MINER
YEARB

1 9

Prepared by the staff of the

BUREAU OF MINES

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Lead[1]

By Richard H. Mote and Edith E. den Hartog

GENERAL SUMMARY

THE TRANSITION in lead supply from insufficiency to abundance accompanied by falling prices highlighted the domestic lead industry in 1949. Noteworthy also was the consumers' cautious buying and general lack of confidence in price stability that resulted in purchases of quantities substantially smaller than actual needs and an 18-percent reduction in consumers' inventories during the year. Some stability was rendered the lead market by the Government through purchase during the year of substantial tonnages of pig lead for the National Stockpile. Contributing to the expanded supply was the high level of imports prevailing in 1949, which resulted in accumulation of nearly 400,000 tons of lead from foreign sources, the largest annual tonnage imported in the peacetime history of the United States.

Although labor strikes continued to exact a toll in reduced output of lead at mines and smelters, the total loss of production was not as great as in 1948. Total mine output advanced 5 percent in 1949, and production of refined lead at primary refineries rose 22 percent to the highest level since 1942. Lead from secondary sources continued for the fourth year to be a greater source of supply than production from domestic mines.

Over-all consumption of primary, antimonial, and secondary lead in the United States in 1949 declined 16 percent from 1948.

Salient statistics of the lead industry in the United States, 1940–44 (average) and 1945–49, in short tons

	1940–44 (average)	1945	1946	1947	1948	1949
Production of refined primary lead:						
From domestic ores and base bullion	434,387	356,535	293,300	381,109	339,413	404,449
From foreign ores and base bullion	86,685	87,050	44,888	59,901	67,281	72,889
Total	521,072	443,585	338,197	441,010	406,694	477,338
Recovery of secondary lead	330,855	363,039	392,787	r 511,970	500,071	412,183
Imports (general):						
Lead in pigs, bars, and old	253,160	230,313	r 118,042	175,538	r 276,013	289,889
Lead in base bullion	18,565	8	125	1,580	7,186	2,373
Lead in ores and matte	87,258	70,005	r 44,286	50,752	63,907	107,279
Exports of refined pig lead	11,516	r 1,408	r 598	r 1,523	r 411	969
Consumption of primary and secondary lead	1,021,329	1,051,602	956,470	1,172,000	1,133,895	957,674
Prices (cents per pound):						
New York:						
Average for period	6.09	6.50	8.11	14.67	18.01	15.36
Quotation at end of period	6.17	6.50	12.55	15.00	21.50	12.00
London average for period	4.49	4.99	8.63	15.27	17.16	16.95
Mine production of recoverable lead	457,046	390,831	335,175	384,221	390,476	409,908
World smelter production of lead	1,743,000	1,233,000	r 1,146,000	r 1,443,000	r 1,488,000	1,723,000

r *Revised figure.*

[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.

DOMESTIC PRODUC

Statistics on lead output may be prepare
refinery basis. Mine-production data cor
content in ore and concentrates and adjus
losses in smelting are a closer measure of
and are most accurate for showing the
production. Pig-lead output, as reported
presents a more precise figure of actual l
only in a general way the source of crude
and refinery output generally differs from
the lag between mine shipments and smel
concentrates.

MINE PRODUCTIO

Domestic mine output of recoverable l
compared with 1948 and was the large
reflected the response to the incentive of
the early part of the year and also fewer
due to labor-management disputes, such
shut down the large lead mines in Sou
months in 1948 at an estimated loss of 25,
ward trend in lead price which began in M
May resulted in some mine closings and
large lead-producing properties but failed
gain in output recorded during the early
January, production during the first half
consistently over the 1,123-ton average
year. Production during the latter half
sharply, and the daily output through
the annual average. The daily product
21 percent above the low point of the yea
only 90 percent of the March rate, which

Production in 11 of the 22 lead-produc
the rates established in 1948, and in some
record high outputs were recorded. In A
far greater than in any other year in the
not since 1917 have California mines pro
recovered in 1949. Colorado lead outpu
since 1927 and in Nevada the 1949 prod
any year since 1936. Similar but less spe
lished in the Mid-Continent region, wh
exceeded that of every year since 1942;
8-year high; and Missouri mines closely a

Of the total lead produced at United
percent came from the output of 25 prop
to rank first among the States in the p
Southeastern Missouri district continued
ducing area, supplying 31 percent of t
As in the past, the St. Joseph Lead Co., pr
put from its Bonne Terre, Desloge, Fec
and Leadwood mine groups in St. Fran
La Motte mine in Madison County. Ea

mill; the five have a combined daily capacity of about 28,800 tons of ore. The St. Louis Smelting & Refining Division, National Lead Co., operated continuously its Madison lead-copper mine and 1,200-ton all-flotation mill at Fredericktown; the output of both lead and copper concentrates showed a large increase over 1948. The Catherine-Fleming mine was operated by the Park City Consolidated Mines Co. from January to March and by the Fredericktown Lead Co. the remainder of the year. In Jefferson County the Fredericktown Lead Co. operated the leased Valle Mine property during January and February and 1 week in May.

Lead production in the Tri-State district gained despite curtailments in rate of ore output and shut-downs caused by falling metal prices. On March 5 the weekly quoted price of lead concentrates at Joplin, Mo., was $290.92 a ton, and in the slightly more than 2 months that followed the quotation dropped without interruption to $148.63 on May 28. About 50 of the mines shut down, and most of the other 76 curtailed production. Output of lead concentrates in June was 34 percent under March production. During July the market price advanced to $183.91 but the monthly production was the lowest of the year, as the mines and mills of the Eagle-Picher Mining & Smelting Co. were shut down by a work stoppage from July 1 to August 7, and other mines shipping to the company's Central mill could not operate during this period. The five leading Tri-State lead-producing companies in 1949, in order of output, were: Eagle-Picher Mining & Smelting Co., Nellie B. Mining Co., Federal Mining & Smelting Co., National Lead Co. St. Louis Smelting & Refining Division, and the W. M. & W. Mining Co. The Tri-State district produced 8 percent of the total domestic lead output in 1949.

Mine production of recoverable lead in the combined Western States dropped 4 percent from 1948. In 1949 lead mines in the region contributed 59 percent of the total domestic production compared with 65 percent in 1948. Idaho was again the largest producer of lead in the Western States and second only to Missouri in the United States. In 1949, 94 percent of the Idaho total lead came from the Coeur d'Alene region. Six properties in the State produced 64 percent of the total lead, 77 percent of which came from zinc-lead ore and old tailings. Lead production in Utah in 1949 declined 5 percent from the 1948 output. Because of a reduced workweek early in May, followed by stoppages late in June at three of the large lead producers and serious curtailment at the fourth in the Park City region, production of lead for the year declined substantially at the properties of the New Park Mining Co., Park Utah Consolidated Mines Co., Silver King Coalition Mines Co., and Pacific Bridge Co. The Calumet mine in the Rush Valley district also produced less lead than in 1948. These losses were compensated in part by increases in lead yield from the United States & Lark group, Chief Consolidated Mining Co. property, Butterfield group, Cardiff mine, and the Hidden Treasure mine, and the return to production of the New Park Mining Co. property on September 15. The United States & Lark property of the United States Smelting, Refining & Mining Co. in the West Mountain (Bingham) district remained first among the State lead producers. Of the State total lead in 1949, 92 percent was recovered from zinc-lead ore. The output of lead in Arizona in 1949 was far greater than in any

previous year in the State's history. Contin
and zinc-lead mines throughout 1949 resulted
33,568 tons of recoverable lead, a gain of 3,(
output in 1948. The Copper Queen mine of
at Bisbee, with an increase of 23 percent in le
by far the largest producer of lead in Arizona
were the St. Anthony property at Tiger, the S
Mining & Smelting Co.) south of Tucson,
Humboldt, and the Flux-January-Norton
More than 92 percent of the lead output in
zinc-lead ore and the rest largely from lead o

Although the sharp drop in base-metal pric
mines to close in 1949, the State output of lea
successive year and was the highest since
producing mines, in order of rank, were the V
Resurrection at Leadville, Treasury Tun
Miguel County, Smuggler Union at Tellur
Red Cliff. Zinc-lead ore yielded 65 percent
during the year. Lead production in Mon
percent from the 1948 figure. As in most ot
drop in output was largely the result of dec
which forced closing of some smaller prope
curtailed activity at other operations. At
the Anaconda Copper Mining Co. a 5-day w
early in June, underground mining was red
lead dump ore ceased, and work on the Gr
temporarily suspended. In mid-November
were resumed. The four leading lead prod
percent of the State lead in 1949, were the Bu
at Butte, the Emma mine at Butte, the Mik
and the Jack Waite mine in Sanders Cou
Nevada mines in 1949 surpassed the 1948 pr
reach the highest level since 1936. The
County, accounted for 62 percent of the lea
in 1949; the leading properties were: The Pi
the Combined Metals Reduction Co., the El
Ely Valley Mines, Inc., and the Prince mine o
Mining Co. Important producers in additio
district included the Copper Canyon Min
mine, Battle Mountain district, Lander C
Yellow Pine mine, Yellow Pine district, Clark
& Hullinger, Cleveland mine, Delano distr
California mine production of recoverable
1949, a 13-percent gain over 1948 and the h
record output in 1917. The Anaconda Co
group of mines in the Coso district, Inyo Co
State's leading producer of lead. The pro
July, August, and part of September owi
prices in the second quarter of the year. Ot
operated in California in 1949 included Ana
also in the Coso district, the Defense and
Modoc district of Inyo County, and the Cor
Afterthought mine in the Cow Creek dis

Despite a work stoppage most of the year at the Grandview mine of the American Zinc, Lead & Smelting Co. in the Metaline district, normally the State's largest lead producer, lead output in Washington in 1949 was only 10 percent under the 1948 figure. The Bonanza mine in Stevens County and the property of the Pend Oreille Mines & Metals Co. in the Metaline district reported substantial increases in lead yield. Production dropped at the Deep Creek mine in Stevens County. The above four properties supplied 97 percent of the State lead in 1949, and of the total lead 64 percent was derived from zinc-lead ore and nearly all the remainder from lead ore. The mine production of lead in New Mexico, the bulk of which comes from mines yielding chiefly zinc, declined 39 percent from 1948. The larger producers in 1949 were the American Smelting & Refining Co. Ground Hog and United States Smelting, Refining & Mining Co. Bayard groups in the Central district and the Kelly group (American Smelting & Refining Co.) and Lynchburg (S. S. Elayer) in the Magdalena district.

Mine production of recoverable lead in the United States, 1940-44 (average) and 1945-49, by States, in short tons

State	1940-44 (average)	1945	1946	1947	1948	1949
Western States and Alaska:						
Alaska	420	11	115	264	329	51
Arizona	14,822	22,867	23,930	28,566	29,899	33,568
California	4,378	7,221	9,923	10,080	9,110	10,318
Colorado	14,992	17,044	17,036	18,696	25,143	26,853
Idaho	100,729	68,447	59,957	78,911	88,541	79,209
Montana	18,755	9,999	8,280	16,108	18,411	17,906
Nevada	6,779	6,275	7,175	7,161	9,777	10,626
New Mexico	5,217	7,662	4,899	6,383	7,653	4,652
Oregon	25	1	2	12	7	12
South Dakota	34	.....	.....	8	16	4
Texas	117	.....	47	78	170	132
Utah	60,999	40,817	30,711	49,698	55,950	53,072
Washington	4,431	3,802	2,987	5,359	7,147	6,417
Wyoming	.....	3	.....	.....	.....	.....
Total	237,598	184,152	165,092	221,357	252,156	243,000
West Central States:						
Arkansas	14	1	2	18	22	1
Kansas	10,898	7,370	6,445	7,285	8,386	9,772
Missouri	179,420	176,575	139,172	132,216	102,288	127,522
Oklahoma	20,549	12,664	13,697	14,289	16,918	19,858
Total	210,881	196,610	159,256	153,838	127,614	157,153
States east of the Mississippi River:						
Illinois	2,048	3,005	3,865	2,325	3,695	3,824
Kentucky	277	129	95	214	216	187
New York	2,101	862	1,073	1,496	1,231	1,317
Tennessee	207	54	125	22	.....	257
Virginia	2,878	4,213	4,381	3,803	4,703	3,313
Wisconsin	956	1,776	1,588	1,166	861	857
Total	8,467	10,060	11,127	9,026	10,706	9,755
Grand total	457,046	390,831	335,475	384,221	390,476	409,908

Mine production of lead in States east of the Mississippi River came from properties in Illinois, Kentucky, New York, Tennessee, Virginia, and Wisconsin and totaled 9,755 tons, a drop of 9 percent from the 1948 output. Reduced production from the Austinville mine of the New Jersey Zinc Co. in Virginia accounted for most of the decrease. The principal lead producers in this region were the New

Jersey Zinc Co. of Virginia, Ozark-Mahoning
St. Joseph Lead Co. in New York, and th
Northern Illinois. Lead was also recover
Oregon, South Dakota, and Texas. Virtual
produced in Alaska in 1949 was recovered
Riverside mine near Hyder in the Southeast

**Mine production of recoverable lead in the United
duced 1,000 tons or more during any year, 1940-
short tons**

District	State	1940-44 (average)	19
Southeastern Missouri region	Missouri	176,032	173,
Coeur d'Alene region	Idaho	92,848	63,
West Mountain (Bingham)	Utah	35,794	22,
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma	34,703	23,
Warren (Bisbee)	Arizona	1,337	9,
Summit Valley (Butte)	Montana	6,247	2,
Park City region	Utah	10,361	8,
Old Hat	Arizona	2,636	5,
Tintic	Utah	7,943	4,
Pioche	Nevada	4,421	2
Upper San Miguel	Colorado	1,584	1,
California (Leadville)	do.	3,191	5,
Coso (Darwin)	California	1,173	5
Pima (Sierritas, Papago, Twin Buttes)	Arizona	609	2
Metaline	Washington	4,145	3
Ten Mile	Colorado	204	
Big Rug	Arizona	925	1
Austinville	Virginia	2,666	4
Rush Valley and Smelter (Tooele County)	Utah	3,943	3
Animas	Colorado	2,507	2
Kentucky-Southern Illinois	Kentucky, southern Illinois	2,238	2
Central	New Mexico	3,670	5
Warm Springs	Idaho	4,227	2
Heddleston	Montana	1,619	3
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin	1,044	2
Bossburg	Washington	16	
Red Cliff	Colorado	1,713	
Harshaw	Arizona	4,392	1
Pioneer (Rico)	Colorado	2,425	2
St. Lawrence County	New York	2,101	
Battle Mountain	Nevada	70	
Aravaipa	Arizona	112	
Tomichi	Colorado	145	
Magdalena	New Mexico	859	1
Creede	Colorado	431	
Ophir	Utah	2,048	
Bayhorse	Idaho	1,501	1
Snowflels	Colorado	321	
Eagle	Montana	2,422	
Modoc	California	21	
Eureka	Colorado	41	
Aldor Creek	Idaho	37	
Northport (Aladdin)	Washington	144	
Resting Springs [1]	California	(2)	

[1] Not listed in order of output.
[2] Bureau of Mines not at liberty to publish figures.

The 25 leading lead-producing mines in
listed in the following table, yielded 66 pe
lead output; the 10 leading mines produced
ing mines 35 percent.

Twenty-five leading lead-producing mines in the United States in 1949, 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 Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead.
3	Leadwood	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
4	Bunker Hill & Sullivan	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co.	Zinc-lead.
5	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp.	Do.
6	Mine La Motte	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
7	Page	Yreka	Idaho	Federal Mining & Smelting Co.	Zinc-lead.
8	Bonne Terre	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
9	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co.	Zinc-lead.
10	Madison	Southeastern Missouri	Missouri	St. Louis Smelting & Refining Co.	Lead-copper.
11	Mammoth-Collins	Old Hat	Arizona	St. Anthony Mining & Development Co.	Zinc-lead.
12	Star	Hunter	Idaho	Sullivan Mining Co.	Do.
13	Combined Metals group	Pioche	Nevada	Combined Metals Reduction Co.	Do
14	Morning	Hunter	Idaho	Federal Mining & Smelting Co.	Dc
15	Chief, Gemini, etc.	Tintic	Utah	Chief Consolidated Mining Co.	Dc
16	Desloge	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
17	Darwin group	Coso	California	Anaconda Copper Mining Co.	Do.
18	Sherman	Lelande	Idaho	Day Mines, Inc.	Do.
19	San Xavier	Pima	Arizona	Eagle-Picher Mining & Smelting Co.	Zinc-lead.
20	Shoshone Group	Resting Springs	California	Anaconda Copper Mining Co.	Lead.
21	Kokomo unit	Ten-Mile	Colorado	American Smelting & Refining Co.	Zinc-lead.
22	Iron King	Big Bug	Arizona	Shattuck-Denn Mining Co.	Do.
23	Resurrection	Leadville	Colorado	Resurrection Mining Co.	Do.
24	Pend Oreille	Metaline	Washington	Pend Oreille Metal & Mining Co.	Do.
25	Park Utah	Uintah	Utah	Park Utah Consolidated Mining Co.	Do.

Detailed information on the productio
the United States may be found in the cha
with the mine production of gold, silver, c
various States.

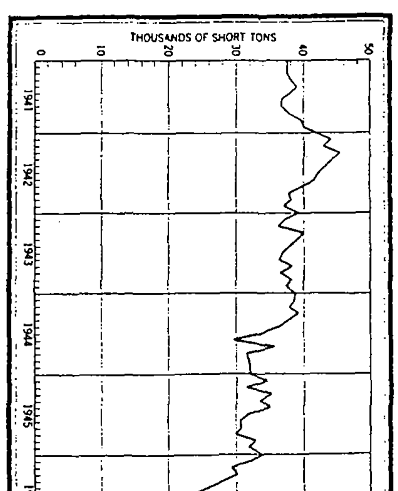

FIGURE 1.—Mine production of recoverable lead in the

Mine production of recoverable lead in the Uni in short tons

Month	1948	1949	
January	33,246	33,203	August..
February	32,517	32,667	Septembe
March	35,009	30,916	October
April	35,200	37,215	Novembe
May	33,370	37,006	Decembe
June	34,543	36,278	
July	23,422	20,836	Tot

SMELTER AND REFINERY P

Pig lead produced in the United States
sources—domestic mine production, impo
bullion, and secondary smelter output f
recovered at primary plants that treat c
quantities of scrap and at secondary plar
sively. Of the eight primary smelters
States, only two (Selby, Calif., and Brad
merchant lead. The other six plants
(containing approximately 98 percent lea
quantities of impurities recovered from
shipped to refineries in the Middle Wes
recovery of the gold and silver and puri
commercial requirements. Both primar
plants may make refined lead or antimonia
quantity of hard lead—such as battery
smelters, the output from this type of c
monial lead alloys. Statistics on the pro

alloys at secondary plants are given in the Secondary Lead section of this chapter. Of the 14 primary smelters and refineries in operation in the United States in 1949, all but 1 consumed primary raw materials in the form of ores and concentrates. During the year these 13 plants consumed 467,128 short tons (lead content) of this type of material, 16 percent of which was of foreign origin. In 1948 these same plants treated 432,543 tons of ores and concentrates, 16 percent of which was foreign.

ACTIVE LEAD SMELTERS AND REFINERIES

Primary lead smelters and refineries operating in the United States in 1949 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).
Murray—Murray plant, American Smelting & Refining Co. (smelter).[2]
Tooele—Tooele plant, International Smelting & Refining Co. (smelter).

REFINED LEAD

Primary refineries in the United States in 1949 produced 500,568 short tons of refined lead, an increase of 22 percent over the 1948 output of 411,646 tons.

Refined lead produced at primary refineries in the United States, by sources, 1945–49, in short tons

Source	1945	1946	1947	1948	1949
Refined lead:					
From domestic ores and base bullion	356,535	293,309	381,109	339,413	404,449
From foreign ores	86,932	44,790	59,838	60,829	71,413
From foreign base bullion	118	98	63	6,452	1,476
Total from primary sources	443,585	338,197	441,010	406,694	477,338
From scrap	18,525	8,013	15,662	4,952	23,230
Total refined lead	462,110	346,210	456,672	411,646	500,568
Average sales price per pound	$0.064	$0.084	$0.143	$0.179	$0.158
Total calculated value of primary refined lead [1]	$56,780,000	$56,820,000	$126,130,000	$145,600,000	$150,840,000

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

[2] Closed for lack of ore and other economic factors on October 1, 1949.

Of the 477,338 tons of primary lead pro
ores and base bullion supplied 85 percent and
base bullion 15 percent. In 1948 the origin
and 17 percent foreign. The following tabl
refined lead by sources and by country of ori
the sources of lead from domestic ores are g
tion section of this chapter.

Refined primary lead produced in the United States,
in short tons

Source	1945	1946
Domestic ore and base bullion	356,535	293,309
Foreign ore:		
Australia	22,087	7,53
Canada	11,151	5,02
Europe		
Mexico	3,097	2,05
South America	25,701	11,34
Other foreign	24,896	18,83
Total	86,932	44,79
Foreign base bullion:		
Australia		
Mexico	63	1
South America	55	8
Other foreign		
Total	118	9
Total foreign	87,050	44,88
Grand total	443,585	338,19

ANTIMONIAL LEA

Antimonial lead output at primary re
sharply from the record level establis.ed
creased at only one of the five primary pl
whereas at the other plants declines of 50 to
outputs were recorded. Distribution of th
is shown in the following table. The ave
antimonial lead produced in 1949 advanced
average content recorded since 1941. Alt
an important byproduct of the refining of
derived from this source is only a small pa
output. The major production is recove
antimonial lead scrap at secondary smelte
lead-smelting plants treating scrap materia
ized in the following section and discussed
Metals—Nonferrous chapter of this volume

Antimonial lead produced at primary lead refineries in the United States, 1945–49

Year	Production (short tons)	Antimony content		Lead content by difference (short tons)			
		Short tons	Percent	From domestic ore	From foreign ore	From scrap	Total
1945	56,495	4,148	7.3	7,286	2,695	42,366	52,347
1946	50,480	3,285	6.5	11,196	2,119	33,850	47,195
1947	86,075	4,933	5.7	14,836	9,850	56,456	81,142
1948	100,764	5,760	5.7	29,561	15,918	49,525	95,004
1949	41,402	3,385	8.2	692	4,620	32,705	38,017

SECONDARY LEAD

Some scrap lead is treated at primary smelters and refineries, but the greater part is received at a large number of plants that treat secondary materials exclusively. Secondary lead is recovered in the form of refined lead, antimonial lead, and other alloys. Recovery at primary and other plants in 1945–49 is shown in the following table. Secondary lead recovery in 1949 surpassed the domestic mine output of recoverable lead for the fourth successive year. Further details appear in the Secondary Metals—Nonferrous chapter of this volume.

Secondary lead recovered in the United States, 1945–49, in short tons

	1945	1946	1947	1948	1949
As refined metal:					
At primary plants	18,525	8,013	15,662	4,952	23,230
At other plants	42,598	65,691	95,843	126,951	129,396
Total	61,123	73,704	111,505	131,903	152,626
In antimonial lead:					
At primary plants	42,366	33,850	56,456	49,525	32,705
At other plants	151,713	159,834	209,470	194,027	140,037
Total	194,079	193,684	265,935	243,552	172,742
In other alloys	107,837	125,399	134,530	124,616	86,815
Grand total:					
Short tons	363,039	392,787	511,970	500,071	412,183
Value	$46,468,992	$65,988,216	$146,423,420	$179,025,418	$130,240,828

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 to 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 used directly in the manufacture of lead pigments and salts) totaled 957,674 short tons in 1949. Of the total consumed, 592,682 tons were refined soft lead, 227,221 tons antimonial lead, 50,922 tons unmelted white scrap, 46,268 tons percentage metals, 15,976 tons copper-base scrap, 15,215 tons drosses and residues, and 9,390 tons from lead ores used directly

in the manufacture of lead compounds.
of the total lead consumed was used i
products. Production of the three lar
batteries, cable covering, and tetraethyl
of all the lead consumed in 1949. Bat
total, cable covering 15 percent, and tet

Consumption of lead in the United States i

	1948	1949
Metal products:		
Ammunition	40,635	24,111
Bearing metals	42,694	20,189
Brass and bronze	23,239	14,046
Cable covering	171,654	144,340
Calking lead	31,473	34,044
Casting metals	8,074	12,672
Collapsible tubes	11,071	8,692
Foil	3,203	2,503
Pipes, traps, and bends	39,843	20,858
Sheet lead	31,559	27,144
Solder	71,025	62,104
Storage batteries (antimonial lead)	203,869	175,308
Storage batteries (oxides)	150,536	138,410
Terne metal	3,278	3,256
Type metal	26,279	20,695
Total metal products	868,232	728,172

[1] Includes lead content of leaded zinc oxide production.

Consumption of lead in the United States 1

Month	1948	1949
January	97,451	91,769
February	92,451	78,186
March	102,601	71,076
April	95,694	62,753
May	86,203	70,272
June	89,847	73,206
July	75,726	75,605

[1] Includes lead content of leaded zinc oxide production.

**Lead consumption in the United States in 19
material, in sho**

Metal products	
Pigments	
Chemicals	
Miscellaneous	
Unclassified	
Total	

[1] Excludes 9,390 tons of lead contained in leaded zinc oxi

STOCKS

Producers' Stocks.—Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal held by all primary refiners and by some of the refiners of secondary material who produce soft lead. According to monthly reports released by the American Bureau of Metal Statistics, stocks of refined lead and antimonial lead declined in the first 2 months of the year to a low of 36,101 tons at the end of February. Inventories gained sharply to 53,422 tons during March and continued to advance through April, May, and June to the peak 1949 level of 96,367 tons on July 1. Stocks declined slightly during July and dropped sharply in August and September to 60,208 tons on October 1. During the remainder of the year the inventories advanced steadily to 70,424 tons on December 31—a net gain of 82 percent from January 1.

Lead stocks at end of year at smelters and refineries in the United States, 1945–49, in short tons

[American Bureau of Metal Statistics]

	1945	1946	1947	1948	1949
Refined pig lead	37,584	40,870	13,634	29,050	61,329
Antimonial lead	7,283	6,717	7,694	9,591	9,095
Total	44,867	47,587	21,328	38,644	70,424
Lead in base bullion—					
At smelters and refineries	8,618	8,453	7,652	9,697	16,364
In transit to refineries	4,889	4,911	5,447	4,101	3,696
In process at refineries	15,097	16,042	16,328	17,939	15,561
Total	28,604	29,406	29,427	31,737	35,621
Lead in ore and matte and in process at smelters	89,462	111,836	77,199	76,373	95,481
Grand total	162,933	188,829	127,954	146,754	201,526

The Bureau of Mines annual survey of primary lead smelters and refiners indicated stocks of 29,048 tons (lead content) of refined lead at plants on January 1, 1949, and 60,826 tons on December 31, 1949. Primary antimonial lead stocks at these same plants decreased from 9,258 short tons (lead content) at the beginning of 1949 to 8,192 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 40 percent—from 44,038 tons to 61,736 tons 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 totaled 7,743 tons at the beginning of January and 7,897 tons at the end of December 1949. The revised figure for January 1, 1948, is 7,728 tons. Stocks of in-process base bullion or work lead at five 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
cent during 1949. Inventories of refined
antimonial lead dropped 52 percent from t
stocks, which on January 1, 1949, were
136,855 tons on March 31 and thereafter
tons on December 31.

**Consumers' stocks of lead at the end of year, 1
in short tons**

Date	Refined soft lead	Antimonial lead	Unmelted white scrap	Percent metal
Dec. 31, 1947	51,619	22,402	3,514	6,
Dec. 31, 1948	62,077	35,088	4,828	7,
Dec. 31, 1949	64,542	16,837	2,957	5,

PRICES

The two major markets for lead in t
York and St. Louis; much of the lead prod
prices normally based upon quotations in
pension of trading on the London Met
1939, the London market has had no dir
quotations, and the differential between
prices has remained 0.2 cent a pound, an
freight charges between the two points.

The market price for common lead,
21.50 cents a pound until March 8, when
A series of price reductions followed the
reached a low of 12.00 cents on May 26.
on July 8, and several additional increase
at 15⅛ cents on August 18. The price t
September 26 and leveled off at 12.00 ce
it remained the balance of the year.

The price of the British Ministry of Su
(equivalent to 22.10 cents a pound) at
April 4 the price was reduced to £106 (1
June 10, and July 12, further reductions
(14.73 cents), and £75 10s. (13.57 cents
It was raised shortly thereafter to £81 (
continued to advance in three successive
cents) on August 9. In mid-September
valued, and price quotations were susp
September 22 the sterling price was £122
15.25 cents a pound at the new $2.80 b
(14.38 cents) was announced, effective O
and 19 the price dropped to £111 (13
cents), respectively. A further decline t
on November 23, at which level the quota
of the year.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1947–49, in cents per pound [1]

Month	1947			1948			1949		
	St. Louis	New York	London [2]	St. Louis	New York	London [2]	St. Louis	New York	London [2]
January	12.76	12.93	12.58	14.82	15.00	16.17	21.32	21.50	22.10
February	13.01	13.18	12.58	14.82	15.00	16.17	21.32	21.50	22.10
March	14.77	14.96	12.58	14.82	15.00	16.17	18.73	18.91	22.10
April	14.82	15.00	16.17	17.04	17.21	16.17	14.99	15.16	19.28
May	14.82	15.00	16.17	17.32	17.50	16.17	13.57	13.72	17.08
June	14.82	15.00	16.17	17.32	17.50	16.17	11.85	12.00	15.45
July	14.82	15.00	16.17	17.63	17.81	16.17	13.39	13.56	14.59
August	14.82	15.00	16.17	19.32	19.50	16.17	14.80	15.01	15.56
September	14.82	15.00	16.17	19.32	19.50	16.17	14.85	15.05	15.51
October	14.82	15.00	16.17	19.32	19.50	20.12	14.23	13.42	13.70
November	14.82	15.00	16.17	21.32	21.50	20.12	12.33	12.52	12.70
December	14.82	15.00	16.17	21.32	21.50	20.12	11.80	12.00	12.12
Average	14.50	14.67	15.27	17.87	18.01	17.16	15.18	15.36	16.95

[1] St. Louis: Metal Statistics, 1950, p. 507. New York: Metal Statistics, 1950, p. 501. London: E&MJ Metal and Mineral Markets.
[2] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board.

FOREIGN TRADE [3]

Tariff.—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, 2⅛ cents per pound. In accordance with the Mexican Trade Agreement of January 30, 1943, these rates were reduced to ¾ cent and 1 1/16 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 duty of 1 1/16 cents a pound on pig lead and ¾ cent a pound on lead in ores and concentrates was reinstated automatically on July 1.

Imports.—Total imports of lead increased in 1949 to a record peacetime high but remained well below the wartime peak level established in 1942. As in previous years, the greater part of the lead imported was in the form of pigs and bars, 46 percent of which came from Mexico, 20 from Canada, 13 from Peru, 9 from Yugoslavia, 6 from Australia, and 6 from 17 other countries. Imports of lead in base bullion, virtually all from Australia, were approximately one-third the quantity imported in 1948. Receipts of lead in ore, concentrate, and matte, principally from Africa, Bolivia, Peru, Australia, Newfoundland, and Mexico, were the largest since 1940.

[3] 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.

Total lead imported into the United States in or and reclaimed, by countries, 194

(U. S. Department of Com

Country	1945
Ore and matte:	
Africa	2,33
Argentina	4,71
Australia	17,91
Bolivia	1,58
Canada	8,08
Newfoundland-Labrador	17,04
Chile	2,33
Guatemala	
Mexico	66
Peru	14,52
Other countries	20
Total ore and matte	70,00
Base bullion:	
Australia	
Korea	
Mexico	
Peru	
Other countries	
Total base bullion	
Pigs and bars:	
Africa	
Australia	13,74
Belgium-Luxembourg	
Burma	
Canada	19,38
Germany	
Italy	
Japan	
Korea	
Mexico	160,17
Netherlands	
Peru	34,15
Spain	
Yugoslavia	
Other countries	
Total pigs and bars	227,46
Reclaimed, scrap, etc.:	
Africa	
Australia	1,47
Belgium-Luxembourg	
Canada	1,37
Canal Zone	
Chile	
France	
Germany	
Italy	
Japan	
Malta, Gozo, and Cyprus	
Mexico	
Netherlands	
Panama	
Philippines	
Yugoslavia	
Other countries	
Total reclaimed, scrap, etc	2,8
Grand total	300,3

[1] Data include lead imported for immediate consumption pl
[2] Revised figure.
[3] Less than 1 ton.

Lead imported for consumption in the United States, 1945–49, by classes [1]

[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		
1945	70,126	$5,758,695	20	$2,242	227,311	$25,280,638	17	$2,778	$32,515	$31,312,708
1946	[2] 28,255	[2] 3,042,765	20	2,302	[2] 104,083	[2] 14,816,926	24	10,251	21,517	[2] 18,089,893
1947	[2] 44,442	[2] 8,561,174	1,758	416,643	158,705	38,008,413	67	42,434	10,453	[2] 50,111,208
1948	33,932	8,350,507	10,922	3,239,135	[2] 244,602	[2] 80,922,770	181	100,519	35,554	[2] 100,968,922
1949	121,848	34,397,026	1,133	374,954	272,437	80,048,110	168	101,084	29,830	118,954,978

[1] In addition to quantities shown (value included in total values), "reclaimed, scrap, etc.," imported as follows—1945: 2,848 tons, $235,840; 1946: Revised figures, 2,539 tons, $196,132; 1947: 15,963 tons, $3,072,151; 1948: Revised figure, 28,897 tons, $8,320,426; 1949: 14,005 tons, $1,003,974. Figures for 1945–49 include lead received by the Government and held in stockpiles.
[2] *Revised figure.*

Miscellaneous products, containing lead, imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Babbitt 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
1945	143	73	$101,132	26,110	24,730	$3,241,735
1946	157	[1] 83	211,122	1,740	1,494	220,645
1947	[1] 264	[1] 171	[1] 208,185	2,406	2,219	753,664
1948	257	184	213,611	[1] 14,732	[1] 13,163	[1] 5,279,080
1949	287	129	463,900	5,861	5,207	2,255,909

[1] Revised figure.

Exports.—Total exports of pig lead (excluding reexports of foreign refined lead) increased from 411 tons (revised figure) in 1948 to 969 tons in 1949. Export restrictions imposed under the Export Control Act of 1940 remained in force throughout 1949.

Lead pigs, bars, and anodes exported from the 1945–49, in short ton

[U. S. Department of Comm

Destination	1945
Countries:	
Argentina	
Belgium-Luxembourg	
Brazil	400
Canada	[2] 9
Canal Zone	
Chile	215
China	
Colombia	25
Cuba	156
Czechoslovakia	
Denmark	
El Salvador	(3)
Honduras	4
Hong Kong	
India	
Madagascar	
Mexico	32
Netherlands	
Netherlands Antilles	14
Panama	23
Philippines	
Portugal	257
Saudi Arabia	13
Turkey	22
U. S. S. R.	66
Uruguay	2
Venezuela	75
Other countries	89
Total	[2] 1,408
Continents:	
North America	[2] 274
South America	761
Europe	323
Asia	44
Africa and Oceania	6
Total: Short tons	[2] 1,408
Value	$219,377

[1] In addition 377 tons of foreign lead were reexported in 1945, 1948, and 86 tons in 1949.
[2] Revised figure.
[3] Less than 1 ton.

WORLD REVIE

Lead is produced in many countries Mexico, Australia, and Canada—have quarters of the world output in recent ye accompanying tables, which show world by countries, 1943–49, insofar as statistic

Lead and Zinc Pigments and Zinc Salts

By Helena M. Meyer and Alethea W. Mitchell

GENERAL SUMMARY

DESPITE diversified movements in industries that are the chief consumers of pigments, there were sharp declines in 1949 in shipments of all of the lead and zinc pigments and zinc salts covered by this report. The decreases in lead pigments ranged from 19 percent for red lead to 41 percent for white lead (dry), in zinc pigments from 27 percent for zinc oxide (lead-free) to 46 percent for the leaded variety; they were 20 and 7 percent, respectively, for zinc chloride and zinc sulfate.

The following trends were noted among the industries that consume large quantities of pigments: Automobile production rose 17 percent to a new all-time peak; total value of construction put in place, both private and public, exceeded $19 billion, surpassing the 1948 record by 3 percent; the value of sales of paints, varnish, and lacquer materials, on the other hand, fell about 9 percent; consumption of natural rubber 8 percent and of the synthetic type 6 percent; and production of synthetic rubber dropped 23 percent, indicating a more pronounced decline in need for pigments than consumption data showed. The relatively greater drop in pigments than in the level of activity in pigment-consuming industries may be explained by a reduction in inventories of pigments at consumers' plants.

Shipments of white lead (dry) dropped 41 percent and of the in-oil variety 40 percent, being the smallest by far for both grades since considerably before the beginning of the present century; total white lead shipments amounted to only 27 percent of the annual average for 1935–39. Litharge shipments declined 22 percent in 1949 and were the smallest since 1943. Red-lead shipments decreased 19 percent, the smallest decline of the pigments covered by this report, and were the lowest since 1933.

Lead-free zinc-oxide shipments dropped 27 percent and were smaller than in any year since 1942, when there were insufficient supplies of zinc metal and scrap for manufacture of the French-process type. The labor strike beginning September 26 and continuing beyond the end of 1949, at the Palmerton plant of the New Jersey Zinc Co., curtailed both production and shipments of the leaded as well as the lead-free grades and likewise reduced tonnages of lithopone. Leaded zinc-oxide shipments fell 46 percent and lithopone 44 percent and were the smallest since 1935 and 1921, respectively.

The World War II and early postwar situation of inadequate supplies of pig lead in relation to consumption requirements was reversed in 1949, when domestic production and peacetime peak imports considerably exceeded demand. Supplies of zinc in 1949 likewise were

more than adequate for all needs. The fore
in part to the drop in general industrial ac
midyear. This decline was largely counterb
dustrial activity in the late months of 1949.

Lead-pigment prices reached new peaks i
timued at top levels early in 1949. Zinc-pigr
very high during the period. The break in n
the spring and early summer of 1949 was acc
for pigments. December prices for lead and
below those for January. Pig lead and lea
lowest levels in the second quarter of the y
recovery in the third; resumption of the do
turn in December to the lowest levels of the
pigments followed the same pattern, in gener
the year's lowest levels at the end of Decembe

Zinc-chloride and zinc-sulfate shipments d
respectively, and were the lowest since 194

Salient statistics of the lead and zinc pigments ir
1940–44 (average) and 19

	1940-44 (average)	1945	1946
Production (shipments) [1] of principal pigments:			
White lead (dry and in oil)...short tons	87,819	51,170	[2] 66,50
Red lead...do	50,351	47,381	32,52
Litharge...do	110,986	138,708	133,79
Zinc oxide...do	129,160	127,955	157,85
Leaded zinc oxide...do	54,127	62,598	67,07
Lithopone...do	148,878	136,161	147,00
Value of products:			
All lead pigments	$41,418,000	$39,045,000	$43,595,00
All zinc pigments	34,858,000	36,644,000	44,195,00
Total	76,276,000	75,689,000	87,790,00
Value per ton received by producers:			
White lead (dry)	$154	$150	[2] $20
Red lead	162	168	19
Litharge	142	148	17
Zinc oxide	131	138	14
Leaded zinc oxide	125	132	14
Lithopone	75	78	8
Foreign trade:			
Lead pigments:			
Value of exports	$1,121,000	$1,427,000	$851,00
Value of imports	8,000	8,000	13,00
Zinc pigments:			
Value of exports	2,521,000	2,279,000	2,911,00
Value of imports	17,000	(4)	9,00
Export balance	3,617,000	3,698,000	3,740,00

[1] Reported as sales before 1945.
[2] Data for basic lead sulfate in 1946 included under white lead; separately.
[3] Excludes value of basic lead sulfate; Bureau of Mines not at lib
[4] Less than $500.

Production and shipments of compe
dropped somewhat from 1948, following th
cessive annual peaks; except for 1948, both

annual rates ever attained. At present the Bureau of Mines is not at liberty to publish figures covering pigments of this class.

Highlights in the distribution of pigments and salts covered by this report are outlined in the following discussion. Shipments of litharge for the manufacture of chrome pigments rose 15 percent in 1949 and made the only advance for pigments covered by this report. This rise, however, followed a poor showing in 1948, when it registered the sharpest percentage drop among litharge uses. The use of pigments in ceramics made conspicuous gains after 1945, but all types of pigments used for this purpose showed substantial losses in this field in 1949. Ceramics—now the second largest use of litharge—established a new peak in 1948 but dropped 33 percent in 1949, or proportionately more than any other important use. Shipments of red lead to makers of ceramics fell more than any other class and amounted to less than one-half of the 1948 tonnage. The use of zinc oxide in ceramics established three successive peaks in 1946, 1947, and 1948 but was reduced 43 percent in 1949 as compared with 27 percent for total zinc-oxide shipments. Zinc oxide and red lead shipped for paint manufacture fared better than other pigments shipped for this purpose. Rubber took proportionately more lithopone in 1949 than in 1948 and except for

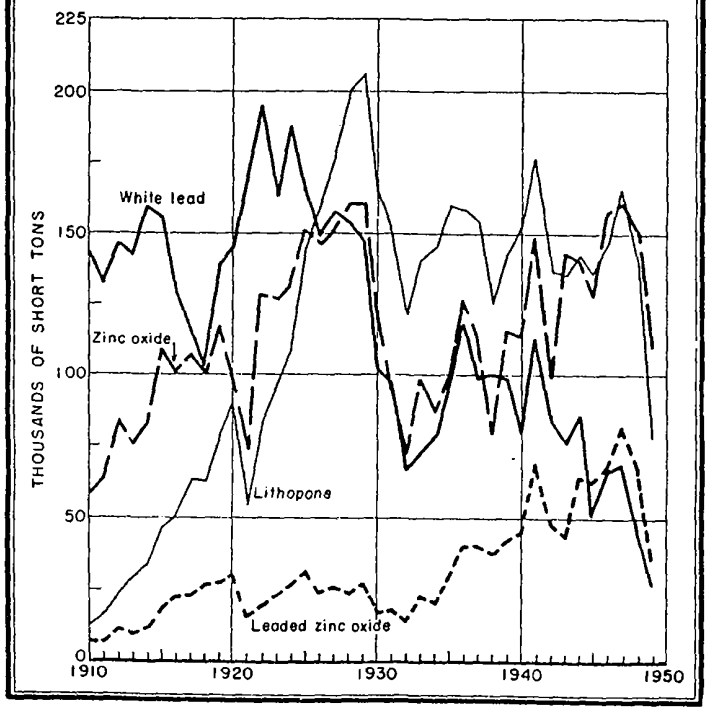

FIGURE 1.—Trends in shipments of white pigments, 1910–49.

1948 used more than in any year since 1941. and lithopone for coated fabrics were in co former falling proportionately more and o shipments of these two classes of pigmen much less of both pigments in 1949, zinc- much higher percentage than total shipmen

Zinc sulfate made the best showing of th report, chiefly because of record-breaking s facture, the gain being 9 percent (dry basis 1948. The agricultural use, which led all ot one-half as much as rayon in 1949.

PRODUCTION

The value of lead and zinc pigments in basic lead sulfate, which cannot be shown) v of 35 percent compared with a 32-percent total tonnage of the lead and zinc pigment and zinc pigments comprised 58 and 42 p total value in 1949 as in 1948.

For many years, figures on sales were us as a better guide than production to activit Beginning with 1945, the base was change with data compiled on Bureau of Mines Available information for 1945 (the year there was little difference between sales a In reporting tonnages of pigments, an att duplication; one of the chief problems is t quently are blended to make another produ zinc oxide, for example, are blended to m in this instance the pigment weights appe named class only. Pigments consumed b make products beyond those covered by t storage batteries, and other articles—are c

LEAD PIGMENTS

Shipments of lead pigments dropped 25 percent in value in 1949 as compared with values received by producers for all but w slightly, explain the greater decrease in tot tity. (Shipments of basic lead sulfate, wh not at liberty to publish, are excluded fro lead pigments covered by this report fell i lead, dry, dropping 41 percent, the in-oil 22, and red lead 19.

Quoted prices for lead pigments dropp year from the all-time peaks at the values reported by producers fell 16 percen arge and 3 percent for white lead (dry), variety gained 1 percent.

Production and shipments of lead pigments [1] in the United States, 1948–49

Pigment [1]	1948				1949			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Short tons	Value [2]			Short tons	Value [2]	
			Total	Average			Total	Average
White lead:								
Dry	25,955	26,551	$9,643,402	$363	15,609	15,719	$5,520,250	$351
In oil [3]	17,672	19,519	6,129,237	468	11,187	11,636	5,504,207	473
Red lead	29,698	30,787	12,190,258	396	26,362	21,866	8,276,801	333
Litharge	159,489	164,775	59,952,202	387	123,157	121,052	39,262,768	324

[1] Bureau of Mines not at liberty to publish figures for basic lead sulfate (sublimed lead).
[2] At plant, exclusive of container. [3] Weight of white lead only but value of paste.

Lead pigments shipped [1] in the United States, 1910–49, in short tons

Year	White lead			Basic lead sulfate (sublimed lead)		Red lead	Orange mineral	Litharge
	Dry	In oil	Total	White	Blue			
1910	32,237	111,573	143,810	9,858		[2] 19,801	[2] 676	23,742
1911	25,834	106,778	132,612	10,019		[2] 19,540	[2] 766	25,100
1912	26,242	120,591	146,833	11,085		[2] 21,120	[2] 545	29,111
1913	24,196	118,430	142,626	12,452		[2] 17,635	[2] 434	23,093
1914	29,076	130,398	159,474	12,665		[2] 18,697	[2] 426	27,345
1915	33,907	122,194	156,101	13,364		[2] 19,435	(3)	26,118
1916	32,938	96,041	128,979	10,977	1,287	[2] 23,035	(3)	37,739
1917	27,869	87,331	115,200	8,231	1,369	[2] 25,478	(3)	44,102
1918	20,089	82,799	102,888	7,403	1,343	[2] 30,069	(3)	48,874
1919	30,085	109,005	139,090	9,068	1,350	[2] 32,362	(3)	46,739
1920	33,678	112,017	145,695	12,412	928	[2] 34,431	(3)	62,329
1921	26,738	143,545	170,283	11,568	463	21,805	381	41,009
1922	41,598	153,393	194,991	13,765	972	30,509	370	58,261
1923	37,786	125,087	162,873	11,949	800	38,037	646	75,107
1924	42,622	144,872	187,494	14,572	1,088	30,813	331	74,724
1925	43,426	120,479	163,905	14,996	1,090	41,669	840	80,546
1926	37,968	111,845	149,813	12,271	1,236	42,550	813	82,540
1927	38,669	119,026	157,695	13,482	1,061	39,073	709	81,655
1928	42,049	111,923	153,972	16,002	1,234	40,497	459	85,570
1929	42,159	104,872	147,031	15,580	1,231	43,021	678	87,916
1930	32,548	69,592	102,140	10,308	1,219	32,911	356	72,578
1931	30,922	66,446	97,368	8,790	896	25,853	282	63,890
1932	19,946	46,728	66,674	5,708	549	18,880	212	58,096
1933	24,628	48,354	72,982	7,320	625	21,988	231	61,193
1934	22,569	56,165	78,734	6,999	668	26,743	234	68,733
1935	27,972	68,859	96,831	7,572	727	28,776	252	79,930
1936	34,775	83,632	118,407	7,531	891	34,896	218	86,246
1937	32,661	65,552	98,213	7,514	1,108	33,931	206	83,902
1938	29,813	70,400	100,213	5,030	771	30,183	127	68,711
1939	30,509	67,920	98,429	4,698	850	39,976	131	89,518
1940	30,115	50,447	80,562	5,493	707	42,200	137	80,811
1941	54,689	58,311	113,000	8,739	1,631	53,858	216	122,280
1942	35,865	47,774	83,639	7,229	1,181	48,369	128	91,513
1943	39,525	36,642	76,167	4,752	845	53,378	79	113,091
1944	46,466	39,260	85,726	5,253	1,080	53,972	284	138,203
1945	27,382	23,788	51,170	2,235	1,660	47,381	230	138,798
1946	[4] 41,892	24,609	[4] 66,501	(5)	(5)	32,526	123	133,799
1947	39,075	29,712	68,787	(5)	(5)	36,064		167,050
1948	26,551	19,519	46,070	(5)	(5)	30,787		154,775
1949	15,719	11,636	27,355	(5)	(5)	24,866		121,052

[1] Reported as sales before 1945.
[2] Small quantity of orange mineral included with red lead.
[3] Orange mineral included with red lead.
[4] Basic lead sulfate included with white lead (dry); Bureau of Mines not at liberty to publish figure.
[5] Bureau of Mines not at liberty to publish figure.

White Lead.—The downtrend in shipments dry and in-oil varieties, continued in 1949, and ties were the smallest by far since considerably the present century. The all-time record pr and 1948, due to stringent supplies of this ra factor in sharp extension of the downward m

Basic Lead Sulfate.—The Bureau of Mines is figures on basic lead sulfate for 1946–49.

Red Lead.—Red-lead shipments fell 19 per the smallest since 1933. Nonetheless, red lead of the pigments covered by this report.

Orange Mineral.—No shipments nor produ were reported in 1947–49.

Litharge.—Shipments of litharge dropped were the smallest since 1943. Shipments of were at a higher level than in any year befo highest of the pigments covered by this repo

Lead Suboxide.—Battery manufacturers pr of black suboxide of lead for their own use in 20 percent below the high record established 1948. Black oxide production required 53,00 and 66,000 tons in both 1948 and 1947.

ZINC PIGMENTS AND SA

Shipments of zinc pigments declined 37 pe percent in value in 1949 as compared with 19 from an all-time peak. All pigments cover lead-free zinc oxide fell 27 percent, the lead lithopone 44 percent. An increase in the av zinc oxide—the largest tonnage pigment—a decline in total value than in total quantity. for lead pigments, dropped during 1949 fron ing when the year began.

Production and shipments of zinc pigments and salts

Pigment or salt	1948				
	Production (short tons)	Shipments			
		Short tons	Value [1]		
			Total	Average	
Zinc oxide [2]	146,565	150,958	$32,862,368	$218	1
Leaded zinc oxide [2]	67,480	67,441	16,548,636	245	3
Lithopone	151,005	140,033	16,135,976	115	7
Zinc chloride, 50° B	67,908	68,701	4,717,963	69	5
Zinc sulfate	20,125	21,513	2,443,869	114	2

[1] Value at plant, exclusive of container.
[2] Zinc oxide containing 5 percent or more lead is classed as leaded leaded zinc oxide include a small quantity containing less than 5 pe

Zinc chloride shipments were 20 percent lo to be the all-time record. The average valu

1949. Zinc sulfate shipments had a 7-percent drop—the smallest decline of the products covered by this report. The average value received by producers rose 4 percent in 1949.

Zinc pigments and salts shipped [1] in the United States, 1910–49, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1910	58,481	6,823	12,655		
1911	63,827	6,765	16,866		
1912	84,002	11,410	24,220		
1913	75,700	9,421	20,685		
1914	82,809	11,317	32,819	(2)	(2)
1915	109,261	18,758	46,494		
1916	100,339	23,003	51,291		
1917	107,586	23,450	63,713		
1918	100,286	26,714	62,403		
1919	117,639	27,591	78,365	[3] 59,228	[3] 2,763
1920	90,444	30,460	89,373	[3] 68,945	[3] 3,072
1921	74,320	16,103	55,016	59,457	3,295
1922	128,465	19,613	83,360	41,627	5,078
1923	126,987	23,504	98,199	42,431	6,375
1924	131,470	26,729	109,469	51,054	4,674
1925	151,354	31,750	145,019	45,610	5,503
1926	146,923	23,859	159,931	47,206	6,612
1927	151,246	26,064	176,994	40,141	6,418
1928	160,904	24,223	209,468	45,669	4,733
1929	169,611	27,149	206,315	43,189	7,454
1930	119,142	17,279	161,065	20,043	6,249
1931	95,700	18,577	151,850	34,885	5,200
1932	72,250	14,305	121,667	23,524	4,252
1933	98,542	22,868	140,831	32,187	5,698
1934	87,088	20,506	145,565	19,614	7,379
1935	99,697	29,976	159,486	(4)	7,892
1936	126,800	40,512	158,319	(4)	9,721
1937	114,652	40,343	154,771	(4)	10,521
1938	79,129	38,216	125,746	(4)	7,757
1939	114,552	42,694	142,759	(4)	10,157
1940	113,213	45,362	151,802	(4)	11,937
1941	148,833	68,920	176,642	(4)	19,201
1942	99,677	48,128	137,320	52,374	14,331
1943	143,402	43,828	135,723	53,707	15,640
1944	140,675	61,395	142,805	57,545	17,156
1945	127,955	62,508	136,161	56,230	20,854
1946	157,851	67,971	147,001	57,316	24,931
1947	160,771	81,459	165,024	65,521	21,547
1948	150,958	67,441	140,033	68,701	21,513
1949	110,132	36,722	78,335	55,208	20,065

[1] Reported as sales before 1945.
[2] No canvass.
[3] Figures represent production.
[4] Data not available.

Zinc Oxide.—Production of lead-free zinc oxide totaled 109,126 tons, or 26 percent less than for 1948. Lead-free zinc oxide shipments dropped 27 percent in 1949 and were the smallest since 1942, when the output was affected adversely by stringent supplies of zinc metal and scrap. Production in 1949 was curtailed by the labor strike beginning September 26 and lasting beyond the end of the year at the Palmerton, Pa., plant of the New Jersey Zinc Co.

Production of zinc oxide (lead-free) by processes, 1944–49, in percent of total

Process	1944 [1]	1945 [1]	1946 [1]	1947	1948	1949
American process (ore and primary residues)	77	77	75	73	76	71
French process (metal and scrap)	16	15	17	17	15	17
Other	7	8	8	10	9	12
Total	100	100	100	100	100	100

[1] Revised figures.

Leaded Zinc Oxide.—The 1949 productio
reported, by grades, as follows (comparison
31,434 (53,915) tons of 35 percent lead an
tons of over 35 percent lead. The strike a
of the New Jersey Zinc Co., already mentio
wise curtailed output of the leaded variety.

Leaded zinc oxide shipments fell 46 perce
period, roughly coinciding with the beg
through 1948, during which peak or nea
tributed. The good performance during
permitted by the fact that leaded zinc oxid
so that inadequate supplies of metal and sc
discussion did not militate against the man

Lithopone.—Lithopone fared worse in
ments covered by this report. Shipmen
smaller percentage than those of leaded zin
since 1921 and only 38 percent of the peak
capacity for the manufacture of lithopone
short tons in 1949, unchanged from 1948 an

The lithopone statistics in this report ar
nary lithopone sold as such plus the ordina
high-strength product. This method of p
the operations of one company that always
high-strength product and has been the o
In 1949, as in 1948 and 1947, one company
duced high-strength lithopone. Consumpt
the manufacture of titanated lithopone has
portions. The trend has been downward a
peak—19,400 tons—was used in 1937. I
changed from the small total for 1948.
following table are included in the totals
other tables.

**Titanated lithopone produced in the United Stat
in its manufacture, 1940–44 (average) a**

Year	Titanated lithopone produced	Ordinary lithopone used
1940–44 (average)	13,240	11,180
1945	9,200	7,800
1946	7,500	6,350

Year	Titanated lithopone produced	Ordinary lithopone used
1947		
1948		
1949		

Zinc Sulfide.—In 1949, as in several pre
pany produced zinc sulfide; the Bureau c
publish figures for this pigment.

Zinc Chloride.—Zinc chloride shipments
20 percent in 1949 from 1948 (believed to l
The figures shown here include the zinc
ammonium and chromated zinc chloride p

Zinc Sulfate.—Shipments of zinc sulfate
the smallest decline in the products cover
nages for 1948 and 1947, almost identical,
time record established in 1946.

RAW MATERIALS USED

Figures covering the raw materials used in making pigments and salts in 1949 and 1948 are shown in the accompanying tables.

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and such secondary materials as scrap. In 1949 roughly 94 (92 in 1948) percent of the lead in pigments was derived from pig lead and the remainder from ore. Of the lead in ore used to make leaded zinc oxide, about 6 (7) percent was from foreign sources. The proportion for zinc pigments in 1949 was 72 (73) percent from ore and concentrates, 8 (8) percent from slab zinc, and 20 (19) percent from secondary materials; about 18 (19) percent of the ore used was foreign.

The following tables give the source of the metal used in manufacturing each pigment and salt. Pig lead is employed exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and is used also in the manufacture of basic lead sulfate. The lead content of leaded zinc oxide made from basic lead sulfate, which in turn was made from pig lead, is credited to pig lead in the table. Zinc oxide is the only pigment in which considerable slab zinc is used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulfide, zinc sulfate, and basic lead sulfate. A substantial proportion of the zinc in lithopone (65 percent in 1949 and 63 in 1948) and most of that in zinc chloride (all in 1949 and 1948) made in the United States are derived from secondary material. For a number of years before the United States entered the recent World War, there had been a large increase in the quantity of secondary zinc used in the manufacture of 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 percentage from metal and scrap rose in 1943 and continued upward almost without interruption in 1944–49. 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.

Lead content of lead and zinc pigments produced by domestic manufacturers, by sources, 1948–49, in short tons

Pigment	1948				1949			
	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			35,011	35,011			21,504	21,504
Red lead			26,924	26,924			23,900	23,900
Litharge			148,038	148,038			114,314	114,314
Leaded zinc oxide	16,639	1,261		17,900	8,835	555		9,390
Total [1]	16,639	1,261	209,973	227,873	8,835	555	159,718	169,108

[1] Excludes lead in basic lead sulfate, data for which Bureau of Mines not at liberty to publish.

Zinc content of zinc pigments and salts produced by sources, 1948–49, in sho

Pigment or salt	1948				
	Zinc in pigments and salts produced from—				Total zinc in pigments and salts
	Ore		Slab zinc	Secondary material [1]	
	Domestic	Foreign			
Zinc oxide	64,880	21,708	15,185	15,483	117,256
Leaded zinc oxide	30,472	2,616			33,088
Lithopone	9,741	1,065	8	18,775	29,589
Total pigments [2]	105,093	25,389	15,193	34,258	179,933
Zinc chloride				14,965	14,965
Zinc sulfate	2,066	101	30	3,016	6,113

[1] These figures are higher than those shown in the report on Seco
Include zinc recovered from byproduct sludges, residues, etc., not
[2] Excludes zinc sulfide, data for which Bureau of Mines not at lib

CONSUMPTION AND

LEAD PIGMENTS

White Lead.—A large part of the shipme
was not classified as to destination; as a co
is shown as going to paint manufacturers.
90-plus percent actually was used to make
of white lead to makers of ceramics decline
not much more than half of the tonnage for

Distribution of white lead (dry and in oil) shipm (average) and 1945–49, in sh

Industry	1940–44 (average) [1]	1945	1946 [2]
Paints	79,406	46,418	60,9
Ceramics	2,187	830	1,3
Unclassified	6,226	3,913	4,1
Total	87,819	51,170	66,5

[1] Reported as sales.
[2] Data for basic lead sulfate included with white lead; Bureau of M

Basic Lead Sulfate.—A distribution of ba
by uses has not been available for public
when 3,009 short tons went to the paint indu
industry, and 686 tons to other industries.
lead sulfate are also used as an intermediat
ture of leaded zinc oxide. Such quantities
this chapter series under leaded zinc oxi
sulfate.

Red Lead.—Storage batteries, regularly
lead, took 49 percent of the total shipped in
tionately more than paints, second in impo

had been gaining, had the sharpest drop, falling to less than half of the 1948 tonnage.

According to a recent study [1] by the Battelle Memorial Institute for the American Iron and Steel Institute, red lead appears to be outstanding for enclosed structural members in steel-housing construction. Some 34 kinds of paint systems were studied during the test. In one phase of the testing, one painted panel was damaged by scratching it lengthwise through the paint film to base metal. In the case of damaged films exposed to immersion in water, "only System C (red lead) offered protection to the bare steel in the damaged zone. In fact, for the majority of the other systems, continued exposure would have resulted in actual perforation of the base metal in this area in a relatively short period of time."

Distribution of red-lead shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average) [1]	1945	1946	1947	1948	1949
Storage batteries	26,890	26,725	19,115	20,883	14,854	12,163
Paints	18,688	16,438	9,318	11,362	10,863	9,634
Ceramics	1,030	626	1,228	977	1,275	603
Other	3,734	3,592	2,865	2,842	3,795	2,466
Total	50,351	47,381	32,526	36,064	30,787	24,866

[1] Reported as sales.

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

Litharge.—Storage batteries took 64 percent of the litharge shipped in 1949 and 65 percent in 1948. Ceramics dropped proportionately more than other uses and accounted for 11 percent of the 1949 total, compared with 13 percent. The manufacture of chrome pigments was the only use that increased in 1949, rising 15 percent; this use took 7 percent of the total, compared with 5 percent in 1948. Chrome pigments had the sharpest percentage drop in 1948. Oil refining and insecticides maintained their same relativ 1948, taking 5 and 4 percent, respectively, nish took 4 compared with 3 percent. Rub coverings had the greatest percentage drop half of the 1948 quantities.

Distribution of litharge shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average) [1]	1945	1946	1947	1948	1949
Storage batteries	51,821	70,981	75,836	111,840	100,645	77,163
Ceramics	12,426	11,511	13,166	18,360	19,979	13,209
Chrome pigments	9,462	11,394	10,877	9,228	7,455	8,557
Oil refining	5,846	6,419	6,682	7,688	7,248	5,720
Insecticides	19,293	18,061	14,259	7,288	6,033	5,353
Varnish	3,207	2,752	3,302	4,258	4,424	4,286
Rubber	3,269	1,864	2,131	2,205	2,835	1,398
Floor coverings	325	115	106	141	152	62
Other	5,337	6,701	7,440	6,042	6,004	5,214
Total	110,986	138,708	123,709	167,050	154,775	121,052

[1] Reported as sales.

[1] Pray, H. A., and Peoples, R. S., No. 31 of a series entitled "Contributions to the Metallurgy of Steel": Abs. in Am. Metal Market, vol. 54, No. 204, Oct. 21, 1949, p. 7.

Lead Suboxide.—Storage-battery manufac from pig lead a black suboxide of lead, whi for litharge. As previously noted, produ short tons, a fifth less than in the peak year

ZINC PIGMENTS AND

Zinc Oxide.—As usual, the manufacture half of the zinc oxide shipped—53 percen 55 percent in 1948—indicating a slightly important use than in the total distribut paint decreased only 2 percent in 1949 an drop in zinc oxide shipments than any o of zinc oxide for ceramics had established years ended in 1948. This use, coated fab coverings had declined considerably above or 43, 45, and 46 percent, respectively.

Distribution of zinc oxide shipments, by indus 1945–49, in short ton

Industry	1940–44 (average) [1]	1945	1946
Rubber	68,308	63,447	83,7
Paints	26,709	28,014	34,7
Ceramics	4,918	5,086	9,0
Coated fabrics and textiles [2]	6,633	12,177	10,0
Floor coverings			2,8
Chemical warfare	9,807	2,053	
Other	12,665	17,178	17,3
Total	129,160	127,955	157,8

[1] Reported as sales.
[2] Includes the following tonnages for rayon: 1946—9,363; 1947—

Leaded Zinc Oxide.—Leaded zinc oxide in the manufacture of paint, and 98 percen were reported to be for this purpose.

Distribution of leaded zinc oxide shipments, by in 1945–49, in short to

Industry	1940–44 (average) [1]	1945	1946
Paints	52,678	58,852	64,8
Rubber	33	200	
Other	1,416	3,546	2,9
Total	54,127	62,598	67,9

[1] Reported as sales.

Lithopone.—Paints, varnish, and lacquers regularly take close to three-quarters of the total lithopone sold. In 1949, 72 percent of shipments was for paints, etc., compared with 75 percent in 1948 and 82 percent in 1947. Paints, etc., took 46 percent less lithopone in 1949 than in 1948 and amounted to less than half of the totals for 1947 and 1946. Coated fabrics and textiles fell only 22 percent in 1949 and moved into second place as users of lithopone, replacing floor coverings, which dropped 49 percent. Consumption for rubber was 23 percent below 1948 but was higher than in every other year since 1941. The use of lithopone by paper makers rose from 3,086 tons in 1945 to 4,814 in 1948 but dropped to less than half of the latter quantity in 1949. Printing ink made the best showing of the uses of lithopone, with a drop of only 18 percent in 1949; 593 tons were shipped for this purpose compared with 727 in 1948, 720 in 1947, 830 in 1946, 864 in 1945, and 1,216 in 1944. One manufacturer regularly includes tonnages for ink as not separable from those sold for paint, but the foregoing tonnages compare totals for identical companies. Exports are included mainly with "Other," but at least one company classifies part of its exports according to end use.

Distribution of lithopone shipments, by industries, 1940–44 (average) and 1945–49, in short tons

Industry	1940–44 (average) [1]	1945	1946	1947	1948	1949
Paints, varnishes, and lacquers [2]	114,328	109,398	123,279	134,830	101,441	56,146
Floor coverings and textiles	17,274	15,821	15,167	17,469	20,859	12,982
Rubber	1,957	977	1,607	3,085	4,192	3,245
Other	15,319	9,965	6,918	9,640	10,541	5,962
Total	148,878	136,161	147,001	165,024	140,033	78,335

[1] Reported as sales.
[2] Includes a quantity, not separable, used for printing ink.

Zinc Chloride.—Statistics on the use and distribution of zinc chloride are not available. Studies of the effectiveness of zinc chloride and other chemicals in the treatment of mine timbers were summarized [2] recently. The report stated:

In a service test of maple timbers treated by the hot- and cold-bath method and installed in main haulageways of the Athens mine of the Cleveland Cliffs Iron Co., Negaunee, Mich., zinc chloride-treated timbers had an average useful life of 13.3 years; borax-treated timbers, 11.2 years; and sodium fluoride-treated timbers, 7.7 years. Untreated timbers used as controls had an average useful life of 3.8 years.

Although it was intended in this experiment to compare the relative effectiveness of zinc chloride, borax, and sodium fluoride, the wide variations in absorptions and penetrations obtained with the three chemicals invalidate such comparison. The zinc chloride absorptions were about as desired, but the absorptions of borax and sodium fluoride (especially the latter) were too low. Although retention of these two chemicals was low, the timbers treated with them, as well as those treated with zinc chloride, proved to be longer-lived and more economical than the untreated timbers used in the test.

[2] Crawford, F. S., and Wirka, R. M., A Test of Treated Timbers in a Mine at Negaunee, Mich.: Bureau of Mines Rept. of Investigations 4622, 1950, 6 pp.

Research in connection with flame-proo
rized [3] recently. The article gives an eval
resin-type treated fabrics. One chemical c
zinc chloride and another, zinc oxide.

Zinc Sulfate.—Rayon, the chief use for
years, established a new peak in 1949, ris
over the previous high in 1948. Shipme
poses—the top use in 1946 when it was a
to less than half of the quantity for rayor
from 1948 and 56 percent from 1946. C
agents dropped 29 and 45 percent, respec
fallen even more sharply from tonnages
the latter compared favorably with yea
the apparent decline in importance of zin
simply be a result of more precise data or
trary to the trend for most other uses, pai
rose substantially in 1949. This use dro
1949 increase marked resumption of the 19

**Distribution of zinc sulfate shipments, by indu
1945–49, in short to**

Industry	1940–44 (aver-age) [1]	1945	1946		
	Gross weight	Gross weight	Gross weight	Dry basis	Gr we
Rayon	4,492	6,720	7,634	5,883	8,
Agriculture	3,566	6,645	10,816	8,178	7,
Chemicals	2,680	2,617	2,254	1,488	2.
Flotation reagents	664	1,242	1,084	643	1.
Paints and varnish processing	1,723	589	174	151	
Glue	640	260	511	335	
Electrogalvanizing	307	255	488	315	
Textile dyeing and printing	92	534	552	491	
Other	1,491	1,993	1,418	943	1,
Total	15,655	20,854	24,931	18,427	21.

[1] Reported as sales.

PRICES

Total and average values received by p
pigments and zinc salts are given in the ta
report. Following two successive years
new peaks in average values for lead pigm
dropped in 1949; the declines ranged fr
and litharge to 3 percent for white lead (
likewise were at peaks for many years an
for all time in the 2 years, but, except
unlike those for lead pigments in 1949 and
values of both types dropped substantially
smaller tonnages involved. The small ga

[3] Church, James M., Little, Robt. W., and Copp
Resistant Fabrics; Ind. and Eng. Chem., vol. 42, No.

values probably indicate that sales during the year were greater at the higher part of the price range.

There were substantial drops in average quoted prices for lead pigments in 1949 from the all-time peaks established in 1948, and those for zinc pigments in general followed the same pattern. In most instances lead-pigment prices were at their lowest levels in June, made noteworthy recovery in the next several months, and returned to or close to midyear low points in December. Zinc-pigment quotations reached their lowest levels a little later in the year and after recoveries similar to those for the lead group resumed down trends but ended the year a little above the year's lowest figures.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1946–49, in cents per pound

[Oil, Paint and Drug Reporter]

Product	1946	1947	1948	1949
White lead (basic lead carbonate), dry, carlots, barrels	8.25–13.75	13.75–16.00	[1] 16.00–22.10	[1] 14.75–22.10
Basic lead sulfate (sublimed lead), less than carlots, barrels	7.50–13.50	13.25–15.75	15.75–21.25	14.25–21.25
Red lead, dry, 95 percent or less, less than carlots, barrels	9.50–16.00	15.75–18.60	18.00–25.25	15.75–25.25
Orange mineral, American, small lots, barrels	12.00–18.25	17.75–21.00	20.50–27.60	18.10–27.60
Litharge, commercial, powdered, barrels	8.00–14.75	13.75–17.60	16.60–24.25	13.75–24.25
Zinc oxide:				
American process, lead free, bags, carlots	7.25–9.00	9.00–10.00	10.00–13.50	10.00–15.50
American process, 5 to 35 percent lead, barrels, carlots	7.25–10.75	9.25–12.00	10.25–15.38	10.25–17.38
French process, red seal, bags, carlots	8.50–10.25	10.25–11.25	11.25–14.75	11.50–16.75
French process, green seal, bags, carlots	9.00–10.57	10.75–11.75	11.75–15.25	11.75–17.25
French process, white seal, barrels, carlots	9.75–12.00	11.50–12.50	12.50–16.00	12.50–18.00
Lithopone, ordinary, small lots, bags	4.50–5.25	5.25–6.25	6.25–6.75	6.50–6.75
Zinc sulfide, less than carlots, bags, barrels	8.50–10.00	10.00–11.00	10.75–14.00	12.50–14.00
Zinc chloride, works:				
Solution, tanks	2.50	2.50–3.00	3.00–3.25	3.25
Fused, drums	5.00–6.50	5.00–7.40	6.25–7.90	6.75–8.15
Zinc sulfate, crystals, barrels	3.65–4.40	3.65–5.00	4.55–6.85	4.95–6.85

[1] Quotations for bags.

FOREIGN TRADE [1]

Imports of lead and zinc pigments are insignificant in relation to domestic shipments of the various items. Total value of lead-pigment entries, following a substantial percentage rise in 1948, dropped 77 percent in 1949 to close to the 1947 level. The declines were due to lower tonnages rather than to falling average values, despite the fact that prices were substantially lower at the end than at the beginning of the year. Imports of zinc pigments rose sharply in 1949 but were scarcely one-third of the total value of lead-pigments receipts.

The total value of exports of lead pigments gained and that of zinc pigments fell in 1949. Values of both classes were far in excess of corresponding imports but were small as compared with domestic shipments.

Values of both imports and exports of the lead and zinc compounds covered by the accompanying table dropped in 1949.

In quantity as well as value, exports of lithopone and of zinc oxide

[1] 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.

are the most important items in foreign tr
ments and zinc salts. Both classes dropped
in 1949.

Value of foreign trade of the United States in lead
1947–49

[U. S. Department of Commer

	Imports		
	1947	1948	
Lead pigments:			
White lead	$238	$82,538	
Red lead	7,687	96,506	
Litharge	127,375	421,595	
Other lead pigments	15,060	32,089	
Total	150,360	633,328	
Zinc pigments:			
Zinc oxide	30,594	7,361	
Lithopone	21		
Total	30,615	7,361	
Lead and zinc salts:			
Lead arsenate	20,700		
Other lead compounds		448	
Zinc chloride			
Zinc sulfate	16,867	10,397	
Total	37,567	10,845	
Grand total	218,542	651,534	

[1] Data not strictly comparable to earlier years.
[2] Data not available.

Lead pigments and salts imported for consumption

[U. S. Department of Comm

Year	Short tons				
	White lead (basic carbonate)	Red lead	Litharge	Lead suboxide	p n
1945	1		8	10	
1946	1	54	15	11	
1947	1	22	416	33	
1948	203	247	1,064	34	
1949	161	23	96	23	

[1] Less than 1 ton.

Zinc pigments and salts imported for consumption in the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1945	(1)		(1)			421	$16,806
1946	41		(1)	(1)	2	415	26,528
1947	117	1	(1)			295	47,482
1948	27	(1)				180	17,758
1949	219	(1)	12		17	120	60,084

[1] Less than 1 ton.

Lead pigments and salts exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons						Total value
	White lead	Basic lead sulfate	Red lead	Orange mineral	Litharge	Lead arsenate	
1945	4,079	53	1,922	3	2,512	3,170	$2,162,548
1946	910	(1)	1,355	(1)	2,180	1,398	1,184,872
1947	863	(1)	787	(1)	1,212	1,552	1,632,143
1948	663	(1)	953	(1)	644	1,019	1,404,001
1949	699	(1)	1,042	(1)	1,357	430	1,343,513

[1] Figure not available.

Zinc pigments and salts exported from the United States, 1945–49

[U. S. Department of Commerce]

Year	Short tons		Total value [1]	Year	Short tons		Total value [1]
	Zinc oxide	Lithopone			Zinc oxide	Lithopone	
1945	7,102	11,576	$2,554,177	1948	8,612	21,015	$5,228,962
1946	10,955	9,651	2,911,457	1949	5,010	14,460	3,426,118
1947	19,082	13,652	6,551,250				

[1] Includes also in 1945: Zinc sulfide, $25,399 (173,475 pounds); zinc chloride, $93,596 (1,199,755 pounds); zinc sulfate, $62,119 (1,243,826 pounds); other zinc salts and compounds, $179,747 (750,108 pounds). Beginning January 1, 1946, none of the foregoing classes separately recorded.

WORLD REVIEW

Canada.—A report of the Dominion Burea published early in 1950 gave data on pigmer and varnish industry in Canada in 1947 ar 1948 are as follows (1947 figures for com Basic carbonate white lead (dry) 2,344 (3,2 bonate white lead in oil 717 (1,741) tons, b (7) tons, red lead including orange minera 300 (312) tons, zinc oxide (lead-free) 2,9 zinc oxide 2,096 (1,546) tons, lithopone (11,851 (9,712) tons, titanium dioxide 5,76 titanium dioxide pigments 8,791 (7,199) to ments" 590 (710) tons.

Canada's imports of lithopone, 14,787 and in 1948 and 1947, were large enough more t years. Imports of zinc white (zinc oxide) respectively. Imports of the other items giv graph are very small, although titanium separately in the report. According to U titanium dioxide and pigments, 19,787 tons in 1948 and 13,274 tons in 1947.

Germany.—According to a recent article of lithopone in all of Germany was about 100 of the industry being located in what after zone. The original capacity was said to be v mum production could probably be obtained Sales of lithopone in the American-British decreased because of the slowing of building of linseed oil. Exports, however, were sai largely to the Middle East, eastern Asia, t Scandinavia.

United Kingdom.—Construction of an ad lithopone was reported [7] begun at the Widn plant of the Imperial Smelting Corp., Ltd.

[6] Brennan, James V., Germany's Chemical Recovery: At Ind., vol. 34, No. 2, February 1950, p. 162.
[6] Foreign Commerce Weekly, vol. 37, No. 5, Oct. 31, 1949
[7] Foreign Commerce Weekly, vol. 34, No. 10, Mar. 7, 1946

the corporation was in process of liquidation early in 1950 owing to the fact that the grade of ore mined at Roseland is too low to be profitable. The Calco Chemical Division of American Cyanamid Co. continued to produce ilmenite at Piney River, also in Nelson County.

CONSUMPTION AND USES

Consumption of ilmenite dropped 10 percent in 1949 and thus failed to establish a new peak for the first time in 7 years; except for 1948, the rate of use in 1949 was at a higher level than ever before. The manufacture of pigments, as usual, took 99 percent of all ilmenite consumed. In addition a high percentage of the rutile used was consumed in the manufacture of pigments. Actually the material so used was a mixed product containing altered ilmenite, leucoxene, and rutile, which in titanium dioxide content resembled rutile more closely than ilmenite. The total tonnage shown as rutile was 16 percent above 1948, but the quantity for customary rutile uses dropped in 1949.

Consumption of ilmenite and rutile in the United States, 1941–46 (total) and 1947–49, by poducts, in short tons

Product	Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
1941	275,106	150,066	6,361	5,986
1942	257,535	141,412	10,616	9,952
1943	302,822	142,868	17,631	16,451
1944	360,911	175,475	14,803	13,837
1945	381,178	187,580	9,791	9,144
1946	401,283	202,663	7,134	6,670
1947				
Pigments (manufactured titanium dioxide) [1]	473,151	248,230		
Welding-rod coatings [1]	141	71	6,425	5,007
Alloys and carbide	5,972	2,431	1,131	1,050
Ceramics			102	95
Miscellaneous	254	123	34	31
Total consumption	479,521	250,859	7,692	7,083
1948				
Pigments (manufactured titanium dioxide) [1]	558,148	297,728	(2)	(2)
Welding-rod coatings [1]	115	72	7,835	7,289
Alloys and carbide	6,377	2,591	952	889
Ceramics			175	166
Miscellaneous	30	17	[3] 1,218	[3] 1,144
Total consumption	565,000	300,408	[4] 10,230	[4] 9,488
1949				
Pigments (manufactured titanium dioxide) [1]	505,432	265,854	(2)	(2)
Welding-rod coatings [1]	165	85	6,309	5,904
Alloys and carbide	4,969	2,037	660	619
Ceramics			143	136
Miscellaneous	42	24	[5] 4,686	[5] 4,204
Total consumption	510,608	268,000	[4] 11,888	[4] 10,863

[1] "Pigments" include all manufactured titanium dioxide, consumption of which in welding-rod coatings was 1,257 tons in 1947, 1,338 tons in 1948 and 1,082 tons in 1949.
[2] Bureau of Mines not at liberty to publish; figures included in "Miscellaneous."
[3] Revised figures. Includes rutile used to make pigments.
[4] Revised figures.
[5] Includes a mixed product containing altered ilmenite, leucoxene, and rutile, used to make pigments and metal.

Titanium Pigments.—Production and shipme
ments in 1949 dropped somewhat from 1948, fo
ment of five successive peaks; except for 1948,
highest annual rates ever attained. Figures on
plied in confidence and, consequently, are not gi
stated, a mixed product containing altered ilm
rutile, produced at a domestic mine was used
manufacture of pigments.

Distribution of titanium pigments shipments, by indus
of total

Year	Paints, varnishes, and lacquers		Floor coverings (linoleum and felt base)		Coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.)		Rubber		Paper	
	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content	Gross weight	TiO_2 content
1935	73.7	61.8	2.0	3.5	3.7	4.8	4.6	4.2	6.8	9.4
1936	77.4	66.7	2.1	3.8	4.9	6.2	3.2	3.6	7.0	10.6
1937	79.4	69.1	2.0	3.7	4.1	4.9	3.3	3.9	6.4	9.8
1938	76.8	65.9	2.6	4.7	3.5	4.3	3.7	4.2	8.9	13.1
1939	76.9	66.5	3.3	5.3	3.4	4.1	3.6	4.3	7.7	11.1
1940	76.4	66.7	3.6	5.3	2.7	3.3	3.0	3.7	6.9	10.4
1941	79.0	70.8	3.1	4.4	2.8	3.3	2.8	3.5	6.2	9.2
1942	79.1	71.3	2.6	3.6	2.7	3.5	.8	1.0	5.3	7.6
1943	78.0	69.5	2.4	3.1	1.9	2.6	.8	1.1	6.7	9.5
1944	79.1	71.9	2.0	2.7	1.9	2.4	.7	1.0	6.4	8.6
1945	79.7	73.4	2.0	2.5	1.5	2.0	1.1	1.6	6.7	9.3
1946	78.6	71.9	2.5	3.1	1.8	2.3	2.0	2.8	6.1	8.6
1947	81.5	74.3	3.7	4.7	2.1	2.6	2.6	3.4	5.5	7.8
1948	76.4	69.9	4.5	5.9	2.1	2.7	2.5	3.2	5.4	7.4
1949	74.5	67.5	4.6	5.8	1.6	2.1	3.1	3.9	6.6	9.6

Metal.—Titanium metal was produced on a
Newport, Del., by E. I. du Pont de Nemours
successive year. One pilot plant was operated co
imately 100 pounds a day throughout the year an
of somewhat larger capacity went into product
the year. Bureau of Mines produced metal at t
a week, except for several brief interruptions. E
of the output was in the form of powder, but a
production was largely in the form of sponge. A
production was under construction at Sayreville,
Lead Co. at the end of 1949 and began to produc
potential uses of titanium metal were recently disc
indicated that although this relatively new me
highly desirable properties has a promising fu
today is too costly to warrant the conclusion tha

[1] Ralston, Oliver, and Cservenyak, F. J., Potential Uses of
Chem., vol. 42, No. 2, February 1950, pp. 214–218.

universal applications and compete with steel, aluminum, and copper where these cheaper metals can function satisfactorily.

Welding-Rod Coatings.—Production of titanium-coated welding rods was 154,000 short tons in 1949, a drop of 18 percent from the 188,000 tons for 1948; 153,000 tons were coated in 1947, 133,000 in 1946, and 481,000 in 1943. Of the 1949 tonnage, 54 percent was coated with natural rutile, 33 percent with manufactured titanium dioxide, and nearly 7 percent each with both varieties and with ilmenite.

Other Uses.—In a recent article[4] it was pointed out that alkyl titanates, derived from the action of titanium tetrachloride on alcohols, are very effective waterproofing agents. These compounds, the titanium analogs of alkyl silicates, are capable of imparting a water-repellent finish to such diverse materials as paper, cotton, wool, rayon, nylon, silk, felt, and wood.

An article[5] stated that, although the superior qualities of titanium dioxide as an opacifier have been known for many years, its commercial utilization as the major opacifying agent in porcelain enamels is a comparatively recent development. The development and physical properties of these enamels were discussed. The fact that the enamels are applied directly to the metal without the need of an intermediate ground coat was said to be an outstanding development. Another article[6] discussed the standards and practices that permit application of titanium enamel to steel without the use of a ground coat. A development of increasing scientific and technical importance, another article[7] stated, was the electromechanical effect exhibited by barium titanate ceramics under the influence of a high electric polarizing field. Titanate ceramics, the author said, have become an important raw material for the manufacture of capacitors, especially in certain types of high-voltage condensers, such as those used in televison sets.

Titanium carbides were discussed in articles[8] appearing recently.

Experiments were conducted on the preparation of metal-ceramic seals by use of brazing alloy and a flux of titanium hydride in an atmosphere of highly purified hydrogen.[9]

Efforts to form single crystals of rutile were described[10] in recent literature. Synthetic rutile for use as gem stones is an outgrowth of such investigations.

STOCKS

Inventories of ilmenite rose 33 percent in 1949 and were equivalent to 15 months' requirements at the record rate of consumption maintained in 1948; they were adequate for 17 months at the 1949 rate.

[4] Speer, Robt. J., and Carmody, D. R., Organic Compounds of Titanium: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 251–253.
[5] Spencer-Strong, G. H., and Patrick, Robt. F., Titanium in Porcelain Enamels: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 253–256.
[6] Swartz, John C., Titanium Enamel to Titanium Steel: Steel, vol. 124, No. 3, Jan. 17, 1949, pp. 64–65 and 96.
[7] Jaffe, Hans, Titanate Ceramics for Electromechanical Purposes: Ind. Eng. Chem., vol. 42, No. 2, February 1950, pp. 264–268.
[8] Redmond, Joyn C., Cemented Titanium Carbide: Jour. Metals, vol. 1, No. 12, December 1949, pp. 987–993.
Rose, Kenneth, Cemented Carbides: Materials & Methods, vol. 29, No. 2, February 1949, pp. 74–84.
[9] Metal Progress, Brazing Metals to Nonmetals: Vol. 57, No. 2, February 1950, pp. 261, 262 and 264.
[10] Moore, Chas. H., Jr., Formation and Properties of Single Rutile Crystals of Synthetic Rutile: Min. Eng., vol. 1, No. 6, June 1949, pp. 194–199.

Rutile stocks rose 18 percent in 1949 and would s
the 1949 rate of use for 11 months.

Stocks of titanium concentrates in the United States at enc
short tons

Stocks	1948					
	Ilmenite		Rutile		Ilmenit	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	n T co
Mine	3,981	1,800	1,500	1,399	16,033	
Distributors [1]	4,499	1,800	4,218	3,986	2,478	
Consumers	522,077	250,559	3,493	3,255	683,535	3
Total stocks	530,559	254,168	9,211	8,640	703,046	3

[1] Includes ilmenite and rutile content of mixed zirconium-titanium concentra

PRICES

The average E&MJ Metal and Mineral Markets q
ton for ilmenite containing 56–59 percent TiO_2, f.
board, dropped from a range of $18–$20, according
purities, at the beginning of the year to $16–$18
to $15–$17 late in that month, and further to $14–$1
of November. There were no further changes in
were given as nominal. Nominal quotations for
minimum 94-percent concentrate, after continuing
pound for a number of years fell to 6–8 cents i
to 4–6 cents in May 1949, and further to 4–5 cents
year.

According to the magazine Steel, quotations for f
unchanged throughout 1949, as follows:

Ferrotitanium, Low-Carbon: (Ti 20–25 percent, Al 3.5
Si 4 percent maximum, C 0.10 percent maximum). Contra
$1.40 per pound of contained Ti; less ton $1.45. (Ti 38–43
maximum, Si 4 percent maximum, C 0.10 percent maximu
less ton $1.35, f. o. b. Niagara Falls, N. Y., freight allowed
add 5¢.

Ferrotitanium, High-Carbon: (Ti 15–18 percent, C 6–8
$160 per net ton, f. o. b. Niagara Falls, N. Y., freight allowe
of Mississippi River and north of Baltimore and St. Louis.

Ferrotitanium, Medium-Carbon: (Ti 17–21 percent, C 3
tract, $175 per ton, f. o. b. Niagara Falls, N. Y., freight not
rate allowed.

Titanium metal, 96–98 percent, was quoted at $5–
mid-September 1948 through September 1949, aft
quoted for the remainder of the year at $5.

Manufactured titanium dioxide (anatase), chalk
and (rutile) nonchalking, in bags, carlots, delivered
Oil, Paint and Drug Reporter throughout the year
21½ cents a pound, respectively. Beginni[illegible] Octob
on a ceramic grade were added; this grade w[illegible] quot
pound from then to the end of the year.

Primary slab zinc produced in the United States, by States where smelted, 1940–44 (average) and 1944–49, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Texas and West Virginia [1]	Total	
								Short tons	Value
1940–44 (average)	37,649	38,874	155,247	196,286	98,881	210,715	104,504	840,156	$135,034,000
1944	31,350	36,562	155,362	224,391	107,364	206,315	107,958	880,302	149,520,000
1945	29,391	33,110	124,904	179,251	106,115	200,709	91,081	764,561	131,504,492
1946	18,720	34,832	104,002	186,662	104,125	178,811	101,110	728,262	129,630,636
1947	17,158	41,801	113,192	197,453	128,398	193,524	110,969	802,495	171,894,429
1948	15,586	42,064	93,229	207,717	137,844	171,276	120,048	787,764	209,860,330
1949	17,316	41,854	86,823	216,578	167,650	156,920	137,841	814,782	202,381,849

[1] Includes Missouri, 1943–44 and 1947–49.

SECONDARY ZINC

In addition to the redistilled secondary slab zinc (unalloyed) already reported herein, some remelted slab zinc is produced, and a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. Additional information on secondary zinc is given in the Secondary Metals—Nonferrous chapter of this volume.

BYPRODUCT SULFURIC ACID

Sulfuric acid made from the sulfur dioxide gases produced in roasting zinc blende (sphalerite) is an important byproduct of zinc smelting. To utilize a larger proportion of their acid-producing capacity, some plants also consume large quantities of native sulfur. The production of sulfuric acid at zinc-blende roasting plants decreased 20 percent in 1949.

Sulfuric acid (basis, 100 percent) made at zinc-blende roasting plants in the United States, 1945–49

Year	Made from zinc blende [1]		Made from native sulfur		Total [1]		
	Short tons	Value [2]	Short tons	Value [2]	Short tons	Value [2]	
						Total	Average per ton
1945	910,938	$7,944,478	235,594	$3,063,693	846,532	$11,008,081	$10.10
1946	644,520	6,842,541	160,886	2,021,666	705,416	8,864,217	9.76
1947	598,703	8,001,205	266,104	3,556,281	864,807	11,557,486	10.38
1948	529,478	7,478,271	233,099	3,292,261	762,577	10,770,532	10.07
1949	476,932	7,276,481	130,592	1,992,423	607,524	9,268,904	11.88

[1] Includes acid from foreign blende.
[2] At average of sales of 60° B. acid.

ZINC DUST

Zinc-dust production in 1949 dropped to the lowest level since 1940. Zinc powder and blue powder are not included in the Bureau of Mines production totals; the zinc dust statistically reported is restricted to commercial grades that comply with severe specifications as to percentage of unoxidized metal, evenness of grading, and fineness of

particles. The zinc content of the dust produced in 94.97 to 99.70 percent and averaged 99.5 percent. S dust, which totaled 22,715 tons—2 percent of which countries—were slightly lower than production. T sumed at manufacturers' plants (3 percent of output) the difference between production and shipments, wi producers' stocks decreased from 1,206 tons at the tons at the close of the year.

The average price of zinc dust shipped to domes 1949 was 13.56 cents a pound compared with 15.5 The raw materials used to manufacture zinc dust ar Secondary Metals—Nonferrous chapter of this volu production is from zinc scrap (principally galvanizers is recovered from zinc ore, slab zinc, and as a b refining.

Zinc dust [1] produced in the United States, 1940–44 (aver

Year	Short tons	Value		Year	Sho ton
		Total	Average per pound		
1940–44 (average)	24,093	$4,698,765	$0.098	1947	30,6
1944	26,511	5,408,244	.102	1948	32,2
1945	25,877	5,227,154	.101	1949	22,7
1946	28,574	6,057,688	.106		

[1] All produced by distillation.

ZINC PIGMENTS AND SALTS

The principal zinc pigments are zinc oxide and li principal salts are the chloride and sulfate. These pr factured from various zinc-bearing materials, inclu scrap, and residues. Details of the production of z salts are given in the Lead and Zinc Pigments and Z of this volume.

CONSUMPTION AND USES

According to reports from 610 plants, 711,841 were put in process in 1949, a 13-percent drop fro Receipts at consumers' plants in 1949 were 696,73 parison of the calculated figure of slab zinc availa and the actual measured consumption since 1943 ind age of the plant survey was approximately 96 perce Galvanizing continued to be the largest field of although the quantity consumed was less than the sumption in 1948 owing to the labor strike which oc steel industry during the latter part of 1949. Zinc-b die castings, continued to be the second-largest use as in galvanizing, the quantity consumed in 1949 fell the record high established in 1948. Consumption o manufacture of brass products dropped sharply, con as a result of the abnormally large return of brass s which reduced requirements for primary metals. Re 28 percent less slab zinc in 1949 than in 1948.