



# 2010 Minerals Yearbook

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## IRON OXIDE PIGMENTS

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# IRON OXIDE PIGMENTS

By Arnold O. Tanner

Domestic survey data were prepared by Hoa P. Phamdang, statistical assistant, and the world production table was prepared by Lisa D. Miller, international data coordinator.

In 2010, natural iron oxide pigment (IOP) production in the United States decreased slightly compared with that of 2009. U.S. production data are withheld to avoid disclosing company proprietary data. Finished natural and synthetic IOPs sold by processors increased to 54,700 metric tons (t) valued at \$80.7 million in 2010 from 50,800 t valued at \$74.0 million in 2009. Exports of all grades of IOPs and hydroxides increased to slightly more than 54,000 t valued at \$51.4 million in 2010 compared with 17,000 t valued at \$34 million in 2009. Imports of natural and synthetic IOPs increased to 151,000 t valued at \$167 million in 2010 compared with 106,000 t valued at \$127 million in 2009.

## Production

Natural IOPs, probably the most important of the natural minerals suitable for use as pigments after milling, are low cost, color stable, and nontoxic. They are derived from hematite, which is a red iron oxide mineral; limonite, a mineral that varies from yellow to brown, such as ochers, siennas, and umbers; and magnetite, a black iron oxide mineral. Synthetic IOPs are widely used as colorants and compete with natural IOPs in many color applications. They are manufactured using three methods: thermal decomposition of iron salts or iron compounds; precipitation of iron salts, usually accompanied by oxidation; and reduction of organic compounds by iron. Organic colorants are used for some colorant applications but several of organic compounds fade over time from exposure to sunlight.

U.S. production data for crude (natural) IOPs sold or used in 2010 were developed from a U.S. Geological Survey (USGS) voluntary survey of three companies, of which two responded. These data collected through the USGS survey are withheld to avoid disclosing company proprietary data. With a slight decrease in production, sales remained less than 50,000 t in 2010.

In a second voluntary USGS survey, production data for finished (natural and synthetic) IOPs received from seven of eight known processing operations, represented 90% of the tonnage shown in table 1. Data for the nonrespondent was estimated on the basis of prior-year levels of output and industry trends. Based upon this survey, sales of finished pigments were 54,700 t in 2010, up from 50,800 t in 2009. Production data for finished IOPs are collected only from operations that process material, such as the crushing and grinding of natural IOPs, or that synthesize IOPs, not operations that simply blend, mix, repack, and (or) resell IOP material.

At least four U.S. companies, operating nine plants, produced regenerated iron oxide during steelmaking (table 2). Iron oxide is obtained during steelmaking when steel is treated with hydrochloric acid to remove surface oxides. Iron oxide is formed when the spent pickle liquor is treated to recycle the

acid. Regenerated iron oxide data were not included in table 1 because it must be processed before it is suitable for use in typical iron oxide pigment applications.

## Environment

Iron Oxide Recovery, Inc. (a subsidiary of Hedin Environmental, Mt. Lebanon, PA) processed iron sludge collected from acid mine drainage as part of the Upper Latrobe abandoned mine drainage treatment project near Unity, Westmoreland County, PA. The sludge was collected from a passive treatment system of three settling ponds created by directing water from a borehole drilled to a 43-meter deep pooling of the mine drainage. Drainage from three separate discharges had been polluting Loyalhanna Creek, a popular fishing and recreation area. The sludge was to be processed into a dry powder and sold as a natural pigment for cements, mulch, paints, paper, and plastics. The remediation and landfill disposal costs were eliminated in an environmentally safe manner and resultant product sales fully financed costs (Panian, 2010).

## Consumption

End-use data for IOPs are not surveyed by the USGS or other organizations. Will (2008, p. 12) estimated that world consumption of natural IOPs and synthetic IOPs was 167,000 t and 1.13 million metric tons (Mt), respectively, in 2006. More recent data are unavailable, but the global economic downturn since 2008 likely resulted in decreased consumption of IOP in 2008 and 2009 as may be inferred by the decrease in reported world production of natural IOPs in 2009. In 2010, consumption of natural IOPs likely increased as compared with that of 2009 based upon reported increases in world production. Uses for natural IOPs were estimated to be construction materials (48%), coatings (42%), other unspecified applications (7%), and ceramic, glass, paint, paper, and plastic applications (3%). Uses for synthetic IOPs were estimated to be construction materials (48%), coatings (24%), other unspecified applications (21%), and ceramic, glass, paint, paper, and plastic applications (7%).

Construction materials included concrete products such as block, brick, or segmental retaining wall units; mortar; paving stones; precast products of various sizes or dimensions; ready-mixed concrete; and roofing tiles. IOPs are used almost exclusively to color decorative concrete. The tinted concrete is often stamped so that it resembles brick, slate, stone, and many more shapes and forms found in nature, including wood (Pinto, 2008, p. 4, 6).

Sales of IOPs in these construction markets increased but still experienced lingering negative effects from the sharp decline in domestic and foreign construction activity since 2008. In the United States, construction starts for new privately owned

housing increased to 587,000 units in 2010 from 554,000 units in 2009 but were significantly lower than the 906,000 units started in 2008 (U.S. Census Bureau, 2011b). The value of all residential and commercial construction, both of which use tinted brick and concrete products, again decreased to \$804 billion in 2010 from \$903 billion in 2009 and \$1.07 trillion in 2008 (U.S. Census Bureau, 2011a).

The second largest market for IOPs is as a tint in paints and coatings. The paint and coatings market experienced a modest increase in shipments in 2010 owing to increased construction and manufacturing activity, including those of the automobile industry. This followed decreased shipments in 2009 from those of 2008 owing to decreased construction and manufacturing activity during the economic recession. Shipments of total paint and allied products (comprising architectural coatings, original equipment manufacture product coatings, special-purpose coatings, and miscellaneous allied paint products) were 4.26 billion liters (1.13 billion gallons) in 2010 compared with 4.0 billion liters (1.06 billion gallons) in 2009 and 4.55 billion liters (1.2 billion gallons) in 2008 (U.S. Census Bureau, 2011c). Other end uses of IOPs included colorants for ceramics, glass, paper, plastics, rubber, and textiles; in foundry sands; industrial chemicals, such as catalysts; animal feed; cosmetics; ferrites; fertilizers; and magnetic ink and toner.

A major end use for regenerator iron oxides was ferrite ceramic magnets. There are two types of ferrites—hard, which retain magnetism permanently, and soft, which do not. Hard ferrites are used in flexible magnets, generators, loudspeakers, and motors. Uses of soft ferrites include computers, cores for radio frequency coils, inverter cores, memory cores, microwave communication systems, microwave ferrites for telecommunications, pot cores, rectangular modulus cores, television deflection yokes, and other industrial applications.

Rockwood Pigments NA, Inc. introduced a new generation IOP, Solarox™, which responds to sunlight, enabling surfaces to inhibit microbial growth, reduce air pollutants, and self-clean. Working with the University of Turin in Italy, Rockwood Pigments developed a process to merge IOPs with the photocatalytic properties of titanium dioxide. Solarox, attractive for its environmental properties, is suitable for use in construction materials such as concrete masonry, pavers, plaster, stucco, roofing materials, wall renderings, and decorative concrete; it was available in the complete range of black, red, and yellow IOP shades and could be blended into brown, buff, gold, and tan color combinations (Rockwood Pigments NA, Inc., 2010b).

## Prices

The annual average producer price index (PPI) for IOPs under North American Industry Classification System code 325131–72 was 202.1 in 2010 (1983=100) compared with 200.2 in 2009. The PPI ranged between 192.7 and 213.9 in 2010, with the high being reached in December and the low in May. The PPI measured the average change in the selling prices charged by domestic producers of IOPs over time (U.S. Bureau of Labor Statistics, 2011). Unit values for finished natural and synthetic IOP sold by domestic producers ranged from \$0.32 to \$3.45 per kilogram, with an average unit value of \$1.08 per kilogram.

LANXESS AG, a leading world producer of natural and synthetic IOPs, raised prices in the spring by as much as \$135 (EUR 100) per metric ton and in December by up to \$147 (EUR 110) per metric ton. The company cited increasing raw material costs, investments made to address environmental protection issues and maintain product quality, and rising energy and freight costs as the primary reasons for the increases (LANXESS AG, 2010b).

Rockwood Pigments, with manufacturing sites in Australia, China, France, Germany, Italy, the United Kingdom, and the United States, announced global price increases of 5% to 10% for selected products in its full range of natural and synthetic IOPs. Following 2 years of stable pricing, Rockwood Pigments cited increased raw material costs, energy prices, and transportation charges as reasons for the increases (Rockwood Pigments, NA, Inc., 2010a).

## Foreign Trade

While commercial construction, a major market for IOP colorants in concrete, remained weak in the United States and much of Europe in 2010, U.S. exports of IOPs rose significantly. Exports of all grades increased to most world markets, especially to Asian markets, where economic recovery was taking place at a faster pace than in other regions.

U.S. exports of pigment-grade IOPs and hydroxides in 2010 totaled 9,500 t valued at \$17.0 million, up from 5,640 t valued at \$15.5 million in 2009. China was the leading destination of pigment-grade IOPs, accounting for 34% of U.S. exports, and Mexico was second with 21%. The average unit value of exports of pigment-grade IOPs and hydroxides was \$1.79 per kilogram in 2010, down from \$2.74 per kilogram in 2009 (table 3).

Exports of other grades of IOPs and hydroxides rose to 44,700 t valued at \$34.4 million in 2009 compared with 11,300 t valued at \$18.5 million in 2009. China, Canada, and Spain, in descending order, were the major destinations for exports of other grades of IOPs and hydroxides, accounting for 84% of the export tonnage. China, Spain, Canada, and Hong Kong, in descending order, accounted for the largest increases in exports of other grades of IOPs. The average unit value of exports of other grades of IOPs and hydroxides was \$0.77 per kilogram in 2010, down from \$1.63 per kilogram in 2009 (table 3).

U.S. imports of IOPs rose more than 40% to 151,000 t valued at \$167 million in 2010 from 106,000 t valued at \$127 million in 2009 (tables 1, 4). Unit values of imports of IOPs and hydroxides ranged from \$0.50 to \$2.06 per kilogram, depending on the type and grade. The average unit value of all IOP imports combined was \$1.10 per kilogram in 2010 compared with \$1.19 per kilogram in 2009. Micaceous IOP imports declined slightly, but their average unit value doubled. Imports of natural IOP grades averaged \$0.71 per kilogram in 2010, compared with \$0.56 per kilogram in 2009. The leading source was Cyprus, with 65% of the tonnage, followed by France with 12%. Synthetic IOP import grades averaged \$1.11 per kilogram in 2010 compared with \$1.20 per kilogram in 2009. The leading sources of synthetic IOP imports were China with 53% of the tonnage; Germany, 25%; Brazil, 7%; and Canada, 5%. Following the significant declining trend of 2007–09, the

increase in imports showed some evidence of a possible increase in construction activity in the United States in 2010 (table 5).

## World Review

Sixteen countries reported production of natural IOP in 2010. Production increased in Germany, India, and South Africa, decreased in Pakistan, and remained unchanged in most other countries (table 6). Production in Germany included synthetic IOP. A number of other countries, including Azerbaijan, China, Honduras, Kazakhstan, Russia, and Ukraine, produce iron oxide pigments, but output, probably substantial, was not reported and no basis was available for estimating output levels.

In the European Union, a decline in spending in the construction industries slowed in 2010 to less than 2%, much less than 2008–09 levels. Consumption of construction-focused pigments in 2010 was more than that of 2009, although less than that of 2007–08. Emerging markets, such as Africa, Brazil, China, and India, increased their consumption of pigment minerals. Traditional markets, such as Europe and the United States, are needed for the pigments industry to return to prior levels because many emerging countries remain much smaller volume markets (Roberts, 2011). LANXESS performed process and plant optimization to increase production and expand IOP production capacities at all of its Brazil, China, and Germany sites (LANXESS AG, 2010a).

In a study of the European coatings industry, Information Research Ltd. identified factors that continued to influence the market for pigments in the coatings industry. These included the elimination of heavy metals and heavy-metal salts as pigments and an increase in competitively priced high-performance pigments from the Far East. Inorganic pigments, although losing some appeal owing to barium, cadmium, or chromium content, continued to be preferred where heat, light, and chemical resistance properties were required. Growth in most sectors of the paint pigments market was between 2% and 4%. Innovation in the pigment industry in Europe is being driven by increasingly restrictive legislation, changing formulation practices, and increased use in functional applications (Paint and Coatings Industry, 2010).

**China.**—China increased its IOP production in the past 5 to 6 years, decreasing its dependence on imports from the United States. A rising demand for IOPs in China mainly was driven by the country's ongoing urbanization. Higher levels of construction activity and economic recovery from the global recession resulted in increased imports of IOPs from the United States in 2010 from those of 2009 (particularly for other grades of IOPs and hydroxides), but they were still only about one-half the levels of several previous years (table 3).

LANXESS began producing black iron oxide pigments at its new unit in Jinshan, Shanghai Province. The new 10,000-metric-ton-per-year (t/yr) plant is adjacent to the company's 28,000 t/yr yellow iron oxide production unit. The company was developing new markets for the bluish type of black IOPs in the Asia/Pacific region including Australia, China, and India. All plant wastewater was contained within a closed-circuit and directly linked to an industrial water treatment plant, resulting in the reduction of wastewater generated compared with similar production units in the region. The new unit recycled byproducts

from other processes into high quality black IOPs. In April 2010, LANXESS completed phase I of technical improvements to the yellow iron oxide production unit, allowing that plant to run at full capacity. Phase 2 improvements (begun in 2009) were designed to reduce that plant's emissions by at least 15% and were scheduled for completion in 2011. While able to service customers globally, both plants principally supplied Asian markets (LANXESS AG, 2010a).

**Spain.**—Promindsa SA, which set a company record by selling 15,000 t of iron oxide in 2009, anticipated sales of 17,000 to 20,000 t in 2010. Of 2009 sales, 87% was exported to 57 countries. The Santa Rosa Mine, an underground mine outside Zaragoza, consists of a seam of hematite with an average purity of 85% to 90% Fe<sub>2</sub>O<sub>3</sub> at depths of up to 250 meters. Promindsa sold its iron oxide as a red pigment for use in paints, roof tile, brick, and asphalt, but recently entered new markets with products for use in glass and ceramics (Moores, 2010).

## Outlook

IOP production increased slightly worldwide in 2010 from that of 2009, reflecting a small recovery from the global economic recession, which caused decreased construction activity and lower demand for IOPs for coloring concrete and paint, the two major markets for IOPs.

Rockwood Pigments, a major global IOP producer, indicated that, following declines in sales of surface treatment and colored concrete products in North America and Europe in 2008–09, net sales stabilized somewhat in European markets in 2010, similar to 2008 levels, but remained lower in North America. Although the company was concerned that a continued slowdown in the construction industry in North America might negatively impact its results in 2011, having had overall increased sales of coating products in 2010, Rockwood Pigments expected the upward trend to continue in most market sectors in 2011 (Rockwood Holdings, Inc., 2011, p. 38).

Despite only modest recovery of the construction sector in western industrialized countries, LANXESS' pigment product sales rebounded in 2010. The company expected IOP demand to continue to increase in 2011, especially as a result of increases in construction in some emerging markets and developing countries such as China and India, where the United Nations reported a trend toward urbanization (LANXESS AG, 2011, p. 24, 71).

International Monetary Fund (IMF) forecasts for 2011 and 2012 were mostly unchanged. The world economy was expected to grow about 4.5% each year, with offsetting changes across various economies—advanced economies growing at about 2.5% and emerging and developing economies at about 6.5% (International Monetary Fund, 2011). Improvement in the global economy may result in increased activity in IOP markets in 2011–12. In North America, IOP markets may increase by 2% to 3% while those in Europe and Asia may increase by 3% or more and 5% or more, respectively.

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TABLE 1  
SALIENT U.S. IRON OXIDE PIGMENTS STATISTICS<sup>1</sup>

		2006	2007	2008	2009	2010
<b>Crude pigments sold or used:<sup>2</sup></b>						
Quantity	metric tons	W	W	W	W	W
Value	thousands	W	W	W	W	W
<b>Finished pigments sold:<sup>e,3</sup></b>						
Quantity	metric tons	70,300	88,100	83,300	50,800	54,700
Value	thousands	\$69,300	\$122,000	\$116,000	\$74,000	\$80,700
<b>Exports:<sup>4</sup></b>						
Quantity	metric tons	3,100	5,410	4,740	5,640	9,490
Value	thousands	\$8,090	\$15,900	\$12,100	\$15,500	\$17,000
<b>Imports for consumption:<sup>3</sup></b>						
Quantity	metric tons	199,000	178,000	155,000	106,000	151,000
Value	thousands	\$159,000	\$154,000	\$164,000	\$127,000	\$167,000

<sup>e</sup>Estimated. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Mined.

<sup>3</sup>Natural (mined) and synthetic.

<sup>4</sup>Pigment grade.

TABLE 2  
PRODUCERS OF IRON OXIDE PIGMENTS AND REGENERATED IRON OXIDES  
IN THE UNITED STATES IN 2010

Producers	Plant location
Crude pigments:	
Alabama Pigments Co., LLC	Green Pond, AL.
Hoover Color Corp.	Hiwassee, VA.
New Riverside Ochre Co., Inc.	Cartersville, GA.
Finished pigments:	
Alabama Pigments Co., LLC	Green Pond, AL.
Dynamic Color Solutions, Inc.	Milwaukee, WI.
Hoover Color Corp.	Hiwassee, VA.
LANXESS Corp.	New Martinsville, WV.
New Riverside Ochre Co., Inc.	Cartersville, GA.
Prince Minerals, Inc.	Quincy, IL; and Bowmanstown, PA.
Rockwood Pigments NA, Inc.	Beltsville, MD; Cartersville, GA; King of Prussia, PA; Los Angeles, CA; and St. Louis, MO.
Regenerator iron oxides:	
American Iron Oxide Co. <sup>1</sup>	Allenport, PA; Portage, IN; and Rockport, IN.
ArcelorMittal Weirton Inc.	Weirton, WV.
Bailey-PVS Oxides, L.L.C.	Decatur, AL; Fairfield, AL; and Delta, OH.
International Steel Services, Inc.	Burns Harbor, IN; and Warren, OH.

<sup>1</sup>Division of International Steel Services, Inc.

TABLE 3  
U.S. EXPORTS OF IRON OXIDES AND HYDROXIDES, BY COUNTRY<sup>1</sup>

Country	Pigment grade				Other grade			
	2009		2010		2009		2010	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	166	\$512	443	\$1,220	5	\$39	70	\$74
Belgium	700	3,360	862	3,630	54	389	19	109
Brazil	235	1,210	172	883	105	222	274	595
Canada	61	81	61	114	6,800	11,800	9,390	15,400
China	2,280	2,360	3,250	2,730	190	436	22,600	5,520
France	78	488	44	144	18	111	35	572
Germany	54	140	47	69	79	547	59	625
Hong Kong	165	517	389	1,050	44	131	936	867
India	30	154	71	277	21	74	19	76
Italy	42	144	43	165	520	441	783	613
Japan	60	82	56	109	19	161	64	92
Korea, Republic of	662	3,910	--	--	138	437	63	513
Mexico	472	420	1,970	1,440	2,130	1,310	2,500	1,540
Spain	29	93	65	143	--	--	5,540	1,270
Taiwan	44	217	161	716	23	193	202	2,060
Thailand	20	116	8	44	27	80	35	26
United Kingdom	112	493	159	681	285	745	627	1,540
Other	427 <sup>f</sup>	1,180 <sup>f</sup>	1,690	3,600	871 <sup>f</sup>	1,340 <sup>f</sup>	1,450	2,940
Total	5,640	15,500	9,490	17,000	11,300	18,500	44,700	34,400

<sup>f</sup>Revised. -- 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 4  
U.S. IMPORTS FOR CONSUMPTION OF SELECTED IRON OXIDE AND HYDROXIDE PIGMENTS, BY TYPE<sup>1</sup>

Type	2009		2010		Principal sources, 2010 (metric tons)
	Quantity (metric tons)	Value <sup>2</sup> (thousands)	Quantity (metric tons)	Value <sup>2</sup> (thousands)	
<b>Natural:</b>					
Earth colors <sup>3</sup>	862	\$440	2,330	\$1,160	Cyprus, 2,180; Spain, 135.
Micaceous	1,040	633	1,030	1,230	France, 414; Germany, 208; China, 147; Austria, 137.
<b>Total</b>	<b>1,900</b>	<b>1,070</b>	<b>3,360</b>	<b>2,390</b>	
<b>Synthetic:</b>					
Black	25,100	36,600	34,200	38,900	Germany, 12,000; China, 7,870; Canada, 6,850; Italy, 3,520; Japan, 3,500.
Red	40,700	41,200	62,900	63,500	China, 44,400; Germany, 14,700; Italy, 1,250; Colombia, 1,220.
Yellow	37,500	45,300	49,100	58,700	China, 25,400; Germany, 10,600; Brazil, 10,100.
Other <sup>4</sup>	1,250	2,770	1,520	3,130	China, 588; Canada, 455; Mexico, 272.
<b>Total</b>	<b>105,000</b>	<b>126,000</b>	<b>148,000</b>	<b>164,000</b>	
<b>Grand total</b>	<b>106,900</b>	<b>127,000</b>	<b>151,000</b>	<b>167,000</b>	

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

<sup>2</sup>Customs value.

<sup>3</sup>Includes those earth colors not elsewhere specified or included.

<sup>4</sup>Includes synthetic brown oxides, transparent oxides, and magnetic and precursor oxides.

Sources: U.S. Census Bureau and the U.S. International Trade Commission.

TABLE 5  
U.S. IMPORTS FOR CONSUMPTION OF IRON OXIDE AND IRON HYDROXIDE PIGMENTS, BY COUNTRY<sup>1</sup>

Country	Natural				Synthetic			
	2009		2010		2009		2010	
	Quantity (metric tons)	Value <sup>2</sup> (thousands)	Quantity (metric tons)	Value <sup>2</sup> (thousands)	Quantity (metric tons)	Value <sup>2</sup> (thousands)	Quantity (metric tons)	Value <sup>2</sup> (thousands)
Austria	208	\$247	137	\$197	3	\$52	6	\$61
Belgium	--	--	--	--	2,340	1,640	14	85
Brazil	--	--	--	--	7,970	8,810	10,100	11,900
Canada	--	--	(3)	9	1,520	3,260	7,830	3,560
China	20	14	158	166	48,400	44,300	78,300	73,800
Colombia	--	--	--	--	1,400	1,880	2,020	2,460
Cyprus	686	332	2,180	1,030	--	--	--	--
France	163	127	414	326	148	520	166	998
Germany	37	42	208	268	29,600	38,100	37,300	44,300
Italy	(3)	2	35	163	7,510	13,000	6,420	12,200
Japan	--	--	1	11	3,870	12,600	3,620	12,700
Spain	786	285	219	164	241	192	308	193
Sweden	--	--	--	--	356	76	285	47
Other	2	24	5	53	1,100	1,550	1,400	1,900
<b>Total</b>	<b>1,900</b>	<b>1,070</b>	<b>3,360</b>	<b>2,390</b>	<b>105,000</b>	<b>126,000</b>	<b>148,000</b>	<b>164,000</b>

-- Zero.

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

<sup>2</sup>Customs value.

<sup>3</sup>Less than ½ unit.

Sources: U.S. Census Bureau and the U.S. International Trade Commission.

TABLE 6  
NATURAL IRON OXIDE PIGMENTS: ESTIMATED WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2006	2007	2008	2009	2010
Austria	5,000	5,000 <sup>r</sup>	5,000	4,000 <sup>r</sup>	4,000
Brazil	2,000	2,000	2,000	2,000	2,000
Cyprus, umber	12,000	12,000	12,000	12,000	12,000
France	2,791 <sup>4</sup>	2,800	2,800	2,800	2,800
Germany <sup>5</sup>	242,264	240,310	251,412	209,172	233,909 <sup>4</sup>
India, ocher	370,000	375,000	380,000	385,000	390,000
Iran	2,600	2,600	2,600	2,600	2,600
Italy	500	500	500	500	500
Lithuania	4	4	4	4	4
Pakistan, ocher	5,500	6,000	6,000	6,200 <sup>r</sup>	6,000
Paraguay, ocher	250	250	250	250	250
South Africa	590 <sup>4</sup>	232 <sup>4</sup>	39 <sup>4</sup>	183 <sup>r,4</sup>	244
Spain, ocher	140,000	140,000	140,000	140,000	140,000
Turkey <sup>6</sup>	206,000	260,000	220,000	100,000	100,000
United Kingdom, iron oxides and hydroxides <sup>7</sup>	8,913 <sup>4</sup>	8,000	8,000	8,000	8,000
United States	W	W	W	W	W

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Table includes data available through April 20, 2011.

<sup>3</sup>In addition to the countries listed, a number of others undoubtedly produce iron oxide pigments, but output is not reported and no basis is available for formulating estimates of output levels. Such countries include Azerbaijan, China, Honduras, Kazakhstan, Russia, and Ukraine. Unreported output is probably substantial.

<sup>4</sup>Reported figure.

<sup>5</sup>Production includes natural and synthetic iron oxide pigments.

<sup>6</sup>Production includes micaceous iron oxide pigment and earth paints.

<sup>7</sup>Includes iron oxide pigments.