

MINER YEARB

196

Volume I of Fo

METALS AND

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Prepared by staff of the

BUREAU OF MINES

N49788

Lead

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INDUSTRIAL requirements for lead i from all sources and resulted in a sign producer stocks and a rising metal price and primary refinery output were disru the labor closure of the largest domesti quarter of the year, domestic output of re 7 percent to 253,400 tons and produc antimonial lead increased 6 percent to secondary lead from scrap materials wa level but the other major source of lea sumption, declined about 15 percent to of lead increased 5 percent to 1,163,400 to in gasoline antiknock additives and s refined lead at producers' plants decline and stocks of primary lead in all cate during the year while consumer stocks in tons, last exceeded in 1959. The price increased in the second half of the year cents to 12.50 cents on November 21.

LEGISLATION AND GOVERN

Import quotas on lead ores and metal continued in effect. The quota, subd for specified countries were filled for lea while lead metal quotas were filled ex The U.S. Tariff Commission submitted

¹ Commodity specialist, Division of Minerals.

and related developments in the lead-zinc industry to the President on October 1 in accordance with Executive Order 10401, establishing the quotas. The Commission concluded that conditions had not changed sufficiently to warrant, at that time, a formal investigation directed toward revision of the quotas. Legislation was introduced in Congress proposing establishment of a flexible import quota system for lead and zinc and was still pending at yearend.

The Government did not acquire lead for the stockpile during the year. A small tonnage of lead in the Defense Production Act stockpile was released for use by Government agencies during the year, thereby reducing total inventory to 1,378,000 tons. The Office of Emergency Planning devoted major attention to two major stockpile programs during the year—the development of disposal procedures for surplus materials and the development of new stockpile objectives. In relation to supply-requirements for conventional war, the stockpile objective for lead was established at zero on June 17. Legislation was introduced in Congress in October to revise procedures for disposal of surplus material by the Government and was still awaiting action at yearend.

The small mines stabilization program, authorized by Public Law 87-374 enacted in October 1961, applied to eligible production during the year. As of December 31, 1963, a total of 125 applications from small mines in 13 States has been received of which 98 were certified as eligible and 5 were being reviewed. In 1963 a total of 6,529 tons of lead qualified under provision of the act for stabilization payments amounting to \$356,916.

Government participation in exploration projects for lead and zinc under the program of the Office of Minerals Exploration (OME) was withdrawn at the end of June 1962. Five projects approved prior to this action were active during 1963 and one of these projects, United Park City mine, was completed and certified as a discovery.

The International Lead and Zinc Study Group held its seventh session in Geneva, Switzerland, from October 28 to November 7. The Government of Austria was admitted to membership and the Group now has 26 governments participating. The Group concluded that new supplies of lead were then in reasonable balance with consumption but the rising trend in lead consumption, estimated at 2.8 million tons in 1963 and expected to rise in 1964, could result in a supply shortfall in 1964. A Special Working Group, which met in Geneva in March, examined and reported to the Study Group on the various aspects of intergovernment arrangements for lead and zinc and it was decided to continue study in this area.

TABLE 1.—Salient lead statistics

	1964-68 (average)	1959	
United States:			
Production:			
Domestic ores, recoverable lead content...short tons..	324,373	255,586	
Value.....thousands..	\$91,996	\$58,785	
Primary lead (refined):			
From domestic ores and base bullion			
short tons..	321,870	225,270	
From foreign ores and base bullion			
short tons..	180,503	115,661	
Antimonial lead (primary lead content)...short tons..	15,471	12,402	
Secondary lead (lead content).....short tons..	476,149	451,387	
Imports, general:			
Lead in ores and matte			
short tons..	187,054	138,834	
Lead in base bullion...do....	123	80	
Lead in pigs, bars, and old			
short tons..	311,715	271,695	
Exports of refined pig lead...do....	2,265	2,766	
Stocks December 31 (lead content):			
At primary smelters and refineries.....short tons..	140,346	171,079	
At consumer plants...do....	123,661	125,496	
Consumption of metal, primary and secondary.....short tons..	1,128,347	1,091,149	1.
Price: New York, common lead, average, cents per pound.....	14.39	12.21	
World:			
Production:			
Mine.....	2,484,000	2,570,000	2.
Smelter.....	2,380,000	2,410,000	2.
Price: London, common lead, average, cents per pound.....	11.99	8.88	

1 Revised figure.

DOMESTIC PRODUCTION

MINE PRODUCTION

The domestic output of 253,400 tons represented an increase of 7 percent over the output at the Missouri mines of St. Joseph Lead Co. in 1962, which was not ended until April 1, 1962, of the strike and reopening of the St. Joseph Lead Co. during the last 8 months of the year was an annual production of 284,000 tons.

Missouri regained the position of top lead-producing State with 79,800 tons followed by: Idaho 22,500 tons; and Colorado 19,900 tons. These three States represented 31 percent of the U.S. output. The 220,500 tons, or 87 percent of the U.S. output, represented the output of 15 States.

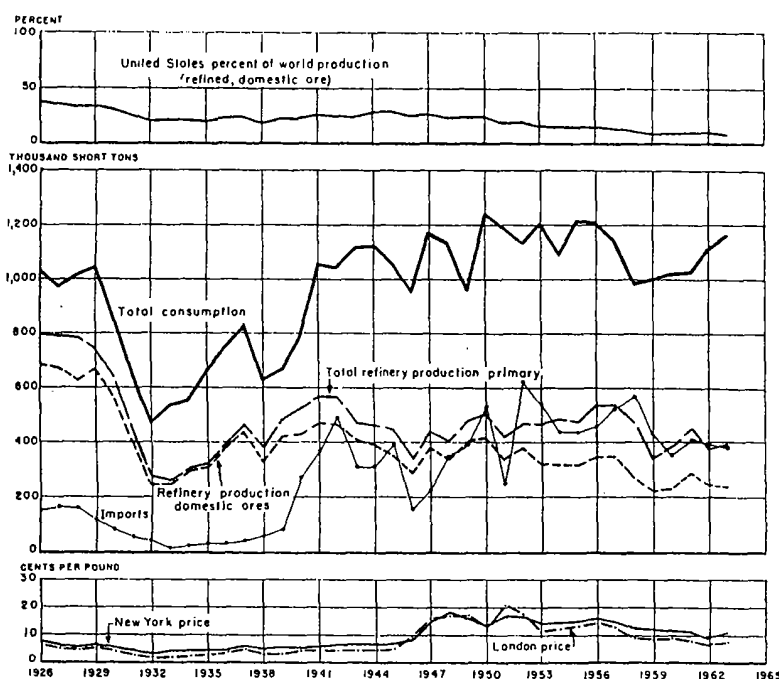


FIGURE 1.—Trends in the lead industry in the United States, 1926-63. Consumption includes primary refined, antimonial, and secondary lead, and lead in pigments made directly from ore. Imports are factored to include 95 percent of lead content or ores, mattes, and concentrates and 100 percent of pigs, bars, base bullion, and scrap.

TABLE 2.—Mine production of recoverable lead in the United States, by States

State	(Short tons)					
	1954-58 (average)	1959	1960	1961	1962	1963
Arizona.....	10,906	9,999	8,495	5,937	6,906	5,815
Arkansas.....		38				
California.....	4,706	227	440	103	455	823
Colorado.....	17,729	12,907	18,080	17,765	17,411	19,918
Idaho.....	64,605	62,395	42,907	71,476	84,058	75,759
Illinois.....	3,238	2,570	3,000	3,430	3,610	2,901
Kansas.....	4,544	481	781	1,449	970	1,027
Kentucky.....	247	409	558	856	743	831
Missouri.....	122,783	105,165	111,948	98,785	60,082	79,844
Montana.....	14,445	7,672	4,879	2,643	6,121	5,000
Nevada.....	4,669	1,357	987	1,701	771	1,126
New Mexico.....	3,327	829	1,096	2,332	1,134	1,014
New York.....	1,216	481	775	879	1,063	1,009
North Carolina.....	5		424	318	219	62
Oklahoma.....	10,311	601	930	980	2,710	3,192
Utah.....	45,061	36,030	39,398	40,894	38,199	45,028
Virginia.....	3,286	2,770	2,152	3,733	4,050	3,500
Washington.....	10,738	10,310	7,725	8,053	6,033	5,374
Wisconsin.....	1,698	745	1,105	680	1,304	1,116
Other States.....	8		23	27	58	30
Total.....	324,373	255,680	246,669	261,921	230,956	263,369

Improvement in the market for lead, resulted in expansion of activity in exploring lead deposits, as well as rehabilitation of current production facilities. Production of this activity will not be forthcoming until activity is, however, reflected in the following.

The new lead belt in southeast Missouri is attracting major lead exploration attention in the area. Major companies were actively engaged in exploration in this area during the year and it appears to be a belt some 50 miles long through Washington, Iron, Reynolds, and other counties. In 1963 the St. Joseph Lead Co. concentrated on the old lead belt under the production shaft was bottomed at the installation of production facilities. The concentrator was increased to 7,000 tons per day and the new Fletcher plant located in the area began on June 27 with a planned production of 100 tons per day and initial production expected in 1964.

The 25 leading lead-producing mines produced 77 percent of the total domestic mine production; the 4 largest units 53 percent. Production of lead by Idaho mines decreased 10 percent in 1963. The production came from the Coeur d'Alene area, where the output by the Bunker Hill and Lucky Star (Star unit area) and Page mines. Development in the Coeur d'Alene area, and progress was made in expanding ore reserves. The Coeur d'Alene Co. continued driving a crosscut from the 3100 level of the Crescent mine to the 3250 level of the Star-Morning mine. Development work in the Star-Morning mine was completed. The Friday mine to the 3250 level and began production. The Jutila property.

Mines situated in Utah reported output of 45,028 tons, a 20 percent increase compared with 1962. Significant producers: United States and Idaho Refining & Mining Co. (USSR & M Co.), and Ophir (USSR & M Co.). Kennecott was sinking a 1,500-foot production shaft in the Tintic district and shipped development ore. The Smelting & Refining Co. lead smelter at Panguitch was expanded. The USSR & M Co. from the United States Butterfield mine of Kennecott was extended. The Mammoth mine shaft in Idaho was deepened to an ore shoot previously completed a crosscut to an ore shoot previously.

* St. Joseph Lead Co. Annual Report, 1963, p. 12.

TABLE 3.—Ores yielding lead and zinc in the United States in 1963
(Short tons)

State	Lead ore			Zinc ore			Lead-zinc ore			Copper-lead, copper-zinc, and copper-lead-zinc ores			All other sources ¹			Total		
	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc	Gross weight	Lead	Zinc
Arizona.....	2,127	178	11	8,454	42	1,099	283,021	5,553	16,266	116,251	29	7,788	26,899,785	13	255	26,319,038	5,815	25,419
Arkansas.....	1,294	436	2	(²)	(²)	(²)	3,043	383	96	501,069	11,943	15,321	4,510	8,847	4	8,847	8,847	101
California.....	1,453	84	11	(²)	(²)	(²)	4,444,202	8,473	32,344	32,344	11,943	15,321	4,510	8,847	4	8,847	19,018	48,109
Colorado.....	183,337	19,217	1,627	25,617	(²)	(²)	8,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Idaho.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Illinois.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Kansas.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Kentucky.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Louisiana.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Montana.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Nevada.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
New Mexico.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Oklahoma.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Tennessee.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Utah.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Washington.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Wisconsin.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
New Jersey.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
New York.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
North Carolina.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Indiana.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Pennsylvania.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Virginia.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Other States.....				(²)	(²)	(²)	1,898,036	33,473	8,094	501,069	11,943	15,321	4,510	8,847	4	8,847	75,759	63,267
Total.....	3,450,063	101,544	2,148	6,184,106	6,730	231,894	4,541,237	124,086	235,206	2,049,671	11,228	31,858	55,734,667	9,781	29,148	71,959,749	253,360	829,254

¹ Lead and zinc recovered from other ores (copper, gold, silver, etc.) and from mill slugs, tailings, and dumps.
² Combined with lead-zinc ore to avoid disclosing individual company confidential data.

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TABLE 4.—Mine production of recoverable lead
(Short tons)

Month	1962	1963	
January.....	22,726	15,476	August.....
February.....	21,994	13,180	September.....
March.....	23,675	14,772	October.....
April.....	23,943	20,786	November.....
May.....	24,984	24,083	December.....
June.....	23,955	22,322	
July.....	21,179	23,599	

TABLE.—Twenty-five leading lead-producing
1963, in order of o

Rank	Mine	District or region	State
1	Federal.....	Southeastern Missouri	Missouri.....
2	Bunker Hill.....	Coeur d'Alene	Idaho.....
3	Viburnum.....	Southeastern Missouri	Missouri.....
4	United States & Lark.....	West Mountain (Bingham)	Utah.....
5	Lucky Friday.....	Coeur d'Alene	Idaho.....
6	Star-Morning Unit.....	Coeur d'Alene	Idaho.....
7	Idarado.....	Upper San Miguel	Colorado.....
8	Indian Creek.....	Southeastern Missouri	Missouri.....
9	Page.....	Coeur d'Alene	Idaho.....
10	United Park City.....	Blue Ledge	Utah.....
11	Iron King.....	Big Bug	Arizona.....
12	Pend Oreille.....	Metaline	Washington.....
13	Mayflower Unit.....	Blue Ledge	Utah.....
14	Austinville & Ivanhoe Mines.....	Austinville	Virginia.....
15	Eagle.....	Red Cliff (Battle Mountain)	Colorado.....
16	Badger State.....	Summit Valley	Montana.....
17	Sunnyside.....	Eureka	Colorado.....
18	Ophir Unit.....	Ophir	Utah.....
19	Tintic.....	Tintic	Utah.....
20	Deardorff Group.....	Upper Mississippi Valley	Illinois.....
21	Emperius.....	Creda	Colorado.....
22	Balmat.....	St. Lawrence County	New York.....
23	Three Kids.....	Las Vegas	Nevada.....
24	Kearney.....	Central	New Mexico.....
25	Keystone.....	Elk Mountain	Colorado.....

Output of lead from mines in Colorado increased 10 percent. Activity increased at the mineral area. Major production was operated by The New Jersey Zinc Co. Telluride, operated by Idarado Mining

continued activity at the Sunnyside and Shenandoah mines at Silverton. Consolidated Parnett Co. continued operations at the Wellington mine and concentrator at Breckenridge. The Emperius mine at Creede was reopened, and the Keystone mine at Crested Butte resumed operations. Humphreys Engineering Co. operated the Cascade mine in Clear Creek County.

Lead production of Washington again declined to 5,400 tons. The Metaline district was the main producing area with mines operated by Pend Oreille Mines & Metals Co. and American Zinc, Lead & Smelting Co. Production from the Grandview mine and adjoining Mineral Rights property was substantially reduced in order to augment underground development.

Arizona production declined to 5,800 tons. The principal producer continued to be the Iron King mine of Shattuck Denn Mining Corp. Nash & McFarland increased output from the Flux mine in Santa Cruz County.

Montana production decreased to 5,000 tons. The reduction was due, in part, to decreases in production at the Badger mine at Butte and to decreases in lead recovered as a byproduct of manganese operations in Philipsburg, slag fuming at East Helena, and other small dump reprocessing operations.

The Hanover mine in New Mexico was reopened in October by The New Jersey Zinc Co., and the Kearney mine was a major producer in the State.

Production from the Kansas-Oklahoma area of the Tri-State district, processed principally at the Central Mill operated by The Eagle-Picher Co., increased about 15 percent.

The Illinois-Wisconsin area output decreased from 5,000 tons to 4,000 tons. A fire at the Shullsburg mine operated by The Eagle-Picher Co., necessitated suspension of operations until July when mill rebuilding and a new incline shaft were completed. Eagle-Picher also opened the Booty-Thompson mine in April and trucked the ore to the Graham mill near Galena, Ill. American Zinc, Lead & Smelting Co. operated the Hancock-Winskill and the Thompson-Temperly mines with the ore treated in the Vinegar Hill mills near Shullsburg, Wis. The Ivey Construction Co. operated a mine at Linden, Wis., under lease from The Eagle-Picher Co., and the Grimes Mining Co. began production from a mine and mill on the Burshaw property.

Nevada increased production although byproduct lead from the Three Kids manganese operation was terminated in 1962. California output was almost double that achieved in 1962.

Lead produced as a byproduct of predominately zinc ore in Kentucky, New York, North Carolina, and Virginia was some 11 percent below the 1962 output.

SMELTER AND REFINERY PRODUCTION

Refined lead was produced in the United States at primary refineries that processed ore and concentrate, base bullion, and small quantities of scrap as well as at secondary smelters that process scrap almost exclusively. The lead was derived from three principal sources—domestic mine production, imports of foreign ore and base bullion, and scrap materials. Refined lead and antimonial lead were produced

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at both primary and secondary plants. They comprise the domestic primary lead production.

Smelters:

American Smelting and Refining Co.
East Helena, Mont.
El Paso, Tex.
International Smelting & Refining Co.
Tooele, Utah

Smelter-refineries:

American Smelting and Refining Co.
Selby, Calif.
Perth Amboy, N.J.
The Bunker Hill Co.
Kellogg, Idaho
St. Joseph Lead Co.
Herculaneum, Mo.
The Eagle-Picher Co.
Galena, Kans.

Refineries:

United States Smelting Lead Refinery, Inc.
East Chicago, Ind.
American Smelting & Refining Co.
Omaha, Nebr.

Major secondary smelting firms that report are as follows:

American Smelting & Refining Co. (including Federal Smelter)
Los Angeles, San Francisco, and Selby, Calif.
Whiting, Ind.
Omaha, Nebr.
Newark and Perth Amboy, N.J.
Houston, Tex.
Bers & Co., Inc., Philadelphia, Pa.
The Bunker Hill Co., Seattle, Wash.
Continental Smelting & Refining Co., McCook, Ill.
Electric Storage Battery Co., Philadelphia, Pa.
General Battery & Ceramic Corp., Reading, Pa.
Goldsmith Bros. Division of National Lead Co., Chicago, Ill.
Gopher Smelting & Refining Co., St. Paul, Minn.
Gulf Coast Lead Co., Tampa, Fla.
Imperial Type Metals Co., plants: Chicago, Ill.,
Industrial Metal Melting Co., Inc., Baltimore, Md.
Inland Metals Refining Co., Chicago, Ill.
Nassau Smelting & Refining Co., Inc., Tottenville, N.Y.
National Lead Co. (including Magnus Metal Division)
Inc., and Master Metals, Inc.), plants:
Los Angeles, Calif.
Atlanta, Ga.
Chicago and Granite City, Ill.
Indianapolis, Ind.
Topeka, Kans.
Baltimore, Md.
St. Louis Park, Minn.
St. Louis, Mo.
Fremont, Nebr.
Perth Amboy, N.J.
Depew, N.Y.
Cincinnati and Cleveland, Ohio
Portland, Oreg.
Pittsburgh, Pa.
Dallas and Houston, Tex.

National Metal & Smelting Co., Fort Worth, Tex.
 North American Smelting Co., Wilmington, Del.
 Price Battery Corp., Hamburg, Pa.
 Revere Smelting & Refining Co., Newark, N.J.
 Schuylkill Products Co., Baton Rouge, La.
 Southeastern Lead Co., Tampa, Fla.
 Southern Lead Co., Dallas, Tex.
 United States Smelting Lead Refinery, Inc., East Chicago, Ind.
 Hyman Viener & Sons, Richmond, Va.
 Western Lead Products Co., City of Industry, Calif.
 Winston Lead Smelting Co., Winston-Salem, N.C.

Refined Lead, Primary and Secondary.—Production of refined lead in the United States produced from all sources—primary, secondary, and remelt—amounted to 529,300 tons compared with 494,500 tons in 1962. Primary refineries produced 394,700 tons from primary sources of which domestic ores supplied 61 percent and 3,800 tons were from secondary materials. Secondary plants produced 130,800 tons from processed secondary materials. Remelt lead from all sources totaled 25,600 tons for the year.

Antimonial Lead, Primary and Secondary.—The lead content of antimonial lead produced in the United States totaled 276,300 tons. Of this total, 237,100 tons, or 86 percent, came from secondary plants and the remaining 39,200 tons from primary plants. Scrap was the source of 20 percent, domestic ore 42 percent, and foreign ores 38 percent of the primary smelter output.

Raw Material Source.—Primary lead materials smelted in primary plants provided 394,700 tons of refined lead and 31,500 tons of lead in antimonial lead. Domestic sources contributed 60 percent of the total and foreign sources the remaining 40 percent.

Secondary lead recovered from scrap amounted to 493,500 tons. Of this, 134,500 tons was in the form of refined and remelt soft lead; 244,800 tons in antimonial lead; and 114,200 tons in other alloys. New scrap, primarily drosses from scrap smelting, contributed 13 percent of the lead, and old scrap, predominantly battery plates, furnished 87 percent.

TABLE 6.—Refined lead produced at primary refineries in the United States, by source material

	(Short tons)					
	1954-58 (average)	1959	1960	1961	1962	1963
Refined lead:						
From primary sources:						
Domestic ores and base bullion...	321,870	225,270	228,890	288,078	245,645	230,660
Foreign ores and base bullion...	180,603	115,661	153,537	161,487	130,418	155,072
Total.....	502,373	340,931	382,426	449,565	376,063	385,732
From secondary sources.....	3,763	1,104	4,776	1,560	1,842	3,741
Grand total.....	506,136	342,125	387,212	451,134	377,905	389,473
Average sales price per pound.....	\$0.141	\$0.116	\$0.117	\$0.103	\$0.093	\$0.108
Calculated value of primary refined lead (thousands) ¹	\$141,669	\$78,414	\$89,490	\$92,610	\$69,948	\$85,262

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

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TABLE 7.—Antimonial lead produced at primary States

Year	Production (short tons)	Antimony content	
		Short tons	Percent
1954-58 (average).....	61,755	3,258	5.3
1959.....	37,487	1,924	5.1
1960.....	30,230	1,675	5.2
1961.....	35,080	1,894	5.4
1962.....	33,325	2,249	6.7
1963.....	41,077	1,890	4.6

TABLE 8.—Stocks and consumption of new antimonial States in 1963

Class of consumers and type of scrap	(Short tons, gross weight)	
	Stocks Jan. 1 ¹	Receipts
Smelters and refiners:		
Soft lead.....	3,218	53,249
Hard lead.....	1,265	15,868
Cable lead.....	1,133	27,313
Battery-lead plates.....	23,377	419,373
Mixed common babbitt.....	233	3,312
Solder and tinny lead.....	290	9,027
Type metals.....	1,069	28,025
Drosses and residues.....	14,545	92,446
Total.....	45,130	646,603
Foundries and other manufacturers:		
Soft lead.....	122	326
Hard lead.....	295	147
Cable lead.....	31	28
Battery-lead plates.....	21	3
Mixed common babbitt.....	127	13,930
Solder and tinny lead.....	41	275
Type metals.....		
Drosses and residues.....	201	
Total.....	838	14,707
Grand total:		
Soft lead.....	3,340	53,575
Hard lead.....	1,560	16,005
Cable lead.....	1,164	27,339
Battery-lead plates.....	23,398	419,376
Mixed common babbitt.....	360	17,242
Solder and tinny lead.....	331	9,302
Type metals.....	1,069	28,025
Drosses and residues.....	14,746	92,446
Grand total.....	45,988	661,310

¹ Revised figures.

TABLE 12.—Lead consumption in the United States, by products

(Short tons)					
Product	1962	1963	Product	1962	1963
Metal products:			Pigments—Continued		
Ammunition.....	47,779	49,894	Pigment colors.....	11,660	11,767
Bearing metals.....	16,472	21,713	Other ¹	3,892	7,813
Brass and bronze.....	20,907	21,943	Total.....	102,068	99,076
Cable covering.....	56,676	57,707	Chemicals:		
Calking lead.....	72,648	76,308	Gasoline antiknock addi-		
Casting metals.....	7,355	7,856	tives.....	168,926	192,811
Collapsible tubes.....	11,972	14,832	Miscellaneous chemicals.....	2,715	632
Foil.....	3,720	3,952	Total.....	171,641	193,443
Pipes, traps, and bends.....	19,819	20,100	Miscellaneous uses:		
Sheet lead.....	28,540	20,495	Annealing.....	5,306	4,847
Solder.....	66,873	67,945	Galvanizing.....	1,146	1,631
Storage batteries:			Lead plating.....	236	220
Battery grids, posts,			Weights and ballast.....	10,330	12,207
etc.....	217,525	222,286	Total.....	17,018	18,905
Battery oxides.....	202,381	216,795	Other, unclassified uses.....	17,479	16,057
Terne metal.....	1,402	1,983	Grand total ²	1,109,635	1,163,358
Type metal.....	26,760	26,069			
Total.....	800,529	835,878			
Pigments:					
White lead.....	11,091	8,846			
Red lead and litharge.....	76,325	70,649			

¹ Includes lead content of leaded zinc oxide and other pigments and chemicals.² Includes lead which went directly from scrap to fabricated products.

TABLE 13.—Lead consumption in the United States, by months

(Short tons)					
Month	1962	1963	Month	1962	1963
January.....	98,828	100,789	August.....	90,303	93,833
February.....	88,415	96,023	September.....	91,122	94,587
March.....	91,040	92,606	October.....	105,145	111,149
April.....	86,859	95,340	November.....	96,293	101,723
May.....	94,685	98,264	December.....	91,500	99,372
June.....	89,988	94,024	Total ¹	1,109,635	1,163,358
July.....	79,567	85,048			

¹ Includes lead content of leaded zinc oxide and other pigments and lead which went directly from scrap to fabricated products.

TABLE 14.—Lead consumption in the United States in 1963, by class of products and types of material

(Short tons)					
Product	Soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
Metal products.....	208,311	80,634	47,368	16,451	356,604
Storage batteries.....	220,860	218,214	7		439,081
Pigments.....	94,912	178			95,090
Chemicals.....	193,443				193,443
Miscellaneous.....	10,915	7,987	3		18,905
Unclassified.....	13,719	1,525	665		15,809
Total.....	740,160	314,438	47,943	16,451	1,118,992

¹ Excludes 40,381 tons of lead that went directly from scrap to fabricated products and 3,965 tons of lead contained in leaded zinc oxide and other pigments and chemicals.

TABLE 15.—Lead consumption

(Short tons)		
State	Refined soft lead	Lead in antimonial lead
California.....	81,297	
Colorado.....	1,500	
Connecticut.....	12,446	
District of Columbia.....	107	
Florida.....	4,847	
Georgia.....	21,692	
Illinois.....	71,485	
Indiana.....	62,568	
Kansas.....	9,710	
Kentucky.....	2,888	
Maryland.....	5,766	
Massachusetts.....	5,697	
Michigan.....	16,116	
Missouri.....	34,069	
Nebraska.....	6,439	
New Jersey.....	184,658	
New York.....	32,689	
Ohio.....	12,634	
Pennsylvania.....	48,483	
Rhode Island.....	1,638	
Tennessee.....	218	
Virginia.....	2,505	
Washington.....	6,925	
West Virginia.....	15,731	
Wisconsin.....	767	
Alabama and Mississippi.....	563	
Arkansas and Oklahoma.....	4,028	
Hawaii and Oregon.....	542	
Iowa and Minnesota.....	1,946	
Louisiana and Texas.....	112,605	
Montana and Idaho.....	12,376	
New Hampshire, Maine, Delaware.....	6,393	
North and South Carolina.....	222	
Utah, Nevada, Arizona.....	122	
Total.....	740,160	8

¹ Excludes 40,381 tons of lead which went directly from scrap contained in leaded zinc oxide and other nonspecified pigments.

LEAD PIGMENTS

Production of lead pigments, consumer, and battery manufacturers increased in 1963. All of the white lead, as 175,000 tons of black oxide (battery refined pig lead and, combined, represented the manufacture of lead oxide was the lead content of ore used to produce of basic lead is not published and litharge, is included with litharge.

Consumption and Uses, White Lead again declined, both dry and in oil, with 800 tons less than the 1962 shipment. Most of the consumption decreased in the ceramic industry consumed 1 percent. Chemicals, greases, plasticizers, and stearates.

Basic Lead Sulfate.—Most of the lead in leaded zinc oxide. Individual production held to avoid disclosure of company consumption.

Red Lead.—Production and shipments higher in 1963. Shipments totaled 26,200 tons.

accounted for 50 percent. The other 50 percent was widely distributed for use in lubricants, petroleum, rubber, and miscellaneous small uses.

Litharge.—Shipments of litharge exceeded production in 1962 by 9,900 tons. The shipments were distributed among various manufacturers. Ceramics, chrome pigments, oil refining, rubber, and varnish accounted for 30 percent of the total. To avoid disclosing company confidential data, a large percentage of litharge shipped has been incorporated into the group classified "Other." Production of leaded litharge, known to the trade as "black oxide," by battery manufacturers amounted to 182,900 tons in comparison to the 161,000 tons produced in 1962.

Prices.—The quoted price of white lead was 16.5 cents per pound in carload lots, f.o.b. plants until September 9, when it increased to 17.75 cents per pound. The average value of 1963 shipments of dry white lead was \$366 per ton; white lead in oil averaged \$467 per ton. Red lead price advanced on January 21 from 13.75 cents to 14.25 cents per pound where it held until June 10 when raised to 14.50 cents per pound. During the last 6 months the price advanced five times to 16.25 cents per pound, quoted on December 2. The average value of shipments, as reported, however, declined from \$285 per ton to \$282 per ton in 1963. The price of commercial litharge, f.o.b. works in less than carload lots also trended upward during the year advancing from the year opening quotation of 13.25 cents per pound in 7 increments to a yearend price of 15.75 cents per pound reached on December 2. Average value of litharge shipments was \$238 per ton.

TABLE 16.—Production and shipments of lead pigments¹ and oxides in the United States

Pigment	1962				1963			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Short tons	Value ¹			Short tons	Value ²	
			Total	Average per ton			Total	Average per ton
White lead:								
Dry	10, 161	10, 697	\$4, 240, 382	\$400	10, 239	10, 075	\$3, 688, 456	\$3.66
In oil ³	5, 410	5, 602	2, 687, 363	476	3, 758	5, 327	2, 485, 397	4.67
Total	15, 571	16, 199	6, 907, 725	426	13, 997	15, 402	6, 173, 823	4.01
Red lead	24, 898	25, 517	7, 279, 183	285	25, 780	26, 245	7, 391, 928	2.82
Litharge	102, 908	103, 397	23, 860, 746	231	93, 958	103, 834	24, 672, 270	2.38
Black oxide	161, 023				182, 934			

¹ Except for basic lead sulfate, figures withheld to avoid disclosing individual company confidential data.

² At plant, exclusive of container.

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

LEAD

TABLE 17.—Lead content of lead and zinc pigments by domestic manufacturers, by

(Short tons)

Pigment	1962			Total lead in pigments
	Lead in pigments produced from—		Pig lead	
	Ore			
	Domestic	Foreign		
White lead.....			12,457	12,457
Red lead.....			22,570	22,570
Litharge.....			95,704	95,704
Black oxide.....			153,819	153,819
Leaded zinc oxide.....	1,727	760		2,487
Total.....	1,727	760	284,550	287,037

¹ Excludes lead in basic lead sulfate; figures withheld to avoid disclosing data.

TABLE 18.—Distribution of white lead (dry and in oil)

(Short tons)

Industry	1954-58 (average)	1959	1960
Paints.....	19,117	15,148	14,141
Ceramics.....	(¹) 508	243	21
Other.....	4,131	3,833	3,677
Total.....	23,756	19,224	17,839

¹ Excludes basic lead sulfate; figures withheld to avoid disclosing data.

² Figures for plasticizers and stabilizers withheld to avoid disclosing data.

TABLE 19.—Distribution of red lead shipments

(Short tons)

Industry	1954-58 (average)	1959	1960
Paints.....	14,185	12,098	12,000
Storage batteries.....	(¹)	(¹)	(¹)
Ceramics.....	(¹)	(¹)	(¹)
Other.....	12,495	9,807	9,400
Total.....	26,680	21,905	22,630

¹ Included with "Other."

TABLE 20.—Distribution of litharge shipments, by industries
(Short tons)

Industry	1964-68 (average)	1969	1960	1961	1962	1963
Ceramics.....	(¹)	15,340	15,763	14,393	17,762	17,762
Chrome pigments.....	4,321	4,682	(¹)	(¹)	(¹)	5,763
Floor covering.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Insecticides.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Oil refining.....	3,421	3,096	2,371	2,147	2,404	1,973
Rubber.....	1,705	1,808	1,373	1,243	1,792	1,702
Storage batteries.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Varnish.....	3,878	4,725	3,471	3,394	4,083	4,240
Other.....	110,448	76,302	76,672	77,773	77,366	72,394
Total.....	123,773	106,913	98,640	98,960	103,397	103,834

¹ Included with "Other."

TABLE 21.—U.S. imports for consumption of lead pigments and compounds

Kind	1962		1963	
	Short tons	Value (thousands)	Short tons	Value (thousands)
White lead.....	2,361	\$578	2,434	\$549
Red lead.....	555	83	1,171	198
Litharge.....	15,697	2,220	22,440	3,692
Other lead pigments.....	34	13	12	9
Other lead compounds.....	439	124	238	52
Total.....	18,986	3,027	26,295	4,400

Source: Bureau of the Census.

TABLE 22.—U.S. exports of lead pigments and compounds

Kind	1962		1963	
	Short tons	Value (thousands)	Short tons	Value (thousands)
Lead pigments ¹	1,919	\$595	1,845	\$620
Lead arsenate.....	711	249	401	135
Total.....	2,630	844	2,246	755

¹ Includes white lead, red lead, and litharge.

Source: Bureau of the Census.

STOCKS

Stocks of refined lead at primary producing plants declined 87,200 tons during the year to 49,300 tons at yearend, and antimonial lead stocks increased to 7,300 tons. Total yearend stocks representing physical inventories at primary plants, regardless of ownership, but not including material in process or in transit, were 120,800 tons compared with 196,700 tons at the close of 1962.

Stocks reported by the American Bureau of Metal Statistics indicated an additional 20,300 tons of lead in bullion was in process at

LEAD

or in transit to primary plants and about 2 was in process at smelters. Total stocks of in raw materials was thus 166,900 tons, a decrease the year.

Consumer and secondary smelter stocks 93,500 tons at the end of 1962 to 119,900 and were last exceeded in 1959. The major soft lead with a gain of 20,400 tons and in amount of 6,200 tons.

On December 31, the total lead inventory stockpiles was 1,378,400 tons of which 1, national (strategic) stockpile and 328,000 stockpile.

TABLE 23.—Stocks of lead at primary smelters
States, Dec. 31

Stocks	(Short tons)		
	1964-68 (average)	1969	1960
Refined pig lead.....	76,280	107,683	148,412
Lead in antimonial lead.....	11,483	11,361	10,483
Lead in base bullion.....	12,000	12,840	26,021
Lead in ore and matte.....	40,887	89,196	65,210
Total.....	140,346	171,079	250,142

TABLE 24.—Consumer stocks of lead in the United States
material

Year	(Short tons, lead content)	
	Refined soft lead	Antimonial lead
1959.....	80,277	38,688
1960.....	49,725	39,230
1961.....	55,951	33,633
1962.....	51,121	34,389
1963.....	71,658	40,606

PRICES

The quoted New York price for common 1963 was 10.00 cents per pound. On January 10.50 cents and then increased in increments July 23, August 19, September 16, and October the price firmed at 12.50 cents for the remainder of the year.

Quotations on the London Metal Exchange £53.75 per long ton in January (equivalent U.S. currency—computed on the average rate to a high of £77.38 (9.66 cents) on December the year was 7.93 cents per pound.

Small quantities of certain alloying elements change the oxidation rate of tin.⁹ If the formation of tin oxide (SnO) is thermodynamically favored, elements with a valence greater than tin increase the rate of formation of SnO. When the formation of SnO is not favored, the alloying element is oxidized preferentially.

Stannic oxide was found to be a broadband semiconductor, and the antimony-doped specimens showed n-type behavior.¹⁰

Tributyl tin oxide additions to preparations for treating hospital floors and walls and in laundry rinse solutions was effective in the control of staphylococcus in hospitals.¹¹

The manufacture of tinplate and tin coating, thickness of the tin coating, composition of the steel base, and production of tinplate in various countries was described.¹²

A corrosion test for tinplate was described.¹³ The polarization resistance and corrosion current, both related to corrosion rate, are determined from graphs of voltage versus current and of voltage versus the log of the current, respectively.

A new, short-cycle continuous heat-treating process to anneal mild steel strip in 15 seconds is being developed.¹⁴ The strip is preheated in a duct of molten lead-bismuth alloy, annealed in an electric heating section, quenched to 200°-300° C in a second duct of lead-bismuth alloy, and air-cooled in storage.

A small continuous hot-tinning line on which copper or steel strips or wire could be tinned under any desired conditions was constructed by the Tin Research Institute, London.¹⁵ Oil well drill pipe couplings were tinplated, enabling faster makeup or breaking of a string of pipe by reducing friction and sealing joints.¹⁶

⁹ Boggs, W. E., R. H. Kachik, and G. E. Pellissier. The Effect of Alloying Elements on the Oxidation of Tin. *J. Electrochem. Soc.*, v. 110, No. 1, January 1963, pp. 4-11.

¹⁰ Loch, L. D. The Semiconducting Nature of Stannic Oxide. *J. Electrochem. Soc.*, v. 110, No. 10, October 1963, pp. 1081-1083.

¹¹ Rees, Glyn. A Possible Solution to the Problem of the Ubiquitous Hospital Infection. Tin and Its Uses, No. 60, Tin Research Institute (Middlesex, England) 1963, pp. 1-3.

¹² Hoare, W. E. Tinplate Handbook. 4th ed., Tin Research Institute (Middlesex, England) March 1963, 58 pp.

¹³ Butler, T. J., and P. R. Carter. A Polarization Method for Determining the Corrosion Rate of Tinplate. *Electrochem. Tech.*, v. 1, No. 1-2, January-February 1963, pp. 22-27.

¹⁴ Iron Age. Tinplate Gets "Instant" Anneal. V. 191, No. 17, Apr. 25, 1963, p. 123.

¹⁵ Thwaites, O. J. The Continuous Hot-Tinning of Strip and Wire. *Metallurgia* (Manchester, England), v. 67, No. 406, August 1963, pp. 69-80.

¹⁶ American Metal Market. Tinplate Finds New Use in Drill Pipe Couplings. V. 70, No. 231, Dec. 4, 1963, p. 6.

Titanium

By John W. Stamper¹



PRODUCTION and consumption of titanium were the second highest on record. Ilmenite output of 888,000 tons and rutile production was the highest. Production of titanium pigments was down 4 percent, but consumption was up 3 percent over that of 1962.

Owing to the increased demand for rutile in the oxide by the chloride process, world output of rutile jumped 47 percent over that of 1962. Ilmenite was chiefly for making titanium dioxide by the sulfate process, 3 percent.

A titanium sponge metal plant in the United Kingdom to resume production in 1964. New titanium dioxide plants and expansions of existing facilities were completed in Australia, Canada, and West Germany. Adco, which included two 25,000-ton-per-year plants, and the process, were planned in France, Spain, India, and a 20,000-ton-per-year plant was built in the United States by the chloride process.

LEGISLATION AND GOVERNMENT

Under the Antidumping Act of 1921, as amended, the U.S. Customs and Tariff Department investigated charges by domestic producers of titanium dioxide pigment in the United States from Finland, France, Japan, and the United Kingdom. The U.S. Customs and Tariff Department found no evidence of dumping by Finland and the United Kingdom; however, by France and Japan. France and Japan were held to be dumping under the act and were referred to the U.S. Tariff Commission for a determination of whether the practice was injurious to the domestic industry. The Commission ruled that imports from France and Japan were dumping and that domestic industry. Imports from Japan were referred to the Tariff Commission early in 1964.

A total of 85 short tons of titanium sponge metal of 30-35 Rockwell C hardness was sold by General Services Administration at a price of \$1.18 per pound.

¹ Commodity specialist, Division of Minerals.

TABLE 1.—Salient titanium statistics

	1954-58 (average)	1959	1960	1961	1962	1963
United States:						
Ilmenite concentrate: ¹						
Mine shipments, short tons..	637,723	637,283	789,237	782,629	809,037	890,071
Value, thousands.....	\$12,980	\$12,106	\$14,656	\$13,320	\$13,974	\$16,529
Imports, short tons.....	359,227	371,687	265,645	207,161	166,434	200,380
Consumption, do.....	771,741	917,747	888,080	929,147	944,707	874,958
Titanium slag: Consumption						
do.....	128,452	143,320	120,492	130,184	138,205	162,416
Rutile concentrate:						
Mine shipments, do.....	8,212	8,648	9,226	7,964	8,033	11,311
Value, thousands.....	\$1,009	\$877	\$957	\$778	\$933	\$1,262
Imports, short tons.....	40,959	23,228	20,235	27,497	35,960	71,920
Consumption, do.....	84,270	23,741	24,229	20,648	31,749	85,189
Sponge metal:						
Production, do.....	9,839	3,898	6,311	6,727	6,730	7,679
Imports for consumption						
do.....	1,683	1,563	2,231	2,490	925	1,468
Consumption, do.....	6,957	3,953	5,487	6,991	7,136	8,565
Price: Grade A-1, Dec. 31						
per pound.....	\$2.72	\$1.60	\$1.60	\$1.60	\$1.50	\$1.50
World production:						
Ilmenite concentrate, short tons..	1,623,300	1,937,900	2,207,000	2,305,900	2,168,000	2,222,000
Rutile concentrate, do.....	103,200	100,400	114,200	128,600	160,000	220,100
Sponge metal, do.....	13,460	7,000	7,900	9,300	8,500	9,800

¹ Includes a mixed product containing rutile, leucocane, and altered ilmenite.² Includes titanium slag.³ Excludes use for making titanium dioxide pigment, 1960-63, inclusive.⁴ Revised figure.

DOMESTIC PRODUCTION

Concentrates.—A record 888,000 tons of ilmenite was produced in New York, Florida, New Jersey, and Virginia. Production of 11,900 tons of rutile in Florida and Virginia was the highest since 1956.

Ilmenite production was reported by American Cyanamid Co., Piney River, Va.; E. I. du Pont de Nemours & Co., Inc., Starke and Lawley, Fla.; M & T Chemicals, Inc., Hanover County, Va.; National Lead Co., Tahawus, N.Y.; The Glidden Co., Lakehurst, N.J.; Titanium Alloy Manufacturing Division, National Lead Co., Skinner, Fla.; and The Florida Minerals Co., Vero Beach, Fla. Porter Brothers Corp. shipped ilmenite from stockpiles at Boise, Idaho.

Rutile producers were as follows: M & T Chemicals, Inc., Beaver Dam, Va.; Titanium Alloy Manufacturing Division, National Lead Co., Skinner, Fla.; and The Florida Minerals Co., Vero Beach, Fla.

The town of Tahawus, N.Y., was moved 10 miles to the southwest to permit extending the open pit mine of the Titanium Alloy Manufacturing Division.²

Metal.—Titanium sponge metal production rose 17 percent above that of 1962. Consumption of sponge metal also was at high level and output of titanium ingot was the second highest on record.

Commercial producers of titanium sponge metal were E. I. du Pont de Nemours & Co., Inc., Newport, Del.; U.S. Industrial Chemicals Co., Ashtabula, Ohio; and Titanium Metals Corp. of America (TMCA), Henderson, Nev.

² Skillings' Mining Review. Tahawus Mining Town Moved to New Site. V. 62, No. 49, Dec. 7, 1963, p. 12.

TITANIUM

TABLE 2.—Production and mine shipments of titanium domestic ores in the United States

Year	Production, short tons (gross weight)	Short tons (gross weight)
ILMENITE ¹		
1954-58 (average).....	627,246	637,723
1959.....	634,886	637,283
1960.....	786,372	789,237
1961.....	782,412	782,629
1962.....	807,725	809,037
1963.....	888,400	890,071
RUTILE		
1954-58 (average).....	9,206	8,212
1959.....	9,466	8,648
1960.....	8,808	9,226
1961.....	9,045	7,964
1962.....	9,981	8,033
1963.....	11,916	11,311

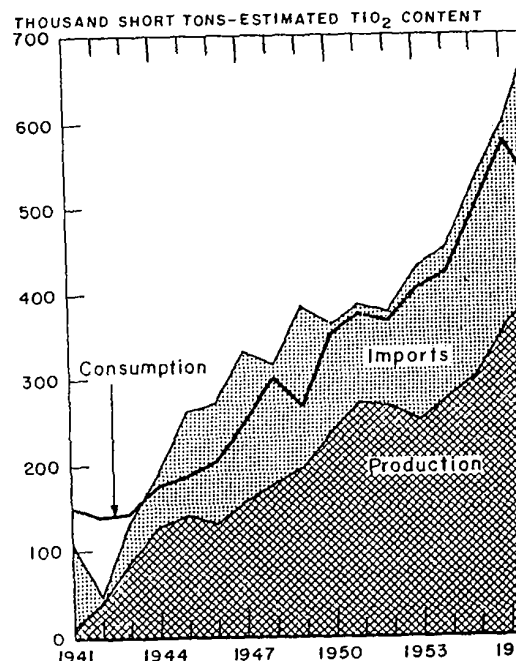
¹ Includes a mixed product containing rutile, leucocane, and altered ilmenite.² Revised figure.

FIGURE 1.—Domestic production, imports, and consumption of titanium domestic ores and mixed product

Titanium melters were Harvey Aluminum, Inc., Torrance, Calif.; Bridgeport Brass Co. (Reactive Metals Products), Niles, Ohio; Oregon Metallurgical Corp., Albany, Oreg.; Crucible Steel Co. of America, Midland, Pa.; Republic Steel Corp., Massillon and Canton, Ohio; and TMCA, Henderson, Nev.

Oregon Metallurgical Corp. produced ingots and castings. The other companies produced and processed ingots into mill products such as sheet, strip, plate, forging billets, and bars. Harvey Aluminum, Inc., produced titanium castings in addition to other mill products. Ladish Co., Cudahy, Wis., processed ingots into forged products.

The Babcock & Wilcox Co., Beaver Falls, Pa., and the Wolverine Tube Division of Calumet & Hecla, Inc., Allen Park, Mich., produced titanium pipe, tubing, and extrusions. Titanium Products Corp. produced seamless titanium pipe at Grosse Point, Mich.

TABLE 3.—Titanium-metal data
(Short tons)

	1950	1960	1961	1962	1963
Sponge metal:					
Production	3,898	5,311	6,727	6,730	7,879
Imports for consumption	1,563	2,231	2,400	925	1,458
Industry stocks	1,100	1,100	1,200	1,300	1,400
Government stocks (DPA inventories)	22,474	22,474	22,461	22,461	22,871
Consumption	3,053	5,487	6,991	7,136	8,868
Scrap-metal consumption	1,690	2,527	2,501	3,160	2,239
Ingot:					
Production	6,017	8,207	9,371	10,400	11,183
Consumption	6,964	7,978	8,878	9,773	10,508
Mill shape production ¹	3,211	5,071	5,647	6,507	6,112

¹ Includes alloy constituents.

² Bureau of the Census and Business and Defense Services Administration, Current Industrial Reports Series BDSA-F-263 (63).

³ Net shipments derived by subtracting the sum of producers' receipts of each mill shape from the industry's gross shipments of that shape. Data not comparable with previous years.

THOUSAND SHORT TONS—ESTIMATED TiO₂ CONTENT

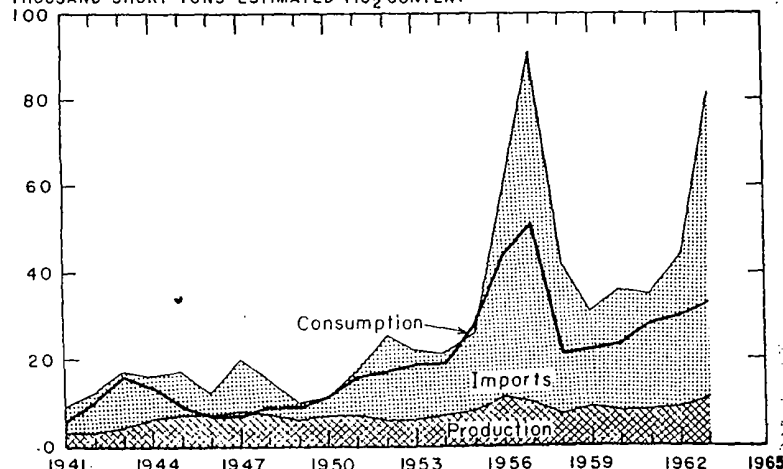


FIGURE 2.—Domestic production, imports, and consumption of rutile (excluding that used in 1961 through 1963 for making TiO₂ pigment), 1941-63.

Pigments.—On a gross-weight basis, production of titanium pigments decreased 4 percent and shipments increased 1 percent from the levels of 1962. Data on domestic production and shipments in table 4 are based on TiO₂ content.

Titanium pigments were produced by the following companies: American Cyanamid Co., Piney River, Va., and S. Glidden Co., Baltimore, Md.; E. I. du Pont de Nemours & Co., Edge Moor, Del., Baltimore, Md., and New Johnson City, N.Y.; National Lead Co., St. Louis, Mo., and Sayreville, N.J.; and Jersey Zinc Co., Gloucester City, N.J.

Cabot Titanium Corp. completed construction of a new per-year plant at Ashtabula, Ohio, for producing titanium pigments via the chloride process.

American Potash & Chemical Corp. announced plans for a new per-year chloride process titanium pigment plant at Aberdeen, Miss.

Welding-Rod Coating.—A total of 265,000 tons of titanium-containing materials in their coatings, was produced in 1962, total output, 45 percent contained rutile; 18 percent, a mixture of rutile and manufactured titanium dioxide; 3 percent, manufactured titanium dioxide; 3 percent, miscellaneous mixtures.

TABLE 4.—Titanium pigment data (TiO₂ content)

Year	Production (short tons)
1954-58 (average)	421,584
1959	506,334
1960	455,553
1961	502,879
1962	523,201
1963	619,458

¹ Includes interplant transfers.

² Data not available.

Source: Facts for Industry and Current Industrial Reports series, M19A and M19B, published jointly by the Bureau of the Census and Business and Defense Services Administration, Department of Commerce.

CONSUMPTION AND USES

Concentrates.—Consumption of ilmenite, which is used in making titanium dioxide pigment by the sulfate process, increased 7 percent; however, titanium slag consumption, which is used for the same purpose, increased 10 percent. Rutile consumption, exclusive of that used for making titanium pigments, reported in table 5, was 11 percent more than in 1962. In producing titanium pigments was substituted for rutile in 1962.

Metal.—Consumption of 8,900 tons of titanium metal in 1963 was 24 percent higher than in 1962. About one-fourth of the scrap was used for each ton of titanium consumed. An output of 11,000 tons of ingot was produced. U

gauge, titanium mill products consumption was 6 percent less than in 1962.

TABLE 5.—Consumption of titanium concentrates in the United States, by products

(Short tons)

Year and product	Ilmenite ¹		Titanium slag		Rutile	
	Gross weight	Estimated TiO ₂ content	Gross weight	Estimated TiO ₂ content	Gross weight	Estimated TiO ₂ content
1954-58 (average).....	771,741	406,429	126,452	89,251	34,270	32,505
1959.....	914,747	476,000	143,329	101,106	23,741	22,483
1960.....	808,080	464,614	120,492	85,095	24,229	22,942
1961.....	929,147	497,614	130,184	92,011	29,548	28,018
1962:						
Pigments.....	941,954	499,471	137,576	98,195	(²)	(²)
Titanium metal.....	(³)	(³)	(⁴)	(⁴)	13,633	13,126
Welding-rod coatings.....	503	298	453	318	15,492	14,627
Alloys and carbide.....	2,282	1,391	(⁵)	(⁵)	223	211
Ceramics.....	80	31	(⁶)	(⁶)	330	309
Fiber glass.....	(⁷)	(⁷)	(⁸)	(⁸)	1,018	993
Miscellaneous ⁸	8	6	176	119	1,053	999
Total.....	944,797	501,196	138,205	98,632	31,749	30,228
1963:						
Pigments.....	872,747	458,128	152,151	108,458	(⁹)	(⁹)
Titanium metal.....	(¹⁰)	(¹⁰)	(¹¹)	(¹¹)	14,734	14,021
Welding-rod coating.....	523	307	207	146	17,444	16,465
Alloys and carbide.....	1,659	1,036	(¹²)	(¹²)	329	314
Ceramics.....	49	30	(¹³)	(¹³)	460	430
Fiber glass.....	(¹⁴)	(¹⁴)	(¹⁵)	(¹⁵)	939	918
Miscellaneous ¹⁶	8	6	58	41	1,283	1,181
Total.....	874,986	459,500	152,416	108,645	35,189	33,326

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

² Includes ilmenite that was upgraded to a product containing more than 90 percent TiO₂ for use in making pigments and the losses of ilmenite incurred in upgrading the ilmenite.

³ Figure withheld to avoid disclosing individual company confidential data.

⁴ Included with "Pigments" to avoid disclosing individual company confidential data.

⁵ Included with "Miscellaneous" to avoid disclosing individual company data.

⁶ Includes consumption for chemicals and experimental purposes and losses in grinding.

According to a large producer, missile and space applications replaced military jet engines as the chief use for titanium. The estimated distribution of titanium mill product consumption was as follows:

Application:	Percent
Missile and space components.....	82
Military airframes.....	27
Jet engines.....	25
Civilian airplanes.....	9
Industrial (chemical).....	4
Ordnance.....	2
Experimental (submarines).....	1
Total.....	100

Wide use of titanium was scheduled for the Gemini two-man spacecraft.³ The tricycle landing gear, the pressurized compartment for the crew, various pressure vessels, and the solid-fuel cases for the retrorockets were expected to be made largely of titanium and its alloys such as Ti-6Al-4V and Ti-7Al-4Mo. Tankage and other components of titanium were expected to be utilized in the Lunar Excursion

³ Materials in Design Engineering. V. 58, No. 2, September 1963, p. 7.

Module scheduled to land on the moon. Solid rocket and other components for a new upper-stage booster for launch vehicle were scheduled to be built of titanium.⁴

Titanium was reported to be a basic material for a sonic transport (SST).⁵ The SST was expected to fly between mach 2.2 and mach 3 (1,500 to 2,000 miles per hour) at 15 to 50 tons of titanium per plane. Depending on the number of planes built, this could greatly increase the use of approximately 25,000 to 35,000 tons of a sponge metal in the 1970's.

Titanium was used in fabricating experimental seals to test the feasibility of using the metal for deep-diving submersibles.

Industrial uses of titanium continued to grow at a rapid rate. Titanium tubing and plates were planned for use in wet chlorine, electroplating solutions, oxidizing brines.⁶ An all-titanium anodizing rack was used in place of anodized aluminum parts. The titanium frame door was used in wet chlorine, electroplating solutions, oxidizing brines.⁶ A titanium heat exchanger, used to cool chlorination equipment for flash evaporation of sea water to produce solid lubricant coating which can be used with steel ball valves, was scheduled to use 1,750 feet of 3-inch titanium pipe.

A titanium heat exchanger, used to cool chlorination equipment for flash evaporation of sea water to produce solid lubricant coating which can be used with steel ball valves, was scheduled to use 1,750 feet of 3-inch titanium pipe.

A new calcium hypochlorite plant being built at Chas. was scheduled to use 1,750 feet of 3-inch titanium pipe of thin-wall 3-inch tubing.¹⁰

Technical developments resulted in marketing of new titanium shapes, such as an all-titanium locknut, utilizing solid lubricant coating which can be used with steel ball valves, was scheduled to use 1,750 feet of 3-inch titanium pipe of thin-wall 3-inch tubing.¹⁰

A titanium-aluminum alloy was used in the valve train of a British racing car.¹⁴

Pigments.—Consumption of titanium pigments by weight and using shipments as a gauge, increased 3 percent in 1963 over 1962.

⁴ American Metal Market. Space Vehicle To Use Titanium. V. 70, No. 1, 1963, p. 14.

⁵ Cooke, Richard P. Titanium Likely To Be Basic Material In U.S. Space Program. Advocate Say Weight Saving Would Override High Cost: A Metal? Wall Street J., v. 101, No. 121, June 21, 1963, pp. 1, 16.

⁶ American Metal Market. Nuclear Metals To Develop Titanium Alloy Submarine. V. 70, No. 75, Apr. 19, 1963, p. 13.

⁷ American Metal Market. Titanium Used in Water Desalting Unit Plant. V. 70, No. 183, Sept. 23, 1963, p. 15.

⁸ Iron Age. Titanium Ball Valves Handle Corrosives. New Materials. V. 192, No. 24, Dec. 12, 1963, p. 110.

⁹ E&M Metal and Mineral Markets. V. 34, No. 52, Dec. 30, 1963, p. 8.

¹⁰ American Metal Market. Astro Completes Big Titanium Tube Order Plant. V. 70, No. 152, Aug. 8, 1963, pp. 1, 11.

¹¹ Iron Age. All-Titanium Fastener. V. 192, No. 7, Aug. 15, 1963, p. 1.

¹² Ruth, John P. NRC Develops 99.999% Pure Titanium For Thin Devices. American Metal Market, v. 71, No. 43, Mar. 3, 1963, p. 9.

¹³ American Metal Market. Largest Titanium Plate. V. 70, No. 233, Dec. 1, 1963, p. 1.

¹⁴ Metallurgia (England). Titanium Alloy in B.R.M. V. 67, No. 40, 1963, p. 1.

The Bureau of Mines canvass of titanium-pigment producers was expanded to obtain additional data on shipments to include four new categories, formerly reported as "Other." These are roofing granules, ceramics, plastics, and exports. Beginning in 1963, shipments to industries in the "Other" category included welding rods, leather, shoe dressing, and synthetic fabrics.

TABLE 6.—Distribution of titanium-pigment shipments, by industries¹
(Percent)

Industry	1954-58 (average)	1959	1960	1961	1962	1963
Distribution by gross weight:						
Paints, varnishes, and lacquers.....	65.1	64.8	65.1	63.4	61.9	63.3
Paper.....	10.0	11.7	11.3	12.5	13.0	12.5
Floor coverings (linoleum and felt base).....	4.5	4.0	4.8	4.5	4.7	4.3
Rubber.....	3.6	4.2	4.0	4.1	4.2	4.0
Coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.).....	2.8	3.1	2.8	3.3	3.3	2.0
Printing ink.....	1.3	1.7	1.3	1.0	1.7	1.6
Roofing granules.....	(2)	(2)	(2)	(2)	(2)	2.1
Ceramics.....	(2)	(2)	(2)	(2)	(2)	1.2
Plastics (except floor covering and vinyl-coated fabrics and textiles).....	(2)	(2)	(2)	(2)	(2)	2.9
Other.....	12.2	9.8	10.7	10.8	11.2	1.8
Export.....	(2)	(2)	(2)	(2)	(2)	4.3
Total.....	100.0	100.0	100.0	100.0	100.0	100.0
Distribution by titanium dioxide content:						
Paints, varnishes, and lacquers.....	57.8	58.2	58.5	57.0	55.3	57.0
Paper.....	14.1	15.1	14.6	15.7	16.2	15.5
Floor coverings (linoleum and felt base).....	5.3	6.3	6.2	5.6	5.8	5.2
Rubber.....	4.5	5.4	4.9	5.1	5.2	4.9
Coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.).....	3.6	3.9	3.5	4.1	4.0	2.0
Printing ink.....	1.8	2.2	1.7	2.0	2.1	2.0
Roofing granules.....	(2)	(2)	(2)	(2)	(2)	2.6
Ceramics.....	(2)	(2)	(2)	(2)	(2)	1.6
Plastics (except floor covering and vinyl-coated fabric and textiles).....	(2)	(2)	(2)	(2)	(2)	3.7
Other.....	12.9	8.0	10.6	10.5	11.4	2.2
Export.....	(2)	(2)	(2)	(2)	(2)	3.4
Total.....	100.0	100.0	100.0	100.0	100.0	100.0

¹ Data based on figures supplied to the Bureau of Mines by producers.

² Data not available. Included with "Other."

TABLE 7.—Stocks of titanium concentrates in the United States, Dec. 31
(Short tons)

Year and stock	Ilmenite		Titanium slag		Rutile	
	Gross weight	TiO ₂ content, estimated	Gross weight	TiO ₂ content, estimated	Gross weight	TiO ₂ content, estimated
1962:						
Mine.....	29,121	14,387			9,148	8,605
Distributor.....	254	140			5,701	5,431
Consumer.....	572,071	313,504	140,152	100,095	60,538	57,522
Total.....	601,446	328,040	140,152	100,095	75,387	71,558
1963:						
Mine.....	27,450	13,675			9,752	9,337
Distributor.....	224	131			9,469	8,158
Consumer.....	625,581	346,118	105,641	75,315	78,572	73,073
Total.....	653,255	359,924	105,641	75,315	92,793	88,568

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STOCKS

Industry stocks of rutile and ilmenite increased 2 percent respectively. Titanium-slag inventories decreased 2 percent. Government stocks of rutile on December 31 totaled 46,231 tons, 18,599 tons was in the national (strategic) stockpile, 1,400 tons in Defense Production Act (DPA) inventories; and 1,400 tons in the supplemental stockpile.

Yearend stocks of titanium sponge metal held by producers, and semifabricators totaled 1,400 tons, compared with 1,400 tons on hand at the end of 1962. Titanium metal scrap and semifabricators at yearend was 3,400 tons, 100 tons in 1962. Government-held stocks of titanium sponge metal totaled 392 tons, 22,371 tons in DPA inventories, and 9,021 tons in the supplemental stockpile.

PRICES

Concentrates.—The price quoted for ilmenite in the Mineral Markets remained unchanged at \$23 to \$26 per short ton of TiO₂, f.o.b. Atlantic seaboard.

The quoted price of rutile (94 percent TiO₂, f.o.b. Atlantic seaboard) increased from \$95 per short ton at the end of 1962 to \$100 per short ton at the end of 1963.

Manufactured Titanium Dioxide.—The base prices of base grades of manufactured titanium dioxide pigments remained unchanged. Titanium-rutile base titanium pigments were unchanged. The per-pound price differential on shipments of one color pigment to users west of the Rocky Mountains was eliminated. Reductions of the base price was given to purchasers of rutile following prices were quoted in the Oil, Paint and Chemical Markets at yearend:

Anatase, chalk-resistant, regular and ceramic, carlots, delivered.....
Less than carlots, delivered.....
Rutile, nonchalking, bags, carlots, delivered East.....
Less than carlots, delivered East.....
Titanium pigment, calcium-rutile base, 80 percent TiO₂, bags, delivered.....
Less than carlots, delivered.....

Metal.—Prices per pound for various grades of metal at the beginning of 1963 ranged from \$1.32 to \$1.60, and at the end of the year from \$1.27 to \$1.60.

Quoted prices of most titanium mill shapes were unchanged for the year. Prices per pound of mill shapes (f.o.b. mill) for pure grades, in lots of 10,000 pounds) were quoted as follows:

Sheet.....
Strip.....
Plate.....
Wire.....
Forging billets.....
Hot-rolled bars.....

Ferrotitanium.—Nominal prices at yearend for various grades of ferrotitanium were quoted in E&MJ Metal and Mineral Market as follows:

	Price
Low-carbon: ¹	
Titanium, 40 percent; carbon, 0.10 percent maximum	\$1.85
Titanium, 25 percent; carbon, 0.10 percent maximum	1.50
Medium-carbon: ²	
Titanium, 17 to 21 percent; carbon, 3 to 5 percent	875
High-carbon: ³	
Titanium, 15 to 19 percent; carbon, 6 to 8 percent	310

¹ Price per pound contained titanium in 1 ton or more, lump (¾-inch, plus), packed; f.o.b. destination northeastern United States.
² Price per short ton, carload lots, lump, packed; f.o.b. destination northeastern United States.

FOREIGN TRADE

Imports.—Increased imports of ilmenite (chiefly titanium slag) from Canada and resumption of imports of Indian ilmenite resulted in a 21-percent increase in the total. Rutile imports from Australia were double those of the previous year and reflected the increased demand for rutile used in making titanium dioxide.

Imports of titanium metal totaled 1,468 short tons, 59 percent higher than in 1962. As in past years Japan with 1,318 tons accounted for most of the total; however, imports of 133 tons from the United Kingdom were the highest recorded from that country. Canada, with almost 17 tons, and West Germany accounted for the remainder. Of the totals, about 7 tons from Canada and 3 tons from the United Kingdom were free under certain public laws. The remainder was dutiable.

Imports of titanium dioxide and titanium pigments totaled 25,277 tons, nearly double the quantity brought in during 1962. The chief sources of imported pigment were France, 4,927 tons; Japan, 5,106 tons; Finland, 8,944 tons; Italy, 2,879 tons; West Germany, 1,887 tons; and Spain, 1,500 tons. Most of the remainder came from the United Kingdom and Canada. About 270 tons of titanium compounds was imported.

Exports.—Titanium dioxide and pigment exports totaling 26,702 tons, declined for the seventh successive year. As in past years, Canada, receiving 10,884 tons, was the destination of most of the exports. Other countries that received more than 1,000 tons were as follows: The Philippines, 2,272 tons; Mexico, 1,889 tons; Italy, 1,107 tons; The Netherlands, 1,564 tons; the United Kingdom, 1,142 tons; and Belgium-Luxembourg, 1,030 tons.

Exports of 1,212 tons of titanium ores and concentrates included 790 tons to Canada, 200 tons to Hong Kong, and 75 tons to Iran. Smaller quantities were sent to Colombia, West Germany, Kuwait, Argentina, Mexico, and the United Kingdom.

Titanium sponge and scrap exports increased 5 percent over that of 1962. Of the 1,261 tons exported, the United Kingdom was shipped 1,056 tons, West Germany, 77 tons, and most of the remainder was sent to France, Austria, The Netherlands, Italy, and Sweden.

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TABLE 8.—U.S. imports for consumption of titanium concentrates (Short tons)

Country	1954-58 (average)	1959	1960	1961
Ilmenite:				
Australia	4,587	47,817	83,089	85,127
Canada ²	160,226	187,206	104,243	127,44
India	188,161	167,074	128,313	
Malaya, Federation of	6,229			
Other countries	25			
Total: Short tons	359,227	371,687	265,645	207,1
Value	\$7,061,108	\$7,901,208	\$5,068,502	\$5,017,
Rutile:				
Australia	40,917	22,954	27,847	26,1
South Africa, Republic of		274	1,358	1,
Other countries	42		30	
Total: Short tons	40,959	23,228	29,235	27,
Value	\$5,362,335	\$2,943,258	\$3,610,616	\$2,644,

¹ Classified as "ore" by the Bureau of the Census.

² Chiefly titanium slag averaging about 70 percent TiO₂.

³ Less than 1 ton.

⁴ Data known to be not comparable with other years.

⁵ Excludes 19 tons rutile content of zirconium ore as reported to the Bureau.

Source: Bureau of the Census.

Exports of primary forms of titanium metal de... Of this total, 238 tons went to Canada, 135 tons to West Germany, and most of the remainder to Italy. Of the 211 tons of titanium ferroalloys exported, Canada, The Netherlands, 11 tons; and most of the Belgium-Luxembourg, United Kingdom, Sweden, and Republic of South Africa.

TABLE 9.—U.S. exports of titanium products,

Year	Ores and concentrates		Metal and alloys in crude form and scrap ¹		Primary forms, n.e.c. ²		Ferrous
	Short tons	Value	Short tons	Value	Short tons	Value	
1954-58 (average)	1,392	\$208,177	48	\$290,768	376	\$5,547,142	204
1959	4,655	289,507	496	643,104	409	5,161,074	321
1960	1,260	166,685	879	868,846	428	3,237,940	248
1961	1,436	190,480	886	928,783	384	2,702,322	212
1962	1,224	166,987	818	925,495	561	4,102,113	130
1963	1,212	176,231	1,281	1,232,245	494	3,443,940	211

¹ Beginning Jan. 1, 1955, classified as sponge and scrap.

² Beginning Jan. 1, 1955, classified as intermediate mill shapes and mill products.

Source: Bureau of the Census.

WORLD REVIEW

The United States continued to be the principal source of titanium metal and the chief market for ilmenite and rutile in the world. Australia was the leading rutile producer, accounting for approximately 93 percent of the total. In addition,

Michigan led the 21 States in the consumption of slab zinc in making zinc-base alloys. Other large consuming States were Illinois, Ohio, New York, and Indiana.

TABLE 17.—Reported slab zinc consumption in the United States in 1963, by industries and States

(Short tons)					
State	Galvanizers	Brass mills ¹	Die casters ²	Other ³	Total
Alabama.....	(⁴)	(⁴)	(⁴)	(⁴)	37,238
Arizona.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Arkansas.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
California.....	24,091	1,821	8,883	731	35,526
Colorado.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Connecticut.....	2,732	38,862	(⁴)	(⁴)	46,127
Delaware.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Florida.....	(⁴)	(⁴)	(⁴)	(⁴)	1,650
Georgia.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Hawaii.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Idaho.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Illinois.....	48,770	16,669	75,397	20,100	158,836
Indiana.....	58,921	(⁴)	30,715	(⁴)	109,220
Iowa.....	(⁴)	(⁴)	(⁴)	(⁴)	1,681
Kansas.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Kentucky.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Louisiana.....	(⁴)	(⁴)	(⁴)	(⁴)	1,367
Maine.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Maryland.....	(⁴)	(⁴)	(⁴)	(⁴)	32,160
Massachusetts.....	(⁴)	(⁴)	(⁴)	(⁴)	8,545
Michigan.....	2,786	15,976	128,727	(⁴)	149,742
Minnesota.....	(⁴)	(⁴)	(⁴)	(⁴)	2,199
Mississippi.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Missouri.....	4,822	(⁴)	7,766	(⁴)	13,429
Nebraska.....	(⁴)	(⁴)	(⁴)	(⁴)	1,696
New Hampshire.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
New Jersey.....	2,888	(⁴)	(⁴)	(⁴)	29,675
New York.....	13,702	(⁴)	44,239	(⁴)	76,034
North Carolina.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Ohio.....	83,083	(⁴)	51,867	(⁴)	145,132
Oklahoma.....	2,260	(⁴)	(⁴)	(⁴)	6,136
Oregon.....	(⁴)	(⁴)	(⁴)	(⁴)	891
Pennsylvania.....	54,641	(⁴)	23,616	(⁴)	114,471
Rhode Island.....	(⁴)	(⁴)	(⁴)	(⁴)	725
South Carolina.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
South Dakota.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Tennessee.....	719	(⁴)	(⁴)	(⁴)	1,628
Texas.....	13,553	(⁴)	(⁴)	(⁴)	42,360
Utah.....	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Virginia.....	(⁴)	19	(⁴)	(⁴)	1,364
Washington.....	889	(⁴)	(⁴)	697	1,486
West Virginia.....	7,315	(⁴)	(⁴)	(⁴)	8,377
Wisconsin.....	2,195	(⁴)	(⁴)	(⁴)	14,374
Undistributed.....	97,741	37,993	96,515	66,008	69,238
Total ⁵	416,996	126,076	407,705	87,436	1,098,213

¹ Includes brass mills, brass ingotmakers, and brass foundries.

² Includes producers of zinc-base diecastings, zinc-alloy dies, and zinc-alloy rods.

³ Includes slab zinc used in rolled-zinc products and in zinc oxide.

⁴ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed".

⁵ Excludes remelt zinc.

ZINC PIGMENTS AND SALTS

Production of zinc pigments and salts increased 2 percent to 262,300 tons. Shipments increased 7 percent to 268,800 tons, principally to the rubber, paint, and ceramic industries.

Production.—Output of lead-free zinc oxide decreased 1 percent to 157,400 tons, and production of leaded zinc oxide increased 5 percent to 15,100 tons. Zinc chloride (50° Baumé) production decreased 7 percent to 49,700 tons and zinc sulfate output increased 31 percent to 40,100 tons.

ZINC

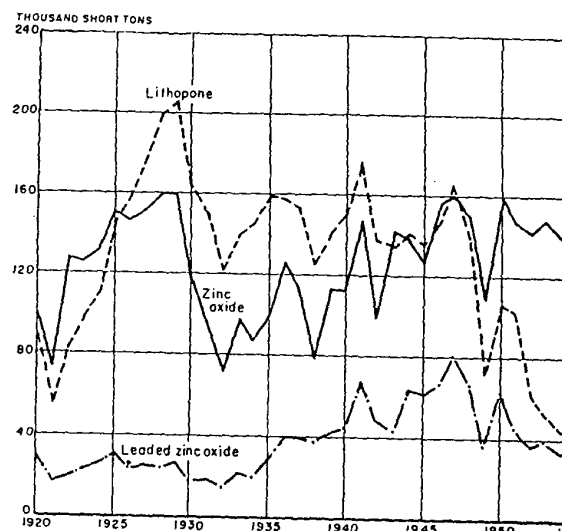


FIGURE 2.—Trends in shipments of zinc pigments

TABLE 18.—Production and shipments of zinc pigments and salts, United States

Pigment or salt	Production (short tons)	1962			Production (short tons)	Shipments (short tons)
		Short tons	Shipments			
			Value *			
			Total	Average per ton		
Zinc oxide †	158,844	154,840	\$35,627,808	\$230	157,371	162,300
Leaded zinc oxide †	14,377	15,094	3,652,330	233	15,060	15,100
Zinc chloride, 50° B †	53,733	50,438	(†)	(†)	49,728	50,000
Zinc sulfate	50,639	31,221	(†)	(†)	40,100	40,000

¹ Excludes lithopone; figure withheld to avoid disclosing individual company confidential data.

² Value at plant, exclusive of container.

³ Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide.

⁴ Includes zinc chloride equivalent of zinc ammonium chloride and chromated.

⁵ Figure withheld to avoid disclosing individual company confidential data.

Pigments and salts were made from various zinc-base materials including ore, slab zinc, scrap, and residues. Zinc pigments and salts made directly from ore, both domestic and foreign, exceeded 90,000 tons; zinc in zinc oxide and zinc chloride exceeded 16,000 tons; and the zinc in products and secondary materials in zinc pigments and salts exceeded 40,000 tons.

TABLE 19.—Zinc content of zinc pigments¹ and salts produced by domestic manufacturers, by sources
(Short tons)

Pigment or salt	1962					1963				
	Zinc in pigments and salts produced from—				Total zinc in pigments and salts	Zinc in pigments and salts produced from—				Total zinc in pigments and salts
	Ore		Slab zinc	Secondary material		Ore		Slab zinc	Secondary material	
	Domestic	Foreign				Domestic	Foreign			
Zinc oxide.....	63,565	17,256	18,297	27,622	126,740	65,245	16,250	16,037	28,026	125,558
Leaded zinc oxide.....	8,232	3,378			8,610	8,165	4,087			9,252
Total pigments.....	68,797	20,634	18,297	27,622	135,350	70,410	20,337	16,037	28,026	134,810
Zinc chloride ²			(³)	11,715	11,715			(³)	11,130	11,130
Zinc sulfate.....	(³)	(³)		(³)	10,922	(³)	(³)		(³)	13,372

¹ Excludes zinc sulfide and lithopone; figures withheld to avoid disclosing individual company confidential data.

² Includes zinc content of zinc ammonium chloride and chromated zinc chloride.

³ Figure withheld to avoid disclosing individual company confidential data.

Lead-free zinc oxide was made by several processes; 67 percent was made from ores and residues by the American process, 18 percent from metal by the French process, and 15 percent from scrap residues and secondary materials by other processes. Leaded zinc oxide was made from ores; zinc chloride was made from slab zinc and secondary zinc materials; and zinc sulfate was made from ores and secondary materials.

Four grades of leaded zinc oxide, classified according to lead content, were produced. Only a very small quantity of 5 percent or less leaded zinc oxide was produced; the more than 5 to 35 percent grade constituted most of the production. Small quantities of the more than 35 through 50 percent and over 50 percent grades were produced.

Lithopone, a coprecipitate of zinc sulfide and barium sulfate, was produced, but figures are withheld to avoid disclosing individual company confidential data.

Consumption and Uses.—Shipments of lead-free zinc oxide were 162,300 tons, 5 percent greater than in 1962. The quantity received by the rubber, paint, and ceramic industries accounted for 78 percent of the total shipped.

The paint industry accounted for 96 percent of the 15,500 tons of leaded zinc oxide shipped.

Lithopone was used in paint, varnish and lacquer, coated fabrics and textiles, rubber, and floor covering.

The principal uses of zinc chloride were for battery making, galvanizing, vulcanizing fiber, preserving wood, and refining oil, as well as for fungicides, solder, and tinning fluxes.

The chief uses of zinc sulfate were in rayon manufacture and agriculture. Other uses were in glue manufacture, flotation reagents, rubber, and medicine.

Prices.—American-process zinc oxide was quoted at 13.50 cents per pound in carlots, freight allowed, throughout 1963. Quotations for Red-seal, Green-seal, and White-seal French-process zinc oxide

ZINC

TABLE 20.—Distribution of zinc oxide shipments
(Short tons)

Industry	1964-68 (average)	1969
Rubber.....	77,623	79,605
Paints.....	32,703	33,708
Ceramics.....	9,484	10,488
Coated fabrics and textiles ¹	6,397	2,125
Floor coverings.....	1,537	1,207
Other.....	22,484	27,203
Total.....	150,208	164,234

¹ Figures for zinc oxide used for rayon are withheld to avoid disclosing individual company confidential data.

² Included with "Other."

TABLE 21.—Distribution of leaded zinc oxide shipments
(Short tons)

Industry	1964-68 (average)	1969
Paints.....	27,924	20,748
Rubber.....	334	1,878
Other.....		
Total.....	28,258	22,626

TABLE 22.—Distribution of zinc sulfate shipments
(Short tons)

Year	Rayon		Agriculture	
	Gross weight	Dry basis	Gross weight	Dry basis
1954-58 (average).....	15,626	13,927	8,730	7,520
1959.....	28,062	23,354	5,262	4,606
1960.....	15,727	14,087	4,320	3,848
1961.....	12,284	11,007	5,673	5,098
1962.....	(¹)	(¹)	8,544	7,313
1963.....	(¹)	(¹)	10,785	9,407

¹ Figure withheld to avoid disclosing individual company confidential data.

in carlots, freight allowed, remained unchanged at 15.25 cents, and 15.50 cents, respectively.

Leaded zinc oxide of the 35 percent grade was quoted at 15.25 cents per pound for carlots, freight allowed.

Zinc chloride (50° Baumé) was quoted at 15.25 cents per pound until July when it increased to 5.25 where it remained for the rest of the year. Zinc sulfate (Monohydrate) was quoted at 9.25 cents per pound in October, and remained at this level through the year.

Foreign Trade.—Imports of zinc pigments increased 7 percent in quantity and value over that of 1962. Imports of zinc oxide increased 8 percent and decreased 6 percent in quantity and value over that of 1962.

TABLE 23.—U.S. imports for consumption of zinc pigments and salts

Kind	1962		1963	
	Short tons	Value (thousands)	Short tons	Value (thousands)
Zinc oxide.....	12,890	\$2,325	13,957	\$2,532
Zinc sulfide.....	461	140	423	133
Lithopone.....	98	13	169	22
Zinc arsenate.....	1	(¹)	(²)	(¹)
Zinc chloride.....	1,000	168	936	140
Zinc sulfate.....	832	83	886	84
Total.....	15,282	2,729	16,360	2,911

¹ Loss than \$1,000.² Less than 1 ton.

Source: Bureau of the Census.

TABLE 24.—U.S. exports of zinc pigments

Kind	1962		1963	
	Short tons	Value (thousands)	Short tons	Value (thousands)
Zinc oxide.....	2,061	\$500	2,962	\$827
Lithopone.....	350	68	839	136
Total.....	2,411	658	3,801	963

Source: Bureau of the Census.

STOCKS

National Stockpile.—There was 1,257,000 tons of zinc in the national (strategic) stockpile and 324,000 tons in the supplementary stockpile at the end of the year. On June 17, the Office of Emergency Planning (OEP) established a conventional war stockpile objective of zero for zinc. The previous maximum objective, based on different criteria, had been 178,000 tons. Studies continued by OEP to determine stockpile needs to meet the requirements of general nuclear war including reconstruction.

Producer Stocks.—Stocks of slab zinc at producer plants were 144,700 tons at the beginning of the year, increased about 4,000 tons by the end of March, and then rapidly declined to 47,900 tons by yearend. This was the lowest yearend stocks recorded since 1955.

TABLE 25.—Stocks of zinc at zinc-reduction plants in the United States, Dec. 31 (Short tons)

	1959	1960	1961	1962	1963
At primary reduction plants.....	152,410	178,200	143,494	142,059	46,374
At secondary distilling plants.....	3,800	7,673	3,303	2,687	1,536
Total.....	156,210	185,872	146,887	144,746	47,910

Consumer Stocks.—Stocks of slab zinc at consumer plants of 79,900 tons at the start of the year were drawn down about 12,000 tons by the end of May, followed by a generally upward trend result-

ZINC

ing in yearend stocks of 96,600 tons. An slab zinc was in transit to consumer plants on

TABLE 26.—Consumer stocks of slab zinc at plant

Date	(Short tons)			
	Galvanizers	Brass mills ¹	Zinc die-casters ²	Zinc rolling mills ³
Dec. 31, 1962 ⁴	42,764	8,780	24,957	4,100
Dec. 31, 1963.....	55,935	9,846	21,851	4,100

¹ Includes brass mills, brass ingotmakers, and foundries.² Includes producers of zinc-base diecastings, zinc-alloy dies, and zinc³ Figures partly revised.⁴ Stocks on Dec. 31, 1962 and Dec. 31, 1963 include 198 and 302 tons

PRICES

Prices.—The quoted price of Prime West Louis, was 11.5 cents a pound at the start of increases of ½-cent each on July 2, July 30, and in the yearend price of 13.0 cents per pound.

On the London Metal Exchange, the yearling exchange rate recorded by the Federal Reserve the average was £67.585 (8.45 cents per pound) rose for the next four successive months (cents) for May, declined slightly in June and upward trend, reaching an average quotation (11.84 cents).

TABLE 27.—Average monthly quoted prices of 60 percent zinc concentrates in the Joplin region and of common zinc (prompt delivery of London¹)

Month	1962		
	60-percent zinc concentrates in the Joplin region (per ton)	Metallic zinc (cents per pound)	
		East St. Louis	London ²
January.....	\$72.00	12.00	8.78
February.....	72.00	12.00	8.67
March.....	72.00	12.00	8.74
April.....	68.00	11.61	8.75
May.....	68.00	11.60	8.62
June.....	68.00	11.50	8.37
July.....	68.00	11.50	8.26
August.....	68.00	11.50	8.07
September.....	68.00	11.50	8.01
October.....	68.00	11.50	8.25
November.....	68.00	11.50	8.56
December.....	68.00	11.50	8.38
Average for year.....	69.00	11.63	8.43

¹ Joplin: Metal Statistics, 1964, p. 503. East St. Louis: Metal Statistics and Mineral Markets.² Conversion of English quotations into U.S. money based on a Federal Reserve Board.³ A average of daily mean of bid and asked quotations at morning session