

# BARITE

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In 2004, primary barite production (sold or used by producers) increased for the fourth year in a row and totaled 532,000 metric tons (t) at a value of \$18.7 million. Imports were 2 million metric tons (Mt), exports were 70,000 t, and apparent consumption was 2.46 Mt.

Barite, a name that was derived from the Greek word *barus* (heavy), is the mineralogical name for barium sulfate. In commerce, the mineral is sometimes referred to as barytes. As used in this report, the term primary barite refers to the first marketable product, which includes crude barite that has usually undergone simple beneficiation methods, such as washing, jigging, and tabling, or more complex methods, such as heavy media separation, flotation, and magnetic separation. Most crude barite requires some upgrading to minimum purity or density levels.

## Production

Barite production in 2004 was 532,000 t, an increase of about 14% compared with that of 2003. The value of domestic production was \$18.7 million, an increase of 34% that reflected a significant increase in the unit value. The bulk of mine production was from Nevada with a small amount reported from Georgia.

Domestic production and sales data for barite were derived from voluntary responses to the U.S. Geological Survey (USGS) canvass of 33 known mines and grinding plants. The USGS received responses from 30 of the operations, representing 97% of barite sold and used by processors. Six mines were included in the survey; five were producing, and one was idle. Of the producing mines, four were in Nevada, and one was in Georgia; the idle mine was in Tennessee. There were 24 grinding plants operating at the end of the reporting year. The Georgia mine and three of the Nevada mines had associated nearby grinding plants, while one small Nevada mine supplied a grinding plant in California. Some of the ore from Nevada was sent for grinding to the coast of the Gulf of Mexico. Most ore in Nevada was ground onsite or in California and sold either into the Western United States and southwestern Canadian petroleum drilling markets or to local industrial users.

There were 14 facilities on the coast of the Gulf of Mexico (6 in Louisiana and 8 in Texas) that produced American Petroleum Institute (API)-grade barite in 2004. These stand-alone grinding plants received mostly relatively low-priced crude barite primarily from China and India for grinding to API specifications for the oil and gas drilling market. In Louisiana, two grinding plants operated in the Amelia/Morgan City area, one in Houma, one near the Lake Charles/Westlake area, one in New Iberia, and one near New Orleans. In Texas, there were two grinding plants in Brownsville, three in Corpus Christi,

one in Galveston, and two in Houston, at least one of which, in addition to supplying the drilling market, also produced commercial filler-grade barite.

Grinding plants that produce commercial filler-grade barite or chemical-grade barite are located in northern Georgia or in the Mississippi River Valley. There were three mills and one mine in Georgia, and single mills in Illinois, Missouri, and Tennessee. The location of mills near the Mississippi River allowed them to receive imported barite by barge and to ship the finished product by barge, if possible, or rail or truck, to industrial users in the Midwestern United States.

In 2004, the leading barite companies that mined and ground barite in the United States were also major oil service companies and included Baker Hughes INTEQ (a division of Baker Hughes, Inc.), Baroid (the drilling fluids and industrial barite subsidiary of Halliburton Energy Services, Inc.), and MI-SWACO (a joint venture between Smith International Inc. and Schlumberger Ltd.). Baker Hughes INTEQ, Halliburton, and MI-SWACO are world renowned and operate in many countries, mining barite and providing drilling sales and services. These three companies mined barite in Nevada with associated beneficiation plants and grinding plants and also operated grinding plants in Louisiana and Texas. Excalibur Minerals Inc. (a division of Newpark Resources, Inc. of Houston) was a major barite importer and grinder in Louisiana and Texas for the oil and gas drilling market. The company also operated an industrial barite plant in Tennessee. There were other, smaller companies near the Gulf of Mexico that received imported barite by ship through Louisiana and Texas ports. Ambar Drilling Fluids LP in Houma grinds barite for its service unit. U.S. Clay LP of Birmingham, AL, grinds bentonite for itself in Brownsville and crude barite for the other grinders (tolls) when the other grinders are short of grinding capacity. The other grinding plant in Brownsville is owned by Milwhite, Inc.

After being ground to API specifications, the barite is transferred directly to containers on barges docked in canals, lakes, and rivers near the plants for large-scale deliveries to the offshore drilling platforms. These near-shoreline barite staging locations also are closer to the clusters of onshore areas with significant petroleum production in the Petroleum Administration for Defense (PAD) District 3. The PAD districts were World War II divisions of the oil-producing areas of the United States; these designations continue to be used.

## Consumption

Apparent consumption increased by more than 18% to 2.46 Mt in 2004 from 2.08 Mt in 2003 (table 1). Ground barite sales increased by more than 9% to 2.44 Mt in 2004 from 2.23 Mt in 2003. In 2004, sales by grinding plants in Louisiana were

essentially unchanged at 1.05 Mt, while the sales by grinding operations in Texas increased by about 19% to 753,000 t from 632,000 t (table 2). About 2.3 Mt, or about 94%, of barite sales from domestic crushers and grinders was for petroleum well-drilling markets, and about 6% was for industrial end uses (table 3).

Barite used for drilling petroleum wells can be black, blue, brown, buff, or gray depending on the ore body. Most barite needs to be ground to a small uniform size before it is used as a weighting agent in petroleum-well-drilling mud based on specifications set by the API or the former Oil Companies' Materials Association (OCMA).

The barite is finely ground so that at least 97% of the material, by weight, can pass through a 200-mesh (Tyler) [75-micrometer ( $\mu\text{m}$ )] screen, and no more than 30%, by weight, can be less than 6  $\mu\text{m}$ , effective diameter, which is measured using sedimentation techniques. The ground barite also must be dense enough so that its specific gravity is 4.2 or greater, soft enough to not damage the bearings of a tricone drill bit, chemically inert, and containing no more than 250 milligrams per kilogram (mg/kg) of soluble alkaline salts (American Petroleum Institute, 1993, p. 6-11). A small percentage of iron oxide is allowable. An additional benefit of barite is noninterference with magnetic measurements taken in the borehole, either during logging-while-drilling or in separate drill hole logging.

At the end of the 2004, the total number of oil and gas rigs operating in the United States was 1,126, or an increase of more than 10% compared with the previous year. This compares quite closely with the more than 9% increase in barite sold or used for drilling. Since 1998, consumption of barite in well drilling in the United States has been driven more by the demand for natural gas than for oil. The percentage of drill rigs in the United States drilling for gas averaged 86% for the year (Baker Hughes, 2005<sup>1</sup>). According to the U.S. Department of Energy, Energy Information Administration (2005<sup>§</sup>), the average wellhead price of natural gas was \$5.49 per thousand cubic feet, up from the \$4.88 per thousand cubic feet average for 2003. Continued high prices for natural gas and strong U.S. demand for natural gas during the year helped fuel the high level of domestic drilling activity, which resulted in increased consumption of barite.

In 2004, sales of domestic and imported barite sold for industrial uses increased by 10% to 142,000 t (table 3). Barite used in such industrial end uses as barium chemicals (the largest by volume is barium carbonate), filler in paint and plastics, and powder coatings also requires grinding to a small uniform size. The size will vary depending on the use, but for paint- and plastic-grade material, it will average about 2 to 3  $\mu\text{m}$ . Barite-containing materials that are used for sound reduction in engine compartments are gaining market share among automotive manufacturers. Barite also is used in the base coat of automobile finishes for smoothness and corrosion resistance and continues to be used in friction products for automobiles and trucks.

<sup>1</sup>References that include a section mark (§) are found in the Internet References Cited section.

Barite that is used as an aggregate in "heavy" cement or radiation shielding cement is crushed and screened to sizes ranging from 4 mesh (Tyler) (4.75 millimeters) to 1.5 inches (3.75 millimeters) for the coarse grade. New Riverside Ochre Co., Inc. in Georgia is the primary supplier of barite aggregate.

## Foreign Trade

Barite exports during 2004 increased by nearly 58% to 69,900 t. Canada received 88% of the total, and Mexico received 11%. Another 18 countries received the remaining 1% and received 133 t or less per country (table 4). Imports of crude natural barite [Harmonized Tariff Schedule of the United States (HTS) code 2511.10.5000] increased by 21% to 1.96 Mt; all imports came from China (92%) and India (8%). Imports for the several forms of barite reported under the HTS nomenclature "Other sulfates of barite" rose by 3% to 33,800 t (table 5). Crude natural barite imports into Texas included 476,000 t that entered through the Houston Customs District and 77,600 t that entered through the Laredo [TX] Customs District, which includes Brownsville and Port Isabel, TX, on the Gulf Coast. All remaining imports of crude barite (1.4 Mt) entered through the New Orleans Customs District in Louisiana.

## Prices

The average weighted sales value per ton for primary barite from mines and their associated beneficiation plants in the United States increased to \$35.08 per metric ton, an 18% increase compared with that of 2003 (table 1). The average weighted sales value for drilling-grade barite ground in Louisiana increased by nearly 11% to \$84.19 per ton. The sales value of barite ground in Texas (of which nearly 99% was drilling grade) increased by about 7% to \$86.19 per ton. The average weighted sales value of the production of the other States increased to \$84.65 per ton, nearly a 38% increase compared with that of 2003 (table 2). Barite for barium chemicals, filler and extender, and glass use increased by 29% to about \$200 per ton for 2004 (table 3).

According to Industrial Minerals (2004), at yearend, U.S. import prices for API grade, lump, including cost, insurance, and freight, U.S. Gulf Coast, increased to \$62.50 to \$64.50 per ton for Chinese barite and to \$69 to \$71 per ton for Indian barite. Ground, OCMA, bulk, delivered to Aberdeen (United Kingdom) was unchanged at £50 to £55 per ton (about \$96 to \$106 per ton based on the average December 2004 exchange rate). Micronized, off white, minimum 99% less than 20  $\mu\text{m}$ , delivered to the United Kingdom also was unchanged at £140 to £150 per ton (about \$270 to \$289 per ton).

## World Review

Worldwide, it is estimated that oil and gas drilling accounted for 85% to 90% of barite consumption compared with 94% in the United States. The nondrilling markets for barite are larger outside of the United States, particularly in China and Europe where there is significant barium chemicals manufacturing. Data on nondrilling uses of barite are not readily available,

but based on increased drill rig activity, it is estimated that worldwide consumption of barite outside of North America increased in 2004. According to the world drill rig reports, which do not cover most of the Commonwealth of Independent States or China, the average monthly world drill rig count (excluding the United States) increased by about 6% to 1,205 rigs from an average of 1,142 in 2003. The growth in the counted drill rigs was in Latin America (+46), the Far East (+20), and the Middle East (+19). Other regions, including Africa, Canada, and Europe, experienced decreases in their rig counts (Baker Hughes, 2005§).

## Outlook

The demand for barite in the United States is expected to increase. The level of drilling activity in North America is expected to remain high as a result of strong U.S. demand for natural gas. Most of the drill rigs in 2004 in North America were directed toward gas, and the trend is expected to continue. Through the first half of 2005, the U.S. rig count continued to rise and averaged 1,308 rigs per month hitting a high of 1,355 rigs in June (Baker Hughes, 2005§). As a result of this high rig count, in 2004 and into 2005, drilling companies were experiencing permitting delays as well as shortages of rigs and trained drilling personnel.

The price of domestically mined barite has risen in recent years, increasing by 40% since 2000. The price of imported barite also rose during the same period but only by about 6%. Prices of domestic and imported barite are expected to continue to rise fueled by increased demand by the drilling industry.

## References Cited

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## GENERAL SOURCES OF INFORMATION

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TABLE 1  
SALIENT BARITE STATISTICS<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2000	2001	2002	2003	2004
<b>United States:</b>					
<b>Barite, primary:</b>					
Sold or used by producers:					
Quantity	392	400	420	468	532
Value	9,840	11,000	12,200	13,900	18,700
Exports:					
Quantity	36	45	47	44	70
Value	4,180	5,330	4,230	4,620	6,400
Imports for consumption: <sup>2</sup>					
Quantity	2,100	2,510	1,540	1,650	2,000
Value	108,000	125,000	81,300	85,500	109,000
Consumption, apparent <sup>3</sup>	2,460	2,870	1,920	2,080	2,460
Crushed and ground, sold or used by processors: <sup>4</sup>					
Quantity	2,100	2,670	1,980	2,230	2,440
Value	159,000	206,000	151,000	165,000	208,000
World, production	6,560 <sup>r</sup>	6,740 <sup>r</sup>	6,440 <sup>r</sup>	6,650 <sup>r</sup>	7,240 <sup>c</sup>

<sup>c</sup>Estimated. <sup>r</sup>Revised.

<sup>1</sup>Data are rounded to no more than three significant digits.

<sup>2</sup>Includes crude and ground.

<sup>3</sup>Sold or used plus imports minus exports.

<sup>4</sup>Includes imports.

TABLE 2  
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS IN THE UNITED STATES, BY STATE<sup>1,2</sup>

State	2003			2004		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	8	1,070	\$80,900	6	1,050	\$88,400
Texas	8	632	50,700	8	753	64,900
Other <sup>3</sup>	10	537	33,000	10	641	54,300
Total	26	2,230	165,000	24	2,440	208,000

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes imports.

<sup>3</sup>Includes California, Georgia, Illinois, Missouri, Nevada, and Tennessee.

TABLE 3  
CRUSHED AND GROUND BARITE SOLD OR USED BY PROCESSORS IN THE UNITED STATES, BY USE<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Use	2003		2004	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and/or extender, glass	129	20,000	142	28,400
Well drilling	2,110	145,000	2,300	179,000
Total	2,230	165,000	2,440	208,000

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes imports.

TABLE 4  
U.S. EXPORTS OF NATURAL BARIUM SULFATE (BARITE), BY COUNTRY<sup>1</sup>

Country	2003		2004	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Azerbaijan	--	--	40	\$5
Brazil	--	--	9	3
Canada	38,600	\$3,480	61,800	4,850
Costa Rica	--	--	133	71
Czech Republic	--	--	8	63
Ecuador	4	20	6	36
El Salvador	3	7	--	--
France	17	8	10	33
Germany	--	--	8	46
Greece	--	--	2	7
Hong Kong	--	--	11	38
Japan	84	56	110	94
Korea, Republic of	7	9	5	3
Kuwait	40	8	54	9
Lebanon	42	21	--	--
Mexico	5,500	724	7,580	956
Philippines	14	20	49	60
Senegal	--	--	103	16
South Africa	16	248	1	3
Spain	1	3	--	--
Thailand	--	--	14	63
Trinidad and Tobago	25	6	--	--
United Kingdom	17	8	3	20
Venezuela	1	4	53	20
Total	44,400	4,620	69,900	6,400

-- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 5  
U.S. IMPORTS FOR CONSUMPTION OF BARITE, BY COUNTRY<sup>1</sup>

Country	2003		2004	
	Quantity (metric tons)	Value <sup>2</sup> (thousands)	Quantity (metric tons)	Value <sup>2</sup> (thousands)
<b>Barite, crude:</b>				
Chile	100	\$3	--	--
China	1,530,000	64,200	1,800,000	\$83,000
India	87,100	3,910	156,000	7,610
Norway	4,880	135	--	--
Total	1,620,000	68,200	1,960,000	90,600
<b>Barite, ground:</b>				
China	--	--	4,630	651
Hong Kong	40	4	--	--
Mexico	134	10	475	49
Total	174	14	5,100	700
<b>Barite, other sulfates of:</b>				
Australia	1	6	--	--
Belgium	--	--	20	14
Canada	406	366	920	729
China	16,300	3,550	17,400	3,670
Finland	--	--	( <sup>3</sup> )	2
Germany	11,000	9,900	10,300	9,390
India	--	--	1	5
Italy	4,180	2,260	4,040	2,350
Japan	579	919	884	1,530
Netherlands	39	42	--	--
Spain	220	196	246	170
Switzerland	20	28	--	--
Total	32,800	17,300	33,800	17,800

-- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Cost, insurance, and freight value.

<sup>3</sup>Less than ½ unit.

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

TABLE 6  
U.S. IMPORTS FOR CONSUMPTION OF BARIUM CHEMICALS<sup>1</sup>

	2003		2004	
	Quantity (metric tons)	Value <sup>2</sup> (thousands)	Quantity (metric tons)	Value <sup>2</sup> (thousands)
Barium chloride	270	\$150	130	\$135
Barium oxide, hydroxide, peroxide	3,560	3,260	3,540	3,360
Barium nitrate	4,620	7,740	4,300	5,910
Barium carbonate, precipitated	9,810	4,860	10,200	5,190

<sup>1</sup>Data are rounded to no more than three significant digits.

<sup>2</sup>Cost, insurance, and freight value.

Source: U.S. Census Bureau.

TABLE 7  
BARITE: WORLD PRODUCTION, BY COUNTRY<sup>1, 2</sup>

(Metric tons)

Country	2000	2001	2002	2003	2004 <sup>c</sup>
Afghanistan <sup>e, 3</sup>	2,000	2,000	2,000	2,000	2,000
Algeria	51,925	43,020	51,733	45,649 <sup>r</sup>	47,945 <sup>p, 4</sup>
Argentina	5,472	6,955	3,048	3,261	3,500
Australia <sup>e</sup>	20,000	20,000	--	20,000	20,000
Bolivia	3,050	6,253	15,556 <sup>r</sup>	1,851 <sup>r</sup>	2,000
Bosnia and Herzegovina <sup>e, 5</sup>	2,000	2,000	2,000	1,851 <sup>4</sup>	1,900 <sup>4</sup>
Brazil, beneficiated	53,741	54,790	54,895	55,000 <sup>e</sup>	55,000
Bulgaria <sup>e, 6</sup>	120,000	125,000 <sup>r</sup>	100,000 <sup>r</sup>	95,000 <sup>r</sup>	95,000
Burma	32,333 <sup>r</sup>	26,780 <sup>r</sup>	15,050 <sup>r</sup>	2,000 <sup>r</sup>	1,000
Canada	67,000	23,000	19,000	23,000	21,000 <sup>4</sup>
Chile	1,026	584	384	229 <sup>r</sup>	230
China <sup>e</sup>	3,500,000	3,600,000	3,100,000	3,500,000	3,900,000
Colombia <sup>e</sup>	600	600	600	600	600
Egypt <sup>e</sup>	500	500	500	500	500
France	91,000 <sup>r</sup>	81,000 <sup>r</sup>	80,000 <sup>r</sup>	81,000 <sup>r</sup>	82,000
Georgia <sup>e</sup>	15,000	15,000	15,000	15,000	15,000
Germany, marketable Ba <sub>2</sub> SO <sub>4</sub>	111,800 <sup>r</sup>	108,100 <sup>r</sup>	101,000 <sup>r</sup>	109,500 <sup>r</sup>	110,000
Greece, crude ore <sup>e</sup>	800	800	800	800	800
Guatemala <sup>e</sup>	113	700 <sup>r, 4</sup>	100	100 <sup>r</sup>	100
India <sup>e</sup>	840,000 <sup>4</sup>	850,000	916,000 <sup>r</sup>	675,000 <sup>r</sup>	723,000
Iran <sup>3</sup>	185,000 <sup>e</sup>	195,539	178,652 <sup>r</sup>	180,000 <sup>r</sup>	204,000
Italy <sup>e</sup>	25,000	25,000	25,000	25,000	25,000
Kazakhstan <sup>5</sup>	14,000 <sup>e</sup>	45,000	46,000	40,000 <sup>e</sup>	40,000
Korea, North <sup>e</sup>	70,000	70,000	70,000	70,000	70,000
Korea, Republic of	30	--	--	-- <sup>e</sup>	--
Laos	2,000	4,400 <sup>r</sup>	12,695 <sup>r</sup>	18,070 <sup>r</sup>	18,000
Malaysia	7,274	649	3,082	-- <sup>r</sup>	--
Mexico	127,420	142,017	163,620	287,451 <sup>r</sup>	300,000
Morocco	343,557	471,102	469,934	356,394	357,000
Nigeria <sup>e, 7</sup>	5,000	5,000	5,000	5,000	5,000
Pakistan <sup>e</sup>	21,234 <sup>4</sup>	22,000	25,000	25,000	25,000
Peru	11,403	11,031	3,806	2,906	2,906 <sup>p, 4</sup>
Poland	2,000	2,500	2,700	3,000 <sup>e</sup>	3,000
Romania, processed	4,266	2,849	100	2,000 <sup>e</sup>	8,000
Russia <sup>e</sup>	60,000	60,000	60,000	60,000	60,000
Saudi Arabia <sup>e</sup>	8,000	9,000	9,000	9,000	10,000
Slovakia, concentrate	14,000	14,000	11,000	14,000 <sup>e</sup>	14,000
South Africa <sup>e</sup>	1,628 <sup>4</sup>	--	--	--	--
Spain, marketable Ba <sub>2</sub> SO <sub>4</sub>	28,796 <sup>r</sup>	50,640 <sup>r</sup>	52,494 <sup>r</sup>	44,660 <sup>r</sup>	45,000
Thailand	56,180	23,559	137,469	115,600 <sup>r</sup>	125,000
Tunisia	3,702	2,208	5,539	3,000 <sup>r</sup>	1,800
Turkey	120,893	57,373	106,843	119,648 <sup>r</sup>	120,000
United Kingdom <sup>e</sup>	55,000 <sup>r</sup>	55,000 <sup>r</sup>	66,000 <sup>r</sup>	59,000 <sup>r</sup>	60,000
United States <sup>8</sup>	392,000	400,000 <sup>e</sup>	420,000	468,000	532,000
Vietnam	52,529	71,114	60,228	81,456	101,040 <sup>4</sup>
Total	6,560,000 <sup>r</sup>	6,740,000 <sup>r</sup>	6,440,000 <sup>r</sup>	6,650,000 <sup>r</sup>	7,240,000

<sup>c</sup>Estimated. <sup>p</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Table includes data available through June 10, 2005.

<sup>3</sup>Data are for fiscal year beginning March 21 of that stated.

<sup>4</sup>Reported figure.

<sup>5</sup>Based on an estimated 70% recovery factor.

<sup>6</sup>Marketable concentrate based on reported or estimated noncountry data but is in accord with the trends in reported Bulgarian raw barite production.

<sup>7</sup>Considerably more barite is produced, but it is considered to be commercially unusable.

<sup>8</sup>Sold or used by producers.