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MINERAL YEARBOOK

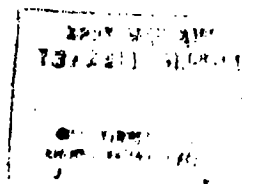
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Lead¹

By O. M. Bishop and Edith E. den Hartog



GENERAL SUMMARY

THE LEAD INDUSTRY in 1951 was characterized by a marked decrease in imports, lessened mine output, and the greatest recovery of secondary lead on record. Although consumption was 4 percent less than in 1950, new supplies were inadequate, and lead was withdrawn from the stocks of consumers, producers, and Government to meet the demand. A ceiling price of 17.00 cents per pound, New York, was established January 26 on domestic lead, and selling prices were generally quoted at the ceiling until October 2 when the Office of Price Stabilization authorized an increase of 2 cents a pound. The increase became effective immediately and remained to the end of the year. Before October 2 domestic consumers could buy lead abroad at any price, but after that date regulations prevented the purchase of foreign lead at prices over the domestic ceiling price plus duty. Unable to sell all of the lead they produced outside of the United States, certain foreign producers were forced to lower their prices, and there was every indication that by early 1952 additional foreign supplies would be available at the ceiling price.

The total supply of 1,155,000 short tons of lead was composed of 388,000 tons of recoverable mine production, 518,000 tons of secondary lead, and imports (excluding scrap) equal to 249,000 tons, lead content. Consumption of lead, including that in pigments and chemicals, totaled 1,185,000 tons. Producers' stocks of refined primary lead declined from 28,894 tons at the beginning of the year to 18,518 tons on December 31, 1951, but antimonial lead stocks remained about the same. Consumers' stocks decreased 37,124 tons during the year to 102,760 tons.

The drop in mine output from 431,000 tons in 1950 to 388,000 tons in 1951 was attributed partly to shutdowns at most lead mines and mills in the Western States from August 23 to September 6. The decrease in producers' stocks was due partly to strikes at the Selby, Omaha, Perth Amboy, Herculaneum, and Bunker Hill plants and to a fire at the Tooele smelter which curtailed production. The decline in imports was attributed almost wholly to the higher prices paid in foreign markets and to the existence of a domestic tariff that added to the cost of foreign metal.

GOVERNMENT REGULATIONS

In 1951 the Government exercised limited controls over the lead industry owing to concern over possible shortages for defense requirements. Lead was brought under inventory control on February 16 through National Production Authority Order M-38. This order was

¹ This report deals primarily with the smelting, refining, and consuming phases of the industry. For details of mining operations, see various State chapters of this volume.

LEAD

TABLE 1.—Salient statistics of the lead industry in the United States (average) and 1947-51, in short tons

	1942-46 (average)	1947	1948	1949
Production of refined primary lead:				
From domestic ores and base bullion...	383,640	381,109	339,413	404,772
From foreign ores and base bullion...	72,959	59,001	67,281	72,959
Total.....	456,599	441,010	406,694	477,731
Recovery of secondary lead.....	350,467	511,970	500,071	415,000
Imports (general):				
Lead in pigs, bars, and old.....	237,638	175,538	276,013	28,000
Lead in base bullion.....	9,726	1,580	7,188	10,000
Lead in ores and matte.....	71,434	50,752	63,907	10,000
Exports of refined pig lead.....	4,294	1,523	411	10,000
Consumption of primary and secondary lead.....	1,056,644	1,172,000	1,133,895	950,000
Prices (cents per pound):				
New York:				
Average for period.....	6.82	14.67	18.04	21.50
Quotation at end of period.....	7.71	15.00	21.50	21.50
London average for period.....	5.42	15.27	17.16	17.16
Mine production of recoverable lead ¹	418,644	384,221	390,476	400,000
World smelter production of lead.....	1,461,800	1,456,000 ²	1,505,000 ²	1,700,000

¹ Includes Alaska.
² Revised figure.

amended on May 28 to set forth certain limitations of rated orders so as to provide for creation of a soft pig lead to meet emergency conditions and to restrict on the use of lead and lead products. Beginning June 1, order restricted the use of lead to not more than 1 average monthly quantity used during the first 6 months prohibited its use for any new purposes. Order M-26, placed the supply of soft pig lead produced by under allocation control as of September 1 to assure allocation. Effective November 1, imported pig lead was allocation control by Order M-76 as amended.

DOMESTIC PRODUCTION

Statistics on lead output may be prepared on a mine refinery basis. Mine-production data, compiled on content in ores and concentrates, adjusted to account in smelting, are a better measure of domestic output and are most accurate for showing the geographic production. Pig-lead output, as reported by smelter presents a more precise figure of actual lead recovery in a general way the source of crude material treatment refinery output generally differs from the mine figures between mine shipments and smelter treatment of concentrates.

MINE PRODUCTION

Domestic mine output of recoverable lead declined in 1951 compared with 1950 and was the lowest annual Production during the first half of the year was at a 1,063-ton average daily output for the entire year. and September production was considerably below

Production in 9 of the 16 States producing over 1,000 tons of recoverable lead in 1951 decreased from the 1950 output. Virginia's output was the lowest since the State's production was first recorded separately in 1939. In Arizona, Nevada, and Idaho mine production was the smallest since 1944, 1945, and 1946, respectively. On the other hand, Colorado produced more lead in 1951 than in any year since 1927, and Montana's output was the largest since 1940.

Lead production in the Tri-State district declined 14 percent in 1951, chiefly because of the lower grade of ore mined. This decrease occurred despite substantially higher concentrate prices than in 1950 and a 14-percent increase in zinc production. The Eagle-Picher Co., Mining & Smelting Division, was by far the largest producer in the district and was followed by the American Zinc, Lead & Smelting Co., Nellie B. Division. Other large producers were the National Lead Co. St. Louis Smelting & Refining Division, Federal Mining & Smelting Co., and Bilharz Mining Co. In December 1951, 19 mine mills and 3 tailings mills were operating in the district compared to 16 mine mills and 4 tailings mills in 1950.

Idaho continued to be the largest producer of lead in the Western States and second only to Missouri in the United States despite a 23-percent reduction in output in 1951. The decline resulted principally from a shortage of underground miners in late summer and early fall and a 2-week strike of mine, mill, and smelter workers in August and September. In 1951, 92 percent of Idaho's total lead came from the Coeur d'Alene region and most of the remainder from the Warm Springs and Bayhorse districts. The Bunker Hill & Sullivan mine at Kellogg was by far the largest producer. The 5 leading producing

Lead production in Colorado in 1951 was the second consecutive year and was the largest since 1911. The mines, in order of rank, were the Red Mountain, Tunnel-Black Bear (Idarado) group, East of Silverton and Shenandoah-Dives group. Zinc-lead ores yielded 69 percent of State total lead, silver and silver ores 9 percent, and lead ore 7 percent.

Arizona's output of lead in 1951 dropped total owing chiefly to a marked decrease in lead ore from the Copper Queen mine at Bisbee. Reserves were nearly depleted. The St. Johns was the leading lead producer in the State, followed by the Iron King mine at Humboldt, the Sahuarita, Flux group near Patagonia, Coconino, and Aravaipa group near Klondike. About 40 per cent of the total lead was obtained from zinc-lead ore.

Mine production of lead in California is from the record output established in 1911 by the Inyo Mining Co. Inyo County properties, the Shoshone group, Resting Spring district, and the Shoshone group, Resting Spring district, the bulk of the State lead. Moderate quantities of lead are produced from ore from the Coronado Copper & Zinc Co. and from flue dust accumulated at the site of the Copper smelter, both in Shasta County. The total output was derived from lead ore and zinc ore.

Lead output in Washington in 1951 decreased nearly 23 percent from the record quantity produced in 1950, chiefly because of reduced output at the Grandview and Bonanza mines. The 4 largest mines—Pend Oreille, Grandview, Bonanza, and Deep Creek—supplied 98 percent of the State total lead during the year. Over 77 percent of the output was from zinc-lead ore and most of the remainder from lead ore.

Nevada lead output dropped 24 percent in 1951 compared with 1950. Of the State total, 66 percent was mined in the Pioche district, Lincoln County. The leading producers in order of output were the Pioche group and Ely Valley mine, Pioche district; San Rafael mine, Quartz Mountain district; Copper Canyon mine, Battle Mountain district; and Bristol mine, Jack Rabbit district. About 77 percent of the total lead output was recovered from zinc-lead and zinc-lead-copper ores and most of the remainder from lead ore.

Production of lead in New Mexico increased 41 percent in 1951. Such a large percentage gain was to be expected as output in 1950 was unusually low, because most of the mines that shut down when metal prices declined in 1949 remained idle several months in 1950. The largest producers were the Ground Hog and Bayard groups in the Central district and the Lynchburg mine in the Magdalena district. Zinc and zinc-lead ore yielded 80 percent of the State total lead and lead ore 18 percent in 1951.

TABLE 2.—Mine production of recoverable lead in the United States, 1942-46 (average) and 1947-51, by States, in short tons

State	1942-46 (average)	1947	1948	1949	1950	1951
Western States and Alaska:						
Alaska.....	157	264	329	51	149	21
Arizona.....	18,401	28,565	20,899	33,568	26,383	17,394
California.....	6,760	10,080	9,110	10,318	15,831	13,967
Colorado.....	16,998	18,696	25,143	26,853	27,007	30,336
Idaho.....	84,466	78,944	88,644	79,299	100,025	76,713
Montana.....	13,552	16,108	18,411	17,996	10,617	21,302
Nevada.....	6,044	7,101	9,777	10,626	9,408	7,148
New Mexico.....	6,031	6,383	7,653	4,652	4,150	6,846
Oregon.....	7	12	7	12	17	2
South Dakota.....	32	8	16	4	—	2
Texas.....	48	78	170	132	129	43
Utah.....	52,247	40,698	55,950	53,072	44,753	50,451
Washington.....	4,497	5,359	7,147	6,417	10,334	8,002
Wyoming.....	1	—	—	—	—	—
Total.....	209,241	221,357	252,156	243,000	257,503	231,227
West Central States:						
Arkansas.....	1	18	22	1	0	33
Kansas.....	8,368	7,285	8,386	9,772	9,487	8,947
Missouri.....	174,966	132,246	102,288	127,522	134,626	123,702
Oklahoma.....	16,569	14,289	16,918	19,858	20,724	16,575
Total.....	199,904	153,838	127,614	157,153	164,846	149,257
States east of the Mississippi River:						
Illinois.....	2,646	2,325	3,695	3,824	2,720	3,160
Kentucky.....	194	214	216	187	66	107
New York.....	1,674	1,496	1,231	1,317	1,484	1,500
Tennessee.....	123	22	—	257	113	14
Virginia.....	3,467	3,803	4,703	3,313	3,264	1,568
Wisconsin.....	1,295	1,166	861	857	532	1,391
Total.....	9,399	9,026	10,706	9,755	8,178	7,680
Grand total.....	418,544	384,221	390,476	409,908	430,827	388,164

Mines in States east of the Mississippi produced less lead in 1951 than in 1950. Decrease in output at a 54-percent drop in production from Virginia mine of the New Jersey Zinc Co. was because of a strike. Lead is produced as a by-product of zinc and fluorspar mining in Tennessee.

Small quantities of lead were also recovered from mines in Alaska, Oregon, South Dakota,

TABLE 3.—Mine production of recoverable lead in the United States, 1947-51, in short tons

District	State	1947-51 (average)
Southeastern Missouri region.....	Missouri.....	170,945
Coeur d'Alene region.....	Idaho.....	78,616
West Mountain (Bingham).....	Utah.....	28,334
Tri-State (Joplin region).....	Kansas, Southwestern Missouri, Oklahoma.....	28,808
Summit Valley (Butte).....	Montana.....	8,795
Park City region.....	Utah.....	12,050
Upper San Miguel.....	Colorado.....	1,919
Cerro (Darwin).....	California.....	3,747
California (Leadville).....	Colorado.....	4,701
Tithe.....	Utah.....	6,585
Metaline.....	Washington.....	4,028
Pioche.....	Nevada.....	3,248
Red Cliff.....	Colorado.....	1,341
Old Hat.....	Arizona.....	3,822
Big Bug.....	Idaho.....	1,496
Animas.....	Colorado.....	2,597
Central.....	New Mexico.....	3,957
Warm Springs.....	Idaho.....	2,949
Pine (Sierritas, Papago, Twin Buttes).....	Arizona.....	1,479
Rush Valley and Smelter (Tooele County).....	Utah.....	3,453
Kentucky-Southern Illinois.....	Kentucky, Southern Illinois.....	2,626
Pioneer (Rico).....	Colorado.....	2,458
Upper Mississippi Valley.....	Iowa, Northern Illinois, Wisconsin.....	1,508
Bossburg.....	Washington.....	133
Bayhorse.....	Idaho.....	1,410
Harshaw.....	Arizona.....	2,720
Warren (Disbee).....	Idaho.....	6,052
Austinville.....	Virginia.....	3,252
St. Lawrence County.....	New York.....	1,674
Hedderston.....	Montana.....	2,580
Aravala.....	Arizona.....	226
Creede.....	Colorado.....	428
Snodgrass.....	Idaho.....	321
Magdalena.....	New Mexico.....	1,264
Northport (Aladdin).....	Washington.....	134
Tomlin.....	Colorado.....	281
Ophir.....	Utah.....	780
Eureka.....	Colorado.....	93
Modoc.....	California.....	247
Smelter (Lewis and Clark County).....	Montana.....	1,286
Alder Creek.....	Idaho.....	54
Ten Mile.....	Colorado.....	490
Eagle.....	Montana.....	1,155
Battle Mountain.....	Nevada.....	66
Resting Springs.....	California.....	(1)

¹ Figure not shown in order to avoid disclosure of individual output.

² This district is not listed in order of 1951 output.

TABLE 4.—Twenty-five leading lead-producing mines in the United States in 1951, 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 and Park	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead.
3	Bunker Hill & Sullivan	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co.	Do.
4	Leadwood	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead
5	Butte Hill mines and dumps	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co.	Zinc-lead.
6	Mine La Motte	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead
7	Bonne Terre	do.	Idaho	do.	Do.
8	Pogo	Yreka	Idaho	Federal Mining & Smelting Co.	Zinc-lead.
9	Star	Hunter	do.	Sullivan Mining Co.	Do.
10	Darwin group	Caso	California	Anaconda Copper Mining Co.	Lead.
11	Madison	Southeastern Missouri	Missouri	St. Louis Smelting & Refining Co.	Lead-copper.
12	Stoshone group	Leetling Springs	California	Anaconda Copper Mining Co.	Lead.
13	Resurrection	Leadville	Colorado	Resurrection Mining Co.	Zinc-lead.
14	Normal	Upper San Miguel	Idaho	Federal Mining & Smelting Co.	Do.
15	Combining Tunnel Black Bear	Union	Idaho	Idaho Mining Co.	Do.
16	Combined Metals group	Ploche	Nevada	Combined Metals Reduction Co.	Do.
17	Chief and Eureka Hill	Tropic	Utah	Chief Consolidated Mining Co.	Do.
18	Eagle	Red Cliff	Colorado	New Jersey Zinc Co.	Zinc.
19	Park Utah Consolidated	Park City	Utah	Park Utah Consolidated Mines Co.	Zinc-lead.
20	Mammoth-Collins	Old Hat	Arizona	St. Anthony Mining & Development Co.	Do.
21	Desloge	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
22	Big Bug	do.	Arizona	Shattuck-Denn Mining Co.	Zinc-lead.
23	Iron King	Park City	Utah	Silver King Coalition Mines Co.	Do.
24	Smuggler Union	Upper San Miguel	Colorado	Telluride Mines, Inc.	Do.
25	Park Galena and Mayflower	Park City	Utah	New Park Mining Co.	Do.

LEAD

The 25 leading lead-producing mines in the United States, listed in table 4, yielded 68 percent of the total lead. The 10 leading mines produced 51 percent of the total.

Detailed information on the production of lead in the various districts in the United States may be found in the volume dealing with the mine production of lead, and zinc in the various States.

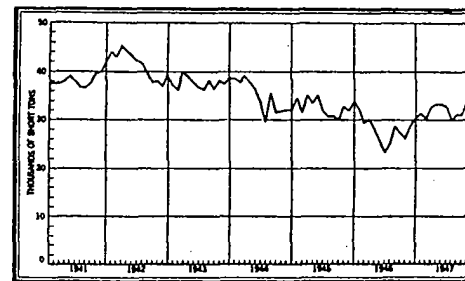


FIGURE 1.—Mine production of recoverable lead by months.

TABLE 5.—Mine production of recoverable lead by months, in short tons

Month	1950	1951	
January.....	35,084	35,102	August.....
February.....	34,716	32,804	September.....
March.....	38,960	36,474	October.....
April.....	36,432	32,972	November.....
May.....	37,900	33,537	December.....
June.....	37,439	32,148	
July.....	32,037	30,040	Total.....

SMELTER AND REFINERY PRODUCTION

Fig (refined) lead produced in the United States from three principal sources—domestic mine production, scrap, and base bullion, and scrap materials (from smelters)—and is recovered at primary refineries, bullion, and small quantities of scrap and process scrap exclusively. Of the 13 primary refineries in the United States, 6 combine smelting and refining, and only base bullion (containing approximately 1 percent gold and silver, and small quantities of other metals from the ores smelted), and 2 confine to refining. Refined lead and antimonial or "hard" lead are produced in primary and secondary plants. Because of the high cost of hard lead, such as battery scrap, melted and refined, output from this type of operation is small. Statistics on the production of refined lead and antimonial lead plants are given in the Secondary Lead section.

Of the 13 primary smelters in operation in 1951, all but 2 consumed substantial quantities of primary materials in the form of ores and concentrates. During the year these 11 plants consumed 435,894 short tons (lead content) of this type of material, of which 18 percent was of foreign origin. In 1950, 511,433 tons (lead content) of ores and concentrates were consumed, 17 percent of which was foreign.

Active Lead Smelters and Refineries.—Primary lead smelters and refineries operating in the United States in 1951 were as follows:

California: Selby—Selby plant, American Smelting & Refining Co. (smelter and refinery).

Colorado: Leadville—Arkansas Valley plant, American Smelting & Refining Co. (smelter).

Idaho: Bradley—Bunker Hill Smelter, Bunker Hill & Sullivan Mining & Concentrating Co. (smelter and refinery).

Illinois: Alton—Federal plant, American Smelting & Refining Co. (smelter and refinery).

Indiana: East Chicago—U. S. S. Lead Refinery, Inc. (refinery).

Kansas: Galena—Galena plant, Eagle-Picher Co. (smelter and refinery).

Missouri: Herculaneum—Herculaneum plant, St. Joseph Lead Co. (smelter and refinery).

Montana: East Helena—East Helena plant, American Smelting & Refining Co. (smelter).

Nebraska: Omaha—Omaha plant, American Smelting & Refining Co. (refinery).

New Jersey: Barber—Perth Amboy plant, American Smelting & Refining Co. (smelter and refinery).

Texas: El Paso—El Paso plant, American Smelting & Refining Co. (smelter).

Utah:

Midvale—Midvale plant, United States Smelting, Refining & Mining Co. (smelter).

Tooele—Tooele plant, International Smelting & Refining Co. (smelter).

REFINED LEAD

Primary refineries in the United States produced 422,000 short tons of refined lead in 1951 or 18 percent less than the 1950 output of 514,000 tons.

Of the 418,000 of refined lead produced from primary sources during the year, domestic ores and base bullion were the source of 82 percent and imported ores and base bullion of 18 percent, the same proportions for domestic and foreign materials as in 1950. Table 7 gives the production of refined lead by source material and 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, 1947-51, by source material, in short tons

Source	1947	1948	1949	1950	1951
Refined lead:					
From domestic ores and base bullion	381,109	339,413	404,449	418,809	342,044
From foreign ores	50,838	60,829	71,413	80,241	71,984
From foreign base bullion	63	6,462	1,476	3,204	3,065
Total from primary sources	441,010	406,694	477,338	508,314	417,893
From scrap	18,602	4,962	23,230	5,465	3,893
Total refined lead	459,612	411,656	500,568	513,779	421,786
Average sales price per pound	\$0.143	\$0.179	\$0.158	\$0.135	\$0.173
Total calculated value of primary refined lead ¹	\$128,130,000	\$145,000,000	\$160,840,000	\$137,245,000	\$144,522,000

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

LEAD

TABLE 7.—Refined primary lead produced by source material and country of origin

Source	1947	1948
Domestic ore and base bullion	381,109	
Foreign ore:		
Australia	5,952	
Canada	3,548	
Europe		
Mexico	5,523	
South America	17,096	
Other foreign	27,719	
Total	59,838	
Foreign base bullion:		
Australia		
Mexico	30	
South America	33	
Other foreign		
Total	63	
Total foreign	59,901	
Grand total	441,010	

ANTIMONIAL

Antimonial lead output at primary refineries was above the 1950 level but was well below 1948. Production increased at 3 of the 4 refineries in 1951. Distribution of antimonial lead by source material and country of origin in 1947-51 by source material and country of origin. The average antimony content.

Although antimonial lead is an important part of base bullion, the quantity derived from it is a small part of total domestic output. The refined lead from the smelting of antimonial lead and concentrates exclusively are summarized in the following table.

TABLE 8.—Antimonial lead produced at primary refineries in the United States, 1947-51

Year	Production (short tons)	Antimony content	
		Short tons	Percent
1947	80,075	4,933	6.7
1948	100,784	5,760	5.7
1949	41,402	3,385	8.2
1950	57,959	4,504	7.8
1951	65,309	4,416	6.7

SECONDARY LEAD

Some scrap lead is treated at primary refineries. Some part is processed at a large number of secondary refineries. Secondary materials in the form of refined lead, antimonial lead,

Secondary lead recovery in 1951 was the highest on record—7 percent above the 1950 figure—and exceeded the domestic mine output of recoverable lead for the sixth consecutive year. Data on recovery, by type of plant, in 1947-51 are shown in table 9. Detailed information on secondary lead appears in the Secondary Metals—Nonferrous chapter of this volume.

TABLE 9.—Secondary lead recovered in the United States, 1947-51, in short tons

	1947	1948	1949	1950	1951
As refined metal:					
At primary plants.....	15,062	4,952	23,230	5,455	3,803
At other plants.....	95,843	126,951	120,306	123,858	165,023
Total.....	111,505	131,903	143,536	129,313	168,826
In antimonial lead:					
At primary plants.....	56,456	49,525	32,705	38,383	34,303
At other plants.....	209,479	194,027	140,037	187,257	195,060
Total.....	265,935	243,552	172,742	225,640	229,363
In other alloys.....	134,530	124,616	86,815	127,322	110,231
Grand total:					
Short tons.....	511,970	500,071	412,183	482,275	518,110
Value.....	\$140,423,420	\$170,025,418	\$130,249,828	\$130,214,250	\$179,286,060

LEAD PIGMENTS

The principal lead pigments are litharge, white lead, red lead, sublimed lead, leaded zinc oxide, and orange mineral. These products are manufactured for the most part from metal, but some ore and concentrates are converted directly into pigments. Details of the production of lead pigments are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

CONSUMPTION AND USES

Domestic lead consumption (including lead in lead ore consumed directly in the manufacture of lead pigments and salts) totaled 1,184,793 short tons in 1951. Of the total consumed, 749,590 tons was refined soft lead and 296,555 tons was contained in antimonial lead, 26,205 tons in unmelted white scrap, 45,784 tons in "percentage metals" (the alloy pig metals derived from the secondary lead industry), 24,303 tons in copper-base scrap, 29,538 tons in drosses and residues, and 12,818 tons recovered from ores in leaded zinc oxide. In 1951, 42 percent of all lead consumed was used in the manufacture of metal products (excluding storage batteries). Production of the 3 largest lead-consuming items—batteries, cable coverings, and tetraethyl fluid—took 54 percent of all lead consumed during the year. Batteries took 32 percent and cable covering and tetraethyl fluid each 11 percent.

LEAD

TABLE 10.—Consumption of lead in the United States, by product, in short tons

	1950	1951	
Metal products:			
Ammunition.....	38,438	40,242	Pigment
Bearing metals.....	38,241	35,410	White
Brass and bronze.....	21,461	29,858	Red
Cable covering.....	131,080	131,863	Pigment
Calking lead.....	63,450	46,544	Other
Casting metals.....	19,295	22,497	T
Collapsible tubes.....	13,386	13,657	Chemical
Foil.....	3,941	2,881	Tetra
Pipes, traps, and bends.....	41,261	33,006	Miscellaneous
Sheet lead.....	30,778	31,210	T
Solder.....	94,606	82,465	Miscellaneous
Terne metal.....	3,805	2,051	T
Type metal.....	24,776	25,236	Miscellaneous
Total metal products.....	515,527	500,009	
Storage batteries:¹			
Antimonial lead.....	212,464	199,838	Lead
Lead oxides.....	185,945	175,546	Weight
Total storage batteries.....	398,409	375,384	

¹ Classified under "metal products" before 1950.

² Includes lead content of leaded zinc oxide production.

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

Month	1950	1951	
January.....	83,671	126,022	August
February.....	78,401	101,603	September
March.....	88,030	120,826	October
April.....	84,673	118,372	November
May.....	100,620	102,524	December
June.....	103,443	94,468	T
July.....	95,686	81,427	

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:¹	
Pigments.....	
Chemicals.....	
Miscellaneous.....	
Unclassified.....	
Total.....	

¹ Formerly classified under metal products.

² Excludes 12,818 tons of lead contained in leaded zinc oxide.

STOCKS

Producers' Stocks.—Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in table 13. Stocks of refined and antimonial lead include metal held by all primary refiners and by some of the refiners of secondary metal who produce soft lead. According to reports released by the American Bureau of Metal Statistics, monthly stocks of refined lead and antimonial lead in 1951 were, on the average, less than half of the tonnage held in comparable periods of 1950. Inventories totaled 25,339 tons on December 31, 1951, compared with year-end stocks of 35,619 tons in 1950.

TABLE 13.—Stocks of lead at smelters and refineries in the United States at end of year, 1947–51, in short tons

[American Bureau of Metal Statistics]

	1947	1948	1949	1950	1951
Refined pig lead.....	13,634	29,050	61,320	28,894	18,618
Antimonial lead.....	7,604	9,604	9,005	6,726	6,621
Total.....	21,238	38,644	70,424	35,619	25,339
Lead in base bullion—					
At smelters and refineries.....	7,652	9,697	16,364	11,903	11,315
In transit to refineries.....	5,447	4,101	3,696	4,950	3,909
In process at refineries.....	16,328	17,939	15,661	15,341	15,700
Total.....	29,427	31,737	35,021	32,203	30,924
Lead in ore and matte and in process at smelters.....	77,199	76,373	95,481	60,757	67,817
Grand total.....	127,954	140,754	201,526	137,669	124,080

The Bureau of Mines annual survey of primary smelters and refiners indicated stocks of 28,894 tons (lead content) of refined soft lead at plants on January 1, 1951, and 18,517 tons on December 31, 1951. Primary antimonial lead stocks at these same plants totaled 6,152 tons (lead content) at the beginning of 1951 and 6,367 tons at the end of the year. In terms of lead content, stocks of ore and concentrates at the operating primary smelters and refineries increased from 42,346 tons to 44,378 during the same period. The inventory of base bullion at refineries that receive base bullion as a raw material and at smelters that produce base bullion for shipment to refineries was 11,658 tons at the beginning of the year and 12,731 tons on December 31, 1951. 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 decreased 27 percent during 1951. The decline was consistent through the first 6 months, was reversed in July, and then continued the downward trend through the remainder of the year, dropping from 139,884 tons on January 1 to 102,760 on December 31. Stocks of antimonial lead gained 2 percent and percentage metals 9 percent, but stocks of refined soft lead dropped 35 percent, white-metal scrap 42 percent, copper-base scrap 8 percent, and drosses 46 percent.

TABLE 14.—Consumers' stocks of lead in the United States at end of year, 1948–51, by type of material, in short tons

Year	Refined soft lead	Antimonial lead	Unmelted white scrap	Percentage
1948.....	62,077	35,088	4,828	
1949.....	64,542	16,837	2,957	
1950.....	87,285	27,737	5,406	
1951.....	56,731	28,221	3,140	

¹ Revised figures.

PRICES

The two major markets for lead in the United States are New York and St. Louis. Much of the lead produced in the United States is sold at prices normally based upon quotations in London. The London Metal Exchange, which has had no direct influence on the London market, and the differential between St. Louis and London remained 0.2 cent a pound, an amount which was charged between the two cities.

The price of lead was controlled by the Federal Reserve Board during 1951. Ceiling prices were established for lead in January 1951, at the highest price (for each seller) between December 19, 1950, and January 1, 1951. The ceiling prices were established at 17.00 cents per pound, common lead, and remained in effect until October 1951. Stabilization permitted a rise of 2 cents in price occurred in 1951.

TABLE 15.—Average monthly and yearly quotations for lead in New York, and London, 1949–51, in cents per pound

Month	1949			St. Louis
	St. Louis	New York	London ¹	
January.....	21.32	21.50	22.10	11.80
February.....	21.32	21.60	22.10	11.80
March.....	18.73	18.91	22.10	10.70
April.....	14.99	15.16	19.28	10.42
May.....	13.67	13.72	17.08	11.52
June.....	11.85	12.00	15.45	11.61
July.....	13.39	13.56	14.69	11.46
August.....	14.80	15.01	15.66	12.73
September.....	14.85	15.05	15.51	15.80
October.....	13.23	13.42	13.79	16.84
November.....	12.33	12.52	12.79	16.80
December.....	11.80	12.00	12.12	16.80
Average.....	15.18	15.36	16.95	13.10

¹ St. Louis: Metal Statistics, 1952, p. 531. New York: Metal and Mineral Markets.

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

The official London price of £136 per long ton of lead (equivalent to 17.00 cents per pound computed on the 280.00-cent per pound base), fixed by the Ministry of Supply on November 1, 1950, remained in effect until April 1, 1951, when the Ministry raised the price to £160 (20.00 cents). The price was increased again on July 14 to £180 (22.50 cents). On October 1 the official price was reduced to £175 (21.88 cents), at which level it remained for the balance of the year. (During the latter half of 1951 sterling exchange rates varied between 278.63 and 280.00 cents per pound, hence actual dollar prices were at times slightly less than the 21.88-cent equivalent shown).

FOREIGN TRADE ²

Tariff.—There has been a tariff on lead for well over a century, ranging from a low of 15 percent ad valorem to a high of 3 cents a pound. The import duty set by the Tariff Act of 1930 on lead-bearing ores, flue dust, and mattes (lead content) was 1½ cents per pound and on lead bullion, pigs, bars, scrap lead, antimonial lead, type metal, babbitt metal, solder, and alloys not specifically provided for, 2½ cents per pound. In accordance with the Mexican Trade Agreement of January 30, 1943, these rates were reduced to ¼ cent and 1½ cents per pound, respectively. In June 1948 these duties were suspended for 1 year by act of Congress. As the Congress took no action on a bill to extend the suspension beyond June 30, 1949, the expiration date of the original legislation, the import duties provided for in the Mexican Trade Agreement were reinstated automatically on July 1, 1949, and continued at those levels throughout 1950. Abrogation of the agreement, effective January 1, 1951, restored the full duties established by the Tariff Act of 1930. The Mexican Agreement was reaffirmed on June 6, 1951, reestablishing the 1½-cent and ¼-cent duties on pig lead and lead in ores and concentrates, respectively.

Imports.—Total imports of lead declined to 258,000 tons in 1951 or less than half the record quantity of 542,000 tons imported in 1950. The drastic decline resulted from the reluctance of foreign producers to export lead to the United States, when the Free World market price for lead was considerably higher than the United States ceiling price. However, since foreign demand could not absorb the available foreign lead, stocks in the hands of producers accumulated until producers were compelled to reduce prices. By the end of the year Free World prices were essentially at the United States level.

Of total imports, 178,900 tons (69 percent) was as pigs and bars, 67,700 tons (26 percent) in ore and matte, 9,100 tons (4 percent) as reclaimed, scrap, etc., and 2,300 tons (1 percent) in base bullion. Canada supplied 32 percent of the pigs and bars, Mexico 21 percent, Yugoslavia 20 percent, Peru 18 percent, Australia 8 percent, and other countries 1 percent. Imports of ore and matte came principally from Peru, Bolivia, Africa, Canada, and Australia.

² Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

LEAD

TABLE 16.—Total lead imported into the United States as pigs, bars, and reclaimed, 1947–51, by country

[U. S. Department of Commerce]

Country	1947
Ore and matte:	
Africa.....	5,818
Australia.....	7,054
Bolivia.....	0,234
Canada.....	14,833
Chile.....	3,048
El Salvador.....	1
Guatemala.....	—
Honduras.....	—
Mexico.....	3,065
Peru.....	10,477
Other countries.....	424
Total ore and matte.....	50,782
Base bullion:	
Australia.....	—
Guatemala.....	—
Japan.....	—
Korea.....	285
Mexico.....	1,255
Peru.....	40
Other countries.....	—
Total base bullion.....	1,580
Pigs and bars:	
Africa.....	78
Australia.....	10,636
Belgium-Luxembourg.....	—
Burma.....	—
Canada.....	50,070
Germany.....	—
Italy.....	—
Japan.....	—
Korea.....	1,655
Mexico.....	85,782
Netherlands.....	—
Peru.....	1,151
Spain.....	—
Yugoslavia.....	1,120
Other countries.....	—
Total pigs and bars.....	159,511
Reclaimed, scrap, etc.:	
Africa.....	478
Australia.....	1,111
Belgium-Luxembourg.....	—
Canada.....	8,070
Canal Zone.....	20
Chile.....	6
France.....	—
Germany.....	6
Italy.....	6
Jamaica.....	3
Japan.....	5,338
Malta, Gozo, Cyprus.....	7
Mexico.....	—
Netherlands.....	—
Panama.....	4
Philippines.....	43
Yugoslavia.....	—
Venezuela.....	—
Other countries.....	11
Total reclaimed, scrap, etc.....	16,020
Grand total.....	227,873

¹ Data are "general imports," that is, include lead imported into the country under bond.

² In addition to data shown "flue dust or fume containing lead (lead content), imported as follows—11 tons.

³ Revised figure.

⁴ Less than 0.5 ton.

TABLE 17.—Lead imported for consumption in the United States, 1947-51, by classes¹

[U. S. Department of Commerce]

Year	Lead in ores, flue dust, and mattes, n.s.p.f.		Lead in base bullion		Pigs and bars		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1947.....	44,442	\$3,561,174	1,758	\$416,643	158,705	\$38,008,443	67	\$42,434	\$10,453	\$50,111,208
1948.....	33,932	8,850,507	10,922	3,239,135	244,692	80,922,779	181	100,519	35,554	100,988,922
1949.....	121,848	34,397,026	1,133	374,954	272,437	80,148,110	178	101,084	20,830	119,054,978
1950.....	² 95,068	² 21,045,414	² 1,148	² 193,356	² 434,410	² 104,340,645	207	78,111	78,690	² 129,613,215
1951.....	31,470	8,310,145			178,896	63,641,204	255	123,377	174,265	74,426,044

¹ In addition to quantities shown (value included in total values), "reclaimed, scrap, etc." imported as follows—1947: 15,963 tons, \$3,072,151; 1948: 28,897 tons, \$3,320,428; 1949: 14,076 tons, \$4,003,974; 1950: Revised figures, 22,324 tons, \$3,876,999; 1951: 7,890 tons, \$2,100,389, and flue dust or fume containing lead and zinc and other minerals or metals, (lead content) imported as follows—1951: 11 tons, \$70,694. Figures include lead received by the Government and held in stockpiles, but exclude imports for manufacture in bond and export, which are classified as "imports for consumption" by the U. S. Department of Commerce.

² Revised figure.

TABLE 18.—Miscellaneous products containing lead, imported for consumption in the United States, 1947-51

[U. S. Department of Commerce]

Year	Dabbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1947.....	204	171	\$208,185	2,406	2,219	\$753,664
1948.....	257	184	213,614	14,732	13,163	5,279,080
1949.....	281	127	459,236	5,861	5,207	2,255,909
1950 ¹	4,345	2,744	2,814,264	12,518	10,582	3,431,650
1951.....	1,633	988	1,494,792	9,336	8,660	3,845,671

¹ Revised figures.

Exports.—Total exports of pig lead in 1951 were 1,281 tons compared with 2,735 tons in 1950. Export restrictions imposed under the Export Control Act of 1940 remained in force throughout 1951.

TABLE 19.—Lead pigs, bars, and anodes exported, 1947-51, by country of destination

[U. S. Department of Commerce]

Destination	1947
Country:	
Argentina.....	894
Belgium-Luxembourg.....	63
Brazil.....	10
Canada.....	62
Canal Zone.....	52
Chile.....	10
Cuba.....	12
Colombia.....	38
Denmark.....	
El Salvador.....	9
Honduras.....	7
Hong Kong.....	23
India.....	19
Israel.....	
Madagascar.....	44
Mexico.....	16
Netherlands.....	100
Pakistan.....	(?)
Panama.....	24
Philippines.....	
Portugal.....	3
Saudi Arabia.....	50
Turkey.....	27
United Kingdom.....	30
Uruguay.....	40
Venezuela.....	
Other countries.....	1,623
Total.....	1,623
Continent:	
North America.....	144
South America.....	1,079
Europe.....	119
Asia.....	184
Africa and Oceania.....	47
Total: Short tons.....	1,623
Value.....	\$388,599

¹ In addition 102 tons of foreign lead was reexported in 1947, none in 1951.

² Less than 0.5 ton.

WORLD REVIEW

Lead is produced in many countries, Mexico, Australia, and Canada—have accounted for a large share of the world output in recent years, as is shown by the figures for 1951, which show world mine and smelter production at 1,281,000 metric tons, 21, which show world mine and smelter production at 1,281,000 metric tons, 51, insofar as statistics are available.

Algeria.—See French Morocco.

Argentina.—The chief lead-producing company in Argentina, the Compania Minera Aguilar, where the Compania Minera Aguilar, where the St. Joseph Lead Co., operates the Aguilar mine, production in 1951 was 70 percent of the mine's capacity, due to change difficulties which made it difficult to replace worn-out equipment. During the year, 199,904 metric tons of lead concentrate from which 26,219 tons of lead concentrate was produced, represents an increase over the previous year, when 23,777 metric tons of lead concentrate were milled to produce 23,777 metric tons of lead concentrate.

centrate was smelted at the National Lead Co., S. A., smelter at Barranqueras, Chaco Territory.

Australia.—Both mine and smelter output of lead increased slightly above the 1950 level despite continued shortages of labor and supplies and the requirement that producers supply domestic needs at a price approximately one-third of that received for export lead. Mine output in 1951 was 228,000 metric tons or approximately 14 percent of the world total.

The most important districts are Broken Hill, New South Wales, and Mount Isa, Queensland. Other large deposits occur at Captain's Flat (Lake George Mines) New South Wales and the Read-Roseberry mine in Tasmania.

TABLE 20.—World mine production of lead, 1946-51, by countries, in metric tons¹

[Compiled by Pauline Roberts]

Country ¹	1946	1947	1948	1949	1950	1951
Algeria.....	1,015	1,205	1,047	1,222	1,408	2,838
Argentina.....	18,100	21,200	21,800	10,000	20,000	20,000
Australia.....	180,785	109,779	220,437	216,918	222,694	228,407
Austria.....	981	1,971	3,482	4,297	4,440	4,522
Belgian Congo.....	870	670	400	180		
Bolivia (exports) ¹	8,434	11,310	25,610	26,351	31,203	30,032
Burma.....		22	36	(¹)	78	2,000
Canada.....	160,559	146,662	151,727	144,945	150,317	143,193
Newfoundland.....	25,213	21,121				
Chile.....	85	3,507	6,223	2,859	3,318	4,000
Czechoslovakia.....	2,200	(¹)	(¹)	(¹)	(¹)	(¹)
Ecuador.....	2,307	172	269	380	229	30
Finland.....	149	182	72	130	142	136
France.....	8,295	7,495	7,645	9,938	11,459	10,605
French Equatorial Africa.....	2,807	2,336	2,603	731	1,814	2,504
French Morocco.....	11,202	21,200	28,600	37,200	48,759	68,134
Germany: West Germany.....	15,378	14,756	22,344	40,944	44,830	50,368
Greece.....	475	936	1,280	2,051	2,307	4,852
Guatemala.....	(¹)	(¹)	(¹)	3,164	3,000	3,300
Honduras.....			143	449	279	464
Hungary.....	100	200	(¹)	(¹)	300	(¹)
Italy.....	13,900	24,000	30,400	34,600	38,300	38,738
Japan.....	4,344	5,208	6,672	8,132	10,896	12,072
Korea: Korea, Republic of.....		900	300	143	136	136
Mexico.....	140,144	223,133	193,317	220,703	238,078	225,468
Nigeria.....		93	273	29	12	66
Northern Rhodesia ¹	8,371	15,891	13,229	14,169	13,905	14,194
Norway.....	20	141	265	301	300	300
Peru.....	44,518	54,814	48,538	65,367	62,118	82,350
Philippines.....			(¹)	550	879	671
Poland ¹	10,915	12,761	10,874	17,850	18,000	18,000
Portugal.....	375	398	635	746	845	900
Rumania.....	3,224	3,495	(¹)	(¹)	(¹)	(¹)
Salvador.....			203	630	530	470
Southern Rhodesia.....				83		
South-West Africa.....		13,100	33,600	38,400	33,680	39,230
Spain.....	38,602	30,382	20,702	31,550	32,257	55,745
Spanish Morocco.....	240	65	215	159	178	300
Sweden.....	21,290	20,858	23,579	23,900	22,673	16,059
Tunisia.....	8,055	12,240	13,219	14,880	19,200	21,280
Turkey.....			2,756	165	280	600
Union of South Africa.....	152	133	156	165	600	900
U. S. S. R. ¹	48,000	63,000	75,000	90,000	111,500	128,400
United Kingdom.....	2,807	3,228	2,432	2,505	3,338	4,159
United States ¹	304,336	348,558	354,232	371,880	390,838	352,135
Yugoslavia.....	45,523	54,786	62,861	72,144	85,039	78,750
Total (estimate).....	1,150,000	1,359,000	1,424,000	1,535,000	1,643,000	1,679,000

¹ Lead may be produced in Brazil, China, Cuba, East Germany, India, and North Korea, but accurate data on production are not available and estimates by the senior author of chapter have been included in the world total.

² Estimate.

³ Revised figure.

⁴ Tonnage recoverable from ore.

⁵ Data not available; estimate by the senior author of the chapter included in the total.

⁶ Exports.

⁷ Smelter production.

LEAD

TABLE 21.—World smelter production of lead, 1946-51, in tons¹

[Compiled by Pauline Roberts]

Country	1946	1947	1948
Argentina.....	16,190	17,800	17,800
Australia.....	139,665	161,093	162,000
Austria.....	4,476	3,795	9,300
Belgium ¹	23,762	40,520	60,000
Brazil.....	420	402	(¹)
Burma.....			7,500
Canada.....	150,350	147,104	145,200
China.....	14	771	800
Czechoslovakia.....	2,800	4,460	5,700
France.....	32,010	29,218	38,200
French Morocco.....			2,800
Germany:			
East Germany.....		(¹)	(¹)
West Germany.....	27,059	24,350	49,300
Greece.....	1,127	948	1,100
Guatemala.....	131	110	(¹)
Hungary.....	10	60	(¹)
India.....		234	500
Italy.....	14,209	17,701	20,700
Japan.....	4,032	6,106	6,500
Korea:			
Korea, Republic of.....		250	200
North Korea.....	2,000	2,000	(¹)
Mexico.....	137,742	217,877	187,000
Northern Rhodesia.....	8,371	15,891	13,200
Peru.....	36,478	32,810	34,200
Poland.....	10,915	12,761	16,800
Portugal.....	280	321	200
Rumania.....	3,225	3,315	(¹)
South-West Africa.....		84	
Spain.....	32,246	34,382	25,300
Sweden.....	11,223	9,229	6,200
Tunisia.....	7,498	9,891	17,900
U. S. S. R. ¹	48,000	63,000	75,000
United Kingdom ¹	2,807	3,245	2,300
United States (refined) ¹	305,717	400,018	383,000
Yugoslavia.....	32,600	40,400	49,200
Total (estimate).....	1,057,000	1,320,000	1,365,000

¹ Data derived in part from Monthly Bulletin of the United Nations, Industry (Imperial Institute, London), and the Yearbook of the American Statistical Association.

² Revised figure.

³ Includes scrap.

⁴ Data not yet available; estimate by senior author of chapter included.

⁵ Estimate.

⁶ American and British zones only.

⁷ Figures cover lead refined from domestic and foreign ores; refined lead not included.

Four companies—the North Broken Hill, South, Ltd., the New Broken Hill Consolidated Zinc Corp., Ltd.—mine and mill. During 1951 the Consolidated Zinc Corp., Ltd. of developing and equipping its mine for inc course of the year the company mined and m containing 58,981 tons of recoverable lead. and milled 211,608 tons of ore (16,706 tons re for the account of New Broken Hill Consolida company made excellent progress during the of the No. 19 level and construction of new m and power plant, which were expected to be p 1952. Broken Hill South, Ltd., reported min ore which assayed 12.0 percent lead, 12.1 perc of silver per ton. The tonnage mined by Ne increased slightly, but recoveries of both lead and

the ores treated from the British, Junction, and Block 14 areas were partly oxidized.

The Electrolytic Zinc Co. of Australasia operated the Hercules and Roseberry mines in the Read-Roseberry district of Tasmania, increasing both reserves and output of lead during the year. Output of ore for the year ended June 30, 1951, was 159,429 long tons, which yielded 10,084 long tons of lead concentrate, 46,153 of zinc concentrate, and 3,781 of copper concentrate.

Mount Isa Mines, Ltd., which owns and operates the great Mount Isa deposits in Queensland, continued its operations at a normal rate. During the year the company became interested in working the Protheroe lead mine at Northampton, Western Australia, which produced about 500 tons of lead concentrate monthly.

Bolivia.—In 1951 Bolivia exported 30,000 metric tons of recoverable lead in ore. Small miners continued to dominate the lead industry and provided 63 percent of the total lead exported, with the Aramayo and Hochschild groups furnishing 15 percent each. Although official figures were not available on the amount of lead smelted in Bolivia, it was known that the 3 smelters at La Paz, Cochabamba, and Tupiza had a bullion capacity of about 500 tons per month. A fourth smelter under construction at Oruru was expected to increase total capacity to an estimated 700 tons of bullion per month.

Canada.—Although the value of recoverable lead from Canadian mines was 17 percent greater than in 1950, the output (143,000 metric tons) was the least since 1933. The Sullivan mine of the Consolidated Mining & Smelting Co., Kimberley, British Columbia, continued to be the principal source of Canadian lead. Ore production in 1951 at this mine totaled 2,533,212 short tons compared to 2,680,962 tons in 1950. As in 1950 the grade decreased somewhat because of the mining of lower grade ores and the dilution consequent to mining pillars. The company milled about 10,000 tons of ore daily, using a combination of sink-float and flotation equipment. The waste from the sink-float plant, which amounted to about 25 percent of the feed, was used for backfill in the mine. Lead concentrate was treated at the company smelter, Trail, B. C., with ores and concentrate from other properties. Production of refined pig lead at the Trail plant totaled 162,712 tons in 1951 compared with 170,364 in 1950. Work progressed on construction of new lead-smelting facilities that would both improve metallurgical efficiency and increase capacity. Accumulated and current lead-bearing residues from the Trail zinc smelter were to be smelted.

The Big Bull and Tulsequah Chief mines in northwest British Columbia came into production during the year, jointly producing 250 tons of complex ore per day. The Yale Lead and Zinc Mine, 30 miles northeast of Nelson, B. C., began producing at the rate of 190 tons of ore daily in April. Other mines were being developed in British Columbia and Nova Scotia, and exploration of the Pine Point mine on the south shore of Great Slave Lake was continued.

French Morocco and Algeria.—Perhaps the outstanding development in the lead industry abroad in 1951 was the increased production of the mines of French Morocco. Mine output of 68,100 metric tons of lead was 40 percent above that of 1950. It was unofficially reported that Société des Mines Zellidja milled 835,889 tons of ore to recover

38,885 tons of 74-percent lead concentrate and 10,000 tons of 60-percent zinc concentrate. The company's ore-treatment capacity of 3,300; it was suspended after August 1, 1952. Total Zellidja output was to be 27,000,000 tons, of which 10,000,000 tons were to be lead. Other important producers of lead in Morocco were Société des Mines d'Aouli and the Compagnie des Mines.

The lead-zinc district extends into Algeria. Société Nord Africaine du Plomb was operating a plant containing 16 percent zinc and 2 percent lead, directed from Zellidja, and plans provided for increasing daily at Zellidja's No. 1 mill beginning about 1953.

The lead smelter of the Société des Mines du Maroc Heimer produced 18,400 tons of refined lead in 1951. The smelter was said to be 4,000 tons of capacity.

Guatemala.—Output of the Caquipec mine in Alta Verapaz more than tripled that of 1950. The greater except for transportation difficulties. Production ranged from 20 to 42 percent lead, were shipped to the U. S. and Canada for smelting. Small producer Huehuetenango continued to mine and smelt lead in the market by primitive methods.

Mexico.—Mine production of lead decreased in 1951, higher prices permitted lower grade ores to be mined. According to the annual report to the stockholders of the Mexico Mines of Mexico, Ltd., shortage of capital curtailed production. The company's output of ore compared to 623,000 tons in 1950 was 544,000 tons of 64.34-percent lead concentrate, 68,452 tons of 60-percent zinc concentrate, and 6,148 tons of 26.24-percent lead concentrate. Reserves at the end of September 1951 were 6.50 percent lead, 9.35 percent zinc, and 0.15 percent copper.

South-West Africa.—The Tsumeb mine near Swakopmund, a rich and important Tsumeb mine near Swakopmund territory. In spite of transportation difficulties, production of facilities and production. In the year 1951 the concentrator treated 392,780 short tons of ore, of which 11,231 tons of lead, 12,847 tons of copper, and 12,847 tons of zinc. Sinking of the new vertical 7-compartment shaft to a depth of 2,460 feet by the end of 1951. The shaft is to 4,150 feet and equipped with a hoist and 2,000 tons of ore daily. During the year 1951 the company mined a lead-zinc deposit near Windhoek. The company expanded milling capacity at the A. G. property near Grootfontein.

Tunisia.—During 1951, 12 mines in Tunisia produced 39,350 tons of ore and concentrate to produce 1,000 tons of pig lead.

Lead and Zinc Pigments and Zinc Salts

By Robert L. Mentch

GENERAL SUMMARY

MODERATE declines in shipments of lead and zinc pigments and zinc salts featured the industry in 1951. However, owing largely to continuing defense activities, shipments remained substantially above those of 1949. Decreases from 1950 to 1951 in shipments of zinc pigments ranged from 3 percent for lithopone to 31 percent for leaded zinc oxide. Litharge and white lead (dry and in oil) declined 13 and 22 percent, respectively, while red-lead shipments were approximately the same as in 1950. Zinc salts (zinc sulfate and zinc chloride) decreased 2 and 6 percent, respectively.

Decreases in shipments of pigments and salts are attributed partly to decreases in the volume of business in industries that are important consumers of these products: Passenger-automobile production dropped 20 percent in 1951 (truck output rose 7 percent), and consumption of natural and synthetic rubber declined 3 percent (natural rubber fell 37 percent and synthetic rubber increased 41 percent) compared with 1950. The value of sales of varnish and lacquer materials was 5 percent greater than in 1950, the value of public construction increased 27 percent, and the value of private construction was approximately the same as in 1950; paint and construction gains, however, in part reflected rising costs of materials and labor.

Supplies of lead and zinc, the chief raw materials of the pigments industry, were smaller in 1951 than in 1950; yet the demand for these as metal continued high, causing a reduction in quantities available for the manufacture of pigments and also partly accounting for the decreases in shipments. Ceiling prices were established for lead and zinc on January 26, 1951, at the highest price (for each seller) at which sales were made between December 19, 1950, and January 25, 1951. Thus a number of ceiling prices were maintained for both lead and zinc. The bulk of lead and zinc sales, however, was at 17 cents per pound and 17.50 cents, respectively. These prices were for common lead, New York, and Prime Western grade slab zinc, East St. Louis, and remained in effect until October 2, 1951, when the Office of Price Stabilization permitted rises of 2 cents per pound for both metals.

Lead- and zinc-pigment price quotations maintained their historically close relationship to pig-lead and slab-zinc prices throughout the year. There were virtually no fluctuations, owing to imposition of ceiling prices by the Office of Price Stabilization early in the year. Quotations advanced up to 2 cents a pound shortly after the 2-cent rise in lead- and zinc-metal prices in October. Zinc-pigment prices reached alltime highs during the year. Lead-pigment prices, although relatively high, did not attain the record levels of 1948 and early 1949.

LEAD AND ZINC PIGMENTS

TABLE 1.—Salient statistics of the lead and zinc States, 1942-46 (average) and 1947 and 1948

	1942-46 (average)	1947	1948
Production (shipments) ¹ of principal pigments:			
White lead (dry and in oil) short tons..	* 72, 041	68, 787	46, 071
Red lead.....do.	47, 125	30, 004	30, 785
Litharge.....do.	123, 081	167, 050	164, 771
Zinc oxide.....do.	133, 912	160, 771	160, 912
Leaded zinc oxide short tons..	57, 384	81, 459	67, 412
Lithopone.....do.	139, 822	165, 024	140, 031
Value of products:			
All lead pigments.....	\$42, 100, 000	*\$90, 199, 000	*\$90, 915, 000
All zinc pigments.....	37, 434, 000	63, 801, 000	65, 547, 000
Total.....	79, 540, 000	*154, 000, 000	*156, 462, 000
Value per ton received by producers:			
White lead (dry).....	\$165	\$308	\$308
Red lead.....	174	333	333
Litharge.....	164	313	313
Zinc oxide.....	139	186	186
Leaded zinc oxide.....	134	204	204
Lithopone.....	79	105	105
Foreign trade:			
Lead pigments:			
Value of exports.....	\$1, 212, 000	\$1, 041, 000	\$670, 000
Value of imports.....	7, 000	150, 000	633, 000
Zinc pigments:			
Value of exports.....	2, 637, 000	6, 554, 000	5, 229, 000
Value of imports.....	5, 000	31, 000	7, 000
Export balance.....	3, 737, 000	7, 414, 000	5, 559, 000

¹ Reported as sales before 1945.

* Includes shipments of basic lead sulfate in 1946, figure for which no company operations.

* Excludes value of basic lead sulfate; withheld to avoid disclosure.

The supply-demand situation in lead led to the National Production Authority Order, M-38, effective February 1, 1950, which imposed limitations on inventories of lead and zinc pigments and other than ores and concentrates. This order was amended on July 28 and again on July 26 to set forth certain provisions for the issuance of rated orders to permit equitable distribution and to provide for the creation of a set-aside for emergency situations, and establish limitations on lead products.

National Production Authority Order M-38, effective February 1, 1950, restricted civilian use of zinc metal to an average quarterly rate of 80 percent of the first 6 months of 1950. Rated orders were to be in addition to the civilian inventory, restricted to a 45-day supply or to a "prudent inventory," whichever was less. This order was amended on July 1, 1951, to restrict use of Special High-Grade zinc metal to an average quarterly rate of 70 percent of the first 6 months of 1951; consumption of all other zinc was to be in accordance with the earlier order. Under NPA Order M-38, 1950, producers of zinc, zinc oxide, and zinc salts were required to maintain inventories of these materials at levels not exceeding 100 percent of the first 6 months of 1950.

required to accept rated orders for shipment in one month exceeding 10 percent of production.

Shipments of white lead (dry) and of the "in-oil" variety dropped 18 and 28 percent, respectively, from 1950 totals. Shipments of the "in-oil" variety, moreover, were the smallest by far since long before the beginning of the present century. White lead (dry) shipments, except for 1949 and 1918, were also smaller than at any time in more than 50 years. Litharge shipments decreased 13 percent in 1951 but were well above average yearly shipments during World War II. Shipments of red lead were approximately the same as in 1950 but considerably lower than in World War II years. Figure 1 shows trends in shipments of lead pigments for 1910-51.

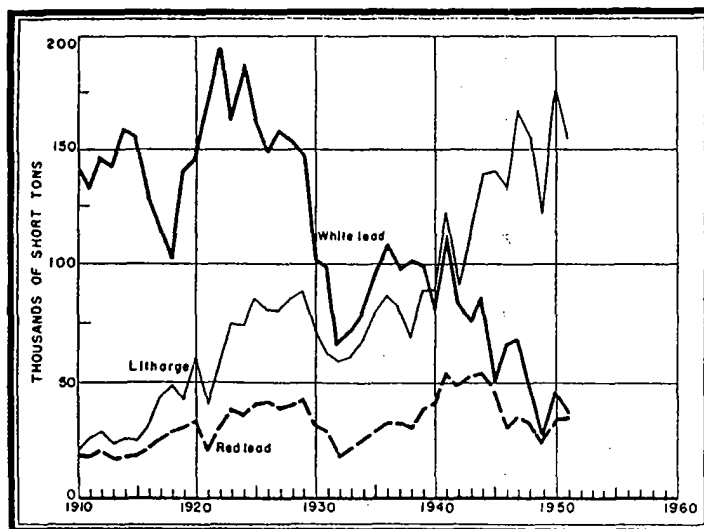


FIGURE 1.—Shipments of lead pigments, 1910-51.

Shipments of zinc oxide (lead-free), although declining 8 percent in 1951, were comparable in quantity to those during the World War II period. Shipments of leaded zinc oxide decreased 31 percent from the previous year, the largest drop among the products covered by this report. Shipments of lithopone were down 3 percent from the 1950 total and considerably lower than all years from 1925-48, inclusive. Trends in shipments of zinc pigments are shown in figure 2.

Shipments of zinc salts changed relatively little compared with 1950; zinc chloride decreased 6 percent, and zinc sulfate fell 2 percent.

The distribution of shipments of pigments to consumers in 1951 remained essentially the same as in previous years. The paint industry continued to be the largest user of white lead, leaded zinc oxide, and lithopone, accounting for approximately 81, 99, and 75 percent, respectively, of shipments. In addition, 42 percent of red-lead shipments, 22 percent of zinc oxide shipments, and 11 percent

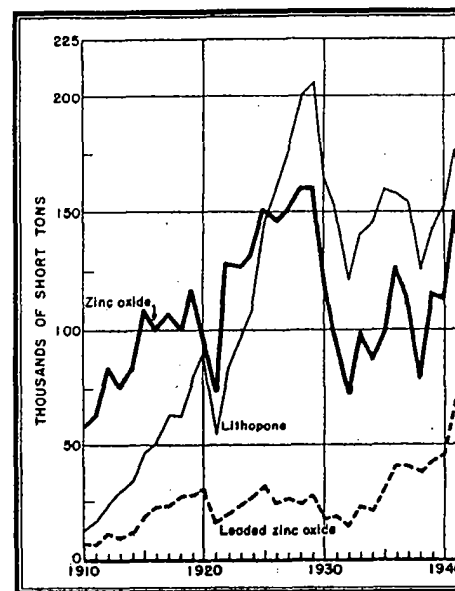


FIGURE 2.—Shipments of zinc pigments, 1910-51.

of litharge shipments went into paint manufacturing. The rubber industry was the chief user of litharge and 47 percent, respectively, of producers' shipments. Shipments of zinc oxide to the rubber industry remained half of total shipments. Relatively small quantities of lithopone, and leaded zinc oxide are also used. The ceramics industry ranks fourth in consumption of pigments, being surpassed only by the paint and rubber industries. In 1951, 15 percent of zinc oxide shipments, and 31 percent of leaded zinc oxide and red lead were used in making ceramic glazes.

Titanium pigments continued to furnish a small but increasing share of lead and zinc pigments in paintmaking. Shipments of titanium pigments were at alltime high levels in 1951, respectively, above the previous records of 1948. Adequate plant capacity and shortages of raw materials were the principal factors in titanium-pigment production for 1951. Even greater increases. At present, the industry is free to publish statistics covering pigments.

PRODUCTION

The value of shipments of lead and zinc pigments in 1951 was an 8-percent increase over 1950 despite a decline in tonnage. Lead pigments and zinc pigments

percent, respectively, of the total value in 1951 compared with 53 and 47 percent, respectively, in 1950.

For many years, figures on "sales" were used in this series of reports as a better guide than production to activity in the pigments industry. Beginning with 1945, the base was changed to "shipments" to conform with data compiled on Bureau of Mines lead and zinc schedules. Available information for 1945 (the year of change) indicates little difference between sales and shipments in that year. In reporting tonnages of pigments, an attempt is made to avoid all duplication, one of the chief problems being that finished pigments frequently are blended to make another product. Basic lead sulfate and zinc oxide, for example, are blended to make leaded zinc oxide, and in this instance the pigment weights appear in the total for the last-named class only. Pigments consumed by producing companies to make products beyond those covered by this report—that is, paints, storage batteries, and other articles—are considered as shipments.

LEAD PIGMENTS

Shipments of lead pigments decreased 13 percent in quantity but increased 12 percent in value in 1951 compared with 1950. Substantial gains in average prices received by producers increased the total value. Shipments of white lead (dry and in oil) and litharge declined 22 and 13 percent, respectively, while red-lead shipments were slightly higher than in 1950.

Average values of lead pigments reported by producers reached alltime highs: The yearly average for white lead (dry) was \$426 per ton, 27 percent above the 1950 average; red lead sold at an average of \$397 per ton, an increase of 26 percent; and litharge brought \$383 per ton, 31 percent higher than the 1950 average.

White Lead.—The general decline in shipments of white lead—first evident in the late 1920's—continued, as competitive pigments supplanted both classes in many paint formulas. Total shipments declined 22 percent and, except for 1949, were the lowest by far since much before the beginning of the twentieth century.

TABLE 2.—Production and shipments of lead pigments¹ in the United States, 1950–51

Pigment	1950				1951			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Short tons	Value ¹			Short tons	Value ¹	
			Total	Average			Total	Average
White lead:								
Dry.....	27,954	28,506	\$9,853,687	\$336	22,982	23,350	\$9,052,883	\$426
In oil.....	16,778	16,670	7,403,032	444	11,177	12,056	0,007,291	498
Red lead.....	34,066	35,072	11,013,908	314	31,065	35,352	14,025,182	397
Litharge.....	178,225	177,658	61,887,453	292	162,155	164,753	69,287,262	383

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.

LEAD AND ZINC PIGMENTS AND

TABLE 3.—Lead pigments shipped by manufacturer, 1942–46 (average) and 1947–51,

Year	White lead			Basic lead or sublimate
	Dry	In oil	Total	White
1942–46 (average) ¹	138,226	34,415	172,641	5,642
1947.....	30,075	29,712	68,787	(*)
1948.....	25,551	19,519	46,070	(*)
1949.....	15,719	11,436	27,355	(*)
1950.....	28,506	16,670	45,176	(*)
1951.....	23,350	12,056	35,415	(*)

¹ Basic lead sulfate for 1946 included with white lead (dry) in company operations.

² 1941–45 average; see footnote 1.

³ Figure withheld to avoid disclosure of individual company operations.

Basic Lead Sulfate.—Because there was no production of basic lead sulfate in 1946, the Bureau of Mines is not at liberty to publish figures for 1946–51.

Red Lead.—Shipments of red lead in 1951 were the same as in 1950 but were 25 to 35 percent lower than in 1949.

Orange Mineral.—No shipments of orange mineral were reported in 1947–51.

Litharge.—Although declining 13 percent in quantity, litharge shipments remained at a comparatively high level, exceeding only in 1947, 1948, and 1950. It has been the largest quantity pigment of the group.

Battery manufacturers produced 77,000 tons of suboxide of lead in 1951 for their own use. This quantity compares with 80,000 tons in 1950. Oxide production required 73,000 tons of pigments in 1950, and 53,000 tons in 1949.

ZINC PIGMENTS AND

Owing to substantial gains in average prices, the value of shipments of zinc pigments in 1951 was 11 percent higher than in 1950, despite an 11-percent decrease in the quantities of zinc oxide (lead-free), the most important in tonnage and value, declined 8 percent; zinc oxide fell 31 percent; and shipments of zinc silicate 14 percent.

Producers' average values attained new highs, the records established in 1950. Average values of shippers were as follows: Zinc oxide (lead-free), \$21 per ton; leaded zinc oxide, \$320 per ton; and lithopone, \$141 per ton, or 14 percent higher than in 1950.

Shipments of the zinc salts—zinc chloride, zinc sulfate, and zinc silicate—declined 6 and 2 percent, respectively, from 1950 to 1951. Zinc chloride was compared favorably with tonnages in previous years. The two compounds were \$85 and \$160 per ton, compared with \$73 and \$131 in 1950.

TABLE 4.—Production and shipments of zinc pigments and salts in the United States, 1950-51

Pigment or salt	1950				1951			
	Pro- duction (short tons)	Shipments			Pro- duction (short tons)	Shipments		
		Short tons	Value ¹			Short tons	Value ¹	
			Total	Average			Total	Average
Zinc oxide ²	161,374	160,829	\$41,439,269	\$258	153,714	147,710	\$45,948,219	\$311
Leaded zinc oxide ³	63,194	63,973	16,752,888	262	50,972	44,341	14,179,993	320
Lithopone.....	99,321	105,650	13,129,363	124	107,519	102,837	14,470,742	141
Zinc chloride, 50° B.....	63,843	64,564	4,703,250	73	62,527	60,730	5,182,382	86
Zinc sulfate.....	23,587	23,912	3,124,413	131	23,603	23,524	3,709,825	160

¹ Value at plant, exclusive of container.² Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide. In this table data for leaded zinc oxide include a small quantity containing less than 5 percent lead.TABLE 5.—Zinc pigments and salts shipped¹ by manufacturers in the United States, 1942-46 (average) and 1947-51, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1942-46 (average).....	133,912	57,384	139,822	55,434	18,584
1947.....	160,771	81,459	165,024	65,521	21,547
1948.....	160,958	87,441	140,033	68,701	21,513
1949.....	110,132	30,722	78,335	55,208	20,005
1950.....	160,829	63,973	105,650	64,564	23,912
1951.....	147,716	44,341	102,837	60,730	23,624

¹ Reported as sales before 1945.

Zinc Oxide.—Shipments of lead-free zinc oxide were 8 percent lower in 1951 than in 1950, owing partly to the reduced availability of raw materials from which the oxide is produced.

Leaded Zinc Oxide.—Shipments of leaded zinc oxide declined 31 percent in 1951, the largest decrease among the pigments covered by this report.

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—5 percent or less lead, over 35 to 50 percent lead, and over 50 percent lead—are produced. Production by grades in 1951 (1950 in parentheses) was as follows: 35 percent lead and under, 46,960 (54,641) tons; over 35 percent lead, 4,012 (8,553) tons.

Lithopone.—Shipments of lithopone fell 3 percent below those in 1950 and were much lower than in all years from 1924-48, inclusive.

TABLE 6.—Production of zinc oxide (lead-free) by processes, 1946-51, as percent of total

Process	1946	1947	1948	1949	1950	1951
American process (ore and primary residues).....	75	73	76	71	72	75
French process (metal and scrap).....	17	17	15	17	18	18
Other.....	8	10	9	12	10	7
Total.....	100	100	100	100	100	100

LEAD AND ZINC PIGMENTS AND

The lithopone statistics in this report are for ordinary lithopone sold as such plus the ordinary of the high-strength product.

Consumption of ordinary lithopone in the lithopone has diminished to very small proportions, been downward almost continuously since 1949, was used in making the titanated product. for this purpose in 1951 was 55 percent below 1950 and the smallest on record. The lithopone are included in the totals for ordinary lithopone.

TABLE 7.—Titanated lithopone produced in the United States, 1942-46 (average) and 1947-51, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year
1942-46 (average).....	9,000	8,150	1949.....
1947.....	2,000	2,200	1950.....
1948.....	2,100	1,700	1951.....

Zinc Sulfide.—In 1951 as in several previous years, the company produced zinc sulfide, hence the B. liberty to publish figures for this pigment.

Zinc Chloride.—Shipments of 50° B. solution were 6 percent in 1951 but were at a comparative level exceeded in only 4 earlier years.

Zinc Sulfate.—Although zinc sulfate shipments in 1950, the total was the third-highest on record, 19 percent below the peak established in 1946.

RAW MATERIALS USED

Lead pigments and zinc pigments and salts are made from a variety of materials, including ore, refined materials as scrap, residues, ashes, drosses, and so on. As in 1950 and 1949, approximately 94 percent of the lead used was derived from pig lead and the remainder from ore used to make leaded zinc oxide, about 15 percent was from foreign sources. The sources of zinc used are as follows: 76 percent (73 in 1950) from ore, 15 percent from slab zinc, and 15 (17) percent from scrap. About 19 (22) percent of the ore used was of the high-strength type. Tables 8 and 9 give the quantities and sources of materials used in manufacturing each pigment and salt. Pigments are produced, either directly or indirectly, in many ways, including litharge, red lead, and orange mineral and ising basic lead sulfate. The lead content of the materials used in the production of pig lead is shown in the table. Zinc oxide is the only material used in the production of lithopone, zinc sulfide, and lead sulfate. Over half of the zinc contained in 1951 and 59 in 1950) and virtually all of the

percent in 1951 and 1950) produced in the United States are derived from secondary material. The proportion of zinc oxide production derived from metal and scrap dropped to 24 percent in 1951 compared with 29 percent in 1950. For a number of years before the United States entered World War II, there had been a large increase in the quantity of secondary zinc used in manufacturing zinc oxide. The scarcity of supplies of both metal and scrap caused the proportion of the total oxide made by the French process—which uses only metal and scrap—to drop sharply in 1942 and to continue comparatively low in 1943–46, despite the fact that the total percentage from metal and scrap rose in 1943 and continued upward almost without interruption in 1944–50. The production of zinc oxide from metal and 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.

TABLE 8.—Lead content of lead and zinc pigments¹ produced by domestic manufacturers, 1950–51, by sources, in short tons

Pigment	1950				1951			
	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.....			35,807	35,897			27,409	27,409
Red lead.....			30,884	30,884			30,880	30,880
Litharge.....			165,428	165,428			141,215	141,215
Leaded zinc oxide.....	12,606	2,061		14,667	11,237	1,581		12,818
Total.....	12,606	2,061	232,209	246,876	11,237	1,581	199,504	212,322

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, 1950–51, by sources, in short tons

Pigment or salt	1950					1951				
	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 ¹		Ore		Slab zinc	Secondary material ¹	
	Domestic	Foreign				Domestic	Foreign			
Zinc oxide.....	69,412	22,327	16,866	19,749	128,354	77,805	18,275	15,565	14,909	126,644
Leaded zinc oxide.....	26,916	5,274	—	—	32,220	21,304	4,046	—	—	25,410
Lithopone.....	6,380	1,507	30	11,494	19,411	7,684	2,010	59	11,098	20,851
Total pigments.....	102,738	29,108	16,896	31,243	179,985	106,853	24,331	15,714	26,007	172,905
Zinc chloride.....	—	—	—	14,346	14,346	—	—	—	14,078	14,078
Zinc sulfate.....	2,127	461	—	4,710	7,298	2,203	453	—	5,008	7,669

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

LEAD PIGMENT

White Lead.—The paint industry is by far the largest consumer of white lead, generally accounting for 90 percent of this pigment. Available statistics show that the consumption of white lead has increased in recent years, but this is probably due to the inability of the paint industry to obtain data on end-use classification. It is known that the white lead sold to the Government has been used for the manufacture of white lead paint for want of information on actual end use. A substantial part of the entire "Other" classification is accounted for by white lead under paint. Shipments to ceramics makers, plasticizers and stabilizers accounted for 4 percent of the total distribution in 1951.

TABLE 10.—Distribution of white lead (dry and anhydrous) (average) and 1947–51, by industry

Industry	1942–46 ¹ (average)	1947	1948
Paints.....	66,117	61,285	46,880
Ceramics.....	1,282	1,665	1,665
Other.....	5,242	5,857	2,455
Total.....	72,641	68,787	50,999

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:

Basic Lead Sulfate.—A distribution of basic lead sulfate by uses has not been available for public consumption. In 1950, 686 tons went to the paint industry, 200 tons to other industries. Substantially all of the basic lead sulfate is also used as an intermediate product in the manufacture of zinc oxide. Such quantities have always been small compared with the quantities of zinc oxide produced under leaded zinc oxide rather than basic lead sulfate.

Red Lead.—Producers' deliveries to the paint industry again accounted for the largest proportion of red lead shipments—47 percent compared with 50 percent in 1950. In the past, the paint industry was the second largest consumer of red lead pigment, taking 42 percent (40 in 1950). In 1951, relatively small quantities were used in making red lead paint.

TABLE 11.—Distribution of red-lead shipments¹ by industry, in short tons

Industry	1942–46 (average)	1947	1948
Storage batteries.....	25,242	20,883	19,410
Paints.....	17,424	11,362	10,810
Ceramics.....	859	977	977
Other.....	3,600	2,842	2,842
Total.....	47,125	36,064	34,039

¹ Reported as sales before 1945.

Orange Mineral.—No shipments of orange mineral have been reported since 1946, when 78 tons went to the ink industry, 18 tons to the color-pigment industry, and 27 tons to other industries.

Litharge.—The largest single use of litharge is for storage batteries. This use took 61 percent of total shipments in 1951 and since 1947 has accounted for roughly two-thirds of all shipments. The ceramics industry is the second largest consumer of litharge; shipments for this purpose were the second highest on record in 1951 despite an 18-percent decrease from the previous year. Shipments to insecticide makers were 47 percent less than in 1950, the largest drop among the end-use items in this report. Tonnages used for chrome pigments and varnish increased 11 and 28 percent, respectively, while shipments to oil refineries and rubber manufacturers decreased 6 and 13 percent. Shipments for use in floor coverings, regularly a very small item, increased over eight fold in 1951.

TABLE 12.—Distribution of litharge shipments¹, 1942-46 (average) and 1947-51, by industry, in short tons

Industry	1942-46 (average)	1947	1948	1949	1950	1951
Storage batteries.....	65,354	111,840	100,645	77,163	105,558	94,064
Ceramics.....	11,290	18,360	19,979	13,299	27,771	22,815
Chrome pigments.....	9,440	9,228	7,455	8,567	10,017	11,117
Oil refining.....	5,741	7,688	7,248	5,720	6,488	6,068
Insecticides.....	18,660	7,288	6,033	5,353	10,651	5,691
Varnish.....	3,184	4,268	4,424	4,288	4,347	5,584
Rubber.....	2,958	2,205	2,835	1,398	3,047	2,641
Floor coverings.....	168	141	162	62	220	1,772
Other.....	6,291	6,042	6,004	5,214	9,559	5,001
Total.....	123,081	187,050	154,775	121,052	177,658	154,753

¹ Reported as sales before 1945.

ZINC PIGMENTS AND SALTS

Zinc Oxide.—The distribution pattern of lead-free zinc oxide shipments was essentially the same in 1951 as in previous years. The largest tonnages went to rubber manufacturers, 48 percent (52 in 1950); the paint industry, 22 percent (25); and ceramics makers, 7 percent (8). Shipments to all consuming industries, except manufacturers of coated fabrics and textiles, whose consumption increased

TABLE 13.—Distribution of zinc oxide shipments¹, 1942-46 (average) and 1947-51, by industry, in short tons

Industry	1942-46 (average)	1947	1948	1949	1950	1951
Rubber.....	65,472	82,248	82,895	58,406	82,044	71,507
Paints.....	28,554	32,867	26,779	26,205	39,699	32,934
Ceramics.....	4,788	11,350	12,327	6,982	12,679	10,324
Coated fabrics and textiles ²	9,293	9,100	9,474	5,200	6,303	7,265
Floor coverings.....	10,308	4,735	4,938	2,665	3,670	3,114
Chemical warfare.....	15,499	20,471	14,545	10,584	15,534	22,572
Other.....	15,499	20,471	14,545	10,584	15,534	22,572
Total.....	133,912	180,771	150,958	110,132	160,829	147,716

¹ Reported as sales before 1945.

² Includes the following tonnages for rayon: 1947-7,302; 1948-5,209; 1949-4,470; 1950-4,850; 1951-5,275.

LEAD AND ZINC PIGMENTS

15 percent, declined in 1951. One common use of lead oxide for chemical warfare purposes; but is not complete, the tonnage is included in the total.

Leaded Zinc Oxide.—Leaded zinc oxide is used exclusively as a pigment in paint manufacture. About 1 percent of total shipments was for this purpose (less than 1 percent of shipments) are used in other industries. Shipments of leaded zinc oxide were 15 percent less than in 1950, year, and, as a result, stocks increased. The production of leaded zinc oxide is produced from ores and materials improves its competitive position when metal and scrap are in short supply.

TABLE 14.—Distribution of leaded zinc oxide shipments¹, 1942-46 (average) and 1947-51, by industry, in short tons

Industry	1942-46 (average)	1947	1948
Paints.....	55,049	77,094	6,068
Rubber.....	105	131	5,691
Other.....	2,230	3,334	5,584
Total.....	57,384	81,459	6,068

¹ Reported as sales before 1945.

Lithopone.—Lithopone is used principally in paints, varnish, and lacquers; approximately 75 percent of total shipments are to these industries. In 1951, 75 percent (74 in 1950) of the total. The largest use of the pigment is in paper manufacturing increased 69 percent. In other purposes except printing ink decreased 39, 19, and 13 percent, respectively.

TABLE 15.—Distribution of lithopone shipments¹, 1942-46 (average) and 1947-51, by industry, in short tons

Industry	1942-46 (average)	1947	1948
Paint, varnish, and lacquers ²	110,911	134,830	10,324
Paper.....	4,010	4,069	7,265
Coated fabrics and textiles.....	5,046	8,421	3,114
Floor coverings.....	9,856	9,048	22,572
Rubber.....	1,087	3,085	15,534
Printing ink.....	(³)	(⁴)	147,716
Other.....	8,312	5,571	
Total.....	139,822	165,024	

¹ Reported as sales before 1945.

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

³ Revised figure.

⁴ Included in "Other" before 1950, except for those quantities.

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

Zinc Sulfate.—The textile (rayon) industry has been the largest consumer of zinc sulfate since 1946, when agricultural use led; in 1951 the quantity used for rayon fell 10 percent from 1950 but was higher than in all years except 1950 and 1949. Agriculture and chemicals continued as the second and third largest uses, with shipments for agricultural purposes decreasing 4 percent from the previous year and shipments to producers of chemicals increasing 53 percent. Shipments for textile dyeing and printing in 1951 were almost 11 times higher than in 1950, by far the largest gain for any one end use of any of the pigments covered by this report. Shipments for flotation reagents, glue, electrogalvanizing, and paint and varnish processing decreased markedly in 1951.

TABLE 16.—Distribution of zinc sulfate shipments¹, 1942-46 (average) and 1947-51, by industry, in short tons

Industry	1942-46 (average)	1947		1948		1949		1950		1951	
	Gross weight	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis
Rayon.....	5,601	8,210	6,173	9,900	7,333	10,591	7,957	11,217	8,322	10,073	7,925
Agriculture.....	5,977	7,827	6,125	5,210	4,248	4,429	3,595	5,841	4,880	5,588	4,847
Chemicals.....	2,113	2,120	1,439	1,734	1,193	1,197	851	1,879	1,377	2,871	2,243
Textile dyeing and printing.....	272	60	38	102	66	30	21	145	129	1,400	1,103
Flotation reagents.....	1,017	1,112	717	1,632	1,366	921	757	962	727	868	736
Glue.....	490	824	444	501	462	453	370	579	404	395	337
Electrogalvanizing.....	285	233	146	319	206	217	154	324	203	190	129
Paint and varnish processing.....	1,200	61	51	121	104	663	585	189	119	32	20
Other.....	1,539	1,300	864	1,934	1,191	1,564	979	2,780	1,820	2,116	1,274
Total.....	18,584	21,547	15,907	21,513	16,168	20,065	15,200	23,012	18,041	23,524	18,674

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 early part of this chapter. Average values for white lead and red lead established new peaks in 1951, 17 percent and less than 1 percent, respectively, over the previous highs set in 1948. The average value for litharge was only 1 percent under the 1948 record. As previously stated, lead-pigment quotations were relatively steady throughout the year, the only notable changes occurring on October 2, when the price of lead advanced 2 cents a pound.

Average values received by producers of zinc pigments reached unprecedented highs in 1951, with gains over the previous peaks, recorded in 1950, ranging from 14 percent for lithopone to 22 percent for leaded zinc oxide. Quotations for pigments began at high levels and increased up to 2 cents a pound in October following the rise in zinc-metal prices.

New highs were also recorded for zinc chloride and zinc sulfate; average values were 16 and 22 percent, respectively, above the peaks established in 1950.

LEAD AND ZINC PIGMENTS

TABLE 17.—Range of quotations on lead pigments at New York (or delivered in the East)

Product	1948
White lead (basic lead carbonate), dry, carlots, barrels.....	16.00-22.00
Basic lead sulfate (sublimed lead), less than carlots, barrels.....	15.75-21.00
Red lead, dry, 95 percent or less, less than carlots, barrels.....	18.00-25.00
Orange mineral, American, small lots, barrels.....	20.50-27.00
Litharge, commercial, powdered, barrels.....	16.00-24.00
Zinc oxide:	
American process, lead free, bags, carlots.....	10.00-13.00
American process, 5 to 35 percent lead, barrels, carlots.....	10.25-15.00
French process, red seal, bags, carlots.....	11.25-14.00
French process, green seal, bags, carlots.....	11.75-15.00
French process, white seal, barrels, carlots.....	12.50-16.00
Lithopone, ordinary, small lots, bags.....	6.25-8.00
Zinc sulfide, less than carlots, bags, barrels.....	10.75-14.00
Zinc chloride, works:	
Solution, tanks.....	3.00-3.50
Fused, drums.....	6.25-7.00
Zinc sulfate, crystals, barrels.....	4.55-6.00

¹ Includes granulated.

FOREIGN TRADE

Foreign trade in lead and zinc pigments has been of minor importance in relation to domestic production and consumption. A "favorable balance of trade" in these commodities—exports over value of imports—is generally maintained. In 1951 the value of exports was \$2,116,000 compared with imports valued at \$2,116,000, a net increase over 1950 of 155 percent for imports.

Imports of white lead (basic lead compound) entries, were 7 and 1 percent of domestic shipments; and imports of zinc oxide were 1 and 1 percent of domestic shipments. Small quantities of lead suboxide, lead arsenate, and lead chromate were also imported for consumption in 1951.

Lithopone and zinc oxide are the two pigments of greatest tonnage from the United States. Exports of lithopone were 20,473 and 8,895 tons, respectively, in 1950 and 1951. Exports of zinc oxide were 9,357 and 3,094 tons. The 1951 tonnage was 20 and 6 percent of the total shipment.

Litharge, white lead, red lead, and zinc chloride are produced by the United States, but exports consist of small quantities of shipments by domestic producers.

¹ Figures on imports and exports compiled by M. B. Price, Chief, Bureau of Foreign Trade, U. S. Department of Commerce.

TABLE 18.—Value of foreign trade of the United States in lead and zinc pigments and salts, 1949-51

[U. S. Department of Commerce]

	Imports for consumption			Exports		
	1949	1950	1951	1949	1950	1951
Lead pigments:						
White lead.....	\$73,486	\$271,035	\$880,073	\$270,888	\$243,344	\$272,095
Red lead.....	11,818	27,114	89,351	408,491	194,930	285,068
Litharge.....	39,822	4,570	788,084	471,143	511,042	445,201
Other lead pigments.....	17,448	40,781	32,373	(¹)	(¹)	(¹)
Total.....	142,603	343,600	1,796,761	(¹)	(¹)	(¹)
Zinc pigments:						
Zinc oxide.....	49,809	1,081,816	779,299	1,607,205	875,829	3,238,685
Zinc sulfide.....		14,470		(¹)	(¹)	(¹)
Lithopone.....	2,053	179,197	151,165	1,018,913	1,248,538	3,615,915
Total.....	51,862	1,275,492	930,464	3,426,118	2,124,367	6,854,600
Lead and zinc salts:						
Lead arsenate.....			2,664	184,091	215,034	165,215
Other lead compounds.....	4	1,055	68,609	(¹)	(¹)	(¹)
Zinc chloride.....	2,650	39,447	194,593	(¹)	(¹)	(¹)
Zinc sulfate.....	6,472	11,202	15,695	(¹)	(¹)	(¹)
Total.....	9,126	42,704	281,433	(¹)	(¹)	(¹)
Grand total.....	203,591	1,661,690	3,008,658	(¹)	(¹)	(¹)

¹ Data not available.

TABLE 19.—Lead pigments and salts imported for consumption in the United States, 1947-51

[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	
1947.....	1	22	416	33	—	60	—	\$171,050
1948.....	203	217	1,044	34	30	—	1	633,776
1949.....	161	23	90	23	0	—	(¹)	142,607
1950.....	941	70	12	57	27	—	2	344,556
1951.....	2,575	215	1,855	53	—	7	180	1,808,034

¹ Less than 0.5 ton.

TABLE 20.—Zinc pigments and salts imported for consumption in the United States, 1947-51

[U. S. Department of Commerce]

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1947.....	117	1	(1)			295	\$47,482
1948.....	27	(1)				180	17,768
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

¹ Less than 0.5 ton.

LEAD AND ZINC PIGMENTS AND SALTS

TABLE 21.—Lead pigments and salts exported from the United States, 1947-51

[U. S. Department of Commerce]

Year	Short tons		Total value
	White lead	Red lead	
1947.....	863	—	\$272,095
1948.....	603	—	285,068
1949.....	699	1,044	445,201
1950.....	815	—	445,201
1951.....	767	—	—

TABLE 22.—Zinc pigments and salts exported from the United States, 1947-51

[U. S. Department of Commerce]

Year	Short tons		Total value	Y
	Zinc oxide	Lithopone		
1947.....	10,955	9,651	\$2,911,457	1949.....
1948.....	19,082	13,652	6,551,250	1950.....
1949.....	8,642	21,016	5,228,962	1951.....