FLUORSPAR

(Data in thousand metric tons unless otherwise specified)

Domestic Production and Use: In 2023, minimal fluorspar (calcium fluoride, CaF_2) 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. An estimated 40,000 tons of fluorosilicic acid (FSA), equivalent to about 65,000 tons of fluorspar grading 100% CaF_2, was recovered from three phosphoric acid plants processing phosphate rock. The U.S. Department of Energy continued to produce aqueous hydrofluoric acid (HF) as a byproduct of the conversion of depleted uranium hexafluoride to depleted uranium oxide at plants in Paducah, KY, and Portsmouth, OH; the aqueous HF was sold into the commercial market.

U.S. fluorspar consumption was satisfied by imports. Domestically, production of anhydrous HF in Louisiana and Texas was by far the leading use for acid-grade fluorspar. 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. 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:	2019	2020	2021	2022	2023[e]
Production:					
Finished, metallurgical grade	NA	NA	NA	NA	NA
Fluorosilicic acid from phosphate rock	29	22	40	[e]40	40
Imports for consumption:					
Acid grade	346	427	391	438	350
Metallurgical grade	59	65	59	88	40
Total fluorspar imports	405	492	451	526	390
Hydrofluoric acid	124	103	103	99	100
Aluminum fluoride	38	21	28	21	25
Cryolite	21	26	42	28	34
Exports, fluorspar, all grades[1]	8	9	15	24	22
Consumption, apparent[2]	398	483	436	502	370
Price, average unit value of imports, cost, insurance, and freight, dollars per metric ton:					
Acid grade	304	309	322	383	430
Metallurgical grade	292	149	151	223	360
Employment, mine, number[e]	14	16	17	15	15
Net import reliance[2] 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 use. Primary aluminum producers recycle HF and fluorides from smelting operations.

Import Sources (2019–22):[3] Mexico, 64%; Vietnam, 15%; China, 6%; South Africa, 6%; and other, 9%.

Tariff: Item	Number	Normal Trade Relations 12–31–23
Metallurgical grade (97% or less CaF_2)	2529.21.0000	Free.
Acid grade (more than 97% 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: World production of fluorspar was estimated to have increased by 6% in 2023, primarily from increased production in Mongolia. Mines in Canada, Germany, Italy, Spain, and the United States, some of which had been idle for decades, were preparing to restart operations.

Innovations in fluorine chemistry continued. A company in the United Kingdom developed technology that bypassed use of HF as an intermediate in fluorochemical production, enabling synthesis directly from fluorspar or fluorinated waste streams. Other companies continued to advance projects to develop alternatives to fluorspar in the production of aluminum fluoride (AlF_3) and HF. A company in Australia was finalizing the design of a pilot plant to recover fluorine from aluminum smelting bath which would be used to produce AlF_3, and a company in Aurora, NC, finalized construction and began commissioning a plant to produce HF from FSA.

In July, the U.S. Department of Energy released an updated assessment of critical materials, including fluorine, deemed important for advancements in clean energy technology. Fluorine's future demand trajectory was based solely on its use in lithium-ion batteries, specifically on its use in electrolyte salts, binders, and separator coatings. In a related development, scientists from Argonne National Laboratory and Lawrence Berkeley National Laboratory demonstrated that fluorine-containing electrolyte solvents improved performance of lithium-ion batteries in sub-zero temperatures.

Globally, the regulatory framework governing the production and use of per- and polyfluoroalkyl substances (PFAS) continued to evolve, although countries and localities differed significantly in their approach. For example, in March, the U.S. Environmental Protection Agency announced proposed drinking water standards that would set limits on six PFAS. The European Union, however, proposed new rules that would establish new restrictions on as many as 10,000 PFAS.

World Mine Production and Reserves: Reserves for China, Iran, Mongolia, Spain, the United States, and Vietnam were revised based on company and Government reports.

	Mine production		Reserves[4]
	2022	2023[e]	
United States	NA	NA	NA
China	5,700	5,700	67,000
Germany	60	60	NA
Iran	116	120	4,500
Mexico	1,000	1000	68,000
Mongolia	425	930	34,000
Pakistan	52	52	NA
South Africa	406	410	41,000
Spain	153	150	15,000
Vietnam	218	170	3,400
Other countries	190	170	50,000
World total (rounded)	8,320	8,800	280,000

World Resources:[4, 5] 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% fluorspar equivalent assuming an average fluorine content of 3.5% in the phosphate rock. World reserves of phosphate rock are estimated to be 74 billion tons, containing about 5 billion tons of 100% fluorspar equivalent.

Substitutes: FSA has been used as an alternative to fluorspar in the production of AlF_3 and HF. Because of differing physical properties, AlF_3 produced from FSA is not readily substituted for AlF_3 produced from fluorspar. Aluminum smelting dross, borax, calcium chloride, iron oxides, manganese ore, silica sand, and titanium dioxide have been used as substitutes for fluorspar fluxes.

[e]Estimated. NA Not available.

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

[2]Defined as total fluorspar imports – exports.

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

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

[5]Measured as 100% CaF_2.