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2007 Minerals Yearbook

FLUORSPAR [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

September 2008

FLUORSPAR

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In 2007, there was no primary fluorspar production in the United States, although a small amount of fluorspar was recovered as a byproduct of limestone quarrying in Illinois and stockpiled for future processing. The bulk of U.S. consumption was supplied by imports, although imports were supplemented by sales of material from the National Defense Stockpile (NDS) and by small amounts of byproduct synthetic fluorspar produced from industrial waste streams. Byproduct fluorosilicic acid (FSA) production from some phosphoric acid producers supplemented fluorspar as a domestic source of fluorine but was not included in fluorspar production or consumption calculations. According to the U.S. Census Bureau, U.S. imports of fluorspar increased by 12%, imports of hydrofluoric acid (HF) decreased by about 3%, and exports of fluorspar increased by about 4% compared with those in 2006 (tables 1, 4-6).

Fluorspar is used directly or indirectly to manufacture such products as aluminum, gasoline, insulating foams, plastics, refrigerants, steel, and uranium fuel. Most fluorspar consumption and trade involve either acid grade (also called acidspar), which is greater than 97% calcium fluoride (CaF_2), or subacid grade, which is 97% or less CaF_2. Subacid grade includes metallurgical and ceramic grades, and is commonly called metallurgical grade or metspar.

Legislation and Government Programs

During calendar year 2007, the Defense National Stockpile Center (DNSC) sold 7,691 short dry tons [6,977 metric tons (t)] of metallurgical-grade fluorspar. According to the DNSC, this sale represented the last of the DNSC inventory of fluorspar (Defense Logistics Agency, Defense National Stockpile Center, 2007). At yearend 2007, however, the DNSC inventory still listed 1,602 short dry tons (1,453 t) of metallurgical-grade fluorspar as inventory authorized for disposal. Unsold quantities that remain in the NDS are discussed in the "Stocks" section of this report.

Production

In 2007, there was no reported mine production of fluorspar in the United States. There is no U.S. Geological Survey (USGS) data survey for synthetic fluorspar. FSA is produced as a byproduct from the processing of phosphate rock into phosphoric acid. Domestic production data for FSA were developed by the USGS from a voluntary canvass of U.S. phosphoric acid operations known to recover FSA. Of the five FSA operations surveyed, responses were received from four plants representing 91% of the total sold or used by producers. Production and sales data for the one nonrespondent were estimated based on company information or prior year data.

In 2007, there were three companies producing marketable byproduct FSA at phosphoric acid plants (part of a phosphate fertilizer operation). J.R. Simplot Co., Mosaic Fertilizer (a subsidiary of The Mosaic Co.), and PCS Phosphate Co. Inc. operated five plants in Florida, Louisiana, North Carolina, and Wyoming that produce marketable FSA. Production of byproduct FSA was 53,900 t (100% basis H_2SiF_6), and quantities sold or used totaled 53,600 t (equivalent to approximately 94,300 t of fluorspar grading 92% CaF_2). This material was valued at about $17.4 million.

Some synthetic fluorspar was recovered as a byproduct of petroleum alkylation, stainless steel pickling, and uranium processing. The majority of the marketable product was estimated to come from uranium processing, but the actual amount of synthetic fluorspar recovered is unknown.

Hastie Mining and Trucking Co. (Cave-In-Rock, IL), Oxbow Carbon and Minerals LLC (Aurora, IN), and Seaforth Mineral & Ore Co. Inc. (East Liverpool, OH), screened and dried acid-grade and metallurgical-grade fluorspar. These materials were either purchased from the NDS or imported from Mexico.

Hastie Mining and Moodie Mineral Co. conducted additional drilling on a large vein deposit in Livingston County, KY. The partners were exploring a previously unmined vein deposit that runs parallel to one mined in the early 1940s by Klondike Fluorspar Co. Mine development was expected to begin in 2008. Hastie installed a briqueting machine at its limestone quarry in Hardin County, IL, to manufacture fluorspar briquets for the metallurgical market. The company plans to install a heavy-media plant in 2008 to process stockpiled fluorspar ore produced as a byproduct at its limestone quarry. Work on restarting an idle flotation plant at Salem, KY, also was planned for 2008 (D. Hastie, owner, Hastie Mining and Trucking Co., oral commun., October 1, 2007).

Consumption

Domestic consumption data were developed by the USGS from a quarterly consumption survey of three large consumers that provide data on HF and aluminum fluoride (AlF_3) consumption and four distributors that provide data on the merchant market (metallurgical and other uses). Quarterly data were received from all seven respondents, and these responses accounted for 100% of the reported consumption in table 2.

Industry practice has established three grades of fluorspar—acid grade, containing more than 97% CaF_2; ceramic grade, containing 85% to 95% CaF_2; and metallurgical grade, normally containing 60% to 85% CaF_2. Fluorspar grades are defined by the intended use, but these grades are essentially just ranges derived from customer and supplier specifications. During the past several decades, there has been a general movement in

the United States toward the use of higher quality fluorspar by many of the consuming industries. For example, welding rod manufacturers may use acid-grade fluorspar rather than ceramic grade, and some steel mills use ceramic or acid grade rather than metallurgical grade.

Total reported U.S. fluorspar consumption increased by 3% in 2007 compared with that of 2006. Consumption of acid grade for HF and AlF_3 increased by about 5% to 464,000 t, while consumption of fluorspar for metallurgical and other uses decreased by 5% (table 2).

Acid-grade fluorspar, which accounted for 94% of the total U.S. fluorspar consumption, was used primarily as a feedstock in the manufacture of HF. Two companies reported fluorspar consumption for the production of HF—E.I. du Pont de Nemours & Co. Inc. (DuPont) and Honeywell International Inc. Fluorspar consumption for HF production increased by more than 8% compared with that of 2006. Since most acid-grade fluorspar is converted to HF before consumption, it is necessary to discuss HF uses and markets in order to properly analyze fluorspar consumption. This included primary HF production, the HF produced in the AlF_3 production process, and HF imports of 152,000 t.

The leading use of HF was for the production of a wide range of fluorocarbon chemicals, including hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs), fluoroelastomers, and fluoropolymers. Production of these compounds accounted for an estimated 55% of domestic HF consumption. They were produced in the United States by Arkema Inc., DuPont, Great Lakes Chemical Corp., Honeywell, INEOS Fluor Americas LLC, MDA Manufacturing Ltd., and Solvay Solexis Inc.

Acid-grade fluorspar was used in the production of AlF_3 and cryolite (Na_3AlF_6), which are the main fluorine compounds used in aluminum smelting. Alumina is dissolved in a bath that consists primarily of molten Na_3AlF_6, AlF_3, and fluorspar to allow electrolytic recovery of aluminum. Fluorine losses are made up entirely by the addition of AlF_3, the majority of which will react with excess sodium from the alumina to form Na_3AlF_6.

Most AlF_3 is produced directly from acid-grade fluorspar or from byproduct FSA. In 2007, Alcoa World Alumina LLC (a business unit of Alcoa Inc.) produced AlF_3 from fluorspar at Point Comfort, TX. Alcoa's consumption of fluorspar decreased by about 17% compared with that of 2006. AlF_3 imports, however, increased by 247% compared with those of 2006, with significant increases from Canada, China, and Sweden.

The merchant fluorspar market in the United States included sales of metallurgical- and acid-grade material mainly to steel mills, where it was used primarily as a fluxing agent to increase the fluidity of the slag. Sales were also made to smaller markets such as cement plants, foundries, glass and ceramics plants, and welding rod manufacturers in rail car, truckload, and less-than-truckload quantities. In 2007, this merchant market totaled 75,600 t, which included sales of 43,100 t of acid grade (57% of the merchant market) and sales of 32,500 t of metallurgical grade (43% of the merchant market). During the past 20 to 30 years, fluorspar usage in such industries as steel and glass has declined because of product substitutions or changes in industry practices.

In the United States, consumption of fluorspar in metallurgical markets (mainly steel) decreased by nearly 13% compared with that of 2006. Acid-grade consumption accounted for 95% of the overall decrease in metallurgical consumption. Consumption in this sector was 62% metallurgical grade and 38% acid grade.

In 2007, byproduct FSA sold for water fluoridation was about 42,100 t valued at $4.8 million, and about 11,500 t valued at $6.6 million was sold or used for other uses. There were no sales for AlF_3 production in 2007. Water fluoridation sales increased by 16% compared with those of 2006.

Stocks

Data for stocks were available from some fluorspar distributors and HF and AlF_3 producers. Known consumer and distributor stocks totaled about 90,100 t. At yearend 2007, unsold NDS material consisted of about 1,450 t of metspar.

Transportation

The United States depends on imports for the majority of its fluorspar supply. Fluorspar is transported to customers by truck, rail, barge, and ship. Metallurgical grade is shipped routinely as lump or gravel, with the gravel passing a 75-millimeter (mm) sieve and not more than 10% by weight passing a 9.5-mm sieve. Acid grade is shipped routinely in the form of damp filtercake that contains 7% to 10% moisture to facilitate handling and to reduce dust. This moisture is removed by heating the filtercake in rotary kilns or other kinds of dryers before treating with sulfuric acid to produce HF. Acid-grade imports from China and South Africa are usually shipped by ocean freight using bulk carriers of 10,000 to 50,000 t deadweight capacity; ships in this size range are termed "handymax." Participants negotiate freight levels, terms, and conditions. Some acid grade and ceramic grade is marketed in bags for small users and shipped by truck.

Ocean freight rates remained high in 2007. The various ocean shipping indices that track freight rates all increased during 2007.

Prices

In recent years, the import values [cost, insurance, and freight (c.i.f.)] for some acidspar imports have been underreported. As a result, average import values for acidspar are no longer listed in table 1.

At yearend, according to published prices, the average price range, U.S. Gulf of Mexico port, c.i.f., dry basis, for Chinese acid grade increased by about $70 per metric ton (table 3). The South African price range for acid grade [free on board (f.o.b.) Durban] increased by $15 per metric ton. The average range of prices for standard Mexican acid-grade fluorspar (f.o.b. Tampico) and for low-arsenic acid grade were unchanged (Industrial Minerals, 2007). Prices for metallurgical-grade fluorspar listed in table 3 were calculated from fourth-quarter statistics from the U.S. Census Bureau.

Foreign Trade

In 2007, U.S. exports of fluorspar were 13,600 t (table 4). This level of exports represents about a 4% increase compared with that of 2006, but is significantly lower than the levels reported prior to 2006. This was primarily because of the depletion of the fluorspar in the NDS, which supplied a significant amount of the fluorspar available for export. Exports may rise slightly when Hastie Mining's Kentucky mine goes into full production.

In 2007, imports for consumption of fluorspar increased by 12% compared with those of 2006 (table 5). The leading suppliers of fluorspar to the United States were Mexico and China (45% each) and South Africa (7%).

In 2007, import patterns by U.S. fluorspar consumers shifted significantly. Mexico edged out China as the leading import source for fluorspar, although China remained the leading source of acidspar imports. Imports from China decreased by 23% compared with those of 2006, while combined acidspar and metspar fluorspar imports from Mexico increased by 136% compared with those of 2006. This shift was the result of a reduction in Chinese fluorspar available for export, higher prices for Chinese fluorspar, and high ocean freight rates.

In recent years, the import values [cost, insurance, and freight (c.i.f.)] for some acid-grade fluorspar imports have been underreported. Quantities as reported in table 5 are thought to be reasonably accurate, but the accompanying values reported for acid-grade imports at some customs districts appear to be low.

Imports of HF decreased by about 3% to 152,000 t (table 6). This was a slight reversal in the trend that had seen HF imports increase by 45,000 t or 41% from 2003 through 2006. Imports of synthetic and natural Na_3AlF_6 increased by 13% to 4,470 t and imports of AlF_3 increased by 247% to 27,600 t (tables 7, 8).

World Review

Estimated world production increased only slightly compared with the revised total for 2006. The leading producers were, in descending order, China, Mexico, Mongolia, and South Africa.

Australia.—Minemakers Ltd. (West Perth, Western Australia), owners of the Moina fluorspar-polymetallic deposit in Tasmania announced that a review of existing data by Delta Minerals Ltd. indicated that, owing to the mixed nature of the mineralization, production of a premium-grade fluorspar product would not be possible. Delta did suggest, however, that there may be demand for a long-term and stable supply of nonpremium-grade fluorspar. With this in mind, a flotation testwork program was recommended (Minemakers Ltd., 2007). The announcement did not go into detail, but it is assumed that the difficulty would be in attaining a minimum 97% CaF_2 content for acid-grade fluorspar.

NiPlats Australia Pty. Ltd. (Perth, Western Australia) has compiled 100%-owned mineral exploration tenements in the East Kimberley region of Western Australia covering approximately 473 square kilometers. This property includes the Speewah veined-fluorite resource, which was targeted as part of the company's drilling program in 2007. A total of 48 drill holes were assayed for fluorspar, including 39 holes on the Main Zone that hosts the previously drilled resource totaling 4.4 million metric tons (Mt) at 23.6% CaF_2. The 2007 drilling showed that fluorite mineralization extends an additional 250 meters (m) to the south and 250 m to the north in two of the primary veins in the Main Zone. The results of the drilling will be used to help interpret the vein structures in order to update the resource model and to assist in future drill targeting (NiPlats Australia Pty. Ltd., 2008).

China.—The Government, which had introduced a 10% export tax on fluorspar in the fourth quarter of 2006, announced that it was raising the tax rate to 15% effective June 1, 2007. The tax was part of a new Government policy designed to conserve important resources for domestic use. This was another factor pushing Chinese fluorspar prices in an upward direction. In recent years, Chinese prices have risen significantly as a result of the export license fees, cancelation of the rebate for the value added tax, decreasing export quotas, high ocean freight rates, bottlenecks within China's internal freight network that included severe shortages of railcars and massive port congestion, and now the new export taxes (O'Driscoll, 2007).

China has once again reduced its fluorspar export quota, lowering the amount available for export in 2008 to 550,000 t. This follows the 2007 quota of 685,000 t and the 2006 quota of 710,000 t.

South Africa.—Sallies Ltd. continued to have major problems at its Witkop and Buffalo fluorspar operations. Problems at the Witkop Mine included poor mining methods and mining ore with too low a cutoff grade, which resulted in poor ore blends and plant stoppages. The Buffalo operation was beset by problems resulting from mixed ore grades, contaminants, and labor problems. Company engineers and metallurgists were performing a strategic review of both operations. Fluorspar production at Witkop increased from 83,400 dry metric tons (dmt) for the year ending June 2006, to 92,200 dmt for the year ending June 2007 (Naidoo, 2007).

In an effort to expand its customer base, Sallies sent test samples to prospective customers in North America in an attempt to reenter the North American market. Sallies canceled its last North American supply contract with Honeywell because of a disagreement over payments. Honeywell appealed this decision to the Arbitration Tribunal of the International Chamber of Commerce, Switzerland, but the case still had not been heard by yearend (Seccombe, 2007).

Sweden.—During 2007, Tertiary Minerals plc. (United Kingdom) applied for an exploration license on a large, low-grade fluorspar deposit located near Storuman in northern Sweden. The company was awarded the exploration license in January 2008. The Storuman fluorspar deposit was first evaluated by Sweden's Gränges Group in the 1970s when drilling, resource evaluation, and metallurgical test work was performed. The deposit is a flat-lying replacement deposit that, in 1974, was reported to have an ore reserve of 12.5 Mt grading 13.3% CaF_2. According to the original 1970s evaluation, about 40% of the ore body was judged minable by open pit methods, and the rest would require underground mining techniques. Tertiary planned to drill the property to confirm ore grades, perform resource calculations, and provide samples for metallurgical test work (Tertiary Minerals plc., 2008). Unless drilling proves higher ore grades, the development of

this resource would entail mining one of the lowest ore grade fluorspar deposits in the World. The only other fluorspar mine currently working such a low-grade deposit is Sallies' Witkop Mine in South Africa, which, for various reasons (many unrelated to geology of the ore deposit), reportedly has operated in the red in recent years (Hill, 2008). The Nui Phao deposit under development in Vietnam has a lower fluorspar ore grade (about 8% CaF_2), but that project is a polymetallic deposit that will be mined primarily for tungsten and fluorspar with recovery of small amounts of bismuth, copper, and gold; all of which are integral parts of the project's profitability.

Tunisia.—In late 2006, Maghreb Minerals plc was awarded four exploration permits in the Zaghoun fluorite district 60 kilometers (km) south of Tunis. The Zriba-Guebli permit covers the Zriba Mine and the Guebli deposit, which is thought to be an extension of the deposit worked in the Zriba Mine. The Zriba Mine operated between 1967 and 1992, when it was closed because of low fluorspar prices. Fluorspar production from the mine was used to supply Tunisia's AlF_3 plant, which since the mine closure has been supplied entirely by imports. The Zriba Mine is largely worked out, and although the bedded deposit extends to the northwest and southeast these areas are known to be thinner than the mined section. The Guebli deposit occurs southwest of the Zriba deposit; it was extensively drilled in the past with some trial mining. The stratabound deposit is at least 60 m to 70 m below the surface with an average ore grade of 18% to 20% CaF_2. In 2007, Maghreb Minerals operated two drilling rigs on the Zriba-Guebli permit for deposit evaluation and quantification. The drilling showed that there were significant quantities of fluorite present but with rapidly varying thickness. A preliminary geological study indicated the deposit has mining potential (Maghreb Minerals Plc, 2006; 2007).

United Kingdom.—INEOS Fluor (Runcorn, United Kingdom) announced that it had acquired Glebe Mines Ltd., which is the United Kingdom's sole fluorspar mining company. Glebe Mines has been a primary supplier of acidspar to INEOS Fluor's fluorochemicals facility at Runcorn. Glebe Mines will operate as a stand-alone company and the name will remain the same (Chemie.DE Information Service GmbH, 2007).

Vietnam.—Dragon Capital Management Ltd. (Vietnam) acquired Tiberon Minerals Ltd. (Canada) and the Nui Phao tungsten-fluorspar project. The project is located within the Dai Tu district of Thai Nguyen Province. The site is approximately 80 km northwest of the capital of Hanoi and about 150 km south of Vietnam's northern border with China. With the change in ownership, information on the project's status has become scarce. Mine startup was reportedly scheduled for September 2010 (Tiberon Minerals Ltd., 2007; VietNamNet Bridge, 2008).

Outlook

With China reducing its export quota and only limited new capacity expected for 2008, international fluorspar supplies are expected to be tight. China's system of export license fees, value added taxes, and export tariffs, coupled with tight supplies, will probably keep acidspar prices high. Another factor pushing fluorspar prices upward is high ocean freight rates, which were expected to remain high owing to vessel shortages and high fuel costs. According to Industrial Minerals magazine, listed import prices for Chinese acidspar had increased by about $75 per metric ton between December 2007 and July 2008 (Industrial Minerals, 2007; 2008).

The long-term demand for fluorspar will depend to a large degree on the competition for the future refrigeration market between fluorochemical and not-in-kind systems (carbon dioxide, ammonia, etc.). For example, Arkema, Du Pont, and Honeywell are backing the hydrofluoroolefin HFO-1234yf as a replacement for HFC-134a. HFC-134a is currently the standard refrigerant used in automobile air conditioning systems but is being phased out in the European Union because of its high global warming potential (GWP). HFO-1234yf reportedly has a GWP of 4 (where carbon dioxide = 1) compared with a GWP of 1,300 for HFC-134a.

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TABLE 1
SALIENT FLUORSPAR STATISTICS[1, 2]

		2003	2004	2005	2006	2007
United States:						
Exports:[3]						
Quantity	metric tons	30,700	20,600	36,100	13,000	13,600
Value[4]	thousands	$4,610	$3,200	$7,840	$2,430	$2,650
Imports:[3]						
Quantity	metric tons	567,000	599,000	629,000	553,000	620,000
Value[5]	thousands	$76,300	$95,300	$122,000	$112,000	$111,000
Average value:[5]						
Acid grade	dollars per metric ton	138	167	202	217	(6)
Metallurgical grade	do.	85	83	93	101	111
Consumption:						
Reported	metric tons	616,000	618,000	582,000	523,000	539,000
Apparent[7]	do.	589,000	691,000	616,000	608,000	613,000
Stocks, December 31:						
Consumer and distributor	do.	206,000 [8]	105,000 [8]	131,000 [8]	89,900 [8]	90,100
Government stockpile	do.	95,000	83,400	35,200	8,110	1,450
World, production	do.	4,850,000	5,230,000 [r]	5,390,000 [r]	5,690,000 [r]	5,690,000 [e]

[e]Estimated. [r]Revised. do. Ditto.

[1]Data are rounded to no more than three significant digits.

[2]Does not include fluorosilicic acid production or imports of hydrofluoric acid and cryolite.

[3]Source: U.S. Census Bureau; may be adjusted by the U.S. Geological Survey.

[4]Free alongside ship values at U.S. ports.

[5]Average unit value for the year, includes cost, insurance, and freight values at U.S. ports.

[6]Value data for acid-grade fluorspar imports appear to be underreported, accurate average value calculations cannot be made.

[7]Imports minus exports plus adjustments for changes in stocks held by Government and three leading consumers.

[8]Includes fluorspar purchased from the National Defense Stockpile (NDS) but still located at NDS depots.

TABLE 2
U.S. REPORTED CONSUMPTION OF FLUORSPAR, BY END USE[1]

(Metric tons)

End use or product	Containing more than 97% calcium fluoride		Containing not more than 97% calcium fluoride		Total	
	2006	2007	2006	2007	2006	2007
Hydrofluoric acid and aluminum fluoride	444,000	464,000	--	--	444,000	464,000
Metallurgical	15,600	14,800	29,100	24,300	44,800	39,000
Other[2]	31,100	28,400	3,750	8,270	34,900	36,600
Total	490,000	507,000	32,900	32,500	523,000	539,000
Stocks, consumer, December 31[3]	56,900	78,200	22,400	11,900	79,400	90,100

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]May include acid grade or metallurgical grade used in enamel, glass and fiberglass, steel castings, and welding rod coatings.

[3]Stocks are from hydrofluoric acid and aluminum fluoride producers and major distributors.

TABLE 3
PRICES OF IMPORTED FLUORSPAR

(Dollars per metric ton)

Source and grade	2006	2007
Acidspar:		
Chinese, dry basis, cost, insurance, and freight (c.i.f.) Gulf port, filtercake	230-240	305-310
Mexican, free on board (f.o.b.) Tampico, filtercake	180-200	180-200
Mexican, f.o.b. Tampico, arsenic <5 parts per million	210-220	210-220
South African, f.o.b. Durban, filtercake	160-204	175-204
Metspar, Mexican, c.i.f. port of U.S. entry, metspar[1]	111	110

[1]Metspar prices are the average value per metric ton of imported Mexican metspar for the fourth quarter calculated from the U.S. Census Bureau statistics.

Sources: Industrial Minerals, no. 471, December 2006, p. 74; no. 483, December 2007, p. 76.

TABLE 4
U.S. EXPORTS OF FLUORSPAR, BY COUNTRY[1]

Country	2006		2007	
	Quantity (metric tons)	Value[2]	Quantity (metric tons)	Value[2]
Australia	--	--	5	$3,060
Canada	7,400	$1,570,000	6,000	1,470,000
Dominican Republic	466	86,900	558	113,000
India	--	--	34	10,000
Mexico	757	111,000	--	--
Netherlands	6	5,820	3	2,910
Philippines	--	--	23	2,590
Taiwan	4,380	655,000	6,930	1,040,000
Total	13,000	2,430,000	13,600	2,650,000

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Free alongside ship values at U.S. ports.

Source: U.S. Census Bureau.

TABLE 5

U.S. IMPORTS FOR CONSUMPTION OF FLUORSPAR, BY COUNTRY AND CUSTOMS DISTRICT[1]

Country and customs district	2006 Quantity (metric tons)	2006 Value[2] (thousands)	2007 Quantity (metric tons)	2007 Value[2] (thousands)
Containing more than 97% calcium fluoride (CaF_2):				
China:				
Anchorage, AK	--	--	41	$8
Baltimore, MD	6	$4	--	--
Houston, TX	161,000	35,400	193,000	37,600
New Orleans, LA	199,000	44,500	83,900	18,900
Total	359,000	79,900	277,000	56,500
Germany, Savannah, GA	17	13	--	--
Japan, Los Angeles, CA	61	10	--	--
Mexico:				
Laredo, TX	39,600	8,300	61,000	13,800
New Orleans, LA	15,300	2,160	174,000	23,600
Total	54,900	10,500	235,000	37,300
Mongolia:				
Houston, TX	27,600	5,600	23,800	4,450
New Orleans, LA	4,940	988	--	--
Total	32,500	6,590	23,800	4,450
South Africa:				
Houston, TX	23,500	4,910	30,800	5,150
New Orleans, LA	19,800	4,180	10,600	2,840
Total	43,300	9,090	41,400	7,990
United Kingdom:				
Houston, TX	6	25	31	37
Los Angeles, CA	345	41	345	42
Total	351	66	376	79
Grand total	490,000	106,000	577,000	106,000
Containing not more than 97% CaF_2:				
Mexico:				
Charleston, SC	3,100	306	3,030	345
Laredo, TX	1,640	175	2,440	232
New Orleans, LA	57,500	5,810	36,700	4,090
Total	62,200	6,290	42,100	4,670
Namibia:				
Charleston, SC	--	--	191	17
Houston, TX	--	--	278	24
Total	--	--	469	41
South Africa, NewYork, NY	--	--	37	8
Grand total	62,200	6,290	42,600	4,720
Grand total, all grades	553,000	112,000	620,000	111,000

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Cost, insurance, and freight values at U.S. ports.

Source: U.S. Census Bureau; may be adjusted by the U.S. Geological Survey.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF HYDROFLUORIC ACID, BY COUNTRY[1]

Country	2006 Quantity (metric tons)	2006 Value[2] (thousands)	2007 Quantity (metric tons)	2007 Value[2] (thousands)
Canada	42,600	$52,300	31,500	$49,500
China	2,080	1,470	2,120	1,970
Germany	294	653	427	1,010
India	--	--	177	192
Italy	38	51	--	--
Japan	1,390	3,010	1,080	2,340
Korea, Republic of	106	343	--	--
Liechtenstein	--	--	(3)	6
Mexico	109,000	109,000	116,000	121,000
Netherlands	300	467	--	--
Peru	40	21	61	31
Singapore	238	524	48	97
Switzerland	(3) r	5	--	--
Taiwan	32	84	--	--
United Kingdom	--	--	3	11
Total	156,000	168,000	152,000	176,000

-- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Cost, insurance, and freight values at U.S. ports.
[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF CRYOLITE, BY COUNTRY[1]

Country	2006 Quantity (metric tons)	2006 Value[2] (thousands)	2007 Quantity (metric tons)	2007 Value[2] (thousands)
Belgium	19	$16	36	$37
China	936	782	1,060	960
Denmark	346	578	709	532
Germany	1,970	1,790	2,210	2,140
Hungary	371	357	265	256
Japan	255	278	149	205
United Kingdom	2	4	19	26
Other[3]	57	66	27	51
Total	3,960	3,870	4,470	4,200

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Cost, insurance, and freight values at U.S. ports.
[3]Includes Canada, France, Russia, South Africa, and Spain.

Source: U.S. Census Bureau.

TABLE 8

U.S. IMPORTS FOR CONSUMPTION OF ALUMINUM FLUORIDE, BY COUNTRY[1]

Country	2006		2007	
	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)
Brazil	11	$8	--	--
Canada	1,970	2,150	10,800	$12,900
China	389	390	8,650	11,800
Germany	1	19	61	83
Italy	--	--	266	410
Japan	(3)	4	9	23
Mexico	4,600	4,510	4,130	4,220
Sweden	977	1,020	3,690	3,860
Total	7,950	8,090	27,600	33,300

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Cost, insurance, and freight values at U.S. ports.

[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9
FLUORSPAR: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country and grade[3, 4]	2003	2004	2005	2006	2007[e]
Argentina	5,422	6,437 [r]	7,502 [r]	8,278 [r]	8,280
Brazil, marketable:					
Acid grade	34,462	40,948	47,143 [r]	45,159 [r]	45,200 [p]
Metallurgical grade	21,884	16,824	19,369 [r]	18,445 [r]	18,500 [p]
Total	56,346	57,772	66,512 [r]	63,604 [r]	63,700
China:[e]					
Acid grade	1,500,000 [r]	1,600,000 [r]	1,650,000 [r]	1,800,000 [r]	1,850,000
Metallurgical grade[5]	1,150,000 [r]	1,100,000 [r]	1,150,000 [r]	1,300,000 [r]	1,350,000
Total	2,650,000	2,700,000	2,800,000 [r]	3,100,000 [r]	3,200,000
Egypt[e]	500	500	500	500	500
France:[e, 6]					
Acid and ceramic grades	79,000	80,000	80,000	35,000	--
Metallurgical grade	10,000	10,000	10,000	5,000	--
Total	89,000	90,000	90,000	40,000	--
Germany, acid grade	33,289	33,203	35,364	53,009 [r]	53,000
India:[e, 7]					
Acid grade	4,200	4,300	4,400	500 [r]	1,000
Metallurgical grade	6,300	6,400	6,500	5,000 [r]	5,000
Total	10,500	10,700	10,900	5,500 [r]	6,000
Iran[8]	47,730	54,052	64,601 [r]	65,000 [r, e]	65,000
Italy[6]	26,387	17,915	15,000 [e]	8,000 [e]	--
Kazakhstan	3,500	4,000	4,750	4,750 [e]	4,750
Kenya, acid grade	95,278	108,000	97,261	83,428	82,000 [9]
Korea, North, metallurgical grade[e]	12,000	12,000	12,500	12,500	12,500
Kyrgyzstan[e]	3,973 [9]	4,000	4,000	4,000	4,000
Mexico:[10]					
Acid grade	409,122	401,753	324,568	466,000 [r]	513,000
Metallurgical grade	347,136	440,945	550,882	470,000 [r]	420,000
Total	756,258	842,698	875,450	936,000 [r]	933,000
Mongolia:					
Acid grade	120,000 [e]	148,200	134,100	137,600	130,000
Other grades[11]	155,000 [e]	206,700	233,400	255,000 [r]	250,000
Total	275,000 [e]	354,900	367,500	392,600 [r]	380,000
Morocco, acid grade	81,225	112,100	95,000 [e]	95,000 [e]	90,000
Namibia, acid grade[12]	79,349	104,785	114,886 [r]	132,249 [r]	118,000
Pakistan, metallurgical grade[e]	1,000	1,026 [9]	1,040	1,050	1,060
Romania, metallurgical grade[e]	15,000	15,000	-- [r, 9]	-- [r, 9]	--
Russia	170,000 [e]	226,400	245,500	210,000 [e]	180,000
South Africa:[e, 13]					
Acid grade	221,000 [9]	250,000	252,000	240,000 [r]	270,000
Metallurgical grade	14,000 [9]	15,000	14,000	16,000 [r]	15,000
Total	235,000 [9]	265,000	266,000	256,000 [r]	285,000
Spain:					
Acid grade	129,195	135,505	133,495	139,500 [r]	140,000 [p]
Metallurgical grade	10,503	10,186 [r, e]	10,500 [r]	10,500 [r, p]	10,500
Total	139,698	145,691 [r]	143,995 [r]	150,000 [r]	150,500
Tajikistan[e]	9,000	9,000	8,500 [r]	8,500 [r]	8,500
Thailand, metallurgical grade	2,180	2,375	295	3,240 [r]	1,820 [9]
Turkey, metallurgical grade	718	880	800	800	900

See footnotes at end of table.

TABLE 9—Continued

FLUORSPAR: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country and grade[3, 4]	2003	2004	2005	2006	2007[e]
United Kingdom[e]	56,000	50,080 [9]	60,980 [r, 9]	60,000 [r]	40,000
Grand total	4,850,000	5,230,000	5,390,000 [r]	5,690,000 [r]	5,690,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through June 6, 2008.

[3]In addition to the countries listed, Bulgaria is thought to have produced fluorspar in the past, but production is not officially reported, and available information is inadequate for the formulation of reliable estimates of output levels.

[4]An effort has been made to subdivide production of all countries by grade (acid, ceramic, and metallurgical). Where this information is not available in official reports of the subject country, the data have been entered without qualifying notes.

[5]Includes submetallurgical-grade fluorspar used primarily in cement that may account for 33% to 50% of the quantity.

[6]Mine closed in 2006.

[7]Year beginning April 1 of that stated.

[8]Year beginning March 21 of that stated. Data for 2003-05 are reported by Iranian Mines and Mining Development and Renovation Organization.

[9]Reported figure.

[10]Data are reported by Servivio Geológico Mexicano.

[11]Principally submetallurgical-grade material.

[12]Data are in wet tons.

[13]Based on data from the South African Minerals Bureau; data show estimated proportions of acid-, ceramic-, and metallurgical-grade fluorspar within the reported totals.