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Prepared by the staff of the
BUREAU OF MINES
MINERALS DIVISION

N49777

Lead

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THE OUTSTANDING feature of the United States lead industry in 1952 was the transition from scarcity to plenty. Imports, more than double the 1951 total, established a new record and were the determining factor in the change in the supply position. The great influx of foreign lead resulted from expanded free-world production and price drops in foreign markets, which stimulated shipments to the United States. The increased availability of lead was first indicated late in 1951 and became more apparent early in 1952. Foreign prices began a steady decline in February, and in April domestic prices dropped for the first time since June 1950. The United States selling price declined from the 19-cent-a-pound ceiling in effect since October 1951 to a low of 13.5 cents, but by the end of the year had risen to 14.75 cents. The National Production Authority revoked all controls on lead May 15 owing to abundant supplies. Free trading was established on the London Metal Exchange on October 1 for the first time in 13 years, and dealings in lead futures were resumed in the New York Commodity Exchange on May 26.

Lead supply totaled 1,477,000 tons in 1952, an increase of 28 percent over 1951, comprising 390,000 tons of recoverable mine production, 471,000 tons of secondary lead, and 616,000 tons of imports (exclusive of scrap). Consumption of lead, including the quantities consumed in pigments and chemicals, totaled 1,131,000 tons compared with 1,185,000 tons in 1951. Producers' stocks of primary refined lead increased from 19,000 tons on December 31, 1951, to 31,000 tons at the end of 1952, and antimonial lead stocks increased from 6,000 tons to 11,000 tons during the year. Consumers' stocks rose 19 percent to 123,000 tons.

In 1952 the five-volume report by the President's Materials Policy Commission, popularly known as the Paley report, was released. Volume II, Resources for Freedom, reviewed the lead supply and demand of the United States and evaluated reserves, conservation practices, market demand, and position of the free world. Projected demand for lead in 1975 is estimated at 1,950,000 tons, or approximately 61 percent more than in 1950. Projected supply at that time is estimated at 300,000 tons of domestic mine production, 750,000 tons of secondary lead, and 900,000 tons of imports.

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LEAD

GOVERNMENT REGULATION

Adequate supplies of lead resulted in on March 3, 1952, whereby all restrictions removed and consumers were permitted inventory instead of the 30-day supply program. On May 15 the National Production Authority revoked M-38 and M-76, governing the use and distribution of lead, thus ending all domestic controls. The National Production Authority withdrew list A, designating scarce materials, and the International Trade Commission removed quota restrictions on lead that might be exported. Exports, however, for exports to all countries except

GOVERNMENT PROGRAMS UNDER ACT OF 1951

The Defense Minerals Administration, under provisions of the Defense Production Act of 1951, is responsible for the production of critical minerals and metals. Late in 1951 this organization was transferred to the Department of Defense in respect to exploration activities by the Defense Minerals Administration and with respect to procurement by the Defense Materials Procurement Agency.

The objective of the Defense Minerals Administration was to encourage mineral exploration and production of strategic and critical minerals. With this program, the Government financed a total cost of approved exploration projects. At the end of 1952, 151 exploration contracts were in force. Government participation in these contracts totaled \$5,595,473 or approximately 10 percent of total cost. Government participation in all defense-mineral exploration programs.

The Defense Materials Procurement Agency's procurement function made purchases of critical minerals (domestic and foreign), granted floor-price contracts, and made recommendations for production expansion. The Agency also certified the essentiality of critical minerals for accelerated programs.

Table 2 in the Zinc chapter of this volume lists the Defense Minerals Exploration Administration's exploration and tables 3, 4, and 5 list purchase contracts, amortization programs and access roads for zinc.

TABLE 1.—Salient statistics of the lead industry in the United States, 1943-47 (average) and 1948-52, in short tons

	1943-47 (average)	1948	1949	1950	1951	1952
Production of refined primary lead:						
From domestic ores and base bullion...	366,388	339,413	404,449	418,809	342,644	383,358
From foreign ores and base bullion...	65,045	67,281	72,889	89,605	75,049	89,494
Total.....	431,433	406,694	477,338	508,414	417,693	472,852
Recovery of secondary lead.....	388,201	500,071	412,183	482,275	618,110	471,294
Imports (general):						
Lead in pigs, bars, and old.....	198,895	276,013	280,889	461,827	*188,175	523,050
Lead in base bullion.....	1,271	7,180	2,373	3,488	2,281	389
Lead in ores and matte.....	65,712	63,907	107,279	76,620	*67,471	104,515
Exports of refined pig lead.....	4,211	*399	969	2,735	1,281	1,762
Consumption of primary and secondary lead.....	1,082,344	1,133,895	957,674	1,237,981	1,184,793	1,130,705
Prices (cents per pound):						
New York:						
Average for period.....	8.46	18.04	15.36	13.30	17.49	16.47
Quotation at end of period.....	9.41	21.50	12.00	17.00	10.00	14.12
London average for period.....	7.57	17.16	16.05	13.29	20.25	17.09
Mine production of recoverable lead.....	396,140	390,476	408,908	430,827	388,164	390,162
World smelter production of lead.....	1,386,000	*1,504,000	*1,659,000	*1,812,000	*1,768,000	1,980,000

* Includes Alaska.

* Revised figure.

DOMESTIC PRODUCTION

Statistics on lead output may be prepared on a mine or smelter and refinery basis. Mine-production data, compiled on the basis of lead content in ores and concentrates, adjusted to account for average losses in smelting, are a better measure of domestic output from year to year and are more accurate for showing the geographic distribution of production. Pig-lead output, as reported by smelters and refiners, presents a more precise figure of actual lead recovery but indicates only in a general way the source of crude material treated. Smelter and refinery output usually differs from the mine figure owing to the lag between mine shipments and smelter treatment of ores and concentrates.

MINE PRODUCTION

Domestic mine output of recoverable lead increased slightly to 390,000 tons in 1952. Gains were made in the first half of the year, when higher prices stimulated production; during the latter half of the year, when lead and zinc prices were lower, lead was produced at a rate 4 percent below the 1951 rate. Missouri was by far the leading producing State, supplying 33 percent of the total United States output. Idaho and Utah ranked second and third in production, with 19 percent and 13 percent of the total, respectively. Production in 7 of the 16 principal States was higher than in 1951; the largest tonnage increases were in Missouri, Washington, and Virginia, and the largest decreases were in Kansas, Idaho, and California. Lead output in Kansas was the lowest since 1918, and in Arizona, Nevada, Idaho, and New York mine production was the smallest since 1943, 1945, 1946, and 1946, respectively. On the other hand, production in 1952 from Washington was larger than in any year, that from Wisconsin was the largest since 1927, and that of Illinois was the largest in more than 50 years.

LEAD

Of the total lead produced in the United States came from 25 properties. Missouri continued to be the largest lead-producing State in the production of lead, and the St. Joseph district continued to be the largest lead-producing district, nearly 32 percent of the total domestic output. The first 6 months from Southeast Missouri was of the output in the last 6 months, indicating which began in April, had less effect on production had elsewhere in the lead-mining industry. However, was curtailed to some extent. The St. Joseph continued as the largest individual lead producer in the United States. The company operated its 4 million daily capacity of 26,800 tons, and its Bonneville (including Doe Run), and Leadwood groups throughout the year. It also began production at the Creek property in September and continued development of the Creek property. In addition, the St. Joseph Mine La Motte and its 2,000-ton mill as a Refining Division) operated its Madison lead-ore mill throughout the year.

TABLE 2.—Mine production of recoverable lead in the United States, 1943-47 (average) and 1948-52, by States, in short tons

State	1943-47 (average)	1948	1949
Western States and Alaska:			
Alaska.....	127	329	33,5
Arizona.....	21,159	29,899	10,3
California.....	7,748	9,110	26,8
Colorado.....	17,701	25,143	78,2
Idaho.....	77,473	88,544	17,9
Montana.....	12,763	18,411	10,6
Nevada.....	6,401	9,777	4,6
New Mexico.....	6,388	7,653	7
Oregon.....	5	7	1
South Dakota.....	17	16	1
Texas.....	28	170	6,4
Utah.....	47,800	55,950	53,0
Washington.....	4,599	7,147	6,4
Wyoming.....	1		
Total.....	202,206	252,156	243,000
West Central States:			
Arkansas.....	4	22	9,7
Kansas.....	7,941	8,388	127,5
Missouri.....	161,505	102,288	19,85
Oklahoma.....	14,896	16,918	
Total.....	184,318	127,614	157,150
States east of the Mississippi River:			
Illinois.....	2,642	3,695	3,82
Kentucky.....	170	216	18
New York.....	1,486	1,231	1,31
Tennessee.....	80	25	25
Virginia.....	3,867	4,703	3,31
Wisconsin.....	1,373	861	85
Total.....	9,618	10,706	9,760
Grand total.....	396,140	390,476	400,900

Lead production in the Tri-State district increased nearly 2 percent over the 1951 total. Output in Kansas and Oklahoma declined 34 percent and 9 percent, respectively, while output from southwestern Missouri increased markedly and accounted for the overall increase in the district. Production dropped 20 percent in the latter half of the year as compared with the first 6 months; many small mines curtailed production or were closed because of the sharp decline in the zinc price, as zinc constitutes the major values in most of the district. The Quick Seven pit (Brown & Root and American Zinc, Lead & Smelting Co.), the Kelsey Norman pit of the Wild Goose Mining Syndicate, and the Potter-Sims Snap open-pit mine were the major sources of lead and zinc produced in southwestern Missouri. The Eagle-Picher Co. remained by far the largest lead producer in the Tri-State district, followed by the American Zinc, Lead & Smelting Co. Other significant producers were the National Lead Co. (operations were shut down on account of a labor strike during the last 4 months of the year), Beck Mining Co., Potter-Sims Mines, Inc., Federal Mining & Smelting Co., and the Dines Mining Co.

Mine production of recoverable lead in the combined Western States decreased 1 percent in 1952. During the year mines in these States accounted for 59 percent of the total domestic output, or slightly less than in 1951.

Idaho continued to be the leading producer of lead in the Western States and second only to Missouri in the United States, despite a 4-percent decrease in output in 1952. Declining market prices for lead and zinc and a restriction on the use of electric power were the principal factors contributing to the reduced output. The Signal Mining Co. Hilarity mine and the Idaho Custer Mines, Inc., Livingston mine were shut down, and Day Mines, Inc., Spokane-Idaho Mining Co., and Sunset Minerals, Inc., curtailed operations because of low metal prices. Pacific Northwest consumers of power using more than 8,000 kw.-hr. per week were required to reduce their consumption to 90 percent of that in 1951, owing to the lack of rain during the summer and fall. More than 90 percent of the State total lead output in 1952 came from the Coeur d'Alene region. The remainder was produced chiefly in the Warm Springs, Bayhorse, and Texas districts. The Bunker Hill & Sullivan mine was again by far the largest producer in the State, followed by the Pago, Star, Morning, and Triumph mines. Other important producers were the Sunshine, Golconda, Sidney group, and Constitution properties and the Dayrock mine of Day Mines, Inc. These 6 mines accounted for 65 percent of the State lead. Zinc-lead ore yielded about 79 percent of the State output.

Output of recoverable lead in Utah in 1952 was approximately the same as in 1951. Zinc-lead ore supplied 92 percent of the State total lead. About 68 percent of the output came from the West Mountain (Bingham) district, 15 percent from the Park City region, and 9 percent from the Tintic district. The United States & Lark property remained by far the largest producer in the State and was followed by the Chief Consolidated mine, New Park property, West Calumet, Park Utah property, Silver King Coalition mine, and the Butterfield group. In the Park City region the Park Utah Consolidated Mining

Co. property was shut down on June 25 by the Silver King Coalition Mining Co. property because of low metal prices. The Chief Consolidated property in the Tintic district was shut down for nearly 3 months during the summer.

Mine production of lead in Colorado in 1952 was 10 percent below that in 1951. Many mines could not operate because of low metal prices in effect the latter part of the year. The mostly small producers, shut down. The major groups of output were the Resurrection group, Teller group, Eagle group, Smuggler Union group, and the Leadville group. Zinc-lead and zinc-lead-copper ore accounted for 15 percent of the State total lead, zinc ore 15 percent, and lead ore 70 percent.

Montana's production of lead in 1952 was 10 percent below that in 1951. The bulk of the output came from the Anaconda Mining Co. owned and leased operations at Anaconda. The bulk of lead were obtained from the American subsidiary, the Mike Horse mine (which was shut down because of low prices and a substantial exhaustion of the ore). Jack Waite and Iron Mountain mines. State lead was recovered from zinc-lead ore and lead ore.

Lead output in Arizona decreased 5 percent in 1952 since 1943. Reduced output resulted largely from the closure of the Eagle-Picher Co. San Xavier mine in Arizona. The chief producers in the State were the Iron King mine, Mammoth-Santa Rita group, San Xavier mine, Copper Queen mine, and the Six districts—Aravaipa, Big Bug, Harshbarger, and Warren—accounted for 88 percent of the State total. Zinc-lead ore yielded 93 percent of the total output.

Production of lead in Washington in 1952 was 10 percent above the 1951 output and 14 percent above the 1950 output. The leading producers in order of output were the Oreille mine, Grandview mine, Bonanza mine, and the Bunker Hill mine. These four properties accounted for 88 percent of the State lead during the year. Over 88 percent of the lead was recovered from zinc-lead ore, and most of the remainder from lead ore and old lead tailings.

California's lead output in 1952 was 20 percent below that in 1951. The Anaconda Copper Mining Co. Darby property supplied the bulk of the State production. The Anaconda property curtailed production in June to explore for lead. The Anaconda Copper & Zinc Co., the only other large lead producer in the State, terminated mining operations at the Anaconda property in August owing to ore depletion. Many other producers ceased operations after midyear owing to low prices. There was some exploration for lead activity centering mainly in Inyo, San Bernardino, and San Diego counties. Zinc-lead ore provided about 60 percent of the State lead ore 36 percent.

Mine production of lead in New Mexico in 1952 increased 20 percent above the 1951 output. Most of the output came from mines in the Central and Magdalena districts; minor tonnages of lead and barite ores were mined in the Hansonberg district. The leading producers in order of output were the Ground Hog group, Bayard group, and the Lynchburg mine. Zinc ore yielded 64 percent of the State total lead, zinc-lead ore 21 percent, and lead ore 15 percent.

TABLE 3.—Mine production of recoverable lead in the United States, 1943-47 (average) and 1948-52, and by districts that produced 1,000 tons or more during any year, 1948-52, in short tons

District	State	1943-47 (average)	1948	1949	1950	1951	1952
Southeastern Missouri region.	Missouri.....	157,390	100,654	126,269	133,680	122,318	122,942
Coeur d'Alene region.....	Idaho.....	71,933	82,587	74,152	94,697	70,570	67,330
West Mountain (Bingham).	Utah.....	25,567	30,672	32,600	27,472	29,120	34,328
Tri-State (Joplin region)...	Kansas, Southwestern Missouri, Oklahoma.	26,788	20,901	30,883	31,157	26,906	27,356
Summit Valley (Butte)...	Montana.....	4,480	13,217	11,490	15,079	16,030	16,153
Upper San Miguel.....	Colorado.....	2,087	3,804	5,285	7,780	8,008	7,657
Park City region.....	Utah.....	11,192	12,670	8,583	7,538	11,719	7,404
California (Leadville).....	Colorado.....	4,891	4,745	5,080	6,392	5,996	6,624
Pioche.....	Nevada.....	3,393	5,013	6,630	6,751	4,781	4,632
Central.....	New Mexico.....	4,005	3,740	2,479	2,316	3,133	4,486
Tintic.....	Utah.....	5,783	5,970	6,676	6,620	5,563	4,279
Big Bug.....	Utah.....	1,770	2,076	3,330	4,357	4,035	4,136
Red Cliff.....	Colorado.....	1,078	1,120	1,000	2,110	4,274	3,980
Old Hat.....	Arizona.....	4,382	5,406	6,788	5,980	4,241	3,913
Austinville.....	Virginia.....	3,080	4,703	3,313	3,254	1,608	3,792
Upper Mississippi Valley.....	Iowa, Northern Illinois, Wisconsin.	1,000	1,807	2,046	1,801	1,923	3,832
Animas.....	Colorado.....	2,591	1,880	2,935	3,069	3,963	3,464
Warm Springs.....	Idaho.....	2,569	1,304	2,339	2,648	3,096	3,455
Kentucky-Southern Illinois.	Kentucky, Southern Illinois.	2,494	2,965	2,822	1,626	2,616	2,790
Rush Valley and Smelter (Tooele County).....	Utah.....	3,451	4,185	2,953	1,393	2,074	2,595
Pioneer (Rico).....	Colorado.....	2,410	2,430	1,388	1,138	2,231	2,230
Harshaw.....	Arizona.....	1,772	1,999	1,546	1,931	1,608	1,921
Pima (Sierritas, Papago, Twin Buttes).....	do.....	2,058	3,917	4,232	2,906	2,834	1,864
Warren (Disbee).....	do.....	7,584	11,253	13,865	7,700	1,600	1,828
Creede.....	Colorado.....	387	451	1,102	1,422	1,167	1,513
Heddlleston.....	Montana.....	2,539	1,940	2,336	930	1,398	1,251
St. Lawrence County.....	New York.....	1,480	1,211	1,317	1,484	1,407	1,120
Dayhorse.....	Idaho.....	1,489	1,880	1,073	1,079	1,732	1,091
Magdalena.....	New Mexico.....	1,480	2,820	1,102	926	1,004	1,046
Sniefeld.....	Colorado.....	(1)	756	1,064	800	1,094	1,044
Ophir.....	Utah.....	613	791	1,089	948	712	999
Battle Mountain.....	Nevada.....	54	234	1,290	504	.....	907
Aravalpa.....	Arizona.....	355	1,142	1,271	1,498	1,294	865
Eureka.....	Colorado.....	215	1,107	578	323	569	759
Tombichl.....	do.....	563	1,785	1,221	645	761	739
Eagle.....	Montana.....	834	600	1,024	1,013	(1)	733
Madoc.....	California.....	266	1,001	729	87	317	111
Ten Mile.....	do.....	625	4,177	3,671	910	6	8
Coso (Darwin).....	California.....	4,906	6,078	4,928	8,479	7,191	(1)
Metaline.....	Washington.....	3,508	4,297	4,030	7,445	5,234	(1)
Northport (Aladdin).....	do.....	198	1,426	342	237	937	(1)
Bossburg.....	do.....	330	1,394	2,011	2,840	1,768	(1)
Resting Springs.....	California.....	(1)	(1)	(1)	(1)	(1)	(1)

¹ Revised figure.

² Figure not shown to avoid disclosure of individual company operations.

³ This district is not listed in order of 1952 output.

LEAD

TABLE 4.—Twenty-five leading lead-producing mines in the United States in 1952, in order of output

Rank	Mine	District	State	Operator	Type of ore
1	Federal	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
2	United States & Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead.
3	Bunker Hill & Sullivan	Yreka	Idaho	Bunker Hill Sullivan Mining & Concentrating Co.	Lead.
4	Leadwood	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
5	Butte Hill mines and dumps	Summit Valley (Butte)	Montana	Anasconda Copper Mining Co.	Zinc-lead.
6	Mine La Motte	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
7	Bonne Terre	do	do	do	do
8	Darwin group	Coso	California	Anasconda Copper Mining Co.	do
9	Madison	Southeastern Missouri	Missouri	St. Louis Smelting & Refining Co.	Lead-copper.
10	Page	Yreka	Idaho	Federal Mining & Smelting Co.	Zinc-lead.
11	Star	Hunter	do	Sullivan Mining Co.	do
12	Padgett	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
13	Red Bull	Medina	Idaho	Pend Oreille Mines & Metals Co.	Zinc-lead.
14	Restoration	Leadville	Colorado	Restoration Mining Co.	do
15	Monier	Hunter	Idaho	Restoration Mining Co.	do
16	Treasury Tunnel-Black Bear	Upper San Miguel	Colorado	Leadville Mining Co.	do
17	Grandview	Pioche	Nevada	Combined Metals Reduction Co.	do
18	Metaline	Washington	Washington	American Zinc-Lead Smelter Co.	do

Recoverable lead output in Nevada in 1952 decreased 5 percent below the 1951 tonnage, owing chiefly to the closing of the Copper Canyon Mining Co. Copper Canyon mine in October and the Ely Valley Mines, Inc., mine in August because of low metal prices. The Pioche group of mines was by far the largest producer in the State, followed by the Copper Canyon and Ely Valley properties. Zinc-lead ore supplied 76 percent of the State total lead and lead ore 20 percent.

Mines in States east of the Mississippi River produced 47 percent more lead in 1952 than in 1951. Lead is produced chiefly as a by-product or coproduct of zinc and fluorspar mining in these States. Increased output was attributed in part to resumption of full-scale operations at the Austinville mine in Virginia and to greatly increased production from mines in Wisconsin and Illinois.

Small quantities of lead were also recovered in 1952 from ores mined in Oregon, South Dakota, Texas, and Arkansas.

The 25 leading lead-producing mines in the United States in 1952, listed in table 4, yielded 69 percent of the total domestic output; the 10 leading mines produced 51 percent and the 4 leading mines 37 percent.

Detailed information on the production of mines and mining districts in the United States may be found in Volume III of this Yearbook.

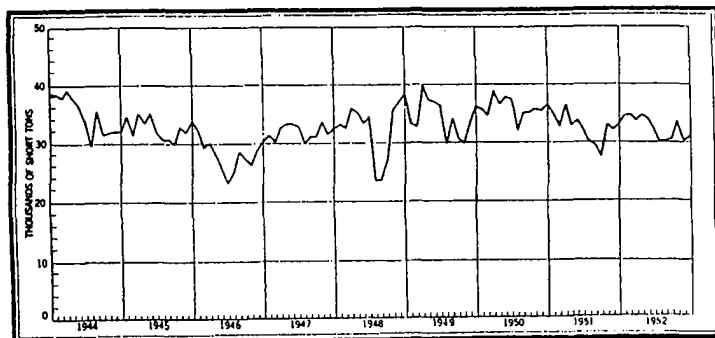


FIGURE 1.—Mine production of recoverable lead in the United States, 1944–52, by months.

TABLE 5.—Mine production of recoverable lead in the United States,¹ 1951–52, by months, in short tons

Month	1951	1952	Month	1951	1952
January.....	35,102	34,551	August.....	20,487	30,464
February.....	32,864	34,601	September.....	27,404	30,633
March.....	30,474	33,037	October.....	33,058	33,853
April.....	32,972	34,724	November.....	32,050	30,152
May.....	33,537	34,087	December.....	32,928	31,178
June.....	32,148	32,202	Total.....	388,164	390,103
July.....	30,040	30,090			

¹ Includes Alaska.

LEAD

SMELTER AND REFINERY

Pig (refined) lead produced in the United States comes from three principal sources—domestic mine production, base bullion, and scrap materials (from smelters)—and is recovered at primary and secondary smelters, and small quantities of scrap are recovered in the process scrap exclusively. Of the 13 primary smelters, 6 combine smelting and refining, 4 produce base bullion (containing approximately 90 percent silver, and small quantities of other impurities), and 2 confine their activities to the production of antimonial or "hard" lead may be produced at secondary plants. Because of the large quantities of battery scrap, melted at secondary smelters, this type of operation is principally antimonial and the production of refined lead and alloys at secondary smelters. The Secondary Lead section of this chapter discusses the 11 primary smelters in operation.

The 11 primary smelters in operation produced 10,000 short tons (lead content) of primary materials, concentrates, of which 81 percent was of foreign origin. Consumption was 14 percent of the total, almost 3 percent below that of 1950.

ACTIVE LEAD SMELTERS AND REFINERIES

Primary lead smelters and refineries in operation in 1952 were as follows:

- California: Selby—Selby plant, American Smelter and Refinery.
- Colorado: Leadville—Arkansas Valley plant, American Smelter and Refinery.
- Idaho: Bradley—Bunker Hill Smelter, Bunker Hill Corporation (smelter and refinery).
- Illinois: Alton—Federal plant, American Smelter and Refinery.
- Indiana: East Chicago—U. S. S. Lead Refinery, U. S. Steel Corporation.
- Kansas: Galena—Galena plant, Eagle-Picher Corporation.
- Missouri: Herculaneum—Herculaneum plant, American Smelter and Refinery.
- Montana: East Helena—East Helena plant, American Smelter and Refinery.
- Nebraska: Omaha—Omaha plant, American Smelter and Refinery.
- New Jersey: Barber—Perth Amboy plant, American Smelter and Refinery.
- Texas: El Paso—El Paso plant, American Smelter and Refinery.
- Utah: Midvale—Midvale plant, United States Smelter and Refinery.
- Tooele—Tooele plant, International Smelter and Refinery.

REFINED LEAD

Primary refineries in the United States produced 10,000 short tons of refined lead in 1952, an increase of 13 percent over 1951. Of the 472,900 tons of refined lead produced during the year, domestic ores and base bullion accounted for 14 percent and imported ores and bullion for 86 percent.

percent, respectively, in 1951). Table 7 gives the production of refined lead by source material and by country of origin. Details of the sources of lead from domestic ores are given in the Mine Production section of this chapter.

TABLE 6.—Refined lead produced at primary refineries in the United States, 1943-47 (average) and 1948-52, by source material, in short tons

Source	1943-47 (average)	1948	1949	1950	1951	1952
Refined lead:						
From domestic ores and base bullion.....	366,388	339,413	404,449	418,809	342,644	383,358
From foreign ores.....	64,944	60,829	71,413	86,241	71,984	89,092
From foreign base bullion.....	101	6,452	1,476	3,264	3,065	402
Total from primary sources.....	431,433	400,694	477,338	508,314	417,693	472,852
From scrap.....	11,086	4,952	23,230	5,455	3,893	3,070
Total refined lead.....	442,519	411,646	500,568	513,769	421,586	475,922
Average sales price per pound.....	\$0.084	\$0.179	\$0.158	\$0.135	\$0.173	\$0.161
Total calculated value of primary refined lead ¹	\$71,866,000	\$145,800,000	\$150,840,000	\$137,245,000	\$144,522,000	\$153,246,884

¹ Excludes value of refined lead produced from scrap at primary refineries.

TABLE 7.—Refined primary lead produced in the United States, 1943-47 (average) and 1948-52, by source material and country of origin, in short tons

Source	1943-47 (average)	1948	1949	1950	1951	1952
Domestic ore and base bullion.....	366,388	339,413	404,449	418,809	342,644	383,358
Foreign ore:						
Australia.....	14,793	6,729	6,465	6,984	9,056	5,888
Canada.....	6,344	3,608	3,317	7,892	7,086	7,113
Europe.....	43	30	30	17	17	454
Mexico.....	3,628	4,427	8,477	5,992	3,620	2,344
South America.....	15,437	24,589	29,163	38,770	30,849	48,626
Other foreign.....	24,742	21,433	23,961	26,603	14,456	24,668
Total.....	64,944	60,829	71,413	86,241	71,984	89,092
Foreign base bullion:						
Australia.....	44	406	1,382	2,427	2,815	70
Mexico.....	67	5,637	30	436	27	177
South America.....	67	52	68	402	75	177
Other foreign.....	297	297	-----	148	148	165
Total.....	101	6,452	1,476	3,264	3,065	402
Total foreign.....	65,045	67,281	72,889	89,605	75,049	89,494
Grand total.....	431,433	400,694	477,338	508,314	417,693	472,852

ANTIMONIAL LEAD

Production of antimonial lead at primary refineries in 1952 dropped 11 percent below the 1951 output. Production increased at 2 of the alloy-producing plants but declined at the other 4. Distribution of antimonial lead production at primary refineries in 1948-52 by source material is shown in table 8, as is also the average antimony content.

Although antimonial lead is an important byproduct of the refining of base bullion, the quantity derived from this source is only a small part of total domestic output. The major production is recovered

LEAD

from the smelting of antimonial lead scrap. Production data from lead-smelting plants exclusively are summarized in the following table.

TABLE 8.—Antimonial lead produced at primary refineries in the United States, 1943-47 (average) and 1948-52, in short tons

Year	Production (short tons)	Antimony content	
		Short tons	Percent
1943-47 (average).....	62,893	4,081	6.6
1948.....	100,784	5,760	5.7
1949.....	41,402	3,385	8.2
1950.....	57,069	4,604	7.8
1951.....	66,309	4,410	6.7
1952.....	58,203	4,302	7.5

SECONDARY LEAD

Some scrap lead is treated at primary refineries. The remainder is processed at a large number of plants throughout the country. The amount of secondary materials. Secondary lead produced in 1952 fell 11 percent below the 1951 output.

Secondary lead recovered in 1952 fell 11 percent below the 1951 output. Production of secondary lead recovered in 1952 fell 11 percent below the 1951 output. Production of secondary lead recovered in 1952 fell 11 percent below the 1951 output.

TABLE 9.—Secondary lead recovered in the United States, 1943-47 (average) and 1948-52, in short tons

	1943-47 (average)	1948	1949
As refined metal:			
At primary plants.....	11,080	4,052	23,129
At other plants.....	60,884	120,951	129,454
Total.....	71,964	131,903	152,583
In antimonial lead:			
At primary plants.....	40,007	49,525	32,140
At other plants.....	162,282	194,027	140,626
Total.....	202,289	243,552	172,766
In other alloys.....	114,032	124,616	86,817
Grand total:			
Short tons.....	388,281	500,071	412,169
Value.....	\$69,017,982	\$179,025,418	\$130,249,000

LEAD PIGMENTS

The principal lead pigments are litharge, sublimed lead, leaded zinc oxide, and orange lead. The principal lead pigments are litharge, sublimed lead, leaded zinc oxide, and orange lead. The principal lead pigments are litharge, sublimed lead, leaded zinc oxide, and orange lead.

CONSUMPTION AND USES

Domestic lead consumption (including lead in lead ore consumed directly in the manufacture of lead pigments and salts) totaled 1,131,000 tons in 1952—a 5-percent decline from 1951. Of the total consumed, 726,000 tons was refined soft lead, 275,000 tons was contained in antimonial lead, 29,000 tons in white metal scrap, 43,000 tons in percentage metals, 26,000 tons in copper-base scrap, and 22,000 tons in residues and drosses; and 10,000 tons was recovered from ore in leaded zinc oxide. About 42 percent of all lead consumed was used in metal products, 31 percent in storage batteries, 11 percent in pigments, 13 percent in chemicals, including tetraethyl lead, and 3 percent for miscellaneous and other purposes. Cable covering took about 13 percent (12.6 percent) of the total and tetraethyl lead almost 13 percent (12.9 percent).

In June 1952 Chemical Engineering³ reported that the Ethyl Corp. had completed a new tetraethyl lead plant with a capacity of 40,000 tons per year on the Houston, Tex., ship channel and noted that the E. I. du Pont de Nemours & Co., was completing new facilities at Deepwater, N. J., that would increase the capacity to 25,000 tons of tetraethyl lead per year. These new plants give the United States a total tetraethyl lead capacity of about 270,000 tons per year. Current trends point to higher octane gasoline requirements, which can be met most economically by the use of ethyl fluid.

TABLE 10.—Consumption of lead in the United States in 1951–52 by products, in short tons

	1951	1952		1951	1952
Metal products:			Pigments:		
Ammunition.....	40,242	38,182	White lead.....	25,578	22,943
Bearing metals.....	35,410	38,545	Red lead and litharge.....	88,031	76,742
Brass and bronze.....	29,858	25,807	Pigment colors.....	12,796	12,839
Cable covering.....	131,863	142,571	Other ¹	13,099	9,775
Calking lead.....	40,544	45,150	Total pigments.....	139,504	122,299
Casting metals.....	22,497	18,017	Chemicals:		
Collapsible tubes.....	13,057	10,095	Tetraethyl lead.....	128,407	146,723
Foil.....	2,891	2,124	Miscellaneous chemicals.....	6,949	3,990
Pipes, traps, and bends.....	33,095	29,405	Total chemicals.....	135,356	150,719
Sheet lead.....	31,210	28,007	Miscellaneous uses:		
Solder.....	82,405	72,064	Annealing.....	6,056	5,084
Terne metal.....	2,051	1,812	Galvanizing.....	2,173	2,002
Type metal.....	28,230	27,413	Lead plating.....	1,444	1,037
Total metal products.....	600,009	476,542	Weights and ballast.....	7,913	7,860
Storage batteries:			Total miscellaneous uses.....	18,186	15,783
Antimonial lead.....	189,838	187,505	Other, unclassified uses.....	16,354	14,522
Lead oxides.....	176,546	163,424	Grand total.....	1,184,793	1,130,795
Total storage batteries.....	376,384	350,930			

¹ Includes lead content of leaded zinc oxide production.

³ Chemical Engineering, Big Jump for TEL Vol. 59, No. 6, June 1952, p. 274.

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TABLE 11.—Consumption of lead in the United States, by month, in short tons¹

Month	1951	1952	
January.....	126,022	97,503	August.....
February.....	101,603	92,527	September.....
March.....	120,826	88,664	October.....
April.....	118,373	83,719	November.....
May.....	102,524	82,714	December.....
June.....	94,458	87,679	Total.....
July.....	81,427	85,568	

¹ Includes lead content of leaded zinc oxide production.

TABLE 12.—Consumption of lead in the United States, by type of material, in short tons

Metal products.....	
Storage batteries.....	
Pigments.....	
Chemicals.....	
Miscellaneous.....	
Unclassified.....	
Total.....	

¹ Excludes 9,633 tons of lead contained in leaded zinc oxide.

STOCKS

Producers' Stocks.—Lead stocks, as Bureau of Metal Statistics, are shown in and antimonial lead include metal held by some of the refiners of secondary metal according to reports released by the American Bureau of Metal Statistics, total lead stocks increased during 1949, 149,778 tons (21 percent) and refined and antimonial lead 25,339 to 43,560 tons (72 percent).

TABLE 13.—Stocks of lead at smelters and refineries, by year, 1943–47 (average) and 1948

	1943–47 (average)	1948
Refined pig lead.....	27,302	29,050
Antimonial lead.....	5,980	9,594
Total.....	33,282	38,644
Lead in base bullion:		
At smelters and refineries.....	8,139	9,697
In transit to refineries.....	4,338	4,101
In process at refineries.....	15,592	17,539
Total.....	28,069	31,737
Lead in ore and matte and in process at smelters.....	85,527	76,373
Grand total.....	146,878	146,754

The Bureau of Mines annual survey of primary smelters and refiners indicated stocks of 31,400 tons of refined soft lead at these plants on December 31, 1952, compared with 18,500 tons on January 1. Stocks of primary antimonial lead (lead content) at these plants increased from 6,400 to 11,000 tons during the year. Stocks of ore and concentrates (in terms of lead content) decreased in 1952 from 44,400 to 34,000 tons, and inventories of base bullion at refineries that receive bullion and smelters that produce bullion for shipment to refineries increased from 12,700 to 13,500 tons. Stocks of in-process base bullion or work lead at four combination smelter-refinery plants are not included in reports to the Bureau of Mines. No direct comparison can be made between these data and the figures of the American Bureau of Metal Statistics. Figures reported to the Bureau of Mines represent physical inventory at the plants, irrespective of ownership, and do not include material in process or in transit.

Consumers' Stocks.—Consumers' stocks of lead increased 19 percent in 1952. On January 1 they totaled 103,000 tons, increased to 132,000 tons at the end of July, dropped to 105,000 tons by October 31, and rose again in November and December to total 123,000 tons on December 31. Stocks of refined soft lead, white metal scrap, lead in copper-base scrap and in the drosses increased 43, 23, 60, and 45 percent, respectively; decreases were reported in antimonial lead and percentage metals.

TABLE 14.—Consumers' stocks of lead in the United States at end of year, 1948–52, by type of material, in short tons, lead content

Year	Refined soft lead	Antimonial lead	Unmelted white scrap	Percentage metals	Copper-base scrap	Drosses, residues, etc.	Total
1948.....	62,077	35,088	4,828	7,932	2,301	6,972	119,198
1949.....	64,542	16,837	2,957	5,405	2,087	5,439	97,267
1950.....	87,285	27,737	5,406	6,446	1,558	11,452	139,884
1951.....	66,731	28,221	3,140	7,054	1,429	6,185	102,760
1952.....	80,888	20,309	3,877	6,191	2,282	8,983	122,530

PRICES

The two major markets for lead in the United States are New York and St. Louis. The bulk of the lead produced domestically is sold at prices normally based upon quotation in these markets. The differential between St. Louis and New York prices is about 0.2 cent a pound, an amount approximating the freight charges between the two cities, the St. Louis price being the lower. The London market has had no direct influence on New York quotations since suspension of trading on the London Metal Exchange in September 1939; however, on October 1, 1952, free trading in lead on the Exchange was resumed, and United States prices declined to the lowest point of the year, following sharp reductions in the London quotations.

The market price for common lead, New York, held at the ceiling of 19 cents per pound set by the Office of Price Stabilization on October 2, 1951, until April 29, 1952, when increased supplies and lower consumption caused a decline to 18 cents. Later drops brought the price to 15 cents a pound on May 12. The quoted price advanced to 16

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cents on June 24, where it remained until it dropped to 15 cents. Limited buying came in the following weeks, and on October 22 the price reached the low point of the year. In November prices improved, and on December 30 the quotation was 16 cents a pound.

TABLE 15.—Average monthly and yearly quoted prices of lead in New York, and London, 1950–52, in cents

Month	1950			St. Louis
	St. Louis	New York	London ²	
January.....	11.80	12.00	12.11	16.80
February.....	11.80	12.00	12.11	16.80
March.....	10.76	10.96	11.06	16.80
April.....	10.43	10.63	10.67	16.80
May.....	11.52	11.72	11.61	16.80
June.....	11.61	11.81	11.84	16.80
July.....	11.46	11.66	11.58	16.80
August.....	12.73	12.93	12.84	16.80
September.....	15.60	15.80	15.70	16.80
October.....	16.84	16.04	16.00	18.72
November.....	16.80	17.00	17.00	18.80
December.....	16.80	17.00	17.00	18.80
Average.....	13.10	13.30	13.29	17.29

¹ St. Louis: Metal Statistics, 1953, p. 533. New York: Metal Statistics, 1953, p. 533.

² Conversion of English quotations into American money based on the Federal Reserve Board.

³ Free trade in lead on London market resumed October 1, 1952. Quotations as quoted in E&MJ Metal and Mineral Markets.

The official London price of £175 per long ton, or 21.86 cents per pound computed on the basis of 100 pounds to the long ton, was lowered to £170 (21.86 cents) on October 1, 1951, was lowered to £170 (21.86 cents) in 1952. Thereafter subsequent drops reduced the price to £160 (21.86 cents) on July 10, where it remained until the London free lead market was opened, and the London market functioned since August 31, 1952. In the first 10 weeks of free trading the price ranged from £180 (9.99 cents). At the close of the year the price was £102 15s (12.83 cents).

FOREIGN TRADE

Imports.—Imports of lead reached an all-time high in 1952, total, including 12,000 tons of scrap, was 12,000 tons, or 12 times greater than the quantity imported in the previous record established in 1950. The increase in 1952 was brought about chiefly by this country's demand, which in turn reflected increased world production in excess of foreign demand.

⁴ Figures on imports and exports compiled by Mae B. Price and others from records of the U. S. Department of Commerce.

Exports.—Total exports of pig lead in 1951. Exports of 2,400 to 2,700 tons in 1952. Export restrictions under the Export Control Act of 1940 remained in force.

Lead and Zinc Pigments and Zinc Salts

By Robert L. Mentch¹



THE OUTSTANDING feature of the lead and zinc pigments industry in 1952 was the continuing decline in volume of business. Shipments of the products covered by this report were well below the 1951 rate. Decreases in shipments of zinc pigments ranged from 4 percent for lead-free zinc oxide to 40 percent for lithopone. Shipments of lead pigments declined from 9 percent for litharge to 25 percent for white lead (dry and in oil). Zinc salts (zinc chloride and zinc sulfate) decreased 14 and 17 percent, respectively.

Decreases in shipments of pigments and salts were attributable partly to decreases in the volume of business in industries that are important consumers of these products and partly to increased use of substitutes. In 1952 the production of passenger automobiles was 19 percent lower than that in 1951, and output of trucks and buses declined 15 percent from the 1951 total. Consumption of natural and synthetic rubber increased 4 percent compared with 1951. The value of public and private construction was 5 percent greater than in 1951, and the value of sales of paint, varnish, and lacquer materials in 1952 was approximately the same as the 1951 total. Construction gains reflected, in part, higher material and labor costs.

Lead and zinc, the chief raw materials of the pigments industry, were in plentiful supply during the latter half of the year in contrast with the situation in 1951 and the first several months of 1952, when demand exceeded available supplies. Increased production of both lead and zinc on a worldwide basis permitted greatly expanded imports, which, combined with lower consumption in the United States, resulted in an oversupply situation in both metals and brought about marked reductions in prices as the year progressed. The price for common lead, New York, dropped from the 19-cent-a-pound ceiling established in October 1951 to 18 cents per pound on April 29 and was selling for 14.75 cents at the end of the year. The quotation for Prime Western grade slab zinc, East St. Louis, fell from 19.5 cents, first effective in October 1951, to 17.5 cents on June 2 and thereafter declined to 12.5 cents per pound on October 23, at which level it remained for the balance of the year.

Lead- and zinc-pigment price quotations maintained their historically close relationship to pig-lead and slab-zinc prices throughout the year. Prices for the pigments and zinc salts dropped considerably following the declines in metal prices; decreases averaged about 20 percent compared with reductions of 22 percent and 36 percent in the selling prices of lead and zinc.

¹ Commodity-industry analyst.

LEAD AND ZINC PIGMENTS AND

All National Production Authority restrictions were revoked completely on May 15 and June 1, 1952, due to the increased abundance of these metals.

Shipments of white lead (dry) and of the litharge and zinc oxide varieties in 1952 were the smallest by far since the beginning of the present century. Litharge shipments in 1952 but were considerably above average for the period since World War II. Shipments of red lead declined well below the yearly average for World War II. Shipments of lead pigments shows trends in shipments of lead pigments.

Zinc oxide (lead-free) shipments declined lowest percentage decrease among the pigments in 1952, and were comparable in quantity to those during the World War II period. Leadings were 15 percent lower than in 1951 and, except for zinc chloride, since 1935. Shipments of lithopone dropped 40 percent below 1951 and the lowest since 1935. Shipments of zinc pigments are shown in figure 1.

Shipments of zinc salts declined considerably. Shipments of zinc chloride decreased 14 percent and zinc sulfate fell 17 percent.

TABLE 1.—Salient statistics of the lead and zinc pigments industry, 1943-47 (average) and 1948 and 1949

	1943-47 (average)	1948	1949
Production (shipments) of principal pigments:			
White lead (dry and in oil) short tons..	60,670	46,070	27,355
Red lead.....do.....	44,664	30,787	24,866
Litharge.....do.....	138,188	154,775	121,052
Zinc oxide.....do.....	146,131	150,958	110,132
Leadings.....do.....			
Leaded zinc oxide short tons..	64,050	67,441	36,722
Lithopone.....do.....	145,363	140,033	78,335
Value of products:			
All lead pigments.....	\$52,267,400	\$90,915,000	\$58,504,000
All zinc pigments.....	44,055,600	65,547,000	43,152,000
Total.....	96,323,000	156,462,000	101,716,000
Value per ton received by producers:			
White lead (dry)....	\$194	\$363	\$351
Red lead.....	206	396	333
Litharge.....	187	387	324
Zinc oxide.....	149	218	230
Leaded zinc oxide....	149	245	242
Lithopone.....	54	115	115
Foreign trade:			
Lead pigments:			
Value of exports.....	\$1,229,000	\$970,000	\$1,157,000
Value of imports.....	36,000	633,000	143,000
Zinc pigments:			
Value of exports.....	3,299,600	5,229,000	3,425,000
Value of imports.....	9,300	7,000	52,000
Export balance.....	4,483,300	5,559,000	4,388,000

¹ Reported as sales before 1945.

² Data for basic lead sulfate in 1946 included under white lead; separately.

³ Excludes value of basic lead sulfate; Bureau of Mines not at liberty.

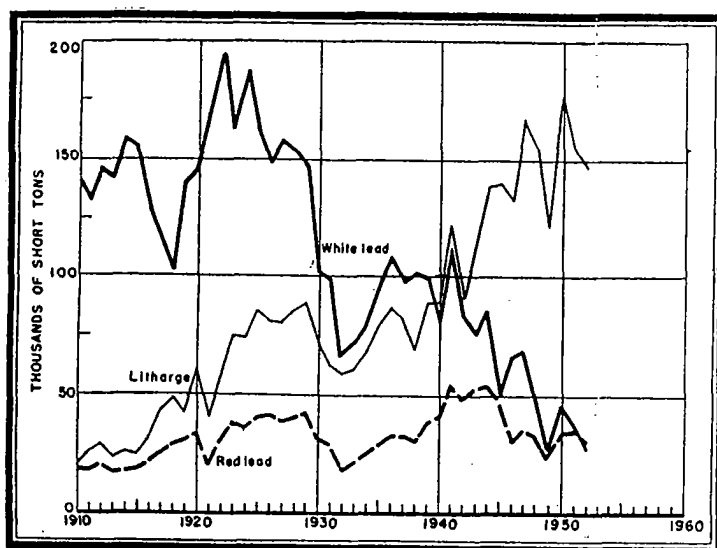


FIGURE 1.—Shipments of lead pigments, 1910-52.

The distribution of shipments of pigments to consumers in 1952 remained essentially the same as in previous years. The paint industry continued the largest user by far of white lead, leaded zinc oxide, and lithopone, receiving approximately 90, 99, and 73 percent, respectively, of shipments. In addition, 43 percent of red-lead shipments, 22 percent of zinc oxide (lead-free) shipments, and 4 percent of litharge shipments went into paint manufacture. Storage-battery makers were the chief users of litharge and red lead, taking 69 and 45 percent, respectively, of producers' deliveries. The rubber industry continued as the largest consumer of zinc oxide, taking 51 percent of total shipments. Relatively small quantities of litharge, lithopone, and leaded zinc oxide were also used in the manufacture of rubber products. The ceramics industry ranks fourth in consumption of lead and zinc pigments and was surpassed only by the paint, storage-battery, and rubber industries. In 1952, 11 percent of litharge shipments, 5 percent of zinc oxide (lead-free) shipments, 4 percent of white lead shipments, and 1 percent of red lead shipments were used in making ceramics.

Titanium pigments continued to furnish the chief competition to lead and zinc pigments in paint making. Production and shipments of titanium pigments dropped 4 and 11 percent, respectively, from the records established in 1951. Insufficient plant capacity and shortages of raw materials had been limiting factors in titanium pigment production in previous years; in 1952, however, the decrease was attributed principally to the general reduction in consumption of all types of pigments. At present, the Bureau of Mines is not at liberty to publish statistics for titanium pigments.

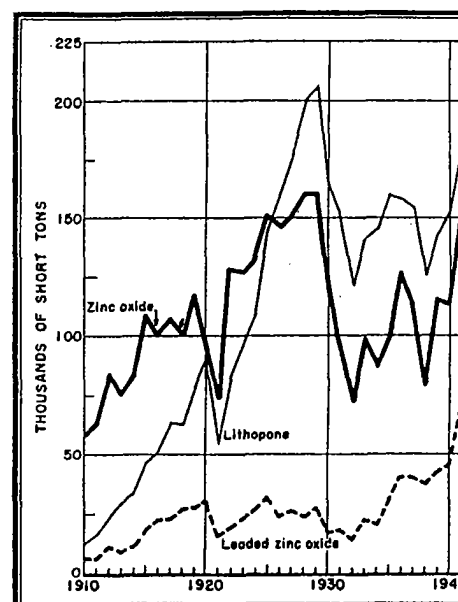


FIGURE 2.—Shipments of zinc pigments, 1910-52.

PRODUCTION

The value of shipments of lead and zinc pigments decreased 17 percent of that for basic lead sulfate, which cannot be compared with 1951 value. 53 percent of the total value and zinc pigments compared with 54 and 46 percent, respectively.

For many years figures on "sales" were used as a better guide to activity in the pigment industry. Beginning with 1945 the base was changed to data compiled on Bureau of Mines. Available information for 1945 (the year of difference between sales and shipments) shows tonnages of pigments, an attempt is made to solve one of the chief problems being that finished pigments are blended to make another product. Basic pigments, for example, are blended to make lead pigments. In instance the pigment weights appear in the class only. Pigments consumed by products beyond those covered by this report—batteries, and other articles—are considered.

LEAD PIGMENTS

Shipments of lead pigments decreased 19 percent in value in 1952. Substantial prices received by producers accounted

decrease in value. Shipments of white lead, red lead, and litharge declined 25, 13, and 9 percent, respectively, from those in 1951.

Average values of lead pigments reported by producers were well below the record selling prices of 1951; the yearly average for white lead (dry) was \$403 per ton, 5 percent under the 1951 average; red lead sold at an average of \$376 per ton, also a decrease of 5 percent; and litharge brought \$348 per ton, 9 percent less than the 1951 average.

White Lead.—The decline in shipments of white lead, first evident in the late 1920's, continued as competitive pigments supplanted both classes in many paint formulations. Total shipments fell 25 percent and were the lowest by far since long before the beginning of the 20th century. Paint manufacturers that had been using white lead almost exclusively are now using increasing quantities of other pigments.

Basic Lead Sulfate.—The Bureau of Mines is not at liberty to publish figures on basic lead sulfate for 1946–52.

TABLE 2.—Production and shipments of lead pigments¹ in the United States, 1951–52

Pigment	1951				1952			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Short tons	Value ¹			Short tons	Value ¹	
			Total	Average			Total	Average
White lead:								
Dry.....	22,982	23,359	\$9,952,883	\$420	16,405	15,779	\$8,353,285	\$403
In oil ²	11,177	12,056	6,007,291	498	11,454	10,782	5,177,314	476
Red lead.....	34,065	35,352	14,025,182	397	32,620	30,926	11,634,969	376
Litharge.....	152,165	184,763	59,287,262	383	144,664	140,798	49,064,874	348

¹ Except for basic lead sulfate, figure for which is withheld to avoid disclosure of individual company operations.

² At plant, exclusive of container.

³ Weight of white lead only, but value of paste.

TABLE 3.—Lead pigments shipped by manufacturers in the United States, 1943–47 (average) and 1948–52, in short tons

Year	White lead			Basic lead sulfate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	Total	White	Blue			
1943–47 (average) ¹	28,868	30,802	59,670	5,642	1,279	44,064	143	138,188
1948.....	26,651	19,519	46,070	(²)	(²)	30,787	.....	154,776
1949.....	15,719	11,636	27,355	(²)	(²)	24,866	.....	121,052
1950.....	28,506	16,670	45,176	(²)	(²)	35,072	.....	177,658
1951.....	23,359	12,050	35,415	(²)	(²)	35,352	.....	154,753
1952.....	15,779	10,884	26,663	(²)	(²)	30,926	.....	140,798

¹ Basic lead sulfate for 1946 included with white lead (dry) in order to avoid disclosure of individual company operations.

² 1941–46 average; see footnote 1.

³ Figure withheld to avoid disclosure of individual company operations.

Red Lead.—Shipments of red lead declined 13 percent in 1952, were 43 percent below shipments in 1944,

Orange Mineral.—No shipments of orange mineral were reported in 1952.

Litharge.—Although declining 9 percent in 1952, litharge shipments remained at a comparable level, having exceeded only in 1947, 1948, 1950, and 1951. Litharge has been the largest quantity of lead pigments covered by this report.

Battery manufacturers produced 76,000 tons of suboxide of lead in 1952 for their own use. This suboxide production required 73,000 tons of lead, the same as in 1951, and 77,000 tons in 1950.

ZINC PIGMENTS AND

Total shipments of zinc pigments decreased 14 percent in value in 1952. Shipments of the most important of the zinc pigments, zinc oxide, declined 4 percent; tonnage shipments of lead oxide fell 10 percent; and lithopone shipments fell 40 percent among the products covered by this report.

Although declining slightly from the 1951 producers' average values were the second lowest values received by primary shippers were (lead-free) \$307 per ton, a loss of 1 percent per ton, a drop of 2 percent; and lithopone, a drop of 3 percent.

Shipments of the zinc salts, zinc chloride, declined 14 and 17 percent, respectively, from 1951. Of the two compounds increased; zinc chloride, \$93 per ton in 1951 to \$93 per ton and zinc sulfate, \$100 per ton.

TABLE 4.—Production and shipments of zinc pigments in the United States, 1951–52

Pigment or salt	1951			
	Production (short tons)	Shipments		
		Short tons	Value ¹	
			Total	Average
Zinc oxide ²	158,714	147,716	\$45,948,219	\$311
Leaded zinc oxide ²	50,972	44,841	14,179,963	320
Lithopone.....	107,619	102,837	14,470,742	141
Zinc chloride, 50° B.....	62,527	60,730	5,152,882	85
Zinc sulfate.....	23,663	23,824	3,799,825	160

¹ Value at plant, exclusive of container.

² Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide; a small quantity containing less than 5 percent

TABLE 5.—Zinc pigments and salts shipped¹ by manufacturers in the United States, 1943-47 (average) and 1948-52, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (60° B.)	Zinc sulfate
1943-47 (average).....	146,131	64,050	145,363	58,004	20,027
1948.....	160,958	67,441	140,033	68,701	21,513
1949.....	110,132	30,722	78,335	55,208	20,065
1950.....	106,829	63,973	105,680	64,664	23,912
1951.....	147,718	44,341	102,837	60,730	23,524
1952.....	142,210	37,892	61,832	51,968	19,587

¹ Reported as sales before 1946.

Zinc Oxide.—Lead-free zinc oxide shipments remained at a relatively high level in 1952, declining only 4 percent from 1951.

TABLE 6.—Production of zinc oxide (lead-free) by processes, 1943-47 (average) and 1948-52, as percent of total

Process	1943-47 (average)	1948	1949	1950	1951	1952
American process (ore and primary residues).....	77	76	71	72	75	74
French process (metal and scrap).....	10	15	17	18	18	20
Other.....	7	9	12	10	7	6
Total.....	100	100	100	100	100	100

Leaded Zinc Oxide.—Shipments of leaded zinc oxide in 1952 were 15 percent lower than in 1951.

Four grades of leaded zinc oxide, classified according to lead content, are produced in the United States. The bulk of the output, however, is the 5- to 35-percent grade; only relatively small quantities of the other grades—less than 5 percent lead, over 35 to 50 percent lead, and over 50 percent lead—are produced. For publication purposes, the 2 top and 2 lower grades are combined. Production in 1952 (comparison with 1951 in parentheses) was as follows: 38,401 (46,960) tons of 35 percent lead and under and 5,468 (4,012) tons of over 35 percent lead.

Lithopone.—Lithopone shipments fell 40 percent below 1951 deliveries and were much lower than all years from 1922-51, inclusive.

The lithopone statistics in this report are given on the basis of ordinary lithopone sold as such plus the ordinary lithopone content of the high-strength product.

Consumption of ordinary lithopone in the manufacture of titanated lithopone has diminished to very small proportions. The trend has been downward almost continuously since 1937, when 19,400 tons were used in making the titanated variety. The tonnage consumed for this purpose in 1952 was 42 percent below the quantity used in 1951 and was the smallest on record. The lithopone figures in table 7 are included in the totals for ordinary lithopone in other tables.

Zinc Sulfide.—In 1952 only one company produced zinc sulfide, hence the Bureau of Mines is not at liberty to publish figures for this pigment.

LEAD AND ZINC PIGMENTS AND

TABLE 7.—Titanated lithopone produced in the United States and lithopone used in its manufacture, 1943-47 (average) and 1948-52, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	
1943-47 (average).....	7,780	6,010	1950.....
1948.....	2,100	1,700	1951.....
1949.....	2,000	1,700	1952.....

Zinc Chloride.—Shipments of 50° B. solid zinc chloride in 1952 were 14 percent in 1952 and were the lowest in the series.

Zinc Sulfate.—Zinc sulfate shipments in 1952 were 14 percent of the 1951 total and were the smallest since 1949.

RAW MATERIALS USED

Figures covering the raw materials used in the manufacture of zinc salts in 1952 and 1951 are shown in the accompanying tables.

Lead pigments and zinc pigments and salts are produced from a variety of materials, including ore, refined materials as scrap, residues, ashes, drosses, and other by-products. Approximately 95 percent of the lead in pigments is derived from pig lead and the remainder from ore; in 1952, 94 percent of the lead contained in lead pigments was derived from leaded zinc oxide, about 13 percent (12 percent in 1951) from other sources. The proportion of zinc in zinc pigments is 76 percent (76 in 1951) from ore and 24 percent (24 in 1951) from metal. Of the 26 (19) percent of the ore used was of foreign origin.

Tables 8 and 9 give the source of the materials used in the manufacture of each pigment and salt. Pig lead is either obtained directly or indirectly, in manufacturing white and orange mineral and is used also in the manufacture of zinc sulfate. The lead content of leaded zinc sulfate, which in turn is made from pig lead, is shown in the table. Zinc oxide is the only pigment in which slab zinc is used. Ore is employed in the manufacture of leaded zinc oxide, lithopone, zinc sulfide, and zinc sulfate. Nearly half of the zinc contained in lithopone in 1952 and 53 in 1951) and virtually all of the zinc in lithopone produced in 1952 and 1951) produced from secondary material. The production of lithopone derived from metal and scrap increased in 1952 compared with 24 percent in 1951. For a number of years the United States entered World War II there was a sharp increase in the quantity of secondary zinc used in the manufacture of pigments. The scarcity of supplies of both metal and of the total oxide made by the French process and scrap—to drop sharply in 1942 and low in 1943-46, despite the fact that the total production and scrap rose in 1943 and continued upward in 1944-50. The production of

scrap accounted for the following percentages in relation to total production: 41 percent in 1939, 16 percent in 1942, 19 percent in 1943, 22 percent in 1944, 25 percent in 1945, 26 percent in 1946, 28 percent in 1947, 26 percent in 1948, and 29 percent in 1949 and 1950.

TABLE 8.—Lead content of lead and zinc pigments¹ produced by domestic manufacturers, by sources, 1951-52, in short tons

Pigment	1951				1952			
	Lead in pigments produced from—			Total lead in pigments	Lead in pigments produced from—			Total lead in pigments
	Ore		Pig lead		Ore		Pig lead	
	Domestic	Foreign			Domestic	Foreign		
White lead.....			27,409	27,409			22,287	22,287
Red lead.....			30,880	30,880			29,570	29,570
Litharge.....			141,215	141,215			134,445	134,445
Leaded zinc oxide.....	11,237	1,581		12,818	8,358	1,275		9,633
Total.....	11,237	1,581	199,504	212,322	8,358	1,275	180,302	190,935

¹ Excludes lead in basic lead sulfate, data for which are withheld to avoid disclosure of individual company operations.

TABLE 9.—Zinc content of zinc pigments¹ and salts produced by domestic manufacturers, by sources, 1951-52, in short tons

Pigment or salt	1951					Total zinc in pigments and salts	1952					Total zinc in pigments and salts
	Zinc in pigments and salts produced from—				Zinc in pigments and salts produced from—							
	Ore		Slab zinc	Secondary material ¹	Ore		Slab zinc	Secondary material ¹				
	Domestic	Foreign			Domestic				Foreign			
Zinc oxide.....	77,805	18,275	15,665	14,909	126,644	57,839	23,811	10,240	12,872	110,762		
Leaded zinc oxide.....	21,384	4,046	.....	.....	25,410	15,357	3,211	.....	.....	18,568		
Lithopone.....	7,084	2,010	59	11,098	20,861	5,544	796	2	5,261	11,603		
Total pigments.....	106,853	24,331	15,714	26,007	172,905	78,740	27,818	16,242	18,133	140,933		
Zinc chloride.....	.....	.....	.....	14,078	14,078	.....	.....	.....	11,399	11,399		
Zinc sulfate.....	2,203	458	.....	5,008	7,669	2,422	297	.....	3,022	6,341		

¹ Excludes zinc sulfide, data for which are withheld to avoid disclosure of individual company operations.
² These figures are higher than those shown in the report on Secondary Metals—Nonferrous because they include zinc recovered from byproduct sludges, residues, etc., not classified as purchased scrap material.

CONSUMPTION AND USES

LEAD PIGMENTS

White Lead.—The bulk of the white lead used in the United States goes into the making of paint; the paint industry usually accounts for 90 percent or more of total consumption. In 1952, however, the customary percentage was not indicated by available statistics. This situation probably was due to the inability of shippers to give complete data on end-use classification. It is known that in the past

LEAD AND ZINC PIGMENTS

some white lead sold to the Government and it is likely that a substantial part of production belongs properly under paint. Shipments and manufacturers of plasticizers and stabilizers account for 4 percent of total distribution in 1952.

TABLE 10.—Distribution of white lead (dry and anhydrous) 1943-47 (average) and 1948-52 (average)

Industry	1943-47 (average) ¹	1948	1949-52 (average)
Paints.....	63,003	40,892	29,570
Ceramics.....	1,252	1,369	1,369
Other.....	5,415	3,809	3,809
Total.....	69,670	46,070	34,748

¹ Reported as sales before 1945.
² Shipments of basic lead sulfate included with white lead for many operations.

³ Includes the following tonnages for plasticizers and stabilizers: 1943-47, 1,252 tons; 1948, 1,369 tons; 1949-52, 1,369 tons.

Basic Lead Sulfate.—Statistics covering shipments by uses have not been available since 1945, when 3,000 tons went to the paint industry, and 700 tons to other industries. Large quantities of lead sulfate are used as an intermediate in the manufacture of leaded zinc oxide. Such quantities are shown in this chapter under leaded zinc oxide.

Red Lead.—Shipments to storage-battery manufacturers represented the largest proportion of distribution margin than in previous years. In 1952, storage-batteries comprised 45 percent of the total consumption. In the paint industry, the second largest proportion accounted for 43 percent of the total consumption. Relatively small quantities were used in other industries.

TABLE 11.—Distribution of red-lead shipments by industry, 1943-47 (average) and 1948-52, in short tons

Industry	1943-47 (average)	1948	1949-52 (average)
Storage batteries.....	24,710	14,854	14,854
Paints.....	15,493	10,863	10,863
Ceramics.....	866	1,275	1,275
Other.....	3,595	3,795	3,795
Total.....	44,664	30,787	30,787

¹ Reported as sales before 1945.

Orange Mineral.—No shipments of orange mineral were reported since 1946 when 123 tons went to the paint industry. The use of litharge for the manufacture of plasticizers and stabilizers accounts for roughly two-thirds of total consumption. The paint industry accounts for 69 percent compared with the ceramics industry is the second largest

ments for this purpose declined 30 percent from 1951 and comprised 11 percent of the total in 1952. Shipments to insecticide makers fell 52 percent, and deliveries to oil refineries and rubber manufacturers decreased 33 and 20 percent, respectively. The tonnage of litharge used for varnish was about the same as in 1951, whereas shipments for chrome pigments declined 25 percent. Shipments to makers of floor coverings dropped 55 percent but were well above average yearly quantities in previous years.

TABLE 12.—Distribution of litharge shipments,¹ by industry, 1943-47 (average) and 1948-52, in short tons

Industry	1943-47 (average)	1948	1949	1950	1951	1952
Storage batteries.....	78,996	100,645	77,163	105,558	94,064	97,656
Ceramics.....	13,057	10,879	13,299	27,771	22,815	15,906
Chrome pigments.....	9,817	7,455	8,557	10,917	11,117	8,376
Varnish.....	3,351	4,424	4,286	4,347	5,684	5,572
Oil refining.....	6,325	7,248	5,720	6,488	6,068	4,080
Insecticides.....	17,160	6,033	5,353	10,651	5,691	2,724
Rubber.....	2,705	2,835	1,398	3,047	2,641	2,109
Floor coverings.....	115	152	62	220	1,772	791
Other.....	6,062	6,004	5,214	9,559	5,001	3,584
Total.....	138,188	154,776	121,052	177,658	154,753	140,798

¹ Reported as sales before 1945.

ZINC PIGMENTS AND SALTS

Zinc Oxide.—Shipments of lead-free zinc oxide to consuming industries followed the same distribution pattern in 1952 as in previous years. The rubber industry and paint manufacturers remained by far the leading consumers, accounting for 51 percent (48 in 1951) and 22 percent (22), respectively, of total shipments. Shipments for ceramics and coated fabrics and textiles comprised 5 and 4 percent of the total (7 and 5 in 1951), respectively. Except for the rubber industry, which increased its receipts of zinc oxide slightly, shipments to all consuming industries declined in 1952.

TABLE 13.—Distribution of zinc oxide shipments,¹ by industry, 1943-47 (average) and 1948-52, in short tons

Industry	1943-47 (average)	1948	1949	1950	1951	1952
Rubber.....	71,377	82,896	58,496	82,944	71,507	72,774
Paints.....	30,103	26,779	26,205	39,699	32,934	31,424
Ceramics.....	6,470	12,327	6,982	12,679	10,324	7,760
Coated fabrics and textiles ²	11,016	9,474	5,200	6,303	7,265	6,262
Floor coverings.....	10,308	4,938	2,656	3,670	3,114	2,413
Chemical warfare.....	16,867	14,645	10,584	15,534	22,572	21,577
Other.....	146,131	150,958	110,132	160,829	147,716	142,210
Total.....	146,131	150,958	110,132	160,829	147,716	142,210

¹ Reported as sales before 1945.

² Includes the following tonnages for rayon: 1948—8,209; 1949—4,470; 1950—4,850; 1951—5,275; 1952—5,852.

Leaded Zinc Oxide.—Leaded zinc oxide (all grades) is used almost exclusively as a pigment in paint manufacturing; in 1952 over 99 percent of total shipments was for this purpose. Small quantities (less

LEAD AND ZINC PIGMENTS

than 1 percent of shipments) are used by the fact that leaded zinc oxide is produced from or secondary materials improves its color in manufacture when metal and scrap are in

TABLE 14.—Distribution of leaded zinc oxide shipments,¹ by industry, 1943-47 (average) and 1948-52, in short tons

Industry	1943-47 (average)	1948	1949
Paints.....	61,237	64,912	35,000
Rubber.....	132	218	218
Other.....	2,681	2,311	2,311
Total.....	64,050	67,441	37,529

¹ Reported as sales before 1945.

Lithopone.—The chief use of lithopone is in paints, varnish, and lacquers; approximately 73 percent (75 in 1951) of the total. Shipments of fabrics and textiles increased 18 percent, lithopone end-use items covered by this category for other purposes—rubber, paper, floor coverings—declined—54, 52, 35, and 24 percent, respectively.

TABLE 15.—Distribution of lithopone shipments,¹ by industry, 1943-47 (average) and 1948-52, in short tons

Industry	1943-47 (average)	1948	1949
Paint, varnish, and lacquers ²	116,033	104,441	56,000
Coated fabrics and textiles.....	6,092	8,436	6,000
Paper.....	4,139	4,814	2,000
Floor coverings.....	9,747	12,423	6,000
Rubber.....	1,494	4,192	3,000
Printing ink.....	(³)	(³)	(³)
Other.....	7,858	5,727	3,000
Total.....	145,363	140,033	78,000

¹ Reported as sales before 1945.

² Includes a small quantity, not separable, used for printing ink.

³ Included in "Other" before 1950, except for those quantities in lacquers.

Zinc Chloride.—Statistics on the zinc chloride shipments are not available. The chloride is used in wood preserving, battery manufacturing, and as a soldering flux.

Zinc Sulfate.—The textile (rayon) industry's consumption of zinc sulfate since 1946 when the use of and fungicides) led; in 1952 shipments for rayon from 1951 and were the smallest since 1946. The second largest use; shipments for this use. Among the smaller uses, shipments for coloring in printing, and glue decreased, whereas shipments for electrogalvanizing, and paint and varnish

TABLE 16.—Distribution of zinc sulfate shipments,¹ by industry, 1943-47 (average) and 1948-52, in short tons

Industry	1943-47 (average)	1948		1949		1950		1951		1952	
	Gross weight	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis
Rayon.....	6,813	9,900	7,333	10,591	7,987	11,217	8,322	10,073	7,925	8,181	6,812
Agriculture.....	6,718	5,210	4,248	4,429	3,595	5,841	4,880	5,538	4,847	5,111	4,446
Chemicals.....	2,018	1,734	1,193	1,197	851	1,879	1,377	2,871	2,243	1,675	1,489
Flotation reagents.....	1,188	1,632	1,366	921	757	952	727	853	736	1,070	950
Glue.....	465	561	462	453	370	579	464	396	337	391	329
Textile dyeing and printing.....	272	102	66	30	21	145	129	1,400	1,163	350	301
Electroplating.....	288	319	205	217	154	324	203	190	129	342	243
Paint and varnish processing.....	919	121	104	663	585	189	119	32	20	172	130
Other.....	1,666	1,934	1,191	1,564	979	2,786	1,820	2,116	1,274	2,295	1,422
Total.....	20,027	21,513	16,168	20,065	15,269	23,912	18,041	23,524	18,674	19,587	16,122

¹ Reported as sales before 1945.

PRICES

Total and average values received by producers for lead and zinc pigments and zinc salts are given in the tables in the first part of this report. Average values for red lead, white lead, and litharge declined \$21, \$23, and \$35 per ton in 1952 but remained at high levels compared with other years. The average value for white lead was the second highest on record, being smaller only than in 1951; red lead and litharge were higher than in any year except 1948 and 1951. Quotations for lead pigments reached a low for the year during the last week of October when lead was selling at its lowest level (13.5 cents per pound). Pigment prices at that time were about 4 cents a pound or 20 percent under quoted prices at the beginning of the year. When the

TABLE 17.—Range of quotations on lead pigments, and zinc pigments and salts at New York (or delivered in the East), 1949-52, in cents per pound

[Oil, Paint and Drug Reporter]

Product	1949	1950	1951	1952
White lead (basic lead carbonate), dry, carlots, barrels.....	14.75-22.10	14.00-18.50	18.50-20.10	16.25-20.10
Basic lead sulfate (sublimed lead), less than carlots, barrels.....	14.25-21.25	13.25-18.75	18.75-20.10	15.75-20.19
Red lead, dry, 95 percent or less, less than carlots, barrels.....	15.75-25.25	14.25-20.75	20.75-22.57	17.25-22.57
Orange mineral, American, small lots, barrels.....	18.10-27.60	16.60-23.10	23.10-24.02	19.60-24.92
Litharge, commercial, powdered, barrels.....	13.75-24.25	13.25-19.75	19.75-21.65	16.25-21.65
Zinc oxide:				
American process, lead free, bags, carlots.....	10.00-15.50	11.00-16.00	16.00-17.60	14.25-17.60
American process, 5 to 35 percent lead, barrels, carlots.....	10.25-17.38	11.25-16.88	16.88-18.35	14.40-18.35
French process, red seal, bags, carlots.....	11.50-16.75	12.25-17.25	17.25-18.85	15.25-18.85
French process, green seal, bags, carlots.....	11.75-17.25	12.75-17.75	17.75-19.35	16.00-19.35
French process, white seal, barrels, carlots.....	12.50-18.00	13.50-18.50	18.25-19.85	16.50-19.85
Lithopone, ordinary, small lots, bags.....	6.50- 6.75	6.50- 6.50	8.50- 8.90	8.25- 8.90
Zinc sulfide, less than carlots, bags, barrels.....	12.50-14.00	13.50-25.00	25.00-26.30	26.30
Zinc chloride, works:				
Solution, tanks.....	3.25	3.25- 4.10	4.10- 5.35	4.10- 5.35
Fused, drums.....	6.75- 8.15	7.00- 9.85	9.85	9.60- 9.85
Zinc sulfate, crystals, ¹ barrels.....	4.95- 6.85	4.95-10.15	10.15-11.20	10.00-11.20

¹ Includes granulated.

price of lead rose to 14.75 cents in D registered proportionate increases.

Although declining slightly in 1952, ments were the second highest on rec values in 1951, the peak year. Quota and leaded) dropped about 3.5 cents per price of zinc fell from 19.5 cents to 12.5 declined about 0.5 cent per pound.

New highs were again recorded for average values were 9 and 2 percent, established in 1951.

FOREIGN TRADE

Foreign trade in lead and zinc pigments and salts has been of minor importance in relation to domestic ties. A "favorable balance of trade" exceeding value of imports—is generally these products. In 1952 the value of m \$5,285,000 compared with imports value represented decreases from 1951 figures 80 percent for imports.

Tonnage imports and exports of lead salts in 1952 were also at much reduced

White lead and litharge, usually the and 67 percent, respectively, from 19 and zinc chloride, the principal zinc ite 61 percent, respectively. Small quant

TABLE 18.—Value of foreign trade of the United States in lead and zinc pigments and salts, 1950

[U. S. Department of Commerce]

	Imports for consumption	
	1950	1951
Lead pigments:		
White lead.....	\$271,035	\$388,900
Red lead.....	27,114	89,300
Litharge.....	4,570	788,000
Other lead pigments.....	40,781	32,000
Total.....	\$43,500	\$1,796,200
Zinc pigments:		
Zinc oxide.....	1,081,816	779,200
Zinc sulfide.....	14,479	14,479
Lithopone.....	179,197	181,100
Total.....	\$1,275,492	\$830,400
Lead and zinc salts:		
Lead arsenate.....		2,600
Other lead compounds.....	1,055	68,000
Zinc arsenate.....		194,500
Zinc chloride.....	30,447	15,500
Zinc sulfate.....	11,202	15,500
Total.....	\$42,704	\$281,400
Grand total.....	\$1,661,696	\$3,008,600

¹ Data not available.

² Figures on imports and exports compiled by Mae B. Friedman from records of the U. S. Department of Commerce.

lead suboxide, lead arsenate, and other lead compounds were also imported for consumption in 1952.

Litharge, white lead, red lead, and lead arsenate are also exported by the United States, but totals constitute only a small portion of shipments by domestic producers.

Zinc oxide and lithopone are the pigments exported in greatest tonnages from the United States. Exports of these pigments decreased 14 and 51 percent, respectively, from the quantities exported in 1951. Tonnages given comprise 5 and 16 percent, respectively, of total domestic shipments.

TABLE 19.—Lead pigments and salts imported for consumption in the United States, 1948-52

[U. S. Department of Commerce]

Year	Short tons							Total value
	White lead (basic carbonate)	Red lead	Litharge	Lead suboxide	Lead pigments n. s. p. f.	Lead arsenate	Other lead compounds	
1948.....	203	247	1,064	34	30	—	1	\$633,776
1949.....	161	23	90	23	6	—	(1)	142,607
1950.....	944	70	12	57	27	—	2	344,555
1951.....	2,575	215	1,855	53	—	7	180	1,588,034
1952.....	390	2	621	53	(1)	81	32	499,986

¹ Less than 0.5 ton.

TABLE 20.—Zinc pigments and salts imported for consumption in the United States, 1948-52

[U. S. Department of Commerce]

Year	Short tons							Total value
	Zinc oxide		Litho- pone	Zinc sulfide	Zinc chloride	Zinc arsenate	Zinc sulfate	
	Dry	In oil						
1948.....	27	(1)	—	—	—	—	180	\$17,758
1949.....	239	(1)	12	—	17	—	120	60,984
1950.....	5,093	2	1,201	33	210	—	159	1,317,141
1951.....	1,772	10	794	—	714	—	201	1,140,624
1952.....	173	(1)	11	—	275	(1)	66	189,798

¹ Less than 0.5 ton.

TABLE 21.—Lead pigments and salts exported from the United States, 1948-52

[U. S. Department of Commerce]

Year	Short tons				Total value
	White lead	Red lead	Litharge	Lead arsenate	
1948.....	663	953	644	1,019	\$1,404,001
1949.....	699	1,042	1,357	430	1,343,513
1950.....	815	549	1,612	520	1,166,269
1951.....	767	585	1,038	313	1,149,209
1952.....	675	435	1,233	128	996,089

TABLE 22.—Zinc pigments and salts exported from the United States, 1948-52

[U. S. Department of Commerce]

Year	Short tons		Total value	Y
	Zinc oxide	Lithopone		
1948.....	8,642	21,015	\$5,228,902	1951.....
1949.....	5,040	14,460	3,426,118	1952.....
1950.....	3,094	9,367	2,124,367	

WORLD REVIEW

France.—The Belgian and French work de zinc de la Vielle-Montagne produced white in 1952. The New Jersey distillation of "snow" zinc oxide (oxyde de zinc "neige") the end of 1951 and is working regularly.

Germany, West.—Two methods are used zinc oxide of pigment quality: The "indirect" process (that is, producing zinc oxide from virgin metal, removing the "direct" process (that is, producing zinc oxide from zincy slags, residues, or byproducts containing zinc mainly in the indirect process produces a first-quality pigment. By the direct process a zinc oxide of second quality and largely unsuited for pigment.

The zinc oxide produced in the indirect process in Germany, whereas the zinc oxide obtained in the direct process is called, simply, zinc oxide. If suitable for pigment zinc oxide; if not suitable for pigment zinc oxide or off-grade zinc oxide.

Nearly all German producers of zinc white which was developed 80 years ago at the Grillo process. This method has been periodically improved but the principle has remained the same. Only to a small extent is the Grillo process in operation.

Five firms in Western Germany use the Grillo process to manufacture zinc white. These are: Grillo, Hamburg; Lindgens u. Sohne, Cologne; Gelbke, Cologne; and Zinkhütte Hamburg, Hamburg. The capacity of about 30,000 tons of zinc white is produced annually.

In its essentials the Grillo process consists in heating zinc with producer gas. The zinc is heated in the producer gas; this mixture leaves the retort and enters through a combustion chamber.

¹ Metal Bulletin (London), No. 3796, May 29, 1953, p. 19.

TABLE 26.—Exports of tin in concentrates from Thailand, 1948-52, in long tons

Destination	1948	1949	1950	1951	1952
United States.....	3,911	4,671	2,908	2,727	4,677
Malaya.....	1,740	3,312	8,040	6,003	4,580
Netherlands.....			7	79	504
Total.....	5,651	7,983	10,955	8,809	9,761

United Kingdom.—Mine production in the United Kingdom (Cornwall and Devon) totaled about 1,000 long tons in 1952 compared with about 1,200 in 1951. United Kingdom smelter production of tin was the second largest in the world in 1952. Output increased 13 percent compared with 1951. Year-end stocks of tin in concentrates were 2,400 tons (1,900 at the beginning of the year) and of metal 4,200 tons (8,000 at the beginning). Total stocks, including tin metal and concentrates afloat and visible consumer stocks, were reported to be 7,000 tons at the end of 1952—a 47-percent decrease from 13,100 tons at the beginning of the year. Total virgin tin consumed totaled 22,600 tons, a 6-percent decrease from 1951.

During 1952 both the South Crofty, Ltd., and Geevor Tin Mines, Ltd., had successful years. Although the New Consols mine continued to work throughout most of the year, the directors decided to abandon operations late in the autumn, and the pumps were withdrawn from the lower levels after development results were disappointing. Mineral Recovery, Ltd., was producing tin at the Kieve mill. Another small producer of tin was the Malayan Tin Syndicate, which is working old dumps at Carnkie near Redruth.³⁴

On January 18, 1952, the Governments of the United States and the United Kingdom concluded an agreement on steel, aluminum, and tin. Under that agreement, the United Kingdom provided for the supply of 20,000 long tons of tin during 1952 in roughly equal installments at \$1.18 per pound for tin of Straits quality or equivalent, f. o. b. Penang, Singapore, London, or Liverpool (at the option of the United Kingdom). By August 1, 1952, the United Kingdom Government had virtually completed the purchase of tin for delivery to the United States pursuant to section C, paragraph 1, of the agreement, dated January 18, 1952.³⁵

³⁴ Mining Journal (London), Ann. review No., May 1953, p. 171.

³⁵ Department of State, Press Release 605, July 31, 1952.

Titanium

By Alfred F. Tumin¹ and Frank J. C.



GOVERNMENT programs established in 1951 for the production of titanium dioxide pigment and titanium metal. Titanium-metal production in 1952 was slightly higher than in 1951; however, the production of titanium metal was slightly lower than in 1951.

Rutile, required mainly for welding-rod coating, was produced during the first part of 1952. The removal of rutile from the market resulted in record imports from Australia and requirements and to double year-end inventory.

An appreciable quantity of titanium slag imported in 1952 compensated for lower ilmenite imports. Production and shipments of ilmenite changed little.

The Bureau of Mines published reports covering the production and properties of titanium metal, brookite and titaniferous iron ores. Extensive use of titanium metal also was reported by other sources and by industry.

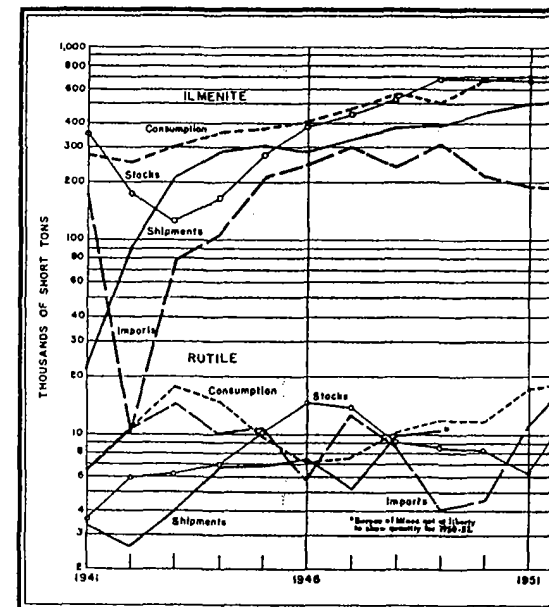


FIGURE 1.—Domestic shipments, imports, consumption, and stocks of ilmenite and rutile, 1941-52.

¹ Commodity-Industry Analyst.
² Chief, Light Metals Branch.

DOMESTIC PRODUCTION

Concentrates.—Output of ilmenite in 1952 decreased 7,200 short tons from the record established in 1951. On the other hand, mine shipments increased 11,700 tons over 1951 and established a new record for the sixth successive year.

Lower production was reported by the American Cyanamid Co., Piney River, Va.; E. I. du Pont de Nemours & Co., Starke, Fla.; National Lead Co., Tahawus, N. Y.; Rutile Mining Co. of Florida, Jacksonville, Fla.; and the Yadkin Mica & Ilmenite Co., which ceased operations at Findley, N. C., in October 1952. The Florida Ore Processing Co., Melbourne, Fla., tripled its 1951 production, and Baumhoff-Marshall, Inc., doubled its 1951 recovery of ilmenite from monazite operations at Boise, Idaho. Production of Baumhoff-Marshall, Inc., included output of the Idaho-Canadian Dredging Co. and Warren Dredging Corp. Ilmenite statistics in 1952 include a mixed product containing ilmenite, rutile, and leucoxene. Of the total ilmenite production, New York continued to supply over half and Florida about one-third; the remainder came from North Carolina, Virginia, and Idaho. A small quantity of low-grade ilmenite produced in California for nontitanium use is not included in the production and shipments of titanium concentrates.

Factors that contributed to the new peak in ilmenite shipments in 1952 were larger shipments from the National Lead Co., Tahawus, N. Y., and the Yadkin Mica & Ilmenite Co., Finley, N. C. The latter company in 1952 shipped all of its production and material in stock. Shipments by other ilmenite producers were about the same as production, except for Baumhoff-Marshall, Inc., which reported no ilmenite shipments in 1952. Shipments of ilmenite ranged from 45 to 66 percent TiO_2 .

Rutile production in the United States in 1952 decreased slightly from 1951 output. Rutile was produced in 1952 by the Rutile Mining Co. of Florida, Jacksonville, Fla., and the Florida Ore Processing Co., Melbourne, Fla. Domestic production of rutile is not published as it would disclose operations of the major producer. Shipments of rutile ranged from 93 to 97 percent TiO_2 .

Under the Defense Production Act of 1950, the Defense Minerals Exploration Administration issued Order 1 on March 7, 1952, placing rutile and brookite in the classification of strategic and critical minerals and set forth provisions whereby the Government would contribute up to 75 percent of the total exploration cost of these minerals.

Titanium Pigments.—Production and shipments of titanium pigments in 1952 decreased 4 and 11 percent, respectively, from 1951, as production dropped to the 1950 level, and shipments fell to near the 1948 figure. Titanium pigments were produced by the American Cyanamid Co., Calco Chemical Division, Bound Brook, N. J.; Chemical & Pigment Co. Division of the Glidden Co., Baltimore, Md.; E. I. du Pont de Nemours & Co., Wilmington, Del.; and the National Lead Co., New York, N. Y. Statistics in this industry are supplied in confidence and consequently are not given here. The percentage distribution of titanium-pigment shipments, by consuming industries, is shown in table 3.

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TABLE 1.—Production and mine shipments of titanium ores in the United States, 1943-47 (average)

Year	Ilmenite			
	Production (gross weight)	Shipments		
		Gross weight	TiO_2 content	Value
1943-47 (average).....	281,931	283,959	130,436	\$5,675,565
1948.....	383,745	381,508	177,447	8,793,973
1949.....	402,334	389,234	188,535	9,212,348
1950.....	1,408,320	1,452,370	1,230,526	15,606,584
1951.....	1,535,835	1,610,940	1,261,982	17,689,272
1952.....	1,628,688	1,622,515	1,265,596	18,023,752

¹ Includes a mixed product containing altered ilmenite, leucoxene, and rutile.

² Bureau of Mines not at liberty to publish.

Defense Production Administration announced an expansion goal for titanium dioxide pigment production capacity of 370,000 short tons by 1955, an expansion of 88,000 tons over the capacity of the amortization certificates approved as of February 1951 for 69,000 tons of the expanded capacity. The Government was open for issuance of certificates of material.

Metal.—Commercial titanium-sponge production in 1952 was 1,075 short tons, approximately double the 1951 production. Plants operated by E. I. du Pont de Nemours & Co., Del.; Titanium Metals Corp. of America, Houston, Tex.; and the Bureau of Mines, Boulder City, Nev., pilot plant.

The Defense Production Authority, in November 1951, authorized production of commercial titanium sponge per year by the end of 1955. The Titanium Metals Corp. of America signed a letter of intent in August 1951 for construction of a plant at Henderson, Nev., to produce 3,600 tons of sponge per year for 5 years. An advance of \$15,000,000 was made by the Government to the Titanium Metals Corp. of America by the Government. One year later (July 28, 1952), the Defense Production Agency contracted with E. I. du Pont de Nemours & Co., Del., for additional production of 13,500 tons of sponge during the next 5 years. The Government agreed to pay the company \$14,700,000 to increase the capacity of the plant to 10 tons per day. The agreement with the company was one the Government made with Titanium Metals Corp. in August 1951, whereby the loan, plus interest on the unpaid balance, is repayable either in cash or in metal.

The revolving-fund purchase and resale program of the General Services Administration in August 1951 for operation of sponge-manufacturing facilities for the development of military applications, continued.

Inventory controls that called for a practicable minimum working inventory were placed on titanium products, such as sponge, semi-fabricated shapes, sheets, tubes, extrusions, titanium-bearing alloys and titanium-base alloy scrap as of October 22, 1951, under NPA Regulation 1, as amended, and remained in effect throughout 1952.

An analysis of titanium aircraft-engine parts and steels showed the following weight savings, per pound of steel replaced: crankshaft front, center, and rear, 18, 21 and 23 percent, respectively; articulated and master rods, 1 and 7 percent; turbine support, 1 pound; and compressor blade, and rotor blade, 11, 0.02, and 0.04 percent, respectively. Other comparisons between these metals were developed.

¹ Hanink, H. H., *Titanium Aircraft Engine Parts, an Analysis*: Iron Age, pp. 121-125.

TABLE 2.—Consumption of ilmenite and rutile in the United States, 1943-49 total, and 1950-52, by products, in short tons

Product	Ilmenite		Rutile	
	Gross weight	Estimated TiO ₂ content	Gross weight	Estimated TiO ₂ content
1943.....	302,822	142,868	17,634	16,451
1944.....	360,941	175,475	14,813	13,837
1945.....	381,178	187,680	9,701	9,144
1946.....	404,283	202,063	7,134	6,670
1947.....	479,524	250,859	7,092	7,083
1948.....	505,000	300,408	10,230	9,488
1949.....	510,608	268,000	11,888	10,863
1950.....				
Pigments (manufactured titanium dioxide) ¹	671,335	347,747	(²)	(²)
Welding-rod coatings ³	210	106	9,218	8,516
Alloys and carbide.....	7,066	3,803	1,454	1,366
Ceramics.....			195	185
Miscellaneous.....	33	19	854	802
Total.....	679,244	351,675	11,721	10,869
1951.....				
Pigments (manufactured titanium dioxide) ¹	703,068	367,937	(²)	(²)
Welding-rod coatings ³	258	130	11,708	10,834
Alloys and carbide.....	10,024	4,962	2,039	2,752
Ceramics.....			265	248
Miscellaneous.....	13	8	2,316	2,184
Total.....	713,363	373,037	17,227	16,018
1952 ⁴				
Pigments (manufactured titanium dioxide) ¹	670,829	345,308	(²)	(²)
Welding-rod coatings ³	719	416	11,418	10,798
Alloys and carbide.....	11,293	5,763	2,997	2,858
Ceramics.....	6	3	281	265
Miscellaneous.....	4	3	3,621	3,432
Total.....	682,850	351,553	18,317	17,353

¹ Includes a mixed product containing altered ilmenite, leucosene, and rutile used to make pigments and metal.

² "Pigments" includes all manufactured titanium dioxide, consumption of which in welding-rod coatings was 1,439 tons in 1950, 1,770 tons in 1951, and 2,209 tons in 1952.

³ Included with "Miscellaneous," to avoid disclosure of individual company operations.

⁴ Includes metal and fiberglass.

⁵ A total of 24,236 short tons (10,746 tons TiO₂) of titanium slag was consumed in 1952 for titanium pigments, welding-rod coatings, and experimental purposes.

Commercially pure and alloy-grade titanium metal was reported used as a substitute for aluminum alloy and stainless steel in aircraft engine nacelles in 1952. According to aircraft manufacturers, the weight reduction by using titanium in aircraft structural parts, such as fuselage webs, channels, frames, and angles where operating temperatures do not exceed 800° F., would increase the operating range of an airplane by 150 miles. Additional reduction of 300 pounds in the weight of an airplane can be obtained, according to the manufacturers, by replacing 88 percent of the skin of the engine nacelles with titanium sheet.⁴ The United States Air Force announced that

⁴ Light Metals Bulletin, vol. 14, No. 24, Dec. 4, 1952, p. 17.

Engineering and Mining Journal, Metal and Mineral Markets, Titanium in Planes: Vol. 23, No. 24, June 19, 1952, p. 7.

Eshman, A. N., Titanium Sheet Metal Parts Successfully Made: Iron Age, vol. 170, No. 3, July 17, 1952, pp. 132-135.

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530 pounds of sheet titanium instead of sheet steel in the production of certain airframe parts for the B-36.

Evaluation service tests were performed by the USN, on use of titanium in wet exhaust mufflers, engines; meter disks for oil, gasoline, and salt-water pumps; and heat-exchanger tubes with high water velocity. Water valves; and blades for steam turbines. Titanium tested 900 hours under normal wet operation and thermal shock operation, showed no perceptible wear. Disks were found superior to all other materials in condenser and heat-exchanger tubes tested over a year in perfect condition; the titanium seats for the salt-water gate valves 18 months were found in perfect condition. Some titanium blading in cold-peening the tenons onto the steam turbine blading for steam turbines installed in a 300-kw. turbogenerator, of the tenons; however, this was overcome by peening between 600° to 900° F. Applications of titanium in submarine snorkel tubing, submarine fairwater construction, aircraft landing gear components, peller blades, armor plate, and a 30-gallon shipboard water tank were also under investigation during 1952.⁵

TABLE 3.—Distribution of titanium-pigment shipments, (average) and 1948-52, in percent of total

Industry	1938-47 (average)	1948	1949
Distribution by gross weight:			
Paints, varnishes, and lacquers.....	78.4	76.4	76.4
Paper.....	6.6	5.4	5.4
Floor coverings (linoleum and felt base).....	2.8	4.5	4.5
Rubber.....	2.1	2.5	2.5
Coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.).....	2.4	2.1	2.1
Printing ink.....	1.0	.9	.9
Other.....	6.7	8.2	8.2
Total.....	100.0	100.0	100.0
Distribution by titanium dioxide content:			
Paints, varnishes, and lacquers.....	70.2	60.9	60.9
Paper.....	9.5	7.4	7.4
Floor coverings (linoleum and felt base).....	3.9	5.9	5.9
Rubber.....	2.7	3.2	3.2
Coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.).....	3.1	2.7	2.7
Printing ink.....	1.6	1.4	1.4
Other.....	9.0	9.5	9.5
Total.....	100.0	100.0	100.0

⁵ Iron Age, Airborne Titanium: vol. 170, No. 14, Oct. 9, 1952, p. 215.

⁶ Michalos, L. G. P., USNR, Titanium—The New Metal: Bureau of Ships, September 1952, pp. 7-14.

Beardman, E. L., Navy Has Large Titanium Program: Jour. Metals, vol. 1, 1952, pp. 128-132.

The Army Ordnance Corps, USA, authorized production of 81 mm. mortar-base plates from titanium in 1952. The lightness of titanium as compared to steel allowed the mortar-base plate to be redesigned to a 1-piece welded construction, weighing only 24 instead of 48 pounds, and releasing 1 man for other duties. Other items from titanium, such as armor plate for tanks and vehicles, flash suppressors, structural components such as outriggers, and helical springs, were under test.⁷

At the National Metal Exposition in October 1952, at Philadelphia, Pa., a titanium ingot weighing 4,000 pounds and a continuous sheet of titanium coil, 0.015 inch thick, 460 feet long, and worth \$12,000, were displayed for the first time. A model of the J-47 Air Force engine highlighted the uses of titanium in blades, casings, compressor wheels, and other components. Titanium was displayed also in the following forms: 0.38 caliber paratrooper's pistol, filters, cutting tools, valves, and other machine parts. An organic bonding agent ideal for low-heat bonding of titanium was revealed, and parts drawn from commercially pure titanium were demonstrated.

Staurolite ($2\text{FeO} \cdot 5\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$), previously wasted, was recovered in 1952 from ilmenite operations in Florida by using induced-roll magnetic separators. This mineral, containing approximately 50 percent Al_2O_3 , was reported as a source of aluminum and iron in making cement. Staurolite production schedules called for 25,000 tons per year; however, plant capacity in 1952 was reported at about 35,000 tons per year.⁸

Tanarc produced from titanium slag was manufactured in 1952 by the Foote Mineral Co., Philadelphia, Pa., and consumed in the welding-electrode industry as a partial substitute for rutile. Tanarc, which contains about 70 percent TiO_2 , was not used as a complete substitute for natural rutile but was mixed with rutile to yield a product containing approximately 25 percent Tanarc. Additional research by the electrode manufacturers may increase the proportion of Tanarc up to 50 percent in the mixture. Production of Tanarc, considered still in the development stage, was estimated at 500 tons in 1952.

Titanium dioxide rectifiers, consisting of a layer of semiconducting titanium dioxide, a sheet of titanium metal, and a counterelectrode of some other conducting material, were described in an article released by the National Bureau of Standards. The rectifiers were reported to withstand reverse voltages of 20 volts per plate and operate satisfactorily at elevated temperatures.⁹

Studies on the use of titanium pigments, anatase and rutile, for exterior house paints showed that after exposure for 5 years rutile-pigment paint protected the surface and was in good condition for repainting, whereas the anatase paint had completely chalked away and offered no protection to the surface. Repeat tests on the same

⁷ Mesick, Col. B. S., Titanium Evaluated for Ordnance: Jour. Metals, vol. 5, No. 2, February 1953, pp. 136-137.

⁸ Engineering and Mining Journal, Induced-Roll Magnetic Separators Now Recovering Staurolite Formerly Wasted: vol. 153, No. 12, December 1952, pp. 108-109.

⁹ Breckenridge, R. G., and Hosler, W. R., Research Paper 2344: Nat. Bureau of Standards, Jour. Research, vol. 49, No. 2, August 1952, pp. 65-72.

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paints but with short exposures showed clean, v panels for anatase paints and dirty mildewed surf versions. Other comparisons between these tw discussed.¹⁰ An informal summary on the develop properties, and uses of titanium pigments was also

STOCKS

Year-end stocks of ilmenite decreased slightly equivalent (TiO_2 content basis) to 11½ months' re rate of consumption in 1952. The pigment p lower ending inventories in 1952; however, this increase in stocks of titanium slag. Stocks of titan from 3,000 short tons at the end of 1951 to 17,000 stocks in 1952 more than doubled 1951 ending inve sustain industry (TiO_2 content basis) at the 1952 months. Even though rutile consumption in 1952 peak, supply was greater than demand owing to re Australia, the sole supplier of rutile to the Unite

The National Production Authority announced i on rutile January 28, 1952, in NPA Regulation 1, ever, rutile was removed from the inventory control 1952, in NPA Regulation 1, as amended.

TABLE 4.—Stocks of titanium concentrates in the United S 1951-52, in short tons

Stocks	1951 ¹					
	Ilmenite		Rutile		Ilmenite	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
Mine.....	57,139	28,925	55	51	63,212	30
Distributors ²	592	415	539	511	958	307
Consumers.....	619,714	307,211	5,861	5,491	610,499	307
Total stocks....	677,445	334,551	6,395	6,053	674,669	337

¹ Revised figures reflecting inventory corrections reported by industry.

² Consumers stocks of titanium slag imported from Canada totaled 17,000 short tons of estimated TiO_2 .

³ Includes ilmenite and rutile content of mixed zirconium-titanium concentrates.

PRICES

Ore.—Quotations in E&MJ Metal and Mineral M per gross ton for ilmenite containing 56 to 59 perc Atlantic seaboard, were \$16-\$18 at the beginning of 1 to \$16-\$20 in March and to \$18-\$20 in April, at price of ilmenite remained for the rest of the year were nominal.

¹⁰ Paint, Oil and Chemical Review, Francis G. Smith Tells N. Y. Production vol. 115, No. 8, Mar. 13, 1952, p. 61.

¹¹ E. I. du Pont de Nemours & Co., Wilmington, Del., Titanium—The Comm

Ferrotitanium.—Price quotations on all grades of ferrotitanium remained the same in 1952 as that quoted in the latter part of 1951. Steel Magazine quoted ferrotitanium in 1952 as follows:

(Ti, 20-25 percent; Al, 3.5 percent maximum; Si, 4 percent maximum; C, 0.10 percent maximum). Contract, ton lots 2' x 10' per pound of contained Ti.....	\$1.50
Less-than-ton lots per pound.....	1.55
(Ti, 38-43 percent, Al, 8 percent maximum, Si, 4 percent maximum; C, 0.10 percent maximum). Ton lots per pound.....	1.35
Less-than-ton lots per pound.....	1.37

(fi, 17-21 percent; C, 2-4.5 percent) contract per ton, f. o. b.
Niagara Falls, N. Y., freight not exceeding St. Louis rate
allowed

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Manufactured Titanium Dioxide.—Manufacturers of (anatase), ceramic, chalk-resistant, and regular grades delivered, were all quoted throughout 1952 at 21-22¢. Rutile, nonchalking, was quoted at 23-23½¢.

FOREIGN TRADE ¹²

Exports.—Shipments of titanium dioxide and concentrates declined 9 percent under the record established in 1952 receiving 21,300 short tons, a decrease of 1,000 tons over 1951. Other countries receiving 500 tons as follows: Belgium and Luxembourg, 1,300; France, 1,100; Italy, 800; Japan, 800; Mexico, 1,100; and Union of South Africa, 1,100. The remainder were distributed among 45 other countries. Shipments of concentrates increased slightly in 1952 over 1951. Two new export classifications; namely, titanium metal in crude form and scrap and titanium metal in primary form were shipped to Canada and Hong Kong, initiated by the Department of Commerce in 1952. Increased production of titanium metal. Metal in primary form and scrap were shipped in 1952, in pounds, to France, 1,400; Italy, 2,200; and the United Kingdom, 300. Recipients of titanium metal in primary form were Belgium and Luxembourg, 4,500; Canada, 2,100; and the United Kingdom, 300. Exports of titanium ferroalloys in 1952, in pounds, were to Belgium and Luxembourg, 4,500; Canada, 2,100; and the United Kingdom, 300.

¹³ Figures on imports and exports compiled by Mae D. Price and Elsie D. from records of the U. S. Department of Commerce.

1951 shipments as exports to Canada totaled 290 short tons, an increase of 126 tons over 1951. The remaining quantity of 70,300 pounds was shipped to Chile, 7,000; France, 14,600; Italy, 25,200; the United Kingdom, 22,500; and Western Germany, 1,000.

TABLE 5.—Titanium concentrates¹ imported for consumption in the United States, 1943-47 (average) and 1948-52, by countries, in short tons
[U. S. Department of Commerce]

Country of origin	1943-47 (average)	1948	1949	1950	1951	1952
ILMENITE						
Australia.....	776	(²)	—	112	100	—
Brazil.....	3,205	8,708	—	—	1	—
Canada.....	22,675	4,519	540	1,367	3,770	38,481
Ceylon.....	930	—	2	—	—	—
Egypt.....	—	—	721	—	—	—
France.....	—	—	—	—	—	—
India.....	145,369	184,308	289,739	187,834	185,145	145,562
Malaya.....	—	3,335	—	—	56	—
Norway.....	12,200	41,248	33,155	27,155	—	—
Total as reported.....	185,155	242,119	324,167	215,459	189,078	184,013
Australia: In "zirconium ore" ³	1,999	—	—	—	—	—
Grand total.....	188,154	242,119	324,167	215,459	189,078	184,013
Value of "as reported".....	\$1,084,933	\$1,758,848	\$2,479,071	\$1,198,545	\$1,323,438	\$2,478,077
ROUTLE						
Australia.....	3,921	8,771	3,085	3,427	11,023	19,394
Brazil.....	1,371	—	—	—	—	—
French Cameroun.....	220	—	—	—	—	—
India.....	213	—	—	—	—	—
Norway.....	—	(²)	—	—	—	—
Total as reported.....	5,725	8,771	3,085	3,427	11,023	19,394
Australia: In "zirconium ore" ³	3,955	—	1,096	1,133	210	156
In "ilmenite" ⁴	1,012	—	—	—	—	—
Grand total.....	10,692	8,771	4,181	4,560	11,233	19,550
Value of "as reported".....	\$375,336	\$688,713	\$179,746	\$149,733	\$491,383	\$1,728,803

¹ Classified as "ore" by the U. S. Department of Commerce.

² Less than 1 ton.

³ Includes titanium slag.

⁴ Chiefly all titanium slag averaging about 70 percent TiO₂.

⁵ Ilmenite content of zirconium ore as reported to the Bureau of Mines by importers.

⁶ Rutile content of zirconium ore as reported to the Bureau of Mines by importers.

⁷ Rutile content of ilmenite as reported to the Bureau of Mines by importers.

⁸ Revised figures.

TABLE 6.—Exports of titanium products from the United States, 1943-47 (average) and 1948-52, by classes
[U. S. Department of Commerce]

Year	Ore and concentrates		Metal and alloys in crude form and scrap		Primary forms, n. e. c.		Ferroalloys		Dioxide and pigments	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1943-47 (average).....	825	\$134,259	(¹)	(¹)	(¹)	(¹)	671	\$102,340	14,200	\$2,854,779
1948.....	1,454	187,225	(¹)	(¹)	(¹)	(¹)	450	82,874	26,824	7,128,956
1949.....	1,505	149,412	(¹)	(¹)	(¹)	(¹)	179	40,918	29,621	8,140,991
1950.....	630	57,753	(¹)	(¹)	(¹)	(¹)	171	42,741	32,660	8,709,758
1951.....	646	63,050	(¹)	(¹)	(¹)	(¹)	175	107,718	39,242	13,274,143
1952.....	870	110,737	762	\$31,134	3	\$38,979	325	88,064	35,636	10,091,008

¹ Before Jan. 1, 1952, not separately classified.

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TECHNOLOGY

Investigations on a vacuum-distillation magnesium and magnesium chloride from titanium by modifications of the Kroll process were conducted on a small scale by the Bureau of Mines laboratory at Boulder City, Nev. The results far superior to those achieved by the leaching. In the purification method, magnesium was volatilized away from titanium in a vacuum, leaving the titanium virtually magnesium-free. A description of the pilot-plant equipment, method of sponge recovery, operation data, and requirements are discussed in a Bureau of Mines report.

Pilot-plant investigations on 105 production metal was made in 200-pound batches were conducted at the Bureau of Mines at Boulder City, Nev. Techniques developed brought about a decrease in the moisture absorption of titanium chloride in the reaction mass, lowered iron content of the labor- and time-consuming job of cleaning, reduction, and lowered the temperature during to 750° C. to give better and more consistent results. The techniques used in preparing raw materials and removal of the mass from the reaction vessel were published in a Bureau of Mines report. Mineral-dressing investigations on titanium Christy deposit in the Magnet Cove area, Ark., conducted by the Bureau of Mines laboratory at Boulder City, Nev. The flotation concentrates containing 91 to over 92 percent titanium dioxide yielded a 60.6-percent titanium dioxide and a 55.2-percent of 92.8 percent titanium dioxide and a 55.2-percent of 91.2 percent titanium dioxide.¹⁵

Studies were made by the Bureau of Mines at Park, Md., on the recovery of titania, iron, and ferrous iron ore from deposits at Tahawus, N. Y. Ore from Tahawus, N. Y., was roasted with ground, and magnetically separated to produce titania and byproducts were recovered from position. Combined data from tests indicate that the titania content of the ore is recoverable of the iron can be recovered as a metallic-iron.

With certain modifications, the process magnetite was reported applicable to a titaniferous Mine Hill near Woonsocket, R. I.¹⁶

Development of a method for treating titanium from the Iron Mountain, Wyo., deposit to produce titanium as high-grade, salable product.

¹⁵ Cook, M. A., and Wartman, F. S., Removal of Magnesium and Manganese by Vacuum Distillation; Bureau of Mines Rept. of Investigations 4912, 1952.

¹⁶ Fuller, H. C., Baker, D. E., Jr., and Wartman, F. S., Recent Progress in Titanium Plant; Bureau of Mines Rept. of Investigations 4913, 1952.

¹⁷ Fine, M. M., and Frommer, D. W., Minerals Dressing Investigations; Hot Spring County, Ark.; Bureau of Mines Rept. of Investigations 4914, 1952.

¹⁸ MacMillan, R. T., Heindl, R. A., and Conley, J. E., Soda-Silica-Titaniferous Ores; Bureau of Mines Rept. of Investigations 4912, 1952.