's minimum mining and processing requirements. The China Non-Metallic Minerals Industry Association estimated that actual production was closer to 6 million tons.

⁶Measured as 100% CaF₂.