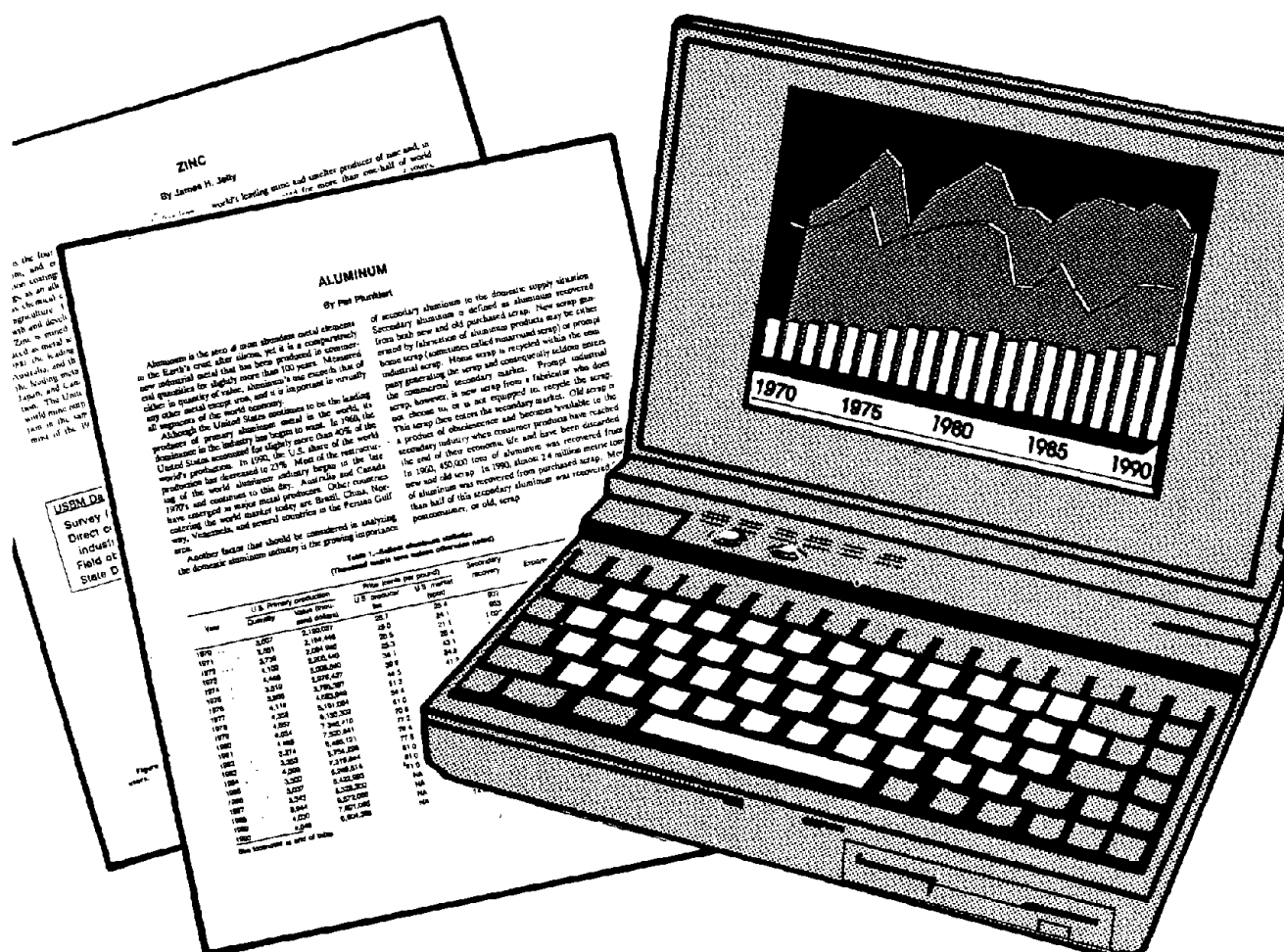




PB94-134418

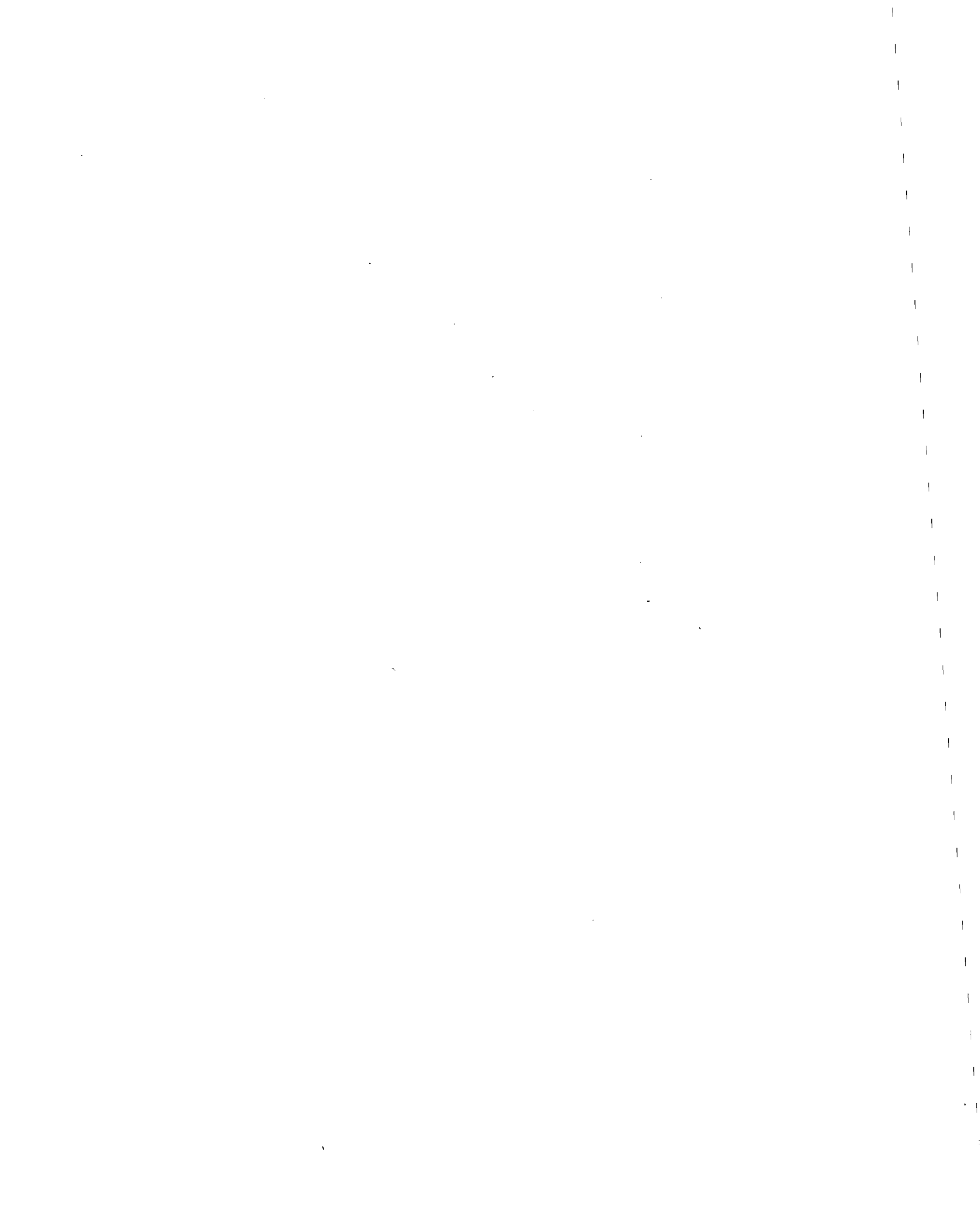
Statistical Compendium

UNITED STATES DEPARTMENT OF THE INTERIOR



BUREAU OF MINES

REPRODUCED BY:
U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161





PB94-134418

Special Publication

December 1993

STATISTICAL COMPENDIUM

By Staff, Bureau of Mines

**UNITED STATES DEPARTMENT OF THE INTERIOR
Bruce Babbitt, Secretary**

BUREAU OF MINES

Library of Congress Cataloging in Publication Data:



PB94-134418

Minerals yearbook statistical compendium / by staff, U.S. Bureau of Mines.

p. cm.

Includes bibliographical references.

1. Minerals industries—United States—Statistics. 2. Scrap metal industry—United States—Statistics. I. United States. Bureau of Mines. II. Minerals yearbook. III. Title: Statistical compendium.

HD9506.U62M455 1993 338.2'0973'021—dc20 93-20961 CIP

FOREWORD

The U.S. Bureau of Mines, the primary Federal Agency responsible for collecting mineral statistics, is pleased to publish its first Statistical Compendium for selected commodities with additional commodities to be included in future editions. The Statistical Compendium provides comprehensive long-term mineral statistics on production, consumption, and trade of mineral commodities and is arrayed by commodity and State. These statistics provide information to evaluate historical and emerging trends of the mineral industries. This publication is intended to provide users with official Federal Government minerals statistics with which to perform their analyses. We welcome your suggestions on how we can improve its contents.

P^u

ACKNOWLEDGMENTS

This historical Statistical Compendium was planned, assembled, edited, and published by the U.S. Bureau of Mines under the direction of David S. Brown, Associate Director, Information and Analysis; Michael J. McKinley, Chief, Division of Statistics and Information Services; Donald G. Rogich, Chief, Division of Mineral Commodities; and George Coakley, Chief, Division of International Minerals.

Herman Enzer, currently Acting Director of the U.S. Bureau of Mines, and George White, former Chief, Office of Special Projects, and currently on the staff of the Associate Director, Information and Analysis, were responsible for planning the project during the early stages along with a task force chaired by Barbara M. Carrico, Chief, Branch of Data Collection and Coordination. Members of the task force were Patricia Devine, William Engels, Elizabeth Hardy, Keith Harris, Charles Kimball, Kim Shedd, and William Zajac.

We gratefully acknowledge Division, Office, and Field Chiefs in the Information and Analysis Directorate for the suggestions and changes recommended by them in the early preparation stage.

Grateful acknowledgment is here made to the Division of Mineral Commodities for commodity specialist efforts in writing the commodity profiles and in assisting in compilation and review of statistical tables and to the

country specialists in the Division of International Minerals for review of the world production tables.

Recognition deserving acknowledgment goes to Barbara M. Carrico, Chief, Branch of Data Collection and Coordination; Imogene Bynum, Chief, Section of Metals Data; Barbara Gunn, Technical Industry Data Specialist; Sarah Guerrino, Former Chief of Ferrous Metals Data (retired); and Rosa McGee, Chief, Industrial Minerals Data, for supervising all aspects of the compilation of the data.

Special recognition goes to the tremendous effort and contributions of all of the statistical personnel in the Branch of Data Collection and Coordination who researched, compiled, formatted, and reviewed the statistical tables in addition to their regular responsibilities. Their efforts are gratefully acknowledged and sincerely appreciated.

Finally, the contributions of the Division of Statistics and Information publication staff deserve special recognition. Special recognition goes to Keith Harris, Chief, Branch of Publication Services, for supervision and guidance in each step in the publications process, to Gloria Ruggiero for planning and supervision of the publication aspects, and to Rodger Wedgeworth for editing the manuscript and for preparing the material for layout and printing.

CONTENTS

	<i>Page</i>
Forward	i
Acknowledgments	ii
Introduction	1
Summary of Methods Used to Compile Bureau Data	2
Aluminum	7
Bauxite and Alumina	21
Cement	23
Chromium	27
Clays	37
Cobalt	89
Copper	103
Ferroalloys	125
Gold	129
Iron ore	131
Iron and steel	149
Iron and steel scrap	153
Lead	155
Lime	169
Magnesium	185
Manganese	203
Nickel	219
Phosphate rock	227
Platinum-group metals	229
Rare earths	237
Salt	241
Sand and gravel, construction	249
Sand and gravel, industrial	273
Silicon	283
Silver	287
Soda ash	293
Sodium sulfate	301
Stone, crushed	309
Stone, dimension	333
Sulfur	337
Tin	343
Titanium	361
Tungsten	375
Zinc	379
Appendix A.—Unit conversion factors	413
Appendix B.—U.S. Bureau of Mines—the minerals information source	415
Appendix C.—Other U.S. Bureau of Mines publications	417

This page intentionally left blank.

INTRODUCTION

The U.S. Bureau of Mines Information and Analysis Directorate collects worldwide data on virtually every commercially important nonfuel mineral commodity. These data form the base for tracking and assessing the health of the minerals sector of the U.S. economy.

The Bureau's data collection activity was instituted by the 47th Congress in an appropriations act of August 7, 1882 (22 Stat. 329), which placed the collection of mineral statistics on an annual basis. The most recent authority for the U.S. Bureau of Mines survey activity is the

National Materials and Minerals Policy, Research and Development Act of 1980 (Public Law 96-479, 96th Congress). This act strengthens protection for proprietary data provided to the U.S. Department of the Interior by persons or firms engaged in any phase of mineral or mineral-material production or consumption.

In this Statistical Compendium, the Bureau is providing a consistent set of official, long-term (20 years or more) data series for selected commodities to facilitate analysis of long-term trends in these minerals sectors.

LEGAL JUSTIFICATION

The following statutes give the U.S. Bureau of Mines authority to collect and publish minerals and metal data.

- The Organic Act of 1910 (P. L. 61-179) established a Bureau of Mines in the U.S. Department of the Interior.

- The Interior Department Appropriations Act of 1935 (P. L. 74-53) gives the Bureau its basic authority to collect and disseminate information by transferring from the Department of Commerce, Bureau of Foreign and Domestic Commerce, to the Department of the Interior, Bureau of Mines, all of the activities concerned with the economic and statistical analysis of domestic mineral commodities.

- The Strategic and Critical Materials Stock Piling Act (P. L. 79-520 and P. L. 100-180) was signed into law by the President on July 23, 1946. This law authorizes the Secretary of the Interior, through the Director of the Bureau of Mines, to collect information concerning all aspects of minerals substance found in the United States which is essential to the common defense or industrial needs of the country because natural resources of the United States in certain strategic and critical materials is insufficient in supplying essential military, industrial and civilian needs for the National Defense. Hence, this act provides the acquisition and retention of stocks for strategic and critical materials and decreases dependence on foreign commodities for such supplies.

- The Defense Production Act of 1950 (P. L. 81-774 and P. L. 99-441) mandates that the Secretary of the Interior maintain data on strategic and critical materials which are necessary for the defense of the country. Therefore, materials data are to be established to facilitate the production of goods and services necessary for national security.

- The Helium Act Amendment of 1960 (P. L. 86-777) authorizes the conservation, production, and exploitation of helium gas and mandates the Secretary of the Interior

to acquire land, make contracts, etc. concerning the conserving, producing, buying, and selling of helium.

- Mining and Minerals Policy Act of 1970 (P. L. 91-631) declares that it shall be the responsibility of the Secretary of the Interior to carry out the policy of fostering and encouraging private enterprise in:

- A. The development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries.
- B. The orderly and economic development of domestic minerals resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs.
- C. Mining minerals and metallurgical research including the use and recycling of scrap to promote the efficient use of our natural and reclaimable mineral resources.
- D. The study and development of methods for the disposal, control and reclamation of mineral waste products and the reclamation of mined land, so as to lessen any adverse impact of minerals extraction and processing upon physical environment that may result from mining or mineral activities. Additionally, an annual report to Congress is required on the state of the utilization and duplication of these resources.

- The National Materials and Minerals Policy Research and Development Act of 1980 (P. L. 96-479) directs the Secretary of the Interior to initiate a coherent national materials and minerals policy to insure that materials will be available for National defense and industrial production. The law authorizes the Secretary to collect, evaluate and analyze information concerning mineral occurrence, production and use from industry, academia and Federal and State agencies.

SUMMARY OF METHODS USED TO COMPILE BUREAU DATA

DATA COLLECTION SURVEYS

The Bureau begins the collection of domestic nonfuel minerals and materials statistics by appraising the information requirements of Government and private organizations of the United States. Requirements that can be met by collecting data from minerals establishments are posed as questions on U.S. Bureau of Mines surveys. Figures 1 and 2 show both sides of a typical survey form.

Specific questions about the production, consumption, shipments, etc., of mineral commodities are structured in the survey forms to provide meaningful aggregated data. Thus, the entire mineral economic cycle from production through consumption is covered by 162 monthly, quarterly, semiannual, annual, and biennial surveys.

After the survey form has been designed, a list of the appropriate establishments to be canvassed is developed. Many sources are used to determine which companies, mines, plants, and other operations should be included on the survey mailing list. Bureau of Mines State Mineral Officers, State geologists, Federal organizations (e.g., Mine Safety and Health Administration), trade associations, industry representatives, and trade publications and directories are some of the sources that are used to develop and update survey listings. With few exceptions, a complete canvass of the list of establishments is employed rather than a sample survey. The iron and steel scrap industry is one of the exceptions where a sample survey is conducted.

The Paperwork Reduction Act requires that any Government agency wishing to collect information from 10 or more people first obtain approval from the Office of Management and Budget (OMB). OMB approves the need to collect the data and protects industry from unwarranted Government paperwork.

SURVEY PROCESSING

The Bureau surveys approximately 21,000 establishments. Each year, the Bureau mails about 50,000 forms that gather information for 162 different surveys. Each completed survey form returned to the Bureau undergoes extensive scrutiny to ensure the highest possible accuracy of the mineral data. The statistical staff monitors all surveys to ensure that errors are not created by reporting in physical units different from the units requested on the form. Relationships between related measures, such as produced crude ore and marketable crude ore, are analyzed for consistency. Engineering relationships, such as recovery factors from ores and concentrates, are also

employed. The totals for each form are verified, and currently reported data are checked against prior reports to detect possible errors or omissions.

For the majority of the surveys, which are automated, the forms are reviewed to ensure that data are complete and correct before entering into the computer. The computer is programmed to conduct a series of automated checks to verify mathematical consistency and to identify discrepancies between the data reported and logically acceptable responses.

The U.S. Bureau of Mines is modernizing and automating all of its survey processing and data dissemination functions. Automated commodity data system functions include computerized preparation of statistical tables; the use of desktop publishing to integrate text and tables; a microcomputer bulletin board, known as MINES-DATA, and a Faxback system for electronic dissemination of minerals data.

Survey Responses

To enable the reader to better understand the basis on which the statistics are calculated, each commodity annual report includes a section entitled "Domestic Data Coverage." This section briefly describes the data sources, the number of establishments surveyed, the response percentage, and the method of estimating the production or consumption for nonrespondents.

To produce reliable aggregated data, the Bureau employs efficient procedures for handling instances of nonresponse. Failure to return the initial survey form results in a second mailing of the form. If the second form is not returned, telephone calls are made to the nonrespondents. The followup calls provide the necessary data to complete the survey forms and/or verify questionable data entries. Periodic visits to important minerals establishments are also made by Bureau commodity specialists or State Minerals Officers to gather missing data and to explain the importance of the establishment's reporting. By describing the use of the published statistics and showing the impact of nonresponse, the Bureau strives to encourage respondents to give a complete and accurate reply.

The OMB "Guidelines for Reducing Reporting Burden" stipulates that the minimum acceptable response rate shall be 75% of the panel surveyed. In addition, the Bureau strives for a minimum reporting level of 75% of the quantity produced or consumed (depending on the survey) for certain key statistics. Response rates are periodically reviewed. For those surveys not meeting the minimum reporting level, procedures are developed and implemented to improve response rates.

Estimation for Nonresponse

When efforts to obtain a response to a survey fail, it becomes necessary to employ estimation or imputation techniques to account for missing data. These techniques are most effective when the response rate is relatively high. Some of the estimation methods depend on knowledge of prior establishment reporting, while other techniques rely on external information to estimate the missing data. When survey forms are received after the current publication has been completed, the forms are edited, necessary imputations are made for missing data, and the survey data base is updated. The revised data are reported in later publications.

Protection of Proprietary Data

The U.S. Bureau of Mines relies on the cooperation of the U.S. minerals industry to provide the mineral data that are presented in this and other Bureau publications. Without a strong response to survey requests, the Bureau would not be able to present reliable statistics. The Bureau in turn respects the proprietary nature of the data received from the individual companies and establishments. To ensure that proprietary rights will not be violated, the Bureau analyzes each of the aggregated statistics to determine if the data reported by an individual establishment can be deduced from the aggregated

statistics. If, for example, there are only two significant producers of a commodity in a given State, the Bureau will not publish the State total because either producer could readily estimate the production of the other. It is this obligation to protect proprietary information that results in the "Withheld" or "W" entries in the published tables. However, if a company gives permission in writing, the Bureau will publish the data as long as the data from other producers are protected from disclosure.

INTERNATIONAL DATA

International data are collected by country specialists in the U.S. Bureau of Mines Division of International Minerals with assistance from the Section of International Data. The data are gathered from various sources, including published reports of foreign Government mineral and statistical agencies, international organizations, the U.S. Department of State, the United Nations, the Organization of Petroleum Exporting Countries, and personal contact by specialists traveling abroad. Each February, an annual "Minerals Questionnaire" is sent through the Department of State to more than 130 U.S. Embassies asking them to provide estimates of mineral production for the host country for the preceding year. Missing data are estimated by Bureau country specialists based on historical trends and specialists' knowledge of current production capabilities in each country.

Form 6-1115-MA
Nonfer. (6-91)



C54

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON, D.C. 20241

SCRAP AND SECONDARY
COPPER, BRASS, AND NICKEL

D.M.B. No. 1032-0004.
Approval Expires: 12/31/92

DEFENSE MOBILIZATION
AGENCIES

have requested this information and each may receive a copy of your report. Unauthorized disclosure of this information is subject to penalties in accordance with 44 USC 3510 (b).

Brass Ingot Makers and
Miscellaneous Remelters - Plant Report
Check one: ☐ Own ☐ Toll

"The Paperwork Reduction Act of 1980 (44 U.S.C. 35) requires us to inform you that this information is being collected to provide guidance on policy or assist users in decision-making. This information will be used to analyze non-fuel mineral trends and to prepare official reports to the executive and legislative branches of Government, as well as the private sector. The response is mandatory."

FACSIMILE NUMBER
1-800-543-0661

(Please correct if name or address has changed.)

Public reporting burden for this collection of information is estimated to average 3.5 HOURS per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Bureau of Mines, Branch of Statistics and Methods Development, Washington D.C. 20241; and Office of Information and Regulatory Affairs, Office of Management and Budget, Washington D.C. 20503.

This report is mandatory under the authority of the Defense Production Act of 1950, as amended. This form must be filed by any brass ingot maker or miscellaneous remelter which produces, ships or holds inventory of copper or copper-base alloy in any calendar period. File this report with the Bureau of Mines, Section of Nonferrous Data, Washington, D.C. 20241, not later than the 15th day of the month following the period reported.

1. Stocks, receipts and disposition of purchased copper, brass, and nickel scrap (thousands of pounds):

Entries for each item should balance: (2) plus (3) should equal (6) plus (7) plus (8).

Scrap item (1)	Line Code (2)	ADP Code (3)	Stocks, beginning of period (4)	Received during period			Used or resold during period		Stocks, end of period (8)
				Quantity (5)	New scrap (%) (6)	Old scrap (%) (7)	Melted or refined (8)	Resold as scrap (9)	
COPPER SCRAP:									
No. 1 wire and heavy copper.....	181	101							
No. 2 wire, mixed heavy, and light copper.....	182	102							
Copper scale.....	162	103							
COPPER-BASE SCRAP:									
Composition turnings and solids.....	131	105							
Zincy-bronze.....	159	106							
Cocks and faucets.....	136	110				100			
Yellow brass and castings.....	137	111							
Light brass.....	139	112							
Old rolled brass and brass pipe.....	140	113							
Brass clippings and turnings.....	141	114			100				
Yellow rod-brass ends and turning.....	144	115			100				
Auto radiators (unsweated).....	107	120				100			
Electrotype shells.....	157	117				100			
Nickel silver.....	109	125							
Gilding metal clips.....	147	129			100				
Manganese bronze.....	148	116							
Cartridge cases.....	106	119							
Refinery brass (Cu _____ %)	145	135							
Brass ashes and skimmings.....	169	140			100				
88-10-2:88-6-1 1/2-4 1/2 solids and turnings.....	152	121							
Other solids and turnings.....	154	122							
Other (specify).....									
Total copper-base scrap.....	199	150							
NICKEL SCRAP (Nonferrous):									
New nickel clippings, etc.....	201	151			100				
Old nickel scrap.....	202	152				100			
New nickel copper metal clips, etc.....	203	153			100				
Old nickel copper scrap.....	204	154				100			
Nickel-covered plating racks.....	205	155			100				
Nickel-bearing residues (Ni _____ %)	206	156							
Other (specify).....									
Total nickel scrap.....	299	158							

1 Please footnote each item used in aluminum ingot and enter the quantities consumed here:

OVER

Figure 1.—Side one of a typical survey form.

2. PRODUCTION, DISPOSITION, AND STOCKS OF SECONDARY COPPER AND COPPER ALLOYS (thousands of pounds):

(Secondary metals are those metals or alloys recovered from scrap and residues.)

Report black copper only if produced for shipment to other plants for refining.

Product (1)	Line Code	ADP Code	Stocks, beginning of period (2)	Produced during period (3)	Consumed in own plant during period (4)	Shipped during period (5)	Stocks, end of period (6)
A. METALLIC COPPER:							
Electrolytic grade	401	201					
Fire refined	402	202					
Black copper (for shipment only)	403	203					
Copper powder	404	204					
Other (specify)							
Total metallic copper	499	207					
B. COPPER-ALLOY INGOT, BILLETS, AND CAKES: (Ingot identification #'s)							
Tin bronzes (193-257)	501	208					
Lead red brass and semi-red brass (100-132)	503	209					
High-lead tin bronze (295-327)	506	210					
Yellow brass (400-409)	508	211					
Manganese bronze (420-424)	509	212					
Aluminum bronze (415)	510	213					
Nickel silver (410-414)	511	214					
Silicon bronze and brass (500)	513	215					
Hardeners and master alloys	515	216					
Other alloys (specify)	516	217					
Total copper-alloy ingot, billet, and cakes	599	220					

3. PRODUCTION OF SECONDARY NICKEL AND NICKEL ALLOYS DURING PERIOD (thousands of pounds):

Product (1)	Line Code	ADP Code	Gross weight (2)	Nickel content (3)
Remelt nickel	802	301		
Nickel copper metal	803	302		
Other nickel alloys (specify)	804	303		
Nickel chemicals	805	304		
Total secondary nickel and nickel alloys	899	306		

4. CONSUMPTION OF PURCHASED COPPER-BASE SCRAP IN PRODUCTION OF ITEMS NOT LISTED IN SECTIONS 2 and 3 (thousands of pounds):

Kind of product (1)	Line Code	ADP Code	SCRAP CONSUMED DURING PERIOD		Estimate of copper recovered net weight (4)
			Unalloyed copper, gross weight (2)	Brass and bronze, gross weight (3)	
Aluminum ingot	901	307			
Lead- and tin-base alloys	902	308			
Zinc-base alloys	903	309			
Other (specify)					
Total	999	311			

5. CONSUMPTION OF RAW MATERIALS IN PRODUCTION OF ITEMS LISTED IN SECTIONS 2, 3 and 4 (thousands of pounds):

Material (1)	Line Code	ADP Code	Consumed during period (2)
"Black copper" from others	010	401	
Refined copper:			
Cathodes	021	402	
Wire bars	022	403	
Ingots and ingot bars	023	404	
Cakes and slabs	024	405	
Billets	025	406	
Other	026	407	
Secondary copper-alloy ingots from others	050	410	
Primary nickel	060	411	
Other metals (Zinc, tin, etc.)	080	413	
Total raw materials	099	415	

REMARKS:

CERTIFICATION. The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this report (Section 1 through Section 5) is correct and complete to the best of their knowledge and belief.

(Name of company)	By	(Signature of authorized official)
(Title)	(Telephone)	(Date)

The U.S. Code, Title 18 (Crimes and Criminal Procedure), Section 1001, formerly Section 80, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

Figure 2.—Side two of a typical survey form.

This page intentionally left blank.

ALUMINUM

By Pat Plunkert

Aluminum is the second most abundant metal element in the Earth's crust after silicon, yet it is a comparatively new industrial metal that has been produced in commercial quantities for slightly more than 100 years. Measured either in quantity or value, aluminum's use exceeds that of any other metal except iron, and it is important in virtually all segments of the world economy.

Although the United States continues to be the leading producer of primary aluminum metal in the world, its dominance in the industry has begun to wane. In 1960, the United States accounted for slightly more than 40% of the world's production. In 1990, the U.S. share of the world production had decreased to 23%. Most of the restructuring of the world aluminum industry began in the late 1970's and continues to this day. Australia and Canada have emerged as major metal producers. Other countries entering the world market today are Brazil, China, Norway, Venezuela, and several countries in the Persian Gulf area.

Another factor that should be considered in analyzing the domestic aluminum industry is the growing importance

of secondary aluminum to the domestic supply situation. Secondary aluminum is defined as aluminum recovered from both new and old purchased scrap. New scrap generated by fabrication of aluminum products may be either home scrap (sometimes called runaround scrap) or prompt industrial scrap. Home scrap is recycled within the company generating the scrap and consequently seldom enters the commercial secondary market. Prompt industrial scrap, however, is new scrap from a fabricator who does not choose to, or is not equipped to, recycle the scrap. This scrap then enters the secondary market. Old scrap is a product of obsolescence and becomes available to the secondary industry when consumer products have reached the end of their economic life and have been discarded. In 1960, 397,000 metric tons of aluminum was recovered from new and old scrap. In 1990, almost 2.4 million metric tons of aluminum was recovered from purchased scrap. More than half of this secondary aluminum was recovered from postconsumer, or old, scrap.

Table 1.—Salient aluminum statistics
(Thousand metric tons unless otherwise specified)

Year	U.S. primary production		Price (cents per pound)		Secondary recovery	Exports	Imports	Aluminum industry shipments ¹
	Quantity	Value (thousand dollars)	U.S. producer list	U.S. market (spot)				
1970	3,607	2,190,087	28.7	25.4	907	555	425	4,063
1971	3,561	2,154,446	29.0	24.1	953	266	626	4,476
1972	3,739	2,084,946	26.5	21.1	1,022	298	720	5,214
1973	4,109	2,206,440	25.3	26.4	1,126	509	557	6,241
1974	4,448	3,005,640	34.1	43.1	1,163	475	571	5,807
1975	3,519	2,976,427	39.8	34.8	1,121	399	499	4,139
1976	3,856	3,785,397	44.5	41.2	1,334	439	679	5,264
1977	4,118	4,683,949	51.3	47.8	1,456	373	758	5,567
1978	4,358	5,191,064	54.4	51.0	1,518	472	980	6,204
1979	4,557	6,130,302	61.0	70.7	1,612	701	762	6,280
1980	4,654	7,346,410	70.8	76.1	1,577	1,346	647	5,406
1981	4,489	7,520,841	77.2	59.8	1,789	787	848	5,497
1982	3,274	5,485,121	76.4	46.8	1,666	748	878	4,908
1983	3,353	5,754,298	77.5	68.3	1,773	776	1,091	5,848
1984	4,099	7,319,844	81.0	61.1	1,760	734	1,477	6,355
1985	3,500	6,249,614	81.0	48.8	1,762	908	1,420	6,378
1986	3,037	5,422,993	² 81.0	55.9	1,773	753	1,967	6,504
1987	3,343	5,328,300	NA	72.3	1,986	917	1,850	6,867
1988	3,944	9,572,066	NA	110.0	2,122	1,247	1,620	6,851
1989	4,030	7,801,086	NA	87.8	2,054	1,615	1,470	6,761
1990	4,048	6,604,398	NA	74.0	2,393	1,659	1,514	6,569

See footnotes at end of table.

PRECEDING PAGE
BLANK

Table 1.—Salient aluminum statistics—Continued
(Thousand metric tons unless otherwise specified)

Year	Apparent consumption	World Production
1970	3,404	9,653
1971	3,827	10,317
1972	4,468	11,007
1973	5,284	12,124
1974	4,924	13,169
1975	3,544	12,144
1976	4,611	12,622
1977	4,982	13,779
1978	5,484	14,131
1979	5,342	14,555
1980	4,594	15,383
1981	4,615	15,079
1982	4,379	13,433
1983	5,027	13,904
1984	5,240	15,705
1985	5,209	15,398
1986	5,143	16,396
1987	5,469	17,415
1988	5,373	18,499
1989	4,957	19,100
1990	5,264	19,362

NA Not available.

¹Net shipments of ingot and mill products to domestic markets. Source: Aluminum Association Inc., Aluminum Statistical Review.

²Based on 7 months.

Table 2.—U.S. primary aluminum metal production
(Thousand metric tons)

Year	Quantity	Year	Quantity	Year	Quantity	Year	Quantity
1893	0.1	1918	56.6	1943	835	1968	2,953
1894	.2	1919	58.2	1944	704	1969	3,441
1895	.2	1920	62.6	1945	449	1970	3,607
1896	.5	1921	24.8	1946	372	1971	3,561
1897	1.1	1922	33.4	1947	519	1972	3,739
1898	1.4	1923	58.3	1948	565	1973	4,109
1899	1.5	1924	68.3	1949	547	1974	4,448
1900	2.3	1925	63.5	1950	652	1975	3,519
1901	2.6	1926	65.3	1951	759	1976	3,856
1902	2.6	1927	72.6	1952	850	1977	4,118
1903	3.0	1928	95.3	1953	1,136	1978	4,358
1904	3.6	1929	101.6	1954	1,325	1979	4,557
1905	4.9	1930	104.3	1955	1,421	1980	4,654
1906	6.4	1931	80.7	1956	1,523	1981	4,489
1907	7.4	1932	47.2	1957	1,495	1982	3,274
1908	4.8	1933	39.0	1958	1,421	1983	3,353
1909	13.0	1934	33.6	1959	1,773	1984	4,099
1910	16.0	1935	54.4	1960	1,827	1985	3,500
1911	17.0	1936	102.0	1961	1,727	1986	3,037
1912	19.0	1937	132.4	1962	1,921	1987	3,343
1913	21.4	1938	129.7	1963	2,098	1988	3,944
1914	26.3	1939	148.8	1964	2,316	1989	4,030
1915	41.1	1940	186.9	1965	2,498	1990	4,048
1916	52.3	1941	280.3	1966	2,693		
1917	58.9	1942	473.0	1967	2,966		

Table 3.—Aluminum price
(Average cents per pound)

	1970	1971	1972	1973	1974
U.S. market (spot)	25.4	24.1	21.1	26.4	43.1
U.S. producer list ¹	28.7	29.0	26.5	25.3	34.1
London Metal Exchange	NA	NA	NA	NA	NA
U.S. transaction	NA	NA	NA	NA	NA
	1975	1976	1977	1978	1979
U.S. market (spot)	34.8	41.2	47.8	51.0	70.7
U.S. producer list ¹	39.8	44.5	51.3	54.4	61.0
London Metal Exchange	NA	NA	NA	NA	72.7
U.S. transaction	NA	NA	NA	NA	NA
	1980	1981	1982	1983	1984
U.S. market (spot)	76.1	59.8	46.8	68.3	61.1
U.S. producer list ¹	70.8	77.2	76.4	77.5	81.0
London Metal Exchange	80.8	57.3	45.0	65.3	56.5
U.S. transaction	NA	NA	NA	NA	NA
	1985	1986	1987	1988	1989
U.S. market (spot)	48.8	55.9	72.3	110.0	87.8
U.S. producer list ¹	81.0	² 81.0	NA	NA	NA
London Metal Exchange	47.9	52.2	70.8	³ 115.9	⁴ 88.5
U.S. transaction	⁵ 49.0	56.5	73.3	112.2	88.9
	1990				
U.S. market (spot)	74.0				
U.S. producer list ¹	NA				
London Metal Exchange	74.4				
U.S. transaction	75.0				

NA Not available.

¹Ingot.

²Based on 7 months in 1986.

³Average for 11 months.

⁴London Metal Market, high grade; previous years posted in standard grade.

⁵Metals week started publishing data in 1985.

Source: Metals week.

Table 4.—Aluminum supply-demand relationships
(Thousand metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Primary metal production	3,607	3,561	3,739	4,109	4,448	3,519	3,856	4,118	4,358	4,557
Secondary production (old scrap)	179	196	227	240	276	305	371	482	522	557
Shipments of Government stockpile excesses	22	—	5	662	464	2	8	—	—	—
Imports	425	626	720	557	571	499	679	758	980	762
Industry stocks, Jan. 1	1,716	1,989	2,280	2,205	1,980	2,339	2,721	2,585	2,588	2,492
Total U.S. supply	5,948	6,372	6,972	7,774	7,738	6,664	7,636	7,943	8,448	8,368
Industry stocks, Dec. 31	1,989	2,280	2,205	1,980	2,339	2,721	2,585	2,588	2,492	2,325
Exports	555	266	298	509	475	399	439	373	472	701
Industrial demand	3,404	3,827	4,468	5,284	4,924	3,544	4,611	4,982	5,484	5,342
U.S. DEMAND PATTERN										
Construction	855	1,080	1,317	1,416	1,221	875	1,120	1,191	1,284	1,202
Transportation	587	695	918	1,099	951	663	969	1,142	1,239	1,212
Electrical	517	552	633	724	719	472	502	533	592	620
Containers and packaging	558	588	486	808	886	783	1,029	1,106	1,261	1,271
Consumer durables	355	378	464	523	453	294	406	418	461	406
Machinery and equipment	230	250	309	370	404	251	355	358	395	374
Other	301	282	340	344	290	206	230	234	252	257
Total U.S. demand	3,404	3,827	4,468	5,284	4,924	3,544	4,611	4,982	5,484	5,342
Total U.S. primary demand	3,225	3,631	4,241	5,044	4,648	3,239	4,240	4,501	4,962	4,785

Table 4.—Aluminum supply-demand relationships—Continued
(Thousand metric tons)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Primary metal production	4,654	4,489	3,274	3,353	4,099	3,500	3,037	3,343	3,944	4,030
Secondary production (old scrap)	617	758	782	820	825	850	784	852	1,045	1,011
Shipments of Government stockpile excesses	—	—	—	—	—	—	—	—	—	—
Imports	647	848	878	1,091	1,477	1,420	1,967	1,850	1,620	1,470
Industry stocks, Jan. 1	2,325	2,302	2,995	2,802	2,263	2,690	2,343	2,235	1,894	1,883
Total U.S. supply	8,243	8,397	7,929	8,066	8,664	8,460	8,131	8,280	8,503	8,394
Industry stocks, Dec. 31	2,302	2,995	2,802	2,263	2,690	2,343	2,235	1,894	1,883	1,822
Exports	1,346	787	748	776	734	908	753	917	1,247	1,615
Industrial demand	4,594	4,615	4,379	5,027	5,240	5,209	5,143	5,469	5,373	4,957
U.S. DEMAND PATTERN										
Construction	1,011	974	936	1,118	1,086	1,118	1,126	1,157	1,032	949
Transportation	868	826	715	926	1,117	1,102	1,080	1,204	1,204	1,062
Electrical	533	512	465	514	567	517	494	498	527	486
Containers and packaging	1,286	1,357	1,458	1,519	1,535	1,516	1,512	1,647	1,596	1,548
Consumer durables	340	379	317	414	421	388	427	462	463	399
Machinery and equipment	322	323	269	313	314	305	303	322	338	320
Other	234	244	219	223	200	263	201	179	213	193
Total U.S. demand	4,594	4,615	4,379	5,027	5,240	5,209	5,143	5,469	5,373	4,957
Total U.S. primary demand	3,977	3,857	3,597	4,207	4,415	4,359	4,359	4,617	4,328	3,946
1990										
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Primary metal production	4,048									
Secondary production (old scrap)	1,359									
Shipments of Government stockpile excesses	—									
Imports	1,514									
Industry stocks, Jan. 1	1,822									
Total U.S. supply	8,743									
Industry stocks, Dec. 31	1,820									
Exports	1,659									
Industrial demand	5,264									
U.S. DEMAND PATTERN										
Construction	968									
Transportation	1,112									
Electrical	476									
Containers and packaging	1,729									
Consumer durables	408									
Machinery and equipment	362									
Other	209									
Total U.S. demand	5,264									
Total U.S. primary demand	3,905									

Table 5.—Domestic secondary recovery of old and new aluminum scrap
(Thousand metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
New scrap	728	757	795	886	887	816	963	974	996	1,055	960
Old scrap	179	196	227	240	276	305	371	482	522	557	617
Total scrap	907	953	1,022	1,126	1,163	1,121	1,334	1,456	1,518	1,612	1,577
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
New scrap	1,031	884	953	935	912	989	1,134	1,077	1,043	1,034	
Old scrap	758	782	820	825	850	784	852	1,045	1,011	1,359	
Total scrap	1,789	1,666	1,773	1,760	1,762	1,773	1,986	2,122	2,054	2,393	

Source: U.S. Bureau of Mines Yearbook.

Table 6.—Production and shipments¹ of secondary aluminum alloys by independent smelters in the United States (Metric tons)

	1970		1971		1972	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloys:						
13% Si, 360, etc. (0.6% Cu, maximum)	42,031	41,469	39,882	40,349	51,472	51,876
380 and variations	280,207	275,969	292,210	296,615	344,824	347,253
Sand and permanent mold:						
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	15,338	15,195	16,543	16,350	17,027	17,152
No. 12 and variations	7,722	7,823	6,032	5,621	8,191	7,854
No. 319 and variations	45,068	44,260	42,531	43,173	45,977	46,099
F-132 alloy and variations	(²)	(²)	(²)	(²)	(²)	(²)
Al-Mg alloys	710	708	799	769	1,852	1,801
Al-Zn alloys	4,685	4,271	3,750	3,943	7,324	7,311
Al-Si alloys (0.6% to 2.0% Cu)	5,342	4,974	4,820	5,123	3,514	3,725
Al-Cu alloys (1.5% Si, maximum)	741	682	425	485	969	864
Al-Si Cu Ni alloys	15,883	15,825	15,187	14,805	7,780	8,912
Other	(²)	(²)	(²)	(²)	(²)	(²)
Wrought alloys, extrusion billets	64,295	64,071	77,351	77,811	72,153	70,266
Miscellaneous:						
Steel deoxidation	25,035	25,048	21,850	21,487	19,843	20,106
Pure (97.0% Al)	(²)	(²)	(²)	(²)	(²)	(²)
Aluminum-base hardeners	4,323	4,589	3,885	3,879	5,200	5,175
Other ⁴	22,789	22,797	24,904	25,084	30,818	31,116
Total	534,169	527,681	550,169	555,249	616,944	619,510
Less consumption of materials other than scrap:						
Primary aluminum	14,202	—	14,639	—	14,787	—
Primary silicon	NA	—	NA	—	NA	—
Other	NA	—	NA	—	NA	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵	NA	NAp	NA	NAp	NA	NAp
	1973		1974		1975	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloys:						
13% Si, 360, etc. (0.6% Cu, maximum)	51,618	52,782	45,942	43,725	50,683	44,637
380 and variations	367,941	372,347	308,668	298,692	255,875	257,249
Sand and permanent mold:						
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	17,762	18,123	26,394	25,738	17,600	16,680
No. 12 and variations	9,441	10,013	19,419	19,285	11,256	11,064
No. 319 and variations	56,560	56,916	47,834	47,209	33,550	33,069
F-132 alloy and variations	(²)	(²)	(²)	(²)	12,344	12,498
Al-Mg alloys	3,199	3,153	3,843	3,792	1,447	1,356
Al-Zn alloys	10,130	10,460	9,411	8,959	8,957	8,567
Al-Si alloys (0.6% to 2.0% Cu)	3,612	3,655	4,328	4,181	3,827	3,909
Al-Cu alloys (1.5% Si, maximum)	4,200	4,152	4,419	4,408	4,234	4,430
Al-Si Cu Ni alloys	4,238	4,522	5,670	5,607	W	W
Other	(²)	(²)	(²)	(²)	3,273	3,267
Wrought alloys, extrusion billets	109,788	111,672	90,344	87,073	43,957	44,938
Miscellaneous:						
Steel deoxidation	27,280	27,152	29,308	28,908	18,483	19,751
Pure (97.0% Al)	(²)	(²)	(²)	(²)	4,098	572
Aluminum-base hardeners	6,669	6,792	4,120	4,053	2,680	2,741
Other ⁴	18,926	18,788	16,699	16,835	24,528	24,014
Total	691,364	700,525	616,399	598,465	496,792	488,742
Less consumption of materials other than scrap:						
Primary aluminum	31,567	—	35,653	—	15,333	—
Primary silicon	NA	—	NA	—	NA	—
Other	NA	—	NA	—	NA	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵	NA	NAp	NA	NAp	NA	NAp

See footnotes at end of table.

Table 6.—Production and shipments¹ of secondary aluminum alloys by independent smelters in the United States—Continued
(Metric tons)

	1976		1977		1978	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloys:						
13% Si, 360, etc. (0.6% Cu, maximum)	66,518	64,895	74,684	75,823	98,562	97,783
380 and variations	340,542	338,202	374,998	377,989	384,915	387,137
Sand and permanent mold:						
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	18,185	18,327	22,214	22,050	25,531	26,106
No. 12 and variations	7,420	7,456	W	W	W	W
No. 319 and variations	39,964	39,591	44,156	45,142	49,265	48,445
F-132 alloy and variations	13,756	13,650	14,307	14,314	16,218	16,336
Al-Mg alloys	1,143	1,047	1,229	1,133	1,808	1,601
Al-Zn alloys	13,313	13,628	16,627	16,031	11,089	11,693
Al-Si alloys (0.6% to 2.0% Cu)	3,875	3,746	4,126	4,307	7,262	7,115
Al-Cu alloys (1.5% Si, maximum)	3,602	3,475	2,767	3,007	1,995	1,899
Al-Si Cu Ni alloys	W	W	3,241	3,332	3,026	3,123
Other	2,624	2,630	3,342	3,280	4,038	4,094
Wrought alloys, extrusion billets	53,754	53,746	79,813	79,379	83,213	82,457
Miscellaneous:						
Steel deoxidation	26,749	25,809	27,012	27,813	33,781	33,626
Pure (97.0% Al)	1,529	2,041	W	W	196	537
Aluminum-base hardeners	2,507	2,678	2,312	2,335	2,325	2,099
Other ⁴	18,756	18,337	24,377	24,652	20,905	20,347
Total	614,237	609,258	695,205	700,587	744,129	744,398
Less consumption of materials other than scrap:						
Primary aluminum	20,992	—	23,952	—	29,099	—
Primary silicon	34,693	—	36,504	—	45,240	—
Other	3,343	—	4,275	—	3,629	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵	555,209	NAp	630,474	NAp	666,161	NAp
	1979		1980		1981	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloys:						
13% Si, 360, etc. (0.6% Cu, maximum)	89,691	90,961	70,168	68,965	84,981	84,648
380 and variations	411,458	410,569	368,553	367,142	355,240	356,226
Sand and permanent mold:						
95/5 Al-Si, 356, etc., (0.6% Cu, maximum)	24,329	24,362	22,487	22,175	34,119	33,502
No. 12 and variations	W	W	W	W	W	W
No. 319 and variations	50,892	50,558	48,908	48,879	45,951	45,644
F-132 alloy and variations	19,338	19,267	15,395	15,067	14,289	13,860
Al-Mg alloys	1,682	2,008	1,767	1,547	1,250	1,387
Al-Zn alloys	7,193	7,023	6,127	6,514	7,618	7,118
Al-Si alloys (0.6% to 2.0% Cu)	5,589	5,581	5,353	5,455	5,224	5,050
Al-Cu alloys (1.5% Si, maximum)	2,918	2,915	2,261	2,177	3,052	3,034
Al-Si Cu Ni alloys	3,442	3,493	3,773	3,747	4,335	4,198
Other	7,613	7,687	6,066	5,469	3,709	4,345
Wrought alloys, extrusion billets	92,517	92,030	85,726	86,645	98,098	96,900
Miscellaneous:						
Steel deoxidation	35,466	35,935	33,112	32,639	27,969	28,584
Pure (97.0% Al)	1,974	1,970	4,378	4,368	1,091	869
Aluminum-base hardeners	3,104	3,294	2,942	2,583	1,354	1,685
Other ⁴	9,422	9,640	10,294	10,268	9,132	9,081
Total	766,628	767,293	687,310	683,640	697,412	696,131
Less consumption of materials other than scrap:						
Primary aluminum	35,029	—	31,263	—	39,052	—
Primary silicon	44,301	—	36,920	—	36,284	—
Other	3,935	—	3,348	—	2,520	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵	683,363	NAp	615,779	NAp	619,556	NAp

See footnotes at end of table.

Table 6.—Production and shipments¹ of secondary aluminum alloys by independent smelters in the United States—Continued
(Metric tons)

	1982		1983		1984	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloys:						
13% Si, 360, etc. (0.6% Cu, maximum)	86,091	85,527	94,153	94,114	110,904	111,549
380 and variations	346,051	346,683	355,469	359,867	286,458	285,374
Sand and permanent mold:						
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	31,405	31,710	33,298	33,259	30,188	30,487
No. 12 and variations	W	W	W	W	W	W
No. 319 and variations	43,164	42,812	44,296	44,752	53,647	53,184
F-132 alloy and variations	9,722	10,139	9,492	9,732	13,535	13,296
Al-Mg alloys	600	743	553	618	548	632
Al-Zn alloys	4,589	4,706	4,865	4,748	4,095	4,309
Al-Si alloys (0.6% to 2.0% Cu)	4,317	4,393	5,451	5,489	4,293	4,337
Al-Cu alloys (1.5% Si, maximum)	3,041	3,142	2,936	3,124	2,573	2,512
Al-Si Cu Ni alloys	12,502	12,418	4,718	4,835	2,406	2,250
Other	2,221	2,350	2,211	2,260	481	495
Wrought alloys, extrusion billets	96,548	96,622	107,949	110,757	107,292	105,684
Miscellaneous:						
Steel deoxidation	25,506	25,334	25,825	25,287	23,778	23,084
Pure (97.0% Al)	362	579	405	437	168	169
Aluminum-base hardeners	882	1,064	1,586	1,483	1,557	1,566
Other ⁴	17,566	17,461	14,489	14,639	6,799	6,788
Total	684,567	685,683	707,696	715,401	648,722	645,716
Less consumption of materials other than scrap:						
Primary aluminum	36,525	—	40,528	—	41,443	—
Primary silicon	35,918	—	38,023	—	35,093	—
Other	2,182	—	3,090	—	2,316	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵ . . .	609,942	NAp	626,055	NAp	569,870	NAp
	1985		1986		1987	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloys:						
13% Si, 360, etc. (0.6% Cu, maximum)	111,361	111,042	104,153	104,419	108,807	108,864
380 and variations	279,892	278,868	278,692	279,004	255,405	257,546
Sand and permanent mold:						
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	26,475	27,474	26,706	26,548	27,768	27,839
No. 12 and variations	W	W	W	W	W	W
No. 319 and variations	43,940	44,720	48,391	48,263	54,350	54,994
F-132 alloy and variations	12,116	12,419	8,237	8,326	9,661	9,471
Al-Mg alloys	292	410	84	86	216	235
Al-Zn alloys	5,154	4,955	5,087	4,913	3,835	4,599
Al-Si alloys (0.6% to 2.0% Cu)	5,593	5,490	5,213	5,390	5,986	6,012
Al-Cu alloys (1.5% Si, maximum)	1,807	2,113	1,450	1,465	1,198	1,216
Al-Si Cu Ni alloys	1,012	1,012	1,064	1,048	1,016	1,011
Other	664	653	833	838	3,272	3,288
Wrought alloys, extrusion billets	97,168	96,929	106,297	103,949	147,253	146,644
Miscellaneous:						
Steel deoxidation	27,735	28,010	27,146	27,716	22,311	23,101
Pure (97.0% Al)	168	168	823	667	140	156
Aluminum-base hardeners	1,236	1,275	745	730	1,727	1,638
Other ⁴	14,504	14,305	20,694	20,179	20,853	19,434
Total	629,117	629,843	635,615	633,541	663,798	666,048
Less consumption of materials other than scrap:						
Primary aluminum	45,034	—	47,808	—	42,740	—
Primary silicon	25,028	—	26,223	—	31,122	—
Other	2,227	—	3,091	—	3,263	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵ . . .	556,828	NAp	558,493	NAp	586,673	NAp

See footnotes at end of table.

Table 6.—Production and shipments¹ of secondary aluminum alloys by independent smelters in the United States—Continued
(Metric tons)

	1988		1989		1990	
	Production	Net shipments	Production	Net shipments	Production	Net shipments
Die-cast alloy:						
13% Si, 360, etc. (0.6% Cu, maximum)	107,626	108,475	97,970	97,305	60,935	61,918
380 and variations	326,011	323,698	348,160	349,471	273,432	272,270
Sand and permanent mold:						
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	19,063	18,849	18,451	18,850	16,618	16,606
No. 12 and variations	W	W	W	W	W	W
No. 319 and variations	53,971	53,921	60,542	60,068	57,284	55,577
F-132 alloy and variations	6,945	6,781	6,826	6,763	8,693	11,279
Al-Mg alloys	224	222	49	68	695	700
Al-Zn alloys	2,390	2,296	1,913	2,170	2,648	2,489
Al-Si alloys (0.6% to 2.0% Cu)	6,933	6,737	9,710	9,837	11,896	11,906
Al-Cu alloys (1.5% Si, maximum)	1,189	1,176	350	449	1,753	1,745
Al-Si Cu Ni alloys	933	943	1,121	1,123	1,174	1,178
Other	3,672	3,626	1,209	1,237	1,468	1,357
Wrought alloys, extrusion billets	108,052	108,052	126,482	124,714	125,604	125,937
Miscellaneous:						
Steel deoxidation	8,605	8,903	7,967	7,994	4,866	5,437
Pure (97.0% Al)	—	—	—	—	29	29
Aluminum-base hardeners	1,904	1,933	1,813	1,777	1,478	1,520
Other ⁴	44,307	43,318	31,091	31,226	34,407	34,787
Total	691,825	688,930	713,654	713,052	602,980	604,735
Less consumption of materials other than scrap:						
Primary aluminum	46,939	—	55,731	—	43,336	—
Primary silicon	38,344	—	36,981	—	29,127	—
Other	5,405	—	3,536	—	3,320	—
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot ⁵ . . .	601,137	NAp	617,406	NAp	527,197	NAp

NA Not available.

W Withheld to avoid disclosing company proprietary data; for years 1970-78, included with "Miscellaneous: Other"; for years 1979-90, included with "Sand and permanent mold: Other."

NAp Not applicable.

¹For years 1970-75, no allowance was made for consumption or receipts by producing plants. For years 1976-90, inventory adjustment included.

²Not reported separately prior to 1975, probably included with "Miscellaneous: Other."

³Data included in "Wrought alloys: Extrusion billets."

⁴Includes other die-cast alloys and other miscellaneous.

⁵No allowance made for melt loss of primary aluminum and alloying ingredients.

Table 7.—Month-end U.S. inventories of aluminum ingot, mill products, and scrap
(Thousand metric tons)

Month	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
January	1,730	2,026	2,291	2,195	1,940	2,511	2,727	2,655	2,635	2,458
February	1,753	2,038	2,285	2,161	1,928	2,535	2,738	2,673	2,631	2,375
March	1,741	2,030	2,269	2,130	1,897	2,661	2,676	2,570	2,599	2,270
April	1,769	2,014	2,261	2,097	1,920	2,694	2,641	2,539	2,608	2,280
May	1,788	1,937	2,231	2,068	1,946	2,763	2,578	2,519	2,583	2,250
June	1,783	2,024	2,208	2,091	1,963	2,760	2,519	2,481	2,569	2,224
July	1,833	2,118	2,234	2,076	2,009	2,753	2,542	2,549	2,587	2,237
August	1,860	2,151	2,221	2,061	2,056	2,728	2,515	2,568	2,534	2,235
September	1,861	2,164	2,208	2,043	2,068	2,728	2,513	2,553	2,545	2,247
October	1,880	2,213	2,207	2,006	2,109	2,704	2,546	2,588	2,529	2,247
November	1,941	2,263	2,203	1,984	2,209	2,725	2,594	2,605	2,516	2,274
December	1,989	2,280	2,205	1,980	2,339	2,721	2,585	2,588	2,492	2,325

See footnote at end of table.

Table 7.—Month-end U.S. inventories of aluminum ingot, mill products, and scrap—Continued
(Thousand metric tons)

Month	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
January	2,368	3,014	2,785	2,359	2,676	2,343	2,221	1,938	1,911	1,809
February	2,414	3,049	2,756	2,370	2,642	2,339	2,164	1,979	1,875	1,802
March	2,453	3,011	2,663	2,402	2,629	2,292	2,130	1,970	1,885	1,736
April	2,492	3,023	2,596	2,465	2,608	2,312	2,079	2,241	1,934	1,727
May	2,540	3,023	2,521	2,531	2,591	2,288	2,048	1,970	1,916	1,727
June	2,554	2,974	2,458	2,548	2,538	2,288	2,029	1,912	1,945	1,776
July	2,705	2,997	2,472	2,620	2,530	2,306	1,993	1,921	1,983	1,846
August	2,761	2,944	2,428	2,658	2,500	2,294	1,952	1,894	1,929	1,805
September	2,806	2,910	2,375	2,697	2,467	2,258	1,883	1,894	1,886	1,833
October	2,847	2,908	2,392	2,698	2,415	2,235	1,910	1,875	1,844	1,868
November	2,959	2,891	2,355	2,710	2,377	2,223	1,925	1,868	1,810	1,827
December	2,995	2,802	2,663	2,690	2,343	2,235	1,894	1,883	1,822	1,820

Source: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Series M33-2.

Table 8.—U.S. receipts¹ and consumption of purchased new and old aluminum scrap² and sweated pig
(Metric ton)

	1970		1971		1972	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	431,599	431,787	476,298	459,248	552,760	556,515
Borings and turnings	128,245	127,968	120,795	120,765	92,201	90,071
Dross and skimmings	⁽³⁾	⁽³⁾	⁽³⁾	⁽³⁾	⁴ 85,558	⁴ 93,319
Other	145,563	145,632	133,637	128,736	77,921	77,191
Total new scrap	705,407	705,387	730,730	708,749	808,440	817,096
Old scrap:						
Castings, sheet, clippings	NA	NA	NA	NA	NA	NA
Aluminum-copper radiators	NA	NA	NA	NA	NA	NA
Aluminum cans	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA
Total old scrap	124,215	123,491	125,056	125,128	141,759	137,732
Sweated pig	58,382	53,388	74,054	77,642	89,579	90,641
Total of all scrap consumed	888,004	882,266	929,840	911,519	1,039,778	1,045,469
	1973		1974		1975	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	626,472	626,217	586,359	560,580	467,844	474,425
Borings and turnings	102,934	104,676	93,256	88,592	113,348	115,167
Dross and skimmings	⁴ 81,416	⁴ 83,828	⁴ 90,611	⁴ 88,230	166,416	168,897
Other	91,911	92,792	100,608	100,189	53,055	53,497
Total new scrap	902,733	907,513	870,834	837,591	800,663	811,986
Old scrap:						
Castings, sheet, clippings	NA	NA	NA	NA	108,973	102,726
Aluminum-copper radiators	NA	NA	NA	NA	7,660	7,502
Aluminum cans	NA	NA	NA	NA	81,793	76,054
Other	NA	NA	NA	NA	36,522	37,627
Total old scrap	157,877	160,029	175,716	177,608	234,948	223,909
Sweated pig	76,195	77,723	80,787	78,921	85,785	81,897
Total of all scrap consumed	1,136,805	1,145,265	1,127,337	1,094,120	1,121,396	1,117,792

See footnotes at end of table.

Table 8.—U.S. receipts¹ and consumption of purchased new and old aluminum scrap² and sweated pig—Continued
(Metric ton)

	1976		1977		1978	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	527,434	526,657	593,502	580,862	606,267	628,804
Borings and turnings	136,561	137,786	144,119	141,854	151,313	151,631
Dross and skimmings	212,260	209,446	159,295	160,282	131,614	129,967
Other	84,424	83,117	89,792	88,603	61,230	62,486
Total new scrap	960,679	957,006	986,709	971,601	950,424	972,889
Old scrap:						
Castings, sheet, clippings	140,733	141,414	176,007	176,084	187,958	182,571
Aluminum-copper radiators	17,289	14,568	16,582	17,235	14,950	16,226
Aluminum cans	96,216	98,707	127,483	120,349	153,997	151,651
Other	27,017	27,663	34,816	32,603	38,090	38,536
Total old scrap	281,255	282,352	354,888	346,271	394,995	388,984
Sweated pig	98,124	90,086	94,690	104,789	99,844	104,603
Total of all scrap consumed	1,340,058	1,329,444	1,436,287	1,422,661	1,445,263	1,466,476
	1979		1980		1981	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	647,833	661,448	626,612	616,363	709,975	720,039
Borings and turnings	172,694	172,655	162,083	158,742	162,169	161,303
Dross and skimmings	116,424	120,367	111,271	109,402	102,119	103,023
Other	66,689	65,526	54,468	54,859	50,625	49,473
Total new scrap	1,003,640	1,019,995	954,434	939,366	1,024,888	1,033,838
Old scrap:						
Castings, sheet, clippings	216,534	218,271	199,304	198,019	203,011	206,717
Aluminum-copper radiators	17,380	17,390	16,753	16,186	16,174	16,840
Aluminum cans	163,167	163,259	276,241	271,470	461,236	461,127
Other	37,987	37,653	36,228	36,508	29,031	29,214
Total old scrap	435,068	436,573	528,526	522,183	709,452	713,898
Sweated pig	86,576	90,212	74,296	74,890	80,482	77,905
Total of all scrap consumed	1,525,284	1,546,780	1,557,256	1,536,439	1,814,822	1,825,641
	1982		1983		1984	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	643,964	637,116	691,095	688,577	667,042	675,636
Borings and turnings	149,270	150,245	167,270	167,534	166,600	167,937
Dross and skimmings	107,756	107,055	112,100	110,358	96,832	97,279
Other	46,445	48,265	51,968	50,377	62,837	60,879
Total new scrap	947,436	942,681	1,022,433	1,016,846	993,311	1,001,731
Old scrap:						
Castings, sheet, clippings	200,812	201,221	239,554	241,136	231,201	231,025
Aluminum-copper radiators	19,504	19,620	23,288	22,133	19,680	20,506
Aluminum cans	509,620	511,404	518,867	520,889	555,972	542,780
Other	40,421	40,823	29,643	29,345	30,509	30,051
Total old scrap	770,357	773,068	811,352	813,503	837,362	824,362
Sweated pig	78,452	79,468	79,246	81,660	72,630	72,565
Total of all scrap consumed	1,796,245	1,795,217	1,913,031	1,912,009	1,903,303	1,898,658

See footnotes at end of table.

Table 8.—U.S. receipts¹ and consumption of purchased new and old aluminum scrap² and sweated pig—Continued
(Metric ton)

	1985		1986		1987	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	657,022	647,557	689,697	699,790	785,343	791,152
Borings and turnings	149,215	149,689	162,009	162,878	164,094	165,750
Dross and skimmings	82,581	86,303	62,775	60,611	45,527	48,615
Other	79,446	83,169	102,009	102,236	162,596	160,211
Total new scrap	968,264	966,718	1,016,490	1,025,515	1,157,560	1,165,728
Old scrap:						
Castings, sheet, clippings	200,517	200,755	221,826	221,549	278,962	273,220
Aluminum-copper radiators	16,913	16,944	16,491	16,604	14,098	14,279
Aluminum cans	550,727	570,490	507,056	501,005	523,427	530,674
Other	21,698	22,701	33,107	32,974	31,139	30,489
Total old scrap	789,855	810,890	778,480	772,132	847,626	848,662
Sweated pig	98,612	100,936	85,676	84,908	77,076	81,681
Total of all scrap consumed	1,856,731	1,878,544	1,880,646	1,882,555	2,082,262	2,096,071
	1988		1989		1990	
	Net receipts	Consumption	Net receipts	Consumption	Net receipts	Consumption
New scrap:						
Solids	731,561	702,600	602,545	635,978	580,221	581,179
Borings and turnings	131,518	131,167	151,547	151,291	138,380	137,640
Dross and skimmings	31,386	31,763	30,844	30,963	60,139	58,625
Other	231,177	229,897	243,416	246,714	302,010	299,120
Total new scrap	1,125,642	1,095,427	1,028,352	1,064,946	1,080,750	1,076,564
Old scrap:						
Castings, sheet, clippings	385,831	384,660	365,077	367,634	506,259	502,735
Aluminum-copper radiators	14,345	14,174	9,934	10,457	49,860	49,826
Aluminum cans	651,930	641,271	668,142	651,558	842,069	853,771
Other	32,812	32,812	33,519	35,783	44,683	44,551
Total old scrap	1,084,918	1,072,917	1,076,672	1,065,432	1,442,871	1,450,883
Sweated pig	66,099	66,468	42,324	43,611	33,449	33,930
Total of all scrap consumed	2,276,659	2,234,812	2,147,348	2,173,989	2,557,120	2,561,377

NA Not available.

¹Includes inventory adjustment.

²Includes imported scrap.

³Included in "New scrap: Other."

⁴Includes foil.

Table 9.—World primary aluminum smelter capacities at yearend
(Thousand metric tons)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Argentina	—	—	—	—	—	30	60	140	140	140	140
Australia	190	229	229	229	229	230	232	249	249	280	349
Austria	92	92	92	92	92	92	92	92	92	92	92
Bahrain	—	60	120	120	120	120	120	120	120	120	120
Brazil	99	102	102	111	111	127	170	180	228	268	278
Cameroon	55	55	55	55	55	55	55	62	62	62	62
Canada	1,087	1,097	1,097	1,097	1,097	1,104	1,066	1,066	1,064	1,064	1,120
China	191	191	200	244	244	244	253	272	283	283	302
Czechoslovakia	65	65	65	65	65	65	65	65	60	60	60
Egypt	—	—	—	—	—	100	100	100	100	100	133
France	399	399	411	416	417	409	410	410	412	427	394

See footnote at end of table.

Table 9.—World primary aluminum smelter capacities at yearend—Continued
(Thousand metric tons)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Germany, Federal Republic of:											
Eastern states	80	80	80	85	85	85	85	85	85	85	85
Western states	336	576	562	736	736	740	762	762	744	744	735
Ghana	110	147	147	147	153	153	200	200	200	200	200
Greece	145	145	145	145	145	145	145	145	145	145	145
Hungary	63	63	62	62	62	62	92	92	71	71	76
Iceland	45	45	75	75	75	76	76	76	76	76	86
India	184	187	206	230	230	265	299	304	345	345	343
Indonesia	—	—	—	—	—	—	—	—	—	—	—
Iran	—	—	45	45	45	50	50	50	50	50	50
Italy	183	183	185	284	286	311	291	291	286	286	286
Japan	827	994	1,145	1,233	1,259	1,366	1,582	1,583	1,592	1,504	1,304
Korea, North	32	—	—	—	—	—	—	—	20	20	20
Korea, Republic of	16	16	16	16	18	18	18	18	18	18	18
Mexico	40	40	40	40	45	45	45	45	45	45	45
Netherlands	85	181	181	181	226	266	266	266	266	266	266
New Zealand	—	74	112	112	117	117	150	150	150	150	156
Norway	576	676	692	690	689	665	688	698	708	708	701
Poland	103	103	103	103	103	103	103	103	108	108	48
Romania	114	114	114	109	109	120	200	200	200	200	250
South Africa, Republic of	—	50	52	52	52	80	80	80	80	85	85
Spain	108	136	151	173	174	217	218	218	398	398	398
Suriname	66	66	66	66	66	66	66	66	66	66	60
Sweden	85	86	86	86	86	86	85	85	85	85	82
Switzerland	93	84	91	91	91	95	88	88	94	94	86
Taiwan	33	38	38	38	38	38	38	75	83	83	83
Turkey	—	—	—	20	20	60	60	60	60	60	60
U.S.S.R. ^e	2,000	2,100	2,200	2,200	2,300	2,300	2,500	2,800	3,000	3,300	3,300
United Arab Emirates	—	—	—	—	—	—	—	—	—	135	135
United Kingdom	36	240	303	363	366	366	366	366	374	374	381
United States	3,859	4,231	4,304	4,438	4,438	4,544	4,713	4,713	4,737	4,791	4,993
Venezuela	23	23	23	23	45	50	50	120	195	405	400
Yugoslavia	63	110	110	181	190	180	180	180	205	205	225
World total	11,483	13,078	13,705	14,453	14,679	15,245	16,119	16,675	17,296	17,998	18,152
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Argentina	140	140	140	140	146	148	153	154	162	166	
Australia	376	479	594	812	862	1,012	1,012	1,177	1,188	1,240	
Austria	92	92	92	92	92	92	92	92	92	92	
Bahrain	170	170	170	170	170	180	180	180	205	225	
Brazil	278	404	419	519	629	869	869	869	869	976	
Cameroon	80	80	80	80	80	80	80	80	80	85	
Canada	1,177	1,234	1,234	1,234	1,347	1,462	1,577	1,594	1,594	1,594	
China	342	382	413	413	431	471	695	875	875	935	
Czechoslovakia	60	60	60	60	60	60	60	60	60	60	
Egypt	133	133	166	166	170	170	170	170	170	170	
France	394	394	378	333	304	394	346	346	346	346	
Germany, Federal Republic of:											
Eastern states	85	85	85	85	85	85	85	85	55	55	
Western states	728	756	772	777	777	777	733	733	713	713	
Ghana	200	200	200	200	200	200	200	200	200	200	
Greece	145	145	145	145	145	145	145	145	150	150	
Hungary	76	76	76	76	76	76	76	78	78	78	
Iceland	86	86	86	86	86	86	86	86	86	86	
India	348	358	363	363	363	363	472	472	472	610	
Indonesia	—	75	150	225	225	225	225	225	225	225	
Iran	50	50	50	50	50	50	50	50	50	50	
Italy	286	276	276	276	276	276	276	276	276	276	
Japan	1,136	712	712	712	425	284	64	64	64	64	

See footnote at end of table.

Table 9.—World primary aluminum smelter capacities at yearend—Continued
(Thousand metric tons)

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Korea, North	20	20	20	20	20	20	20	20	20	—
Korea, Republic of	18	18	18	18	18	18	18	18	18	18
Mexico	45	45	45	45	45	45	66	66	66	66
Netherlands	266	266	266	266	266	266	266	266	266	266
New Zealand	156	244	244	244	244	244	244	250	250	259
Norway	705	799	770	770	770	770	834	843	851	851
Poland	48	48	48	48	48	48	48	48	48	48
Romania	250	250	250	250	250	250	250	250	250	250
South Africa, Republic of	85	132	172	172	172	172	172	172	172	172
Spain	398	398	389	389	379	344	344	344	344	344
Suriname	60	60	60	60	60	60	30	30	30	30
Sweden	82	82	82	82	82	82	91	91	91	91
Switzerland	86	86	86	86	86	72	72	72	72	72
Taiwan	83	50	50	50	50	50	50	50	50	—
Turkey	60	60	60	60	60	60	60	60	60	60
U.S.S.R. ^c	3,300	3,400	3,400	3,400	3,500	3,500	3,500	3,600	3,600	3,600
United Arab Emirates	135	140	140	140	140	140	140	140	140	140
United Kingdom	389	287	287	287	287	287	287	287	287	287
United States	4,960	4,988	4,999	4,896	4,706	4,038	3,895	3,960	4,016	4,097
Venezuela	400	400	400	400	400	430	430	460	590	610
Yugoslavia	317	317	317	317	317	317	317	327	337	342
World total	18,245	18,477	18,764	19,014	18,899	18,718	18,780	19,365	19,568	19,999

^cEstimated.

Table 10.—World production of primary aluminum,¹ by country
(Thousand metric tons)

Year	Argentina	Australia	Austria	Bahrain	Brazil	Cameroon	Canada	China ^c	Czechoslovakia
1986 ..	148	882	93	178	757	84	1,355	410	33
1987 ..	153	1,004	93	180	843	79	1,540	615	68
1988 ..	154	1,150	95	183	874	87	1,534	710	67
1989 ..	162	1,244	93	187	890	92	1,555	850	69
1990 ..	166	1,234	89	213	931	93	1,567	850	70
	Egypt	France	Germany, Federal Republic of		Ghana	Greece	Hungary	Iceland	India
			Eastern states ^c	Western states					
1986 ..	175	322	61	765	125	124	74	76	257
1987 ..	179	323	68	793	150	127	74	85	265
1988 ..	173	328	61	753	161	151	75	82	375
1989 ..	180	335	54	734	169	145	75	88	423
1990 ..	179	326	21	715	174	150	75	88	433
	Indonesia	Iran	Italy	Japan	Korea, North ^c	Korea, Republic of	Mexico	Nether- lands	New Zealand
1986 ..	219	40	243	140	10	19	37	266	236
1987 ..	202	45	233	41	10	22	60	276	252
1988 ..	185	40	226	35	10	18	68	278	264
1989 ..	197	45	219	35	10	18	72	279	258
1990 ..	186	59	232	34	—	2	68	270	308

See footnotes at end of table.

Table 10.—World production of primary aluminum,¹ by country—Continued
(Thousand metric tons)

	Norway	Poland (includes secondary)	Romania ²	South Africa, Re- public of	Spain	Suriname	Sweden ²	Switzer- land	Turkey
1986 ..	726	48	253	170	355	29	78	80	60
1987 ..	853	48	260	171	341	2	81	73	42
1988 ..	864	48	266	170	323	10	99	72	57
1989 ..	863	48	269	166	352	28	97	71	62
1990 ..	845	46	178	170	355	32	96	72	61
	U.S.S.R. ⁶	United Arab Emirates: Dubai	United Kingdom	United States	Vene- zuela	Yugo- slavia	Total ³		
1986 ..	3,300	155	276	3,037	418	282	16,396		
1987 ..	3,300	155	294	3,343	428	244	17,415		
1988 ..	3,350	162	300	3,944	437	260	18,499		
1989 ..	3,300	168	297	4,030	540	331	19,100		
1990 ..	3,523	174	290	4,048	590	349	19,362		

⁶Estimated.

¹Weight of liquid aluminum as tapped from pots, excluding the weight of any alloying materials as well as that of any metal produced from either returned scrap or remelted materials. For those countries for which a different definition is given specifically in the source publication, that definition is provided in this table by footnote.

²Includes alloys.

³Data may not add to totals shown because of independent rounding.

BAUXITE AND ALUMINA

By Errol D. Sehnke

Bauxite is a naturally occurring, heterogeneous material primarily composed of one or more aluminum hydroxide minerals and various mixtures of aluminum silicate (clay, etc.), iron oxide, silica, titania, and other impurities in minor or trace amounts. It is principally used for the

production of alumina (Al_2O_3), the oxide of aluminum, which is consumed chiefly in the production of primary aluminum metal. The other major uses of bauxite are in refractories, abrasives, chemicals, proppants, and aluminous cements.

Table 1.—Salient bauxite statistics
(Thousand metric tons and thousand dollars)

Year	U.S. production of crude ore (dry equivalent)	Value ^c	Exports (as shipped)	Imports for consumption ¹	Consumption (dry equivalent)	World: production
1945 ...	997	5,591	128	751	2,472	3,430
1946 ...	1,122	6,893	99	865	1,919	4,360
1947 ...	1,221	6,885	96	1,850	2,606	6,316
1948 ...	1,481	8,697	55	2,528	2,769	8,359
1949 ...	1,167	6,778	36	2,731	2,721	8,230
1950 ...	1,356	7,693	46	2,557	3,378	8,179
1951 ...	1,879	12,478	91	2,865	4,009	10,871
1952 ...	1,694	10,776	42	3,518	4,296	12,802
1953 ...	1,605	13,439	28	4,298	5,718	13,818
1954 ...	2,027	16,403	16	5,068	6,531	16,155
1955 ...	1,817	14,543	14	4,960	7,101	17,780
1956 ...	1,772	15,109	15	5,761	7,875	18,838
1957 ...	1,439	12,868	62	7,212	7,756	20,473
1958 ...	1,332	12,815	12	8,042	7,147	21,413
1959 ...	1,727	17,725	17	8,280	8,757	23,054
1960 ...	2,030	21,107	29	8,879	9,026	27,641
1961 ...	1,248	13,937	153	9,354	8,759	29,410
1962 ...	1,391	15,609	263	10,745	10,747	31,116
1963 ...	1,549	17,234	206	9,408	11,500	30,690
1964 ...	1,627	17,875	283	10,518	12,747	33,359
1965 ...	1,681	18,632	149	11,601	12,735	37,440
1966 ...	1,825	20,095	63	11,928	14,310	40,683
1967 ...	1,681	19,079	2	12,010	14,736	44,593
1968 ...	1,692	23,752	7	11,359	14,323	45,982
1969 ...	1,873	25,725	5	12,355	15,830	51,827
1970 ...	2,115	30,070	3	13,039	15,925	57,786
1971 ...	2,020	28,543	35	12,837	15,870	62,124
1972 ...	1,841	23,238	29	12,803	15,622	64,947
1973 ...	1,909	26,635	12	13,618	16,917	70,355
1974 ...	1,980	25,663	16	15,216	17,175	79,620
1975 ...	1,801	25,083	20	11,714	12,587	74,791
1976 ...	1,989	26,645	15	12,749	14,039	77,417
1977 ...	2,013	27,555	26	12,989	14,528	81,931
1978 ...	1,669	23,185	13	13,847	14,738	80,975
1979 ...	1,821	24,875	15	13,780	15,697	85,522
1980 ...	1,559	22,353	21	14,087	15,962	89,220
1981 ...	1,510	26,489	20	12,802	13,525	85,347
1982 ...	732	12,334	49	10,122	9,217	79,335
1983 ...	679	11,309	74	7,601	9,100	78,687
1984 ...	856	15,643	82	9,435	10,519	87,799

See footnotes at end of table.

Table 1.—Salient bauxite statistics—Continued
(Thousand metric tons and thousand dollars)

Year	U.S. production of crude ore (dry equivalent)	Value ^c	Exports (as shipped)	Imports for consumption ¹	Consumption (dry equivalent)	World: production
1985 ...	674	12,855	56	7,158	8,206	84,189
1986 ...	510	10,361	69	6,456	6,901	88,173
1987 ...	576	10,916	201	9,156	9,548	91,601
1988 ...	588	10,566	63	9,944	10,074	96,957
1989 ...	W	W	44	10,893	11,810	104,081
1990 ...	W	W	53	12,142	12,042	109,601

^cEstimated.

W Withheld to avoid disclosing company proprietary data.

¹Excludes calcined bauxite. Includes bauxite imported to the U.S. Virgin Islands.

Source: U.S. Bureau of Mines Minerals Yearbook.

Table 2.—Domestic mine production
(Metric tons)

Year	Crude	Dry equivalent	Value ¹
1970	2,562	2,115	30,070
1971	2,458	2,020	28,543
1972	2,235	1,841	23,238
1973	2,324	1,909	26,635
1974	2,408	1,980	25,663
1975	2,199	1,801	25,083
1976	2,420	1,989	26,645
1977	2,436	2,013	27,555
1978	2,066	1,669	23,185
1979	2,186	1,821	24,875
1980	1,869	1,559	22,353
1981	1,847	1,510	26,489
1982	896	732	12,334
1983	826	679	11,309
1984	1,054	856	15,643
1985	787	674	12,855
1986	617	510	10,361
1987	689	576	10,916
1988	714	588	10,566
1989	W	W	W
1990	W	W	W

W Withheld to avoid disclosing company proprietary data.

¹Computed from values assigned by producers and from estimates of the U.S. Bureau of Mines.

Source: U.S. Bureau of Mines Minerals Yearbook.

CEMENT

By Cheryl M. Solomon

The term "cement" most commonly refers to hydraulic cement, especially portland cement. Hydraulic cements are those that have the property of hardening under water and are the chief binding agents for concrete and masonry. Portland cement was patented by Joseph Aspdin of Leeds, England, in 1824, and today, it is the predominant variety of hydraulic cement. The name "portland" was chosen because the set cement resembled a building stone quarried from the Isle of Portland off the southern coast of England.

More than 95% of the cement produced in the United States is portland cement; masonry cement used for stucco and mortar accounts for most of the balance. Portland cement concrete is one of the principal materials of construction, and it is anticipated that the use of concrete in construction will continue at a high level worldwide.

In the long term, cement consumption has increased and will continue to increase because increased population leads to increased construction. In the short term, cement demand is subject to the cyclic nature of the U.S. economy in general and the level of construction activity in particular. This is evident in the 20-year data tables, which show a decreased demand in the mid-1970's because of the Organization of Petroleum Exporting Countries' oil-embargo shocks to the world economy, a slump during the recession of the early 1980's, strong growth in demand during the rest of the 1980's as the U.S. economy experienced growth, and a downturn in 1990 as overbuilding, economic slow-down, and tight money supply caused a significant decrease in construction.

Table 1.—Portland and masonry cement demand and production
in the United States^{1,2}
(Million metric tons)

Year	Portland cement		Masonry cement	
	U.S. demand	U.S. pro- duction	U.S. demand	U.S. pro- duction
1970 ..	68.946	66.225	2.722	2.722
1971 ..	71.668	69.860	2.722	3.001
1972 ..	75.122	73.250	3.512	3.458
1973 ..	80.249	75.796	3.773	3.648
1974 ..	73.595	72.108	3.139	3.086
1975 ..	62.667	60.596	2.657	2.653
1976 ..	66.073	64.616	3.020	2.964
1977 ..	71.423	69.255	3.438	3.374
1978 ..	76.964	73.891	3.787	3.371
1979 ..	76.984	72.923	3.443	3.400
1980 ..	69.000	66.820	2.802	2.768
1981 ..	65.228	63.641	2.523	2.521
1982 ..	58.606	56.297	2.212	2.072
1983 ..	64.273	62.066	2.692	2.658
1984 ..	74.324	68.414	3.035	2.981
1985 ..	76.909	68.584	3.060	2.955
1986 ..	80.769	69.261	3.319	3.237
1987 ..	82.166	68.819	3.484	3.303
1988 ..	81.919	67.727	3.397	3.261
1989 ..	80.813	68.279	3.152	2.988
1990 ..	79.537	68.399	3.069	2.911

¹U.S. demand based on cement shipments.

²Includes Puerto Rico and total imports of cement and clinker.

Table 2.—Average annual mill value, in bulk, of cement sold in the United States¹
(Dollars per metric ton)

Year	Portland cement, actual mill value	Masonry cement, actual mill value ²
1970	19.50	20.57
1971	20.66	22.94
1972	22.38	29.25
1973	24.12	32.43
1974	29.23	36.31
1975	34.27	42.86
1976	37.33	47.00
1977	40.08	49.63
1978	49.45	55.70
1979	50.98	60.19
1980	56.09	68.46
1981	57.54	65.36
1982	56.26	67.86
1983	54.99	70.26
1984	56.90	73.88
1985	56.55	73.47
1986	55.23	72.40
1987	53.78	77.77
1988	53.52	75.49
1989	53.94	76.15
1990	54.53	75.92

¹Includes Puerto Rico. Mill value is the actual value of sales to customers, f.o.b. plant, less all discounts and allowances, less all freight charges from producing plant to distribution terminal if any, less total cost of operating terminal if any, less cost of paper bags and pallets.

²Masonry cement made at cement plants only.

Table 3.—Portland cement and clinker annual capacity and capacity utilization in the United States¹

Year	Capacity ²		Capacity ³	
	Finish grinding (million metric tons)	Percent utilized	Clinker (million metric tons)	Percent utilized
1970 ...	NA	NA	NA	NA
1971 ...	NA	NA	NA	NA
1972 ...	NA	NA	72.268	90.3
1973 ...	93.232	83.3	80.872	93.5
1974 ...	98.775	74.8	84.618	85.6
1975 ...	98.773	62.8	86.101	69.6
1976 ...	96.989	68.1	79.469	80.0
1977 ...	95.867	73.5	81.767	81.4
1978 ...	93.968	77.5	70.158	84.5
1979 ...	98.279	77.1	70.853	84.6
1980 ...	98.984	68.9	85.471	75.6
1981 ...	95.437	66.7	82.861	74.2
1982 ...	96.390	58.4	80.523	67.9
1983 ...	96.834	64.1	81.405	71.9
1984 ...	95.996	71.1	83.716	75.2
1985 ...	94.794	72.4	80.544	75.8
1986 ...	94.798	73.1	80.481	78.5
1987 ...	93.918	73.3	80.886	78.4
1988 ...	91.435	74.1	78.327	81.6
1989 ...	90.919	75.1	77.351	82.7
1990 ...	89.745	76.2	75.207	85.6

NA Not available.

¹Includes Puerto Rico.

²Grinding capacity based on fineness necessary to grind Types I and II cement, making allowance for downtime required for maintenance.

³Calculated on individual company data: 365 days minus average days required for maintenance times 24-hour capacity.

Table 4.—U.S. exports for consumption of cement and clinker
(Thousand metric tons and thousand dollars)

Year	Roman, portland, and other hydraulic cement		Hydraulic cement clinker		White nonstaining portland cement		Total	
	Quantity	Value (customs)	Quantity	Value (customs)	Quantity	Value (customs)	Quantity	Value (customs)
1970 ..	1,950	28,596	365	4,320	41	1,260	2,356	34,176
1971 ..	2,111	35,667	645	7,624	30	1,057	2,800	44,348
1972 ..	2,896	51,115	1,534	19,672	25	970	4,455	71,757
1973 ..	3,551	67,450	2,488	35,501	26	1,177	6,065	104,128
1974 ..	3,511	73,315	1,659	26,737	30	1,682	5,200	101,734
1975 ..	2,244	49,286	1,095	20,218	19	1,116	3,358	70,620
1976 ..	1,925	46,635	873	19,136	21	1,314	2,819	67,085
1977 ..	2,172	62,920	1,463	29,224	28	1,861	3,663	94,005
1978 ..	3,256	119,048	2,693	69,264	36	2,330	5,985	190,642
1979 ..	4,231	165,258	4,235	131,873	73	5,227	8,539	302,358
1980 ..	2,932	115,271	1,739	73,931	103	6,371	4,775	195,573
1981 ..	2,408	94,653	1,112	46,447	106	10,140	3,626	151,240
1982 ..	2,149	81,710	426	18,385	82	10,791	2,657	110,886
1983 ..	2,816	109,791	912	33,633	145	18,014	3,872	161,439
1984 ..	5,787	204,899	2,009	59,801	229	29,507	8,025	294,207
1985 ..	8,692	306,472	4,203	103,067	249	27,890	13,142	437,429
1986 ..	10,964	361,149	3,603	79,699	237	28,145	14,804	468,993
1987 ..	12,503	384,989	3,328	79,373	250	24,170	16,081	488,532
1988 ..	13,812	438,978	1,741	48,626	312	28,119	15,865	515,723
1989 ..	12,339	410,326	1,583	50,014	358	29,183	14,280	489,523
1990 ..	10,009	354,662	1,682	56,910	350	28,045	12,041	439,617

Source: Bureau of the Census.

Page Intentionally Left Blank.

CHROMIUM

By John F. Papp

Chromium has a wide range of uses in metals, chemicals, and refractories. It is one of the Nation's most important strategic and critical materials. Chromium use in iron, steel, and nonferrous alloys enhances hardenability and resistance to corrosion and oxidation. The use of chromium to produce stainless steel and nonferrous alloys are two of its more important applications. Other applications are in alloy steel, plating of metals, pigments, leather processing, catalysts, surface treatments, and refractories.

Because the United States has no chromite ore reserves and a limited reserve base, domestic supply has been a concern during every national military emergency since World War I. World chromite resources, mining capacity, and ferrochromium production capacity are concentrated in the Eastern Hemisphere. The National Defense Stockpile contains chromium in various forms including chromite ore, chromium ferroalloys, and chromium metal in recognition of the vulnerability of long supply routes during a military emergency.

Research is conducted by the Federal Government to reduce U.S. vulnerability to potential chromium supply interruption. That research covers both domestic resource utilization and alternative materials identification. Domestic chromium resources include mineral deposits and recyclable materials. The U.S. Geological Survey and the U.S. Bureau of Mines evaluate U.S. territory for chromium mineral deposits. The U.S. Bureau of Mines also studies minerals extraction and processing and materials substitution and recycling. Alternative materials research is also conducted by the National Aeronautics and Space Administration, the National Institute of Standards and Technology, the Department of Defense, and the Department of Energy.

World chromite ore reserves are more than adequate to meet anticipated world demand.

Table 1.—U.S. salient chromite statistics
(Thousand metric tons)

Year	Exports	Reexports	Imports for consumption	Consumption	Consumer stocks	World production
1969	44	136	1,003	1,280	671	5,321
1970	37	66	1,275	1,273	665	6,053
1971	32	132	1,178	992	924	6,435
1972	18	52	958	1,034	777	6,101
1973	19	31	845	1,258	542	6,696
1974	16	90	1,000	1,315	520	7,461
1975	126	41	1,136	799	864	8,288
1976	112	77	1,157	913	915	8,493
1977	170	55	1,173	907	1,214	9,448
1978	21	26	919	916	1,180	10,944
1979	24	25	929	1,101	823	9,323
1980	5	40	891	886	613	9,902
1981	64	61	815	806	661	9,088
1982	7	52	460	506	495	8,480
1983	10	5	173	290	413	8,210
1984	50	4	276	465	297	9,776
1985	91	3	376	508	272	10,945
1986	84	1	443	388	285	12,107
1987	1	5	490	506	332	11,920
1988	4	1	615	551	390	12,890
1989	40	2	525	561	392	13,994
1990	6	4	306	405	355	12,990

Table 2.—U.S. Government stockpile yearend inventories
(Thousand metric tons)

Type of material	1969	1970	1971	1972	1973	1974	1975
Chromite, chemical, stockpile-grade . . .	1,129	1,051	517	826	683	412	337
Chromite, refractory:							
Stockpile-grade	1,113	1,113	1,068	1,060	1,003	892	803
Nonstockpile-grade	(¹)	(¹)	—	—	—	—	—
Chromite, metallurgical:							
Stockpile-grade	2,692	1,918	3,121	3,226	3,166	3,096	2,881
Nonstockpile-grade	817	1,446	—	—	—	—	—
Ferrochromium high-carbon:							
Stockpile-grade	365	365	366	366	366	366	366
Nonstockpile-grade	1	1	—	—	—	—	—
Ferrochromium, low-carbon:							
Stockpile-grade	270	289	289	289	289	289	289
Nonstockpile-grade	18	—	—	—	—	—	—
Ferrochromium-silicon:							
Stockpile-grade	51	54	54	54	54	53	53
Nonstockpile-grade	3	—	—	—	—	—	—
Chromium metal:							
Aluminothermic, stockpile-grade . . .	4	4	—	—	—	—	—
Electrolytic, stockpile-grade	4	4	—	—	—	—	—
Stockpile-grade	—	—	7	7	6	4	4
	1976	1977	1978	1979	1980	1981	1982
Chromite, chemical, stockpile-grade . . .	316	220	NA	220	220	220	220
Chromite, refractory:							
Stockpile-grade	640	364	NA	355	355	355	355
Nonstockpile-grade	—	—	—	—	—	—	—
Chromite, metallurgical:							
Stockpile-grade	2,782	2,603	NA	2,602	1,775	1,775	1,775
Nonstockpile-grade	—	—	NA	—	482	482	482
Ferrochromium high-carbon:							
Stockpile-grade	366	366	NA	365	365	365	365
Nonstockpile-grade	—	—	NA	—	1	1	1
Ferrochromium, low-carbon:							
Stockpile-grade	289	289	NA	289	272	272	272
Nonstockpile-grade	—	—	NA	—	17	17	17
Ferrochromium-silicon:							
Stockpile-grade	53	53	NA	54	52	52	52
Nonstockpile-grade	—	—	NA	—	1	1	1
Chromium metal:							
Aluminothermic, stockpile-grade . . .	—	—	NA	—	—	—	—
Electrolytic, stockpile-grade	—	—	NA	—	—	—	—
Stockpile-grade	4	4	NA	4	4	4	4
	1983	1984	1985	1986	1987	1988	1989
Chromite, chemical, stockpile-grade . . .	220	220	220	220	220	220	220
Chromite, refractory:							
Stockpile-grade	355	355	355	355	355	355	355
Nonstockpile-grade	—	—	—	—	—	—	—
Chromite, metallurgical:							
Stockpile-grade	1,775	1,775	1,763	1,676	1,569	1,491	1,395
Nonstockpile-grade	482	368	284	233	230	216	216
Ferrochromium high-carbon:							
Stockpile-grade	365	365	410	487	487	487	581
Nonstockpile-grade	1	1	1	1	1	1	1
Ferrochromium, low-carbon:							
Stockpile-grade	272	272	272	272	272	272	272
Nonstockpile-grade	17	17	17	17	17	17	17
Ferrochromium-silicon:							
Stockpile-grade	52	52	52	52	52	52	52
Nonstockpile-grade	1	1	1	1	1	1	1
Chromium metal:							
Aluminothermic, stockpile-grade . . .	—	—	—	—	—	—	—
Electrolytic, stockpile-grade	—	—	—	—	—	—	—
Stockpile-grade	4	4	4	4	4	3	3

See footnotes at end of table.

Table 2.—U.S. Government stockpile yearend inventories—Continued
(Thousand metric tons)

Type of material	1990
Chromite, chemical, stockpile-grade . . .	220
Chromite, refractory:	
Stockpile-grade	355
Nonstockpile-grade	—
Chromite, metallurgical:	
Stockpile-grade	1,287
Nonstockpile-grade	252
Ferrochromium high-carbon:	
Stockpile-grade	628
Nonstockpile-grade	1
Ferrochromium, low-carbon:	
Stockpile-grade	272
Nonstockpile-grade	17
Ferrochromium-silicon:	
Stockpile-grade	52
Nonstockpile grade	1
Chromium metal:	
Aluminothermic, stockpile-grade . . .	—
Electrolytic, stockpile-grade	—
Stockpile-grade	3

NA Not available.

¹Less than 1/2 unit.

Table 3.—Production, shipments, and stocks of chromium ferroalloys and metal in the United States
(Metric tons)

	1969	1970	1971	1972	1973	1974	1975	1976
Net production:								
Gross weight	393,239	356,252	320,782	317,840	378,972	387,759	225,520	242,336
Chromium content	246,180	220,194	196,029	189,426	235,907	233,708	135,890	142,980
Net shipments	403,461	378,452	319,969	316,431	419,445	413,116	207,992	244,272
Producer stocks, Dec. 31	40,536	43,627	72,370	78,149	35,417	18,715	71,537	87,195
	1977	1978	1979	1980	1981	1982	1983	1984
Net production:								
Gross weight	247,355	198,358	267,268	216,468	205,474	108,214	33,021	86,545
Chromium content	143,420	119,456	160,601	129,106	115,294	63,014	17,538	53,744
Net shipments	251,136	223,353	261,473	215,427	171,137	108,240	48,268	109,563
Producer stocks, Dec. 31	72,614	43,509	44,392	39,844	56,231	57,725	45,454	22,261
	1985	1986	1987	1988	1989	1990		
Net production:								
Gross weight	99,394	95,624	106,716	119,645	146,844	108,932		
Chromium content	61,864	58,913	68,614	73,282	90,073	67,701		
Net shipments	98,404	104,924	114,734	115,499	135,361	91,735		
Producer stocks, Dec. 31	21,374	12,796	5,114	8,831	20,475	14,935		

Table 4.—Consumption of chromite and tenor of ore used by primary consumer groups in the U.S.

Year	Metallurgical industry		Refractory industry		Chemical industry		Total	
	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)
1969 . .	815,000	49	274,000	35	191,000	45	1,280,000	46
1970 . .	827,000	48	252,000	36	193,000	45	1,273,000	45

See footnote at end of table.

Table 4.—Consumption of chromite and tenor of ore used by primary consumer groups in the U.S.—Continued

Year	Metallurgical industry		Refractory industry		Chemical industry		Total	
	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)	Gross weight (metric tons)	Average Cr ₂ O ₃ (percent)
1971 ..	653,000	48	175,000	36	163,000	46	992,000	45
1972 ..	660,000	48	203,000	36	171,000	46	1,034,000	45
1973 ..	835,000	48	237,000	35	187,000	45	1,258,000	45
1974 ..	820,000	47	268,000	35	228,000	45	1,315,000	44
1975 ..	483,000	45	166,000	35	151,000	45	799,000	43
1976 ..	542,000	43	183,000	35	188,000	45	913,000	42
1977 ..	524,000	41	189,000	36	194,000	45	907,000	41
1978 ..	484,000	40	215,000	37	217,000	45	916,000	40
1979 ..	702,000	38	180,000	35	220,000	45	1,101,000	39
1980 ..	523,104	36	145,338	36	217,671	46	886,113	38
1981 ..	456,360	36	134,130	37	216,332	43	806,822	38
1982 ..	257,170	35	72,357	36	176,842	45	506,369	39
1983 ..	58,341	39	65,363	37	166,569	45	290,273	42
1984 ..	204,776	44	88,422	37	171,422	45	464,620	43
1985 ..	247,557	39	56,468	38	201,659	45	508,406	41
1986 ..	342,281	40	45,303	37	(¹)	(¹)	387,584	40
1987 ..	458,536	41	47,586	40	(¹)	(¹)	506,122	41
1988 ..	494,713	43	55,923	39	(¹)	(¹)	550,636	42
1989 ..	516,931	43	43,780	40	(¹)	(¹)	560,711	43
1990 ..	361,176	44	44,237	40	(¹)	(¹)	405,413	43

¹Included with metallurgical

Table 5.—U.S. consumption of chromium ferroalloys and metal by end use (Metric tons)

Material	1969	1970	1971	1972	1973	1974	1975
Steel:							
Carbon	9,400	6,613	5,578	3,831	3,854	4,276	6,358
Stainless and heat-resisting	238,988	210,269	193,908	246,983	338,751	397,674	184,312
Full alloy	63,427	54,701	57,905	54,874	64,839	69,461	63,288
High-strength low-alloy and electric	NA	NA	NA	14,250	15,069	15,526	15,891
Tool	4,359	2,543	2,165	4,456	6,427	6,720	3,552
Cast irons	7,990	7,641	7,442	9,061	11,148	9,500	9,557
Superalloys	12,620	13,501	10,522	11,260	12,891	15,790	11,234
Alloys (except alloy steels and superalloys):							
Welding materials	2,233	1,959	1,480	1,215	1,535	1,877	2,156
Other alloys	2,903	2,086	3,109	4,182	4,623	4,501	3,774
Miscellaneous and unspecified	9,328	11,743	10,620	4,382	4,638	5,625	4,432
Total (reported) ¹	351,248	311,056	292,728	354,493	463,777	530,952	304,553
Chromium content	NA	194,314	179,878	217,178	286,346	326,532	182,706
Stocks, Dec. 31	36,003	30,731	22,133	24,877	43,959	48,758	61,525
Steel:							
Carbon	5,163	5,807	7,362	7,316	5,747	8,335	5,801
Stainless and heat-resisting	263,828	292,877	313,648	345,470	270,404	273,601	173,608
Full alloy	61,301	62,538	75,070	81,679	61,133	71,399	37,038
High-strength low-alloy and electric	13,855	13,536	12,903	12,361	10,962	10,536	7,475
Tool	4,452	4,627	5,930	4,895	3,984	4,182	1,795
Cast irons	9,877	12,353	14,234	14,114	9,430	9,647	6,402
Superalloys	9,477	10,197	13,748	15,718	14,401	8,420	6,871
Alloys (except alloy steels and superalloys):							
Welding materials	2,084	1,829	2,271	2,391	1,668	1,548	1,160

See footnotes at end of table.

Table 5.—U.S. consumption of chromium ferroalloys and metal by end use—Continued
(Metric tons)

	1976	1977	1978	1979	1980	1981	1982
Alloys (except alloy steels and superalloys)—Continued							
Other alloys	4,300	4,716	5,190	5,663	5,207	3,340	1,983
Miscellaneous and unspecified	3,594	2,856	3,056	2,952	2,099	2,294	1,056
Total (reported) ¹	377,931	411,335	453,413	492,559	385,037	393,302	243,189
Chromium content	225,217	243,701	270,319	293,504	229,058	229,834	142,619
Stocks, Dec. 31	63,456	72,000	74,172	52,902	54,615	50,864	26,383
	1983	1984	1985	1986	1987	1988	1989
Steel:							
Carbon	6,865	8,365	6,371	5,094	6,153	7,037	7,160
Stainless and heat-resisting	288,328	284,012	265,444	268,035	329,901	336,596	280,240
Full alloy	31,163	35,241	31,233	28,637	29,948	31,913	31,849
High-strength low-alloy and electric	6,065	8,773	3,897	3,374	3,514	6,528	12,408
Tool	3,435	4,515	3,829	5,087	3,719	3,714	4,164
Cast irons	5,829	6,895	5,664	6,460	6,195	7,041	7,123
Superalloys	8,912	10,459	10,092	9,982	11,529	11,323	11,333
Alloys (except alloy steels and superalloys):							
Welding materials	1,218	1,222	1,041	1,165	591	462	1,151
Other alloys	2,696	2,223	2,353	2,193	2,771	3,158	3,830
Miscellaneous and unspecified	1,422	2,128	11,586	7,227	8,268	11,152	899
Total (reported) ¹	355,933	363,833	341,512	337,252	402,590	418,924	360,157
Chromium content	208,047	210,430	187,661	190,788	230,989	242,881	213,636
Stocks, Dec. 31	24,195	23,861	29,181	28,839	22,589	30,424	19,486
	1990						
Steel:							
Carbon	7,731						
Stainless and heat-resisting	302,827						
Full alloy	34,832						
High-strength low-alloy and electric	12,923						
Tool	3,700						
Cast irons	9,208						
Superalloys	12,199						
Alloys (except alloy steels and superalloys):							
Welding materials	1,413						
Other alloys	3,273						
Miscellaneous and unspecified	863						
Total (reported) ¹	388,969						
Chromium content	226,071						
Stocks, Dec. 31	17,598						

NA Not available.

¹Data may not add to totals shown because of independent rounding.

Table 6.—Consumer yearend stocks of chromite, by industry
(Metric tons)

Industry	1969	1970	1971	1972	1973	1974	1975
Chemical	130,000	101,000	108,000	87,000	94,000	58,000	88,000
Metallurgical	269,000	351,000	605,000	545,000	308,000	308,000	636,000
Refractory	273,000	213,000	211,000	145,000	140,000	153,000	140,000
Total ¹	671,000	665,000	924,000	777,000	542,000	520,000	864,000
	1976	1977	1978	1979	1980	1981	1982
Chemical	101,000	239,000	327,000	299,000	291,712	336,078	283,775
Metallurgical	691,000	816,000	685,000	377,000	198,621	208,471	108,445

See footnotes at end of table

Table 6.—Consumer yearend stocks of chromite, by industry—Continued
(Metric tons)

Industry	1976	1977	1978	1979	1980	1981	1982
Refractory	123,000	158,000	168,000	146,000	122,242	116,310	102,723
Total ¹	915,000	1,214,000	1,180,000	823,000	612,575	660,860	494,943
	1983	1984	1985	1986	1987	1988	1989
Chemical	217,198	211,610	187,961	249,291	308,870	366,268	368,482
Metallurgical	127,300	22,173	40,244	(²)	(²)	(²)	(²)
Refractory	68,794	63,157	44,121	35,379	23,144	23,353	23,791
Total ¹	413,292	296,941	272,325	284,670	332,014	389,621	392,273
	1990						
Chemical	333,224						
Metallurgical	(²)						
Refractory	21,437						
Total ¹	354,661						

¹Data may not add to totals shown because of independent rounding.

²Included with chemical.

Table 7.—Price quotations at year end for chromium materials

Material	1969	1970	1971	1972	1973	1974	1975	1976
UNITS: DOLLARS PER METRIC TON OF PRODUCT								
Chromite ore:								
South Africa,								
Republic of	19 - 21	25 - 27	25 - 27	24 - 26	32 - 33	46 - 51	36 - 51	37 - 45
Turkey	47 - 58	54 - 55	54 - 55	54 - 55	36	64	130 - 140	130 - 140
U.S.S.R.	39 - 48	64 - 70	52 - 55	45 - 47	37 - 39	53 - 58	150	150
UNITS: CENTS PER POUND OF CHROMIUM CONTENT								
High-carbon								
ferrochromium:								
Domestic:								
50% to 55%								
chromium ¹	20.0	25.0	23.0	20.0	22.0 - 23.0	50	45 - 50	43
66% to 70%								
chromium ²	23.7	28.7	26.7	23.7	23.7	54	54 - 61	61
Imported:								
50% to 55%								
chromium	NA	NA	NA	19.0 - 19.5	21.0 - 22.5	65 - 70	44 - 50	35.5-37
60% to 65%								
chromium	NA	NA	NA	NA	NA	NA	NA	NA
Low-carbon								
ferro-								
chromium:								
Domestic:								
0.025%								
carbon	31.5	39.5	39.5	39.5	36.5	NA	NA	85
0.05%								
carbon	NA	NA	NA	38	35	100	92 - 120	85
Simplex	NA	NA	NA	NA	NA	85	92	85
Imported,								
0.05% car-								
bon	NA	NA	NA	35.0 - 36.0	35.0	140 - 148	73 - 83	68.0-72
UNITS: CENTS PER POUND OF PRODUCT								
Ferrochromium-								
silicon	14.35	15.65	NA	NA	NA	NA	NA	NA
Chromium metal:								
Electrolytic ..	101.00	101.00	130	130	153	230	244	263
Elchrome ..	NA	NA	NA	NA	NA	NA	NA	NA
Aluminothermic	99.00	99.00	115	115	138	230	244	263

See footnotes at end of table.

Table 7.—Price quotations at year end for chromium materials—Continued

Material	1977	1978	1979	1980	1981	1982	1983	1984
UNITS: DOLLARS PER METRIC TON OF PRODUCT								
Chromite ore:								
South Africa,								
Republic of	55 - 60	56 - 61	54 - 58	51 - 55	51 - 55	49 - 52	48 - 52	48 - 52
Turkey	130 - 140	105	110	110	110	110	110	110
U.S.S.R.	150	NA	NA	NA	NA	NA	NA	NA
UNITS: CENTS PER POUND OF CHROMIUM CONTENT								
High-carbon								
ferrochromium:								
Domestic:								
50% to 55% chromium ¹	40.0	43.0 - 44.0	44.25 - 45	25.0 - 47.50	47.5	38	40 - 43	NA
66% to 70% chromium ²	41.0	41.0 - 45.0	45.00 - 53	48.5 - 52.00	52.0 - 54.0	43	42 - 45	54
Imported:								
50% to 55% chromium	33.5	40.0 - 44.0	42.75 - 45	45.0 - 46.25	46.5 - 47.5	36	39 - 40	43 - 45
60% to 65% chromium	35.0	36.5 - 39.5	48.00 - 52	46.0 - 50.00	48.0 - 49.5	41	41 - 42	45 - 46
Low-carbon ferrochromium:								
Domestic:								
0.025% carbon	80.0	80.0	95	100.00	100.0	100	100	100
0.05% carbon	75.0	74.0 - 80.0	90	95.00	95.0	95	95	95
Simplex	75.0	80.0	90	95.00	100.0	100	100	100
Imported, 0.05% carbon	57.0	75.0	89.00 - 95	89.0 - 95.00	89.0 - 95.0	89.0 - 95	89 - 95	89 - 95
UNITS: CENTS PER POUND OF PRODUCT								
Ferrochromium-silicon	29.45	29.32 - 29.47	34.5 - 44.25	34.5	35.3	34.5	34.5	38.6
Chromium metal:								
Electrolytic . .	263 - 279.00	299.00	350.00	425.0	375.0	375.0	375.0	375.0
Elchrom	NA	NA	NA	NA	NA	NA	NA	NA
Aluminothermic	263.00	299.00	NA	NA	NA	NA	NA	NA
	1985	1986	1987	1988	1989	1990		
UNITS: DOLLARS PER METRIC TON OF PRODUCT								
Chromite ore:								
South Africa,								
Republic of	40 - 42	40 - 42	40 - 46	50 - 56	60 - 65	50 - 55		
Turkey	125	125	115	150 - 180	175 - 185	120 - 135		
U.S.S.R.	NA	NA	NA	NA	NA	NA		
UNITS: CENTS PER POUND OF CHROMIUM CONTENT								
High-carbon ferrochromium:								
Domestic:								
50% to 55% chromium ¹	NA	NA	50.25	50.25	50.25	54.5		
66% to 70% chromium ²	54	54.00	52.00	52.00	52.00	NA		
Imported:								
50% to 55% chromium	42.5 - 44	38.25 - 38.75	58 - 60.00	88 - 93.00	52 - 55.50	46.0 - 47.5		
60% to 65% chromium	46.0 - 47	41.50 - 43.25	60 - 65.00	93 - 97.00	51 - 54.50	42.25 - 45.5		

See footnotes at end of table.

Table 7.—Price quotations at year end for chromium materials—Continued

	1985	1986	1987	1988	1989	1990
UNITS: CENTS PER POUND OF CHROMIUM CONTENT—Continued						
Low-carbon ferro-chromium—Continued						
Domestic:						
0.025% carbon	100	100.00	100.00	100.00	100.00	NA
0.05% carbon	95	95.00	95.00	95.00	95.00	95.00
Simplex	100	100.00	110.00	166.00	166.00	166.00
Imported, 0.05% carbon	86.0 - 87	83.00 - 85.00	100 - 105.00	120 - 126.00	94 - 105.00	98.0 - 105.00
UNITS: CENTS PER POUND OF PRODUCT						
Ferrochromium-silicon	38.60	38.60	38.60	38.60	NA	NA
Chromium metal:						
Electrolytic . .	375.00	315 - 375.00	315 - 375.00	375.00	395	370.0
Elchrome . .	NA	NA	NA	NA	NA	422.5
Aluminothermic	NA	NA	NA	NA	NA	NA

NA Not available.

¹Reported as charge chromium before 1977.²Reported as high-carbon ferrochromium before 1977.Table 8.—World annual chromite production, by country
(Thousand metric tons)

Country	1986	1987	1988	1989	1990
Albania	1,159	1,075	1,109	900	910
Brazil	353	338	410	476	267
China ¹	50	32	26	25	25
Cuba	50	52	52	51	50
Finland	678	543	700	498	489
Greece	60	64	50	47	45
India	630	624	821	1,003	939
Indonesia	—	—	8	8	8
Iran	54	92	60	73	77
Japan	11	12	10	12	8
Madagascar	83	107	64	63	73
Morocco	—	NA	1	1	(¹)
New Caledonia	72	62	70	60	6
Oman	5	—	—	13	—
Pakistan	8	10	3	27	18
Philippines	174	188	124	217	186
South Africa, Republic of	3,907	3,789	4,245	4,951	4,618
Sudan	9	13	8	25	13
Thailand	(¹)	(¹)	1	(¹)	—
Turkey	618	762	851	1,100	800
U.S.S.R.	3,640	3,570	3,700	3,800	3,800
Vietnam	4	4	4	4	4
Yugoslavia	9	13	12	13	11
Zimbabwe	533	570	561	627	643
Total ²	12,107	11,920	12,890	13,994	12,990

NA Not available.

¹Less than 1/2 unit.²Data may not add to totals shown because of independent rounding.

Table 9.—U.S. Imports for consumption of chromite ore and ferrochromium
(Metric tons and thousand U.S. dollars)

Year	1969	1970	1971	1972	1973	1974	1975
Chromite ore:							
Gross weight	1,003,000	1,275,000	1,178,000	958,000	845,000	1,000,000	1,136,000
Cr ₂ O ₃ content	459,000	587,000	535,000	453,000	374,000	436,000	507,000
Value	20,030	31,805	31,873	27,605	21,028	28,532	60,651
Ferrochromium:							
Gross weight	52,099	37,471	77,280	128,159	148,712	147,585	289,219
Chromium content	33,481	23,991	48,932	81,888	94,988	93,278	179,612
Value	12,394	9,620	22,697	34,588	37,198	55,924	190,630
	1976	1977	1978	1979	1980	1981	1982
Chromite ore:							
Gross weight	1,157,000	1,173,000	919,000	929,000	890,856	814,652	459,943
Cr ₂ O ₃ content	484,000	488,000	376,000	377,000	371,946	333,844	189,602
Value	70,075	68,697	51,434	55,604	56,525	49,948	29,670
Ferrochromium:							
Gross weight	220,079	203,284	296,637	219,959	269,632	388,492	128,194
Chromium content	136,321	121,753	165,381	123,340	157,938	224,450	76,906
Value	124,819	100,528	113,532	116,591	153,487	213,611	77,495
	1983	1984	1985	1986	1987	1988	1989
Chromite ore:							
Gross weight	172,748	276,310	375,911	442,890	489,901	615,332	525,044
Cr ₂ O ₃ content	78,170	121,859	159,838	193,731	207,410	270,001	236,938
Value	10,390	15,477	20,170	21,657	23,775	43,317	43,949
Ferrochromium:							
Gross weight	254,287	386,288	299,884	352,362	295,314	421,801	343,733
Chromium content	147,869	220,195	171,560	202,983	168,233	251,553	205,396
Value	109,012	183,451	156,748	172,694	150,269	353,053	330,427
	1990						
Chromite ore:							
Gross weight	305,506						
Cr ₂ O ₃ content	133,794						
Value	22,150						
Ferrochromium:							
Gross weight	415,893						
Chromium content	242,356						
Value	246,439						

Page Intentionally Left Blank.

CLAYS

By Robert L. Virta

Clay is a natural, earthy, fine-grained material composed largely of a group of crystalline minerals known as the clay minerals. These minerals are hydrous silicates composed mainly of silica, alumina, and water. Several of these minerals also contain appreciable quantities of iron, alkalies, and alkaline earth.

Clays are bulk commodities that support a variety of substantial industries that are vital in local and regional economies and are important to the national economy. Deposits of common clays, shales, and fire clays are widespread. Ball clay, bentonite, fuller's earth, and kaolin deposits occur in smaller geographic areas.

U.S. production of clays in 1989 was 42 million metric tons valued at \$1.5 billion, from 44 States and Puerto Rico. U.S. clay demand during the last two decades has declined because of decreased construction. Large declines in the manufacture of brick, lightweight aggregates, and portland cement were observed during the period. The specialty clays used in more diversified applications and industries fared better. Demand for these clays—kaolin, ball clay, fuller's earth, and bentonite—has held up well despite some softening in the latter part of the decade.

The forecast range for U.S. clay demand for the year 2000 is between 47 and 77 million metric tons. Probable U.S. demand for 2000 was put at 63 million metric tons. The United States possesses the best overall supply of clays of any country in the world with respect to types as well as quantity. In addition, the United States is more advanced in clay-processing technology than most other countries and is capable of processing clay to meet all domestic consumer requirements.

For several of the clay types, demand and industry employment are strongly influenced by production costs and price. Efficiencies and innovations that would reduce extraction costs would be particularly effective in increasing demand.

Although clays have been used for thousands of years, understanding of the molecular and atomic structure along with tools for measuring and observing the chemical and physical properties of the many clay minerals have only recently been made available and are continually being improved. This type of research is a relatively new field that, if pursued diligently, holds potential for improvements in quality, new physical properties, and even designed physical properties of clays.

Byproducts and coproducts have been given little attention by clay producers. High-quality silica sand is the only significant coproduct. Although the potential for additional coproducts is probably limited by marketing problems, possibilities exist for recovering mica, titanium minerals, and silica from kaolin mining operations.

Most clays are produced from open pits, and the industry is particularly susceptible to land use conflicts. Zoning regulations, waste disposal, and pollution factors will affect the economics of production in a growing number of instances. Devising practices to minimize such conflict demands immediate and concerted attention. Of even more importance is the need for adequate data on clay resources, location of deposits, types of clay, use potential, and tonnage so planners can more intelligently design for the use of land within their purview.

Table 1.—Clays sold or used by producers in the United States in 1971, by State¹
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Bentonite	Fuller's earth	Common clay and shale	Total ²	Total value
Alabama	58,459	—	272,114	W	—	2,314,053	³ 2,644,626	³ \$6,912,844
Arizona	59	—	—	W	—	107,958	³ 108,017	³ 84,398
Arkansas	W	—	—	—	—	849,169	⁴ 849,169	⁴ 1,499,500
California	43,718	W	33,166	30,783	W	2,451,256	2,563,567	7,146,128
Colorado	—	—	38,566	1,404	—	527,232	567,203	1,334,498
Connecticut	—	—	—	—	—	158,000	158,000	322,069
Delaware	—	—	—	—	—	12,626	12,626	8,351
Florida	W	—	—	—	392,529	507,890	⁴ 900,419	⁴ 12,833,664
Georgia	3,340,532	—	W	—	315,740	1,596,985	⁵ 5,253,256	⁵ 119,096,298
Hawaii	—	—	—	—	—	W	W	W
Idaho	W	—	W	W	—	W	46,581	W
Illinois	—	—	81,397	—	W	1,471,147	⁶ 1,552,545	⁶ 3,188,913

See footnotes at end of table.

PRECEDING PAGE
BLANK

Table 1.—Clays sold or used by producers in the United States in 1971, by State¹—Continued
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total ²	Total value
Indiana	69	—	W	—	—	1,201,380	⁵ 1,201,449	\$2,307,747
Iowa	—	—	W	—	—	932,272	⁵ 932,272	⁵ 1,702,207
Kansas	—	—	—	—	—	797,802	797,802	1,151,078
Kentucky	—	W	102,407	—	—	765,130	⁵ 867,536	⁷ 1,377,382
Louisiana	—	—	—	—	—	973,788	973,788	1,606,173
Maine	W	—	—	—	—	38,265	⁴ 38,265	⁴ 56,077
Maryland	2,201	W	—	—	—	929,855	⁷ 932,056	^{4,7} 1,558,148
Massachusetts	—	—	—	—	—	168,493	168,493	376,883
Michigan	—	—	—	—	—	2,229,492	2,229,491	3,365,678
Minnesota	—	—	—	—	—	202,433	202,433	334,717
Mississippi	—	W	—	254,588	W	1,687,657	2,066,787	8,500,953
Missouri	W	—	790,731	38,558	—	1,306,109	^{4,2} 1,335,397	^{3,4,7} 7,454,187
Montana	—	—	W	207,404	—	31,659	⁵ 239,063	⁵ 1,712,299
Nebraska	—	—	—	—	—	62,960	62,960	82,358
Nevada	1,361	—	—	W	—	W	^{3,8} 1,361	W
New Hampshire	—	—	—	—	—	33,316	33,316	33,812
New Jersey	W	W	W	—	—	121,905	182,403	863,903
New Mexico	—	—	W	—	—	69,072	⁵ 69,072	⁵ 114,142
New York	—	W	—	—	—	1,440,621	⁷ 1,440,621	⁷ 1,742,467
North Carolina	W	—	W	—	—	3,177,759	^{4,5} 3,177,759	^{4,5} 3,801,769
North Dakota	—	—	—	—	—	W	W	W
Ohio	236,065	—	597,135	—	—	2,771,127	3,604,328	11,379,777
Oklahoma	—	—	—	W	—	766,224	³ 766,224	³ 1,254,585
Oregon	193	—	—	767	—	141,450	142,410	255,337
Pennsylvania	W	—	507,233	—	—	1,602,342	^{4,2} 1,109,574	^{4,8} 940,288
Puerto Rico	—	—	—	—	—	310,009	310,009	358,449
South Carolina	407,800	—	W	—	—	1,450,853	⁵ 1,858,652	⁵ 10,201,317
South Dakota	—	—	—	W	—	136,142	³ 136,142	³ 127,589
Tennessee	—	342,391	21	—	W	1,051,926	⁶ 1,394,338	⁶ 6,594,844
Texas	W	W	67,870	W	W	3,968,226	4,186,832	10,431,789
Utah	W	—	W	3,675	2,341	W	180,053	1,063,834
Virginia	—	—	—	—	—	1,551,158	1,551,158	1,799,879
Washington	—	—	W	—	—	231,516	⁵ 231,516	⁵ 548,547
West Virginia	—	—	W	—	—	210,628	⁵ 210,628	⁵ 335,565
Wisconsin	—	—	—	—	—	3,651	3,651	7,645
Wyoming	—	—	—	1,589,259	—	41,455	1,630,714	17,377,529
Undistributed	342,225	204,301	271,042	291,899	209,199	234,560	⁹ 992,185	⁹ 13,543,577
Total ²	4,432,681	546,691	2,761,681	2,418,337	919,808	40,637,550	51,716,747	274,789,194

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Data may not add to totals shown because of independent rounding.

³Excludes bentonite.

⁴Excludes kaolin.

⁵Excludes fire clay.

⁶Excludes fuller's earth.

⁷Excludes ball clay.

⁸Excludes common clay and shale.

⁹Incomplete total; difference included with "Undistributed."

Table 2.—Clays sold or used by producers in the United States¹ in 1971, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	—	—	—	—	(³)	49,289	—	⁴ 49,289
Alum, aluminum sulfate, and other chemicals	—	(⁵)	105	17,418	(⁵)	117,910	6,512	141,945
Animal feed	—	81,963	—	—	220	23,414	—	105,596
Animal litter	—	(³)	—	—	255,417	—	—	⁴ 255,417
Building brick	—	(³)	17,794,270	—	—	—	—	⁴ 17,794,270
Catalysts (oil refining)	(⁵)	(⁵)	—	—	(⁵)	50,188	4,570	54,759
Cement, portland	—	(³)	10,543,209	—	—	62,399	—	⁴ 10,605,608
Drain tile	—	—	602,705	—	—	—	—	602,705
Drilling mud	(³)	464,728	—	—	64,453	(³)	—	⁴ 529,181
Enamel, glazes, and glass	—	—	—	—	—	8,541	—	8,541
Fertilizers	—	2,424	—	—	46,495	52,990	—	101,910
Fiberglass	—	—	—	—	—	113,715	—	113,715
Filtering, clarifying, and decolorizing Firebrick and block	—	111,473	—	—	43,306	—	—	154,779
Floor absorbents	(⁵)	(⁵)	—	2,137,208	—	391,571	100,550	2,629,329
Floor, wall, and quarry tile	—	(³)	—	—	321,568	—	—	⁴ 321,568
Flower pots	123,776	—	75,186	(³)	—	253,516	—	⁴ 452,478
Flue linings	—	—	54,224	—	—	—	—	54,224
Foundry sand	—	—	52,610	—	—	—	—	52,610
Gypsum products	—	683,712	—	407,065	—	—	—	1,090,777
Insecticides and fungicides	—	(⁵)	—	—	(⁵)	10,821	544	11,420
Lightweight aggregate	(³)	4,139	—	—	163,991	13,587	—	⁴ 181,717
Mortar and cement, refractory	—	—	9,278,007	—	(³)	—	—	⁴ 9,278,007
Oil well sealing	(³)	—	—	53,062	—	—	—	⁴ 53,062
Paint	—	4,755	—	—	—	1,165	—	5,920
Paper coating	—	(⁵)	(⁵)	—	(⁵)	111,075	3,778	114,853
Paper filling	—	—	—	—	(³)	1,243,359	—	⁴ 1,243,359
Pelletizing (iron ore)	(⁵)	(⁵)	—	—	—	746,281	13,118	759,399
Plastics	—	702,589	—	—	—	—	—	702,589
Roadstone	—	(⁵)	(⁵)	—	—	71,940	275	72,215
Roofing tile	—	—	72,389	—	—	—	—	72,389
Rubber	—	—	41,346	—	—	—	—	41,346
Sewer pipe, vitrified	(³)	—	—	—	—	328,237	—	⁴ 328,237
Structural tile	—	—	1,964,286	4,536	—	—	—	1,968,822
Water sealing and waterproofing ..	—	—	73,570	—	—	—	—	73,570
Whiteware	—	109,494	—	—	—	—	—	109,494
Other:	294,445	—	—	—	—	195,819	—	490,264
Filler	(⁵)	878	(⁵)	—	—	18,506	2,938	22,322
Heavy clay products	—	—	83,144	—	—	—	—	83,144
Pottery	15,253	—	—	14,353	—	16,428	—	46,034
Refractory	32,042	—	—	115,383	—	474	—	147,899
Miscellaneous	8,166	3,919	—	12,656	1,395	42,190	—	68,326
Undistributed ²	73,009	50,189	2,498	—	22,963	—	—	—
Exports	(⁵)	198,072	—	(³)	(⁵)	509,268	16,319	⁴ 723,660
Total ⁶	546,691	2,418,337	40,637,550	2,761,681	919,808	4,432,681	—	51,716,747

¹Includes Puerto Rico.

²Total of clays indicated by footnote 5.

³Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."

⁴Incomplete figure; remainder included with "Miscellaneous."

⁵Withheld to avoid disclosing company proprietary data; included with "Undistributed."

⁶Data may not add to total shown because of independent rounding.

Table 3.—Clays sold or used by producers in the United States in 1972, by State¹
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total ²	Total value
Alabama	101,743	—	317,600	W	—	2,166,414	³ 2,585,756	³ \$7,511,918
Arizona	5	—	W	23,052	—	98,844	⁴ 121,900	⁴ 355,251
Arkansas	W	—	—	—	—	802,992	⁵ 802,993	⁵ 990,269
California	53,291	W	90,963	36,094	W	2,261,882	2,454,753	7,387,342
Colorado	—	—	49,255	843	—	627,516	677,614	1,533,214
Connecticut	—	—	—	—	—	142,177	142,177	291,864
Delaware	—	—	—	—	—	14,043	14,043	9,288
Florida	W	—	—	—	320,665	515,600	⁵ 836,266	⁵ 10,335,900
Georgia	3,598,298	—	W	—	367,564	1,683,332	⁴ 5,649,193	⁴ 132,321,567
Hawaii	—	—	—	—	—	W	W	W
Idaho	W	—	8,952	36	—	W	52,074	415,327
Illinois	—	—	96,164	—	W	1,460,148	⁶ 1,556,312	⁶ 3,314,068
Indiana	—	251	W	—	—	1,287,423	⁴ 1,287,675	⁴ 2,465,238
Iowa	—	—	—	—	—	950,245	950,245	2,642,705
Kansas	—	—	—	—	—	1,060,978	1,060,978	1,456,742
Kentucky	—	W	73,567	—	—	760,741	⁷ 834,308	⁷ 1,405,675
Louisiana	—	—	—	—	—	907,332	907,332	1,454,344
Maine	—	—	—	—	—	36,496	36,496	57,031
Maryland	—	W	3,011	—	—	998,938	⁷ 1,001,949	⁷ 2,121,195
Massachusetts	—	—	—	—	—	198,473	198,473	415,812
Michigan	—	—	—	—	—	2,280,489	2,280,489	3,714,690
Minnesota	W	—	—	—	—	151,874	⁵ 151,874	⁵ 251,119
Mississippi	—	W	—	251,831	W	1,357,778	1,740,682	7,836,817
Missouri	W	—	811,181	W	—	1,521,311	^{3,5} 2,332,492	^{3,5} 9,095,527
Montana	—	—	W	211,728	—	63,845	⁴ 275,573	⁴ 1,589,971
Nebraska	—	—	—	—	—	104,356	104,356	143,424
Nevada	W	—	—	W	—	W	36,493	182,809
New Hampshire	—	—	—	—	—	46,040	46,040	70,125
New Jersey	—	—	53,861	—	—	138,358	192,220	856,450
New Mexico	—	—	W	—	—	59,080	⁴ 59,080	⁴ 1,589,971
New York	—	W	—	—	—	1,452,152	⁷ 1,452,152	⁷ 1,919,417
North Carolina	W	—	—	—	—	3,503,943	⁵ 3,503,943	⁵ 4,473,183
North Dakota	—	—	—	—	—	W	W	W
Ohio	25,738	—	728,917	—	—	2,987,250	3,741,904	11,272,640
Oklahoma	—	—	—	W	—	850,652	³ 850,652	³ 1,397,874
Oregon	121	—	—	1,081	—	135,543	136,745	238,090
Pennsylvania	49,880	—	697,342	—	—	1,685,441	2,432,663	15,828,905
Puerto Rico	—	—	—	—	—	327,243	327,243	382,296
South Carolina	617,871	—	—	—	—	1,397,311	2,015,182	11,267,580
South Dakota	—	—	—	W	—	168,247	³ 168,247	³ 156,140
Tennessee	—	391,111	19	—	W	1,167,211	⁶ 1,558,341	⁶ 7,718,560
Texas	W	W	80,577	80,032	W	4,440,035	4,694,349	11,554,283
Utah	W	—	3,415	3,641	1,887	232,600	⁵ 241,543	⁵ 790,191
Virginia	—	—	—	—	—	1,482,362	1,482,362	1,783,350
Washington	—	—	W	—	—	239,581	⁴ 239,581	⁴ 583,539
West Virginia	—	—	W	—	—	248,850	⁴ 248,850	⁴ 402,927
Wisconsin	—	—	—	—	—	3,494	3,494	7,085
Wyoming	—	—	—	1,643,135	—	55,913	1,699,049	18,509,126
Undistributed	377,136	221,246	233,473	258,706	206,670	98,315	⁸ 1,078,666	⁸ 14,785,960
Total ²	4,824,081	612,608	3,248,298	2,510,179	896,787	42,172,847	54,264,800	303,404,617

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Data may not add to totals shown because of independent rounding.

³Excludes bentonite.

⁴Excludes fire clay.

⁵Excludes kaolin.

⁶Excludes fuller's earth.

⁷Excludes ball clay.

⁸Incomplete total; difference included with "Undistributed."

Table 4.—Clays sold or used by producers in the United States¹ in 1972, by kind and use
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Adhesives	—	(^d)	—	—	(^d)	66,603	—	⁵ 66,603
Alum, aluminum sulfate and other chemicals	—	(^d)	—	(^d)	(^d)	100,702	22,192	122,895
Animal feed	—	91,254	—	—	(^d)	8,575	—	⁵ 99,828
Animal litter	—	3,340	—	—	216,746	—	—	220,086
Asphalt emulsion and tiles	(^d)	(^d)	—	—	—	—	10,079	10,079
Brakes and clutches	—	—	793	—	—	—	—	793
Building brick:								
Common	—	(^d)	3,273,034	—	—	(^d)	—	⁵ 3,273,034
Face	—	(^d)	15,036,873	27,216	—	258,791	—	⁵ 15,322,879
Catalysts (oil refining)	136	(^d)	—	—	(^d)	61,680	3,090	64,905
Cement, portland	—	(^d)	11,376,057	—	(^d)	68,672	—	⁵ 11,444,729
Ceramic—hobby	—	—	1,108	—	—	5	—	1,112
China and dinnerware	(^d)	—	—	—	—	46,086	—	⁵ 46,086
Crockery and other earthenware	(^d)	—	4,643	(^d)	—	18,139	8,604	31,386
Drilling mud	(^d)	487,482	181	—	53,182	(^d)	—	⁵ 540,846
Electrical porcelain	(^d)	—	—	—	—	5,387	—	⁵ 5,387
Fertilizers	—	2,366	(^d)	—	38,107	68,918	—	⁵ 109,391
Fiberglass	—	—	—	—	—	139,514	—	139,514
Filtering, clarifying, and decolorizing:								
Animal oils	—	(^d)	—	—	(^d)	—	28,796	28,796
Mineral oils	—	46,484	—	—	34,459	—	—	80,943
Vegetable oils	—	67,636	—	—	(^d)	—	—	⁵ 67,636
Firebrick, block, and shapes	37,059	5,984	—	2,024,759	—	306,036	—	2,373,838
Floor absorbents	—	(^d)	—	—	311,793	—	—	⁵ 311,793
Flower pots	—	—	43,634	—	—	—	—	43,634
Flue linings	—	—	131,072	(^d)	—	(^d)	56,631	187,703
Foundry sand	—	645,493	—	248,478	—	(^d)	—	⁵ 893,971
Glazes, glass, and enamels	1,411	(^d)	—	(^d)	—	24,608	—	⁵ 26,019
Grogs and crudes, refractory	—	—	—	221,385	—	139,290	—	360,675
Gypsum products	—	—	—	—	—	14,607	—	14,607
High-alumina (minimum 50% Al ₂ O ₃) refractories	(^d)	(^d)	—	202,744	—	(^d)	—	⁵ 202,744
Kiln furniture	(^d)	(^d)	—	(^d)	—	—	20,451	20,451
Lightweight aggregate	—	—	9,752,436	—	—	—	—	9,752,436
Linoleum	—	—	793	—	—	(^d)	—	⁵ 793
Medical, pharmaceutical, cosmetic	—	—	—	—	(^d)	(^d)	2,480	2,480
Mortar, cement, refractory	(^d)	—	(^d)	233,648	(^d)	(^d)	53,145	286,793
Paint	—	(^d)	87	—	(^d)	128,362	3,102	131,551
Paper coating	—	(^d)	—	—	(^d)	1,300,827	—	⁵ 1,300,827
Paper filling	(^d)	—	—	—	(^d)	694,122	—	⁵ 694,122
Pelletizing (iron ore)	—	641,549	—	—	—	—	—	641,549
Pesticides and related products	(^d)	36,476	—	—	130,979	25,802	—	⁵ 193,258
Plastics	—	—	(^d)	—	(^d)	65,176	—	⁵ 65,176
Plug, tap, and wad	—	—	—	6,803	—	—	—	6,803
Pottery	165,535	(^d)	12,036	(^d)	—	21,539	11,024	210,134
Rubber	(^d)	—	—	—	(^d)	341,191	—	⁵ 341,191
Sanitaryware	157,334	—	—	—	—	132,497	—	289,831
Sewer pipe, vitrified	—	—	1,659,087	166,520	—	—	—	1,825,607
Tile:								
Drain	—	—	372,566	—	—	—	—	372,566
Floor and wall ceramic	124,985	—	128,447	3,629	(^d)	39,404	—	⁵ 296,464
Quarry	(^d)	—	113,597	—	—	—	—	⁵ 113,597
Roofing	—	—	47,667	—	—	(^d)	—	⁵ 47,667
Structural	—	—	119,883	—	—	—	—	119,883
Other	—	—	29,232	—	—	—	—	29,232
Waterproofing and sealing	—	35,698	—	—	(^d)	—	—	⁵ 35,698

See footnotes at end of table.

Table 4.—Clays sold or used by producers in the United States¹ in 1972, by kind and use—Continued
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Miscellaneous ⁷	33,457	24,753	11,227	3,787	68,887	60,673	—	202,784
Undistributed	60,319	37,839	21,772	84,300	7,145	8,218	—	—
Exports	32,373	383,825	36,623	25,030	35,489	678,658	—	1,191,998
Total	612,608	2,510,179	42,172,847	3,248,298	896,787	4,824,081	(⁶)	54,264,800

¹Includes Puerto Rico.

²Total of clays indicated by footnote 6.

³Data may not add to total shown because of independent rounding.

⁴Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."

⁵Incomplete figure; remainder included with "Miscellaneous."

⁶Withheld to avoid disclosing company proprietary data; included with "Undistributed."

⁷Includes graphite anodes; caulking, putty, sealers, and glue; dummy and oil well sealing; ink; mineral wool and insulation; roofing granules; textiles; water treatment and filtering; unknown uses; and data indicated by footnotes 3 and 4.

⁸Included with total for each specific use.

Table 5.—Clays sold or used by producers in the United States in 1973, by State¹
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total ²	Total value
Alabama	115,252	—	326,441	W	—	2,219,562	³ 2,661,256	³ \$8,787,607
Arizona	5	—	W	31,812	—	74,608	⁴ 106,425	⁴ 459,074
Arkansas	W	—	—	—	—	1,311,599	⁵ 1,311,599	⁵ 1,411,558
California	23,815	W	108,285	45,071	W	2,291,693	2,470,572	6,853,260
Colorado	—	—	52,731	918	—	666,314	719,963	1,709,851
Connecticut	—	—	—	—	—	146,698	146,698	320,171
Delaware	—	—	—	—	—	13,378	13,378	8,848
Florida	25,360	—	—	—	380,263	627,382	1,033,005	13,717,798
Georgia	4,091,643	—	W	—	403,086	2,509,617	⁴ 7,004,345	⁴ 160,419,215
Hawaii	—	—	—	—	—	W	W	W
Idaho	W	—	W	W	—	10,084	38,182	226,683
Illinois	—	—	88,242	—	W	1,506,205	⁶ 1,594,447	⁶ 3,612,680
Indiana	W	—	W	—	—	1,264,147	1,303,099	2,567,814
Iowa	—	—	—	—	—	877,607	877,607	2,028,001
Kansas	—	—	—	—	—	1,060,739	1,060,739	1,489,564
Kentucky	—	W	129,325	—	—	853,041	⁷ 982,366	⁷ 1,961,325
Louisiana	—	—	—	—	—	887,701	887,701	1,329,396
Maine	—	—	—	—	—	36,989	36,989	74,418
Maryland	—	W	—	—	—	813,381	⁷ 813,381	⁷ 1,973,492
Massachusetts	—	—	—	—	—	196,907	196,907	404,472
Michigan	—	—	—	—	—	1,951,088	1,951,088	3,304,398
Minnesota	W	—	—	—	—	141,117	⁵ 141,117	⁵ 233,283
Mississippi	—	W	—	259,577	W	1,471,986	1,882,395	9,082,347
Missouri	75,065	—	752,495	67,132	—	1,419,470	2,314,161	11,626,350
Montana	—	—	W	160,196	—	38,407	⁴ 198,603	⁴ 1,298,134
Nebraska	—	—	—	—	—	143,760	143,760	285,761
Nevada	1,769	—	41	W	—	W	32,341	176,370
New Hampshire	—	—	—	—	—	39,326	39,326	63,575
New Jersey	—	—	23,952	—	—	142,351	166,303	665,796
New Mexico	—	—	W	—	—	79,658	⁴ 79,658	⁴ 169,455
New York	—	W	—	—	—	1,631,946	⁷ 1,631,946	⁷ 2,146,185
North Carolina	W	—	—	—	—	3,727,781	⁵ 3,727,781	⁵ 5,057,166
North Dakota	—	—	—	—	—	W	W	W
Ohio	—	—	993,798	—	—	3,298,805	4,292,603	12,456,223
Oklahoma	—	—	—	W	—	1,177,253	³ 1,177,253	³ 1,871,026

See footnotes at end of table.

Table 5.—Clays sold or used by producers in the United States in 1973, by State¹—Continued
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total ²	Total value
Oregon	—	—	—	794	—	151,230	152,024	\$290,745
Pennsylvania	W	—	808,977	—	—	1,890,069	⁵ 2,699,046	⁵ 16,664,182
Puerto Rico	—	—	—	—	—	420,590	420,590	473,195
South Carolina	684,897	—	—	—	W	1,356,708	⁶ 2,041,604	⁶ 12,876,561
South Dakota	—	—	—	W	—	181,901	³ 181,901	³ 181,156
Tennessee	—	442,366	—	—	W	1,116,950	⁶ 1,559,315	⁶ 9,082,994
Texas	W	—	79,364	76,766	W	4,835,168	5,141,258	13,114,642
Utah	W	—	4,808	4,427	2,604	208,272	⁵ 220,110	⁵ 770,990
Virginia	—	—	—	—	—	1,492,978	1,492,978	1,885,774
Washington	—	—	W	—	—	259,943	259,942	⁴ 663,873
West Virginia	—	—	W	—	—	315,549	315,549	⁴ 516,300
Wisconsin	—	—	—	—	—	1,606	1,606	3,186
Wyoming	—	—	—	1,910,866	—	214,230	2,125,096	24,043,092
Undistributed	419,389	253,184	321,954	229,804	246,817	79,513	⁸ 1,150,584	⁸ 16,173,349
Total ²	5,437,194	695,550	3,690,413	2,787,364	1,032,769	45,155,306	58,798,596	354,531,335

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Data may not add to totals shown because of independent rounding.

³Excludes bentonite.

⁴Excludes fire clay.

⁵Excludes kaolin.

⁶Excludes fuller's earth.

⁷Excludes ball clay.

⁸Incomplete total; difference included with "Undistributed."

Table 6.—Clays sold or used by producers in the United States¹ in 1973, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Adhesives	(⁴)	(⁴)	—	—	(⁴)	58,652	2,677	¹ 61,329
Alum, aluminum sulfate, and other chemicals	—	(⁴)	—	(⁴)	(⁴)	206,639	5,820	212,458
Animal feed	(⁴)	126,877	113	—	(⁴)	13,607	586	141,183
Asphalt emulsion and tiles	(⁴)	(⁴)	—	—	—	—	14,163	14,163
Brakes and clutches	—	—	843	—	—	—	—	843
Building brick:								
Common	(⁴)	(⁴)	3,088,609	—	—	—	664	3,089,273
Face	11,793	2,653	17,294,406	40,345	—	347,106	—	17,696,304
Catalysts (oil refining)	(⁴)	(⁴)	—	—	(⁴)	81,045	9,806	90,851
Caulking, putty, sealers, and glue	(⁴)	—	—	(⁴)	—	(⁴)	7,697	7,697
Cement, portland	—	(⁴)	11,510,137	—	(⁴)	97,284	21,234	11,628,656
Ceramic—hobby	—	—	493	—	—	—	—	493
China and dinnerware	40,110	—	—	—	—	26,981	—	67,092
Crockery and other earthenware	907	—	5,248	(⁴)	(⁴)	3,287	20,177	29,619
Drilling mud	(⁴)	520,115	(⁴)	—	54,731	—	5,153	579,999
Electrical porcelain	15,545	—	—	—	—	14,433	—	29,978
Fertilizers	—	(⁴)	(⁴)	—	35,408	65,570	10,287	111,265
Fiberglass	—	—	—	—	—	171,740	—	171,740
Filtering, clarifying, and decolorizing:								
Animal/vegetable oils	—	54,519	—	—	—	—	—	54,519
Mineral oils and greases	—	97,959	—	—	27,198	(⁴)	—	⁶ 125,157
Firebrick, block, and shapes	(⁴)	(⁴)	(⁴)	2,218,666	—	283,207	9,971	2,511,844

See footnotes at end of table.

Table 6.—Clays sold or used by producers in the United States¹ in 1973, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Flower pots	—	—	56,718	—	—	—	—	56,718
Flue linings	—	—	132,506	81,189	—	(⁴)	—	⁶ 213,695
Foundry sand	—	716,828	—	208,505	—	(⁴)	—	⁶ 925,332
Glazes, glass, and enamels	1,746	(⁴)	—	(⁴)	—	7,382	38,420	47,548
Grogs and crudes, refractory	3,266	—	—	163,081	—	138,962	—	305,309
Gypsum products	—	597	—	—	—	51,034	—	51,631
High-alumina (minimum 50% Al ₂ O ₃) refractories	(⁴)	—	—	228,110	—	(⁴)	54,889	282,999
Kiln furniture	(⁴)	—	—	(⁴)	—	(⁴)	19,996	19,996
Lightweight aggregate	—	—	10,575,943	—	—	—	—	10,575,943
Linoleum	—	—	843	—	—	(⁴)	—	⁶ 843
Medical, pharmaceutical, cosmetic ..	—	3,401	—	—	(⁴)	(⁴)	859	4,260
Mortar and cement, refractory	(⁴)	—	—	471,641	(⁴)	(⁴)	30,749	502,390
Oil and grease absorbents	—	24,167	—	—	322,756	—	—	346,924
Oil well sealing	—	—	226	—	—	—	—	226
Paint	—	(⁴)	—	—	(⁴)	119,724	4,939	124,663
Paper coating	(⁴)	(⁴)	—	—	(⁴)	1,461,394	3,383	1,464,777
Paper filling	(⁴)	—	—	—	—	748,087	—	⁶ 748,087
Pelletizing (iron ore)	—	704,420	—	—	—	—	—	704,420
Pelletizing (other)	—	—	—	17,418	—	—	—	17,418
Pesticides and related products	(⁴)	32,396	—	—	159,059	26,082	—	⁶ 217,537
Pet absorbent	—	9,689	—	—	301,629	—	—	311,318
Plastics	—	—	(⁴)	—	(⁴)	56,815	434	57,249
Plug, tap, and wad	—	—	—	5,951	—	—	—	5,951
Pottery	154,934	—	15,872	11,807	—	13,744	—	196,357
Roofing granules	—	—	—	—	(⁴)	278	—	⁶ 278
Rubber	422	—	—	—	—	332,663	—	333,085
Sanitaryware	169,972	—	—	—	—	164,306	—	334,278
Sewer pipe, vitrified	—	—	1,648,598	91,571	—	—	—	1,740,170
Tile:								
Drain	—	—	309,972	—	—	—	—	309,972
Floor and wall ceramic	111,965	—	119,764	45,408	—	30,840	—	307,977
Quarry	907	—	130,443	—	—	—	—	131,350
Roofing	—	—	73,167	—	—	—	—	73,167
Structural	—	—	95,238	—	—	—	—	95,238
Terra cotta	—	—	(⁴)	(⁴)	—	—	21,450	21,450
Other	—	—	—	—	—	5	—	5
Waterproofing and sealing	—	52,184	—	—	(⁴)	—	—	⁶ 52,184
Miscellaneous ⁷	17,191	19,914	12,736	6,724	4,914	74,808	—	136,287
Undistributed	90,239	24,103	32,318	61,249	26,791	48,656	—	—
Exports	76,552	397,543	51,112	38,749	100,282	792,865	—	1,457,102
Total ³	695,550	2,787,364	45,155,306	3,690,413	1,032,769	5,437,194	(⁸)	58,798,596

¹Includes Puerto Rico.

²Total of clays indicated by footnote 4.

³Data may not add to totals shown because of independent rounding.

⁴Withheld to avoid disclosing company proprietary data; included with "Undistributed."

⁵Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."

⁶Incomplete figure; remainder included with "Miscellaneous."

⁷Includes abrasives, graphite anodes, tamping dummies, ink, mineral wool, insulation, textiles, water treatment, filtering, unknown uses, and data indicated by footnote 4.

⁸Included with total for each specific use.

Table 7.—Clays sold or used by producers in the United States in 1974, by State¹
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total	Total value
Alabama	306,149	—	287,034	W	—	2,124,181	² 2,717,364	² \$13,298,240
Arizona	—	W	W	29,758	—	148,611	180,232	621,737
Arkansas	72,925	—	—	—	—	819,833	892,758	1,597,397
California	38,743	W	142,541	51,190	W	2,031,333	2,265,460	7,626,341
Colorado	7,212	—	48,319	3,741	—	542,445	601,718	1,588,214
Connecticut	—	—	—	—	—	141,139	141,139	363,446
Delaware	—	—	—	—	—	12,745	12,745	8,429
Florida	24,739	—	—	—	374,235	334,348	733,322	³ 14,261,463
Georgia	4,320,015	—	W	—	443,799	2,214,216	⁴ 6,978,030	⁴ 203,936,262
Hawaii	—	—	—	—	—	W	W	W
Idaho	—	—	W	—	—	8,432	⁴ 8,432	⁴ 10,348
Illinois	—	—	93,064	—	W	1,346,681	⁵ 1,439,744	⁵ 3,744,447
Indiana	—	—	23,801	—	—	966,966	990,767	1,946,636
Iowa	—	—	—	—	—	871,098	871,098	1,869,045
Kansas	—	—	—	—	—	1,188,935	1,188,935	1,785,130
Kentucky	—	W	105,947	—	—	663,536	⁶ 769,483	⁶ 1,476,562
Louisiana	—	—	—	—	—	698,763	698,763	1,425,260
Maine	—	—	—	—	—	132,751	132,751	182,716
Maryland	—	W	—	—	—	802,123	⁶ 802,123	⁶ 2,065,548
Massachusetts	—	—	—	—	—	197,481	197,481	378,780
Michigan	—	—	—	—	—	1,960,361	1,960,361	4,073,629
Minnesota	W	—	—	—	—	W	W	W
Mississippi	—	—	—	302,576	W	1,353,746	1,826,062	10,468,010
Missouri	89,811	—	838,418	W	W	1,398,567	^{2,5} 2,326,796	^{2,5} 13,151,317
Montana	—	—	W	217,080	—	53,183	⁴ 270,263	⁴ 2,189,373
Nebraska	—	—	—	—	—	165,465	165,465	413,878
Nevada	2,183	—	94	W	73	W	35,353	218,126
New Hampshire	—	—	—	—	—	30,687	30,687	55,325
New Jersey	—	—	33,429	—	—	60,624	94,053	524,210
New Mexico	—	—	W	—	—	50,200	⁴ 50,200	⁴ 316,628
New York	—	W	—	—	—	1,315,930	⁶ 1,315,930	⁶ 2,348,006
North Carolina	W	—	—	—	—	3,104,228	³ 3,104,228	³ 4,648,355
North Dakota	—	—	—	—	—	W	W	W
Ohio	—	—	1,019,228	—	—	2,904,476	3,923,704	13,488,248
Oklahoma	—	—	—	W	—	1,169,305	1,169,305	2,105,382
Oregon	—	—	—	1,015	—	125,780	126,795	242,609
Pennsylvania	W	—	811,439	—	—	1,666,972	³ 2,478,411	³ 16,495,699
Puerto Rico	—	—	—	—	—	263,997	263,997	332,481
South Carolina	698,268	—	—	—	W	1,385,500	⁵ 2,083,769	⁵ 13,765,142
South Dakota	—	—	—	W	—	171,995	² 171,995	² 201,654
Tennessee	—	453,886	—	—	W	1,032,016	⁵ 1,485,902	⁵ 9,776,204
Texas	W	36,951	36,971	62,210	W	4,577,585	4,821,480	13,677,250
Utah	W	—	W	2,860	1,972	182,527	210,358	952,946
Virginia	—	—	—	—	—	1,775,131	1,775,131	2,613,820
Washington	—	—	W	—	—	244,418	244,418	698,235
West Virginia	—	—	W	—	—	307,370	⁴ 307,370	⁴ 520,315
Wisconsin	—	—	—	—	—	2,164	2,164	4,393
Wyoming	—	—	—	2,082,215	—	195,864	2,278,079	29,338,785
Undistributed	239,431	250,494	316,223	250,590	290,897	298,560	⁷ 1,271,071	⁷ 22,068,294
Total ⁸	5,799,476	741,330	3,756,509	3,003,236	1,110,975	41,005,981	55,417,507	422,874,315

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes kaolin.

⁴Excludes fire clay.

⁵Excludes fuller's earth.

⁶Excludes ball clay.

⁷Incomplete total; difference included with "Undistributed."

⁸Data may not add to totals shown because of independent rounding.

Table 8.—Clays sold or used by producers in the United States¹ in 1974, by kind and use
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	(³)	(³)	—	—	1,383	59,928	658	61,969
Alum, aluminum sulfate, and other chemicals	—	(³)	—	(³)	(³)	293,248	9,631	302,878
Animal feed	(³)	159,398	65	—	(³)	13,497	503	173,464
Asphalt emulsion and tiles	(³)	(³)	—	—	—	—	19,167	19,167
Building brick:								
Common	(³)	(³)	2,895,294	—	—	—	685	2,895,979
Face	11,793	2,651	15,679,351	95,488	—	385,851	—	16,175,134
Catalysts (oil refining)	(³)	4,426	—	—	(³)	63,445	14,670	82,541
Caulking, putty, sealers, and glue	—	—	—	5	—	4,550	—	4,555
Cement, portland	—	416	10,855,879	—	17,862	121,812	—	10,995,970
Ceramic—hobby	—	—	—	—	—	587	—	587
China and dinnerware	39,273	—	—	—	—	19,554	—	58,827
Crockery and other earthenware	1,031	—	6,253	(³)	(³)	62,110	21,473	90,867
Drilling mud	4,230	544,028	1,295	—	68,924	—	—	618,478
Electrical porcelain	40,943	—	—	—	—	14,001	—	54,944
Fertilizers	—	5,888	7,659	—	49,456	79,911	—	142,914
Fiberglass	—	—	116	—	—	116,105	—	116,221
Filtering, clarifying, and decolorizing:								
Animal oils	—	61,934	—	—	—	—	—	61,934
Mineral oils and greases	—	21,349	—	—	28,239	(⁴)	—	⁵ 49,588
Vegetable oils	—	64,673	—	—	—	—	—	64,673
Firebrick, block, and shapes	24,867	(⁴)	—	2,234,024	—	407,551	—	⁵ 2,666,442
Flower pots	—	—	42,970	—	—	—	—	42,970
Flue linings	—	—	90,527	51,837	—	(⁴)	—	⁵ 142,365
Foundry sand	—	669,552	—	208,104	—	4,873	—	882,530
Glazes, glass, and enamels	1,786	190	—	45,983	—	4,754	—	52,713
Grogs and crudes, refractory	(⁴)	—	—	129,504	—	251,619	—	⁵ 381,123
Gypsum products	—	459	—	—	—	4,374	—	4,833
High aluminum (minimum 50% Al ₂ O ₃) refractories	19,975	—	—	316,190	—	54,886	—	391,051
Ink	—	—	—	—	—	12,848	—	12,848
Kiln furniture	8,481	—	—	227	—	2,037	—	10,745
Lightweight aggregate:								
Concrete block	—	—	5,433,406	—	—	—	—	5,433,406
Structural concrete	—	—	2,691,644	—	—	—	—	2,691,644
Highway surfacing	—	—	884,956	—	—	—	—	884,956
Others	—	—	89,747	—	—	—	—	89,747
Medical, pharmaceutical, cosmetic Mortar and cement, refractory	2 (³)	13,497 —	— —	— 392,594	15 (³)	1,802 1,683	— 65,531	15,315 459,808
Oil and grease absorbents	—	13,481	—	—	371,705	—	—	385,185
Paint	—	4,459	—	—	1,508	237,104	—	243,070
Paper coating	(³)	(³)	—	—	64	1,191,502	2,070	1,193,646
Paper filling	(³)	(³)	—	—	—	918,188	12,483	930,671
Pelletizing (iron ore)	—	789,672	—	—	—	—	—	789,672
Pelletizing (other)	—	—	—	16,329	—	—	—	16,329
Pesticides and related products	(⁴)	21,639	—	—	162,911	25,865	—	⁵ 210,415
Pet absorbent	—	5,733	—	—	324,766	—	—	330,498
Plastics	—	—	—	—	(⁴)	49,237	—	⁵ 49,237
Plug, tap, and wad	—	—	—	8,702	—	—	—	8,702
Pottery	154,414	279	33,541	18,561	—	38,155	—	244,950
Rubber	363	—	91	—	—	343,462	—	343,916
Sanitaryware	158,486	(⁴)	—	—	—	75,091	—	⁵ 233,577
Sewer pipe, vitrified	—	91	1,363,053	96,254	—	—	—	1,459,398
Tamping dummies	—	—	6,967	—	—	—	—	6,967
Tile:								
Drain	—	—	394,093	—	—	—	—	394,093
Floor and wall ceramic	80,262	—	129,518	59,872	—	15,497	—	285,149

See footnotes at end of table.

Table 8.—Clays sold or used by producers in the United States¹ in 1974, by kind and use—Continued
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Tile—Continued								
Quarry	1,036	—	142,329	—	—	—	—	143,365
Roofing	—	11,910	75,781	—	—	—	—	87,691
Structural	—	—	58,596	—	—	—	—	58,596
Terra cotta	—	—	47,196	907	—	—	5,652	53,755
Waterproofing and sealing	(³)	78,286	—	—	(³)	3,224	—	81,510
Water treatment and filtering	—	—	10,570	—	—	—	—	10,570
Miscellaneous ⁴	3,899	45,533	7,943	7,156	4,795	36,321	—	105,648
Undistributed	115,384	9,105	—	23,313	4,720	—	—	—
Exports	75,103	474,587	57,140	51,458	74,626	884,805	—	1,617,720
Total ⁷	741,330	3,003,236	41,005,981	3,756,509	1,110,975	5,799,476	(⁶)	55,417,507

¹Includes Puerto Rico.

²Total of clays indicated by footnote 3.

³Withheld to avoid disclosing company proprietary data; included with "Undistributed."

⁴Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."

⁵Incomplete figure; remainder included with "Miscellaneous."

⁶Includes abrasives, graphite anodes, linoleum, mineral wool and insulation, roofing granules, textiles, unknown uses, and data indicated by footnote 4.

⁷Data may not add to totals shown because of independent rounding.

⁸Included with total for each specific use.

Table 9.—Clays sold or used by producers in the United States in 1975, by State¹
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total	Total value
Alabama	114,441	—	226,170	W	—	1,683,051	² 2,023,665	² \$9,077,299
Arizona	—	W	W	22,787	—	W	117,393	482,825
Arkansas	74,400	—	—	—	—	828,423	902,823	2,231,745
California	W	W	95,478	65,223	—	2,004,723	^{3,4} 2,165,423	^{3,4} 7,373,199
Colorado	—	—	24,094	2,273	—	409,186	435,553	1,100,829
Connecticut	—	—	—	—	—	104,901	104,901	306,531
Delaware	—	—	—	—	—	8,524	8,524	5,638
Florida	20,336	—	—	—	348,858	277,162	646,357	17,062,544
Georgia	3,644,096	—	3,529	—	404,979	1,532,450	5,585,054	195,299,988
Hawaii	—	—	—	—	—	W	W	W
Idaho	12,458	—	W	—	—	W	27,025	283,774
Illinois	—	—	51,378	—	W	1,187,960	⁵ 1,239,338	⁵ 3,248,768
Indiana	—	—	1,467	—	—	990,667	992,134	1,960,571
Iowa	—	—	—	—	—	870,273	870,273	1,916,060
Kansas	—	—	—	—	—	1,068,306	1,068,306	1,603,860
Kentucky	—	W	87,022	—	—	618,509	³ 705,530	³ 1,483,145
Louisiana	—	—	—	—	—	481,647	481,647	1,132,291
Maine	—	—	—	—	—	113,828	113,828	202,380
Maryland	—	W	—	—	—	526,481	³ 526,481	³ 1,450,124
Massachusetts	—	—	—	—	—	112,821	112,821	227,593
Michigan	—	—	—	—	—	1,649,355	1,649,355	3,579,774
Minnesota	W	—	—	—	—	W	W	W
Mississippi	—	W	—	239,532	W	1,045,369	1,444,509	10,605,442
Missouri	94,924	—	774,889	—	W	1,097,034	⁵ 1,966,848	^{4,5} 13,213,580
Montana	—	—	1,220	160,956	—	40,532	202,709	⁶ 1,877,761
Nebraska	—	—	—	—	—	176,878	176,878	416,386
Nevada	1,916	—	—	2,593	—	W	⁷ 4,509	⁷ 136,316
New Hampshire	—	—	—	—	—	W	W	W
New Jersey	—	—	15,712	—	—	45,359	61,071	371,850
New Mexico	—	—	W	—	—	39,778	⁶ 39,778	⁶ 60,699

See footnotes at end of table.

Table 9.—Clays sold or used by producers in the United States in 1975, by State¹—Continued
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total	Total value
New York	—	W	—	—	—	741,294	³ 741,294	³ \$1,561,094
North Carolina	W	—	—	—	—	2,342,315	⁴ 2,342,315	⁴ 4,093,650
North Dakota	—	—	—	—	—	W	W	W
Ohio	—	—	722,807	—	—	2,407,735	3,130,542	11,821,637
Oklahoma	—	—	—	—	—	902,831	902,831	1,700,763
Oregon	—	—	—	1,088	—	107,361	108,449	214,035
Pennsylvania	W	—	708,633	—	—	1,056,115	⁴ 1,764,748	⁴ 13,671,605
Puerto Rico	—	—	—	—	—	309,660	309,660	440,117
South Carolina	496,133	—	—	—	W	1,043,884	⁵ 1,540,017	⁵ 12,828,226
South Dakota	—	—	—	W	—	169,965	² 169,965	² 184,549
Tennessee	—	384,959	—	—	W	803,709	⁵ 1,188,667	⁵ 9,008,356
Texas	W	49,621	31,069	W	W	3,623,777	3,854,037	13,411,165
Utah	W	—	4,636	1,009	1,972	191,666	⁴ 199,282	⁴ 547,995
Virginia	—	—	—	—	—	743,400	743,400	1,152,034
Washington	—	—	W	—	—	262,805	262,805	777,761
West Virginia	—	—	W	—	—	252,470	⁶ 252,470	⁶ 439,165
Wisconsin	—	—	—	—	—	2,177	2,177	4,416
Wyoming	—	—	—	2,181,026	—	161,454	2,342,480	36,045,633
Undistributed	380,355	206,117	212,048	253,056	322,892	320,086	⁸ 1,276,202	⁸ 40,383,192
Total ⁹	4,839,060	640,697	2,960,152	2,929,543	1,078,701	32,355,920	44,804,072	424,996,336

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes ball clay.

⁴Excludes kaolin.

⁵Excludes fuller's earth.

⁶Excludes fire clay.

⁷Excludes common clay and shale.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 10.—Clays sold or used by producers in the United States¹ in 1975, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	910	3	—	—	4,563	80,270	—	85,746
Alum, aluminum sulfate, and other chemicals	400	(³)	—	(³)	(³)	325,899	6,053	332,352
Animal feed	494	159,717	17	—	36	9,637	—	169,901
Asphalt emulsion and tiles	(³)	(³)	—	—	—	—	4,205	4,205
Building brick:								
Common	(³)	(³)	1,912,300	—	—	24	408	1,912,734
Face	10,886	1,030	12,058,080	61,239	—	216,138	—	12,347,372
Catalysts (oil refining)	(³)	6,768	—	—	(³)	71,039	11,141	88,948
Cement, portland	—	305	8,934,910	—	15,995	49,618	—	9,000,836
Ceramic (hobby and artware)	5,746	—	—	—	—	12,044	—	17,790
China and dinnerware	33,198	(⁴)	—	—	—	21,871	—	⁵ 55,070
Crockery and other earthenware	829	—	5,078	(³)	(³)	34,866	19,302	60,075
Drilling mud	2,326	667,919	1,054	—	79,815	—	—	751,115
Electrical porcelain	42,548	—	—	866	—	12,427	—	55,841
Fertilizers	—	7,626	83	—	38,923	48,149	—	94,780

See footnotes at end of table.

Table 10.—Clays sold or used by producers in the United States¹ in 1975, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Fiberglass	—	—	—	—	—	130,543	—	130,543
Filtering, clarifying, and decolorizing:								
Animal oils	—	34,203	—	—	—	—	—	34,203
Mineral oils and greases	—	15,248	—	—	20,196	—	—	35,444
Vegetable oils	—	57,947	—	—	—	—	—	57,947
Firebrick, block, and shapes	27,634	(^d)	—	1,951,350	—	184,075	—	⁵ 2,163,061
Flower pots	—	—	46,919	—	—	—	—	46,919
Flue linings	—	—	94,027	43,635	—	(^d)	—	⁵ 137,662
Foundry sand	—	642,226	—	138,923	—	5,504	—	786,653
Glazes, glass, and enamels	1,620	128	—	37,601	—	4,211	—	43,560
Grogs and crudes, refractory	(^d)	—	—	105,491	—	216,997	—	⁵ 322,488
Gypsum products	—	347	22,680	—	—	2,628	—	25,655
High aluminum (minimum 50% Al ₂ O ₃) refractories	19,142	—	—	219,097	—	47,899	—	286,138
Ink	—	—	—	—	—	10,764	—	10,764
Kiln furniture	7,527	—	—	109	—	1,711	—	9,347
Lightweight aggregate:								
Concrete block	—	—	4,591,881	—	—	—	—	4,591,886
Structural concrete	—	—	1,785,195	—	—	—	—	1,785,197
Highway surfacing	—	—	726,209	—	—	—	—	726,210
Others	—	—	280,186	—	—	—	—	280,186
Linoleum	—	—	—	—	—	21	—	21
Medical, pharmaceutical, cosmetic	439	1,884	—	—	55	687	—	3,065
Mortar and cement, refractory	(³)	—	—	178,107	(³)	1,668	58,493	238,268
Oil and grease absorbents	—	—	—	—	316,675	—	—	316,676
Paint	142	3,721	1,129	—	1,872	103,964	—	110,828
Paper coating	(³)	(³)	—	—	4	1,310,010	1,227	1,311,242
Paper filling	(³)	(³)	—	—	—	551,807	7,693	559,500
Pelletizing (iron ore)	—	796,528	—	—	—	—	—	796,528
Pelletizing (other)	—	—	—	17,418	—	—	—	17,418
Pesticides and related products	1,223	2,703	—	—	179,919	29,133	—	212,978
Pet absorbent	—	27,337	—	—	339,688	—	—	367,025
Plastics	—	—	(³)	—	(³)	41,703	523	42,226
Plug, tap, and wad	—	—	—	7,668	—	—	—	7,668
Pottery	115,609	—	52,696	22,819	—	7,842	—	198,966
Roofing granules	—	—	(³)	7,534	4	29,434	1,574	38,543
Rubber	218	—	—	—	—	257,157	—	257,378
Sanitaryware	88,244	—	—	—	—	94,416	—	182,660
Sewer pipe, vitrified	102	—	1,016,347	41,153	—	(^d)	—	⁵ 1,057,602
Tamping dummies	—	—	6,604	—	—	—	—	6,604
Textiles	—	—	—	—	—	1,671	—	1,671
Tile:								
Drain	—	—	394,717	—	—	—	—	394,717
Floor and wall, ceramic	102,098	443	70,967	29,376	—	20,306	—	223,190
Quarry	829	—	137,682	—	—	—	—	138,511
Roofing	—	6,864	65,680	—	—	(^d)	—	⁵ 72,544
Structural	—	—	97,014	—	—	—	—	97,014
Terra cotta	—	—	24,913	(³)	(³)	—	1,167	26,080
Other	3	—	—	—	—	—	—	3
Waterproofing and sealing	(^d)	32,159	2,136	—	—	9	—	⁵ 34,303
Miscellaneous ⁶	5,670	52,332	5,350	6,430	2,569	82,171	—	154,522

See footnotes at end of table.

Table 10.—Clays sold or used by producers in the United States¹ in 1975, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Undistributed	76,940	6,668	1,757	20,380	6,055	—	—	(⁷)
Exports	95,920	405,437	20,309	70,955	72,331	820,743	—	1,485,696
Total ⁸	640,697	2,929,543	32,355,920	2,960,152	1,078,701	4,839,060	(⁷)	44,804,072

¹Includes Puerto Rico.

²Total of clays indicated by footnote 3.

³Withheld to avoid disclosing company proprietary data; included with "Undistributed."

⁴Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."

⁵Incomplete figure; remainder included with "Miscellaneous."

⁶Includes graphite anodes, mineral wool and insulation, unknown uses, and data indicated by footnote 3.

⁷Included with total for each specific use.

⁸Data may not add to totals shown because of independent rounding.

Table 11.—Clays sold or used by producers in the United States in 1976, by State¹
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total	Total value
Alabama	121,933	—	338,354	W	—	1,570,647	² 2,030,933	² \$10,325,412
Arizona	—	W	—	25,330	—	W	^{3,4} 25,330	^{3,4} \$361,386
Arkansas	43,986	—	—	—	—	905,401	949,386	3,396,274
California	116,853	336	78,189	79,582	—	1,807,554	2,082,514	13,570,198
Colorado	—	—	26,596	W	—	408,417	² 435,012	² 1,976,210
Connecticut	—	—	—	—	—	118,372	118,372	427,080
Delaware	—	—	—	—	—	10,198	10,198	7,900
Florida	22,271	—	—	—	374,515	220,118	616,904	20,671,838
Georgia	4,467,567	—	9,018	—	472,903	1,828,468	6,777,956	273,145,169
Hawaii	—	—	—	—	—	W	W	W
Idaho	W	—	W	W	—	W	W	W
Illinois	—	—	46,160	—	W	1,141,362	⁵ 1,187,522	⁵ \$3,271,685
Indiana	—	—	1,873	—	—	1,145,450	1,147,323	2,308,429
Iowa	—	—	—	—	—	922,400	922,400	2,244,873
Kansas	—	—	—	W	—	965,092	² 965,092	² 1,868,714
Kentucky	—	W	77,849	—	—	606,385	³ 684,234	³ 2,394,957
Louisiana	—	—	—	—	—	464,998	464,998	1,158,137
Maine	—	—	—	—	—	121,215	121,215	216,060
Maryland	—	W	—	—	—	637,171	³ 637,171	³ 1,816,949
Massachusetts	—	—	—	—	—	114,245	114,245	237,706
Michigan	—	—	—	—	—	1,754,799	1,754,799	4,741,192
Minnesota	W	—	—	—	—	W	W	W
Mississippi	—	W	—	338,795	W	1,010,353	^{3,5} 1,349,147	^{3,5} \$8,849,111
Missouri	61,252	—	734,160	—	—	1,139,695	1,935,107	14,914,610
Montana	—	—	1,148	143,966	—	28,721	173,836	2,356,634
Nebraska	—	—	—	—	—	135,420	135,420	344,683
Nevada	W	—	—	6,815	W	W	^{4,5,6} 6,815	^{4,5,6} 174,300
New Hampshire	—	—	—	—	—	W	W	W
New Jersey	—	—	10,477	—	—	45,359	55,836	330,712
New Mexico	—	—	W	—	—	50,735	50,735	⁷ 116,086
New York	—	W	—	—	—	589,256	³ 589,256	³ 2,089,523
North Carolina	W	—	—	—	—	2,494,769	⁶ 2,494,769	⁶ 4,677,254
North Dakota	—	—	—	—	—	W	W	W
Ohio	—	—	635,100	—	—	3,254,657	3,889,757	14,703,927
Oklahoma	—	—	—	—	—	1,047,487	1,047,487	1,678,247
Oregon	—	—	—	1,646	—	131,776	133,422	315,431
Pennsylvania	W	—	760,908	—	—	1,317,894	⁶ 2,078,802	⁶ 16,036,949

See footnotes at end of table.

Table 11.—Clays sold or used by producers in the United States in 1976, by State¹—Continued
(Metric tons)

State	Kaolin	Ball clay	Fire clay	Ben- tonite	Fuller's earth	Common clay and shale	Total	Total value
Puerto Rico	—	—	—	—	—	W	W	W
South Carolina	565,378	—	—	—	14,515	1,479,675	2,059,568	\$17,288,029
South Dakota	—	—	—	W	—	112,348	² 112,348	² 137,066
Tennessee	—	466,062	—	W	W	921,631	^{2,5} 1,387,693	^{2,5} 11,577,910
Texas	W	14,309	49,292	35,756	W	3,263,065	^{5,6} 3,362,421	^{5,6} 8,846,656
Utah	W	—	4,164	1,814	2,030	179,024	⁶ 187,033	⁶ 530,933
Virginia	—	—	—	—	—	782,026	782,026	1,210,199
Washington	—	—	W	—	—	345,507	⁷ 345,507	⁷ 1,140,537
West Virginia	—	—	W	—	—	249,601	⁷ 249,601	⁷ 463,583
Wisconsin	—	—	—	—	—	W	W	W
Wyoming	—	—	—	2,264,150	—	182,743	2,446,893	40,015,203
Undistributed	159,773	245,832	267,821	295,785	353,100	587,647	1,909,957	37,220,920
Total ⁸	5,559,012	726,538	3,041,111	3,193,637	1,217,063	34,091,678	47,829,039	529,158,672

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes ball clay.

⁴Excludes common clay and shale.

⁵Excludes fuller's earth.

⁶Excludes kaolin.

⁷Excludes fire clay.

⁸Data may not add to totals shown because of independent rounding.

Table 12.—Clays sold or used by producers in the United States¹ in 1976, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	709	1,436	—	—	2,974	68,933	—	74,053
Alum, aluminum sulfate, and other chemicals	—	—	—	—	—	229,081	—	229,081
Animal feed	(³)	142,112	—	—	183	36,246	—	⁴ 178,541
Asphalt emulsion and tiles	(³)	(³)	—	—	—	(³)	33,201	33,201
Building brick:								
Common	(³)	(³)	3,181,907	(³)	—	55,114	6,277	3,243,298
Face	(³)	—	12,725,036	127,745	—	204,820	—	⁴ 13,057,601
Catalysts (oil refining)	(³)	2,011	(³)	—	—	39,416	37,943	79,371
Cement, portland	—	227	9,992,958	—	45,581	15,576	—	10,054,342
Ceramic (hobby and artware)	—	—	54	—	—	1,871	—	1,925
China and dinnerware	45,962	(³)	—	—	—	19,228	—	65,189
Crockery and other earthenware	3,507	—	4,014	(³)	(³)	62,917	24,998	95,437
Drilling mud	(³)	883,190	1,124	—	72,849	20	—	⁴ 957,183
Electrical porcelain	26,735	—	—	—	—	12,171	—	38,906
Fertilizers	249	8,310	17,532	—	40,788	18,312	—	85,191
Fiberglass	—	—	—	—	—	154,601	—	154,601
Filtering, clarifying, and decolorizing:								
Animal oils	—	(³)	—	—	(³)	—	16,465	16,465
Mineral oils and greases	—	17,068	—	—	22,486	—	—	39,554
Vegetable oils	—	143,638	—	—	—	—	—	143,638
Firebrick, block, and shapes	5,205	6,982	2,124	1,921,892	—	12,650	—	1,948,853
Flower pots	(³)	—	32,362	(³)	—	—	16,411	48,773

See footnotes at end of table.

Table 12.—Clays sold or used by producers in the United States¹ in 1976, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Flue linings	—	—	90,838	69,320	—	7,889	—	168,047
Foundry sand	—	586,471	—	111,631	—	4,992	—	703,094
Glazes, glass, and enamels	2,543	33	—	10,011	—	3,572	—	16,158
Grogs and crudes, refractory	(³)	—	—	171,995	—	519,552	—	⁴ 691,547
Gypsum products	—	426	36,287	—	—	4,355	—	41,069
High aluminum (minimum 50% Al ₂ O ₃)refractories	18,779	—	—	262,073	—	56,804	—	337,656
Ink	—	—	—	—	—	10,170	—	10,170
Kiln furniture	6,782	—	—	—	—	1,493	—	8,275
Lightweight aggregate:								
Concrete block	—	—	3,919,640	—	—	—	—	3,919,640
Structural concrete	—	—	1,168,736	—	—	—	—	1,168,736
Highway surfacing	—	—	386,313	—	—	—	—	386,313
Others	—	—	132,298	—	—	—	—	132,298
Linoleum	—	—	—	—	—	318	—	318
Medical, pharmaceutical, cosmetic	—	1,391	—	—	46	1,877	—	3,314
Mortar and cement, refractory	(³)	—	132,217	206,790	(³)	21,237	46,541	406,785
Oil and grease absorbents	13	—	18,144	—	354,869	18	—	373,044
Paint	—	3,239	726	—	2,532	191,690	—	198,186
Paper coating	(³)	(³)	—	—	136	1,437,347	725	1,438,208
Paper filling	(³)	(³)	—	—	(³)	833,467	9,504	842,971
Pelletizing (iron ore)	—	788,296	—	—	—	—	—	788,296
Pelletizing (other)	—	—	—	21,841	—	—	—	21,841
Pesticides and related products	(³)	3,271	13,608	—	185,990	30,510	—	⁴ 233,379
Pet absorbent	—	32,129	(³)	—	383,113	(³)	60,140	475,382
Plastics	—	—	(³)	—	—	55,992	768	56,761
Plug, tap, and wad	—	215	—	4,192	—	—	—	4,407
Pottery	237,004	—	136,107	23,588	—	37,895	—	434,593
Roofing granules	—	—	37,144	—	—	30,303	—	67,446
Rubber	(³)	—	—	—	5	275,439	—	⁴ 275,443
Sanitaryware	71,099	—	—	—	—	74,254	—	145,353
Sewer pipe, vitrified	422	—	1,047,763	39,984	56	—	—	1,088,226
Tamping dummies	—	—	6,604	—	—	—	—	6,604
Textiles	—	—	—	—	—	1,343	—	1,343
Tile:								
Drain	—	—	396,042	—	—	—	—	396,042
Floor and wall, ceramic	82,906	433	112,196	8,899	—	10,576	—	215,009
Quarry	900	—	130,310	—	—	—	—	131,210
Roofing	—	14,034	63,234	—	—	(⁵)	—	⁴ 77,268
Structural	—	—	101,191	—	—	—	—	101,191
Terra cotta	—	—	20,328	998	—	—	—	21,326
Other	2,558	29,916	—	272	7,719	1,089	—	41,555
Waterproofing and sealing	(³)	59,685	—	—	(³)	179	5,469	65,332
Miscellaneous ⁶	14,288	9,518	381	8,000	5,488	125,445	20,761	183,881
Undistributed	109,979	7,377	68,741	33,355	6,008	53,742	—	(⁷)
Exports	96,899	452,230	115,720	18,525	86,239	836,510	—	1,606,122
Total ⁸	726,538	3,193,637	34,091,678	3,041,111	1,217,063	5,559,012	(⁷)	47,829,039

¹Includes Puerto Rico.

²Total of clays indicated by footnote 3.

³Withheld to avoid disclosing company proprietary data; included with "Undistributed."

⁴Incomplete figure; remainder included with "Miscellaneous."

⁵Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."

⁶Includes graphite anodes, mineral wool and insulation, unknown uses, and data indicated by footnote 5.

⁷Included with total for each specific use.

⁸Data may not add to totals shown because of independent rounding.

Table 13.—Clays sold or used by producers in the United States in 1977, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,886,920	241,796	—	299,641	² 2,428,357	² \$21,984,807
Arizona	W	30,229	W	W	—	—	119,514	668,952
Arkansas	—	—	824,099	—	—	72,283	896,381	5,406,935
California	134	86,427	2,187,815	—	—	62,550	2,336,927	12,178,572
Colorado	—	W	840,605	30,877	—	—	² 871,482	² 4,712,339
Connecticut	—	—	86,330	—	—	—	86,330	250,023
Delaware	—	—	9,920	—	—	—	9,920	6,561
Florida	—	—	108,328	—	393,532	24,830	³ 526,690	³ 22,312,987
Georgia	—	—	1,808,188	—	523,202	4,521,056	6,852,445	288,223,200
Hawaii	—	—	W	—	—	—	W	W
Idaho	—	W	W	W	—	W	20,451	92,127
Illinois	—	—	829,019	33,151	W	—	⁴ 862,170	⁴ 5,117,809
Indiana	—	—	1,148,789	1,093	—	—	1,149,882	2,236,552
Iowa	—	—	800,595	—	—	—	800,595	2,460,989
Kansas	—	W	1,013,718	—	—	—	² 1,013,718	² 1,965,100
Kentucky	W	—	561,476	87,573	—	—	⁵ 649,049	⁵ 2,499,768
Louisiana	—	—	364,120	—	—	—	364,120	784,976
Maine	—	—	88,978	—	—	—	88,978	160,427
Maryland	W	—	809,988	—	—	—	⁵ 809,988	⁵ 2,343,614
Massachusetts	—	—	135,523	—	—	—	135,523	274,856
Michigan	—	—	1,821,075	—	—	—	1,821,075	5,125,835
Minnesota	—	—	147,542	—	—	W	147,542	³ 276,483
Mississippi	W	308,561	1,036,794	—	W	—	1,549,067	16,030,657
Missouri	—	—	1,298,848	790,626	W	62,657	⁴ 2,152,131	⁴ 16,891,956
Montana	—	177,139	25,611	662	—	—	203,412	3,557,444
Nebraska	—	—	145,668	—	—	—	145,668	367,533
Nevada	—	8,741	W	—	W	W	48,551	521,367
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	47,195	14,595	—	—	61,790	374,248
New Mexico	—	—	62,972	W	—	—	⁶ 62,972	⁶ 112,734
New York	W	—	511,987	—	—	—	⁵ 511,987	⁵ 1,728,329
North Carolina	—	—	2,741,563	—	—	W	³ 2,741,563	³ 4,989,585
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	2,578,058	658,334	—	—	3,236,392	12,834,544
Oklahoma	—	—	921,601	—	—	—	921,601	1,686,862
Oregon	—	—	107,879	—	—	—	107,879	192,578
Pennsylvania	—	—	1,581,390	509,118	—	W	³ 2,090,508	³ 13,074,564
Puerto Rico	—	—	246,748	—	—	—	246,748	387,246
South Carolina	—	—	1,313,447	—	W	656,380	⁴ 1,969,827	⁴ 18,705,139
South Dakota	—	W	179,115	—	—	—	² 179,115	² 232,727
Tennessee	570,100	W	861,525	—	W	—	³ 1,525,058	³ 17,784,727
Texas	W	35,917	3,252,832	50,890	W	W	3,456,310	16,271,957
Utah	—	6,241	202,003	12,822	W	W	226,246	828,261
Virginia	—	—	807,224	—	—	—	807,224	1,293,836
Washington	—	—	280,634	W	—	—	⁶ 280,634	⁶ 1,091,008
West Virginia	—	—	352,932	W	—	—	⁶ 352,932	⁶ 599,333
Wisconsin	—	—	W	—	—	—	W	W
Wyoming	—	2,505,498	184,949	—	—	—	2,690,447	48,368,571
Undistributed	240,995	240,004	209,160	258,816	379,022	186,925	⁷ 946,379	⁷ 22,549,843
Total ⁸	811,229	3,398,757	34,423,163	2,690,354	1,295,756	5,886,322	48,505,582	579,557,961

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes kaolin.

⁴Excludes fuller's earth.

⁵Excludes ball clay.

⁶Excludes fire clay.

⁷Incomplete total; difference included with "Undistributed."

⁸Data may not add to totals shown because of independent rounding.

Table 14.—Clays sold or used by producers in the United States¹ in 1977, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	181	W	—	—	6,563	W	81,182	87,927
Alum, aluminum sulfate, and other chemicals	—	W	—	—	W	281,971	9,830	291,801
Animal feed	W	176,834	W	—	228	28,741	650	206,453
Asphalt emulsion and tiles	2,939	239	—	—	—	31,669	—	34,847
Building brick:								
Common	W	3,233	2,933,360	65,843	—	52,786	W	3,055,223
Face	W	—	14,091,671	37,580	—	255,802	W	14,385,053
Catalysts (oil refining)	W	11,007	—	—	W	81,221	34,851	127,079
Cement, portland	—	408	9,022,020	—	—	18,019	—	9,040,447
Ceramic (hobby and artware) ...	—	—	W	—	—	10,921	W	10,921
China and dinnerware	38,205	—	—	—	—	25,621	—	63,826
Crockery and other earthenware	6,046	W	3,866	—	—	33,442	W	43,354
Drilling mud	W	961,768	—	—	89,807	W	398	1,051,973
Electrical porcelain	17,481	—	—	—	—	29,995	—	47,477
Fertilizers	W	2,186	—	—	51,217	21,372	W	74,776
Fiberglass, mineral wool, and other insulation	80,151	—	—	—	—	131,545	—	211,695
Filtering, clarifying, and decolorizing:								
Animal oils	—	66,581	—	—	—	—	—	66,581
Mineral oils and greases	—	28,956	—	—	23,792	—	—	52,748
Vegetable oils	—	59,001	—	—	—	—	—	59,001
Firebrick, block, and shapes	6,519	W	10,176	1,763,234	—	297,777	W	2,077,706
Flower pots	W	3	29,526	1,960	—	—	W	31,488
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃) refractories	14,923	—	150,544	204,661	—	120,554	—	490,682
Foundry sand	—	786,806	—	115,178	—	4,603	—	906,587
Glazes, glass, and enamels	1,208	109	—	W	—	3,932	W	5,249
Grogs and crudes, refractory ...	W	—	—	89,560	—	274,821	W	364,381
Gypsum products	—	275	—	—	W	8,101	W	8,376
Ink	—	W	—	—	—	11,529	W	11,529
Kiln furniture	5,806	—	—	—	—	556	—	6,362
Lightweight aggregate:								
Concrete block	—	—	4,126,061	—	46	—	—	4,126,107
Structural concrete	—	—	1,059,650	—	—	—	—	1,059,650
Highway surfacing	—	—	369,702	—	—	—	—	369,702
Others	—	—	119,767	W	—	W	300	120,067
Linoleum and asphalt tile	—	—	—	—	—	32,775	—	32,775
Medical, pharmaceutical, cosmetic	—	4,081	—	W	65	1,671	W	5,817
Mortar and cement, refractory ...	49,851	W	246,105	306,084	W	31,875	54,274	688,189
Oil and grease absorbents	—	W	W	—	399,249	W	27,846	427,095
Paint	—	14,983	W	—	6,945	147,741	W	169,669
Paper coating	28,487	W	—	—	—	1,645,988	W	1,674,476
Paper filling	45,984	W	—	—	3,200	725,767	W	774,951
Pelletizing (iron ore)	—	570,940	—	—	—	W	W	570,940
Pelletizing (other)	—	—	—	18,234	—	—	—	18,234
Pesticides and related products	—	4,536	14,016	—	177,064	20,241	—	215,857
Pet absorbent	—	23,134	W	—	360,034	—	W	383,168
Plastics	—	W	W	—	W	63,432	1,520	64,953
Plug, tap, and wad	—	W	—	6,514	—	—	W	6,514
Pottery	235,512	1	56,744	16,810	—	17,208	—	326,275
Roofing granules	—	—	W	—	W	18,679	49,152	67,831
Rubber	W	W	—	—	48	296,304	886	297,238
Sanitaryware	—	—	—	—	—	145,745	—	145,745

See footnotes at end of table.

Table 14.—Clays sold or used by producers in the United States¹ in 1977, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Sewer pipe, vitrified	—	W	1,249,148	35,336	W	—	148	1,284,632
Tamping dummies	—	—	W	—	—	—	—	W
Tile:								
Drain	—	—	254,021	—	—	—	—	254,021
Floor and wall, ceramic	46,321	—	135,276	435	—	14,122	—	196,154
Quarry	—	—	161,449	W	—	W	773	162,222
Roofing	—	—	75,633	—	—	W	W	75,633
Structural	—	—	65,709	—	—	W	W	65,709
Terra cotta	—	—	W	—	—	—	—	W
Other	—	—	W	—	—	—	—	W
Waterproofing and sealing	W	71,070	—	—	W	118	845	72,033
Miscellaneous ³	68,950	76,730	5,846	564	4,892	71,850	—	228,832
Undistributed	77,630	23,502	137,558	13,812	64,704	114,147	161,279	⁴ 168,695
Exports	85,034	512,374	105,316	14,549	107,901	813,683	—	1,638,857
Total ⁵	811,229	3,398,757	34,423,163	2,690,354	1,295,756	5,886,322	(⁶)	48,505,582

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Total of clays indicated by symbol W.

³Includes graphite anodes and unknown uses.

⁴Incomplete total; remainder included with "Miscellaneous."

⁵Data may not add to total shown because of independent rounding.

⁶Included with total for each specific use.

Table 15.—Clays sold or used by producers in the United States in 1978, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,900,051	383,337	—	240,149	² 2,253,537	² \$24,884,908
Arizona	W	32,479	W	W	—	—	129,555	731,189
Arkansas	—	—	977,840	—	—	53,855	1,031,695	5,119,310
California	288	79,583	2,111,262	—	—	57,810	2,248,942	15,106,031
Colorado	—	W	454,033	42,674	—	—	² 496,707	² 2,753,433
Connecticut	—	—	95,475	—	—	—	95,475	324,210
Delaware	—	—	9,479	—	—	—	9,479	7,837
Florida	—	—	107,404	—	411,433	26,086	544,923	28,849,655
Georgia	—	—	2,109,683	—	561,371	5,018,398	7,689,452	358,653,559
Idaho	—	W	W	W	—	W	24,292	147,785
Illinois	—	—	633,923	38,818	W	—	³ 672,741	³ 3,185,048
Indiana	—	—	1,157,363	894	—	—	1,158,257	2,494,530
Iowa	—	—	811,102	—	—	—	811,102	2,694,011
Kansas	—	W	1,052,987	—	—	—	² 1,158,257	² 2,314,449
Kentucky	W	—	574,187	38,843	—	—	⁴ 613,030	⁴ 2,671,675
Louisiana	—	—	468,887	—	—	—	468,887	4,785,755
Maine	—	—	90,565	—	—	—	90,565	163,895
Maryland	W	—	860,393	—	—	—	⁴ 860,393	⁴ 2,642,315
Massachusetts	—	—	140,651	—	—	—	140,651	332,939
Michigan	—	—	1,924,781	—	—	—	1,924,781	6,993,043
Minnesota	—	—	158,231	—	—	W	⁵ 158,231	⁵ 2,089,514
Mississippi	W	325,013	1,230,301	—	W	—	1,777,683	19,622,829
Missouri	—	—	1,301,099	701,103	W	46,640	³ 2,048,842	³ 16,879,690
Montana	—	164,434	31,863	640	—	—	196,937	3,699,330
Nebraska	—	—	132,734	—	—	—	132,734	417,837
Nevada	—	7,943	W	—	W	W	46,022	513,730

See footnotes at end of table.

Table 15.—Clays sold or used by producers in the United States in 1978, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	47,367	14,376	—	—	61,743	\$375,738
New Mexico	—	—	58,669	W	—	—	⁶ 58,669	⁶ 108,072
New York	W	—	597,625	—	—	—	⁴ 597,625	⁴ 2,121,131
North Carolina	—	—	3,213,678	—	—	—	⁵ 3,213,678	⁵ 9,067,127
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	2,696,910	730,871	—	—	3,427,780	15,394,261
Oklahoma	—	—	924,839	—	—	—	924,839	1,874,322
Oregon	—	—	127,246	—	—	—	127,246	261,194
Pennsylvania	—	—	1,757,458	574,940	—	W	⁵ 2,332,398	⁵ 18,175,134
Puerto Rico	—	—	259,021	—	—	—	259,021	544,065
South Carolina	—	—	1,427,790	—	W	711,812	³ 2,139,602	³ 22,537,630
South Dakota	—	W	195,816	—	—	—	² 195,816	² 267,738
Tennessee	600,770	W	896,115	—	W	—	1,596,404	21,718,849
Texas	W	50,275	3,587,599	45,620	W	W	3,800,057	19,818,416
Utah	—	6,278	229,202	W	W	—	240,126	913,082
Virginia	—	—	946,529	—	—	—	946,529	3,266,027
Washington	—	—	323,657	W	—	—	⁶ 323,657	⁶ 1,417,738
West Virginia	—	—	311,268	W	—	—	⁶ 311,268	⁶ 574,887
Wisconsin	—	—	W	—	—	—	W	W
Wyoming	—	3,131,953	162,911	—	—	—	3,294,864	66,975,003
Undistributed	⁷ 248,296	⁷ 254,987	⁷ 257,205	⁷ 263,701	⁷ 414,844	⁷ 171,335	⁸ 1,007,824	⁸ 24,329,113
Total ⁹	849,353	4,052,944	36,355,201	2,835,818	1,387,647	6,326,086	51,807,049	717,818,034

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fuller's earth.

⁴Excludes ball clay.

⁵Excludes kaolin.

⁶Excludes fire clay.

⁷Total of States indicated by symbol W.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 16.—Clays sold or used by producers in the United States¹ in 1978, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	465	2,492	—	—	1,760	73,578	—	78,296
Alum, aluminum sulfate, and other chemicals	—	—	—	—	W	266,769	W	270,738
Animal feed	W	191,661	W	—	844	8,815	814	202,134
Building brick:				W				
Common	W	4,279	2,783,464	W	—	69,801	159,880	3,017,423
Face	W	W	15,468,489	43,729	—	249,500	32,137	15,793,855
Catalysts (oil refining)	W	15,280	—	—	4,107	45,723	W	128,980
Cement, portland	—	W	10,196,534	—	—	26,369	W	10,223,693
China and dinnerware	38,285	—	—	W	—	29,716	—	68,001
Crockery and other earthenware	15,194	W	2,621	W	—	20,675	5,821	44,311
Drilling mud	W	1,037,862	—	—	101,750	—	W	1,139,726
Electrical porcelain	32,957	—	—	—	—	25,258	—	58,215
Fertilizers	—	2,211	—	—	62,902	27,739	—	92,852
Fiberglass, mineral wool, and other insulation	W	—	—	—	—	182,380	W	210,439

See footnotes at end of table.

Table 16.—Clays sold or used by producers in the United States¹ in 1978, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Filtering, clarifying, and decolorizing:								
Animal oils	—	62,969	—	—	—	—	—	62,969
Mineral oils and greases	—	21,516	—	—	10,185	—	—	31,701
Vegetable oils	—	57,320	—	—	—	—	—	57,320
Firebrick, block, and shapes	7,819	W	W	1,732,150	—	254,270	11,364	2,005,604
Flower pots	W	W	34,708	—	—	16,497	48,829	101,441
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃) refractories	19,014	—	151,504	1,406	—	379,873	—	757,637
Foundry sand	—	939,688	—	125,975	—	2,597	—	1,068,260
Glazes, glass, and enamels	1,597	W	—	W	—	4,340	2,879	8,816
Grogs and crudes, refractory	3,782	—	—	66,485	—	112,838	—	183,105
Gypsum products	—	W	—	—	W	5,751	7,364	13,114
Ink	—	W	—	—	—	W	—	2,390
Kiln furniture	5,666	—	—	—	—	2,575	—	8,241
Lightweight aggregate:								
Concrete block	—	—	3,690,910	—	—	—	—	3,690,910
Structural concrete	—	W	1,064,507	—	—	—	W	1,064,524
Highway surfacing	—	—	465,759	—	—	—	—	465,759
Other	—	—	83,218	—	—	—	—	83,218
Linoleum and asphalt tile	—	—	7,220	—	—	36,273	—	43,493
Medical, pharmaceutical, cosmetic	W	1,163	—	W	W	990	8,692	10,844
Mortar and cement, refractory	52,379	W	184,415	375,177	W	18,234	57,947	688,153
Oil and grease absorbents	—	W	W	—	428,808	—	27,107	455,915
Paint	W	24,476	W	—	8,161	151,772	953	185,361
Paper coating	603	1,721	—	—	—	2,030,640	—	2,032,964
Paper filling	W	W	—	—	3,800	693,631	9,542	706,973
Pelletizing (iron ore)	—	852,261	—	—	—	W	W	854,921
Pelletizing (other)	—	—	—	W	—	—	W	17,237
Pesticides and related products	757	4,314	W	—	164,208	29,984	W	212,718
Pet waste absorbent	—	W	W	—	412,471	W	84,512	496,983
Plastics	—	1,288	W	—	1,004	63,693	W	66,289
Plug, tap, and wad	—	W	—	30,219	—	—	W	30,384
Pottery	239,051	—	53,889	9,443	—	12,007	—	314,389
Roofing granules	—	—	W	—	5,335	37,450	W	64,123
Rubber	651	W	—	—	W	307,231	1,086	308,968
Sanitaryware	128,232	—	—	—	—	109,925	—	238,157
Sewer pipe, vitrified	—	W	1,134,042	12,809	W	—	100	1,146,950
Tamping dummies	—	—	5,697	—	—	—	—	5,697
Tile:								
Drain	—	—	363,562	—	—	—	—	363,562
Floor and wall	103,187	—	109,419	W	—	33,133	W	246,374
Quarry	—	—	160,767	W	—	—	W	171,880
Roofing	—	—	93,887	—	—	1,760	—	95,647
Structural	—	—	23,093	—	—	W	W	23,473
Terra cotta	—	—	310	—	—	—	—	310
Other	3,622	66,807	12,967	W	4,975	28,759	W	117,673
Waterproofing and sealing	489	67,494	W	—	—	W	32,979	100,962
Miscellaneous ³	103,030	93,262	151,915	205,426	68,071	5,056	—	(⁴)
Undistributed	2,254	54,362	—	—	—	89,710	—	⁵ 114,043
Exports	90,318	550,520	112,303	25,752	109,267	870,775	—	1,758,935
Total ⁶	849,353	4,052,944	36,355,201	2,835,818	1,387,647	6,326,086	(⁴)	51,807,049

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Total of clays indicated by symbol W.

³Includes asphalt emulsion, graphite anodes, unknown uses, and data indicated by symbol W.

⁴Included with total for each specific use.

⁵Incomplete total; difference included with "Miscellaneous."

⁶Data may not add to totals shown because of independent rounding.

Table 17.—Clays sold or used by producers in the United States in 1979, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,686,198	224,308	—	422,304	² 2,332,810	² \$33,823,852
Arizona	W	25,561	W	—	—	—	125,574	642,162
Arkansas	—	—	827,548	—	—	119,762	947,311	7,685,510
California	410	73,627	2,167,517	—	—	54,460	2,296,014	18,621,176
Colorado	—	W	434,873	38,008	—	—	² 472,881	² 7,717,230
Connecticut	—	—	101,222	—	—	—	101,222	434,701
Delaware	—	—	9,798	—	—	—	9,798	8,640
Florida	—	—	144,311	—	445,286	28,113	617,710	32,909,669
Georgia	—	—	1,489,769	—	563,508	5,496,738	7,550,015	437,671,308
Idaho	—	W	W	W	—	W	25,439	263,465
Illinois	—	—	467,490	24,058	W	—	³ 491,548	³ 2,355,435
Indiana	—	—	1,074,359	963	—	—	1,075,322	2,340,711
Iowa	—	—	788,957	—	—	—	788,958	2,883,074
Kansas	—	W	962,406	—	—	—	² 962,406	² 2,635,856
Kentucky	W	—	665,955	54,689	—	—	⁴ 720,644	⁴ 3,258,996
Louisiana	—	—	376,950	—	—	—	376,950	6,073,392
Maine	—	—	81,674	—	—	—	81,674	163,004
Maryland	W	—	884,352	—	—	—	⁴ 884,352	⁴ 2,854,067
Massachusetts	—	—	141,110	—	—	—	141,110	367,070
Michigan	—	—	1,879,784	—	—	—	1,879,786	7,429,990
Minnesota	—	—	122,900	—	—	W	⁵ 122,900	⁵ 1,904,984
Mississippi	W	288,556	1,108,039	—	W	—	1,650,979	21,841,270
Missouri	—	—	1,358,202	724,919	—	49,765	2,132,886	20,522,192
Montana	—	349,954	34,635	456	—	—	385,045	11,507,793
Nebraska	—	—	141,651	—	—	—	141,652	453,984
Nevada	—	30,930	W	—	W	W	68,973	1,162,703
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	47,126	13,648	—	—	60,774	558,956
New Mexico	—	—	67,410	W	—	—	⁶ 67,410	⁶ 124,242
New York	W	—	758,027	—	—	—	⁴ 758,027	⁴ 3,027,177
North Carolina	—	—	3,001,281	—	—	W	⁵ 3,001,281	⁵ 8,385,151
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	2,449,700	610,811	—	—	3,060,511	13,494,990
Oklahoma	—	—	860,612	—	—	—	860,612	1,999,129
Oregon	—	—	126,269	—	—	—	126,269	262,740
Pennsylvania	—	—	1,599,516	639,307	—	W	⁵ 2,238,823	⁵ 20,099,305
Puerto Rico	—	—	235,616	—	—	—	235,616	555,757
South Carolina	—	—	1,365,081	—	W	695,790	³ 2,060,871	³ 24,491,683
South Dakota	—	—	186,398	—	—	—	186,398	291,506
Tennessee	⁶ 91,399	W	632,371	—	W	—	1,416,240	26,070,795
Texas	W	59,715	3,275,161	52,978	W	W	3,511,891	21,533,353
Utah	—	7,497	309,035	W	W	—	321,667	1,246,001
Virginia	—	—	960,302	—	—	—	960,302	3,512,044
Washington	—	—	307,320	W	—	—	⁶ 307,320	⁶ 1,549,254
West Virginia	—	—	299,651	W	—	—	⁶ 299,651	⁶ 591,668
Wisconsin	—	—	W	—	—	—	W	W
Wyoming	—	2,980,105	168,982	—	—	—	3,149,087	75,096,102
Undistributed	⁷ 203,593	⁷ 195,697	⁷ 219,211	⁷ 276,035	⁷ 413,897	⁷ 173,375	⁸ 842,281	⁸ 21,222,590
Total ⁹	895,402	4,011,640	33,818,771	2,660,178	1,422,690	7,040,300	49,848,981	846,644,677

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fuller's earth.

⁴Excludes ball clay.

⁵Excludes kaolin.

⁶Excludes fire clay.

⁷Total of States indicated by symbol W.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 18.—Clays sold or used by producers in the United States¹ in 1979, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	498	1,106	—	W	920	W	61,064	63,588
Alum, aluminum sulfate, and chemicals	—	—	—	—	W	316,657	—	316,657
Animal feed	W	166,965	—	—	631	11,841	W	179,438
Building brick:								
Common	W	W	3,674,427	W	—	73,770	13,317	3,761,514
Face	W	W	12,821,793	46,152	—	250,389	23,919	13,142,252
Catalysts (oil refining)	W	4,092	W	—	3,504	56,401	54,384	118,381
Cement, portland	—	W	9,532,086	W	—	11,609	1,955	9,545,650
China and dinnerware	40,348	—	—	—	—	33,378	—	73,726
Crockery and other earthenware	20,417	W	7,504	—	—	11,656	W	39,578
Drilling mud	W	1,157,691	—	—	95,082	W	152	1,252,925
Electrical porcelain	31,806	—	—	—	—	26,926	—	58,732
Fertilizers	—	4,322	—	—	74,598	24,733	—	103,652
Fiberglass, mineral wool, and other insulation	W	W	—	—	—	196,417	39,743	236,160
Filtering, clarifying, and decolorizing:								
Animal oil	—	79,722	—	—	—	—	—	79,722
Mineral oils and greases	—	9,026	—	—	21,056	—	—	30,082
Vegetable oil	—	16,790	—	—	—	—	—	16,790
Firebrick, block, and shapes	7,685	W	W	1,776,349	—	353,143	9,120	2,146,296
Flower pots	—	—	35,744	907	—	W	W	36,651
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃)								
refractories	6,476	—	148,113	172,366	—	49,204	—	376,160
Foundry sand	—	813,085	—	146,186	—	699	—	959,970
Glazes, glass, and enamels	1,491	W	—	—	—	3,267	W	4,758
Grogs and crudes, refractory	3,894	W	—	81,922	—	517,389	W	603,205
Gypsum products	—	W	—	—	W	5,971	10,160	16,131
Ink	—	W	—	—	—	W	—	1,856
Kiln furniture	1,984	—	21,047	—	—	2,080	—	25,111
Lightweight aggregate:								
Concrete block	—	—	3,451,057	—	—	—	—	3,451,057
Structural concrete	—	—	1,144,850	—	—	—	—	1,144,850
Highway surfacing	—	—	427,188	—	—	—	—	427,188
Other	—	—	130,864	—	—	—	—	130,864
Linoleum and asphalt tile	5,481	—	1,301	—	—	39,500	—	46,282
Medical, pharmaceutical, cosmetic	W	2,989	—	W	W	2,095	8,733	18,353
Mortar and cement, refractory	70,161	—	180,058	334,360	W	33,307	W	617,886
Oil and grease absorbents	—	—	W	—	403,702	W	33,771	437,473
Paint	W	12,614	W	—	3,540	153,426	762	170,342
Paper coating	709	W	—	—	W	2,065,275	423	2,066,407
Paper filling	W	W	—	—	W	781,183	13,589	794,772
Pelletizing (iron ore)	—	818,016	—	—	—	W	W	818,016
Pelletizing (other)	—	W	—	W	—	—	—	12,988
Pesticides and related products	664	3,801	W	—	180,798	41,781	W	227,045
Pet waste absorbent	—	W	W	—	410,471	W	80,690	491,161
Plastics	—	W	W	—	W	59,178	2,313	61,492
Plug, tap, and wad	—	—	—	5,670	—	—	—	5,670
Pottery	224,130	—	210,819	14,598	—	29,687	—	479,234
Roofing granules	—	—	W	—	W	12,899	25,845	38,173
Rubber	W	W	—	—	—	310,268	2,144	312,412
Sanitaryware	137,534	—	—	—	—	133,346	—	270,880
Sewer pipe, vitrified	—	W	915,918	W	W	W	40,931	956,850

See footnotes at end of table.

Table 18.—Clays sold or used by producers in the United States¹ in 1979, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Tamping dummies	—	—	5,697	—	—	W	W	5,697
Tile:								
Drain	—	—	282,943	—	—	—	—	282,943
Floor and wall	102,911	W	100,710	W	—	24,784	753	229,912
Quarry	—	—	171,397	—	—	W	W	171,397
Roofing	—	W	92,977	—	—	W	673	93,651
Structural	—	—	33,161	—	—	W	W	33,161
Terra cotta	—	—	1,371	—	—	—	—	1,371
Waterproofing and sealing	—	68,668	—	—	—	640	—	69,308
Miscellaneous ³	23,378	99,493	219,007	28,313	5,489	79,189	—	454,870
Undistributed	104,559	112,701	136,420	35,854	83,187	73,439	134,574	433,377
Exports	111,275	640,559	72,318	17,501	139,711	1,254,771	—	2,236,135
Total ⁵	895,402	4,011,640	33,818,771	2,660,178	1,422,690	7,040,300	(⁶)	49,848,981

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Total of clays indicated by symbol W.

³Includes asphalt emulsion, graphite anodes, unknown uses, and data indicated by symbol W.

⁴Incomplete total; difference included with "Miscellaneous."

⁵Data may not add to totals shown because of independent rounding.

⁶Included with total for each specific use.

Table 19.—Clays sold or used by producers in the United States in 1980, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,256,891	202,435	—	374,822	² 1,834,148	² \$29,831,488
Arizona	W	31,892	W	—	—	—	136,574	1,151,324
Arkansas	—	—	849,678	—	—	193,555	1,043,233	14,402,465
California	W	58,392	2,197,290	W	—	47,175	2,320,954	17,765,630
Colorado	—	33,530	249,797	21,889	—	—	305,216	2,223,278
Connecticut	—	—	83,632	—	—	—	83,632	481,692
Florida	—	—	150,305	—	378,621	27,920	³ 556,846	³ 24,163,771
Georgia	—	—	1,199,819	—	588,583	5,725,614	7,514,016	500,554,800
Idaho	—	W	W	W	—	W	24,807	300,774
Illinois	—	—	398,674	17,924	W	—	⁴ 416,598	⁴ 1,918,873
Indiana	—	—	845,283	232	—	—	845,515	1,929,500
Iowa	—	—	683,908	—	—	—	683,908	2,555,129
Kansas	—	27,216	776,351	—	—	—	806,567	2,324,805
Kentucky	W	—	628,047	50,310	—	—	⁵ 678,357	⁵ 3,691,921
Louisiana	—	—	344,583	—	—	—	344,583	5,841,314
Maine	—	—	70,691	—	—	—	70,691	173,803
Maryland	W	—	665,104	—	—	—	⁵ 665,104	⁵ 2,267,089
Massachusetts	—	—	190,923	—	—	—	190,923	870,273
Michigan	—	—	1,798,002	—	—	—	1,798,002	7,211,572
Minnesota	—	—	84,967	—	—	—	84,967	1,206,310
Mississippi	W	249,474	956,578	—	W	—	1,447,465	21,714,159
Missouri	—	—	944,124	634,587	—	69,956	1,648,667	16,797,962
Montana	—	549,872	17,293	485	—	—	567,650	22,200,218
Nebraska	—	—	139,508	—	—	—	139,508	456,295
Nevada	—	10,161	W	—	W	W	58,480	2,082,297
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	47,369	10,196	—	—	57,565	524,683
New Mexico	—	—	54,310	W	—	—	⁶ 54,310	⁶ 113,910

See footnotes at end of table.

Table 19.—Clays sold or used by producers in the United States in 1980, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
New York	W	—	540,847	—	—	—	⁵ 540,847	⁵ \$2,479,416
North Carolina	—	—	2,587,064	—	—	W	³ 2,587,064	³ 7,307,603
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	2,089,924	372,229	—	3,266	2,465,419	11,516,403
Oklahoma	—	—	881,444	—	—	—	881,444	2,249,374
Oregon	—	—	155,755	—	—	—	155,755	321,214
Pennsylvania	—	—	1,216,151	280,333	—	W	³ 1,496,484	³ 12,112,190
Puerto Rico	—	—	263,869	—	—	—	263,869	677,050
South Carolina	—	—	1,408,696	—	W	596,703	⁴ 2,005,399	⁴ 25,168,879
South Dakota	—	W	153,009	—	—	—	² 153,009	² 283,080
Tennessee	549,377	W	453,419	—	W	—	1,077,845	22,844,243
Texas	W	98,567	3,152,786	51,466	W	W	3,414,132	27,022,341
Utah	—	7,715	316,194	W	W	—	331,264	1,517,212
Virginia	—	—	690,941	—	—	—	690,941	3,172,455
Washington	—	—	273,153	W	—	—	⁶ 273,153	⁶ 1,571,409
West Virginia	—	—	263,950	W	—	—	⁶ 263,950	⁶ 642,183
Wisconsin	—	—	W	—	—	—	W	W
Wyoming	—	2,610,008	184,743	—	—	—	2,794,750	71,511,898
Undistributed	⁷ 261,305	⁷ 119,397	⁷ 213,756	⁷ 258,794	⁷ 424,239	⁷ 108,693	⁸ 755,151	⁸ 22,604,254
Total ⁹	810,682	3,796,224	29,478,829	1,900,880	1,391,443	7,147,704	44,525,762	897,756,539

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes kaolin.

⁴Excludes fuller's earth.

⁵Excludes ball clay.

⁶Excludes fire clay.

⁷Total of States indicated by symbol W.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 20.—Clays sold or used by producers in the United States¹ in 1980, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Adhesives	1,464	3,353	—	—	879	68,652	68,652	74,348
Alum, aluminum sulfate, and other chemicals	—	18,722	—	—	W	318,876	W	336,598
Animal feed	W	154,617	—	—	281	15,217	W	170,115
Building brick:								
Common	—	—	2,358,887	—	—	27,461	—	2,386,348
Face	W	W	11,143,582	16,251	—	206,551	29,819	11,396,203
Catalysts (oil refining)	W	7,912	W	—	—	60,856	40,763	109,531
Cement, portland	—	W	8,717,485	—	—	17,188	W	8,734,674
China and dinnerware	33,845	—	—	—	—	32,709	—	66,554
Crockery and other earthenware	12,270	—	4,859	—	—	7,747	—	24,876
Drilling mud	W	1,300,188	—	—	144,838	W	424	1,445,449
Electrical porcelain	25,545	—	W	—	—	31,150	W	56,695
Fertilizers	—	4,226	—	—	77,761	37,734	—	119,721
Fiberglass, mineral wool, and other insulation	W	W	—	—	—	167,757	35,328	203,084
Filtering, clarifying, and decolorizing:								
Animal oils	—	81,883	—	—	—	W	W	81,883
Mineral oils and greases	—	11,300	—	—	20,247	—	—	31,546

See footnotes at end of table.

Table 20.—Clays sold or used by producers in the United States¹ in 1980, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total
Vegetable oils	—	8,384	—	—	—	—	—	8,384
Firebrick, block, and shapes	13,839	W	75,054	1,302,113	—	183,211	W	1,574,216
Flower pots	—	—	29,664	454	—	960	960	31,077
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃) refractories	8,172	—	66,791	152,675	—	41,359	—	268,998
Foundry sand	—	573,413	W	46,392	—	1,491	W	621,296
Glazes, glass, and enamels	2,547	W	—	—	—	3,445	W	5,992
Grogs and crudes, refractory	953	W	—	66,717	—	734,694	W	802,364
Gypsum products	—	—	—	—	W	9,805	W	18,580
Ink	—	W	—	—	—	W	—	1,844
Kiln furniture	2,272	—	—	—	—	1,865	—	4,138
Lightweight aggregate:								
Concrete block	—	—	3,224,947	—	—	—	—	3,224,947
Structural concrete	—	W	1,231,104	—	—	—	W	1,231,104
Highway surfacing	—	—	313,983	—	—	—	—	313,983
Others	—	—	162,901	—	—	—	—	162,901
Linoleum and asphalt tile	4,454	—	1,301	—	—	10,654	—	16,409
Medical, pharmaceutical, cosmetic	—	2,224	—	—	74	1,805	—	4,103
Mortar and cement, refractory . . .	81,247	W	258,955	239,028	W	36,478	46,701	662,409
Oil and grease absorbents	—	W	W	—	357,851	W	25,898	383,749
Paint	—	12,801	W	—	3,386	149,141	W	165,328
Paper coating	714	W	—	—	—	2,273,955	W	2,274,669
Paper filling	11,872	W	—	—	2,271	874,119	W	888,262
Pelletizing (iron ore)	—	782,345	—	—	—	W	W	782,345
Pesticides and related products . . .	815	5,393	W	—	163,832	44,301	W	214,342
Pet waste absorbent	—	W	W	—	383,905	—	70,474	454,379
Plastics	—	W	—	—	W	53,826	2,399	56,225
Plug, tap, and wad	—	—	—	5,485	—	—	—	5,485
Pottery	201,196	—	234,784	10,898	—	25,625	—	472,504
Roofing granules	—	—	W	—	W	17,736	4,547	22,283
Rubber	W	W	—	—	328	251,394	48,385	300,107
Sanitaryware	76,599	—	—	—	—	119,963	—	196,562
Sewer pipe, vitrified	—	—	698,907	W	—	—	W	698,907
Tamping dummies	—	—	3,810	—	—	—	—	3,810
Tile:								
Drain	—	—	168,062	—	—	W	W	168,062
Floor and wall	82,180	W	149,519	W	—	21,049	1,052	253,800
Quarry	—	—	181,235	W	—	—	W	181,235
Roofing	—	—	52,025	—	—	—	—	52,025
Structural	—	—	38,696	—	—	W	W	38,696
Terra cotta	—	—	1,120	—	—	—	—	1,120
Waterproofing and sealing	—	83,147	W	—	—	630	W	83,777
Miscellaneous ³	123,194	49,566	156,141	15,004	60,765	8,850	—	413,520
Undistributed	9,634	121,575	178,772	31,305	11,488	58,286	107,315	⁴ 293,217
Exports	117,867	575,174	26,243	14,559	163,537	1,231,163	—	1,930,983
Total	810,682	3,796,224	29,478,829	1,900,880	1,391,443	7,147,704	(⁵)	⁶ 44,525,762

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Total of clays indicated by symbol W.

³Includes asphalt emulsion, graphite anodes, unknown uses, and data indicated by symbol W.

⁴Incomplete total; difference included with "Miscellaneous."

⁵Included with total for each specific use.

⁶Data do not add to total shown because of independent rounding.

Table 21.—Clays sold or used by producers in the United States in 1981, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,272,687	233,944	—	226,247	² 1,732,878	² \$25,406,161
Arizona	—	30,155	104,257	—	—	—	134,412	1,105,236
Arkansas	—	—	669,716	—	—	128,533	798,248	9,332,946
California	W	68,298	1,980,591	W	—	29,313	2,094,489	19,118,482
Colorado	—	37,285	190,543	22,446	—	—	250,274	1,734,234
Connecticut	—	—	66,092	—	—	—	66,092	390,668
Florida	—	—	164,168	—	469,950	29,094	663,212	³ 35,318,515
Georgia	—	—	1,097,149	—	529,889	5,657,085	7,284,123	553,726,128
Idaho	—	W	W	W	—	W	23,899	288,377
Illinois	—	—	272,330	19,553	W	—	⁴ 291,882	⁴ 1,540,081
Indiana	—	—	626,496	—	—	—	626,496	1,601,914
Iowa	—	—	432,046	—	—	—	432,046	2,374,802
Kansas	—	24,494	805,321	—	—	—	829,815	4,756,060
Kentucky	W	—	439,220	5,275	—	—	⁵ 444,495	⁵ 2,394,327
Louisiana	—	W	344,659	—	—	—	² 344,659	² 6,337,687
Maine	—	—	51,392	—	—	—	51,392	166,460
Maryland	W	—	541,418	—	—	—	⁵ 541,418	⁵ 1,984,202
Massachusetts	—	—	234,828	—	—	—	234,828	1,322,424
Michigan	—	—	1,460,171	—	—	—	1,460,171	5,862,484
Minnesota	—	—	76,002	—	—	—	76,002	1,077,154
Mississippi	W	258,952	588,895	—	W	—	1,104,684	23,309,359
Missouri	—	—	883,335	606,761	—	94,790	1,584,886	18,413,648
Montana	—	532,509	11,880	495	—	—	544,884	23,110,541
Nebraska	—	—	123,345	—	—	—	123,345	409,278
Nevada	—	12,816	W	—	W	—	66,176	2,947,865
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	46,979	9,656	—	—	56,636	562,898
New Mexico	—	—	57,806	W	—	—	⁶ 57,806	⁶ 118,811
New York	W	—	541,840	—	—	—	⁵ 541,840	⁵ 2,310,037
North Carolina	—	—	1,914,505	—	—	W	³ 1,914,505	³ 6,838,420
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	1,681,288	326,615	—	3,259	2,011,161	10,411,492
Oklahoma	—	—	760,529	—	—	—	760,529	2,063,568
Oregon	—	—	159,990	—	—	—	159,990	299,642
Pennsylvania	—	—	925,578	205,123	—	W	³ 1,130,701	³ 7,497,144
Puerto Rico	—	—	181,481	—	—	—	181,481	473,932
South Carolina	—	—	823,209	—	W	657,459	⁴ 1,480,667	⁴ 28,600,339
South Dakota	—	W	105,460	—	—	—	² 105,460	² 209,050
Tennessee	507,541	W	365,895	—	W	—	949,927	23,134,060
Texas	W	105,321	3,539,656	38,048	W	W	3,785,106	29,134,663
Utah	—	7,117	224,321	W	W	—	262,733	2,295,997
Virginia	—	—	455,252	—	—	—	455,252	2,015,834
Washington	—	—	238,274	W	—	—	⁶ 238,274	⁶ 1,524,212
West Virginia	—	—	199,302	W	—	—	⁶ 199,302	⁶ 502,231
Wyoming	—	3,251,611	245,765	—	—	—	3,497,376	100,926,186
Undistributed	⁷ 259,175	⁷ 159,430	⁷ 83,366	⁷ 280,341	⁷ 502,327	⁷ 123,693	⁸ 848,084	⁸ 26,371,300
Total ⁹	766,716	4,487,988	24,987,037	1,748,257	1,502,166	6,949,473	40,441,638	989,318,849

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes kaolin.

⁴Excludes fuller's earth.

⁵Excludes ball clay.

⁶Excludes fire clay.

⁷Total of States indicated by symbol W.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 22.—Clays sold or used by producers in the United States¹ in 1981, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Adhesives	3,245	347	—	—	1,112	64,875	—	69,578
Alum, aluminum sulfate, and other chemicals	66,495	1,854	—	—	W	409,457	W	477,806
Animal feed	W	142,531	—	W	5,415	10,913	1,431	160,291
Building brick:								
Common	W	W	1,786,963	W	—	30,329	24,202	1,841,494
Face	W	W	9,278,060	W	—	214,750	29,540	9,522,349
Catalysts (oil refining)	W	7,034	—	—	W	116,668	28,858	152,560
Cement, portland	—	W	7,932,924	W	—	9,167	2,575	7,944,665
China and dinnerware	33,806	—	—	—	—	23,186	—	56,992
Crockery and other earthenware	8,378	—	W	—	—	1,285	W	9,663
Drilling mud	W	1,873,012	—	—	175,372	W	2,397	2,050,781
Electrical porcelain	21,558	—	W	—	—	21,548	W	43,107
Fertilizers	—	3,678	—	—	71,017	26,815	—	101,510
Fiberglass	—	5,583	—	—	—	123,062	—	128,645
Filtering, clarifying, and decolorizing:								
Animal oils	—	81,556	—	—	—	—	—	81,556
Mineral oils and greases	—	13,982	—	—	18,731	—	—	32,712
Vegetable oils	—	50,496	—	—	—	—	—	50,496
Firebrick, block, and shapes	6,074	W	58,249	1,136,656	—	119,106	W	1,320,085
Flower pots	—	—	29,647	544	—	1,129	—	31,321
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃)								
refractories	8,554	—	32,833	138,905	—	61,858	—	242,149
Foundry sand	—	718,236	W	32,875	—	731	W	751,842
Glazes, glass, and enamels	2,329	W	—	—	—	4,430	W	6,759
Grogs and crudes, refractory	1,028	—	W	145,834	W	576,722	W	723,583
Gypsum products	—	—	—	—	—	11,489	W	11,489
Ink	—	—	—	—	—	10,709	—	10,709
Kiln furniture	2,304	—	—	—	—	4,610	—	6,915
Lightweight aggregate:								
Concrete block	—	—	2,706,664	—	—	—	—	2,706,664
Structural concrete	—	—	1,406,204	—	—	—	—	1,406,204
Highway surfacing	—	—	209,429	—	—	—	—	209,429
Others	—	—	117,250	—	—	—	—	117,250
Linoleum and asphalt tile	3,563	—	—	—	—	4,495	—	8,058
Medical, pharmaceutical, cosmetic	—	2,556	—	—	67	894	—	3,518
Mortar and cement, refractory	79,013	W	189,838	187,119	47,002	23,351	W	526,322
Oil and grease absorbents	—	W	—	—	402,142	W	42,731	444,874
Paint	W	13,074	W	—	4,851	69,822	4,945	92,693
Paper coating	797	W	—	—	—	2,182,238	W	2,183,035
Paper filling	13,295	W	—	—	4,057	1,075,078	W	1,092,429
Pelletizing (iron ore)	—	802,837	—	—	—	—	—	802,837
Pesticides and related products	692	3,064	W	—	167,120	73,174	W	244,051
Pet waste absorbent	—	W	W	—	381,686	—	61,750	443,437
Plastics	—	W	W	—	W	60,171	9,198	69,369
Plug, tap, and wad	—	—	—	2,712	—	—	—	2,712
Pottery	198,696	—	136,324	11,294	—	17,735	—	364,049
Roofing granules	W	—	—	—	W	9,438	35,453	44,891
Rubber	W	W	—	—	229	188,382	1,827	190,438
Sanitaryware	73,326	—	—	—	—	141,143	—	214,469
Sewer pipe, vitrified	—	—	547,556	W	—	—	W	547,556
Tamping dummies	—	—	3,992	—	—	—	—	3,992
Tile:								
Drain	—	—	104,606	—	—	W	W	104,606

See footnotes at end of table.

Table 22.—Clays sold or used by producers in the United States¹ in 1981, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Tile—Continued								
Floor and wall, ceramic	74,494	—	70,238	544	—	16,202	—	161,479
Quarry	—	—	138,275	W	—	—	W	138,275
Roofing	—	—	31,594	—	—	1,457	—	33,051
Structural	—	—	38,203	—	—	—	—	38,203
Terra cotta	—	—	1,456	—	—	—	—	1,456
Waterproofing and sealing	—	82,353	18	—	—	8,501	—	90,873
Miscellaneous ⁴	9,116	63,625	36,646	18,194	7,861	60,301	—	195,743
Exports	101,962	571,007	24,072	19,812	173,663	1,136,901	—	2,027,417
Total	708,725	4,436,825	24,881,039	1,694,488	1,460,325	6,912,126	244,906	⁵ 40,338,435
Total undistributed	57,992	51,163	105,998	53,769	41,841	37,347	103,203	103,203
Grand total	⁵ 766,716	4,487,988	24,987,037	1,748,257	1,502,166	6,949,473	NAp	40,441,638

W Withheld to avoid disclosing company proprietary data; included with "Total undistributed." NAp Not applicable.

¹Includes Puerto Rico.

²Publishable total of clays indicated by symbol W; unpublished data included with "Total undistributed."

³Data may show incomplete total; difference included with "Total undistributed."

⁴Included asphalt, emulsion, graphite anodes, and unknown uses.

⁵Data do not add to total shown because of independent rounding.

Table 23.—Clays sold or used by producers in the United States in 1982, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,046,074	81,193	—	73,333	² 1,200,600	² \$13,192,542
Arizona	—	24,964	104,744	—	—	—	129,707	997,674
Arkansas	—	—	493,237	—	—	77,289	570,527	6,657,823
California	W	68,628	1,490,104	W	—	23,035	1,598,517	15,642,417
Colorado	—	3,683	176,811	2,204	—	—	182,698	1,123,904
Connecticut	—	—	50,688	—	—	—	50,688	329,459
Florida	—	—	184,187	—	401,205	23,888	609,280	³ 31,339,205
Georgia	—	—	880,370	—	484,604	4,779,375	6,144,349	475,767,539
Idaho	—	91	W	W	—	W	7,325	101,356
Illinois	—	—	402,840	9,493	W	—	⁴ 412,333	⁴ 2,305,455
Indiana	—	—	454,430	—	—	—	454,430	1,220,519
Iowa	—	—	396,225	—	—	—	396,225	2,391,983
Kansas	—	13,608	588,638	—	—	—	602,246	3,656,235
Kentucky	W	—	516,729	8,798	—	—	⁵ 525,527	⁵ 2,038,783
Louisiana	—	15,580	280,015	—	—	—	295,595	⁶ 6,215,920
Maine	—	—	34,009	—	—	—	34,009	75,782
Maryland	W	—	367,171	—	—	—	⁵ 367,171	⁵ 1,346,287
Massachusetts	—	—	190,839	—	—	—	190,839	1,114,663
Michigan	—	—	927,539	—	—	—	927,539	4,369,853
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	210,100	299,241	—	W	—	730,109	21,181,373
Missouri	—	—	772,272	406,118	W	76,474	⁴ 1,254,864	⁴ 13,408,601
Montana	—	188,585	8,777	495	—	—	197,857	⁶ 8,064,312
Nebraska	—	—	121,279	—	—	—	121,279	391,617
Nevada	—	13,154	W	—	14,188	W	93,053	2,639,633
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	45,867	11,016	—	—	56,883	566,160
New Mexico	—	—	54,380	W	—	—	⁶ 54,380	⁶ 112,459
New York	W	—	319,619	—	—	—	⁵ 319,619	⁵ 896,647
North Carolina	—	—	1,427,336	—	—	W	³ 1,427,336	³ 5,243,016
North Dakota	—	—	W	—	—	—	W	W

See footnotes at end of table.

Table 23.—Clays sold or used by producers in the United States in 1982, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Ohio	—	—	1,178,503	137,973	—	—	1,316,476	\$6,099,607
Oklahoma	—	—	682,074	—	—	—	682,074	1,907,322
Oregon	—	—	135,533	—	—	—	135,533	212,385
Pennsylvania	—	—	721,251	123,269	—	W	³ 844,520	³ 5,616,057
Puerto Rico	—	—	146,998	—	—	—	146,998	297,911
South Carolina	—	—	817,903	15,792	W	558,596	⁴ 1,392,290	⁴ 28,165,837
South Dakota	—	W	116,244	—	—	—	² 116,244	² 345,705
Tennessee	381,523	W	203,066	—	W	W	694,680	20,107,083
Texas	W	91,145	3,574,159	34,920	W	W	3,803,515	26,497,224
Utah	—	6,236	158,940	741	W	—	⁴ 165,917	⁴ 994,432
Virginia	—	—	380,419	—	2,595	—	383,014	2,237,051
Washington	—	—	221,447	6,202	—	—	227,649	1,829,407
West Virginia	—	—	190,194	W	—	—	⁶ 190,194	⁶ 583,478
Wyoming	—	2,184,298	139,043	—	—	—	2,323,342	73,695,852
Undistributed	⁷ 201,335	⁷ 123,562	⁷ 101,600	⁷ 147,870	⁷ 623,887	⁷ 159,704	⁸ 834,118	⁸ 34,380,930
Total ⁹	582,858	2,943,634	20,400,795	986,084	1,526,479	5,771,695	32,211,546	825,361,498

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes kaolin.

⁴Excludes fuller's earth.

⁵Excludes ball clay.

⁶Excludes fire clay.

⁷Total of States indicated by symbol W.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 24.—Clays sold or used by producers in the United States¹ in 1982, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Adhesives	W	162	—	W	600	65,046	1,494	67,302
Alum, aluminum sulfate, and other chemicals	—	W	—	—	1,500	289,051	W	290,550
Animal feed	10,569	127,443	—	448	9	5,051	—	143,520
Building brick:								
Common	W	W	2,118,115	—	W	7,553	26,561	2,152,229
Face	—	—	6,885,427	23,074	—	221,545	—	7,130,047
Catalysts (oil refining)	W	3,915	—	—	4,304	168,293	W	176,511
Cement, portland	—	W	6,375,300	W	—	34,851	2,233	6,412,385
China and dinnerware	25,757	—	—	—	—	22,251	—	48,008
Crockery and other earthenware	W	—	W	—	—	W	15,991	15,991
Drilling mud	W	1,292,146	5,017	—	99,088	W	1,893	1,398,144
Electrical porcelain	13,825	—	—	—	—	25,301	—	39,127
Fertilizers	—	2,494	—	—	66,726	15,023	—	84,243
Fiberglass, mineral wool, and other insulation	—	W	—	—	—	178,222	W	178,222
Filtering, clarifying, and decolorizing:								
Animal oils	—	95,823	—	—	—	W	W	95,823
Mineral oils and greases	—	14,904	—	—	17,329	—	—	32,233
Vegetable oils	—	24,616	—	—	—	—	—	24,616
Firebrick, block, and shapes	W	W	25,965	548,402	—	78,490	9,377	662,233
Flower pots	—	—	24,947	W	—	—	W	24,947

See footnotes at end of table.

Table 24.—Clays sold or used by producers in the United States¹ in 1982, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃) refractories	6,974	—	29,261	151,991	—	87,091	—	275,317
Foundry sand	—	466,539	W	21,867	—	454	W	488,860
Grogs and crudes, refractory	W	—	W	104,450	—	199,997	W	304,447
Gypsum products	—	—	—	—	W	6,225	W	6,225
Ink	—	W	—	—	—	11,941	W	11,941
Kiln furniture	1,815	—	—	—	—	1,392	—	3,207
Lightweight aggregate:								
Concrete block	—	—	1,952,305	—	—	W	W	1,952,305
Structural concrete	—	—	1,142,317	—	—	—	—	1,142,317
Highway surfacing	—	—	216,534	—	—	—	—	216,534
Others	—	—	348,725	—	—	—	—	348,725
Linoleum and asphalt tile	—	—	7,257	—	—	3,114	—	10,372
Medical, pharmaceutical, cosmetic	—	7,303	—	—	102	1,510	—	8,915
Mortar and cement, refractory	W	—	267,485	98,176	W	18,081	107,417	491,159
Oil and grease absorbents	—	W	—	—	365,472	W	8,382	373,855
Paint	—	11,792	W	—	4,895	108,378	W	125,065
Paper coating	W	W	—	—	2,800	1,838,420	W	1,841,221
Paper filling	W	W	—	—	—	789,806	W	789,806
Pelletizing (iron ore)	—	359,704	—	—	—	—	—	359,704
Pesticides and related products	W	4,624	W	—	151,987	27,166	W	183,777
Pet waste absorbent	—	W	W	—	617,010	—	W	617,010
Plastics	—	W	W	—	W	43,730	44,770	88,500
Pottery	142,507	—	126,719	W	W	16,099	W	285,325
Roofing granules	W	—	W	—	W	19,514	W	19,514
Rubber	W	W	—	—	—	201,032	W	201,032
Sanitaryware	111,010	—	—	—	—	78,696	—	189,707
Sewer pipe, vitrified	—	—	358,360	—	—	W	W	358,360
Tamping dummies	—	—	4,354	—	—	—	—	4,354
Tile:								
Drain	—	—	46,628	—	—	—	—	46,628
Floor and wall, vinyl, glazes, glass, and enamels	80,035	W	70,770	W	—	37,570	161	188,537
Quarry	—	—	138,914	6,438	—	—	—	145,352
Roofing	—	—	21,044	—	—	—	—	21,044
Structural	—	—	11,375	—	—	—	—	11,375
Terra cotta	—	—	2,837	—	—	—	—	2,837
Waterproofing and sealing	—	95,677	—	—	—	W	W	95,677
Miscellaneous ⁴	14,504	61,651	44,450	15,663	18,255	69,819	—	224,342
Exports	76,544	322,211	6,133	7,114	98,401	1,084,263	—	1,594,665
Total ⁵	483,541	2,891,005	20,230,239	977,622	1,448,478	5,754,978	218,281	32,004,144
Total undistributed	99,317	52,629	170,556	8,461	78,002	16,718	207,402	207,402
Grand total ⁵	582,858	2,943,634	20,400,795	986,084	1,526,479	5,771,695	NAP	32,211,546

W Withheld to avoid disclosing company proprietary data; included with "Total undistributed." NAP Not applicable.

¹Includes Puerto Rico.

²Total of clays indicated by symbol W; unpublishable data included with "Total undistributed."

³Data may show incomplete total; difference included with "Total undistributed."

⁴Includes asphalt emulsion, graphite anodes, and unknown uses.

⁵Data may not add to totals shown because of independent rounding.

Table 25.—Clays sold or used by producers in the United States in 1983, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,473,934	124,495	—	91,870	² 1,690,299	² \$20,757,585
Arizona	—	29,317	107,787	—	2	1	137,106	1,424,645
Arkansas	—	—	697,822	—	—	99,315	797,137	9,955,645
California	—	79,916	1,526,931	W	—	40,249	³ 1,647,096	³ 18,255,415
Colorado	—	3,901	401,708	10,986	—	—	416,595	2,649,521
Connecticut	—	—	78,049	—	—	—	78,049	514,910
Florida	—	—	209,937	—	384,634	26,257	620,828	31,566,251
Georgia	—	—	1,161,931	—	628,163	5,339,460	7,129,554	560,005,491
Idaho	—	W	—	W	—	W	5,250	91,287
Illinois	—	—	650,071	—	W	—	⁴ 650,071	⁴ 3,359,537
Indiana	—	—	505,935	W	—	—	⁵ 505,935	⁵ 1,421,142
Iowa	—	—	522,766	—	—	—	522,766	3,257,649
Kansas	—	13,608	637,963	—	—	—	651,571	3,920,604
Kentucky	W	—	607,179	W	—	—	⁵ 607,179	⁵ 2,142,337
Louisiana	—	W	458,177	—	—	—	² 458,177	10,792,807
Maine	—	—	39,452	—	—	—	39,452	92,522
Maryland	W	—	438,843	—	—	—	⁵ 438,843	⁵ 1,746,874
Massachusetts	—	—	214,996	—	—	—	214,996	1,298,295
Michigan	—	—	1,087,624	—	—	—	1,087,624	5,693,416
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	218,581	855,556	—	W	—	1,311,734	23,846,189
Missouri	—	—	910,591	281,840	W	93,547	⁴ 1,285,978	⁴ 11,848,263
Montana	—	162,448	13,813	171	—	—	176,431	6,205,294
Nebraska	—	—	148,462	—	—	—	148,462	500,951
Nevada	—	18,281	—	—	W	W	52,406	2,347,523
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	45,359	10,903	—	—	56,262	596,000
New Mexico	—	—	43,190	2,042	—	—	45,232	114,506
New York	W	—	336,620	—	—	—	⁵ 336,620	⁵ 868,551
North Carolina	—	—	1,876,010	—	—	W	⁶ 1,876,010	⁶ 6,680,959
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	1,332,006	225,032	—	—	1,557,038	8,060,857
Oklahoma	—	—	781,568	—	—	—	781,568	2,287,746
Oregon	—	—	170,752	—	—	—	170,752	275,397
Pennsylvania	—	—	775,359	55,825	—	W	⁶ 831,185	⁶ 4,310,929
Puerto Rico	—	—	113,633	—	—	—	113,633	251,204
South Carolina	—	—	954,963	16,603	W	673,293	⁴ 1,644,859	⁴ 34,830,474
South Dakota	—	W	111,199	—	—	—	² 111,199	² 353,105
Tennessee	460,618	W	393,012	—	W	W	967,114	26,515,819
Texas	14,152	67,818	3,369,667	39,470	W	W	3,588,238	22,575,292
Utah	—	5,652	199,782	564	W	—	⁴ 205,998	⁴ 1,568,645
Virginia	—	—	675,210	—	36,287	—	711,497	5,466,950
Washington	—	—	249,734	6,350	—	—	256,085	³ 1,714,671
West Virginia	—	—	225,500	W	—	—	225,500	⁵ 531,990
Wyoming	—	1,758,577	182,583	—	—	—	1,941,160	49,058,676
Undistributed	202,726	260,828	82,496	171,981	685,120	170,193	⁷ 1,085,753	⁷ 41,584,074
Total ⁸	677,496	2,618,925	24,668,170	946,262	1,734,206	6,534,185	37,179,243	931,339,998

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fire clay.

⁴Excludes fuller's earth.

⁵Excludes ball clay.

⁶Excludes kaolin.

⁷Incomplete total; difference included with "Undistributed."

⁸Data may not add to totals shown because of independent rounding.

Table 26.—Clays sold or used by producers in the United States¹ in 1983, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Adhesives	W	6,067	W	W	1,692	83,253	2,399	93,411
Alum, aluminum sulfate, and other chemicals	—	W	—	—	1,229	325,553	W	326,783
Animal feed	8,664	124,245	272	—	—	5,552	—	138,733
Building brick:								
Common	W	W	1,895,279	—	W	16,313	36,965	1,948,557
Face	—	—	10,444,464	45,611	—	261,267	—	10,751,341
Catalysts (oil refining)	W	9,532	—	—	W	216,033	6,746	232,311
Cement, portland	—	W	6,794,766	W	—	42,190	3,282	6,840,238
China and dinnerware	31,551	—	—	—	—	20,283	—	51,834
Crockery and other earthenware	W	—	W	—	—	W	17,373	17,373
Drilling mud	W	1,048,496	—	—	73,850	1,363	W	1,123,709
Electrical porcelain	17,647	—	W	—	—	25,140	W	42,787
Fertilizers	—	—	—	—	54,965	14,373	—	69,338
Fiberglass, mineral wool, and other insulation	—	W	—	—	—	232,443	W	232,443
Filtering, clarifying, and decolorizing:								
Animal oils	—	67,327	—	—	—	W	W	67,327
Mineral oils and greases	—	10,728	—	—	20,648	—	—	31,377
Vegetable oils	—	23,091	—	—	—	—	—	23,091
Firebrick, block, and shapes	W	W	10,569	439,987	—	11,658	10,585	472,799
Flower pots	—	—	30,707	W	—	—	W	30,707
Flue linings and high-aluminum (minimum 50% Al ₂ O ₃)								
refractories	7,952	—	32,914	94,829	—	100,532	—	236,227
Foundry sand	—	526,122	—	60,331	—	621	—	587,075
Grogs and crudes, refractory	W	—	W	100,142	—	298,902	W	399,044
Gypsum products	—	W	—	—	W	15,584	2,178	17,762
Ink	—	W	—	—	—	973	—	973
Kiln furniture	1,620	—	—	—	—	1,161	—	2,781
Lightweight aggregate:								
Concrete block	—	—	2,250,532	—	—	—	—	2,250,532
Structural concrete	—	—	1,199,359	—	—	—	—	1,199,359
Highway surfacing	—	—	261,520	—	—	—	—	261,520
Others	—	—	276,343	—	—	—	—	276,343
Linoleum and asphalt tile	—	—	—	—	—	3,298	—	3,298
Medical, pharmaceutical, cosmetic ..	—	4,025	—	—	103	2,426	—	6,554
Mortar and cement, refractory	W	—	348,149	145,156	W	30,671	112,766	636,742
Oil and grease absorbents	—	W	—	—	420,602	—	28,790	449,391
Paint	—	8,367	W	—	7,473	125,737	W	141,577
Paper coating	W	W	—	—	—	2,106,178	W	2,106,178
Paper filling	W	W	—	—	—	907,650	W	907,650
Pelletizing (iron ore)	—	273,387	—	—	—	—	—	273,387
Pesticides and related products	W	7,065	W	—	139,334	16,037	W	162,436
Pet waste absorbent	—	W	W	—	731,582	—	W	731,582
Plastics	—	W	W	—	W	49,405	82,043	131,448
Pottery	177,964	—	17,529	W	W	12,691	W	208,184
Roofing granules	W	—	W	—	—	14,734	W	14,734
Rubber	W	W	—	—	—	253,185	W	253,185
Sanitaryware	124,476	—	—	—	W	67,637	W	192,113
Sewer pipe, vitrified	—	—	299,113	—	—	W	W	299,113
Tamping dummies	—	—	4,354	—	—	—	—	4,354
Tile:								
Drain	—	—	70,194	—	—	—	—	70,194
Floor and wall, vinyl, glazes, glass, and enamels	93,713	W	71,580	W	—	35,428	W	200,721
Quarry	—	—	151,112	—	—	—	—	151,112

See footnotes at end of table.

Table 26.—Clays sold or used by producers in the United States¹ in 1983, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Undistrib- uted ²	Total ³
Tile—Continued								
Roofing	—	—	20,183	—	—	W	W	20,183
Structural	—	—	21,820	—	—	—	—	21,820
Terra cotta	—	—	16,778	—	—	—	—	16,778
Waterproofing and sealing	—	84,924	—	—	—	W	W	84,924
Miscellaneous ⁴	9,215	117,002	140,110	15,524	30,164	122,973	—	434,988
Exports	76,551	249,007	15,942	12,529	156,116	1,097,874	—	1,608,019
Total	549,349	2,559,386	24,373,588	914,109	1,637,757	6,519,119	303,127	36,856,440
Total undistributed	128,142	59,539	294,582	32,152	96,448	15,066	321,574	322,803
Grand total ⁵	677,496	2,618,925	24,668,170	946,261	1,734,206	6,534,185	NAp	37,179,243

W Withheld to avoid disclosing company proprietary data; included with "Total undistributed." NAp Not applicable.

¹Includes Puerto Rico.

²Total of clays indicated by symbol W; unpublizable data included with "Total undistributed."

³Data may show incomplete total; difference included with "Total undistributed."

⁴Includes asphalt emulsion, graphite anodes, and unknown uses.

⁵Data may not add to totals shown because of independent rounding.

Table 27.—Clay sold or used by producers in the United States in 1984, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,381,709	130,877	—	216,382	² 1,728,968	² \$30,499,956
Arizona	—	18,592	106,262	—	—	—	124,854	818,593
Arkansas	—	—	846,785	—	—	77,925	924,710	7,838,122
California	223	85,768	1,765,237	W	—	54,163	³ 1,905,391	³ 23,868,369
Colorado	—	136	266,120	13,422	—	—	279,678	2,111,009
Connecticut	—	—	89,882	—	—	—	89,882	564,620
Florida	—	—	253,964	—	416,853	29,941	700,758	34,048,157
Georgia	—	—	1,452,646	—	516,264	5,904,249	7,873,159	600,029,223
Idaho	+	W	—	W	—	1,328	^{2,3} 1,328	243,429
Illinois	—	—	229,863	—	W	—	⁴ 229,863	⁴ 939,966
Indiana	—	—	592,514	W	—	—	³ 592,514	³ 2,085,427
Iowa	—	—	565,330	—	—	—	565,330	2,694,651
Kansas	—	18,144	814,400	—	—	—	832,544	5,536,598
Kentucky	W	—	600,234	W	—	—	727,774	7,277,490
Louisiana	—	6,966	489,401	—	—	—	496,367	² 10,858,373
Maine	—	—	39,452	—	—	—	39,452	96,522
Maryland	W	—	314,760	—	—	—	⁵ 314,760	⁵ 1,483,631
Massachusetts	—	—	217,660	—	—	—	217,660	1,211,614
Michigan	—	—	1,198,186	—	—	—	1,198,186	5,051,586
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	188,289	1,697,287	—	W	—	2,175,121	30,565,340
Missouri	—	—	978,938	387,986	W	61,813	⁴ 1,428,737	⁴ 14,665,696
Montana	—	345,239	14,898	—	—	—	360,137	15,260,001
Nebraska	—	—	163,244	—	—	—	163,244	555,818
Nevada	—	18,227	—	—	W	W	^{4,6} 18,277	^{4,6} 1,191,011
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	45,359	10,903	—	—	56,262	611,000
New Mexico	—	—	58,771	1,645	—	—	60,416	143,306
New York	W	—	492,935	—	—	—	⁵ 492,935	⁵ 2,434,776
North Carolina	—	—	2,068,957	—	—	42,444	2,111,401	8,986,641
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	1,502,921	275,174	—	—	1,778,094	10,472,960
Oklahoma	—	—	888,398	—	—	—	888,398	2,498,178

See footnotes at end of table.

Table 27.—Clay sold or used by producers in the United States in 1984, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Oregon	—	—	171,609	—	—	—	171,609	\$288,443
Pennsylvania	—	—	818,687	54,891	—	W	⁶ 873,578	⁶ 4,050,275
Puerto Rico	—	—	116,089	—	—	—	116,089	266,435
South Carolina	—	—	958,950	—	W	704,490	⁴ 1,663,440	⁴ 36,809,446
South Dakota	—	W	107,090	—	—	—	² 108,090	² 343,149
Tennessee	550,543	W	508,276	—	W	—	1,149,208	30,207,029
Texas	22,240	56,558	3,090,410	22,000	W	W	3,260,252	23,050,952
Utah	—	3,623	281,626	373	W	—	⁴ 285,622	⁴ 2,222,596
Virginia	—	—	624,114	—	21,772	—	645,887	6,003,785
Washington	—	—	259,420	5,443	—	—	264,863	³ 1,646,120
West Virginia	—	—	257,031	88,962	—	—	345,993	3,409,908
Wyoming	—	1,981,025	193,548	—	—	—	2,174,573	67,290,102
Undistributed	206,786	139,113	104,773	47,029	767,987	121,807	⁷ 810,974	⁷ 37,269,564
Total ⁸	779,792	2,861,681	26,628,735	1,038,703	1,722,876	7,214,542	⁹ 39,762,330	1,037,499,867

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fire clay.

⁴Excludes ball clay.

⁵Excludes fuller's earth.

⁶Excludes kaolin.

⁷Incomplete total; difference included with "Undistributed."

⁸Data may not add to totals shown because of independent rounding.

⁹Total includes adjustment reflecting 1984 revision.

Table 28.—Clays sold or used by producers in the United States¹ in 1984, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	91,593	W	—	390,733	—	482,326
Pet waste absorbents	—	W	W	3,526	724,135	—	727,661
Other ²	—	45,394	118,319	—	—	—	163,712
Ceramics and glass:							
Catalysts (oil-refining)	W	6,450	—	—	W	236,460	242,911
Crockery and other earthenware	W	—	1,840	—	—	1,461	3,300
Electrical porcelain	23,365	—	36	—	—	24,377	47,778
Fine china and dinnerware	32,074	—	—	—	—	31,213	63,286
Glazes, glass, and enamels	2,448	W	—	—	W	403	2,851
Mineral wool, insulation, and fiberglass	W	W	—	—	—	252,906	252,906
Pottery	179,684	—	20,809	499	W	6,331	207,324
Roofing granules	W	—	90,537	—	W	21,264	111,801
Sanitaryware	125,248	—	—	—	W	110,544	235,792
Other ²	89,457	1,460	—	9,675	18,527	10,017	129,136
Chemical manufacturing	—	2,624	—	—	—	306,666	309,290
Civil engineering and sealing	—	51,565	11,692	—	—	6,725	69,982
Drilling mud	115	1,288,444	—	—	95,904	1,363	1,385,827
Fillers, extenders, and binders:							
Adhesives	W	6,046	907	W	1,631	84,404	92,989
Animal feed	8,270	114,156	181	W	W	11,237	133,844
Fertilizers	—	—	—	—	57,032	12,960	69,992
Gypsum products and wallboard	—	—	—	—	W	16,631	16,631

See footnotes at end of table.

Table 28.—Clays sold or used by producers in the United States¹ in 1984, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Fillers, extenders, and binders—Continued							
Ink	—	W	—	—	—	W	W
Linoleum and asphalt tile	W	—	—	—	—	19,140	19,140
Medical, pharmaceutical, cosmetic	W	4,221	—	—	95	2,847	7,163
Paint	W	9,227	45	—	5,993	208,655	223,920
Paper coating	W	W	—	—	—	2,244,897	2,244,897
Paper filling	W	W	—	—	2,962	893,369	896,331
Pesticides and related products	—	6,171	8,455	—	196,336	38,357	249,318
Plastics	W	W	—	W	W	53,443	53,443
Rubber	W	W	4,292	W	—	267,229	271,520
Other ²	20,902	2,897	—	1,693	15,980	20,455	61,926
Filtering, clarifying, and decolorizing:							
Animal oils	—	1,394	—	—	—	661	2,056
Desiccants	—	557	—	—	—	—	557
Mineral oils and greases	—	2,287	—	—	17,056	—	19,343
Floor and wall tile:							
Ceramic	116,207	—	80,143	348	—	17,051	213,750
Quarry tile	—	—	180,650	—	—	—	180,650
Other ²	—	—	—	—	—	12,752	12,752
Heavy clay products:							
Brick, common	2,034	1,420	1,991,157	—	—	14,307	2,008,918
Brick, face	—	84	11,946,315	11,370	—	280,122	12,237,891
Drain tile	—	—	40,297	—	—	—	40,297
Flower pots	—	—	25,076	—	—	—	25,076
Flue linings	—	—	44,865	8,274	—	2,749	55,888
Portland and other cements	—	458	7,359,310	465	—	122,993	7,483,226
Roofing tile	—	—	34,087	—	—	—	34,087
Sewer pipe, vitrified	—	—	390,433	—	—	8,923	399,356
Structural tile	—	—	63,651	—	—	320	63,971
Terra cotta	—	—	726	—	—	—	726
Other ²	—	—	7,810	—	—	—	7,810
Lightweight aggregate:							
Concrete block	—	—	2,423,282	—	—	—	2,423,282
Highway surfacing	—	—	406,214	—	—	—	406,214
Structural concrete	—	—	1,083,401	—	—	—	1,083,401
Other ²	—	—	58,703	—	—	—	58,703
Pelletizing iron ore	—	346,454	—	—	—	—	346,454
Refractories:							
Firebrick, blocks, and shapes	W	1,886	29,545	484,737	—	11,301	527,469
Foundry sand	—	590,510	—	98,745	—	826	690,081
Grogs and calcines	W	—	—	54,209	—	381,655	435,864
High-alumina brick and specialties	7,903	—	—	133,595	—	58,775	200,273
Kiln furniture	1,615	—	—	—	—	1,129	2,743
Mortar and cement, refractory	W	—	151,499	130,635	27,304	42,139	351,576
Other ²	87,926	8,365	—	72,674	4,816	1,129	174,911
Other ³	2,410	80,435	3,266	18,764	36,980	53,092	194,948
Exports	80,134	197,584	51,192	9,494	127,391	1,321,262	1,787,058
Total⁴	779,792	2,861,681	26,628,735	1,038,703	1,772,876	7,214,542	⁵39,762,330

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

¹Includes Puerto Rico.

²Includes uses indicated by symbol W.

³Includes tamping dummies and uses not specified.

⁴Data may not add to totals shown because of independent rounding.

⁵Total includes adjustment reflecting 1984 revision.

Table 29.—Clays sold or used by producers in the United States in 1985, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,479,382	117,934	—	101,501	² 1,698,817	² \$13,139,143
Arizona	—	29,777	139,351	—	—	—	169,128	1,503,279
Arkansas	—	—	826,749	—	—	127,252	954,001	10,769,180
California	—	102,412	1,870,848	W	—	25,526	³ 1,998,786	³ 26,600,429
Colorado	—	73	256,199	18,492	—	—	274,764	1,742,690
Connecticut	—	—	96,192	—	—	—	96,192	631,873
Florida	—	—	225,599	—	351,150	32,952	609,700	33,074,154
Georgia	—	—	1,571,918	—	537,991	5,756,275	7,866,183	575,096,905
Idaho	—	W	—	W	—	1,365	²³ 1,365	W
Illinois	—	—	240,828	—	W	—	⁴ 240,828	⁴ 876,123
Indiana	—	—	671,055	W	—	—	671,055	2,776,446
Iowa	—	—	456,584	—	—	—	456,584	2,449,931
Kansas	—	21,772	774,897	—	—	—	796,669	5,325,709
Kentucky	W	—	599,809	W	—	—	702,869	6,486,980
Louisiana	—	—	302,654	—	—	—	302,654	7,016,609
Maine	—	—	44,906	—	—	—	44,906	99,555
Maryland	W	—	304,891	—	—	—	⁵ 304,891	⁵ 1,646,991
Massachusetts	—	—	239,985	—	—	—	239,985	1,388,090
Michigan	—	—	1,340,193	—	—	—	1,340,193	5,513,822
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	179,197	771,748	—	W	—	1,413,666	34,864,168
Missouri	—	—	1,093,025	257,366	W	51,438	⁴ 1,401,829	⁴ 10,271,129
Montana	—	230,786	21,945	456	—	—	253,187	8,295,649
Nebraska	—	—	221,560	—	—	—	221,560	718,214
Nevada	—	72,449	—	—	W	W	^{4,6} 72,449	^{4,6} 3,775,947
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	108,862	9,222	—	—	118,085	2,050,079
New Mexico	—	—	51,753	2,510	—	—	54,263	160,714
New York	W	—	634,815	—	—	—	634,815	3,129,207
North Carolina	—	—	2,369,073	—	—	69,730	2,438,803	10,476,986
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	1,699,191	218,672	—	—	1,917,863	10,580,605
Oklahoma	—	—	904,030	—	—	—	904,030	2,337,657
Oregon	—	—	170,574	—	—	—	170,574	284,626
Pennsylvania	—	—	963,074	73,128	—	W	⁶ 1,036,202	⁶ 5,292,781
Puerto Rico	—	—	107,222	—	—	—	107,222	263,568
South Carolina	—	—	933,655	—	W	786,359	⁴ 1,720,014	⁴ 37,695,224
South Dakota	—	W	106,200	—	—	—	² 106,200	² 309,052
Tennessee	602,874	—	525,323	—	W	—	⁴ 1,128,197	⁴ 25,912,698
Texas	27,398	42,422	3,555,402	19,229	W	W	3,725,488	28,059,057
Utah	—	12,706	288,235	454	—	—	301,395	2,509,304
Virginia	—	—	713,315	—	25,401	—	738,716	6,976,908
Washington	—	—	220,368	—	—	—	220,368	1,402,107
West Virginia	—	—	211,618	88,962	—	—	300,580	3,342,451
Wyoming	—	1,919,681	168,661	—	—	—	2,088,342	64,146,205
Undistributed	187,717	287,435	86,564	77,548	953,607	117,587	⁷ 1,063,641	⁷ 52,647,917
Total ⁸	817,990	2,898,710	27,368,252	883,974	1,868,149	7,069,985	40,907,059	1,011,640,162

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fire clay.

⁴Excludes fuller's earth.

⁵Excludes ball clay.

⁶Excludes kaolin.

⁷Incomplete total; difference included with "Undistributed."

⁸Data may not add to totals shown because of independent rounding.

Table 30.—Clays sold or used by producers in the United States¹ in 1985, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	31,292	W	—	544,880	—	576,171
Pet waste absorbents	—	W	W	26,490	709,118	—	735,608
Other ²	—	55,786	122,787	—	—	—	178,573
Ceramics and glass:							
Catalysts (oil-refining)	W	7,455	—	—	W	199,521	206,976
Crockery and other earthenware	W	—	7,558	14,637	—	W	22,194
Electrical porcelain	38,319	—	49	—	—	22,790	61,159
Fine china and dinnerware	24,939	—	—	—	—	14,597	39,536
Glazes, glass, and enamels	1,457	W	—	4,536	W	444	6,436
Mineral wool, insulation, and fiberglass	W	W	—	—	—	275,377	275,377
Pottery	184,606	—	8,492	1,835	W	13,999	208,932
Roofing granules	—	933	91,263	—	—	21,572	113,768
Sanitaryware	138,887	—	—	—	W	124,446	263,333
Other ²	97,989	2,274	—	—	5,688	—	105,951
Chemical manufacturing	—	2,709	—	—	1,608	42,149	46,465
Civil engineering and sealing	—	111,863	134,907	—	—	4,414	251,185
Drilling mud	W	1,076,503	—	—	97,051	94	1,173,648
Fillers, extenders, and binders:							
Adhesives	W	8,108	—	W	2,486	88,517	99,111
Animal feed	12,649	118,373	3,629	W	—	10,076	144,727
Fertilizers	—	—	—	—	52,055	26,401	78,456
Gypsum products and wallboard	—	—	—	—	W	7,636	7,636
Ink	—	W	—	—	—	W	W
Medical, pharmaceutical, cosmetic	W	3,600	—	—	85	3,451	7,136
Paint	W	6,496	45	—	9,430	181,147	197,119
Paper coating	W	W	—	—	—	2,056,449	2,056,449
Paper filling	W	W	—	—	2,503	1,064,289	1,066,792
Pesticides and related products	W	1,027	4,667	—	232,976	60,989	299,659
Plastics	—	W	—	W	W	49,091	49,091
Rubber	W	W	6,722	W	—	284,848	291,570
Other ²	15,149	6,834	—	1,361	2,830	855	27,029
Filtering, clarifying, and decolorizing:							
Animal oils	—	1,579	—	—	—	590	2,169
Desiccants	—	26,490	—	—	—	—	26,490
Mineral oils and greases	—	7,829	—	—	13,899	—	21,728
Floor and wall tile:							
Ceramic	117,074	—	88,674	11,575	—	16,404	233,726
Quarry tile	—	—	171,590	—	—	—	171,590
Other	5,730	—	—	—	—	52,323	58,053
Heavy clay products:							
Brick, common	2,650	3,114	2,288,787	160	—	9,834	2,304,545
Brick, face	—	—	11,295,187	15,296	—	438,666	11,749,149
Drain tile	—	—	27,782	—	—	—	27,782
Flower pots	—	—	38,466	—	—	—	38,466
Flue linings	—	—	58,867	9,056	—	2,780	70,703
Portland and other cements	—	554	7,900,222	3,089	—	122,576	8,026,442
Roofing tile	—	—	21,386	—	—	—	21,386
Sewer pipe, vitrified	—	—	255,888	202	—	7,954	264,044
Structural tile	—	—	33,543	—	—	337	33,880
Terra cotta	—	—	805	—	—	—	805
Other	—	15,045	5,465	—	—	—	20,510
Lightweight aggregate:							
Concrete block	—	—	2,370,182	—	—	—	2,370,182
Highway surfacing	—	—	495,670	—	—	—	495,670

See footnotes at end of table.

Table 30.—Clays sold or used by producers in the United States¹ in 1985, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Lighweight aggregate—Continued							
Structural concrete	—	—	1,281,724	—	—	455	1,282,179
Other	—	—	126,006	—	—	—	126,006
Pelletizing iron ore	—	263,598	—	—	—	—	263,598
Refractories:							
Firebrick, blocks, and shapes	W	1,399	122,882	445,691	—	6,036	576,007
Foundry sand	—	660,963	—	63,028	—	875	724,866
Grogs and calcines	W	—	—	124,682	—	263,831	388,513
High-alumina brick and specialties	6,012	6,091	—	60,520	—	101,545	174,168
Kiln furniture	1,549	—	—	—	—	1,585	3,134
Mortar and cement, refractory	W	—	262,518	82,129	23,766	84,173	452,586
Other ²	100,388	—	—	—	—	—	100,388
Other ³	—	91,810	121,156	14,195	39,393	226,151	492,705
Exports	70,591	386,983	21,334	5,492	130,381	1,180,722	1,795,503
Total ⁴	817,990	2,898,710	27,368,252	883,974	1,868,149	7,069,985	40,907,059

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

¹Includes Puerto Rico.

²Includes uses indicated by symbol W.

³Includes tamping dummies and uses not specified.

⁴Data may not add to totals shown because of independent rounding.

Table 31.—Clays sold or used by producers in the United States in 1986, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,711,472	100,228	—	72,911	² 1,884,611	² \$14,828,248
Arizona	—	14,688	167,756	—	—	—	182,444	1,366,226
Arkansas	—	—	710,859	W	—	173,077	³ 883,937	³ 8,997,727
California	W	113,595	2,021,998	—	—	86,226	⁴ 2,221,819	⁴ 33,288,772
Colorado	—	454	213,898	5,489	—	—	219,841	1,523,079
Connecticut	—	—	142,138	—	—	—	142,138	975,207
Florida	—	—	206,151	—	420,250	32,127	658,528	43,260,551
Georgia	—	—	2,282,770	—	482,485	6,149,346	8,914,600	669,199,737
Idaho	—	W	W	W	—	1,491	^{2,3,5} 1,491	W
Illinois	—	—	256,727	—	W	—	⁶ 256,727	⁶ 1,091,609
Indiana	—	—	674,818	—	—	—	674,818	3,043,873
Iowa	—	—	441,172	—	—	—	441,172	1,420,979
Kansas	—	21,854	797,740	—	—	—	819,594	5,295,181
Kentucky	W	—	654,181	W	—	—	^{3,4} 654,181	^{3,4} 3,450,418
Louisiana	—	—	301,169	—	—	—	301,169	7,669,853
Maine	—	—	41,731	—	—	—	41,731	90,000
Maryland	W	—	328,155	—	—	—	⁴ 328,155	⁴ 1,757,132
Massachusetts	—	—	127,001	—	—	—	127,001	871,199
Michigan	—	—	1,272,278	—	—	—	1,272,278	5,684,283
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	282,174	559,436	—	W	—	^{4,6} 841,610	^{4,6} 13,538,041
Missouri	—	—	1,025,421	168,517	W	4,242	⁶ 1,198,180	⁶ 6,650,298
Montana	—	165,658	35,573	—	—	—	201,231	5,881,704
Nebraska	—	—	200,627	—	—	—	200,627	668,380
Nevada	—	9,356	—	—	W	W	^{6,7} 9,356	^{6,7} 583,519
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	108,862	11,362	—	—	120,224	2,065,919
New Mexico	—	—	52,690	1,908	—	—	54,598	170,121
New York	—	—	561,518	—	—	—	561,518	3,074,611

See footnotes at end of table.

Table 31.—Clays sold or used by producers in the United States in 1986, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
North Carolina	—	—	2,364,740	—	—	46,266	2,411,007	\$10,970,024
North Dakota	—	—	W	—	—	—	W	W
Ohio	—	—	2,412,817	157,043	—	—	2,569,860	11,515,409
Oklahoma	—	—	900,564	—	—	—	900,564	2,328,697
Oregon	—	—	184,699	—	—	—	184,699	288,920
Pennsylvania	—	—	1,078,753	40,524	—	W	⁷ 1,119,277	⁷ 5,060,538
Puerto Rico	—	—	100,695	—	—	—	100,695	222,845
South Carolina	—	—	837,481	—	W	964,417	⁶ 1,801,899	⁶ 37,980,265
South Dakota	—	W	107,699	—	—	—	² 107,699	² 375,112
Tennessee	558,508	—	497,719	—	W	—	⁶ 1,056,226	⁶ 25,227,698
Texas	34,806	29,777	2,198,731	17,844	W	W	2,281,158	^{4,6,7} 11,724,068
Utah	—	6,967	269,313	—	—	—	276,280	2,048,029
Virginia	—	—	776,529	—	30,844	—	807,374	7,699,648
Washington	—	—	226,315	2,428	—	—	228,742	1,559,767
West Virginia	—	—	195,027	—	—	—	195,027	469,708
Wyoming	—	1,577,061	21,068	—	—	—	1,598,129	51,822,807
Undistributed	211,516	330,365	128,277	31,555	799,125	225,856	1,726,693	89,661,827
Total ⁸	804,829	2,551,950	27,196,568	536,897	1,732,703	7,755,962	40,578,909	1,095,402,029

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fire clay.

⁴Excludes ball clay.

⁵Excludes common clay.

⁶Excludes fuller's earth.

⁷Excludes kaolin.

⁸Data may not add to totals shown because of independent rounding.

Table 32.—Clays sold or used by producers in the United States¹ in 1986, by kind and use
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	7,763	W	—	422,174	—	429,937
Pet waste absorbents	—	W	W	—	870,142	—	870,142
Other ²	—	64,712	125,672	—	34,159	—	224,544
Ceramics and glass:							
Catalysts (oil-refining)	W	4,880	—	—	—	113,109	117,988
Crockery and other earthenware	W	—	10,105	—	—	W	10,105
Electrical porcelain	12,713	—	32	—	—	18,884	31,629
Fine china and dinnerware	22,902	—	—	—	—	22,304	45,206
Glazes, glass, and enamels	2,360	—	—	—	—	513	2,874
Mineral wool, insulation, and fiberglass	W	W	—	—	—	333,279	333,279
Pottery	197,949	—	7,563	1,704	—	32,836	240,051
Roofing granules	—	—	93,880	—	W	25,281	119,161
Sanitaryware	135,602	—	—	—	—	135,166	270,768
Other ²	43,404	24,440	907	—	122	19,960	88,833
Chemical manufacturing	—	1,309	—	—	—	140,933	142,242
Civil engineering and sealing	—	57,445	72,448	—	—	12,425	142,317
Drilling mud	W	940,522	—	—	31,497	709	972,729
Fillers, extenders, and binders:							
Adhesives	W	10,253	—	—	6,236	63,411	79,900
Animal feed	W	101,991	454	—	—	33,452	135,896

See footnotes at end of table.

Table 32.—Clays sold or used by producers in the United States¹ in 1986, by kind and use—Continued
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Fillers, extenders, and binders—							
Continued							
Fertilizers	—	337	—	—	39,577	4,396	44,311
Gypsum products and wallboard	—	—	—	—	W	17,278	17,278
Ink	—	W	—	—	—	W	W
Medical, pharmaceutical, cosmetic	—	6,642	—	—	344	2,649	9,634
Paint	—	7,662	45	—	18,039	227,276	253,023
Paper coating	W	W	—	—	—	2,100,736	2,100,736
Paper filling	W	W	—	—	—	1,216,531	1,216,531
Pesticides and related products	W	4,878	3,582	—	148,768	18,849	176,077
Plastics	—	W	—	—	W	45,884	45,884
Rubber	W	W	7,058	—	—	261,221	268,279
Other ²	67,661	9,893	16,904	—	22,877	155,437	272,773
Filtering, clarifying, and decolorizing:							
Animal oils, mineral oils and greases, and vegetable oils	—	140,486	—	—	12,319	508	153,312
Desiccants	—	11,730	—	—	36	—	11,766
Floor and wall tile:							
Ceramic	116,396	47	87,951	—	—	27,831	232,225
Quarry tile	—	—	186,955	—	—	—	186,955
Other	—	—	801	14,160	—	20,765	35,726
Heavy clay products:							
Brick, common	142	4,521	3,637,824	—	—	15,412	3,657,898
Brick, face	—	—	10,703,069	11,005	—	576,236	11,290,310
Drain tile	—	—	43,294	—	—	—	43,294
Flower pots	—	—	36,383	—	—	—	36,383
Flue linings	—	—	38,931	55,187	—	26,127	120,245
Portland and other cements	—	632	7,760,721	—	—	185,373	7,946,727
Roofing tile	—	124	6,315	—	145	—	6,584
Sewer pipe, vitrified	—	—	512,857	132	—	16,084	529,073
Structural tile	—	—	24,764	—	—	316	25,080
Terra cotta	—	—	905	—	—	—	905
Other	—	—	105,463	—	—	380	105,843
Lightweight aggregate:							
Concrete block	—	—	2,201,013	—	—	—	2,201,013
Highway surfacing	—	—	176,780	—	—	—	176,780
Structural concrete	—	—	909,242	—	—	—	909,242
Other	—	—	57,088	—	—	—	57,088
Pelletizing (iron ore)	—	238,063	—	—	—	—	238,063
Refractories:							
Firebrick, blocks, and shapes	W	1,926	127,815	256,924	—	62,459	449,124
Foundry sand	—	559,541	—	51,620	—	374	611,534
Grogs and calcines	W	—	—	54,461	—	355,453	409,914
High-alumina brick and specialties	6,648	—	—	57,102	—	54,580	118,330
Kiln furniture	2,017	277	—	—	—	3,445	5,738
Mortar and cement, refractory	W	22	219,555	2,021	41,710	49,379	312,687
Other ²	90,579	—	—	—	—	—	90,579
Other ³	3,094	9,281	—	24,187	11,609	23,104	71,276
Exports	103,361	342,576	20,190	8,394	72,948	1,335,618	1,883,087
Total ⁴	804,829	2,551,950	27,196,568	536,897	1,732,703	7,755,962	40,578,909

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

¹Includes Puerto Rico.

²Includes uses indicated by symbol W.

³Includes tamping dummies and uses not specified.

⁴Data may not add to totals shown because of independent rounding.

Table 33.—Clays sold or used by producers in the United States in 1987, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,879,406	115,067	—	36,687	² 2,031,161	² \$16,216,547
Arizona	—	25,882	172,021	—	—	—	197,903	1,905,317
Arkansas	—	—	640,640	—	—	183,441	824,081	8,651,462
California	—	105,499	1,898,043	—	—	79,655	2,083,198	33,045,543
Colorado	—	91	262,178	—	—	2,674	264,943	1,763,455
Connecticut	—	—	W	—	—	—	W	W
Florida	—	—	115,682	—	391,130	34,947	541,759	39,496,244
Georgia	—	—	2,213,247	—	536,359	6,734,778	9,484,383	756,093,514
Idaho	—	W	W	—	—	8,114	19,759	229,835
Illinois	—	—	211,328	—	W	—	³ 211,328	³ 977,048
Indiana	—	—	940,451	W	—	—	⁴ 940,451	⁴ 4,055,534
Iowa	—	—	428,906	—	—	—	428,906	1,494,770
Kansas	—	W	547,649	—	—	—	² 547,649	² 2,575,572
Kentucky	W	—	801,287	W	—	—	934,870	8,820,874
Louisiana	—	—	323,778	—	—	—	323,778	9,191,774
Maine	—	—	W	—	—	—	W	W
Maryland	—	—	347,501	—	—	—	347,501	1,939,968
Massachusetts	—	—	W	—	—	—	W	W
Michigan	—	—	1,209,729	—	—	—	1,209,729	5,338,433
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	252,988	507,983	—	W	—	1,019,064	26,932,947
Missouri	—	—	1,033,963	304,894	W	—	³ 1,338,857	³ 10,414,581
Montana	—	—	26,199	W	—	—	⁴ 26,199	⁴ 98,270
Nebraska	—	—	202,963	—	—	—	202,963	721,059
Nevada	—	10,704	—	—	W	W	59,352	2,468,190
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	W	5,430	—	—	⁵ 5,430	⁵ 139,768
New Mexico	—	—	45,677	815	—	—	46,491	141,110
New York	—	—	610,204	—	—	—	610,204	3,562,468
North Carolina	454	—	2,878,532	—	—	50,363	2,929,348	15,282,025
North Dakota	—	—	45,451	—	—	—	45,451	99,701
Ohio	—	—	2,627,181	264,263	—	—	2,891,444	12,713,992
Oklahoma	—	—	723,300	—	—	—	723,300	1,782,741
Oregon	—	16,463	226,503	—	—	—	242,966	985,880
Pennsylvania	—	—	1,072,971	21,204	—	W	⁶ 1,094,175	⁶ 4,750,713
Puerto Rico	—	—	134,290	—	—	—	134,290	317,751
South Carolina	—	—	1,129,342	—	126,275	734,330	1,989,947	³ 38,243,426
South Dakota	—	—	W	—	—	—	W	W
Tennessee	627,382	—	516,463	—	W	—	³ 1,143,845	³ 25,480,282
Texas	W	24,990	2,978,880	3,833	W	W	3,152,446	25,959,476
Utah	—	26,308	259,595	—	—	—	285,903	1,958,941
Virginia	—	—	1,062,715	—	W	—	³ 1,062,715	³ 6,291,100
Washington	—	—	373,788	3,231	—	—	377,020	2,355,954
West Virginia	—	—	241,345	—	—	—	241,345	564,574
Wyoming	—	1,930,168	W	—	—	—	⁵ 1,930,168	⁵ 62,031,122
Undistributed	264,658	152,680	638,038	10,233	812,127	142,922	⁷ 1,423,944	⁷ 67,509,912
Total ⁸	892,493	2,545,772	29,327,227	728,969	1,865,890	8,007,913	43,368,265	1,202,601,873

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fuller's earth.

⁴Excludes fire clay.

⁵Excludes common clay.

⁶Excludes kaolin.

⁷Incomplete total; difference included with individual State totals.

⁸Data may not add to totals shown because of independent rounding.

Table 34.—Clays sold or used by producers in the United States¹ in 1987, by kind and use
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	W	W	—	325,257	—	325,257
Pet waste absorbents	—	W	W	—	949,309	—	949,309
Other ²	—	129,180	140,793	—	10,750	—	280,723
Ceramics and glass:							
Catalysts (oil-refining)	—	15,332	—	—	—	101,761	117,093
Crockery and other earthenware	—	—	W	6,423	—	8,313	14,736
Electrical porcelain	24,913	—	32	—	—	8,031	32,976
Fine china and dinnerware	11,978	—	—	—	—	19,801	31,780
Glazes, glass, and enamels	—	—	—	—	—	579	579
Mineral wool, insulation, and fiberglass	W	W	—	—	—	415,971	415,971
Pottery	192,320	9	17,915	3,629	—	59,183	273,055
Roofing granules	—	—	44,026	3,659	—	6,654	54,339
Sanitaryware	161,888	—	—	272	—	53,920	216,081
Other ²	67,080	2,305	3,385	3,839	—	55,473	132,083
Chemical manufacturing	—	—	—	—	—	193,005	193,005
Civil engineering and sealing	—	89,835	166,119	481	126,429	14,562	397,426
Drilling mud	—	862,363	—	—	28,984	573	891,920
Fillers, extenders, and binders:							
Adhesives	—	13,753	—	—	2,470	61,677	77,900
Animal feed	W	101,383	W	—	W	37,566	138,949
Fertilizers	—	W	—	—	38,132	2,618	40,750
Gypsum products and wallboard	W	—	—	—	23,390	12,494	35,884
Ink	—	W	—	—	—	2,112	2,112
Medical, pharmaceutical, cosmetic	—	6,448	—	—	870	2,940	10,258
Paint	—	7,164	1,588	—	18,419	260,584	287,755
Paper coating	—	W	—	—	—	2,256,422	2,256,422
Paper filling	—	—	W	—	—	1,220,311	1,220,311
Pesticides and related products	W	12,410	3,055	—	158,954	37,017	211,437
Plastics	—	W	—	—	W	51,990	51,990
Rubber	W	W	1,280	W	—	231,028	232,308
Other ²	117,021	17,831	76,096	4,899	14,999	170,825	401,672
Filtering, clarifying, and decolorizing:							
Animal oils, mineral oils and greases and vegetable oils	—	69,147	—	—	31,332	550	101,029
Desiccants	—	14,826	—	—	—	—	14,826
Floor and wall tile:							
Ceramic	131,027	—	184,292	730	—	W	316,050
Quarry tile	—	—	140,345	122	—	—	140,468
Other ²	—	11	177,808	—	—	34,490	212,309
Heavy clay products:							
Brick, extruded	22,485	3,591	11,424,003	17,593	—	244,061	11,711,732
Brick, other	—	—	3,709,035	13,221	—	76,394	3,798,650
Drain tile	—	—	30,848	—	—	—	30,848
Flower pots	—	—	36,257	281	—	—	36,539
Flue linings	—	—	33,481	59,129	—	26,127	118,738
Portland and other cements	—	1,062	7,629,650	1,474	33,219	73,743	7,739,149
Roofing tile	—	123	181	—	173	—	478
Sewer pipe, vitrified	—	—	352,349	—	—	6,246	358,595
Structural tile	—	—	50,625	—	—	356	50,981
Terra cotta	—	—	15	474	—	—	489
Other	—	—	652,711	—	—	17,588	670,299
Lightweight aggregate:							
Concrete block	—	—	2,533,567	—	—	113	2,533,681
Highway surfacing	—	—	727,893	—	—	—	727,893
Structural concrete	—	—	767,077	—	—	—	767,077
Other	—	—	110,937	—	—	—	110,937

See footnotes at end of table.

Table 34.—Clays sold or used by producers in the United States¹ in 1987, by kind and use—Continued
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Pelletizing (iron ore)	—	306,481	—	—	—	—	306,481
Refractories:							
Firebrick, blocks, and shapes	W	W	83,584	378,599	—	107,582	569,766
Foundry sand	—	590,355	—	38,698	—	—	629,053
Grog and calcines	—	—	—	125,514	—	542,688	668,202
High-alumina brick and specialties	20,157	—	—	39,149	—	36,917	96,222
Kiln furniture	—	488	2,670	—	—	W	3,158
Mortar and cement, refractory	—	—	213,278	—	20	—	213,298
Other ²	8,312	12,120	—	—	—	29,257	49,688
Other ³	6,570	1,650	1,814	24,046	14,038	9,290	57,408
Exports	128,742	287,905	10,516	6,737	89,145	1,517,099	2,040,144
Total ⁴	892,493	2,545,772	29,327,227	728,969	1,865,890	8,007,913	43,368,265

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

¹Includes Puerto Rico.

²Includes uses indicated by symbol W.

³Uses not specified.

⁴Data may not add to totals shown because of independent rounding.

Table 35.—Clays sold or used by producers in the United States in 1988, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,735,253	102,975	—	44,371	² 1,882,599	² \$16,039,585
Arizona	—	26,066	142,326	—	—	—	168,392	1,589,936
Arkansas	—	—	591,211	—	—	253,254	844,465	15,376,026
California	608	124,552	1,760,427	—	—	129,900	2,015,487	31,620,027
Colorado	—	3,597	233,545	7,433	—	2,897	247,471	1,889,604
Connecticut	—	—	W	—	—	—	W	W
Florida	—	—	116,250	—	380,522	40,149	536,922	44,422,762
Georgia	—	—	2,263,354	—	583,355	7,427,640	10,274,349	908,770,424
Idaho	—	W	W	—	—	8,519	20,747	253,425
Illinois	—	—	163,571	—	W	—	³ 163,571	³ 703,945
Indiana	—	—	1,035,836	—	—	—	1,035,836	4,629,731
Iowa	—	—	403,922	—	—	—	403,922	1,587,679
Kansas	—	W	555,666	—	—	—	² 555,666	² 2,632,114
Kentucky	W	—	762,396	W	—	—	^{4,5} 762,396	^{4,5} 12,723,643
Louisiana	—	—	340,900	—	—	—	340,900	9,535,143
Maine	—	—	W	—	—	—	W	W
Maryland	—	—	357,833	—	—	—	357,833	2,016,225
Massachusetts	—	—	W	—	—	—	W	W
Michigan	—	—	1,248,120	—	—	—	1,248,120	4,431,929
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	269,434	541,501	—	W	—	1,088,001	30,152,508
Missouri	—	—	1,109,144	325,899	W	—	³ 1,435,043	³ 12,171,526
Montana	—	58,467	33,335	W	—	—	⁵ 91,802	⁵ 1,415,898
Nebraska	—	—	215,419	—	—	—	215,419	785,615
Nevada	—	8,497	—	—	W	W	56,871	2,577,030
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	W	14,954	—	—	⁶ 14,954	⁶ 368,482
New Mexico	—	—	27,026	1,529	—	—	28,555	82,703
New York	—	—	551,374	—	—	—	551,374	3,653,827
North Carolina	—	—	2,832,204	—	—	47,896	2,880,100	16,349,445
North Dakota	—	—	76,917	—	—	—	76,917	146,681

See footnotes at end of tables.

Table 35.—Clays sold or used by producers in the United States in 1988, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Ohio	—	—	3,094,746	270,416	—	—	3,365,161	\$14,422,907
Oklahoma	—	—	684,066	—	—	—	684,066	1,802,787
Oregon	—	17,725	207,276	—	—	—	225,001	1,048,956
Pennsylvania	—	—	1,214,487	33,651	—	W	⁷ 1,248,138	⁷ 5,842,944
Puerto Rico	—	—	148,218	—	—	—	148,218	364,985
South Carolina	—	—	1,011,598	—	136,078	720,152	1,867,828	³ 36,406,649
South Dakota	—	—	W	—	—	—	W	W
Tennessee	654,127	W	511,608	—	W	—	^{2,3} 1,165,735	^{2,3} 27,695,522
Texas	W	38,152	2,642,220	5,096	W	W	2,845,922	26,966,706
Utah	—	29,749	278,835	—	—	—	308,584	2,468,220
Virginia	—	—	1,010,113	—	W	—	³ 1,010,113	³ 6,614,323
Washington	—	—	372,341	4,582	—	—	376,924	2,235,271
West Virginia	—	—	239,472	—	—	—	239,472	586,266
Wyoming	—	2,138,794	W	—	—	—	⁶ 2,138,794	⁶ 72,174,070
Undistributed	335,159	155,939	550,108	26,976	873,182	298,311	⁸ 1,741,551	⁸ 76,629,006
Total ⁹	989,893	2,870,971	29,062,619	793,509	1,973,137	8,973,089	44,663,219	1,401,184,525

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fuller's earth.

⁴Excludes ball clay.

⁵Excludes fire clay.

⁶Excludes common clay.

⁷Excludes kaolin.

⁸Incomplete total; difference included with individual State totals.

⁹Data may not add to totals shown because of independent rounding.

Table 36.—Clays sold or used by producers in the United States¹ in 1988, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	W	W	—	341,452	—	341,452
Pet waste absorbents	—	W	W	—	1,005,021	—	1,005,021
Other ²	—	176,345	145,072	—	18,035	—	339,451
Ceramics and glass:							
Catalysts (oil-refining)	—	12,053	—	—	—	108,499	120,552
Crockery and other earthenware	—	—	W	9,222	—	4,624	13,846
Electrical porcelain	28,717	—	34	—	—	14,951	43,702
Fine china and dinnerware	4,701	—	—	—	—	48,357	53,058
Glazes, glass, and enamels	—	—	—	—	—	2,499	2,499
Mineral wool, insulation, and fiberglass	W	W	36,931	—	—	461,073	498,004
Pottery	243,504	24,425	65,188	—	1,602	29,587	364,306
Roofing granules	—	—	—	—	—	10,239	10,239
Sanitaryware	170,859	—	—	5,291	—	24,355	200,505
Other ²	72,660	W	W	79	—	57,055	129,794
Chemical manufacturing	—	—	—	—	—	211,941	211,941
Civil engineering and sealing	—	110,917	107,712	505	136,078	76,517	431,729
Drilling mud	—	840,109	—	—	32,947	1,054	874,110
Fillers, extenders, and binders:							
Adhesives	—	4,452	2,722	—	210	53,205	60,589
Animal feed	W	109,079	W	—	W	4,472	113,551

See footnotes at end of table.

Table 36.—Clays sold or used by producers in the United States¹ in 1988, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Fillers, extenders, and binders—Continued							
Fertilizers	—	W	—	—	49,409	4,932	54,341
Gypsum products and wallboard	W	—	—	—	20,369	12,882	33,251
Ink	—	W	—	—	—	2,262	2,262
Medical, pharmaceutical, cosmetic . . .	—	10,570	—	—	975	3,288	14,832
Paint	—	W	—	—	18,102	294,350	312,452
Paper coating	—	—	—	—	—	2,483,325	2,483,325
Paper filling	—	W	—	—	—	1,479,822	1,479,822
Pesticides and related products	W	6,665	3,993	—	181,807	55,601	248,066
Plastics	—	W	4,607	—	W	55,639	60,246
Rubber	W	W	—	W	—	203,388	203,388
Other ²	132,593	16,933	77,644	W	21,518	189,000	437,688
Filtering, clarifying, and decolorizing:							
Animal oils, mineral oils and greases, and vegetable oils	—	69,524	—	—	18,831	583	88,939
Desiccants	—	W	—	—	—	—	W
Floor and wall tile:							
Ceramic	106,098	—	261,968	—	—	18,283	386,349
Quarry tile	W	—	102,320	—	—	—	102,320
Other ²	25,688	11	—	—	—	20,798	46,497
Heavy clay products:							
Brick, extruded	W	W	11,477,845	22,833	—	267,688	11,768,366
Brick, other	—	—	3,241,713	12,634	—	104,554	3,358,901
Drain tile	—	—	105,014	—	—	—	105,014
Flower pots	—	—	19,924	—	—	—	19,924
Flue linings	—	—	47,543	18,525	—	6,350	72,418
Portland and other cements	—	18,843	7,347,169	—	29,942	201,012	7,596,966
Roofing tile	—	W	82,465	—	178	—	82,643
Sewer pipe, vitrified	—	—	372,283	3,848	—	6,495	382,627
Structural tile	—	—	84,300	—	—	—	84,300
Terra cotta	—	—	7,408	W	—	—	7,408
Other ²	W	7,324	1,253,516	2,619	—	18,468	1,281,927
Lightweight aggregate:							
Concrete block	—	—	2,319,762	—	—	—	2,319,762
Highway surfacing	—	—	851,004	—	—	—	851,004
Structural concrete	—	W	475,021	—	—	—	475,021
Other ²	—	4,865	163,293	—	—	—	168,159
Pelletizing (iron ore)	—	405,279	80,391	—	—	—	485,670
Refractories:							
Firebrick, blocks, and shapes	W	W	121,067	439,289	—	156,729	717,084
Foundry sand	—	698,698	1,814	85,925	—	585	787,022
Grogs and calcines	—	—	—	106,060	—	593,494	699,554
High-alumina brick and specialties . . .	26,695	—	—	67,958	—	17,053	111,706
Kiln furniture	—	W	2,803	—	—	6,056	8,860
Mortar and cement, refractory	—	—	182,389	—	—	—	182,389
Other ²	W	18,837	—	5,698	—	29,439	53,974
Other ³	40,255	20,824	2,119	5,717	15,328	7,295	91,537
Exports	138,123	315,221	15,587	7,306	81,334	1,625,286	2,182,858
Total ⁴	989,893	2,870,971	29,062,619	793,509	1,973,137	8,973,089	44,663,219

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

¹Includes Puerto Rico.

²Includes uses indicated by symbol W.

³Uses not specified.

⁴Data may not add to totals shown because of independent rounding.

Table 37.—Clays sold or used by producers in the United States in 1989, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,703,001	108,241	—	66,828	² 1,878,070	² \$23,537,759
Arizona	—	36,853	151,358	—	—	—	188,211	2,506,726
Arkansas	—	—	627,825	—	—	243,488	871,313	17,390,659
California	477	152,663	1,919,694	—	—	122,996	2,195,830	39,243,331
Colorado	—	272	248,308	7,477	—	9,378	265,435	2,064,361
Connecticut	—	—	W	—	—	—	W	W
Florida	—	—	115,981	—	405,069	42,632	563,682	46,940,900
Georgia	—	—	1,606,546	—	667,244	7,494,522	9,768,312	1,004,953,225
Idaho	—	W	W	—	—	8,100	20,618	W
Illinois	—	—	142,207	—	W	—	³ 142,207	³ 24,200,095
Indiana	—	—	871,179	—	—	—	871,179	3,835,574
Iowa	—	—	439,323	—	—	—	439,323	1,772,934
Kansas	—	W	533,099	—	—	—	² 533,099	² 2,699,864
Kentucky	W	—	716,990	W	—	—	^{4,5} 716,998	^{4,5} 10,863,307
Louisiana	—	—	233,992	—	—	—	233,992	6,114,609
Maine	—	—	W	—	—	—	W	W
Maryland	—	—	351,464	—	—	—	351,464	1,882,283
Massachusetts	—	—	W	—	—	—	W	W
Michigan	—	—	1,249,198	—	—	—	1,249,198	4,598,922
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	401,748	497,625	—	—	—	⁴ 899,373	⁴ 29,161,419
Missouri	—	—	1,048,814	431,084	W	—	³ 1,479,898	³ 32,474,448
Montana	—	65,567	30,176	W	—	—	⁵ 95,743	⁵ 1,840,726
Nebraska	—	—	224,624	—	—	—	224,624	879,546
Nevada	—	40,045	—	—	17,219	W	⁶ 57,264	⁶ 6,016,172
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	W	18,492	—	—	W	W
New Mexico	—	—	27,887	3,125	—	—	31,012	94,209
New York	—	—	531,559	—	—	—	531,559	3,428,813
North Carolina	—	—	2,204,617	—	—	65,767	2,270,384	15,528,692
North Dakota	—	—	47,903	—	—	—	47,903	W
Ohio	—	—	3,296,737	222,931	—	—	3,519,668	14,983,071
Oklahoma	—	—	565,956	—	—	—	565,956	1,618,977
Oregon	—	12,004	198,889	—	—	—	210,893	875,772
Pennsylvania	—	—	1,035,514	14,459	—	W	⁶ 1,049,973	⁶ 6,140,974
Puerto Rico	—	—	136,873	—	—	—	136,873	310,888
South Carolina	—	—	931,059	—	5,443	659,651	1,596,153	39,075,215
South Dakota	—	—	W	—	—	—	W	W
Tennessee	640,638	—	496,514	—	W	—	W	W
Texas	W	40,059	2,203,895	2,348	30,327	W	2,276,629	25,511,051
Utah	—	45,650	276,299	—	—	—	321,949	2,633,139
Virginia	—	—	1,001,394	—	W	—	³ 1,001,394	³ 11,402,335
Washington	—	—	230,480	2,787	—	—	233,267	1,590,871
West Virginia	—	—	251,385	—	—	—	251,385	553,474
Wyoming	—	2,166,497	W	—	—	—	W	W
Undistributed	262,365	151,007	545,823	14,986	756,209	260,306	⁷ 5,300,311	⁷ 128,886,672
Total⁸	903,480	3,112,365	26,694,188	825,930	1,881,511	8,973,668	42,391,142	1,515,611,013

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Undistributed."

¹Includes Puerto Rico.

²Excludes bentonite.

³Excludes fuller's earth.

⁴Excludes ball clay.

⁵Excludes fire clay.

⁶Excludes kaolin.

⁷Incomplete total; difference included with individual State totals.

⁸Data may not add to totals shown because of independent rounding.

Table 38.—Clays sold or used by producers in the United States¹ in 1989, by kind and use
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	W	W	—	298,009	—	298,009
Pet waste absorbents	—	W	W	—	1,015,192	—	1,015,192
Other ²	—	287,747	204,869	—	23,478	31,026	547,120
Ceramics and glass:							
Catalysts (oil-refining)	—	12,220	—	—	16,786	93,308	122,314
Crockery and other earthenware	—	—	—	181	—	17,954	18,135
Electrical porcelain	21,521	—	—	—	—	15,284	36,805
Fine china and dinnerware	3,360	—	—	—	—	15,175	18,535
Glazes, glass, and enamels	—	W	—	W	—	2,507	2,507
Mineral wool, insulation, and fiberglass	W	W	—	—	—	472,669	472,669
Pottery	125,537	24,416	18,791	20,939	—	30,147	219,830
Roofing granules	—	—	92,418	—	—	10,677	103,095
Sanitaryware	194,077	—	—	—	—	35,131	229,208
Other ²	73,869	W	W	1,596	—	75,989	151,454
Chemical manufacturing	—	W	—	—	W	217,452	217,452
Civil engineering and sealing	13,183	108,907	1,415,906	3,352	W	7,477	1,548,825
Drilling mud	—	846,583	—	—	35,181	485	882,249
Fillers, extenders, and binders:							
Adhesives	—	8,074	907	—	1,025	39,502	49,508
Animal feed	W	93,937	W	—	W	7,571	101,508
Fertilizers	—	W	—	—	48,084	2,295	50,379
Gypsum products and wallboard	W	—	—	—	30,209	10,202	40,411
Ink	—	W	—	—	—	2,025	2,025
Medical, pharmaceutical, cosmetic	—	9,169	—	—	1,395	3,341	13,905
Paint	—	W	W	—	20,248	226,395	246,643
Paper coating	—	—	—	—	—	2,568,846	2,568,846
Paper filling	—	W	—	—	—	1,560,994	1,560,994
Pesticides and related products	W	9,617	14,110	—	141,163	19,692	184,582
Plastics	—	W	—	—	W	48,822	48,822
Rubber	W	W	—	—	—	258,864	258,864
Other ²	118,155	20,258	75,281	—	24,099	193,710	431,503
Filtering, clarifying, and decolorizing:							
Animal oils, mineral oils and greases, and vegetable oils	—	78,475	—	—	15,085	646	94,206
Desiccants	—	W	—	—	—	—	W
Floor and wall tile:							
Ceramic	161,724	—	225,825	4,169	4,536	21,254	417,508
Quarry tile	W	—	14,338	—	—	—	14,338
Other ²	15,018	—	—	—	—	24,756	39,774
Heavy clay products:							
Brick, extruded	W	W	10,188,861	19,818	—	174,214	10,382,893
Brick, other	—	—	2,244,505	—	—	129,002	2,373,507
Drain tile	—	—	10,251	—	—	—	10,251
Flower pots	—	—	45,049	—	—	—	45,049
Flue linings	—	—	10,096	7,303	—	6,350	23,749
Portland and other cements	—	1,583	7,440,067	W	43,551	188,286	7,673,487
Roofing tile	—	W	3,915	—	100	—	4,015
Sewer pipe, vitrified	—	—	366,927	102	—	8,615	375,644
Structural tile	—	—	49,041	—	—	—	49,041
Terra cotta	—	—	18,748	W	—	—	18,748
Other ²	W	3,033	242,997	3,648	—	19,136	268,814
Lightweight aggregate:							
Concrete block	—	—	2,066,480	—	—	—	2,066,480
Highway surfacing	—	—	326,881	—	—	—	326,881
Structural concrete	—	W	773,052	—	—	—	773,052

See footnotes at end of table.

Table 38.—Clays sold or used by producers in the United States¹ in 1989, by kind and use—Continued
(Metric tons)

Use	Ball clay	Ben- tonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Lightweight aggregate—Continued							
Other ²	—	3,615	215,249	—	—	—	218,864
Pelletizing (iron ore)	—	477,275	76,748	—	—	—	554,023
Refractories:							
Firebrick, blocks, and shapes	W	W	100,186	546,769	—	115,292	762,247
Foundry sand	—	609,973	—	64,166	—	669	674,808
Grogs and calcines	—	—	—	58,766	—	628,950	687,716
High-alumina brick and specialties	21,410	—	—	35,613	—	6,622	63,645
Kiln furniture	1,531	W	2,803	—	—	5,933	10,267
Mortar and cement, refractory	—	—	414,294	—	—	1,344	415,638
Other ²	W	35,637	6,146	40,468	—	52,565	134,816
Other ³	46,714	46,752	16,556	—	23,791	9,324	143,137
Exports	107,381	435,094	12,891	19,040	139,579	1,613,170	2,327,155
Total ⁴	903,480	3,112,365	26,694,188	825,930	1,881,511	8,973,668	42,391,142

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

¹Includes Puerto Rico.

²Includes uses indicated by symbol W.

³Uses not specified.

⁴Data may not add to totals shown because of independent rounding.

Table 39.—Clays sold or used by producers in the United States in 1990, by State¹
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	—	W	1,953,519	96,257	—	W	2,258,154	\$37,189,360
Arizona	—	37,643	102,519	—	—	—	140,162	2,318,185
Arkansas	—	—	705,469	—	—	283,914	989,380	21,577,837
California	—	153,450	1,888,032	—	W	122,033	² 2,163,515	² 40,217,102
Colorado	—	272	262,020	—	—	—	262,292	1,868,241
Connecticut	—	—	W	—	—	—	W	W
Florida	—	—	W	—	352,890	38,444	³ 391,334	³ 39,624,955
Georgia	—	—	1,546,304	—	648,009	7,660,935	9,855,248	1,060,539,776
Idaho	—	—	W	—	—	W	W	W
Illinois	—	—	598,479	—	W	—	² 598,479	² 5,515,844
Indiana	W	—	1,051,703	—	—	—	⁴ 1,051,703	⁴ 3,272,624
Iowa	—	—	423,227	—	—	—	423,227	1,376,264
Kansas	—	—	625,969	—	—	—	625,969	4,056,062
Kentucky	W	—	826,205	—	—	—	⁴ 826,205	⁴ 8,282,322
Louisiana	—	—	368,322	—	—	—	368,322	1,066,295
Maine	—	—	W	—	—	—	W	W
Maryland	—	—	338,755	—	—	—	338,755	1,711,599
Massachusetts	—	—	W	—	—	—	W	W
Michigan	—	—	1,201,542	—	—	—	1,201,542	4,093,649
Minnesota	—	—	W	—	—	W	W	W
Mississippi	W	289,372	528,456	—	W	—	² 817,828	² 16,195,868
Missouri	—	—	1,064,884	282,674	W	—	² 1,347,558	² 12,863,415
Montana	—	W	29,741	—	—	—	³ 29,741	³ 192,682
Nebraska	—	—	227,292	—	—	—	227,292	1,685,241
Nevada	—	34,625	—	—	W	W	111,854	8,992,928
New Hampshire	—	—	W	—	—	—	W	W
New Jersey	—	—	W	W	—	—	W	W
New Mexico	—	—	27,994	W	—	—	⁶ 27,994	⁶ 74,250
New York	—	—	490,552	—	—	—	490,552	2,906,006
North Carolina	—	—	2,179,428	—	—	W	⁷ 2,179,428	⁷ 9,355,674

See footnotes at end of table.

Table 39.—Clays sold or used by producers in the United States in 1990, by State¹—Continued
(Metric tons)

State	Ball clay	Ben- tonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
North Dakota	—	—	50,485	—	—	—	50,485	W
Ohio	—	—	2,320,354	225,797	—	—	2,546,151	\$13,333,596
Oklahoma	—	—	631,302	—	—	—	631,302	3,155,987
Oregon	—	24,563	198,889	—	—	—	223,452	1,390,822
Pennsylvania	—	—	840,646	W	—	W	^{6,7} 840,646	^{6,7} 2,899,788
Puerto Rico	—	—	147,721	—	—	—	147,721	W
South Carolina	—	—	831,763	—	—	1,231,061	2,062,824	44,485,828
South Dakota	—	—	W	—	—	—	W	W
Tennessee	543,693	—	482,496	—	W	34,473	² 1,060,662	² 25,775,522
Texas	55,610	W	2,106,485	—	W	W	2,303,458	26,145,493
Utah	—	W	277,795	—	—	—	⁵ 277,795	⁵ 1,773,740
Virginia	—	—	882,383	—	W	—	² 882,383	² 3,740,806
Washington	—	—	158,257	—	—	—	158,257	8,740,806
West Virginia	—	—	164,257	—	—	—	164,257	383,710
Wyoming	—	2,523,573	W	—	—	—	³ 2,523,573	76,082,575
Undistributed	188,360	410,097	562,595	21,080	1,306,577	390,916	⁸ 2,452,653	⁸ 130,529,650
Total ⁹	787,663	3,473,595	26,095,836	625,807	2,307,476	9,761,775	43,052,152	1,620,414,502

W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Undistributed."

¹Includes Puerto Rico.

²Excludes fuller's earth.

³Excludes common clay.

⁴Excludes ball clay.

⁵Excludes bentonite.

⁶Excludes fire clay.

⁷Excludes kaolin.

⁸Incomplete total; difference included with "Undistributed."

⁹Data may not add to totals shown because of independent rounding.

Table 40.—Clays sold or used by producers in the United States¹ in 1990, by kind and use
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Absorbents:							
Oil and grease	—	W	W	—	350,804	—	350,804
Pet waste absorbents	—	W	W	—	1,347,270	—	1,347,270
Other ²	W	196,984	165,184	—	W	—	362,168
Ceramics and glass:							
Catalysts (oil-refining)	—	W	—	—	W	90,772	90,772
Crockery and other earthenware	—	—	—	—	—	2,998	2,998
Electrical porcelain	22,665	—	—	—	W	16,183	38,848
Fine china and dinnerware	W	—	—	—	—	17,711	17,711
Glazes, glass, and enamels	—	W	—	W	—	W	W
Mineral wool, insulation, and fiberglass	—	W	—	—	—	454,131	454,131
Pottery	118,519	W	150,440	W	—	27,852	296,811
Roofing granules	—	—	102,290	—	2,887	9,114	114,291
Sanitaryware	176,809	—	—	—	—	40,947	217,755
Other ²	14,926	47,619	—	W	15,046	83,886	161,477
Chemical manufacturing	—	10,082	—	—	W	218,170	228,252
Civil engineering and sealing	11,793	181,149	598,234	—	—	584,331	1,375,507
Drilling mud	—	712,973	—	—	34,150	—	747,123
Fillers, extenders, and binders:							
Adhesives	W	4,410	—	—	6,350	54,789	65,549
Animal feed	21,661	105,580	W	—	W	W	127,241
Fertilizers	—	W	—	—	61,211	2,725	63,936
Gypsum products and wallboard	W	—	—	—	31,510	2,492	34,002

See footnotes at end of table.

Table 40.—Clays sold or used by producers in the United States¹ in 1990, by kind and use—Continued
(Metric tons)

Use	Ball clay	Bentonite	Common clay and shale	Fire clay (refractory only)	Fuller's earth	Kaolin	Total
Filters, extenders, and binders—							
Continued							
Ink	—	W	—	W	—	W	W
Medical, pharmaceutical, cosmetic	—	16,045	—	—	W	3,118	19,163
Paint	W	5,747	W	—	W	261,219	266,966
Paper coating	—	W	—	—	—	2,753,171	2,753,171
Paper filling	W	W	—	—	—	1,471,298	1,471,298
Pesticides and related products	W	8,394	W	—	167,720	50,309	226,423
Plastics	W	W	—	—	W	61,901	61,901
Rubber	W	W	—	—	W	207,733	207,733
Other ²	93,562	18,993	123,288	—	66,504	187,756	¹ 490,103
Filtering, clarifying, and decolorizing:							
Animal oils, mineral oils and greases, and vegetable oils	—	62,775	—	—	23,237	458	86,470
Desiccants	—	W	—	—	—	—	W
Floor and wall tile:							
Ceramic	158,325	11	212,665	—	—	13,816	384,817
Quarry tile	W	—	530,662	—	—	—	530,662
Other ²	W	—	—	—	—	29,946	29,946
Heavy clay products:							
Brick, extruded	W	W	10,540,509	17,822	—	256,724	10,815,055
Brick, other	—	—	1,837,495	—	—	33,987	1,871,482
Drain tile	—	—	9,604	—	—	—	9,604
Flower pots	—	—	68,026	—	—	—	68,026
Flue linings	—	—	22,140	5,842	—	W	27,982
Portland and other cements	—	W	7,095,811	—	—	176,003	7,271,814
Roofing tile	—	W	W	—	—	—	W
Sewer pipe, vitrified	—	—	107,986	227	—	W	108,213
Structural tile	—	—	54,122	—	—	—	54,122
Terra cotta	—	—	W	—	—	—	W
Other ²	W	5,177	96,439	2,098	—	32,168	135,882
Lightweight aggregate:							
Concrete	—	—	2,523,507	—	—	—	2,523,507
Highway surfacing	—	W	267,861	—	—	—	267,861
Structural concrete	—	—	786,084	W	—	—	786,084
Other ²	—	7,194	226,879	W	—	—	234,073
Pelletizing (iron ore)	—	682,878	W	—	—	—	682,878
Refractories:							
Firebrick, blocks, and shapes	W	W	98,321	453,024	—	134,927	686,272
Foundry sand	—	864,680	—	7,739	—	536	872,955
Grogs and calcines	—	—	—	20,208	—	759,246	779,454
High-alumina brick and specialties	—	—	—	41,192	—	W	41,192
Kiln furniture	15,814	W	—	—	—	W	15,814
Mortar and cement, refractory	852	—	407,145	—	—	—	407,997
Other ²	W	49,386	W	44,469	36,948	41,108	171,911
Other ³	62,167	31,039	52,538	23,822	23,629	10,799	203,993
Exports	90,570	462,483	18,606	9,364	140,210	¹ 1,668,451	² 2,390,684
Total	787,663	3,473,595	26,095,836	625,807	2,307,476	9,761,775	⁴ 43,052,152

¹Revised. W Withheld to avoid disclosing company proprietary data; included with "Total" and/or "Other."

²Includes Puerto Rico.

³Includes uses indicated by symbol W.

⁴Uses not specified.

⁵Data may not add to total shown because of independent rounding.

Page Intentionally Left Blank

COBALT

By Kim B. Shedd

Cobalt is a strategic and critical metal used in many diverse industrial and military applications. The largest use of cobalt is in superalloys, which are used to make jet engine parts. Cobalt is also used in magnetic alloys and in cutting and wear-resistant materials such as cemented carbides. The chemical industry consumes significant quantities of cobalt in a variety of applications including catalysts for petroleum and chemical processing; drying agents for paints and inks; ground coats for porcelain enamels; decolorizers for ceramics and glass; and pigments for ceramics, paints, and plastics.

Cobalt is almost always produced as a byproduct of other more abundant metals. Currently, more than one-half of the world's supply is produced as a byproduct of copper mining and refining in Zaire and Zambia. Cobalt

production in most other countries is a byproduct of nickel mining and/or refining. Although some producers can increase or decrease the amount of cobalt mined or refined, most cobalt production is ultimately dependent on the production of copper and nickel.

The United States is the world's largest consumer of cobalt, but currently has no domestic mine or refinery production. Therefore, the United States is 100% dependent on imports for its supply of primary cobalt. In terms of total supply, currently about 15% of U.S. cobalt consumption is from recycled scrap, resulting in a net import reliance of 85%. To ensure an adequate supply for military, industrial, and essential civilian needs during a national emergency, cobalt metal is included in the National Defense Stockpile.

Table 1.—Salient cobalt statistics
(Metric tons cobalt content unless otherwise specified)

	1968	1969	1970	1971	1972	1973	1974
United States:							
Consumption:							
Reported	5,896	7,080	6,063	5,670	6,409	8,501	8,555
Apparent	6,615	8,850	7,376	6,143	8,829	9,989	10,749
Imports for consumption ..	4,113	5,856	5,632	4,950	6,312	8,726	7,313
Stocks, Dec. 31 ¹	970	994	857	640	541	1,112	929
Price, metal, per pound ² ..	\$1.85	\$2.20	\$2.20	\$2.45	\$2.45	\$3.10	\$3.75
World: Production:							
Mine	19,036	19,739	23,849	24,877	25,022	27,886	29,618
Refinery	17,138	17,731	21,270	22,400	20,272	23,095	24,816
	1975	1976	1977	1978	1979	1980	1981
United States:							
Consumption:							
Reported	5,800	7,476	7,519	9,069	7,893	6,949	5,298
Apparent	6,376	8,998	8,305	9,237	8,530	7,735	5,684
Imports for consumption ..	2,997	7,478	7,960	8,631	9,071	7,394	7,073
Stocks, Dec. 31 ¹	817	1,442	1,696	1,990	1,538	1,921	1,329
Price, metal, per pound ² ..	\$4.00	\$5.40	\$6.40	\$20.00	\$25.00	\$25.00	\$17.26
World: Production:							
Mine	28,039	23,108	23,600	27,232	30,188	31,387	30,744
Refinery	20,727	20,484	20,759	24,654	29,318	30,573	26,187
	1982	1983	1984	1985	1986	1987	1988
United States:							
Consumption:							
Reported	4,295	5,134	5,871	5,616	6,483	6,666	7,308
Apparent	5,194	7,127	8,117	7,118	7,649	7,986	7,824
Imports for consumption ..	5,838	7,811	11,480	8,032	5,574	8,832	7,051
Stocks, Dec. 31 ¹	1,129	1,273	1,428	1,273	1,355	2,043	1,766
Price, metal, per pound ² ..	\$8.56	\$5.76	\$10.44	\$11.43	\$7.49	\$6.56	\$7.09
World: Production:							
Mine	24,554	37,722	40,972	47,374	50,199	41,345	43,969
Refinery	19,287	18,088	23,703	27,461	31,399	27,995	26,407

See footnotes at end of table.

PRECEDING PAGE
BLANK

Table 1.—Salient cobalt statistics—Continued
(Metric tons cobalt content unless otherwise specified)

	1989	1990
United States:		
Consumption:		
Reported	7,172	7,512
Apparent	7,164	7,635
Imports for consumption ..	5,793	6,529
Stocks, Dec. 31 ¹	1,456	1,853
Price, metal, per pound ² ..	\$7.64	\$10.09
World: Production:		
Mine	36,142	35,822
Refinery	25,181	25,316

¹Consumer stocks only, 1968-79; consumer and processor stocks, 1980-90.

²Yearend producer price, 1968-81; weighted average market price derived from "Metals Week" prices, 1982-90.

Table 2.—U.S. reported consumption of cobalt, by form
(Metric tons cobalt content)

Form	1968	1969	1970	1971	1972	1973
Chemical compounds (organic and inorganic) ¹	828	1,169	1,187	1,245	1,221	1,619
Metal	4,743	5,469	4,561	4,085	4,767	6,459
Oxide	260	293	284	283	332	303
Purchased scrap	65	149	31	57	89	² 120
Total ³	5,896	7,080	6,063	5,670	6,409	8,501
	1974	1975	1976	1977	1978	1979
Chemical compounds (organic and inorganic) ¹	1,649	1,302	1,808	1,858	2,571	⁴ 1,598
Metal	6,541	4,174	5,310	5,238	5,816	5,446
Oxide	243	169	210	193	212	319
Purchased scrap	² 122	² 155	² 149	230	470	531
Total ³	8,555	5,800	7,476	7,519	9,069	7,893
	1980	1981	1982	1983	1984	1985
Chemical compounds (organic and inorganic) ¹	1,303	1,225	821	1,131	1,090	854
Metal	4,910	3,379	2,746	3,250	3,967	⁵ 3,878
Oxide	200	253	332	425	415	477
Purchased scrap	537	441	395	328	399	408
Total ³	6,949	5,298	4,295	5,134	5,871	⁵ 5,616
	1986	1987	1988	1989	1990	
Chemical compounds (organic and inorganic) ¹	1,778	1,812	2,032	2,081	2,192	
Metal	3,507	3,826	4,256	3,907	4,095	
Oxide	⁶ (⁷)	⁶ (⁷)	⁶ (⁷)	⁶ (⁷)	⁶ (⁷)	
Purchased scrap	⁷ 1,196	1,028	1,018	1,184	1,225	
Total ³	⁷ 6,483	6,666	7,308	7,172	7,512	

¹1968-85 excludes oxides; 1986-90 includes oxides.

²Includes some chemical compounds.

³Data may not add to totals shown because of independent rounding.

⁴Data not comparable with those of previous years because of a change in reporting.

⁵Data not comparable with those of previous years because of the addition of an estimate for the cemented carbide industry.

⁶Included with "Chemical compounds (organic and inorganic)."

⁷Data not comparable with those of previous years because of the addition of statistical canvass coverage of the superalloy recycling industry.

Table 3.—U.S. reported consumption of cobalt, by end use
(Metric tons, cobalt content)

End use	1970	1971	1972	1973	1974	1975
Steel:						
Full-alloy	62	89	98	103	113	84
High-strength low-alloy	(¹)	(¹)	3	20	4	1
Stainless and heat-resisting	52	23	18	15	18	17
Tool	242	144	164	235	313	132
Superalloys	1,053	899	1,366	1,489	1,855	1,023
Alloys (excludes alloy steels and superalloys):						
Cutting and wear-resistant materials	633	558	577	1,139	1,169	636
Magnetic alloys	1,077	1,033	1,561	1,951	1,568	922
Nonferrous alloys	249	241	295	358	354	315
Welding materials	82	112	90	177	192	215
Other alloys	445	213	307	342	290	179
Mill products made from metal powder	W	W	W	W	W	W
Chemical and ceramic uses:						
Catalysts	182	215	318	522	625	504
Drier in paint or related usage	(²)	(²)	(²)	(²)	(²)	(²)
Feed or nutritive additive	(²)	(²)	(²)	(²)	(²)	(²)
Glass decolorizer	31	27	28	29	23	19
Ground coat frit	59	62	65	75	60	38
Pigments	70	66	75	98	87	59
Miscellaneous chemical and ceramic uses ³	1,190	1,291	1,299	1,708	1,717	1,398
Miscellaneous and unspecified	636	695	144	239	167	257
Total⁴	6,063	5,670	6,409	8,501	8,555	5,800
	1976	1977	1978	1979	1980	1981
Steel:						
Full-alloy	107	163	113	103	53	64
High-strength low-alloy	W	W	5	W	W	W
Stainless and heat-resisting	19	34	61	62	21	16
Tool	101	139	172	187	146	77
Superalloys	1,260	1,684	1,950	2,393	2,851	1,903
Alloys (excludes alloy steels and superalloys):						
Cutting and wear-resistant materials	719	648	833	963	610	488
Magnetic alloys	1,599	1,578	1,709	1,481	1,028	765
Nonferrous alloys	368	295	268	178	68	59
Welding materials	235	200	329	201	281	221
Other alloys	297	125	171	124	95	56
Mill products made from metal powder	W	W	W	W	W	W
Chemical and ceramic uses:						
Catalysts	656	583	736	⁵ 854	751	580
Drier in paint or related usage	(²)	(²)	(²)	(²)	604	625
Feed or nutritive additive	(²)	(²)	(²)	(²)	34	26
Glass decolorizer	14	12	10	⁵ 20	18	18
Ground coat frit	41	35	44	⁵ 251	219	200
Pigments	94	85	90	⁵ 90	128	149
Miscellaneous chemical and ceramic uses ³	1,811	1,716	2,451	⁵ 812	—	—
Miscellaneous and unspecified	156	222	126	173	43	49
Total⁴	7,476	7,519	9,069	7,893	6,949	5,298
	1982	1983	1984	1985	1986	1987
Steel:						
Full-alloy	52	W	W	W	W	W
High-strength low-alloy	W	W	W	W	W	W
Stainless and heat-resisting	23	24	34	28	34	26
Tool	73	112	160	92	116	174
Superalloys	1,505	1,830	2,162	2,418	⁶ 2,924	2,873
Alloys (excludes alloy steels and superalloys):						
Cutting and wear-resistant materials	289	302	377	⁷ 566	518	⁸ 428
Magnetic alloys	700	776	1,002	660	699	675

See footnotes at end of table.

Table 3.—U.S. reported consumption of cobalt, by end use—Continued
(Metric tons, cobalt content)

End use	1982	1983	1984	1985	1986	1987
Alloys (excludes alloy steels and superalloys)—Continued						
Nonferrous alloys	66	77	80	^a W	W	W
Welding materials	202	214	181	W	W	^c 256
Other alloys	25	33	7	^b 55	54	43
Mill products made from metal powder	W	W	W	W	W	W
Chemical and ceramic uses:						
Catalysts	358	483	588	497	656	W
Drier in paint or related usage	505	682	571	517	674	797
Feed or nutritive additive	24	23	26	21	21	W
Glass decolorizer	15	19	19	19	18	W
Ground coat frit	216	295	280	328	350	W
Pigments	173	166	189	182	210	W
Miscellaneous chemical and ceramic uses ³	—	—	—	—	—	—
Miscellaneous and unspecified	67	98	197	233	210	1,396
Total ⁴	4,295	5,134	5,871	⁷ 5,616	⁶ 6,483	6,666
	1988	1989	1990			
Steel:						
Full-alloy	W	W	W			
High-strength low-alloy	W	—	—			
Stainless and heat-resisting	26	74	41			
Tool	180	219	123			
Superalloys	2,865	2,860	3,345			
Alloys (excludes alloy steels and superalloys):						
Cutting and wear-resistant materials	522	538	541			
Magnetic alloys	878	870	710			
Nonferrous alloys	64	27	31			
Welding materials	206	136	180			
Other alloys	86	52	74			
Mill products made from metal powder	W	W	W			
Chemical and ceramic uses:						
Catalysts	W	W	W			
Drier in paint or related usage	892	718	⁵ 751			
Feed or nutritive additive	W	W	W			
Glass decolorizer	W	W	W			
Ground coat frit	W	W	W			
Pigments	W	W	W			
Miscellaneous chemical and ceramic uses ³	—	—	—			
Miscellaneous and unspecified	1,590	1,680	1,717			
Total ⁴	7,308	7,172	7,512			

W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous and unspecified."

¹Included with "Full-alloy."

²Included with "Miscellaneous chemical and ceramic uses."

³Driers in paint and related products, pigments, enamel ground coats, feed, electroplating, etc.

⁴Data may not add to totals shown because of independent rounding.

⁵Data not comparable with those of previous years because of a change in reporting.

⁶Data not comparable with those of previous years because of the addition of statistical canvass coverage of the superalloy recycling industry.

⁷Data not comparable with those of previous years because of the addition of an estimate for the cemented carbide industry.

⁸Data not comparable with those of previous years because of a change in end-use definition.

Table 4.—U.S. Imports for consumption of cobalt, by form

Year	Metal ¹			Oxides		
	Gross weight (metric tons)	Cobalt content ^e (metric tons)	Value (thousands)	Gross weight (metric tons)	Cobalt content ^e (metric tons)	Value (thousands)
1970	5,385	5,385	\$26,020	322	232	\$1,394
1971	4,709	4,709	22,377	329	237	1,426
1972	5,934	5,934	30,650	514	370	2,330
1973	8,345	8,345	53,772	522	376	2,714
1974	6,709	6,709	49,661	684	493	4,514
1975	2,763	2,763	25,611	106	76	779
1976	6,862	6,862	66,299	63	46	573
1977	7,635	7,635	91,381	230	170	2,346
1978	7,479	7,479	167,662	489	362	9,190
1979	8,567	8,567	462,250	229	169	9,429
1980	6,800	6,800	358,583	188	139	7,630
1981	6,308	6,308	238,820	201	149	5,375
1982	5,266	5,266	137,652	164	122	2,560
1983	7,191	7,191	110,076	183	135	1,813
1984	10,576	10,576	202,954	320	237	5,285
1985	7,536	7,536	181,379	112	83	2,258
1986	5,293	5,293	83,295	232	171	4,202
1987	8,442	8,442	122,791	361	267	5,293
1988	6,675	6,675	105,544	337	249	5,692
1989	5,444	5,444	91,960	² 380	³ 273	6,598
1990	⁴ 6,027	⁴ 6,027	⁴ 106,902	² 488	³ 351	8,539
Year	Salts and compounds			Other forms ⁵		
	Gross weight (metric tons)	Cobalt content ^e (metric tons)	Value (thousands)	Gross weight (metric tons)	Cobalt content ^e (metric tons)	Value (thousands)
1970	71	14	\$92	—	—	—
1971	18	4	27	—	—	—
1972	37	7	44	—	—	—
1973	28	5	51	—	—	—
1974	1	(⁶)	12	8,748	111	NA
1975	19	4	73	11,762	154	\$1,353
1976	107	32	365	17,883	538	3,160
1977	112	34	381	9,958	121	895
1978	316	95	2,003	NA	696	10,622
1979	168	50	2,192	NA	284	9,249
1980	297	89	3,572	NA	366	12,105
1981	567	170	4,969	NA	446	11,650
1982	608	183	2,650	NA	267	4,552
1983	758	228	2,244	NA	258	1,969
1984	1,036	311	5,371	NA	357	4,793
1985	651	192	4,413	NA	222	3,356
1986	365	109	2,669	—	—	—
1987	410	123	2,004	—	—	—
1988	424	127	2,689	—	—	—
1989	281	75	1,426	—	—	—
1990	547	150	3,227	—	—	—

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of cobalt, by form—Continued

Year	Total ⁷		
	Gross weight (metric tons)	Cobalt content ^e (metric tons)	Value (thousands)
1970	5,778	5,632	\$27,506
1971	5,056	4,950	23,830
1972	6,485	6,312	33,024
1973	8,895	8,726	56,537
1974	⁸ 7,394	7,313	⁹ 54,187
1975	⁸ 2,888	2,997	27,816
1976	⁸ 7,032	7,478	70,397
1977	⁸ 7,976	7,960	95,003
1978	⁸ 8,283	8,631	189,477
1979	⁸ 8,964	9,071	483,120
1980	⁸ 7,285	7,394	381,890
1981	⁸ 7,076	7,073	260,814
1982	⁸ 6,038	5,838	147,414
1983	⁸ 8,132	7,811	116,102
1984	⁸ 11,932	11,480	218,403
1985	⁸ 8,288	8,032	191,406
1986	5,890	5,574	90,166
1987	9,213	8,832	130,088
1988	7,436	7,051	113,925
1989	6,105	5,793	99,984
1990	⁴ 7,062	⁴ 6,529	⁴ 118,668

^eEstimated. NA Not available.¹Unwrought cobalt, excluding alloys; includes waste and scrap prior to 1989.²Includes hydroxides.³Includes cobalt content of hydroxides.⁴Includes 108 metric tons valued at \$1,747,104 destined for the National Defense Stockpile.⁵Contained cobalt in nickel-copper and nickel matte.⁶Less than 1/2 unit.⁷Data may not add to totals shown because of independent rounding.⁸Excludes gross weight of nickel-copper and nickel matte.⁹Does not include value of nickel-copper and nickel matte.

Source: Bureau of the Census.

Table 5.—U.S. Imports for consumption of cobalt, by country
(Metric tons and thousand dollars)

Year and country	Metal		Oxides		Salts and compounds and other forms ¹		Total cobalt content ^e
	Gross weight	Value	Gross weight	Value	Cobalt	Value	
					content ^e		
1970:							
Belgium	1,322	7,114	322	1,393	NA	NA	NA
Canada	210	1,093	—	—	NA	NA	NA
Finland	205	1,103	—	—	NA	NA	NA
Norway	360	1,748	—	—	NA	NA	NA
Zaire	3,143	14,308	—	—	NA	NA	NA
Other	145	654	(²)	1	NA	NA	NA
Total ³	5,385	26,020	322	1,394	⁴ 14	⁴ 92	5,632
1971:							
Belgium	1,134	5,973	329	1,425	NA	NA	NA
Canada	412	1,933	—	—	NA	NA	NA

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of cobalt, by country—Continued
(Metric tons and thousand dollars)

Year and country	Metal		Oxides		Salts and compounds and other forms ¹		Total cobalt content ²
	Gross weight	Value	Gross weight	Value	Cobalt content ²	Value	
1971—Continued							
Finland	548	2,696	—	—	NA	NA	NA
Norway	363	1,758	—	—	NA	NA	NA
Zaire	2,074	9,545	—	—	NA	NA	NA
Other	178	472	(²)	1	NA	NA	NA
Total ³	4,709	22,377	329	1,426	⁴ 4	⁴ 27	4,950
1972:							
Belgium	1,517	8,242	398	1,913	NA	NA	NA
Canada	287	1,540	100	342	NA	NA	NA
Finland	589	3,189	—	—	NA	NA	NA
Norway	415	2,083	—	—	NA	NA	NA
Zaire	2,306	11,602	16	74	NA	NA	NA
Zambia	486	2,607	—	—	NA	NA	NA
Other	334	1,387	(²)	1	NA	NA	NA
Total ³	5,934	30,650	514	2,330	⁴ 7	⁴ 44	6,312
1973:							
Australia	2	5	—	—	NA	NA	NA
Belgium	1,926	13,762	384	2,158	NA	NA	NA
Canada	228	1,458	103	355	NA	NA	NA
Finland	412	2,850	—	—	NA	NA	NA
Norway	441	2,995	—	—	NA	NA	NA
Zaire	5,078	31,634	—	—	NA	NA	NA
Other	257	1,068	34	201	NA	NA	NA
Total ³	8,345	53,772	522	2,714	⁴ 5	⁴ 51	8,726
1974:							
Australia	(²)	2	—	—	—	—	NA
Belgium	1,896	15,665	668	4,401	(²)	(²)	NA
Botswana	—	—	—	—	NA	NA	NA
Canada	98	770	—	—	(²)	4	NA
Finland	391	3,088	—	—	—	—	NA
French Pacific Islands	—	—	—	—	NA	NA	NA
Norway	599	4,261	—	—	—	—	NA
South Africa, Republic of	—	—	—	—	NA	NA	NA
Zaire	3,387	24,292	—	—	—	—	NA
Zambia	52	354	—	—	—	—	NA
Other	287	1,229	17	113	(²)	8	NA
Total ³	6,709	49,661	684	4,514	111	NA	7,313
1975:							
Australia	5	14	(²)	(²)	—	—	5
Belgium	618	7,727	105	773	(²)	1	694
Botswana	—	—	—	—	42	366	42
Canada	188	1,441	—	—	(²)	(²)	188
Finland	501	4,459	—	—	—	—	501
New Caledonia	—	—	—	—	89	780	89
Norway	320	2,743	—	—	—	—	320
South Africa, Republic of	—	—	—	—	24	207	24
Zaire	1,015	8,643	—	—	—	—	1,015
Other	116	584	1	6	4	72	120
Total ³	2,763	25,611	106	779	158	1,426	2,997
1976:							
Australia	1	10	(²)	2	(²)	(²)	1
Belgium	1,098	12,882	63	569	9	81	1,153
Botswana	—	—	—	—	476	² 2,795	476

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of cobalt, by country—Continued
(Metric tons and thousand dollars)

Year and country	Metal		Oxides		Salts and compounds and other forms ¹		Total cobalt content ²
	Gross weight	Value	Gross weight	Value	Cobalt content ²	Value	
1976—Continued							
Canada	335	3,142	—	—	(¹)	1	335
Finland	383	3,810	—	—	—	—	383
New Caledonia	—	—	—	—	62	^a 365	62
Norway	513	4,674	—	—	—	—	513
Zaire	3,076	29,038	—	—	—	—	3,076
Zambia	784	7,493	—	—	—	—	784
Other	674	5,250	(²)	2	23	283	697
Total ³	6,862	66,299	63	573	570	3,525	7,478
1977:							
Australia	5	34	—	—	—	—	5
Belgium	1,541	21,607	225	2,305	27	303	1,735
Botswana	—	—	—	—	32	^a 237	32
Canada	298	3,600	5	41	—	—	302
Finland	582	7,311	—	—	—	—	582
New Caledonia	—	—	—	—	89	^a 655	89
Norway	362	4,048	—	—	—	—	362
South Africa, Republic of ..	—	—	—	—	(²)	(²)	(²)
Zaire	3,401	39,206	—	—	—	—	3,401
Zambia	1,082	12,228	—	—	—	—	1,082
Other	364	3,347	—	—	7	78	370
Total ³	7,635	91,381	230	2,346	155	1,273	7,960
1978:							
Australia	—	—	—	—	(²)	2	(²)
Belgium	1,073	29,985	475	8,841	83	1,801	1,508
Botswana	—	—	—	—	349	^a 5,328	349
Canada	587	13,703	7	157	(²)	3	593
Finland	388	9,049	—	—	1	26	389
New Caledonia	—	—	—	—	101	^a 1,536	101
Norway	279	6,070	—	—	—	—	279
South Africa, Republic of ..	—	—	—	—	246	^a 3,758	246
Zaire	3,571	77,642	—	—	—	—	3,571
Zambia	968	18,980	—	—	—	—	968
Other	613	12,233	6	192	10	171	628
Total ³	7,479	167,662	489	9,190	791	12,625	8,631
1979:							
Australia	7	326	—	—	20	^a 636	26
Belgium	806	47,161	205	8,275	43	1,962	1,001
Botswana	—	—	—	—	162	^a 5,273	162
Canada	395	23,336	—	—	4	114	398
Finland	523	30,372	—	—	(²)	14	524
New Caledonia	—	—	—	—	47	^a 1,525	47
Norway	420	26,780	—	—	—	—	420
South Africa, Republic of ..	7	405	—	—	56	^a 1,815	63
Zaire	3,984	205,367	—	—	—	—	3,984
Zambia	1,605	84,699	10	348	—	—	1,612
Other	819	43,804	14	806	3	103	832
Total ³	8,567	462,250	229	9,429	335	11,441	9,071
1980:							
Australia	1	18	4	119	48	^a 1,575	52
Belgium	426	27,598	128	5,391	50	2,420	571
Botswana	—	—	—	—	180	^a 5,955	180
Canada	474	24,743	49	1,879	2	48	512
Finland	494	27,718	—	—	—	—	494

See footnotes at end of table.

Table 5.—U.S. imports for consumption of cobalt, by country—Continued
(Metric tons and thousand dollars)

Year and country	Metal		Oxides		Salts and compounds and other forms ¹		Total cobalt content ²
	Gross weight	Value	Gross weight	Value	Cobalt content ²		
					Cobalt content ²	Value	
1980—Continued							
New Caledonia	—	—	—	—	64	*2,115	64
Norway	528	29,299	—	—	—	—	528
South Africa, Republic of ..	35	1,872	—	—	102	*3,214	137
Zaire	2,830	147,279	—	—	—	—	2,830
Zambia	1,009	54,311	—	—	1	9	1,011
Other	1,002	45,745	7	242	9	341	1,016
Total ³	6,800	358,583	188	7,630	455	15,677	7,394
1981:							
Australia	(²)	9	14	381	27	*713	38
Belgium	371	17,199	52	1,628	16	629	426
Botswana	—	—	—	—	287	*7,495	287
Canada	777	26,703	65	1,971	13	332	837
Finland	547	24,099	—	—	—	—	547
New Caledonia	—	—	—	—	39	*1,030	39
Norway	740	28,796	—	—	—	—	740
South Africa, Republic of ..	7	240	—	—	204	*4,966	210
Zaire	1,894	66,726	—	—	—	—	1,894
Zambia	686	27,138	—	—	—	—	686
Other	1,285	47,911	70	1,396	31	1,453	1,368
Total ³	6,308	238,820	201	5,375	617	16,619	7,073
1982:							
Australia	3	23	1	19	73	*1,263	77
Belgium	167	4,345	102	1,397	35	660	278
Botswana	—	—	—	—	165	*2,817	165
Canada	631	13,382	49	881	5	141	673
Finland	362	10,423	—	—	—	—	362
Norway	386	9,053	—	—	—	—	386
South Africa, Republic of ..	—	—	—	—	121	*1,127	121
Zaire	2,255	68,704	—	—	—	—	2,255
Zambia	528	11,323	—	—	(²)	(²)	528
Other	933	20,399	13	263	50	1,194	993
Total ³	5,266	137,652	164	2,560	450	7,202	5,838
1983:							
Australia	—	—	—	—	76	*578	76
Belgium	370	5,469	85	789	76	1,043	509
Botswana	—	—	—	—	181	*1,391	181
Canada	855	11,776	9	91	23	247	885
Finland	461	6,712	—	—	—	—	461
Norway	321	3,592	—	—	(²)	2	321
South Africa, Republic of ..	—	—	—	—	84	281	84
Zaire	3,502	63,082	—	—	1	6	3,503
Zambia	1,065	13,226	—	—	—	—	1,065
Other	616	6,219	89	933	44	665	727
Total ³	7,191	110,076	183	1,813	485	4,212	7,811
1984:							
Australia	7	82	(²)	(²)	99	*1,341	106
Belgium	410	9,137	211	3,578	91	2,405	657
Botswana	—	—	—	—	258	*3,452	258
Canada	1,381	29,016	32	481	15	175	1,419
Finland	435	9,498	—	—	—	—	435
Norway	627	6,312	—	—	—	—	627
South Africa, Republic of ..	18	288	—	—	129	1,395	147
Zaire	5,320	108,172	20	276	5	139	5,340

See footnotes at end of table.

Table 5.—U.S. imports for consumption of cobalt, by country—Continued
(Metric tons and thousand dollars)

Year and country	Metal		Oxides		Salts and compounds and other forms ¹		Total cobalt content ²
	Gross weight	Value	Gross weight	Value			
					Cobalt content ²	Value	
1984—Continued							
Zambia	1,722	29,662	—	—	—	—	1,722
Other	658	10,788	56	949	71	1,256	771
Total ³	10,576	202,954	320	5,285	668	10,163	11,480
1985:							
Australia	3	26	—	—	37	^c 559	39
Belgium	383	9,975	73	1,423	28	908	465
Botswana	—	—	—	—	134	^c 2,027	134
Canada	1,382	33,568	16	317	15	212	1,408
Finland	446	11,712	2	126	5	270	451
Norway	768	18,601	—	—	—	—	768
South Africa, Republic of ..	6	151	(²)	5	125	^c 2,038	131
Zaire	2,178	59,056	—	—	—	—	2,178
Zambia	1,959	39,958	—	—	—	—	1,959
Other	411	8,331	19	387	72	1,774	498
Total ³	7,536	181,379	112	2,258	414	7,788	8,032
1986:							
Australia	3	22	NA	NA	—	—	3
Belgium	232	2,535	147	2,602	7	136	348
Canada	1,508	24,643	9	161	8	134	1,522
Finland	264	6,494	1	16	3	172	268
Norway	820	18,015	—	—	—	—	820
South Africa, Republic of ..	10	179	—	—	10	51	20
Zaire	315	3,931	—	—	4	69	319
Zambia	1,588	19,834	—	—	—	—	1,588
Other	553	7,643	75	1,423	78	2,106	686
Total ³	5,293	83,295	232	4,202	109	2,662	5,574
1987:							
Australia	1	11	—	—	—	—	1
Belgium	127	2,618	150	2,414	3	85	241
Canada	1,505	20,774	33	497	9	108	1,538
Finland	165	4,160	23	349	4	93	186
Norway	704	9,320	—	—	(²)	3	704
South Africa, Republic of ..	(²)	7	—	—	87	799	87
Zaire	4,246	63,835	22	337	(²)	18	4,263
Zambia	1,324	17,040	—	—	—	—	1,324
Other	370	5,029	132	1,693	20	898	488
Total ³	8,442	122,791	361	5,293	123	2,004	8,832
1988:							
Belgium	352	7,508	215	3,744	15	462	526
Canada	1,581	23,651	25	397	18	244	1,618
Finland	99	3,475	38	489	46	558	173
Norway	625	9,257	—	—	—	—	625
South Africa, Republic of ..	2	46	8	142	5	63	13
Zaire	2,442	38,866	—	—	—	—	2,442
Zambia	1,208	16,942	—	—	—	—	1,208
Other	366	5,799	50	920	42	1,362	445
Total ³	6,675	105,544	337	5,692	127	2,689	7,051
1989:							
Belgium	718	14,197	236	4,147	21	380	909
Canada	1,211	19,905	25	415	—	—	1,229
Finland	40	1,506	57	865	18	316	98
Norway	593	9,170	—	—	—	—	593
South Africa, Republic of ..	223	3,687	—	—	16	230	239

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of cobalt, by country—Continued
(Metric tons and thousand dollars)

Year and country	Metal		Oxides		Salts and compounds and other forms ¹		Total cobalt content ²
	Gross weight	Value	Gross weight	Value	Cobalt	Value	
					content ²		
1989—Continued							
Zaire	1,076	19,065	—	—	—	—	1,076
Zambia	1,418	20,852	—	—	—	—	1,418
Other	166	3,578	61	1,171	20	501	230
Total ³	5,444	91,960	380	6,598	75	1,426	5,793
1990:							
Belgium	175	4,042	242	4,078	39	926	388
Canada	1,284	21,551	17	304	3	21	1,299
Finland	54	2,050	143	2,559	24	511	181
Norway	⁵ 844	⁵ 14,096	—	—	—	—	⁵ 844
South Africa, Republic of ..	2	51	24	366	55	939	74
Zaire	1,834	33,754	—	—	—	—	1,834
Zambia	1,611	25,523	—	—	—	—	1,611
Other	225	5,834	61	1,230	29	829	297
Total ³	⁵ 6,027	⁵ 106,902	488	8,539	150	3,227	⁵ 6,529

^cEstimated. NA Not available.

¹1974-85 includes cobalt contained in nickel-copper and nickel matte imported from Australia, Botswana, New Caledonia (formerly the French Pacific Islands), and the Republic of South Africa.

²Less than 1/2 unit.

³Data may not add to totals shown because of independent rounding.

⁴Imports of other forms of cobalt for 1970 were salts and compounds principally from the Federal Republic of Germany and the United Kingdom; for 1971-73, they were salts and compounds principally from France and the United Kingdom.

⁵Includes 108 metric tons valued at \$1,747,104, destined for the National Defense Stockpile.

Source: Bureau of the Census.

Table 6.—U.S. exports of cobalt, by form
(Metric tons unless otherwise specified)

Form	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Metal:¹											
Gross weight	969	401	974	1,131	1,001	1,421	1,436	836	977	564	674
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Value—thousands	\$3,253	\$804	\$3,169	\$4,194	\$4,664	\$7,037	\$7,772	\$4,974	\$17,846	\$19,402	\$14,576
Oxides and hydroxides:											
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetates:											
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorides:											
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Metal:¹											
Gross weight	998	383	494	432	413	544	366	543	355	543	
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	355	543	
Value—thousands	\$16,500	\$7,700	\$5,700	\$7,700	\$7,300	\$7,000	\$7,000	\$10,131	\$9,452	\$8,880	
Oxides and hydroxides:											
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	603	922	
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	432	664	

See footnotes at end of table.

Table 6.—U.S. exports of cobalt, by form—Continued
(Metric tons unless otherwise specified)

Form	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	\$6,073	\$6,776
Acetates:										
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	393	272
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	94	65
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	\$1,476	\$1,450
Chlorides:										
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	25	270
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	6	68
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	\$248	\$1,027
Total:										
Gross weight	NA	NA	NA	NA	NA	NA	NA	NA	1,376	2,007
Cobalt content ^c	NA	NA	NA	NA	NA	NA	NA	NA	889	1,340
Value—thousands	NA	NA	NA	NA	NA	NA	NA	NA	\$17,249	\$18,133

^aEstimated. NA Not available.

^b1970-76 includes unwrought metal, alloys, and waste and scrap; 1977-90 includes unwrought metal, waste and scrap, mattes, and other intermediate products of cobalt metallurgy.

Source: Bureau of the Census.

Table 7.—U.S. cobalt prices¹
(Dollars per pound)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Cobalt metal:										
Market price, cathode or granules (shot) ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Yearend published prices:										
Cathode or granules (shot) ³	2.20	2.45	2.45	3.10	3.75	4.00	5.40	6.40	20.00	25.00
Fine powder (less than 1.6 micrometers) ⁴	NA	3.99	3.99	4.95	6.65	7.10	9.21	10.62	26.32	31.09
Powder (300-mesh, 400-mesh, 100-mesh)	NA	3.24	3.24	4.04	5.07	5.41	7.14	8.33	23.02	27.92
S-grade powder (minus 48-mesh)	2.35	2.55	2.55	3.50	4.00	4.00	5.25	6.40	20.00	NA
Cobalt oxide, yearend published prices:										
Ceramic-grade (70% to 71% cobalt)	2.20	2.27	2.27	2.82	3.63	3.87	5.09	5.93	16.40	19.91
Ceramic-grade (72% to 73% cobalt)	2.26	2.34	2.34	2.91	3.74	3.98	5.23	6.10	16.84	20.45
Metallurgical-grade (76% cobalt)	2.85	2.41	2.41	3.00	3.84	4.10	5.38	6.28	17.39	21.11
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Cobalt metal:										
Market price, cathode or granules (shot) ²	NA	NA	8.56	5.76	10.44	11.43	7.49	6.56	7.09	7.64
Yearend published prices:										
Cathode or granules (shot) ³	25.00	⁵ 17.26	12.50	12.50	11.70	11.70	7.00	7.00	⁵ 7.50	⁵ 8.40
Fine powder (less than 1.6 micrometers) ⁴	32.34	NA	9.91	10.11	16.63	19.05	15.40	15.40	17.75	⁵ 17.75
Powder (300-mesh, 400-mesh, 100-mesh)	27.92	NA	6.20	6.91	13.24	14.87	14.47	14.47	14.74	⁵ 14.71
S-grade powder (minus 48-mesh)	NA	NA	NA	NA	12.00	11.70	7.50	7.50	8.65	⁶ 8.65
Cobalt oxide, yearend published prices:										
Ceramic-grade (70% to 71% cobalt)	19.91	NA	4.61	4.90	9.40	9.98	6.08	6.08	9.70	⁵ 9.42
Ceramic-grade (72% to 73% cobalt)	20.45	NA	4.84	5.04	9.66	10.26	6.24	6.24	9.94	⁵ 9.67
Metallurgical-grade (76% cobalt)	21.11	NA	4.89	5.21	9.86	10.61	6.51	6.51	10.31	⁵ 10.06
	1990									
Cobalt metal:										
Market price, cathode or granules (shot) ²	10.09									
Yearend published prices:										
Cathode or granules (shot) ³	⁵ 8.40									
Fine powder (less than 1.6 micrometers) ⁴	⁵ 22.11									
Powder (300-mesh, 400-mesh, 100-mesh)	⁵ 18.63									
S-grade powder (minus 48-mesh)	⁶ 8.65									
Cobalt oxide, yearend published prices:										
Ceramic-grade (70% to 71% cobalt)	⁵ 11.14									
Ceramic-grade (72% to 73% cobalt)	⁵ 11.44									
Metallurgical-grade (76% cobalt)	⁵ 11.67									

NA Not available.

¹Prices are from Metals Week unless noted.

²Weighted average of Metals Week prices.

³250 kilograms.

⁴50 kilograms.

⁵African Metals Corp.

⁶Sherritt Gordon Ltd.

**Table 8.—Yearend Government and Industrial stocks of cobalt
(Metric tons cobalt content)**

Year	Government	Industrial ¹
1969	38,233	994
1970	35,504	857
1971	35,083	640
1972	30,924	541
1973	27,272	1,112
1974	23,042	929
1975	20,819	817
1976	18,549	1,442
1977	18,508	1,696
1978	18,508	1,990
1979	18,508	1,538
1980	18,508	1,921
1981	18,508	1,329
1982	20,744	1,129
1983	20,863	1,273
1984	20,953	1,428
1985	24,123	1,273
1986	24,090	1,355
1987	24,088	2,043
1988	24,088	1,766
1989	24,088	1,456
1990	23,940	1,853

¹1969-79, consumer stocks only; 1980-90, consumer and processor stocks.

**Table 9.—Cobalt: World mine production, by country¹
(Metric tons cobalt content)**

Country ²	1986	1987	1988	1989	1990
Albania ^{e, 3}	600	600	600	600	600
Australia ^{e, 4}	1,237	1,261	1,200	1,000	1,000
Botswana ⁵	163	181	291	207	206
Brazil ^e	150	150	150	200	200
Canada ⁶	2,297	2,490	2,398	2,344	2,184
Cuba ⁷	1,553	1,566	1,783	1,825	^c 1,600
Finland ⁸	627	190	—	—	—
Morocco ⁸	—	224	253	121	194
New Caledonia ^{e, 9}	700	750	800	800	800
Philippines	92	—	—	—	—
South Africa, Republic of ^e	690	¹⁰ 380	300	300	350
U.S.S.R. ^e	2,800	2,900	3,000	3,000	2,500
Zaire ⁸	33,373	23,200	26,000	18,400	19,000
Zambia ^{8, 11}	5,869	7,365	7,090	7,255	7,086
Zimbabwe ^{e, 12}	48	88	104	90	102
Total	50,199	¹⁰ 41,345	43,969	36,142	35,822

^eEstimated.

¹Table includes data available through June 5, 1992. Figures represent recoverable cobalt content of ores, concentrates, or intermediate products from copper, nickel, platinum, or zinc operations. Morocco was the only country where cobalt was mined as a primary product.

²In addition to the countries listed, Bulgaria, China, the Eastern states of the Federal Republic of Germany, Indonesia, and Poland are known to produce ores that contain cobalt, but information is inadequate for reliable estimates of output levels. Other copper-, nickel-, platinum-, or zinc-producing nations may also produce ores containing cobalt as a byproduct component, but recovery is small or nil.

³Calculated from reported and estimated weight of nickeliferous ore.

⁴Figures represent quantities of cobalt contained in intermediate metallurgical products (cobalt oxide and nickel-cobalt sulfide).

⁵Reported cobalt content of pelletized nickel-copper matte.

⁶Figures represent total cobalt content of all products derived from ores of Canadian origin, including cobalt oxides shipped to the United Kingdom for further processing and nickel-copper-cobalt mattes shipped to Norway for further processing.

⁷Determined from reporting nickel-cobalt content of granular and powder oxide, oxide sinter, and sulfide production.

⁸Cobalt content of concentrates.

⁹Series represents estimated recoverable content of ores and intermediate metallurgical products exported from New Caledonia to France and Japan.

¹⁰Data not comparable with those of the previous year.

¹¹Year beginning Apr. 1 of that stated.

¹²Estimated cobalt content of ore.

Page Intentionally Left Blank.

COPPER

By Janice Jolly

Copper smelting operations have been traced back to at least 5000 B.C., but modern history and growth in demand for copper began with the discovery and commercial development of electricity in the latter part of the 19th century. Electrical and electronic uses still dominate copper markets, composing more than 70% of U.S. copper consumption in 1990. Copper ranks third in world metal consumption after steel and aluminum. The largest refined copper-consuming nations have long been the industrialized countries with large manufacturing bases. The major copper-consuming nations or areas in 1990 were Western Europe (28.5%), the United States (19.1%), Japan (14%), the U.S.S.R. (10.2%), and China (5.3%). Since the 1950's, the trend has been toward increased consumption by the Asian countries, particularly Japan, South Korea, and Taiwan, mainly to support export-oriented fabrication industries. More recently, China has indicated significant growth as it built new rod and brass mills for its increased domestic copper needs. In 1990,

copper was mined in 54 countries. The eight leading mine producing nations, accounting for 68% of production, were Chile and the United States, each with 18%; Canada, 8%; the U.S.S.R. 7%; Zambia 5%; and China, Poland, and Zaire, each with 4% share of the world total. Only 16.5% of the total copper produced as concentrates was available for export to other nations. The eight leading refining nations, accounting for 67% of total refined metal production, were the United States, the U.S.S.R., Japan, Chile, Canada, Zambia, Belgium, and the Federal Republic of Germany. Copper and copper alloy scrap compose a significant share of the world's supply. In the United States, about 44% of total annual copper consumption was from copper in old and purchased new scrap. The largest international sources for scrap are the United States and Europe. Most U.S. trade in copper scrap is with the Far Eastern countries such as South Korea, Taiwan, and Japan.

Table 1.—Salient copper statistics
(Metric tons unless otherwise specified)

Year	Mine production				U.S. refinery production			
	U.S. mine production ¹	Average yield of copper (percent) ²	World mine production	U.S. percent of world mine production	Primary sources			Total
					Domestic	Foreign	Secondary	
1970 ..	1,560,047	.59	5,900,200	26	1,379,994	221,272	464,124	2,065,390
1971 ..	1,380,902	.55	5,942,600	23	1,279,606	164,435	363,475	1,807,516
1972 ..	1,510,318	.55	6,542,700	23	1,524,445	174,924	383,960	2,083,329
1973 ..	1,558,489	.53	6,915,900	22	1,540,706	154,358	421,952	2,117,016
1974 ..	1,448,776	.49	7,098,300	20	1,288,953	212,057	450,787	1,951,797
1975 ..	1,282,184	.47	6,739,100	19	1,166,811	142,600	307,553	1,616,964
1976 ..	1,456,561	.51	7,260,600	20	1,290,673	105,764	340,335	1,736,772
1977 ..	1,364,374	.52	7,417,000	18	1,280,036	77,280	349,645	1,706,961
1978 ..	1,357,586	.51	7,278,700	19	1,327,371	121,684	420,103	1,869,158
1979 ..	1,446,586	.47	7,344,900	20	1,412,795	103,857	498,459	2,015,111
1980 ..	1,181,116	.48	7,204,000	16	1,126,215	88,957	515,083	³ 1,730,254
1981 ..	1,538,160	.51	7,692,900	20	1,430,213	113,807	482,837	2,026,857
1982 ..	1,146,975	.55	7,577,600	15	1,064,215	162,246	467,549	1,694,010
1983 ..	1,038,098	.51	7,609,900	14	1,015,065	178,422	403,527	1,597,014
1984 ..	1,102,613	.58	7,813,700	14	1,079,062	95,016	330,081	1,504,159
1985 ..	1,104,823	.61	7,992,400	14	1,003,713	53,528	371,787	1,429,028
1986 ..	1,144,213	.60	8,319,300	14	1,032,968	41,013	405,944	1,479,925
1987 ..	1,243,596	.57	8,617,400	14	1,126,908	W	414,738	1,541,646
1988 ..	1,416,928	.60	8,681,100	17	1,282,370	123,650	446,427	1,852,447
1989 ..	1,497,818	.61	9,036,600	17	1,351,748	125,085	480,018	1,956,851
1990 ..	1,587,742	.62	9,035,500	18	1,502,014	74,620	440,757	³ 2,017,390

See footnotes at end of table

Table 1.—Salient copper statistics—Continued
(Metric tons unless otherwise specified)

Year	Copper recovered from scrap at U.S. plants ⁴	
	Old scrap	All scrap
1970 ..	457,286	1,131,806
1971 ..	403,812	1,088,731
1972 ..	415,667	1,180,223
1973 ..	441,086	1,190,503
1974 ..	438,562	1,219,547
1975 ..	334,908	881,752
1976 ..	380,225	1,038,975
1977 ..	409,928	1,085,425
1978 ..	501,650	1,247,235
1979 ..	604,301	1,552,525
1980 ..	613,458	1,437,427
1981 ..	591,805	1,407,397
1982 ..	517,726	1,187,466
1983 ..	449,478	1,083,579
1984 ..	460,695	1,119,914
1985 ..	503,407	1,139,084
1986 ..	479,213	1,126,528
1987 ..	497,937	1,214,059
1988 ..	518,179	1,306,891
1989 ..	547,561	1,308,455
1990 ..	535,656	1,309,245

W Withheld to avoid disclosing company proprietary data; included with "Domestic."

¹U.S. mine production is recoverable copper at the smelter level.

²Yield of copper is calculated from the recoverable copper content, at the smelter level, of mined copper ore concentrated or leached.

³Data do not add to total shown because of independent rounding.

⁴Copper recovered from copper-base scrap and other metal-base scrap.

Table 2.—Mine production of recoverable copper in the United States, by State
(Metric tons)

State	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Arizona	832,721	744,047	824,279	841,206	779,075	737,732	929,338	838,037	891,404	949,031	770,118
Colorado	3,401	3,572	3,578	2,833	2,732	3,230	2,205	1,720	1,191	362	461
Idaho	3,277	3,426	2,669	3,289	2,577	2,896	3,050	3,676	3,888	3,618	3,103
Maine	2,452	2,277	1,107	1,004	1,381	1,836	1,602	1,213	—	—	—
Missouri	11,008	7,661	10,441	9,320	11,489	12,935	10,024	10,648	10,819	13,021	13,576
Montana	109,236	80,359	111,684	120,171	118,960	79,795	82,655	78,202	67,326	69,854	37,749
New Mexico ..	150,845	142,808	152,438	185,739	178,339	132,687	156,362	149,412	127,828	164,281	149,394
Utah	268,289	238,999	235,421	232,774	209,191	160,712	168,244	176,111	186,330	193,082	157,775
Other States ¹	178,818	157,752	168,702	162,154	145,032	150,360	103,080	105,356	68,801	53,337	48,940
Total ²	1,560,047	1,380,902	1,510,318	1,558,489	1,448,776	1,282,184	1,456,561	1,364,374	1,357,586	1,446,586	1,181,116
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Arizona	1,040,813	769,521	678,216	746,453	795,622	786,111	751,031	842,728	898,466	978,767	
Colorado	W	575	W	W	W	W	W	W	W	W	
Idaho	4,245	3,074	3,556	3,701	W	W	W	W	W	W	
Maine	—	—	—	—	—	—	—	—	—	—	
Missouri	8,411	7,941	7,725	5,818	W	W	W	W	W	W	
Montana	62,485	64,951	33,337	W	W	W	W	W	W	W	
New Mexico ..	154,114	W	W	W	W	W	246,532	258,660	259,640	262,815	
Utah	211,276	189,090	169,751	W	W	W	W	W	W	W	
Other States ¹	56,816	111,823	145,513	346,641	309,201	358,102	246,033	315,540	339,712	346,160	
Total ²	1,538,160	1,146,975	1,038,098	1,102,613	1,104,823	1,144,213	1,243,596	1,416,928	1,497,818	1,587,742	

W Withheld to avoid disclosing company proprietary data; included in "Other States."

¹Includes Alaska, California, Illinois, Michigan, Nevada, Oklahoma, Oregon, Pennsylvania, Tennessee, Washington, Wisconsin, and data indicated by symbol W.

²Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of Mines

**Table 3.—Primary and secondary copper refined in the United States, by process and type
(metric tons)**

Process and type	1970	1971	1972	1973	1974	1975	1976	1977
Primary:								
Electrolytic	1,410,515	1,289,671	1,507,135	¹ 1,526,500	¹ 1,369,178	¹ 1,177,530	¹ 1,213,788	¹ 1,131,164
Electrowon	18,155	17,852	18,500	22,037	² 20,980	² 28,042	² 94,070	² 125,134
Fire refined	172,596	136,518	173,734	² 146,527	² 110,852	² 103,839	² 88,579	² 101,018
Total	1,601,266	1,444,041	1,699,369	1,695,064	1,501,010	1,309,411	1,396,437	1,357,316
Secondary:³								
Electrolytic	393,169	293,849	309,877	342,483	⁴ 361,945	⁴ 226,559	⁴ 239,195	⁴ 210,095
Fire refined	70,955	69,626	74,083	79,469	88,842	80,994	101,140	139,550
Total	464,124	363,475	383,960	421,952	450,787	307,553	340,335	349,645
Grand total	2,065,390	1,807,516	2,083,329	2,117,016	1,951,797	1,616,964	1,736,772	1,706,961
Primary materials:⁵								
Domestic	1,379,994	1,279,606	1,524,445	1,540,706	1,288,953	1,166,811	1,290,673	1,280,036
Foreign	221,272	164,435	174,924	154,358	212,057	142,600	105,764	77,280
Secondary materials	464,124	363,475	383,960	421,952	450,787	307,553	340,335	349,645
Total	2,065,390	1,807,516	2,083,329	2,117,016	1,951,797	1,616,964	1,736,772	1,706,961
	1978	1979	1980	1981	1982	1983	1984	1985
Primary:								
Electrolytic ¹	¹ 1,246,137	¹ 1,311,429	¹ 1,013,153	1,308,373	1,053,860	1,091,551	1,073,898	966,780
Electrowon	² 98,547	² 100,132	² 117,549	² 161,086	² 131,541	101,936	100,180	90,461
Fire refined	² 104,372	² 105,091	² 84,469	74,561	41,060	W	W	W
Total	1,449,055	1,516,652	1,215,172	1,544,020	1,226,461	1,193,487	1,174,078	1,057,241
Secondary:								
Electrolytic	⁴ 323,397	⁴ 396,226	⁴ 356,928	⁴ 389,096	⁴ 383,095	⁶ 403,527	184,747	264,834
Fire refined	96,706	102,233	158,155	93,741	84,454	W	145,334	106,953
Total	420,103	498,459	515,083	482,837	467,549	403,527	330,081	371,787
Grand total	1,869,157	2,015,111	⁷1,730,254	2,026,857	1,694,010	1,597,014	1,504,159	1,429,028
Primary materials:⁵								
Domestic	1,327,371	1,412,795	1,126,215	1,430,213	1,064,215	1,015,065	1,079,062	1,003,713
Foreign	121,684	103,857	88,957	113,807	162,246	178,422	95,016	53,528
Secondary materials	420,103	498,459	515,083	482,837	467,549	403,527	330,081	371,787
Total	1,869,158	2,015,111	⁷1,730,254	2,026,857	1,694,010	1,597,014	1,504,159	1,429,028
	1986	1987	1988	1989	1990			
Primary:								
Electrolytic ¹	948,623	965,621	1,178,028	1,164,948	1,183,170			
Electrowon	125,357	161,287	227,992	311,885	393,463			
Fire refined	W	W	W	W	W			
Total	⁷ 1,073,981	1,126,908	1,406,020	1,476,833	1,576,633			
Secondary:								
Electrolytic	292,686	311,312	347,442	376,595	328,196			
Fire refined	113,258	103,426	98,985	103,424	112,561			
Total	405,944	414,738	446,427	⁷ 480,018	440,757			
Grand total	1,479,925	1,541,646	1,852,447	⁷1,956,851	2,017,390			
Primary materials:⁵								
Domestic	1,032,968	⁶ 1,126,908	1,282,370	1,351,748	1,502,014			
Foreign	41,013	W	123,650	125,085	74,620			
Secondary materials	405,944	414,738	446,427	480,018	440,757			
Total	1,479,925	1,541,646	1,852,447	1,956,851	⁷2,017,390			

W Withheld to avoid disclosing company proprietary data.

¹Includes copper from foreign sources processed by means other than electrolytic to avoid disclosing company proprietary data.

²Excludes copper refined from foreign sources to avoid disclosing company proprietary data; included in "Primary: Electrolytic."

³Prior to 1978, allocations by process type are approximate owing to distribution by plant classification rather than process.

⁴Includes copper electrowon from secondary sources to avoid disclosing company proprietary data.

⁵Foreign and domestic source is based on reported consumption at smelters and refineries.

⁶Includes primary materials from foreign sources to avoid disclosing company proprietary data.

⁷Data do not add to total shown because of independent rounding.

Table 4.—U.S. production of selected copper products and sulfuric acid
(Metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Copper sulfate (copper content)	10,286	7,858	8,630	9,834	9,546	8,350	7,639	7,199	8,551
Unalloyed copper from scrap:									
Electrolytically refined ¹	393,169	293,849	309,877	342,483	² 361,945	² 226,559	² 239,195	² 210,095	² 323,397
Fire-refined ¹	70,955	69,626	74,083	79,469	88,842	80,994	101,140	139,550	96,706
Copper powder	8,527	25,721	21,839	17,634	14,813	9,940	14,119	15,064	16,992
Copper castings	117	73	84	56	64	63	9	12	25
Total ³	472,768	389,269	405,883	439,643	465,665	317,555	354,463	364,721	437,120
Alloyed copper from scrap:									
Brass and bronze ingots:									
Tin bronze	20,625	21,390	37,189	38,056	36,478	30,367	31,226	18,931	21,831
Leaded red brass and semired brass	137,758	150,061	140,257	135,320	116,346	81,464	109,074	131,426	135,162
High-leaded tin bronze	26,434	22,759	24,315	26,642	30,111	21,141	23,717	24,088	24,806
Yellow brass	14,268	16,406	19,075	18,921	13,905	8,912	11,874	13,649	11,950
Manganese bronze	9,879	10,172	9,613	11,001	10,581	8,264	8,936	9,565	10,778
Aluminum bronze	6,577	6,686	6,456	6,317	7,583	6,117	6,111	6,376	7,193
Nickel silver	3,379	3,230	3,318	3,397	3,544	2,391	2,803	2,884	2,922
Silicon bronze and brass	3,966	3,718	3,693	4,160	4,032	2,344	2,641	3,881	4,339
Copper-base hardeners and master alloys	9,326	8,894	10,016	14,265	14,695	9,766	11,071	10,708	19,257
Total ³	232,213	243,317	253,933	258,078	237,277	170,768	207,452	221,507	238,238
Brass mill products	533,321	573,973	664,515	693,427	637,468	463,013	589,410	602,410	624,091
Brass and bronze castings	47,254	31,401	32,880	33,176	36,434	28,811	33,100	37,688	51,914
Brass powder	1,600	1,967	508	822	737	518	557	649	1,243
Copper in chemical products	2,291	2,908	2,756	3,360	2,403	2,250	3,635	3,283	2,911
Total products from scrap ³	1,289,447	1,242,835	1,360,475	1,428,505	1,379,984	982,915	1,188,617	1,230,258	1,355,517
Sulfuric acid at copper plants	678,378	728,727	916,814	987,309	1,158,874	1,619,093	2,069,825	2,138,567	2,484,111
	1979	1980	1981	1982	1983	1984	1985	1986	1987
Copper sulfate (copper content)	9,286	8,445	9,413	8,385	9,970	9,316	8,264	8,616	8,418
Unalloyed copper from scrap:									
Electrolytically refined ¹	² 396,226	² 356,928	² 389,096	² 383,095	⁴ 403,527	184,747	264,834	292,686	311,312
Fire-refined ¹	102,233	158,155	93,741	84,454	W	145,334	106,953	113,258	103,426
Copper powder	17,411	13,203	13,594	9,686	11,172	13,153	9,776	7,918	8,440
Copper castings	401	6,270	7,372	4,330	5,731	457	5,725	577	579
Total ³	516,271	534,556	503,803	481,565	420,430	343,691	387,288	414,439	423,757
Alloyed copper from scrap:									
Brass and bronze ingots:									
Tin bronze	21,964	21,145	22,064	18,220	15,824	16,075	17,907	23,670	24,340
Leaded red brass and semired brass	136,416	120,869	123,286	102,654	98,111	116,569	106,877	99,150	103,616
High-leaded tin bronze	26,449	19,884	19,416	11,210	10,375	12,716	8,335	7,223	7,425
Yellow brass	12,488	11,892	9,860	6,528	7,628	11,004	8,575	7,641	12,253
Manganese bronze	10,277	8,105	9,436	6,959	7,520	8,062	8,069	8,563	8,430
Aluminum bronze	7,684	8,337	9,486	5,593	6,331	8,331	7,523	6,818	7,171
Nickel silver	3,113	2,707	2,909	2,646	3,265	3,514	2,931	3,215	3,494

See footnotes at end of table.

Table 4.—U.S. production of selected copper products and sulfuric acid—Continued
(Metric tons)

	1979	1980	1981	1982	1983	1984	1985	1986	1987
Brass and bronze ingots—Continued									
Silicon bronze and brass	4,527	3,769	4,009	3,330	3,596	4,526	4,276	4,467	4,953
Copper-base hardeners and master alloys ...	18,135	15,430	16,737	12,620	14,284	15,931	13,274	7,067	6,638
Miscellaneous	NA	NA	NA	NA	693	313	2,898	4,052	9,557
Total ³	241,053	212,138	217,203	169,760	167,627	197,041	180,665	171,866	187,877
Brass mill products ...	692,136	598,672	623,940	500,573	620,858	667,736	616,368	621,850	681,162
Brass and bronze castings	51,555	38,858	39,929	34,646	32,866	41,977	39,134	39,373	44,337
Brass powder	1,197	877	1,102	933	927	510	396	394	281
Copper in chemical products	3,004	2,869	3,227	2,250	1,076	1,048	858	2,967	4,166
Total products from scrap ³	1,505,216	1,387,970	1,389,204	1,189,727	1,243,784	1,252,003	1,224,709	1,250,889	1,341,580
Sulfuric acid at copper plants	2,513,035	2,097,692	2,593,762	1,879,983	1,837,827	2,251,312	2,230,257	2,308,804	2,542,602
	1988	1989	1990						
Copper sulfate (copper content)	8,630	8,349	8,893						
Unalloyed copper from scrap:									
Electrolytically refined ¹	347,442	376,595	328,196						
Fire-refined ¹	98,985	103,424	112,561						
Copper powder	9,370	8,591	8,525						
Copper castings	681	673	618						
Total ³	456,478	489,282	449,901						
Alloyed copper from scrap:									
Brass and bronze ingots:									
Tin bronze	24,952	19,298	15,619						
Leaded red brass and semired brass	108,376	117,465	117,747						
High-leaded tin bronze	8,022	8,137	9,022						
Yellow brass	8,831	8,181	6,962						
Manganese bronze ...	8,691	9,184	10,266						
Aluminum bronze	8,804	7,409	8,968						
Nickel silver	3,538	4,701	2,986						
Silicon bronze and brass	5,437	5,702	5,200						
Copper-base hardeners and master alloys ...	7,080	10,771	10,379						
Miscellaneous	6,564	4,113	3,881						
Total ³	190,295	194,961	191,031						
Brass mill products ...	750,096	713,792	744,224						
Brass and bronze castings	40,975	46,892	55,773						
Brass powder	252	259	288						
Copper in chemical products	3,470	1,948	2,720						
Total products from scrap ³	1,441,566	1,447,134	1,443,938						
Sulfuric acid at copper plants	2,892,655	3,075,859	3,380,940						

NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Electrolytically refined."

¹Prior to 1978, allocations by process type are approximate owing to distribution by plant classification rather than process.

²Includes copper electrowon from secondary sources to avoid disclosing company proprietary data.

³Data may not add to totals shown because of independent rounding.

⁴Includes copper electrowon and copper fire refined from secondary sources to avoid disclosing company proprietary data.

**Table 5.—Reported consumption of refined copper, by industry
(Metric tons)**

Industry	1970	1971	1972	1973	1974	1975	1976	1977
Wire-rod mills	1,214,485	1,201,924	1,384,633	1,517,045	1,337,499	962,755	1,237,444	1,370,940
Brass mills	599,271	594,916	605,290	648,127	607,957	398,227	530,481	570,274
Chemical plants	2,033	1,371	775	1,111	649	424	454	379
Ingotmakers	6,388	6,250	9,029	9,612	8,032	4,067	6,821	6,012
Foundries	14,731	12,378	13,812	13,427	17,561	12,699	13,940	12,858
Miscellaneous ¹	16,746	15,229	17,528	21,531	18,518	13,912	17,868	21,699
Total²	1,853,654	1,832,066	2,031,067	2,210,853	1,990,516	1,392,083	1,807,008	1,982,162
	1978	1979	1980	1981	1982	1983	1984	1985
Wire-rod mills	1,517,413	1,499,596	1,308,922	1,449,583	1,232,841	1,269,858	1,504,695	1,401,665
Brass mills	619,206	610,177	511,627	536,210	393,205	500,262	576,161	513,986
Chemical plants	447	415	333	398	361	608	557	757
Ingotmakers	7,474	6,251	4,967	5,445	4,364	3,151	6,896	5,299
Foundries	12,431	11,918	10,906	11,339	7,645	11,246	16,018	19,959
Miscellaneous ¹	32,330	30,085	25,341	22,194	19,726	18,804	18,407	34,435
Total	2,189,301	2,158,442	1,862,096	2,025,169	1,658,142	1,803,929	2,122,734	1,976,101
	1986	1987	1988	1989	1990			
Wire-rod mills	1,486,648	1,590,228	1,667,190	1,698,351	1,653,490			
Brass mills	564,875	493,879	493,215	461,022	445,220			
Chemical plants	935	1,099	1,002	937	1,086			
Ingotmakers	1,378	1,436	2,607	1,337	4,479			
Foundries	17,099	13,985	14,498	14,926	14,550			
Miscellaneous ¹	26,416	26,551	31,912	26,543	31,601			
Total	2,097,351	2,127,178	2,210,424	2,203,116	2,150,426			

¹Includes iron and steel plants, primary smelters producing alloys other than copper, consumers of copper powder and copper shots, and other manufacturers.

²Data may not add to totals shown because of independent rounding.

**Table 6.—U.S. refined copper inventories, end of year¹
(Thousand metric tons)**

Year	Consumers			Producers ³	COMEX ⁴	Total industry	U.S. Government ⁵	Total United States
	Brass mills	Wire-rod mills	Other ²					
1970	38	95	4	118	16	271	230	501
1971	37	84	5	68	18	213	228	441
1972	25	45	5	52	52	179	228	407
1973	27	39	5	34	5	110	226	335
1974	33	98	6	92	39	268	32	300
1975	28	108	6	188	91	420	24	444
1976	33	103	6	172	182	497	44	541
1977	31	105	6	212	167	522	21	543
1978	28	63	7	153	163	414	21	435
1979	25	44	9	64	90	232	20	252
1980	22	50	10	49	163	294	20	314
1981	26	109	9	151	170	465	20	485
1982	25	125	9	268	248	675	20	695
1983	26	116	5	154	371	672	20	692
1984	27	134	11	125	251	548	20	568
1985	20	100	5	66	109	300	20	320
1986	14	66	4	35	84	205	20	225
1987	15	28	3	29	17	93	20	113
1988	17	29	3	16	12	77	20	97
1989	12	32	4	24	15	87	20	107
1990	10	24	3	26	18	81	20	101

¹Semifabricated forms such as rod, sheet, etc., at consumers are not included.

²Stocks held by chemical plants, foundries, and miscellaneous manufacturers.

³Inventories held by primary and secondary refiners.

⁴Data from Commodity Exchange Inc., New York.

⁵General Services Administration inventory of the National Defense Stockpile.

Table 7.—Average copper prices in the United States and on the London Metals Exchange
(Cents per pound)

Period	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
COMEX FIRST POSITION											
January	70	46	49	52	93	52	55	64	59	73	117
February	72	47	50	57	106	55	57	65	57	86	129
March	75	53	53	66	121	60	61	70	59	91	97
April	75	56	52	70	129	59	69	66	60	92	89
May	70	51	50	69	123	55	69	63	60	84	89
June	65	50	48	76	103	54	71	60	61	83	87
July	62	53	47	87	87	57	75	57	61	81	98
August	57	50	49	88	80	59	69	53	64	87	93
September	56	49	48	86	64	56	66	55	65	92	93
October	51	47	48	92	61	55	58	56	67	93	94
November	49	46	47	97	61	55	58	55	66	97	92
December	46	47	48	98	55	54	59	59	68	103	84
Average	62	50	49	78	90	56	64	60	62	89	97
COMEX FIRST POSITION—Continued											
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990		
January	84	72	73	62	59	65	61	123	155	104	
February	81	71	76	64	61	64	62	100	134	107	
March	82	68	73	68	60	66	64	104	144	124	
April	82	69	76	68	64	64	62	98	140	122	
May	80	69	79	63	63	63	66	99	123	120	
June	78	58	75	61	60	63	70	109	112	113	
July	77	63	76	59	61	59	76	99	110	122	
August	81	62	74	59	60	58	78	96	125	131	
September	77	62	70	57	60	61	81	111	135	130	
October	75	64	65	56	61	59	83	133	128	126	
November	74	64	63	60	61	59	104	147	114	116	
December	73	67	64	58	63	60	127	156	107	112	
Average	79	66	72	61	61	62	78	115	127	119	
U.S. PRODUCER PRICES, DELIVERED WIRE BAR ¹											
1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
January	56	51	50	52	69	69	64	66	64	77	119
February	56	50	51	55	69	64	64	69	64	90	134
March	56	51	53	60	69	64	65	73	62	97	106
April	60	53	53	60	69	64	69	74	65	98	95
May	60	53	53	60	81	64	71	73	65	91	93
June	60	53	53	60	86	64	71	71	67	88	93
July	60	53	53	60	86	63	75	68	64	87	104
August	60	53	51	60	86	64	75	64	67	91	101
September	60	53	51	60	83	64	75	61	68	96	99
October	59	53	51	60	78	64	72	61	70	99	99
November	56	52	51	60	76	64	71	61	71	100	97
December	53	50	51	67	73	64	66	62	72	106	89
Average	58	52	52	60	77	64	70	67	67	93	102
U.S. PRODUCER PRICES, DELIVERED WIRE BAR ¹ —Continued											
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990		
January	89	79	80	69	66	72	67	136	164	116	
February	86	79	83	71	68	70	68	111	146	119	
March	87	77	82	75	67	72	71	112	155	136	
April	88	77	83	77	72	71	70	108	150	134	
May	86	78	86	72	72	69	74	107	133	132	
June	85	71	82	70	69	69	77	117	121	125	
July	84	71	83	66	69	65	83	108	119	134	
August	87	71	81	66	68	64	85	104	134	143	
September	85	71	78	65	68	67	88	118	144	142	
October	82	72	72	64	69	66	92	126	138	138	
November	81	73	67	68	68	65	110	159	124	128	
December	80	74	71	65	70	66	135	168	116	124	
Average	85	74	79	69	69	68	85	123	137	131	

¹Quotations for Warrenton Wirebar after Nov. 1988.

Sources: Commodity Exchange of New York, Metals Week, and American Metal Market.

Table 8.—Selected U.S. refined copper prices
(Cents per pound)

Period	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
U.S. PRODUCER PRICES, DELIVERED CATHODE ¹											
January	56	51	50	52	68	68	63	66	63	75	118
February	56	50	50	54	68	64	63	68	63	88	133
March	56	50	52	59	68	64	64	72	62	95	105
April	59	52	52	59	68	64	69	74	64	97	94
May	60	52	52	59	81	63	70	73	64	90	92
June	60	52	52	59	86	63	70	71	66	87	92
July	60	(²)	50	59	86	62	74	67	63	86	102
August	60	52	50	59	86	63	74	63	67	90	100
September	60	52	50	59	83	63	74	60	67	95	98
October	59	52	50	59	78	63	72	60	70	98	98
November	56	52	50	60	76	63	70	60	71	99	96
December	53	50	50	66	73	63	65	61	71	105	88
Average	58	51	51	59	77	64	69	66	66	92	101
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
U.S. PRODUCER PRICES, DELIVERED CATHODE ¹ —Continued											
January	88	78	78	66	64	70	65	132	158	109	
February	85	78	81	68	66	68	66	108	140	111	
March	86	75	79	73	66	70	68	110	148	128	
April	87	75	81	75	70	69	67	104	143	127	
May	85	77	83	70	70	67	71	104	127	125	
June	84	70	79	67	67	67	74	114	116	117	
July	83	70	80	64	67	64	80	105	113	126	
August	87	70	78	65	66	62	82	101	127	135	
September	84	69	75	63	66	65	86	116	138	134	
October	81	70	70	62	67	63	89	138	132	130	
November	80	70	70	66	66	63	109	152	118	120	
December	79	72	68	64	68	64	133	161	109	116	
Average	84	73	77	67	67	66	83	120	131	123	
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
LONDON METAL EXCHANGE HIGH GRADE AND GRADE A ³											
January	73	45	49	51	92	55	54	63	57	75	118
February	74	46	50	56	104	57	55	65	55	88	132
March	78	52	53	68	124	61	60	69	57	93	105
April	78	56	51	72	138	60	68	65	58	95	94
May	71	50	50	70	130	57	69	62	59	87	93
June	65	48	48	79	111	54	70	60	60	85	91
July	61	50	47	92	87	55	75	57	61	82	99
August	56	49	48	95	82	58	70	53	65	90	94
September	55	47	48	88	66	55	66	54	65	95	93
October	51	46	47	94	63	53	58	55	68	94	93
November	48	45	46	103	64	53	58	54	67	95	91
December	45	47	46	101	58	52	58	57	70	100	85
Average	63	48	49	81	93	56	63	60	62	90	99
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
LONDON METAL EXCHANGE HIGH GRADE AND GRADE A ³ —Continued											
January	85	73	73	62	62	64	61	121	154	107	
February	82	72	75	65	63	64	63	106	140	107	
March	82	68	72	68	63	66	66	107	148	119	
April	83	69	76	69	68	65	67	104	141	122	
May	79	69	80	64	69	64	69	111	124	124	
June	77	59	77	62	65	64	71	115	115	117	
July	76	65	77	60	67	61	77	100	114	126	
August	81	66	74	61	64	59	80	100	125	134	
September	78	65	71	59	62	61	82	110	131	137	

See footnotes at end of table.

Table 8.—Selected U.S. refined copper prices—Continued
(Cents per pound)

Period	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
LONDON METAL EXCHANGE HIGH GRADE AND GRADE A ³ —Continued										
October	76	66	65	58	63	60	89	133	130	124
November	75	65	63	61	62	59	114	150	117	117
December	75	67	64	60	63	61	130	159	110	113
Average	79	67	72	62	64	62	81	118	129	121

¹Cathode contract prices became dominant in the mid 1970's when wirebar began to diminish as a principal refined copper from consumed.

²Average suspended.

³Contract changed from dominantly wire-bar to high-grade (cathode) in 1977. High Grade ceased in 1989 when Grade A contract was initiated.

Sources: Commodity Exchange of New York, Metals Week, and American Metal Market.

Table 9.—Selected U.S. copper scrap and ingot prices¹
(Cents per pound)

Period	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NO.1 BRASS MILL BUYING PRICE, COPPER SCRAP																					
January ..	65	43	47	NA	92	42	50	55	57	70	98	81	65	67	59	55	61	58	106	118	101
February ..	67	45	48	NA	96	42	48	57	56	83	113	76	64	71	63	58	60	58	95	111	103
March ..	68	47	52	60	103	47	54	64	58	84	87	79	62	70	65	56	62	59	93	129	117
April	70	54	50	64	114	47	61	58	58	92	85	78	63	71	67	59	61	60	91	131	118
May	66	47	49	65	118	47	62	59	57	81	80	77	65	73	62	61	60	66	94	115	116
June	58	49	48	69	90	44	61	53	57	81	78	76	51	69	59	56	60	67	100	107	112
July	56	49	46	71	78	48	64	50	60	76	90	74	56	70	57	56	56	70	91	105	117
August ..	55	48	46	82	70	50	61	46	63	85	89	77	54	70	56	57	55	75	89	115	113
September	52	47	46	84	52	48	58	47	62	80	88	74	58	68	54	56	58	78	102	122	122
October ..	48	46	46	88	51	47	49	49	64	82	87	71	60	63	52	56	57	84	116	127	115
November	45	44	46	96	51	47	51	48	61	85	88	68	56	60	56	57	56	95	115	114	110
December	43	44	46	88	44	47	53	52	65	88	77	66	57	61	55	59	57	112	119	100	107
Average	58	47	48	77	80	46	56	53	60	82	88	75	59	68	58	57	58	73	101	116	112
NO. 2 REFINERS BUYING PRICE, COPPER SCRAP																					
January ..	56	35	37	42	67	38	41	48	48	59	88	66	46	56	50	46	51	48	94	104	87
February ..	58	37	39	45	71	40	41	50	46	71	97	65	46	60	51	47	51	48	78	98	88
March ..	60	42	42	52	95	44	46	54	47	76	73	68	44	59	55	47	53	50	82	108	96
April	61	46	41	55	102	43	52	50	49	78	68	69	42	62	56	49	51	49	79	111	102
May	56	41	40	55	96	41	52	48	50	70	68	67	42	64	52	49	50	54	79	100	101
June	49	39	39	59	76	38	54	45	50	68	68	65	38	61	49	46	51	57	84	91	97
July	48	40	38	60	65	42	58	41	50	66	77	64	36	62	47	47	47	62	80	89	100
August ..	43	39	38	66	64	44	53	38	52	71	73	66	38	61	46	47	46	64	79	100	104
September	43	38	38	68	48	42	49	38	53	74	72	63	38	57	44	47	48	68	88	106	102
October ..	41	37	38	72	45	41	41	39	55	73	73	61	38	52	43	48	47	70	94	107	96
November	38	35	38	77	44	40	42	39	54	75	72	60	39	49	46	48	47	83	98	97	93
December	37	35	39	70	40	40	43	43	55	72	65	59	40	51	45	49	47	98	104	88	93
Average	49	39	39	60	68	41	48	44	51	71	75	64	41	58	49	48	49	63	87	100	97
NO. 2 HEAVY COPPER SCRAP, DEALERS PRICE																					
January ..	47	23	31	32	61	32	37	34	34	47	75	58	57	43	41	38	38	38	77	104	74
February ..	47	25	32	36	66	31	38	36	36	59	82	56	57	47	41	38	40	38	68	96	69
March ..	50	28	35	43	73	34	40	42	36	65	70	57	54	52	44	38	40	38	64	99	78
April	52	32	35	44	76	34	42	41	40	69	60	60	54	52	45	38	40	40	63	101	87
May	48	29	34	45	74	31	44	40	39	63	58	58	53	54	43	38	40	41	70	105	87
June	41	27	32	47	61	30	44	36	42	59	57	55	43	55	42	38	40	43	71	91	83
July	38	28	30	47	51	33	47	35	41	58	65	53	47	55	39	38	40	45	70	84	83

See footnotes at end of table.

Table 9.—Selected U.S. copper scrap and ingot prices¹—Continued
(Cents per pound)

Period	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NO. 2 HEAVY COPPER SCRAP, DEALERS PRICE—Continued																					
August	36	27	30	52	49	37	46	34	42	59	65	54	46	54	39	38	38	49	70	88	86
September . .	33	27	30	59	41	38	44	33	43	62	64	53	48	52	38	38	38	50	72	105	92
October	31	28	30	62	39	37	38	33	45	63	65	50	49	48	36	38	38	53	79	102	88
November . . .	27	29	29	68	35	36	35	33	45	62	66	48	49	43	35	38	38	55	84	96	84
December . . .	25	28	29	67	33	36	34	33	45	65	58	46	51	43	36	38	36	65	86	88	82
Average	40	28	31	50	55	34	41	36	41	61	65	54	51	50	40	38	38	46	73	96	83
YELLOW BRASS INGOT (405)																					
January	49	40	40	44	65	57	54	57	59	66	80	77	73	64	70	70	71	71	84	101	114
February . . .	49	40	42	48	68	56	54	57	59	74	91	77	73	67	72	70	71	71	82	105	113
March	50	43	46	54	77	57	58	61	59	77	86	77	72	68	75	70	71	71	82	107	114
April	52	48	47	55	86	59	62	61	79	77	77	71	71	71	76	70	71	71	83	108	118
May	53	48	45	55	91	58	62	60	62	76	71	77	71	71	74	69	71	71	83	115	118
June	51	46	41	55	85	56	62	58	62	74	70	77	70	73	74	71	71	71	84	115	118
July	48	46	41	55	79	56	62	57	62	74	71	77	67	73	74	71	71	73	90	114	118
August	44	46	41	55	74	57	63	54	62	74	75	77	66	73	74	71	71	73	90	113	121
September . . .	41	45	41	59	67	58	62	52	62	74	75	77	66	73	74	71	71	73	90	117	123
October	41	44	41	61	61	56	57	52	63	76	75	75	66	71	74	71	71	76	94	117	123
November . . .	41	42	41	61	60	54	57	55	64	76	80	75	65	70	72	71	71	79	99	116	123
December . . .	41	40	41	65	59	54	57	55	64	76	78	73	63	70	70	71	71	84	100	115	123
Average	47	44	42	56	73	57	59	57	62	75	77	76	69	70	73	71	71	74	88	112	119

¹Delivered U.S. destinations.

Source: American Metal Market.

Table 10.—U.S. imports for consumption of copper and copper manufactures
(Metric tons and thousand dollars)¹

Year	Ore and concentrate		Matte, ash and precipitates		Blister and anode		Refined	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970 . .	59,424	78,618	263	388	203,472	245,778	119,848	149,121
1971 . .	5,033	4,091	169	312	139,298	144,304	147,033	163,076
1972 . .	73,246	81,055	1,993	1,820	69,343	71,827	157,179	169,944
1973 . .	20,936	19,550	1,087	1,093	130,791	176,244	186,945	262,776
1974 . .	77,093	135,986	2,262	12,338	181,927	387,159	275,537	540,592
1975 . .	26,581	37,766	6,657	20,548	70,131	92,841	128,914	169,545
1976 . .	31,931	52,297	13,381	53,910	16,995	22,475	345,948	469,718
1977 . .	16,337	22,856	4,304	14,193	6,873	10,274	360,870	498,400
1978 . .	22,196	28,640	8,669	11,970	76,755	98,998	402,673	529,299
1979 . .	30,416	50,066	519	720	24,595	40,755	203,855	396,508
1980 . .	52,361	75,927	394	818	43,422	88,977	426,948	955,533
1981 . .	39,133	59,213	2,938	3,815	29,904	52,224	330,625	598,336
1982 . .	118,055	145,066	4,104	3,982	97,374	146,220	258,439	402,720
1983 . .	90,597	82,848	3,305	4,556	46,353	67,534	459,567	713,758
1984 . .	11,056	10,421	2,095	2,608	38,851	55,224	444,699	633,353
1985 . .	2,867	2,066	4,017	3,439	12,959	15,992	377,723	503,059
1986 . .	4,232	3,037	702	604	34,546	61,235	501,984	689,342
1987 . .	2,339	2,013	6,869	9,361	24,084	42,640	469,159	744,076
1988 . .	2,776	8,186	5,481	10,473	98,435	200,798	333,072	820,059
1989 . .	46,516	51,311	2,810	6,685	77,218	242,106	300,110	853,805
1990 . .	91,493	131,038	7,961	19,802	44,278	125,238	261,672	674,774

See footnotes at end of table.

Table 10.—U.S. Imports for consumption of copper and copper manufactures—Continued
(Metric tons and thousand dollars)¹

	Unalloyed scrap		Alloyed scrap			Pipes and tubing		
	Quantity	Value	Gross weight	Copper content	Value	Quantity	Value	
1970 ..	1,207	977	3,341	2,438	2,993	17,136	30,221	
1971 ..	4,645	4,454	10,852	7,867	8,483	19,589	31,097	
1972 ..	7,563	7,299	13,512	9,451	10,533	23,377	35,827	
1973 ..	13,353	17,624	15,947	11,326	17,734	25,126	42,009	
1974 ..	22,884	41,064	20,514	14,859	32,954	14,212	34,599	
1975 ..	10,268	11,212	11,628	8,084	11,317	11,021	21,294	
1976 ..	14,241	15,290	17,956	12,413	17,790	15,255	31,368	
1977 ..	12,097	13,215	19,723	14,081	19,782	18,511	40,356	
1978 ..	15,436	17,113	19,018	13,199	18,580	21,014	45,688	
1979 ..	14,652	21,685	21,624	14,983	26,513	20,314	57,379	
1980 ..	16,053	28,796	19,162	13,704	27,433	10,393	34,468	
1981 ..	17,639	25,643	24,100	17,539	31,198	15,335	45,003	
1982 ..	16,459	20,718	25,449	18,844	24,465	16,172	42,717	
1983 ..	23,086	32,735	42,005	31,832	49,541	24,988	62,962	
1984 ..	23,005	29,311	42,369	32,016	47,896	29,839	73,575	
1985 ..	23,014	25,859	32,208	23,517	33,741	29,548	72,709	
1986 ..	27,216	31,809	39,037	28,856	40,632	38,602	91,348	
1987 ..	33,121	45,309	44,164	32,869	52,073	44,973	117,179	
1988 ..	37,152	87,507	50,028	36,122	77,346	42,016	155,558	
1989 ..	31,577	87,919	79,320	^a 57,110	151,265	33,065	149,226	
1990 ..	35,904	80,976	98,710	^a 71,071	192,777	21,123	85,175	
	Plates, sheets, foil, and bars		Wire rod		Wire and cable, stranded		Oxides	
	Quantity	Value	Quantity	Value	Quantity	Value	Gross weight	Value
1970 ..	13,791	23,828	1,101	2,294	NA	NA	380	525
1971 ..	19,424	28,946	1,383	2,359	NA	NA	323	383
1972 ..	23,492	34,524	1,380	2,400	NA	NA	607	697
1973 ..	24,291	42,553	2,413	5,493	NA	NA	459	776
1974 ..	23,747	63,549	1,249	3,403	NA	NA	696	1,509
1975 ..	18,371	36,282	675	1,219	NA	NA	1,058	1,364
1976 ..	29,590	57,972	1,134	2,343	NA	NA	859	1,077
1977 ..	32,594	72,817	6,234	9,940	1,251	2,188	1,492	1,916
1978 ..	45,176	92,237	3,172	5,697	4,191	6,960	1,791	2,691
1979 ..	43,727	113,687	2,799	6,744	2,930	8,216	2,474	4,544
1980 ..	29,761	93,633	2,452	6,971	1,322	4,387	2,289	4,597
1981 ..	38,275	107,730	2,743	7,161	1,239	4,006	3,233	6,505
1982 ..	30,998	83,027	3,345	7,736	1,310	4,201	2,558	5,285
1983 ..	34,852	96,916	3,907	8,726	3,515	8,664	2,258	4,184
1984 ..	53,227	151,196	8,188	16,356	1,765	6,386	1,492	2,659
1985 ..	43,766	115,463	10,359	18,484	1,998	5,040	1,919	2,931
1986 ..	40,053	103,613	12,809	22,527	5,744	11,707	2,800	5,302
1987 ..	41,766	132,039	10,172	21,103	7,581	16,655	3,014	6,129
1988 ..	48,614	172,527	7,021	23,471	7,843	20,846	2,907	6,329
1989 ..	50,571	202,470	4,693	20,108	8,506	29,741	² 3,216	² 8,329
1990 ..	51,532	227,349	2,341	12,014	8,768	27,620	² 3,798	² 9,319
	Copper sulfate							
	Gross weight	Copper content	Value					
1970 ..	335	89	147					
1971 ..	578	153	239					
1972 ..	426	220	149					

See footnotes at end of table.

Table 10.—U.S. Imports for consumption of copper and copper manufactures—Continued
(Metric tons and thousand dollars)¹

	Copper sulfate		
	Gross weight	Copper content	Value
1973 ..	754	193	304
1974 ..	440	143	334
1975 ..	417	105	213
1976 ..	1,161	306	606
1977 ..	2,460	875	1,378
1978 ..	3,413	896	1,750
1979 ..	1,765	587	1,177
1980 ..	974	279	778
1981 ..	1,253	511	957
1982 ..	1,544	542	997
1983 ..	2,403	772	1,477
1984 ..	1,886	928	1,131
1985 ..	2,958	1,033	1,873
1986 ..	2,686	1,144	1,718
1987 ..	4,764	1,900	2,720
1988 ..	10,677	3,878	7,845
1989 ..	13,458	4,102	11,188
1990 ..	12,251	5,810	11,193

²Estimated. NA Not available.

¹Quantities are in copper content unless otherwise specified. Values are those classified by the Bureau of the Census as customs values for 1970-73; beginning 1974 values are c.i.f. (customs, insurance, and freight).

²Includes hydroxides; for 1989, 570,727 kilograms valued at \$1,301,727 and, for 1990, 689,575 kilograms valued at \$1,420,251.

Sources: Bureau of the Census and the U.S. Bureau of Mines.

Table 11.—U.S. exports of copper and copper manufactures
(Metric tons and thousand dollars)

	Ore and concentrate		Matte, ash and residues		Blister and precipitates		Refined		Unalloyed scrap	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970 ...	55,826	52,949	NA	NA	7,081	6,807	200,679	269,370	15,018	13,815
1971 ...	7,372	7,648	NA	NA	26,034	20,178	170,237	170,504	16,724	14,171
1972 ...	16,023	12,852	8,510	5,172	7,774	6,060	165,782	165,498	15,821	12,154
1973 ...	21,326	27,349	13,687	9,340	6,679	7,320	171,817	222,267	38,361	35,085
1974 ...	17,530	15,773	7,469	7,134	2,413	3,237	114,782	206,570	37,505	42,105
1975 ...	7,536	6,275	5,987	5,685	1,402	1,152	156,422	204,496	40,825	37,007
1976 ...	13,474	12,419	4,638	3,136	2,470	2,379	101,502	141,874	33,995	33,638
1977 ...	13,019	11,480	9,735	5,436	6,835	5,499	42,406	63,528	34,375	32,664
1978 ...	17,486	19,816	9,127	6,888	9,285	10,514	83,391	118,112	49,076	54,445
1979 ...	44,565	66,155	5,215	9,415	7,445	9,515	73,677	128,703	54,080	70,624
1980 ...	106,825	203,375	6,881	15,474	3,802	7,296	14,489	31,099	61,225	93,059
1981 ...	150,782	207,012	6,284	7,774	9,227	16,395	24,397	43,353	50,078	70,106
1982 ...	195,275	211,196	2,874	10,385	2,008	3,680	30,558	45,797	54,419	63,484
1983 ...	42,738	48,060	6,934	11,616	7,454	8,083	81,397	132,653	47,986	66,929
1984 ...	60,999	69,085	5,150	11,911	8,379	10,562	91,414	138,834	80,810	96,266
1985 ...	116,308	131,123	12,084	23,200	39,632	20,984	37,937	52,464	134,300	132,386
1986 ...	174,348	187,826	3,826	10,671	15,963	17,434	12,452	18,444	136,422	123,138
1987 ...	124,749	157,010	5,999	13,154	12,339	12,463	9,197	18,928	108,535	104,901
1988 ...	211,147	420,003	4,308	10,276	33,337	65,978	58,325	138,539	119,773	164,933
1989 ...	266,831	539,325	6,908	15,156	8,041	20,209	130,189	303,013	154,935	244,195
1990 ...	258,235	401,785	3,709	40,977	6,422	14,701	211,164	554,833	139,624	227,418

See footnotes at end of table.

Table 11.—U.S. exports of copper and copper manufactures—Continued
(Metric tons and thousand dollars)

	Pipes and tubing		Plates, sheets, foil, and bars		Wire and cable bare		Wire and cable, stranded		Other copper manufactures	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970 ...	965	2,260	325	594	2,705	3,613	21,411	60,171	5,495	7,773
1971 ...	1,133	2,305	260	499	1,746	2,909	22,308	66,276	7,027	8,296
1972 ...	1,036	2,233	253	542	2,510	3,866	26,000	80,114	5,714	6,713
1973 ...	7,025	14,331	430	919	4,714	7,105	36,329	98,288	6,741	11,031
1974 ...	6,113	16,670	719	1,974	5,109	10,376	56,712	171,358	7,559	15,951
1975 ...	1,998	5,697	169	586	3,376	8,406	72,239	203,158	8,635	12,844
1976 ...	2,315	5,384	384	968	4,345	11,274	51,905	127,149	4,465	7,652
1977 ...	2,535	7,540	1,264	2,776	4,798	12,774	69,156	213,901	5,695	9,909
1978 ...	2,645	7,485	813	2,319	8,489	21,911	81,171	289,025	8,594	14,654
1979 ...	8,527	25,480	656	2,342	8,530	27,207	81,616	302,321	19,460	40,462
1980 ...	17,652	58,284	1,843	6,708	6,295	27,868	65,098	317,008	41,071	94,760
1981 ...	10,939	33,038	2,333	7,045	7,022	31,994	82,922	402,520	18,451	37,464
1982 ...	4,576	14,684	11,829	20,036	7,550	29,377	60,634	328,325	17,591	32,787
1983 ...	3,621	11,827	1,370	3,413	8,313	30,395	62,963	354,307	9,439	18,360
1984 ...	4,304	13,541	4,647	10,387	7,379	22,023	28,141	167,214	13,817	30,438
1985 ...	4,542	13,452	786	3,236	6,783	21,188	51,073	357,887	7,883	17,522
1986 ...	5,343	15,605	641	2,151	7,393	32,482	60,816	358,677	9,583	20,799
1987 ...	6,551	18,250	539	2,827	10,194	42,869	88,240	490,556	3,723	9,511
1988 ...	7,749	28,623	863	4,141	12,422	53,449	118,636	667,158	2,350	7,861
1989 ...	21,767	73,061	3,890	21,209	27,560	135,499	90,393	461,725	35,418	115,763
1990 ...	15,998	58,153	20,406	78,291	19,628	78,412	7,165	45,676	5,322	17,996

NA Not available.

Sources: Bureau of the Census and the U.S. Bureau of Mines.

Table 12.—World copper mine production¹
(Thousand metric tons)

Country	1986	1987	1988	1989	1990
Albania ^c	13.5	14.5	15.5	15.5	12.5
Argentina	.3	.4	.5	.7	.5
Australia	248.4	232.7	238.3	296.0	330.0
Bolivia ²	.3	(³)	.2	.3	.2
Botswana ⁴	21.3	18.9	24.4	21.7	19.6
Brazil	40.2	40.3	44.8	47.4	36.4
Bulgaria	38.0	44.0	47.0	48.0	30.0
Burma	10.1	10.6	4.7	5.1	4.4
Canada	698.6	802.2	776.5	723.0	793.7
Chile	1,398.8	1,418.1	1,451.0	1,609.3	1,588.4
China ^c	185.0	250.0	282.0	276.0	300.0
Cuba ^c	3.3	3.5	3.0	1.8	2.8
Cyprus	—	—	—	.3	—
Czechoslovakia ^c	5.3	5.3	5.0	4.9	3.3
Ecuador	.1	.1	.1	.1	.1
Finland	25.9	20.4	20.2	14.5	^c 12.6
France	.3	.3	.5	1.0	.5
Germany, Federal Republic of:					
Eastern states	^c 12.0	10.0	6.4	4.5	3.6
Western states	.8	1.5	.7	.1	—
Honduras	5.0	.6	.6	2.4	1.4
India	48.1	56.5	55.4	57.4	61.0
Indonesia	95.8	102.1	121.5	144.0	178.1
Iran ^{c, 5, 6}	50.0	40.0	51.0	68.0	60.3
Japan	34.9	23.8	16.7	14.7	12.9

See footnotes at end of table.

Table 12.—World copper mine production¹—Continued
(Thousand metric tons)

Country	1986	1987	1988	1989	1990
Korea, North ^e	15.0	15.0	15.0	15.0	15.0
Korea, Republic of	.2	.2	(³)	(³)	.1
Malaysia	28.3	29.9	22.1	23.8	24.3
Mexico	184.9	243.9	273.5	249.3	298.7
Mongolia	136.0	120.8	121.8	123.6	123.9
Morocco	20.2	16.5	15.4	16.0	16.4
Mozambique	.3	.2	.1	.1	(³)
Namibia ⁷	49.6	37.6	40.9	32.8	32.5
Nepal	(³)	(³)	(³)	(³)	(³)
Norway	21.9	22.0	15.9	16.5	19.7
Oman	18.2	18.1	17.1	16.6	14.0
Papua New Guinea	178.2	217.7	218.6	204.0	170.2
Peru ⁸	399.9	417.6	322.8	372.8	334.0
Philippines	222.6	216.1	218.1	193.0	182.1
Poland ^e	434.0	438.0	437.0	384.0	370.0
Portugal ^e	.2	1.1	3.7	103.7	162.9
Romania	35.0	38.0	40.0	43.0	25.0
Saudi Arabia	—	—	.3	.8	.9
South Africa, Republic of	184.2	188.1	168.5	181.9	178.7
Spain	51.1	16.2	13.8	24.6	15.3
Sweden	87.4	85.0	74.4	69.5	74.7
Turkey ⁹	21.2	26.3	30.5	37.1	38.4
U.S.S.R. ^e	1,000.0	1,000.0	1,000.0	1,000.0	950.0
United Kingdom	.6	.8	.7	.5	1.0
United States	1,144.2	1,243.6	1,416.9	¹⁰ 1,497.8	¹⁰ 1,587.7
Yugoslavia ¹¹	138.5	130.5	103.5	138.9	140.1
Zaire	527.8	515.4	495.8	467.2	372.8
Zambia ¹²	462.4	463.2	431.8	451.0	420.1
Zimbabwe ¹³	21.4	19.8	16.9	16.4	14.7
Total world	8,319.3	8,617.4	8,681.1	9,036.6	9,035.5

^eEstimated.

¹Data represent recoverable copper content of mine production.

²Corporacion Minera de Bolivia (COMIBOL) production plus exports by medium and small mines.

³Less than 1/2 unit.

⁴Copper content of nickel-copper matte produced.

⁵Year beginning Mar. 21 of that stated.

⁶Figure reported by World Metal Statistics, apparently based on official Iranian reporting, but may represent gross weight of concentrates produced.

⁷Data compiled from operating company reports of Tsumeb Corp. Ltd., General Mining and Finance Corp. Ltd. for Klein Aub Koper Maatskappy Ltd. mine near Rehobeth, and Falconbridge Nickel Mines Ltd. for Oamites Mining Co. (Pty.) Ltd., Oamites Mine. Data for General Mining and Finance Corp. Ltd. are for fiscal years ending June 30 of that stated, while data for other companies are for calendar years.

⁸Recoverable copper content by analysis of concentrates for export plus nonduplicative total of copper content of all metal and metal products produced indigenously from domestic ores and concentrates; includes leach production for electrowinning in Portugal.

⁹Includes copper content of pyrite.

¹⁰Includes electrowon from concentrates roast-leached.

¹¹Copper content by analysis of ore mined.

¹²Data are for fiscal years beginning Apr. 1 of that year stated. Zambian-mined copper reported recovered during smelting and electrowinning.

¹³Copper content of ore.

Table 13.—Copper world smelter production¹
(Thousand metric tons)

Country ²	1986	1987	1988	1989	1990
Albania	13.0	14.0	15.0	15.0	12.0
Australia	178.8	^e 181.4	188.3	^e 214.0	202.0
Austria	25.5	29.1	34.5	39.1	41.0
Belgium ^e	105.9	92.2	93.4	93.6	103.2

See footnotes at end of table.

Table 13.—Copper world smelter production¹—Continued
(Thousand metric tons)

Country ²	1986	1987	1988	1989	1990
Brazil	116.0	147.0	147.9	153.4	157.1
Bulgaria ^e	50.0	55.0	57.0	57.0	25.5
Canada	484.7	504.6	524.9	500.1	523.0
Chile ^e	1,123.9	1,106.9	1,189.4	1,226.6	1,328.5
China ^e	225.0	300.0	320.0	340.0	350.0
Czechoslovakia ^e	5.3	5.3	5.0	5.5	4.3
Finland	96.5	77.4	79.0	79.5	90.1
France	6.1	7.0	8.5	^e 8.4	9.0
Germany, Federal Republic of:					
Eastern states	64.0	64.0	61.0	62.0	39.9
Western states	238.6	207.7	221.5	255.9	253.6
Hungary ^e	0.1	0.1	0.1	0.1	0.1
India	39.1	32.9	44.3	42.5	40.7
Iran ³	50.0	40.0	52.0	76.0	54.8
Japan	962.1	980.0	994.0	1,005.5	1,040.6
Korea, North ^e	18.0	18.0	18.0	18.0	18.0
Korea, Republic of	123.2	143.8	123.5	123.6	124.0
Mexico ⁴	73.7	126.3	150.3	174.3	175.4
Namibia ⁵	45.7	37.7	42.2	38.0	33.2
Norway	35.2	29.7	31.7	35.0	36.5
Oman	14.7	15.7	16.5	15.2	12.1
Peru	327.2	323.0	246.9	241.2	195.5
Philippines	124.3	124.7	^e 159.2	105.0	110.0
Poland ^e	566.0	367.0	470.0	460.0	346.0
Portugal	5.0	4.0	4.5	2.7	3.0
Romania	36.0	39.0	41.0	44.4	29.3
South Africa, Republic of	192.0	189.8	180.6	184.8	176.0
Spain	135.2	148.7	145.6	152.3	142.0
Sweden	102.5	105.6	115.9	111.7	108.0
Taiwan ⁶	50.4	47.0	43.3	43.2	16.1
Turkey	35.5	19.2	12.9	21.1	20.9
U.S.S.R. ^e	1,200.0	1,200.0	1,200.0	1,200.0	1,100.0
United States ⁷	1,195.9	1,248.7	1,374.6	1,479.5	1,463.3
Yugoslavia	227.9	165.8	172.0	173.0	174.3
Zaire ⁸	498.1	487.4	466.4	449.2	355.8
Zambia ⁹	438.2	422.7	404.8	420.9	383.7
Zimbabwe ¹⁰	20.4	19.0	16.3	15.8	14.1
Total world	9,249.7	9,127.4	9,472.0	9,683.1	9,312.6

^eEstimated.

¹This table includes production of copper metal at the unrefined stage including low-grade cathode produced by electrowinning methods. This smelter feed may be derived from ore, concentrates, copper precipitates or matte (primary), and/or scrap (secondary).

²Argentina presumably produces some smelter copper utilizing its own small mine output together with domestically produced cement copper and possibly using other raw materials including scrap, but the levels of such output cannot be reliably estimated.

³Data may be for year beginning Mar. 21 of that year stated. Only estimated production data are available. Secondary production is estimated to be about 5% of total.

⁴Copper content of impure bars and electrolytic copper.

⁵Data are compiled from operating company reports of Tsumeb Corp. Ltd., General Mining and Finance Corp. Ltd. for Klein Aub Koper Maatskappy Ltd. mine near Rehobeth, and Falconbridge Nickel Mines Ltd. for Oamites Mining Co. (Pty.) Ltd. Oamites Mine. Data for General Mining and Finance Corp. Ltd. are for fiscal years ending June 30 of that stated, while data from other companies are for calendar years.

⁶Includes secondary.

⁷Figures for U.S. primary smelter production may include a small amount of copper derived from precipitates shipped directly to the smelter for further processing; production derived from electrowinning and fire-refining is not included. Copper content of precipitation shipped directly to smelter are as follows, in metric tons: 1986—79,031; 1987—70,136; 1988—49,299; 1989—34,485; and 1990—19,817.

⁸Data include refined copper plus exported blister and leach cathodes.

⁹For fiscal year beginning Apr. 1 of year stated. Includes electrowon production reported less the quantity reported as "finished production, leach cathodes."

¹⁰Refined figure; unrefined data not available. Includes production from low-grade electrowon cathodes produced in nickel processing.

Table 14.—World copper refinery production¹
(Thousand metric tons primary and secondary refined copper)

Country	1986	1987	1988	1989	1990
Albania ^e	11.7	12.0	13.0	13.0	10.0
Argentina	11.0	13.0	12.5	11.0	15.0
Australia	185.1	207.8	222.7	235.0	274.0
Austria	39.6	32.9	38.4	46.3	49.7
Belgium/Luxembourg	457.8	475.9	504.3	564.5	542.5
Brazil	166.0	199.2	185.9	195.6	185.0
Bulgaria ^e	48.0	54.0	55.5	55.8	24.3
Canada	493.4	491.2	528.7	516.0	515.8
Chile	942.3	970.3	1,012.7	1,071.0	1,191.6
China	400.0	400.0	510.0	540.0	560.0
Czechoslovakia ^e	26.2	27.2	27.1	26.9	24.6
Egypt	3.8	2.5	4.0	3.6	3.6
Finland	64.2	59.5	53.9	55.7	65.1
France	41.9	39.3	43.2	49.3	52.0
Germany, Federal Republic of:					
Eastern states	95.0	95.0	95.1	93.6	56.7
Western states	421.9	399.8	426.4	475.3	476.2
Hungary ^e	12.8	12.5	19.2	19.0	19.0
India	36.9	30.8	40.1	41.8	41.6
Iran	26.0	25.0	32.0	40.0	43.3
Italy	65.4	65.0	75.4	83.3	83.0
Japan	943.1	980.3	955.1	989.6	1,008.0
Korea, North ^e	22.0	22.0	22.0	22.0	22.0
Korea, Republic of	165.0	157.9	169.0	179.9	*185.6
Mexico	89.5	135.7	140.8	147.1	152.8
Norway	30.5	29.4	31.7	35.0	36.5
Oman	14.5	15.5	16.5	15.1	12.0
Peru	226.7	225.9	179.6	224.2	181.7
Philippines	134.5	132.1	132.2	132.2	125.5
Poland	388.0	390.2	400.6	390.3	352.0
Portugal	5.3	5.3	5.4	6.0	6.0
Romania ^e	44.0	42.5	43.0	48.0	27.7
South Africa, Republic of	158.6	146.5	136.7	144.2	133.0
Spain	155.1	151.4	158.8	165.7	*166.0
Sweden	91.9	91.9	90.3	94.6	97.3
Taiwan	58.4	57.0	53.3	53.2	22.1
Turkey	75.1	75.6	90.0	86.4	84.2
U.S.S.R. ^e	1,250.0	1,250.0	1,250.0	1,250.0	1,100.0
United Kingdom	125.6	122.3	124.0	119.0	121.6
United States	1,479.9	1,541.6	1,852.4	1,956.9	2,017.4
Yugoslavia	100.0	138.9	145.4	151.1	151.4
Zaire	218.0	210.4	202.8	181.6	140.9
Zambia ²	497.6	496.3	449.6	463.6	438.1
Zimbabwe ^{3,4}	25.3	18.8	16.1	15.7	14.1
Total world	9,847.6	10,050.4	10,565.4	11,008.1	10,828.9

^eEstimated.

¹This table includes total production of refined copper, whether produced by pyrometallurgical or electrolytic refining methods and whether derived from primary unrefined copper or from scrap. Copper cathode derived from electrowinning processing is also included.

²Fiscal Year, begins Apr. 1 of year indicated.

³May not include copper-nickel matte (copper content more than 6,000 metric tons per year) imported from Botswana for tolling refining in 1986-89.

⁴Output of fire-refined copper by Messina (Transvaal) Development Corp. apparently was terminated in 1972. Refined copper output from that date include only electrolytic copper output by Corsyn Consolidated Mines as indicated in company annual reports.

Sources: U.S. Bureau of Mines, various country trade and production sources, World Bureau of Metal Statistics, Metalgesellschaft, U.N. trade publications, and British Geological Survey.

Table 15.—U.S. copper consumption

Year	Reported consumption		Apparent consumption, primary refined copper and old scrap		Apparent consumption, copper primary refined and old and new scrap		Net imports of refined copper (metric tons)
	Refined copper ¹ (metric tons)	Refined from scrap (percent)	Consumption ² (metric tons)	Old scrap contribution (percent)	Consumption ³ (metric tons)	Total scrap contribution (percent)	
1970 ..	1,853,654	25	1,818,866	25	2,493,271	45	-80,801
1971 ..	1,832,066	20	1,886,418	21	2,571,302	42	-21,469
1972 ..	2,031,067	19	2,142,445	19	2,907,205	41	-6,387
1973 ..	2,210,853	19	2,223,351	20	3,031,733	41	15,333
1974 ..	1,990,516	23	2,144,892	20	2,925,112	42	169,484
1975 ..	1,392,083	22	1,473,444	23	2,020,419	44	-26,744
1976 ..	1,807,008	19	1,923,872	20	2,582,859	40	244,447
1977 ..	1,982,162	18	2,069,701	20	2,744,954	40	304,213
1978 ..	2,189,301	19	2,369,537	21	3,115,043	40	310,751
1979 ..	2,158,442	23	2,434,234	25	3,382,368	46	130,188
1980 ..	1,862,096	28	2,178,849	28	3,003,074	48	412,459
1981 ..	2,025,169	24	2,271,416	26	3,086,642	46	306,228
1982 ..	1,658,142	28	1,762,385	29	2,432,125	49	227,881
1983 ..	1,803,929	22	2,012,739	22	2,646,840	41	378,171
1984 ..	2,122,734	14	2,116,058	22	2,775,277	40	353,285
1985 ..	1,976,101	19	2,144,436	23	2,780,113	41	339,788
1986 ..	2,097,351	19	2,138,223	23	2,785,041	40	489,532
1987 ..	2,127,178	19	2,196,540	23	2,912,929	42	459,962
1988 ..	2,210,424	20	2,213,768	24	3,002,257	44	273,346
1989 ..	2,203,116	22	2,180,840	26	2,945,209	44	166,398
1990 ..	2,150,426	20	2,167,892	25	2,942,027	45	50,508
	Refined copper inventories, yearend ⁴ (metric tons)	U.S. import reliance (percent) ⁵	Refined inventories (weeks of consumption) ⁶	Current price (U.S. dollars per pound) ⁷			
1970 ..	501,000	-13	13	0.58			
1971 ..	441,000	2	11	0.52			
1972 ..	407,000	1	9	0.52			
1973 ..	335,000	4	7	0.60			
1974 ..	300,000	10	7	0.77			
1975 ..	444,000	-12	14	0.64			
1976 ..	541,000	8	13	0.70			
1977 ..	543,000	15	13	0.67			
1978 ..	435,000	18	9	0.67			
1979 ..	252,000	13	5	0.92			
1980 ..	314,000	16	7	1.01			
1981 ..	485,000	6	10	0.84			
1982 ..	695,000	1	19	0.73			
1983 ..	692,000	19	17	0.77			
1984 ..	568,000	23	13	0.67			
1985 ..	320,000	27	7	0.67			
1986 ..	225,000	27	5	0.66			
1987 ..	113,000	26	2	0.83			
1988 ..	97,000	13	2	1.21			
1989 ..	107,000	7	2	1.31			
1990 ..	101,000	3	2	1.23			

¹These data are based on monthly reported data from U.S. semifabricators and other refined copper consuming plants. Includes brass mills, wire-rod mills, foundries, ingotmakers, chemical plants, and other manufacturers.

²Apparent consumption represents primary refined production plus production from all old scrap plus net refined imports plus refined copper stock changes. New refined and remelted scrap is not included.

³Apparent consumption represents primary production plus all copper from old and new scrap plus net refined imports plus refined copper stock changes.

⁴Refined inventories include Government-held stocks.

⁵Import reliance is calculated as a percentage of apparent consumption, primary refined copper plus old scrap.

⁶Average number of weeks of available stocks based on average weekly apparent consumption for the year.

⁷U.S. producers price, annual average, delivered refined copper.

Table 16.—U.S. copper scrap and copper alloy consumption and trade
(Metric tons)

	1970	1971	1972	1973	1974	1975	1976
Scrap consumption:							
By plant type:							
Brass mill	541,647	593,426	677,453	704,623	644,908	470,252	600,968
Secondary smelters/refiners	975,271	852,352	873,448	912,585	895,536	611,539	709,941
Foundries and miscellaneous manufacturers	70,344	59,831	65,044	72,994	72,104	54,520	62,516
Total, gross weight	1,587,262	1,505,609	1,615,945	1,690,202	1,612,548	1,136,311	1,373,425
By source: ¹							
Old scrap	710,603	601,412	613,159	625,009	620,300	441,156	518,504
New scrap	876,658	904,197	1,002,786	1,065,194	992,248	695,155	854,921
By type of scrap:							
Unalloyed copper:							
No. 1 wire	276,529	270,116	300,705	382,442	373,164	259,407	302,214
No. 2 wire, mixed	314,158	272,039	301,617	314,218	311,240	220,005	244,891
Total unalloyed	590,687	542,155	602,322	696,660	684,404	479,412	547,105
Red brass	25,467	75,946	79,386	76,831	74,204	48,959	57,264
Cartridge brass	105,960	130,586	102,225	80,788	70,261	50,859	70,963
Yellow brass	291,325	278,740	366,886	367,750	325,036	231,123	293,328
Automobile radiators	51,449	58,872	66,714	62,364	62,791	48,372	61,762
Bronze	31,318	28,400	29,168	31,366	29,173	21,876	22,441
Nickle silver/cupronickel	20,819	25,547	29,575	29,842	36,415	38,127	33,528
Low brass	44,813	49,252	38,538	26,688	28,451	28,410	45,628
Aluminum bronze	1,345	1,068	1,253	1,781	1,358	909	1,244
Low-grade scrap and residues, etc.	346,419	305,440	291,718	307,581	291,290	183,123	234,559
Others	77,660	9,603	8,159	8,551	9,165	5,141	5,603
Total, alloyed	996,575	963,454	1,013,623	993,542	928,144	656,899	826,320
At brass mills, by type of scrap:							
No. 1 wire	106,655	140,635	156,616	206,913	186,236	124,811	144,469
No. 2 wire, mixed	31,964	35,984	51,602	54,681	54,134	39,064	65,116
Cartridge brass	105,635	130,453	102,040	80,657	70,171	50,791	70,786
Yellow brass	232,800	214,973	302,408	308,543	271,304	190,472	244,100
Bronze	5,386	4,418	3,501	4,982	4,825	3,450	3,827
Nickel silver/cupronickel	17,131	21,546	26,307	25,590	32,595	35,592	30,655
Mixed alloy scrap	1,216	—	—	—	—	—	—
Low brass	40,415	45,022	34,563	22,965	25,282	25,716	41,693
Aluminum bronze	544	396	415	292	361	357	322
Total, gross weight	541,647	593,426	677,453	704,623	644,908	470,252	600,968
Copper recovered from scrap: ²							
Refined from scrap	464,124	363,475	383,960	421,953	450,787	312,513	340,335
Unalloyed powder and castings	10,644	25,794	21,923	17,690	14,878	10,002	14,128
Total unalloyed products	474,768	389,269	405,883	439,643	465,665	322,515	354,463
Brass and bronze	630,936	669,334	739,529	710,688	714,062	518,902	635,795
In aluminum alloys	23,148	24,033	29,344	34,093	34,739	35,909	42,653
From other alloys	2,954	6,095	5,468	6,080	5,081	4,426	6,064
Total copper from scrap ³	1,131,806	1,088,731	1,180,223	1,190,503	1,219,547	881,752	1,038,975
Brass mill materials consumption:							
Copper-base scrap	541,647	593,426	677,453	704,623	644,908	470,252	600,968
Refined copper	599,271	594,916	605,290	648,127	607,957	398,227	530,481
Alloy-ingot	5,628	11,933	15,142	13,130	21,684	5,121	7,548
Slab zinc	102,971	123,724	163,095	168,626	154,828	97,016	142,789
Total	1,249,517	1,323,999	1,460,980	1,534,506	1,429,377	970,616	1,281,786
U.S. trade, by scrap type: ²							
Alloyed scrap:							
Imports (copper content)	2,438	7,867	9,451	11,326	14,859	8,084	12,413

See footnotes at end of table.

Table 16.—U.S. copper scrap and copper alloy consumption and trade—Continued
(Metric tons)

	1970	1971	1972	1973	1974	1975	1976
Exports:							
Gross weight	100,121	69,737	61,258	100,112	107,227	90,004	69,587
Copper content	65,078	45,329	39,818	65,073	69,698	58,503	45,232
Unalloyed scrap (copper content):							
Imports	1,207	4,645	7,563	13,353	22,884	10,268	14,241
Exports	15,018	16,724	15,821	38,361	37,505	40,825	33,995
	1977	1978	1979	1980	1981	1982	1983
Scrap consumption:							
By plant type:							
Brass mill	615,205	637,942	703,138	608,205	633,879	508,478	624,466
Secondary smelters/refiners	745,980	918,238	1,281,257	1,168,398	1,115,275	946,480	693,678
Foundries and miscellaneous manufacturers	67,238	86,799	88,831	74,302	76,413	59,889	63,472
Total, gross weight	1,428,423	1,642,979	2,073,226	1,850,905	1,825,567	1,514,847	1,381,616
By source: ¹							
Old scrap	555,140	664,289	830,335	791,080	776,984	659,574	574,376
New scrap	873,283	978,690	1,242,891	1,059,825	1,048,583	855,273	807,240
By type of scrap:							
Unalloyed copper:							
No. 1 wire	304,928	331,910	392,112	380,386	346,295	279,877	271,990
No. 2 wire, mixed	262,413	326,112	447,267	466,951	466,174	417,004	324,665
Total unalloyed	567,341	658,022	839,379	847,337	812,469	696,881	596,655
Red brass	66,001	74,255	80,504	68,171	69,562	55,671	52,812
Cartridge brass	74,601	82,852	80,520	61,354	67,948	54,057	66,306
Yellow brass	294,100	332,779	354,015	299,661	294,156	244,478	328,945
Automobile radiators	73,051	83,453	94,123	65,546	65,058	58,942	64,814
Bronze	24,413	23,299	24,574	22,461	21,708	18,195	20,949
Nickel silver/cupronickel	28,247	18,894	28,449	17,265	22,756	17,564	22,912
Low brass	65,469	53,057	54,377	55,533	61,616	43,849	8,474
Aluminum bronze	1,043	941	1,605	1,551	1,705	1,396	2,137
Low-grade scrap and residues etc.	226,705	305,630	506,757	404,398	400,981	318,221	205,700
Others	7,452	9,797	8,923	7,628	7,608	5,593	11,912
Total, alloyed	861,082	984,957	1,233,847	1,003,568	1,013,098	817,966	784,961
At brass mills, by type of scrap:							
No. 1 wire	148,425	168,534	194,951	185,338	183,583	160,194	188,357
No. 2 wire, mixed	55,686	39,579	50,647	44,280	60,304	36,670	52,535
Cartridge brass	74,488	82,756	80,458	61,205	67,693	54,006	66,306
Yellow brass	245,044	277,189	295,843	247,867	241,163	196,985	279,226
Bronze	4,728	5,234	5,418	4,414	3,903	4,024	3,955
Nickel silver/cupronickel	25,362	16,119	24,857	13,934	19,746	15,020	19,963
Mixed alloy scrap	—	—	—	—	—	—	—
Low brass	61,151	48,288	50,693	50,932	57,305	41,522	14,095
Aluminum bronze	320	243	271	235	182	57	29
Total, gross weight	615,205	637,942	703,138	608,205	633,879	508,478	624,466
Copper recovered from scrap: ²							
Refined from scrap	349,646	420,103	498,459	515,083	482,837	467,549	401,668
Unalloyed powder and castings	15,075	17,017	17,812	19,473	20,966	14,016	17,186
Total unalloyed products	364,721	437,120	516,271	534,556	503,803	481,565	418,854
Brass and bronze	670,712	755,978	976,402	850,188	850,546	660,152	625,349
In aluminum alloys	44,218	48,153	53,608	47,306	47,728	41,930	36,704
From other alloys	5,774	5,984	6,244	5,377	5,320	3,819	2,672
Total copper from scrap ³	1,085,425	1,247,235	1,552,525	1,437,427	1,407,397	1,187,466	1,083,579

See footnotes at end of table.

Table 16.—U.S. copper scrap and copper alloy consumption and trade—Continued
(Metric tons)

	1977	1978	1979	1980	1981	1982	1983
Brass mill materials consumption:							
Copper-base scrap	615,205	637,942	703,138	608,205	633,879	508,478	624,466
Refined copper	570,274	619,206	610,177	511,627	536,210	393,205	500,263
Alloy-ingot	6,606	6,776	4,050	6,087	17,824	12,727	14,759
Slab zinc	119,709	128,006	127,628	90,413	104,330	74,483	99,664
Total	1,311,794	1,391,930	1,444,993	1,216,332	1,292,243	988,893	1,239,152
U.S. trade, by scrap type:²							
Alloyed scrap:							
Imports (copper content)	14,081	13,199	14,983	13,704	17,539	18,844	31,832
Exports:							
Gross weight	74,410	106,717	116,992	129,767	96,149	91,592	81,048
Copper content	48,367	69,366	76,045	84,349	62,497	59,535	52,681
Unalloyed scrap (copper content):							
Imports	12,097	15,436	14,652	16,053	17,639	16,459	23,086
Exports	34,375	49,076	54,080	61,225	50,078	54,419	47,986
	1984	1985	1986	1987	1988	1989	1990
Scrap consumption:							
By plant type:							
Brass mill	675,472	607,136	635,896	687,549	757,047	725,586	754,386
Secondary smelters/refiners	689,375	726,945	800,019	823,032	797,682	828,905	777,833
Foundries and miscellaneous manufacturers	68,610	66,662	63,778	71,670	64,507	66,097	75,654
Total, gross weight	1,433,457	1,400,743	1,499,693	1,582,251	1,619,236	1,620,588	1,607,873
By source:¹							
Old scrap	572,311	570,923	612,896	675,088	644,314	673,258	696,125
New scrap	861,146	840,856	882,113	903,548	974,916	943,501	856,892
By type of scrap:							
Unalloyed copper:							
No. 1 wire	270,228	350,484	390,951	410,636	416,655	418,893	424,128
No. 2 wire, mixed	367,436	259,313	324,975	383,862	409,332	392,755	342,658
Total unalloyed	637,664	609,797	715,926	794,498	825,987	811,648	766,786
Red brass	58,988	89,587	75,252	56,366	53,638	68,448	74,954
Cartridge brass	70,781	66,944	71,549	78,461	139,074	126,224	97,726
Yellow brass	369,673	292,777	293,207	323,969	332,212	320,107	366,052
Automobile radiators	75,440	53,539	55,927	62,260	104,364	96,395	94,947
Bronze	24,593	19,818	20,151	21,050	21,296	21,092	18,608
Nickle silver/cupronickel	21,811	15,905	13,582	9,617	14,968	23,619	21,303
Low brass	8,301	7,035	6,357	5,725	6,737	6,060	5,604
Aluminum bronze	973	994	970	965	1,005	2,696	2,246
Low-grade scrap and residues, etc.	150,535	111,241	115,888	209,216	101,223	102,448	136,395
Others	14,698	133,106	130,884	20,124	18,732	41,806	23,252
Total, alloyed	795,793	790,946	783,767	787,753	793,249	808,895	841,087
At brass mills, by type of scrap:							
No. 1 wire	190,299	193,265	224,114	246,300	271,233	265,038	256,127
No. 2 wire, mixed	68,543	65,311	52,802	56,247	57,667	46,316	64,298
Cartridge brass	70,547	66,984	66,937	78,140	139,349	125,669	97,726
Yellow brass	307,493	265,820	256,875	279,721	256,226	247,535	220,047
Bronze	4,880	3,517	4,094	4,304	4,568	4,613	5,244
Nickel silver/cupronickel	19,245	13,565	10,561	6,177	12,274	19,199	21,303
Mixed alloy scrap	—	—	—	—	—	—	89,641
Low brass	14,447	12,524	12,238	12,542	15,711	17,162	5,507
Aluminum bronze	18	37	7	—	13	9	238
Total, gross weight	675,472	621,023	627,628	683,431	757,041	725,541	754,386

See footnotes at end of table.

Table 16.—U.S. copper scrap and copper alloy consumption and trade—Continued
(Metric tons)

	1984	1985	1986	1987	1988	1989	1990
Copper recovered from scrap:²							
Refined from scrap	306,537	371,787	292,686	311,312	347,442	376,595	328,196
Unalloyed powder and castings	31,652	15,882	121,760	112,445	109,036	112,687	121,705
Total unalloyed products	338,189	387,669	414,446	423,757	456,478	489,282	449,901
Brass and bronze	735,154	716,833	662,242	736,725	800,221	774,701	800,332
In aluminum alloys	43,511	29,423	45,171	47,932	45,632	41,719	55,436
From other alloys	3,060	5,159	4,669	5,645	4,560	2,753	3,576
Total copper from scrap ³	1,119,914	1,139,084	1,126,528	1,214,059	1,306,891	1,308,455	1,309,245
Brass mill materials consumption:							
Copper-base scrap	675,472	607,136	635,896	687,549	757,041	725,586	754,386
Refined copper	576,160	513,985	564,875	488,629	486,843	461,022	445,221
Alloy-ingot	16,553	13,314	15,330	28,975	3,104	7,331	906
Slab zinc	116,392	68,437	64,883	76,454	81,678	70,584	73,728
Total	1,384,577	1,202,872	1,280,984	1,281,607	1,328,666	1,264,523	1,274,241
U.S. trade, by scrap type:²							
Alloyed scrap:							
Imports (copper content)	32,016	23,517	28,856	32,869	36,122	*57,110	*71,071
Exports:							
Gross weight	108,331	140,245	152,102	185,279	199,953	212,522	184,766
Copper content	70,415	91,161	98,867	120,430	129,969	138,139	120,098
Unalloyed scrap (copper content):							
Imports	23,005	23,014	27,216	33,121	37,152	31,577	35,904
Exports	80,810	134,300	136,422	108,535	119,773	154,935	139,624

*Estimated.

¹Gross weight includes copper-base scrap only.

²Data revisions made since latest Bureau publications.

³Data may not add to totals shown because of independent rounding.

Table 17.—U.S. copper mine, smelter, refinery capacity, and percent utilization
(Thousand metric tons)

Year	Mine			Smelter			Refinery		
	Production	Capacity	Percent utilization	Production	Capacity	Percent utilization	Production	Capacity	Percent utilization
1970 ...	1,560	1,678	93	1,795	1,919	94	2,065	2,431	85
1971 ...	1,381	1,724	80	1,550	1,886	82	1,808	2,595	70
1972 ...	1,510	1,724	88	1,746	1,927	91	2,083	2,640	79
1973 ...	1,558	1,814	86	1,805	1,945	93	2,117	2,640	80
1974 ...	1,449	1,658	87	1,678	1,976	85	1,952	2,721	72
1975 ...	1,282	1,742	74	1,498	1,976	76	1,617	3,085	52
1976 ...	1,457	1,857	78	1,585	2,079	76	1,737	2,930	59
1977 ...	1,364	1,879	73	1,479	2,079	71	1,707	2,732	62
1978 ...	1,358	1,875	72	1,497	2,105	71	1,869	2,860	65
1979 ...	1,447	1,833	79	1,541	2,107	73	2,015	2,917	69
1980 ...	1,181	1,877	63	1,258	2,107	60	1,730	2,827	61
1981 ...	1,538	1,936	79	1,536	1,927	80	2,027	2,680	76
1982 ...	1,147	1,870	61	1,208	1,927	63	1,694	2,703	63
1983 ...	1,038	1,687	62	1,131	1,764	64	1,597	2,585	62
1984 ...	1,103	1,540	72	1,183	1,787	66	1,504	2,188	69
1985 ...	1,105	1,476	75	1,191	1,727	69	1,429	2,076	69
1986 ...	1,144	1,514	76	1,196	1,653	72	1,480	2,024	73
1987 ...	1,244	1,502	83	1,249	1,679	74	1,542	1,887	82
1988 ...	1,417	1,654	86	1,363	1,646	83	1,852	2,204	84
1989 ...	1,498	1,778	84	1,480	1,745	85	1,957	2,406	81
1990 ...	1,588	1,858	85	1,464	1,790	82	2,017	2,485	81

Source: U.S. Bureau of Mines.

Page Intentionally Left Blank.

FERROALLOYS

By Clark Neuharth

Ferroalloys impart distinctive qualities to steel and cast iron and serve important functions during iron and steel production cycles. The principal ferroalloys are those of chromium, manganese, and silicon. Manganese, used to neutralize the harmful effect of sulfur and as an alloying element, is essential to the production of virtually all steels and is also important to the production of cast iron. Chromium adds corrosion resistance to stainless steels. Silicon is used primarily for the deoxidation of steel and as an alloying element in cast iron. Boron, cobalt, columbium, copper, molybdenum, nickel, phosphorus, titanium, tungsten, vanadium, zirconium, and the rare earths are among the other elements contributing to the character of

the various alloy steels and cast irons. Most of these elements are normally added to the molten metal as a ferroalloy.

Ferroalloys and related materials are essential to the production of many metals and alloys, including aluminum, iron, and steel. The domestic ferroalloys industry has been in a state of decline since its peak production years in the early 1970's because of decreased demand and competition from low-priced imports. Since that time, many U.S. producers have gone out of business, leaving the domestic ferroalloy industry a lean but surviving element of the country's industrial base.

Table 1.—Ferroalloys produced and shipped from furnaces in the United States
(Metric tons gross weight and thousand dollars)

	1969			1970		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	772,939	759,057	119,308	757,920	732,432	134,456
Silicomanganese	202,191	197,352	35,152	175,285	156,932	32,024
Manganese metal	NA	NA	NA	NA	NA	NA
Silvery pig iron	185,090	184,740	15,891	178,143	188,390	16,853
Ferrosilicon ²	648,793	612,696	112,293	643,455	598,031	136,238
Silicon metal	NA	NA	NA	NA	NA	NA
Ferrochromium ³	380,145	351,766	107,410	368,114	336,518	126,273
Other ⁴	70,802	92,698	9,171	78,333	82,272	82,807
Ferrocolumbium	2,087	1,998	9,298	1,143	1,289	9,385
Ferrophosphorus	118,462	149,105	4,784	148,875	159,724	6,539
Ferrotitanium	4,029	3,830	3,937	3,048	2,986	3,503
Total ⁵	2,384,538	2,353,241	487,244	2,354,316	2,258,572	548,078
	1971			1972		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	689,366	725,379	134,594	726,404	659,153	126,598
Silicomanganese	149,397	130,691	28,094	139,012	132,842	28,440
Manganese metal	NA	NA	NA	NA	NA	NA
Silvery pig iron	155,834	157,995	15,902	147,937	148,519	14,800
Ferrosilicon ²	623,387	615,406	155,850	763,293	711,595	182,100
Silicon metal	NA	NA	NA	NA	NA	NA
Ferrochromium ³	322,649	321,847	137,359	319,606	319,365	111,274
Other ⁴	78,316	73,731	71,579	73,244	74,024	82,416
Ferrocolumbium	753	1,476	7,204	1,052	2,205	11,656
Ferrophosphorus	91,946	80,968	4,527	118,256	107,460	5,739
Ferrotitanium	3,051	2,807	3,261	3,311	3,749	4,566
Total ⁵	2,114,698	2,110,300	558,340	2,292,115	2,158,913	567,589
	1973			1974 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	619,675	707,114	136,907	493,836	520,613	162,082
Silicomanganese	166,652	177,768	39,439	177,935	174,344	57,014
Manganese metal	NA	NA	NA	NA	NA	NA
Silvery pig iron	(7)	(7)	(7)	(7)	(7)	(7)

See footnotes at end of table.

PRECEDING PAGE
BLANK

Table 1.—Ferroalloys produced and shipped from furnaces in the United States—Continued
(Metric tons gross weight and thousand dollars)

	1973			1974 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferrosilicon ²	918,803	964,183	258,120	845,362	841,024	356,965
Silicon metal	NA	NA	NA	NA	NA	NA
Ferrochromium ³	387,228	428,707	156,574	395,121	407,543	231,557
Other ⁴	75,035	89,789	106,505	61,636	62,333	111,617
Ferrocolumbium	1,059	2,502	15,316	1,065	1,160	7,899
Ferrophosphorus	117,613	129,961	7,681	96,603	120,823	9,061
Ferrotitanium	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)
Total ⁵	2,286,065	2,500,022	720,542	2,071,558	2,127,840	936,195
	1975 ⁶			1976 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	522,365	504,514	222,522	437,864	448,351	207,505
Silicomanganese	129,965	114,685	53,913	116,952	120,079	52,649
Manganese metal	NA	NA	NA	NA	NA	NA
Silvery pig iron	(⁷)	(⁷)	(⁷)	(⁷)	(⁷)	(⁷)
Ferrosilicon ²	717,456	644,044	321,470	780,904	808,160	409,726
Silicon metal	NA	NA	NA	NA	NA	NA
Ferrochromium ³	225,723	202,740	177,547	244,257	239,083	175,934
Other ⁴	58,237	50,475	116,809	51,242	46,214	134,322
Ferrocolumbium	558	436	3,549	1,093	846	6,359
Ferrophosphorus	93,346	87,095	10,927	100,610	84,086	11,173
Ferrotitanium	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)
Total ⁵	1,747,650	1,603,989	906,737	1,732,921	1,746,819	997,668
	1977 ⁶			1978 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	303,121	306,565	141,560	247,235	288,596	145,327
Silicomanganese	108,638	110,360	43,112	128,756	138,524	48,696
Manganese metal	NA	NA	NA	NA	NA	NA
Silvery pig iron	(⁷)	(⁷)	(⁷)	(⁸)	(⁸)	(⁸)
Ferrosilicon ²	811,717	815,065	392,152	743,618	757,812	437,269
Silicon metal	NA	NA	NA	NA	NA	NA
Ferrochromium ³	244,747	250,646	159,697	198,358	223,353	146,504
Other ⁴	41,757	45,128	159,813	110,612	133,176	223,289
Ferrocolumbium	1,015	1,099	10,851	1,093	1,332	19,565
Ferrophosphorus	80,417	77,534	12,026	81,714	75,915	11,173
Ferrotitanium	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)
Total ⁵	1,591,412	1,606,397	919,211	1,511,386	1,618,707	1,031,823
	1979 ⁶			1980 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	287,670	299,813	180,828	171,886	176,309	99,626
Silicomanganese	149,730	151,439	69,164	170,838	146,572	70,329
Manganese metal	NA	NA	NA	NA	NA	NA
Silvery pig iron	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)
Ferrosilicon ²	777,547	774,007	516,332	622,671	618,174	442,567
Silicon metal	NA	NA	NA	NA	NA	NA
Ferrochromium ³	267,268	261,473	225,817	216,468	215,427	179,932
Other ⁴	138,912	138,804	296,266	114,509	113,103	289,896
Ferrocolumbium	679	695	17,464	1,413	1,148	34,491
Ferrophosphorus	79,217	71,082	11,760	105,671	77,447	13,060
Ferrotitanium	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)	(⁸)
Total ⁵	1,701,024	1,697,313	1,317,631	1,403,456	1,348,180	1,129,901

See footnotes at end of table.

Table 1.—Ferroalloys produced and shipped from furnaces in the United States—Continued
(Metric tons gross weight and thousand dollars)

	1981 ¹			1983 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	174,805	170,782	104,072	77,954	98,782	53,757
Silicomanganese	157,182	156,528	81,849	W	57,232	21,211
Manganese metal	21,974	20,665	31,891	W	W	W
Silvery pig iron	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Ferrosilicon ²	526,245	462,992	295,104	284,958	327,519	180,301
Silicon metal	117,764	109,904	154,034	110,577	111,649	113,475
Ferrochromium ³	205,474	171,137	146,262	33,021	48,268	53,447
Other ⁴	124,873	115,829	270,295	128,854	88,606	122,139
Ferrocolumbium	805	732	12,608	W	W	W
Ferrophosphorus	73,071	38,710	9,442	68,032	56,315	7,010
Ferrotitanium	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Total ⁵	1,402,193	1,247,279	1,105,557	703,395	788,371	551,340
	1984 ⁶			1985 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	155,246	168,282	106,282	139,298	142,049	100,903
Silicomanganese	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Manganese metal	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Silvery pig iron	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Ferrosilicon ²	444,856	451,839	259,407	400,679	367,168	190,392
Silicon metal	127,792	126,455	171,814	109,738	110,350	157,231
Ferrochromium ³	86,545	109,563	102,101	99,394	98,404	97,723
Other ⁴	89,820	87,709	92,959	81,165	86,509	136,179
Ferrocolumbium	W	W	9,809	W	W	8,843
Ferrophosphorus	82,660	102,969	18,123	56,211	49,815	7,921
Ferrotitanium	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Total ⁵	986,919	1,046,817	760,495	886,485	854,294	699,191
	1986 ⁶			1987 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	106,474	101,235	90,941	102,462	116,698	101,768
Silicomanganese	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Manganese metal	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Silvery pig iron	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Ferrosilicon ²	307,936	336,847	218,382	324,096	340,072	193,227
Silicon metal	112,394	114,375	148,797	135,559	135,817	186,578
Ferrochromium ³	95,624	104,924	87,624	106,716	114,689	107,078
Other ⁴	65,416	69,156	111,848	32,365	46,889	123,669
Ferrocolumbium	W	W	W	(⁶)	(⁶)	(⁶)
Ferrophosphorus	52,750	48,768	7,161	36,458	36,870	6,171
Ferrotitanium	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Total ⁵	740,594	775,305	664,753	737,656	791,035	718,491
	1988 ⁶			1989 ⁶		
	Production	Shipments	Value	Production	Shipments	Value
Ferromanganese ¹	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Silicomanganese	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Manganese metal	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Silvery pig iron	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Ferrosilicon ²	449,328	431,324	298,822	475,255	437,239	319,969
Silicon metal	149,094	147,221	218,934	136,531	132,969	175,888
Ferrochromium ³	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Other ⁴	287,448	268,849	408,322	265,117	260,825	430,705
Ferrocolumbium	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Ferrophosphorus	60,220	46,233	9,583	53,546	63,028	15,327
Ferrotitanium	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Total ⁵	946,090	893,626	935,661	930,449	894,060	941,888

See footnotes at end of table.

Table 1.—Ferroalloys produced and shipped from furnaces in the United States—Continued
(Metric tons gross weight and thousand dollars)

	1990		
	Production	Shipments	Value
Ferromanganese ¹	(⁸)	(⁸)	(⁸)
Silicomanganese	(⁸)	(⁸)	(⁸)
Manganese metal	(⁸)	(⁸)	(⁸)
Silvery pig iron	(⁸)	(⁸)	(⁸)
Ferrosilicon ²	433,726	412,625	274,450
Silicon metal	140,791	133,460	180,093
Ferrochromium ³	(⁸)	(⁸)	(⁸)
Other ⁴	254,157	260,554	408,219
Ferrocolumbium	(⁸)	(⁸)	(⁸)
Ferrophosphorus	46,018	53,793	7,988
Ferrotitanium	(⁸)	(⁸)	(⁸)
Total ⁵	874,692	860,432	870,750

NA Not applicable. W Withheld to avoid disclosing company proprietary data; included with "Other."

¹May include briquets, if any, fused-salt electrolytic, low- and/or medium-carbon ferromanganese, and, starting in 1984, includes silicomanganese and manganese metal.

²May include miscellaneous silicon alloys; in 1971-80, silicon metals; in 1973-77, includes silvery pig iron; and, in 1988, all regular and specialty grades of ferrosilicon, excluding silvery pig iron.

³May include chromium briquets, low- and high-carbon ferrochromium, ferrochromium silicon, chromium metal, exothermic chromium additives, and other miscellaneous chromium alloys.

⁴May include ferrobore, ferronickel, ferromolybdenum, ferrotungsten, ferrovanadium, spiegeleisen, and other miscellaneous ferroalloys; in 1969-70, includes "Alsifer", "Simanal", zirconium-ferrosilicon, and ferrosilicon-zirconium; starting in 1971, other complex boron additive alloys and ferrozirconium; in 1973, ferrotitanium; in 1975, ferroaluminum; in 1980, silvery pig iron; and, in 1988, all chromium-containing ferroalloys and chromium metal.

⁵Data may not add to totals shown because of independent rounding.

⁶Does not include alloys consumed in the making of other ferroalloys.

⁷Included with ferrosilicon.

⁸Included with "Other."

⁹Included with ferromanganese.

GOLD

By John M. Lucas

Gold has been treasured since ancient times for its beauty and permanence. Most of the gold that is fabricated today goes into the manufacture of jewelry. However, because of its superior electrical conductivity and resistance to corrosion and other desirable combinations of physical and chemical properties, gold also emerged in the late 20th century as an essential industrial metal. Gold performs critical functions in computers, communications

equipment, spacecraft, jet aircraft engines, and a host of other products. Although gold is important to industry and the arts, it also retains a unique status among all commodities as a long-term store of value. Until recent times, it was considered essentially a monetary metal, and most of the bullion produced each year went into the vaults of government treasuries or central banks.

Table 1.—Sallent gold statistics
(Kilograms unless otherwise specified)

	1980	1981	1982	1983	1984	1985
United States:						
Mine production	30,164	42,897	45,588	62,286	64,839	75,495
Value	\$594,050	\$633,918	\$550,968	\$849,071	\$751,833	\$771,035
Percentage derived from:						
Precious-metal ores	66	71	80	83	87	92
Base-metal ores	32	27	17	14	11	5
Placers	2	2	3	3	2	3
Refinery production:						
Domestic and foreign ores	24,478	25,038	40,683	61,336	65,348	64,583
Secondary (old scrap)	67,930	50,077	55,520	55,489	55,022	49,824
Exports:						
Refined	146,255	162,907	50,922	58,513	108,317	89,837
Other	44,062	37,306	41,467	39,122	46,612	33,541
Imports for consumption:						
Refined	127,228	129,530	131,806	111,947	187,602	197,849
Other	14,044	15,168	21,233	30,910	57,139	58,008
Gold contained in imported coins ¹	95,830	81,242	90,449	60,590	86,126	64,198
Net deliveries from foreign stocks in						
Federal Reserve Bank	55,520	36,733	41,368	-6,843	11,850	15,054
Stocks, Dec. 31:						
Industry ²	27,122	19,751	24,136	19,004	23,390	18,538
Futures exchange ³	155,455	76,172	71,631	78,692	73,373	65,628
Consumption in industry and the arts	99,998	101,895	107,711	95,737	97,665	96,318
Price ⁴	\$612.56	\$459.64	\$375.91	\$424.00	\$360.66	\$317.66
Employment ⁵	5,500	7,500	6,800	6,500	6,900	6,900
World:						
Production, mine	1,218,613	1,283,036	1,340,729	1,404,736	1,459,670	1,531,858
Official reserves ⁶	35,757	35,769	35,617	35,567	35,536	35,616
	1986	1987	1988	1989	1990	
United States:						
Mine production	116,297	153,870	200,914	265,731	294,527	
Value	\$1,376,860	\$2,216,026	\$2,831,281	\$3,268,548	\$3,609,954	
Percentage derived from:						
Precious-metal ores	96	91	W	W	W	
Base-metal ores	2	6	W	W	W	
Placers	2	3	2	2	1	
Refinery production:						
Domestic and foreign ores	75,618	112,368	137,829	183,685	204,856	
Secondary (old scrap)	47,266	63,843	52,784	37,144	30,199	
Exports:						
Refined	110,555	71,177	271,335	123,599	140,923	
Other	44,810	48,453	56,902	87,492	155,474	

See footnotes at end of table.

Table 1.—Salient gold statistics—Continued
(Kilograms unless otherwise specified)

	1986	1987	1988	1989	1990
Imports for consumption:					
Refined	429,242	75,365	57,590	96,967	64,755
Other	60,621	44,174	34,867	55,537	32,764
Gold contained in imported coins ¹	34,245	33,716	⁷ 17,947	⁷ 13,218	⁷ 8,429
Net deliveries from foreign stocks in Federal Reserve					
Bank	145,938	95,146	208,277	132,231	51,464
Stocks, Dec. 31:					
Industry ²	28,771	23,390	38,360	30,462	37,065
Futures exchange ³	87,370	81,647	44,634	69,727	50,881
Consumption in industry and the arts	110,795	113,319	111,836	115,078	118,065
Price ⁴	\$365.24	\$447.95	\$438.31	\$382.58	\$384.93
average per troy ounce ..					
Employment ⁵	8,300	11,100	13,100	15,100	16,100
World:					
Production, mine	1,606,570	1,660,535	1,848,448	2,023,050	2,127,398
Official reserves ⁶	35,743	35,655	35,829	35,655	35,623
metric tons ..					

W Withheld to avoid disclosing company proprietary data.

¹Calculated by the Gold Institute from reports by the Bureau of the Census.

²Unfabricated refined gold held by refiners, fabricators, dealers, and U.S. Department of Defense.

³Commodity Exchange Inc. only. Stocks held by other exchanges estimated to be less than 2% of totals shown.

⁴Engelhard Industries quotation.

⁵Mine Safety and Health Administration.

⁶Held by market economy country central banks and governments and international monetary organizations. Source: International Monetary Fund.

⁷Net imports (exports).

IRON ORE

By Peter Kuck

Iron is the fourth most abundant rock-forming element and composes about 5% of the Earth's crust. Astrophysical and seismic evidence indicate that iron is even more abundant in the interior of the Earth and has apparently combined with nickel to make up the bulk of the planet's core. Geologic processes have concentrated a small fraction of the crustal iron into deposits that contain as much as 70% of the element. The principal ore minerals of iron are hematite, magnetite, siderite, and goethite. An estimated 98% of the ore shipped in the world is consumed in the manufacture of iron and steel. The remaining 2% is used in the manufacture of cement, heavy-medium materials, pigments, ballast, agricultural products, or specialty chemicals. As a result, demand for iron ore is tied directly to the production of raw steel and the availability of high-quality ferrous scrap.

World production of raw steel was at a record-high in 1989 and would have been even greater in 1990 and 1991 if political and socioeconomic events had not led to the disintegration and dissolution of the U.S.S.R. The U.S.S.R. had been the leading producer of iron ore for more than three decades and traditionally accounted for one-fourth to one-third of the world's annual output. Other major producers include Australia, Brazil, China, India, and the United States. Since 1980, demand for steel

has stabilized and even slackened in many industrialized countries. However, demand continues to escalate in the developing and newly industrialized countries. Much of the recent growth has been in the Far East.

Iron ore mining and beneficiation in the United States has changed significantly since World War II. At that time, natural ores were the mainstay of the domestic mining industry. The natural ores, which consisted primarily of hematite and goethite, were extracted from near-surface zones of enrichment in the Precambrian banded iron ore formations of Minnesota, Michigan, and Wisconsin. The ores came from areas where part of the silica had been leached from the underlying low-grade taconite by weathering or movement of ground water. The old Lake Superior ores averaged 50% to 60% Fe and could be shipped directly to the steelworks without prior beneficiation. In 1944, at the peak of the war, 103 natural ore mines were operating in Minnesota and another 43 in Michigan. That year, the two States shipped 65.5 million metric tons of crude ore directly to consumers and another 23.9 million metric tons to beneficiation plants. Demand for steel during the Korean War accelerated the depletion of these reserves, and the mining companies in the Lake Superior District began turning more and more to magnetic taconite. This trend can be seen in figure 1. By the end of

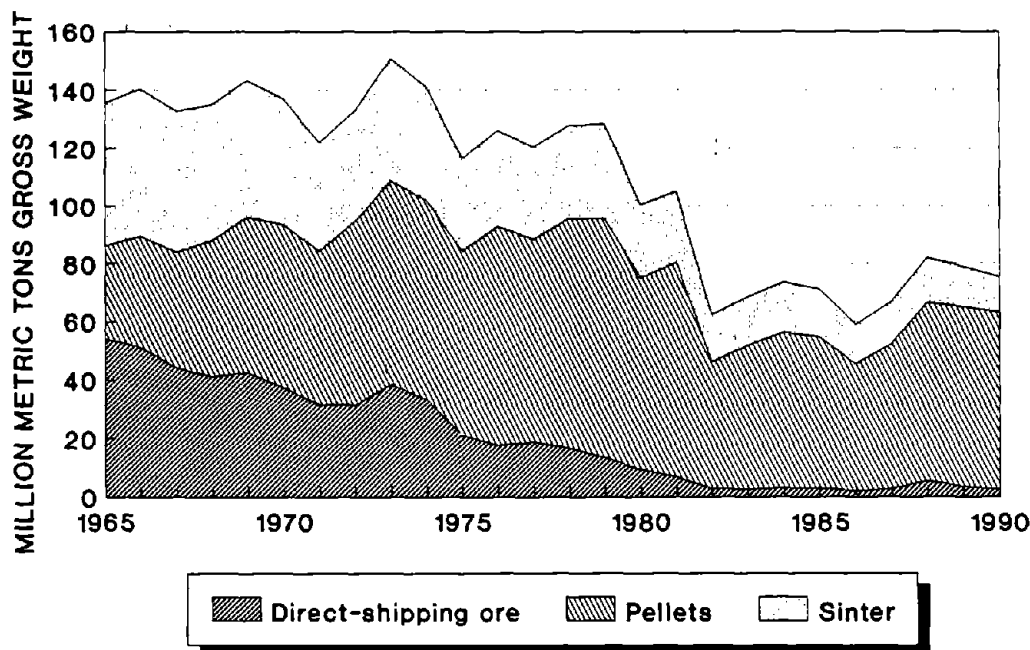


Figure 1.—Consumption of iron ore and agglomerates at U.S. iron and steel plants, by type of product.

the Vietnam Conflict, most of the natural ore in the district had been mined out, with the last mine of this type closing in 1991.

During the 1960's and 1970's, massive pelletizing complexes were built in the Lake Superior District to compensate for the shutdown of the natural ore mines. Today, the district still produces the bulk of the Nation's iron ore, but almost all of the ore being recovered is magnetite. Pellets made from finely ground magnetite concentrate now account for 97% of U.S. usable production (fig. 2). In the late 1980's, blast furnace operators began switching to fluxed pellets in response to environmental restrictions on cokemaking and higher energy costs. This more easily reducible type of pellet is created by adding limestone and/or dolomite to the iron ore concentrate during the balling stage. In 1990, fluxed pellets accounted for 39% of U.S. pellet production.

Since colonial times, the blast furnace has been the principal instrument for converting the ore to molten iron and is expected to remain the mainstay of the steel industry for at least another 30 years. Nevertheless, because of increasing environmental concerns and sharp increases in energy prices, companies have begun evaluating several novel ironmaking and steelmaking processes. In the late 1970's, Venezuela, Mexico, and other countries with surplus natural gas began making significant quantities of a product called direct-reduced iron (DRI). Since then, DRI has become a competitive substitute for high-quality scrap. In 1990, the world produced 29.37 million metric tons of DRI, which typically averages 90% to 94% Fe.

The 29 million metric tons of DRI falls far short of the 500 million metric tons of hot metal and pig iron being produced annually by the blast furnace, but a number of other promising technologies are under development that could help fill the gap.

In 1988, the first commercial Corex plant was commissioned at Pretoria in the Republic of South Africa. Many of the technical problems associated with the startup of this 300,000-metric-ton-per-year demonstration plant have since been solved, and several steel companies are now considering building much larger units in the United States and Western Europe. The proposed Corex plants are still significantly smaller than existing blast furnaces but can be brought up to full operation much quicker with less cost. A key feature of the Corex process is that it uses untreated raw coal in place of coke. The ability to operate without coke gives the Corex plant two environmental advantages over the conventional blast furnace. First, because coke ovens are not needed, all of the problems associated with the generation of benzene and other coal tar byproducts are eliminated. Second, the dust problems associated with blast furnaces are also eliminated because the offgas is used as fuel. Joint Corex and DRI plants are now on the drawing board, with the offgas from the Corex plant being used to fuel the adjoining DRI plant. Direct steelmaking, a much more revolutionary process, is still in the early stages of development. A pilot plant, funded by the American Iron and Steel Institute and the U.S. Department of Energy, has been operating near Pittsburgh since 1990.

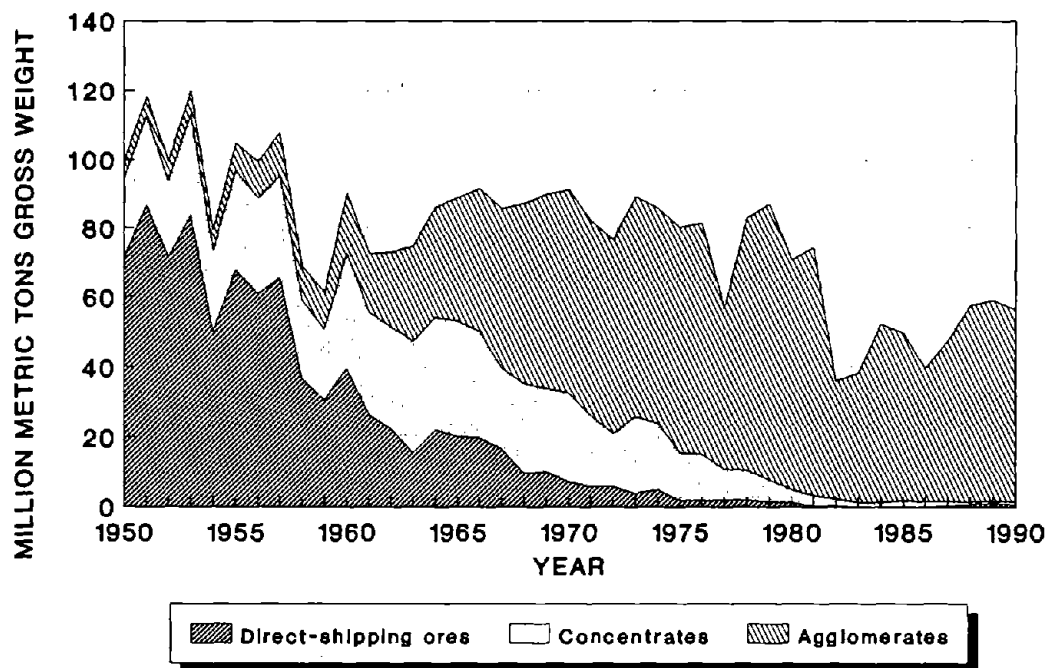


Figure 2.—Usable Iron ore production, by type of product.

Table 1.—Salient iron ore statistics
(Thousand metric tons unless otherwise specified)

Year	Mine production of usable ore ¹	Mine shipments of usable ore ¹	Imports for consumption, all classes	Exports for consumption, all classes	Reported consumption, all end uses ²	Net import reliance ³ (percent)
1965	88,842	86,291	45,827	7,199	134,004	32
1966	91,594	92,281	47,001	7,904	136,198	31
1967	85,530	84,348	45,327	6,001	129,469	31
1968	87,243	83,854	44,646	5,978	133,867	31
1969	89,745	92,035	41,386	5,243	142,485	32
1970	91,200	89,300	45,611	5,580	133,682	29
1971	82,058	78,941	40,768	3,110	118,061	27
1972	76,644	79,543	36,335	2,129	128,980	37
1973	89,076	92,321	43,991	2,791	149,280	35
1974	85,709	86,476	48,800	2,360	140,377	37
1975	80,132	77,185	47,493	2,578	115,957	30
1976	81,277	78,312	45,102	2,960	127,437	31
1977	56,645	54,921	38,514	2,177	117,896	⁴ 48
1978	82,892	84,542	34,155	4,281	126,800	30
1979	87,091	87,603	34,318	5,231	127,444	24
1980	70,730	70,710	25,460	5,780	100,466	24
1981	74,348	73,340	28,783	5,635	106,060	22
1982	36,002	36,330	14,734	3,229	64,942	34
1983	38,165	45,310	13,459	3,842	71,762	38
1984	52,092	51,699	17,463	5,073	73,678	20
1985	49,533	50,203	16,024	5,114	71,708	21
1986	39,486	41,991	17,012	4,554	62,097	33
1987	47,648	47,983	16,849	5,093	67,768	22
1988	57,515	57,113	20,183	5,285	83,694	18
1989	59,032	58,299	19,596	5,365	80,447	22
1990	56,408	57,009	18,054	3,199	76,855	21

¹Direct-shipping ore, concentrates, agglomerates, and byproduct ore.

²Consumption data after 1987 are not entirely comparable with those of prior years owing to changes in data collection.

³Net import reliance is defined as imports minus exports plus adjustments for Government and industry stock changes.

⁴Unusually high import reliance because of reduced production caused by industry strikes.

Table 2.—Iron ore mined and beneficiated in the United States
(Thousand metric tons unless otherwise specified)

Year	Crude ore mined	Usable ore produced ¹	Iron contained in usable ore	Recoverable iron content of crude ore (percent)	Iron content of usable ore (percent)
1965	180,796	88,024	50,174	27.75	57.00
1966	186,147	90,790	52,437	28.17	57.76
1967	186,340	84,745	49,212	26.41	58.07
1968	199,526	86,503	50,689	25.40	58.60
1969	209,987	89,005	53,644	25.55	60.27
1970	215,869	90,352	53,678	24.87	59.41
1971	199,549	81,332	48,973	24.54	60.21
1972	190,659	76,330	46,382	24.33	60.76
1973	222,167	88,778	54,092	24.35	60.93
1974	220,700	85,209	51,642	23.40	60.61
1975	217,964	79,636	48,750	22.37	61.22
1976	227,659	80,554	49,698	21.83	61.69
1977	160,924	56,119	34,709	21.57	61.85

See footnotes at end of table.

Table 2.—Iron ore mined and beneficiated in the United States—Continued
(Thousand metric tons unless otherwise specified)

Year	Crude ore mined	Usable ore produced ¹	Iron contained in usable ore	Recoverable iron content of crude ore (percent)	Iron content of usable ore (percent)
1978 . . .	238,190	82,437	51,290	21.53	62.22
1979 . . .	259,928	86,777	54,299	20.89	62.57
1980 . . .	215,464	70,730	44,592	20.70	63.05
1981 . . .	230,644	74,348	47,286	20.50	63.60
1982 . . .	111,619	36,002	23,004	20.61	63.90
1983 . . .	117,388	38,165	24,555	20.92	64.34
1984 . . .	161,610	52,092	33,641	20.82	64.58
1985 . . .	151,606	49,533	31,798	20.97	64.20
1986 . . .	121,887	39,486	25,298	20.76	64.07
1987 . . .	148,104	47,648	30,526	20.61	64.07
1988 . . .	183,166	57,515	36,468	19.91	63.41
1989 . . .	187,806	59,032	37,413	19.92	63.38
1990 . . .	181,442	56,408	35,695	19.67	63.28

¹Byproduct ore included after 1979.

Table 3.—Shipments of usable iron ore¹ from mines in the United States, by State
(Thousand metric tons)

State	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Alabama	1,519	1,532	1,496	1,169	W	W	422	332	275	W
Arizona	8	W	W	16	18	12	16	W	W	W
Arkansas	W	—	—	—	—	—	—	—	W	W
California	W	W	W	W	W	W	W	W	W	W
Colorado	116	167	W	W	W	W	W	W	W	W
Delaware	—	W	W	W	W	W	W	W	W	—
Georgia	431	454	271	195	245	W	W	W	W	W
Idaho	9	11	W	W	W	W	W	W	W	W
Michigan	13,744	14,608	14,357	12,903	14,284	13,310	12,023	12,896	12,588	11,788
Minnesota	51,689	56,018	50,251	52,098	57,871	55,670	49,841	51,407	63,619	60,376
Mississippi	W	W	—	—	—	—	—	—	—	—
Missouri	1,813	1,917	1,901	1,674	W	W	2,771	2,738	2,672	1,896
Montana	9	12	10	12	13	14	14	9	13	30
Nevada	1,159	1,016	651	578	W	W	W	W	121	141
New Jersey	W	W	—	—	—	—	—	—	—	—
New Mexico	W	W	W	17	W	W	W	W	W	W
New York	W	W	W	W	W	W	W	W	W	W
North Carolina	—	—	—	—	W	W	W	W	W	W
Oregon	W	W	—	—	—	—	—	—	—	—
Pennsylvania	W	W	W	W	W	W	W	W	W	W
South Dakota	—	—	—	—	—	—	—	—	—	W
Tennessee	—	—	W	W	W	W	W	W	W	W
Texas	W	W	W	W	W	W	W	W	W	W
Utah	2,173	1,987	1,735	1,792	1,952	2,022	1,708	1,817	2,018	1,837
Virginia	W	W	W	W	W	W	W	W	W	W
Wisconsin	143	—	—	—	37	819	837	901	971	913
Wyoming	2,120	2,010	1,884	1,999	2,081	1,980	1,838	2,063	2,103	2,139
Undistributed	11,358	12,549	11,792	11,401	15,534	15,473	9,471	7,380	7,941	7,356
Total ²	86,291	92,281	84,348	83,854	92,035	89,300	78,941	79,543	92,321	86,476
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Alabama	W	—	—	—	—	—	—	—	—	—
Arizona	W	W	—	—	—	—	—	—	—	—
Arkansas	W	—	—	—	—	—	—	—	—	—
California	W	W	W	W	W	W	—	W	—	W

See footnotes at end of table.

Table 3.—Shipments of usable iron ore¹ from mines in the United States, by State—Continued
(Thousand metric tons)

State	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Colorado	W	W	W	W	W	W	W	W	W	W
Delaware	—	—	—	—	—	—	—	—	—	—
Georgia	W	W	—	—	—	—	—	—	—	—
Idaho	W	—	—	—	—	—	—	—	—	—
Michigan	14,315	16,506	12,202	17,819	17,472	16,151	14,421	7,901	10,885	13,476
Minnesota	49,956	48,642	30,730	57,379	60,640	46,202	50,981	24,096	31,192	36,173
Mississippi	—	—	—	—	—	—	—	—	—	—
Missouri	2,309	2,167	W	W	W	W	1,366	729	891	1,392
Montana	18	18	W	W	W	—	W	W	W	W
Nevada	111	W	W	W	W	W	101	W	W	W
New Jersey	—	—	W	W	—	—	W	—	W	—
New Mexico	W	W	W	W	W	W	W	W	W	W
New York	W	W	W	W	W	W	W	W	W	W
North Carolina	—	—	—	—	—	—	—	—	—	—
Oregon	—	—	—	—	—	—	—	—	—	—
Pennsylvania	W	W	—	—	—	—	—	—	—	—
South Dakota	W	W	—	W	W	W	—	—	—	—
Tennessee	W	W	W	W	W	W	—	—	—	—
Texas	W	W	W	W	W	W	W	W	W	W
Utah	1,355	1,280	1,963	1,992	1,644	1,328	702	W	W	—
Virginia	W	W	W	W	W	W	W	—	—	—
Wisconsin	804	675	679	660	748	690	867	267	—	—
Wyoming	2,072	2,173	W	W	W	W	W	W	W	—
Undistributed	6,245	6,851	9,347	6,692	7,099	6,339	4,902	3,337	2,342	658
Total ²	77,185	78,312	54,921	84,542	87,603	70,710	73,340	36,330	45,310	51,699
	1985	1986	1987	1988	1989	1990				
Alabama	—	—	—	—	—	—				
Arizona	—	—	—	—	—	—				
Arkansas	—	—	—	—	—	—				
California	W	68	W	W	W	W				
Colorado	W	—	—	—	—	—				
Delaware	—	—	—	—	—	—				
Georgia	—	—	—	—	—	—				
Idaho	—	—	—	—	—	—				
Michigan	12,832	11,133	12,509	14,623	15,045	10,034				
Minnesota	35,538	29,241	34,274	40,735	41,044	45,139				
Mississippi	—	—	—	—	—	—				
Missouri	1,128	816	756	816	1,060	1,002				
Montana	W	W	W	W	W	W				
Nevada	W	W	—	—	—	—				
New Jersey	—	—	—	—	—	—				
New Mexico	W	W	W	W	W	W				
New York	W	W	W	W	W	—				
North Carolina	—	—	—	—	—	—				
Oregon	—	—	—	—	—	—				
Pennsylvania	—	—	—	—	—	—				
South Dakota	—	—	—	W	W	W				
Tennessee	—	—	—	—	—	—				
Texas	W	W	W	W	W	W				
Utah	—	W	W	W	W	W				
Virginia	—	—	—	—	—	—				
Wisconsin	—	—	—	—	—	—				
Wyoming	—	—	—	—	—	—				
Undistributed	705	733	444	939	1,150	834				
Total ²	50,203	41,991	47,983	57,113	58,299	57,009				

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹Includes byproduct ore.

²Data may not add to totals shown because of independent rounding.

Table 4.—Usable iron ore produced in the U.S. Lake Superior District, by range
(Thousand metric tons)

Year	Marquette Range, MI	Menominee Range, MI/WI	Gogebic Range, MI/WI	Vermilion Range, MN	Mesabi Range, MN	Cuyuna Range, MN	Total Lake Superior District
1854-1964 ..	336,115	288,135	324,487	103,473	2,502,649	67,738	3,622,598
1965	9,117	4,669	822	795	51,087	373	66,862
1966	9,743	4,694	115	715	52,332	1,320	68,919
1967	10,395	3,853	50	206	49,641	1,057	65,202
1968	10,248	3,743	—	—	52,236	976	67,202
1969	10,209	3,423	—	—	56,062	—	69,794
1970	10,530	2,432	—	—	56,973	—	69,935
1971	9,647	2,463	—	—	52,106	—	64,216
1972	9,278	2,574	—	—	49,784	—	61,635
1973	9,181	2,443	—	—	60,984	—	72,608
1974	9,063	2,458	—	—	59,422	—	70,943
1975	12,643	2,368	—	—	51,998	—	67,009
1976	14,898	2,355	—	—	50,563	—	67,816
1977	9,956	2,560	—	—	31,440	—	43,956
1978	14,704	2,317	—	—	56,204	—	73,224
1979	15,342	2,065	—	—	60,272	—	77,679
1980	14,682	2,002	—	—	45,887	—	62,570
1981	15,757	76	—	—	51,844	—	67,677
1982	6,984	—	—	—	24,281	—	31,266
1983	9,489	—	—	—	26,676	—	36,165
1984	13,190	—	—	—	37,286	—	50,476
1985	12,679	—	—	—	35,470	—	48,149
1986	10,727	—	—	—	27,476	—	38,204
1987	12,492	—	—	—	34,265	—	46,756
1988	14,590	—	—	—	41,449	—	56,038
1989	15,611	—	—	—	41,370	—	56,981
1990	9,467	—	—	—	45,160	—	54,629
Totals ¹	636,738	334,629	325,474	105,189	3,705,016	71,465	5,178,511
	Spring Valley District, MN	Mayville District, Dodge County, WI	Baraboo District, Sauk County, WI	Pierce County, WI	Black River Falls District, Jackson County, WI		
1854-1964 ..	6,718	2,621	654	42	—		
1965	635	—	—	—	—		
1966	784	—	—	—	—		
1967	59	—	—	—	—		
1968	84	—	—	—	—		
1969	—	—	—	—	39		
1970	—	—	—	—	819		
1971	—	—	—	—	845		
1972	—	—	—	—	902		
1973	—	—	—	—	971		
1974	—	—	—	—	913		
1975	—	—	—	—	797		
1976	—	—	—	—	679		
1977	—	—	—	—	701		
1978	—	—	—	—	671		
1979	—	—	—	—	709		
1980	—	—	—	—	710		
1981	—	—	—	—	868		
1982	—	—	—	—	245		
1983	—	—	—	—	—		
1984	—	—	—	—	—		
1985	—	—	—	—	—		
1986	—	—	—	—	—		
1987	—	—	—	—	—		
1988	—	—	—	—	—		
1989	—	—	—	—	—		
1990	—	—	—	—	—		
Total ¹	8,280	2,621	654	42	9,869		

¹Data may not add to totals shown because of independent rounding.

**Table 5.—Usable iron ore produced in the United States, by type of product
(Thousand metric tons)**

Year	Direct-shipping ore	Concentrates	Agglomerates	Total quantity ¹
1950	71,437	23,177	5,004	99,618
1951	86,651	26,122	5,602	118,375
1952	71,487	22,391	5,611	99,489
1953	83,482	29,630	6,776	119,888
1954	49,894	23,545	5,944	79,383
1955	67,817	29,234	7,601	104,652
1956	60,856	27,782	10,810	99,448
1957	65,538	29,724	12,589	107,851
1958	36,824	22,224	9,750	68,796
1959	30,456	20,291	10,496	61,243
1960	39,593	33,167	17,451	90,209
1961	26,340	29,089	17,044	72,474
1962	22,487	28,916	21,579	72,982
1963	15,462	31,689	27,628	74,780
1964	22,074	31,868	32,255	86,197
1965	19,997	32,857	35,988	88,842
1966	19,889	30,174	41,531	91,594
1967	16,458	23,238	45,834	85,530
1968	9,718	25,598	51,925	87,243
1969	9,947	23,939	55,859	89,745
1970	7,091	25,341	58,768	91,200
1971	5,849	20,210	55,998	82,058
1972	5,924	14,994	55,727	76,644
1973	3,797	21,917	63,362	89,076
1974	² 4,958	18,949	61,801	85,709
1975	1,812	³ 13,696	64,625	80,132
1976	1,848	³ 13,136	66,292	81,277
1977	2,018	8,886	45,741	56,645
1978	2,068	8,405	72,420	82,892
1979	1,471	6,171	79,449	87,091
1980	1,208	3,732	65,790	70,730
1981	197	3,078	71,075	74,348
1982	274	2,164	33,563	36,002
1983	42	1,218	36,904	38,165
1984	52	1,153	50,887	52,092
1985	59	1,751	47,724	49,533
1986	73	1,618	37,795	39,486
1987	256	1,481	45,910	47,648
1988	683	875	55,957	57,515
1989	1,038	709	57,285	59,032
1990	787	805	54,816	56,408

¹Data may not add to totals shown because of independent rounding.

²Byproduct agglomerate included with concentrates in 1974 to avoid disclosing company proprietary data.

³Byproduct concentrate included with agglomerates in 1975 and 1976 to avoid disclosing company proprietary data.

Table 6.—Employment¹ at iron mines and beneficiating plants, quantity and tenor of ore produced, and average output per worker hour in the United States

Year	Employment ²				Total hours (thousands)	Production (thousand metric tons)			Average per worker hour (metric tons)		
	Minnesota	Michigan ³	Other	Total U.S.		Crude ore	Usable ore ⁴	Iron contained	Crude ore	Usable ore ⁴	Iron contained
1965	9,689	3,957	7,127	20,773	46,403	180,796	88,024	50,174	3.90	1.90	1.08
1966	9,871	3,615	6,855	20,341	46,448	186,147	90,790	52,437	4.01	1.95	1.13

See footnotes at end of table.

Table 6.—Employment¹ at iron mines and beneficiating plants, quantity and tenor of ore produced, and average output per worker hour in the United States—Continued

Year	Employment ²				Total hours (thousands)	Production (thousand metric tons)			Average per worker hour (metric tons)		
	Minnesota	Michigan ³	Other	Total U.S.		Crude ore	Usable ore ⁴	Iron contained	Crude ore	Usable ore ⁴	Iron contained
1967 ...	9,300	3,400	6,100	18,800	43,891	186,340	84,745	49,212	4.25	1.93	1.12
1968 ...	9,000	3,400	6,100	18,469	44,459	199,526	86,503	50,689	4.49	1.95	1.14
1969 ...	8,700	3,700	6,300	18,646	42,634	209,987	89,005	53,644	4.93	2.09	1.26
1970 ...	8,500	2,600	5,900	17,000	43,579	215,869	90,352	53,678	4.95	2.07	1.23
1971 ...	8,200	2,500	5,200	15,900	39,385	199,549	81,332	48,973	5.07	2.07	1.24
1972 ...	7,600	2,500	4,400	14,500	35,587	190,659	76,330	46,382	5.36	2.14	1.30
1973 ...	11,210	3,352	5,040	19,602	38,335	222,167	88,778	54,092	5.80	2.32	1.41
1974 ...	^e 11,000	^e 4,000	^e 5,000	^e 20,000	39,118	220,700	85,209	51,642	5.64	2.18	1.32
1975 ...	11,190	3,909	4,819	19,918	39,113	217,964	79,636	48,750	5.57	2.04	1.25
1976 ...	11,721	4,188	4,547	20,456	39,173	227,659	80,554	49,698	5.81	2.06	1.27
1977 ...	11,289	4,468	4,405	20,162	30,385	160,924	56,119	34,709	5.30	1.85	1.14
1978 ...	13,294	4,732	2,922	20,948	39,664	238,190	82,437	51,290	6.01	2.08	1.03
1979 ...	13,915	4,734	3,000	21,649	40,030	259,928	86,777	54,299	6.49	2.17	1.36
1980 ...	11,716	3,886	2,630	18,232	34,090	215,464	70,730	44,592	6.32	2.07	1.31
1981 ...	12,189	3,868	2,103	18,160	34,349	230,644	74,348	47,286	6.71	2.16	1.38
1982 ...	6,049	1,752	1,429	9,230	17,246	111,619	36,002	23,004	6.47	2.09	1.33
1983 ...	5,085	1,795	687	7,567	14,235	117,388	38,165	24,555	8.25	2.68	1.72
1984 ...	5,713	2,129	373	8,215	16,704	161,610	52,092	33,641	9.67	3.12	2.01
1985 ...	5,780	2,083	315	8,178	14,042	151,606	49,533	31,798	10.80	3.53	2.26
1986 ...	4,100	1,716	232	6,048	11,477	121,887	39,486	25,298	10.62	3.44	2.20
1987 ...	3,737	1,834	210	5,781	11,667	148,104	47,648	30,526	12.69	4.08	2.62
1988 ...	4,706	2,090	210	7,006	14,229	183,166	57,515	36,468	12.87	4.04	2.56
1989 ...	5,245	2,205	278	7,728	15,719	187,806	59,032	37,413	11.95	3.76	2.38
1990 ...	5,577	1,701	314	7,592	15,712	181,442	56,408	35,695	11.55	3.59	2.27

^eEstimated.

¹Mining Enforcement and Safety Administration (MESA) provided 1973-77 data. Mine Safety and Health Administration (MSHA) provided 1978-90 data.

²Employment data for 1967-72 are calculated from data provided in the U.S. Bureau of Mines Minerals Yearbook. "Total U.S." employment data for 1968 and 1969 are exact figures, but exact data for individual states are not available.

³Includes workers in Wisconsin for years prior to 1984.

⁴Byproduct ore included after 1979.

Table 7.—Shipments of usable iron ore¹ from mines in the United States
(Thousand metric tons unless otherwise specified)

Year	Shipments	Iron contained in shipments	Iron content of usable ore (percent)	Value of shipments (thousands)	Average value at mine (dollars)
1965	86,291	49,460	57.317	815,014	9.44
1966	92,281	52,642	57.045	864,336	9.37
1967	84,348	49,067	58.172	824,527	9.78
1968	83,854	49,261	58.745	842,808	10.05
1969	92,035	54,513	59.231	937,357	10.18
1970	89,300	53,190	59.562	949,556	10.63
1971	78,941	47,396	60.041	896,754	11.36
1972	79,543	48,125	60.502	954,527	12.00
1973	92,321	55,875	60.523	1,166,300	12.63
1974	86,476	52,249	60.419	1,390,835	16.08
1975	77,185	47,107	61.030	1,627,540	21.09
1976	78,312	48,138	61.469	1,871,114	23.89
1977	54,921	33,859	61.651	1,422,696	25.90
1978	84,542	52,482	62.078	2,401,387	28.40
1979	87,603	54,683	62.422	2,814,440	32.13

See footnotes at end of table.

Table 7.—Shipments of usable iron ore¹ from mines in the United States—Continued
(Thousand metric tons unless otherwise specified)

Year	Shipments	Iron contained in shipments	Iron content of usable ore (percent)	Value of shipments (thousands)	Average value at mine (dollars)
1980	70,710	44,389	62.776	2,544,121	35.98
1981	73,340	46,389	63.252	2,915,239	39.75
1982	36,330	23,077	63.522	1,491,809	41.06
1983	45,310	28,728	63.400	1,944,988	42.92
1984	51,699	32,984	63.799	2,247,686	43.48
1985	50,203	32,022	63.783	2,076,730	41.37
1986	41,991	26,880	64.013	1,472,511	35.07
1987	47,983	30,784	64.157	1,503,087	31.33
1988	57,113	36,223	63.424	1,716,661	30.06
1989	58,299	36,849	63.207	1,839,873	31.56
1990	57,009	36,084	63.294	1,740,925	30.54

¹Includes direct-shipping ore, concentrates, agglomerates, and byproduct ore. Less than 5% manganese.

Table 8.—U.S. and Canadian iron ore shipments on the Great Lakes
(Thousand metric tons gross weight of ore shipped)

Loading district	1965	1966	1967	1968	1969	1970	1971	1972
Lake Superior	60,792	64,601	59,033	60,982	68,693	64,482	57,035	60,076
Lake Michigan	6,162	6,709	6,671	6,324	7,010	9,087	8,493	9,507
Lake Huron	1,169	1,106	1,123	1,193	1,350	1,180	1,341	1,224
Lake Ontario	457	501	456	457	518	470	479	467
Eastern Canada	11,309	13,726	14,616	16,017	10,121	13,196	12,069	11,187
Total ¹	79,889	86,643	81,899	84,973	87,692	88,415	79,417	82,461
U.S. flag fleet shipments ²	NA	NA	NA	NA	NA	NA	NA	NA
Percent carried by U.S. fleet	NA	NA	NA	NA	NA	NA	NA	NA
	1973	1974	1975	1976	1977	1978	1979	1980
Lake Superior	71,515	65,919	58,577	58,036	38,879	65,370	67,775	53,498
Lake Michigan	8,888	9,026	9,093	10,392	8,017	11,618	12,006	9,881
Lake Huron	1,257	1,288	1,176	1,013	1,200	996	231	—
Lake Ontario	472	399	276	458	608	44	—	—
Eastern Canada	13,931	12,351	12,127	18,109	19,423	12,313	13,520	10,759
Total ¹	96,063	88,983	81,249	88,008	68,127	90,341	93,532	74,138
U.S. flag fleet shipments ²	NA	NA	NA	NA	NA	NA	NA	NA
Percent carried by U.S. fleet	NA	NA	NA	NA	NA	NA	NA	NA
	1981	1982	1983	1984	1985	1986	1987	1988
Lake Superior	55,154	27,327	35,619	38,765	37,962	31,677	41,835	46,098
Lake Michigan	8,883	5,405	7,535	8,757	7,503	7,497	6,032	6,660
Lake Huron	16	60	175	221	—	—	—	—
Lake Ontario	—	—	—	—	—	—	—	—
Eastern Canada	12,053	6,338	9,592	10,441	7,542	7,108	8,109	9,209
Total ¹	76,106	39,130	52,921	58,184	53,007	46,282	55,976	61,967
U.S. flag fleet shipments ²	NA	NA	NA	NA	44,027	39,457	48,952	55,028
Percent carried by U.S. fleet	NA	NA	NA	NA	83	85	87	89
	1989	1990						
Lake Superior	45,296	46,661						
Lake Michigan	5,742	4,987						
Lake Huron	—	—						
Lake Ontario	—	—						
Eastern Canada	9,480	10,836						
Total ¹	60,518	62,484						
U.S. flag fleet shipments ²	51,799	54,055						
Percent carried by U.S. fleet	86	87						

NA Not applicable.

¹Includes transshipments. Data may not add to totals shown because of independent rounding.

²Includes mill scale, scarfer ore, and slag in addition to iron ore.

Source: Lake Carrier's Association Annual Reports.

Table 9.—Ore shipments from U.S. ports on the upper Great Lakes¹
(Thousand metric tons gross weight of ore shipped)

Port	1965	1966	1967	1968	1969	1970	1971
Ashland, MI	303	—	—	—	—	—	—
Escanaba, MI	6,162	6,709	6,671	6,324	7,010	9,087	8,493
Marquette, MI	6,413	7,240	7,365	6,435	7,129	4,155	3,470
Duluth, MN	16,018	16,076	14,324	14,458	16,093	16,770	14,450
Silver Bay, MN	10,126	10,807	9,692	9,670	10,820	9,990	9,618
Taconite Harbor, MN	8,123	8,732	9,767	10,890	10,338	10,576	9,368
Two Harbors, MN	—	2,839	2,391	2,607	5,025	5,112	4,476
Superior, WI	16,423	15,871	12,063	12,553	15,112	12,677	11,176
Total ²	63,568	68,274	62,274	62,937	71,527	68,367	61,053
	1972	1973	1974	1975	1976	1977	1978
Ashland, MI	—	—	—	—	—	—	—
Escanaba, MI	9,507	8,888	9,026	9,093	10,392	8,017	11,618
Marquette, MI	3,112	3,489	3,258	4,458	5,633	4,095	6,099
Duluth, MN	15,104	18,229	18,175	14,559	14,275	10,859	13,785
Silver Bay, MN	9,633	11,219	10,687	8,827	9,850	4,520	9,764
Taconite Harbor, MN	10,753	13,335	10,780	10,139	10,419	3,557	8,892
Two Harbors, MN	6,227	7,864	10,546	8,357	8,150	3,253	9,629
Superior, WI	10,336	12,132	10,313	6,527	6,244	7,825	12,735
Total ²	64,671	75,156	72,785	61,960	64,918	42,126	72,522
	1979	1980	1981	1982	1983	1984	1985
Ashland, MI	—	—	—	—	—	—	—
Escanaba, MI	12,006	9,881	8,883	5,405	7,535	8,757	7,503
Marquette, MI	5,417	5,813	5,427	1,965	3,565	4,529	5,152
Duluth, MN	15,280	13,476	13,281	6,078	6,665	7,889	6,231
Silver Bay, MN	8,400	4,470	6,453	2,158	2,761	3,686	3,481
Taconite Harbor, MN	9,619	6,195	7,766	3,682	3,923	3,454	5,052
Two Harbors, MN	11,302	10,170	10,156	4,550	8,470	6,914	8,859
Superior, WI	13,894	10,309	10,840	8,086	8,807	11,329	8,642
Total ²	75,918	60,314	62,806	31,924	41,726	46,558	44,920
	1986	1987	1988	1989	1990		
Ashland, MI	—	—	—	—	—		
Escanaba, MI	7,496	6,032	6,660	5,742	4,987		
Marquette, MI	3,631	7,175	8,054	9,117	5,005		
Duluth, MN	5,116	7,717	7,030	7,408	7,728		
Silver Bay, MN	1,473	186	—	—	2,234		
Taconite Harbor, MN	5,545	8,026	7,842	8,217	8,796		
Two Harbors, MN	6,255	7,236	10,982	9,503	11,668		
Superior, WI	9,142	11,495	12,189	11,052	11,230		
Total ²	38,658	47,867	52,757	51,039	51,648		

¹Year cited refers to navigation season, not calendar year. The navigation season traditionally begins in Mar. and ends in either Dec. or the following Jan.

²Data may not add to totals shown because of independent rounding.

Table 10.—U.S. imports of iron ore and agglomerates, by country
(Thousand metric tons and thousand dollars)

Year	Brazil		Canada		Liberia	
	Quantity	Value	Quantity	Value	Quantity	Value
1965	2,316	23,380	24,137	264,360	2,858	19,978
1966	2,767	26,695	24,325	273,309	3,444	24,851
1967	1,650	14,744	24,603	276,597	3,149	23,737
1968	1,277	11,622	26,762	308,014	2,989	23,389
1969	1,253	11,300	19,283	219,347	3,194	27,227
1970	2,023	17,865	24,318	297,203	1,903	17,216
1971	1,800	16,547	20,668	267,424	1,867	16,768

See footnotes at end of table.

Table 10.—U.S. imports of iron ore and agglomerates, by country—Continued
(Thousand metric tons and thousand dollars)

Year	Brazil		Canada		Liberia	
	Quantity	Value	Quantity	Value	Quantity	Value
1972	1,133	11,990	18,460	247,757	2,805	22,740
1973	3,234	36,295	21,975	311,893	2,778	23,667
1974	6,677	85,259	20,018	341,577	2,774	29,113
1975	7,646	120,947	19,418	420,116	2,536	38,909
1976	5,474	111,797	25,363	625,588	2,187	34,198
1977	2,279	53,342	25,689	693,384	1,821	30,226
1978	4,043	96,773	19,545	555,657	2,205	38,737
1979	3,145	81,446	22,965	683,286	2,225	38,112
1980	2,027	62,889	17,589	581,759	1,616	27,612
1981	1,766	52,267	19,147	707,974	2,195	35,505
1982	988	26,339	9,430	359,708	2,437	43,036
1983	1,296	30,192	8,974	339,472	1,760	31,487
1984	2,574	55,132	11,370	413,473	1,773	25,270
1985	2,581	49,322	8,694	325,248	2,241	31,014
1986	3,752	71,045	8,836	311,757	1,511	21,855
1987	3,698	64,820	1,980	246,181	995	13,707
1988	4,935	78,092	9,157	285,961	128	1,460
1989	5,169	90,885	8,538	292,866	200	2,950
1990	4,276	90,443	9,344	339,622	—	—
	Venezuela		Other		Total ¹	
	Quantity	Value	Quantity	Value	Quantity	Value
1965	12,470	97,925	4,046	38,145	45,827	443,788
1966	12,794	102,040	3,671	35,459	47,001	462,354
1967	13,026	103,718	2,900	25,122	45,327	443,918
1968	10,478	83,153	3,140	32,575	44,646	458,753
1969	13,972	110,745	3,684	33,559	41,386	402,178
1970	13,235	108,493	4,132	38,741	45,611	479,518
1971	13,161	114,176	3,271	35,729	40,768	450,644
1972	11,101	99,951	2,836	33,496	36,335	415,934
1973	13,359	128,169	2,645	33,464	43,991	533,488
1974	15,624	189,188	3,707	51,161	48,800	696,298
1975	13,348	205,304	4,546	75,220	47,493	860,496
1976	9,145	151,635	2,933	57,130	45,102	980,348
1977	6,278	119,076	2,447	60,556	38,514	956,584
1978	6,181	107,392	2,182	46,480	34,155	845,039
1979	4,636	87,613	1,347	32,969	34,318	923,426
1980	3,660	80,981	569	19,603	25,460	772,844
1981	5,152	140,931	522	11,300	28,783	947,977
1982	1,669	36,768	209	4,996	14,734	470,847
1983	1,354	42,934	74	1,646	13,459	445,731
1984	1,548	31,377	198	3,813	17,463	529,065
1985	2,101	39,369	406	7,314	16,024	452,267
1986	2,346	42,126	567	13,860	17,012	460,643
1987	2,621	52,889	1,555	31,186	16,849	408,783
1988	3,567	75,443	2,396	43,587	20,183	484,543
1989	4,232	110,367	1,458	25,194	19,596	522,262
1990	3,503	107,848	932	21,612	18,054	559,525

¹Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 11.—U.S. export of iron ore and agglomerates, by country of destination
(Thousand metric tons and thousand dollars)

	Canada		Japan		Mexico	
	Quantity	Value	Quantity	Value	Quantity	Value
1965	4,633	54,399	2,470	25,425	—	—
1966	3,974	48,567	3,839	42,876	—	—
1967	2,294	29,069	3,660	42,179	—	—
1968	2,315	28,113	3,607	42,314	—	—
1969	2,118	26,255	3,057	35,529	—	—
1970	2,078	27,111	3,257	37,727	—	—
1971	1,265	17,180	1,823	20,850	(²)	1
1972	1,465	20,067	618	6,553	—	—
1973	2,302	32,869	464	4,819	6	70
1974	1,843	30,061	446	4,691	1	14
1975	2,525	59,170	41	658	1	12
1976	2,943	80,981	(²)	2	(²)	5
1977	2,170	62,539	1	16	(²)	3
1978	4,273	136,277	—	—	2	42
1979	5,190	177,069	(²)	4	24	914
1980	5,743	228,868	(²)	6	25	1,212
1981	5,618	243,527	(²)	2	11	720
1982	3,224	150,200	—	—	1	67
1983	3,841	182,490	—	—	(²)	4
1984	5,068	238,856	—	—	(²)	24
1985	5,114	240,435	—	—	(²)	10
1986	4,551	204,600	—	—	1	45
1987	5,091	198,108	—	—	1	42
1988	5,277	193,249	—	—	1	62
1989	5,359	192,334	—	—	1	15
1990	3,193	123,601	—	—	1	103

	Other		Total	
	Quantity	Value	Quantity ¹	Value
1965	96	594	7,199	80,418
1966	91	714	7,904	92,157
1967	47	337	6,001	71,585
1968	57	408	5,978	70,835
1969	67	526	5,243	62,310
1970	245	3,060	5,580	67,898
1971	22	116	3,110	38,147
1972	46	156	2,129	26,776
1973	18	164	2,791	37,922
1974	70	382	2,360	35,148
1975	11	231	2,578	60,071
1976	16	1,204	2,960	82,192
1977	6	202	2,177	62,760
1978	5	402	4,281	136,721
1979	16	762	5,231	178,749
1980	12	482	5,780	230,568
1981	6	436	5,635	244,685
1982	4	255	3,229	150,522
1983	1	250	3,842	182,744
1984	5	377	5,073	239,257
1985	(²)	112	5,114	240,557
1986	2	93	4,554	204,738
1987	1	104	5,093	198,254
1988	7	485	5,285	193,796
1989	5	447	5,365	192,796
1990	4	372	3,199	124,076

¹Data may not add to totals shown because of independent rounding.

²Less than 1/2 unit.

Source: Bureau of the Census.

**Table 12.—Consumption of iron ore and agglomerates at U.S. iron and steel plants, by type of product
(Thousand metric tons)**

Year	Blast furnaces			Steelmaking furnaces			Grand total ¹
	Iron ore and concentrates	Agglomerates	Total ironmaking ¹	Iron ore and concentrates	Agglomerates	Total steelmaking	
1965	45,212	81,343	126,555	6,081	901	6,982	133,537
1966	40,391	89,108	129,499	5,036	996	6,031	135,530
1967	35,407	89,202	124,609	3,766	621	4,387	128,995
1968	33,713	95,602	129,315	3,507	569	4,076	133,392
1969	35,410	103,134	138,544	2,759	715	3,474	142,018
1970	31,590	102,129	133,719	2,377	645	3,022	136,741
1971	22,442	93,146	115,589	1,336	556	1,892	117,480
1972	21,534	105,335	126,869	961	537	1,499	128,367
1973	29,646	116,881	146,527	1,306	815	2,120	148,648
1974	27,679	110,288	137,967	1,160	521	1,682	139,649
1975	17,820	96,168	113,988	550	674	1,223	115,212
1976	15,043	110,190	125,233	597	707	1,305	126,537
1977	14,281	102,058	116,338	439	203	642	116,981
1978	12,300	112,488	124,788	587	472	1,060	125,847
1979	9,259	116,026	125,286	436	705	1,141	126,427
1980	6,131	92,487	98,618	262	435	697	99,315
1981	3,572	100,337	103,909	212	518	731	104,639
1982	4,256	59,295	63,552	226	80	306	63,858
1983	3,938	66,782	70,720	96	98	193	70,914

¹Data may not add to totals because of independent rounding.

Source: American Iron and Steel Institute.

**Table 13.—Consumption of iron ore, pellets, and sinter at U.S. iron and steel plants
(Thousand metric tons)**

Year	Blast furnaces ¹				Steelmaking furnaces ²				Grand total ³
	Direct-shipping ore	Pellets	Sinter ²	Total ironmaking	Direct-shipping ore	Pellets	Sinter ²	Total steel-making ³	
1984	NA	53,296	17,152	70,448	NA	51	34	84	70,533
1985	2,904	51,698	16,182	70,784	90	62	82	233	71,017
1986	1,893	43,610	13,221	58,725	65	31	25	122	58,846
1987	2,696	49,500	14,420	66,616	123	44	42	209	66,824
1988	5,155	61,025	15,497	81,676	194	88	—	282	81,958
1989	3,211	61,659	13,664	78,533	142	76	—	219	78,752
1990	2,479	60,512	12,226	75,217	53	50	13	115	75,333

NA Not available.

¹Method of statistical computation was changed starting in 1984.

²Includes briquettes, nodules, and other.

³Data may not add to totals shown because of independent rounding.

Source: American Iron and Steel Institute.

Table 14.—Consumption of iron ore at U.S. iron and steel plants, by source¹
(Thousand metric tons)

Year	Source of iron ore for consumption in blast furnaces			Total blast consumption ²	Source of iron ore for consumption in blast furnaces			Total steel furnace consumption ²
	United States	Canada	Other		United States	Canada	Other	
1965	60,287	11,042	8,320	79,650	2,067	835	3,627	6,529
1966	62,869	12,003	9,406	84,277	1,584	744	3,039	5,367
1967	60,250	11,470	8,550	80,270	905	725	2,239	3,870
1968	63,453	13,370	7,383	84,206	1,259	780	1,846	3,885
1969	71,147	11,474	10,435	93,056	832	688	1,694	3,214
1970	68,591	12,775	9,690	91,056	744	563	1,306	2,612
1971	63,336	11,541	7,726	82,604	446	334	1,064	1,844
1972	71,997	12,988	8,023	93,008	500	437	845	1,782
1973	79,325	14,974	12,325	106,624	623	255	1,201	2,079
1974	72,951	12,826	14,237	100,014	619	276	1,096	1,991
1975	61,916	10,393	11,244	83,553	294	139	503	936
1976	66,980	15,182	9,870	92,031	212	202	631	1,046
1977	64,214	14,921	8,755	87,890	207	72	402	682
1978	69,732	15,091	9,960	94,784	189	73	521	783
1979	72,464	15,634	6,920	95,019	290	93	560	943
1980	59,272	11,515	3,806	74,593	166	48	278	492
1981	63,861	12,401	3,760	80,022	66	19	258	343
1982	36,595	7,272	2,031	45,898	81	38	129	248
1983	40,154	8,524	2,932	51,610	67	26	131	225
1984	43,808	8,908	3,356	56,072	163	42	176	380
1985	44,320	7,353	3,916	55,589	46	6	132	184
1986	39,023	7,364	2,151	48,539	25	2	69	97
1987	43,364	7,899	3,351	54,614	24	15	105	144
1988	48,914	9,228	5,030	63,172	45	52	186	282
1989	51,547	7,396	6,655	65,598	107	40	190	336
1990	54,795	7,954	4,803	67,552	17	29	42	88

	Source of iron ore for consumption in blast furnaces			Total sintering consumption ²	Miscellaneous uses of iron ore in steel plants	Total consumption of iron ore in iron and steel plants ²
	United States	Canada	Other			
1965	17,827	17,827	9,960	40,609	363	127,151
1966	17,936	12,450	9,441	39,827	272	129,743
1967	15,704	11,335	9,619	36,658	93	120,891
1968	13,538	11,153	9,591	34,282	9	122,382
1969	13,836	9,481	10,980	34,297	46	130,613
1970	12,751	9,212	9,560	31,524	47	125,239
1971	10,472	7,138	8,633	26,243	24	110,715
1972	10,665	7,232	9,136	27,034	38	121,862
1973	11,840	7,130	11,295	30,265	305	130,273
1974	11,128	6,122	11,832	29,081	62	131,148
1975	9,741	5,127	8,517	23,384	62	107,935
1976	8,997	7,808	6,079	22,884	197	116,158
1977	7,563	6,768	7,103	21,435	195	110,202
1978	5,812	7,282	9,160	22,253	350	118,170
1979	4,396	7,682	8,601	20,680	218	116,860
1980	3,839	5,956	5,822	15,617	130	90,832
1981	4,529	6,569	4,931	16,028	87	96,482
1982	2,028	3,368	3,666	9,062	911	56,119
1983	2,253	3,983	4,799	10,134	234	62,202
1984	2,090	3,225	5,038	10,353	245	67,049
1985	1,779	1,748	4,914	8,440	465	64,678
1986	1,886	857	4,682	7,424	110	56,170
1987	1,317	763	4,190	6,270	23	61,051
1988	3,323	153	4,904	8,381	30	71,865
1989	1,894	38	5,187	7,118	10	73,062
1990	811	274	4,725	5,810	235	73,685

¹Data compiled from various statistical publications of the American Iron and Steel Institute, American Iron Ore Association, and the U.S. Bureau of Mines.

²Data may not add to totals shown because of independent rounding.

Table 15.—U.S. consumption of iron ore and agglomerates, by end use
(Thousand metric tons and exclusive of ore containing 5% or more manganese)

Year	Blast furnaces	Steel furnaces	Sintering plants ¹	Miscella- neous ²	Subtotal integrated iron and steel plants ^{3,4}	Direct-reduced iron for steelmaking ⁵	Nonsteel end uses ⁶	Total
1965	79,650	6,529	40,609	363	127,151	NA	467	127,618
1966	84,277	5,367	39,827	272	129,743	NA	667	130,410
1967	80,270	3,870	36,658	93	120,891	NA	473	121,364
1968	84,206	3,885	34,282	9	122,382	NA	476	122,858
1969	93,056	3,214	34,297	46	130,613	NA	467	131,080
1970	91,056	2,612	31,524	47	125,239	81	426	125,746
1971	82,604	1,844	26,243	24	110,715	158	580	111,453
1972	93,008	1,782	27,034	38	121,862	461	613	122,936
1973	106,624	2,079	30,265	305	139,273	633	632	140,538
1974	100,014	1,991	29,081	62	131,148	919	729	132,796
1975	83,553	936	23,384	62	107,935	718	746	109,399
1976	92,031	1,046	22,884	197	116,158	534	899	117,591
1977	87,890	682	21,435	195	110,202	695	915	111,812
1978	94,784	783	22,253	350	118,170	748	953	119,871
1979	95,019	943	20,680	218	116,860	978	1,017	118,855
1980	74,593	492	15,617	130	90,832	800	1,151	92,783
1981	80,022	343	16,028	87	96,482	711	1,421	98,614
1982	45,898	248	9,062	911	56,119	95	1,084	57,298
1983	51,610	225	10,134	234	62,202	—	848	63,050
1984	56,072	380	10,353	245	67,049	179	1,222	68,450
1985	55,589	184	8,440	465	64,678	224	1,147	66,049
1986	48,539	97	7,424	110	56,170	244	1,099	57,513
1987	54,614	144	6,270	23	61,051	325	1,049	62,425
1988	63,172	282	8,381	30	71,865	443	1,293	73,601
1989	65,597	336	7,118	10	73,062	487	1,208	74,757
1990	67,551	89	5,809	235	73,685	583	940	75,208

NA Not available.

¹Excludes dust, mill scale, and other revert iron-bearing materials.

²Sold to nonreporting companies or used for purposes not listed.

³Data from American Iron Ore Association.

⁴Data may not add to totals shown because of independent rounding.

⁵U.S. Bureau of Mines estimates based on production reports compiled by Midrex Corp.

⁶Includes iron ore consumed in production of cement and iron ore shipped for use in manufacturing paint, ferrites, heavy media, cattle feed, refractory and weighting materials, and for use in lead smelting. Data from U.S. Bureau of Mines surveys.

Table 16.—Yearend stocks of iron ore and agglomerates
(Thousand metric tons)

Year	Mines	Receiving and transfer docks ¹	Consuming plants ¹	Total industry ²
1965	12,870	2,534	54,662	70,067
1966	12,355	2,750	55,535	70,641
1967	13,167	3,035	56,006	72,207
1968	16,298	2,842	54,086	73,227
1969	13,784	2,690	51,752	68,227
1970	15,562	3,458	53,628	72,647
1971	17,936	3,479	58,665	80,080
1972	14,915	2,654	50,864	68,433
1973	11,051	3,102	46,728	60,881
1974	9,556	3,325	45,973	58,854
1975	12,496	4,688	53,069	70,254
1976	14,218	4,839	57,149	76,206
1977	15,049	3,027	42,949	61,025
1978	12,557	3,626	39,932	56,115

See footnotes at end of table.

Table 16.—Yearend stocks of iron ore and agglomerates—Continued
(Thousand metric tons)

Year	Mines	Receiving and transfer docks ¹	Consuming plants ¹	Total industry ²
1979	11,447	5,503	39,594	56,544
1980	11,913	6,193	36,279	54,385
1981	12,938	6,676	36,784	56,399
1982	12,324	5,842	30,403	48,569
1983	4,188	3,225	25,903	33,316
1984	5,349	2,989	24,403	32,741
1985	6,046	2,442	21,631	30,119
1986	3,307	2,019	17,439	22,765
1987	2,402	2,056	16,565	21,023
1988	2,957	2,537	18,005	23,499
1989	3,800	2,171	15,730	21,701
1990	3,386	2,273	15,911	21,570

¹Data compiled jointly by the American Iron and Steel Institute and the American Iron Ore Association.

²Data may not add to totals shown because of independent rounding.

Table 17.—Blast furnace production of hot metal and pig iron in the United States

Year	Blast furnace production ¹ (Thousand metric tons)	Number of blast furnaces operating at yearend	Total number of blast furnaces available
1965	80,020	144	236
1966	82,814	161	235
1967	78,743	168	228
1968	80,528	146	227
1969	86,185	164	228
1970	82,820	149	220
1971	73,829	115	217
1972	80,627	144	217
1973	91,914	160	214
1974	86,615	138	204
1975	72,322	110	191
1976	78,787	100	184
1977	73,930	110	183
1978	79,551	119	172
1979	78,902	102	166
1980	62,323	86	159
1981	66,909	64	129
1982	39,319	33	124
1983	44,243	50	112
1984	47,138	46	93
1985	45,326	47	91
1986	40,176	32	89
1987	43,824	49	87
1988	50,571	50	84
1989	50,687	48	83
1990	49,668	46	79

¹U.S. Bureau of Mines Yearbook, Iron and Steel chapter, for 1965 to 1987. Beginning in 1988, data are from the American Iron and Steel Institute, Annual and December Statistical Reports.

Table 18.—World production of iron ore¹
(Thousand metric tons unless otherwise specified)

Year	World production	Metal content	Percent content
1986 ..	863,650	503,768	58.30
1987 ..	889,627	522,173	58.70
1988 ..	907,502	534,580	58.91
1989 ..	928,054	549,912	59.25
1990 ..	917,707	542,524	59.12

¹U.S. Bureau of Mines data differ from that of the United Nations Conference on Trade and Development (UNCTAD) primarily because of differences in interpreting data on iron ore production in China. China produces low-grade ores averaging only about 35% Fe. The U.S. Bureau of Mines adjusts Chinese production data to 50% Fe content, which is more comparable with world marketable production.

Table 19.—Production of iron ore¹ by primary producing countries
(Thousand metric tons unless otherwise specified)

Year	Australia	Brazil	Canada	India	Liberia	South Africa, Republic of
1986 ..	94,015	129,405	36,167	47,800	15,295	24,483
1987 ..	101,748	134,497	37,702	51,018	13,742	22,008
1988 ..	96,064	146,008	39,934	49,961	12,767	25,248
1989 ..	105,810	153,740	39,445	53,418	12,300	29,958
1990 ..	110,508	154,370	36,443	53,700	4,050	30,291
	Sweden	U.S.S.R.	United States	Venezuela	Other	Total world production
1986 ..	20,475	249,959	39,486	16,753	189,812	863,650
1987 ..	19,636	250,874	47,648	17,782	192,972	889,627
1988 ..	20,440	249,754	57,515	18,932	190,879	907,502
1989 ..	21,763	241,348	59,032	18,390	192,850	928,054
1990 ..	19,877	236,200	56,408	20,365	195,495	917,707

¹Includes iron ore, iron ore concentrates, iron ore agglomerates, and byproduct ore.

Table 20.—Metal content of iron ore¹ produced in primary producing countries
(Thousand metric tons)

Year	Australia	Brazil	Canada	India	Liberia	South Africa, Republic of
1986 ..	60,082	85,290	23,002	29,923	9,480	15,914
1987 ..	64,798	89,134	23,882	31,937	8,520	14,297
1988 ..	61,244	97,139	24,268	31,226	7,910	16,461
1989 ..	67,313	102,300	23,971	33,440	7,450	19,461
1990 ..	69,766	102,600	22,147	33,600	2,490	19,689
	Sweden	U.S.S.R.	United States	Venezuela	Other	Total world production
1986 ..	13,246	137,252	25,295	10,817	93,467	503,768
1987 ..	12,809	138,216	30,526	11,670	96,384	522,173
1988 ..	13,393	138,217	36,468	12,340	95,914	534,580
1989 ..	14,124	134,789	37,413	12,016	97,635	549,912
1990 ..	12,901	132,000	35,695	12,655	98,981	542,524

¹Includes iron ore, iron ore concentrates, iron ore agglomerates, and byproduct ore.

Page Intentionally Left Blank

IRON AND STEEL

By Anthony Peters (retired)

Table 1 indicates the decline of the basic open-hearth steelmaking process in favor of the basic oxygen process—both are the domain of the "integrated" steel companies. The rise of the electric arc furnace production illustrates the growth of the "minimills," small producers using only this process.

The tabulation of steel types shows the predominance of "plain carbon" steels and some decline in the production of alloy steels. This is caused by the development of the high-strength low-alloy steels in the 1960's. The alloy content of these steels is well below that of the recognized traditional alloy steels—always under one-quarter of 1%. For this reason, these steels, which took over some applications of alloy steels, are usually classified with the "plain carbon" grades.

The production of stainless steels and their higher alloyed cousins, heat-resisting grades, is growing slowly. These steels are always made in electric arc furnaces and are usually end-refined in argon-oxygen decarburization units.

Table 2 is the history of the U.S. steel industry in a nutshell. Shedding the excess capacity, mainly of older, less efficient units, resulted in better utilization of the remainder. Actually, this meant demolition of open-hearth furnaces, which were replaced by basic oxygen units but were kept as "spare capacity." For several years prior to 1975, capacity numbers were not published, and thus no capacity utilization data could be calculated.

Adoption of the continuous casting process, which replaced the time-honored ingot pouring followed by reheating and rolling the ingots, resulted in a sharp increase in process yield and decrease in worker-hours. Continuous casting produces a semifinished shape directly from liquid steel and bypasses the ingot and primary rolling stages. Since these two stages cause unavoidable steel losses, continuous casting increases yield, sometimes by as much as 12%. Process yield is the ratio of shipped steel weight to the weight of the ingot or cast semifinished section from which it originated.

Work productivity, expressed as hours worked per ton shipped, is actually a combination of better work organization and technological progress, such as adoption of basic oxygen furnaces and continuous casting. It is frequently—but not quite correctly—used as a measure of workers' productivity alone. The U.S. steel industry, with about 170,000 employees in 1990, turned out a similar amount of steel to that in the 1970's with more than one-half of a million, but it is the replacement of the obsolescent processes and installations that accounted for a large part of the reduction of personnel.

Another reason for halving the labor force needed to produce a ton of steel is the growth of minimills, which use the most labor-efficient processes and methods; some easy-to-make sections may use only 2 worker-hours per steel ton.

Table 3 indicates the general extent of the steel trade. At times of strong steel demand worldwide, such as in the years 1973-76 and 1979-80, imports are moderate because exporters ship to countries other than the United States and exports are fairly high. Both are, however, strongly influenced by the exchange value of the dollar: a strong, high-valued dollar promotes imports by making them cheaper and reduces export; this was the situation in 1983-87, although a weak dollar and strong sales efforts by the steel producers resulted in high exports in 1989-90.

Because of the dramatic increase of imports in 1984, the U.S. Government negotiated a number of treaties, Voluntary Restraint Agreements (VRA's), with exporters to restrict imports and thus help the U.S. steel industry. The effectiveness of the VRA's from 1985 onward is quite apparent.

The apparent consumption reported here is not corrected for inventory changes: reduced inventories may indicate increased demand and vice versa. What is regarded as an "inventory" by one person may be "safety stock" for another and "stock earmarked for expected future orders" by a third. Hence, comparisons of such uncertain numbers, which may vary as a function of general business climate, may be misleading. The American Iron and Steel Institute and many other institutions use the "uncorrected" number, and this was used in table 3.

Typically, "stocks" at steel mills are about 8 to 15 million metric tons or 1 to 2 months' demand; at the warehouses and service centers, "stocks" are about 5 to 7 million or 3 to 4 months' demand. User inventories may vary from 10 to 20 million metric tons. As aforementioned, these numbers are based on subjective definitions of "stocks." User inventories tend to go up ahead of expected price increases or in times of strong demand; thus, the increase may actually mask increased consumption.

The intensity of steel consumption as expressed in pounds per person dropped from 1,000-plus pounds in the early 1970's to less than 800 pounds in the late 1980's. About 50 pounds may be accounted for by the down-sizing of automobiles; the remainder is probably caused mainly by the reduction of the steel content of roads and buildings and almost complete replacement of steel cans with aluminum ones. Wide adoption of high-strength low-alloy steels also reduced the amounts of steel used in many applications.

Table 1.—Salient statistics of U.S. production and shipments of steel

Year	Capability ¹ (million metric tons)	Percent of capability ²	Continuous casting (percentage)
1970	NA	—	NA
1971	NA	—	NA
1972	NA	—	NA
1973	NA	—	NA
1974	NA	—	NA
1975	139	76.2	9.1
1976	144	80.9	10.6
1977	145	78.4	12.5
1978	143	86.8	15.2
1979	141	87.8	16.9
1980	139	72.8	20.3
1981	140	78.3	21.6
1982	140	48.4	29.0
1983	137	56.2	32.1
1984	123	68.4	39.6
1985	121	66.1	44.4
1986	115	63.8	55.2
1987	102	79.5	59.8
1988	102	89.2	61.3
1989	105	84.5	64.8
1990	106	84.7	67.4

NA Not available.

¹Defined as the tonnage capability to produce raw steel for a sustained full order book.²100 times raw steel production divided by capability.Table 2.—U.S. raw steel production, by furnace process and by steel type
(Thousand metric tons)

Year	Total	Furnace process			Steel type		
		Open hearth	Basic oxygen	Electric furnace	Carbon ¹	Alloy ²	Stainless ³
1970 ..	119,308	43,565	57,452	18,291	106,513	11,634	1,160
1971 ..	109,264	32,259	58,008	18,997	97,075	11,043	1,146
1972 ..	120,874	31,693	67,661	21,519	106,774	12,682	1,419
1973 ..	136,803	36,088	75,532	25,183	120,426	14,663	1,714
1974 ..	132,195	32,204	73,983	26,008	114,857	15,388	1,950
1975 ..	105,816	20,104	65,137	20,575	91,045	13,763	1,008
1976 ..	116,120	21,292	72,500	22,328	101,612	12,980	1,528
1977 ..	113,700	18,183	70,223	25,294	98,094	13,917	1,689
1978 ..	124,312	19,332	75,735	29,871	106,064	16,475	1,773
1979 ..	123,687	17,380	75,529	30,778	105,438	16,337	1,911
1980 ..	101,455	11,842	61,339	28,273	85,900	14,011	1,543
1981 ..	109,613	12,203	66,434	30,976	92,045	15,987	1,583
1982 ..	67,655	5,543	41,104	21,009	58,190	8,344	1,120
1983 ..	76,761	5,399	47,219	24,145	66,935	8,239	1,588
1984 ..	83,940	7,562	47,919	28,457	72,500	9,832	1,608
1985 ..	80,067	5,831	47,069	27,167	69,580	8,906	1,527
1986 ..	74,032	3,021	43,441	27,569	64,785	7,716	1,532
1987 ..	80,876	2,419	47,624	30,834	70,739	8,298	1,840
1988 ..	90,650	4,643	52,580	33,426	78,764	9,890	1,995
1989 ..	88,852	4,030	52,932	31,891	78,227	8,878	1,747
1990 ..	89,726	3,172	53,044	33,510	78,553	9,325	1,848

¹Including high-strength low-alloy steel.²Excluding stainless and heat-resisting steels.³Including heat-resisting steels.

Table 3.—Shipments, exports, imports, and consumption of steel mill domestic products
(Thousand metric tons unless otherwise specified)

Year	Shipments	Exports	Imports	Apparent consumption ¹	Import reliance ² (percentage)	Consumption (kilograms per person)
1970 ..	82,371	963	12,124	93,531	13.0	456
1971 ..	78,960	2,565	16,605	93,000	17.9	448
1972 ..	83,284	2,606	16,040	96,718	16.6	461
1973 ..	101,088	3,676	13,744	111,156	12.4	524
1974 ..	99,311	5,292	14,488	108,507	13.6	508
1975 ..	72,536	2,679	10,897	80,754	13.5	374
1976 ..	81,145	2,408	12,959	91,696	14.1	420
1977 ..	82,687	1,817	17,515	98,385	17.8	447
1978 ..	88,845	2,197	19,173	105,849	18.1	475
1979 ..	90,956	2,556	15,892	104,292	15.2	464
1980 ..	76,070	3,720	14,057	86,407	16.3	379
1981 ..	80,241	2,634	18,051	95,657	18.9	415
1982 ..	55,853	1,671	15,116	69,298	21.8	298
1983 ..	61,310	1,088	15,486	75,708	20.5	323
1984 ..	66,895	889	23,735	89,741	26.4	379
1985 ..	66,264	845	22,005	87,423	25.1	365
1986 ..	63,742	843	18,771	81,670	23.0	338
1987 ..	69,539	1,024	18,519	87,034	21.3	357
1988 ..	76,058	1,877	18,952	93,133	20.3	378
1989 ..	76,294	4,153	15,713	87,855	17.9	353
1990 ..	77,093	3,904	15,575	88,537	17.5	352

¹Defined as shipments plus imports minus exports.

²Defined as 100 times imports divided by consumption.

This page intentionally left blank.

IRON AND STEEL SCRAP

By Raymond E. Brown

Use of iron and steel scrap to produce new steel and ferrous castings, which are vital to the United States for both national security and economic well-being, represents significant energy, environmental, economic, and resource conservation benefits. Direct-reduced iron, pig iron, and iron carbide can be substituted for iron and steel scrap but are usually considered more expensive than scrap. Also, availability of these substitutes on a large scale is limited, and there are certain technical problems associated with the use of some of these substitute materials. However, these scrap alternatives have certain advantages, which include providing iron free of residual elements, such as copper, for use in producing higher quality steel and ferrous castings products. Iron and steel scrap consists of all ferrous materials, either alloyed or unalloyed, containing iron or steel as a principal component that are the waste of industrial production or are objects discarded because

of obsolescence, failure, or other reasons. Iron and steel scrap is classified as home scrap (revert, runaround, or internally generated scrap), prompt industrial scrap (waste material resulting from fabrication of new iron and steel products), and obsolete scrap (old scrap consisting of iron or steel products that have been discarded or rejected for various reasons). Purchased scrap consists of the last two classifications. An analysis by the U.S. Bureau of Mines of iron and steel scrap consumption by domestic steel mills revealed that two key trends have emerged during the last 20 years. First, steelmakers have increased their use of electric arc furnaces, which use close to 100% scrap as a charge material to produce raw steel. Second, steel producers have extended their use of continuous casting—a more efficient forming technology than ingot casting—which has increased steel mill processing yields but has left progressively less home scrap available to the mills.

Table 1.—Salient U.S. iron and steel scrap and pig iron statistics¹
(Thousand metric tons)

Year	Ferrous scrap							Pig iron consumption
	Receipts of scrap ²	Production home scrap ³	Consumption of both purchased and home scrap ⁴	Shipments of scrap	Scrap ending stocks, Dec. 31	Imports of scrap for consumption ⁵	Exports of scrap ⁵	
1969 ..	39,625	51,063	86,016	6,123	5,944	304	8,095	85,851
1970 ..	35,986	47,695	77,618	5,008	6,956	273	9,173	82,303
1971 ..	35,872	44,628	75,130	4,835	7,706	257	5,517	73,677
1972 ..	42,856	46,433	84,814	4,990	7,411	283	6,511	80,866
1973 ..	46,208	52,384	93,990	5,600	6,428	317	9,865	90,556
1974 ..	52,081	50,122	95,693	5,510	7,628	182	7,708	87,808
1975 ..	37,693	41,769	74,689	4,351	7,952	277	8,566	72,246
1976 ..	43,075	45,383	81,565	5,518	9,061	460	7,146	78,966
1977 ..	43,279	44,921	83,641	5,238	8,494	557	5,311	74,392
1978 ..	46,981	47,248	90,014	5,189	7,509	720	8,200	80,213
1979 ..	48,254	47,372	89,721	5,650	7,914	689	10,028	79,341
1980 ..	42,490	38,290	75,940	5,337	7,274	528	10,131	62,644
1981 ..	42,991	39,245	77,199	4,906	7,365	504	5,820	68,075
1982 ..	28,771	24,609	51,153	3,376	5,822	425	6,172	40,287
1983 ..	34,309	24,718	56,048	3,266	5,268	582	6,822	45,423
1984 ..	36,241	26,559	59,604	3,528	4,773	523	8,616	48,264
1985 ..	39,322	27,622	63,950	4,107	4,630	554	9,026	46,639
1986 ..	37,941	23,944	59,744	3,465	3,941	657	10,618	41,371
1987 ..	43,397	22,444	61,963	2,748	4,394	765	9,405	45,386
1988 ..	47,685	24,898	69,692	2,677	4,131	942	9,161	53,567
1989 ..	44,516	23,014	65,507	2,845	4,213	1,016	11,149	52,968
1990 ..	49,861	25,258	70,451	5,396	4,433	1,309	11,580	51,100

¹Includes manufacturers of pig iron, raw steel, iron and steel castings, and miscellaneous users.

²From brokers, dealers, and other outside sources and other own company plants.

³Recirculating scrap resulting from current operations and obsolete scrap (includes ingot molds, stools, and scrap from old equipment, buildings, etc).

⁴Includes recirculating scrap.

⁵Includes tinplate and terneplate. Excludes used rails for rerolling and other uses, and ships, boats, and other vessels for scrapping.

This page intentionally left blank.

LEAD

By William Woodbury

Lead is one of the oldest metals used by humankind—some historians have theorized that the downfall of the Roman Empire was expedited by the debilitating effects on its citizens of drinking water carried in lead pipes. It is the most corrosion resistant of the common metals; buildings built in Europe four centuries ago still stand under their original lead roofs.

Today's major use of lead is in lead-acid storage batteries. The electrical systems of vehicles, ships, and aircraft depend on such batteries for startup, and, in some cases, batteries provide the actual motive power. Other batteries provide standby electrical power for emergencies, and very large lead-acid systems are designed to provide "peaking" power in such applications as commercial power networks and subway systems. An increasing use is in the uninterruptible power supply systems necessary for voltage control and emergency power in critical computer storage systems. Lead in gasoline, once the second largest use of lead in the United States, has been virtually phased out to eliminate the health hazard it was found to present.

Nontransportation uses for lead include increasing use for soundproofing in office buildings, schools, and hotels. It is widely used in hospitals to block X-ray and gamma radiation and is employed to shield against nuclear radiation both in permanent installations and when nuclear material is being transported.

A major problem with lead in some uses is its toxicity because accumulation of even minute quantities in the aqueous system of the body can cause permanent brain damage and/or central nervous system disability, liver and kidney damage, and even death. Even the use of lead shot

for hunting geese, ducks, and other migratory waterfowl is declining because of lead's toxic effect on the marine life chain.

Besides being a major user of lead, the United States is a major mine producer and by far the world's leading metal producer. Missouri is by far the main producing State. Because of the great number of scrap batteries that become available each year, recycled lead supplies more than 60% of our annual demand. The leading foreign mine producers, with output about equal to that of the United States, are Australia and the former U.S.S.R. The leading foreign metal producers are the former U.S.S.R., the United Kingdom, the Federal Republic of Germany, and Japan. These four countries, together with the United States, account for about one-half of the world's refined lead production.

Lead's toxicity presents problems in producing it as well as in using it, and emissions from lead smelters and refineries are closely regulated, as are worker blood-lead levels and inplant permissible exposure limits in all lead and lead oxide producing, lead-acid battery manufacturing, and other lead products plants. This adds to the cost of producing lead but is necessary to protect both the general public health and the health of lead industry workers. Early in 1991, after 2 years of intense study, the Environmental Protection Agency completed a long-range, multimedia pollution prevention strategy, which will result in significantly stricter regulations being imposed on both the producing and consuming sectors of the lead industry during the next several years.

Table 1.—U.S. salient lead statistics
(Metric tons)

Year	Primary production ¹	Secondary production	Consumption ²	Year	Primary production ¹	Secondary production	Consumption ²
1830 ...	7,260	NA	NA	1842 ...	21,770	NA	NA
1831 ...	6,800	NA	NA	1843 ...	22,680	NA	NA
1832 ...	9,070	NA	NA	1844 ...	23,590	NA	NA
1833 ...	9,980	NA	NA	1845 ...	27,220	NA	NA
1834 ...	10,880	NA	NA	1846 ...	22,680	NA	NA
1835 ...	11,800	NA	NA	1847 ...	25,400	NA	NA
1836 ...	13,600	NA	NA	1848 ...	22,680	NA	NA
1837 ...	12,250	NA	NA	1849 ...	21,320	NA	NA
1838 ...	13,600	NA	NA	1850 ...	19,960	NA	NA
1839 ...	15,880	NA	NA	1851 ...	16,780	NA	NA
1840 ...	15,420	NA	NA	1852 ...	14,240	NA	NA
1841 ...	18,600	NA	NA	1853 ...	15,240	NA	NA

See footnotes at end of table.

Table 1.—U.S. salient lead statistics—Continued
(Metric tons)

Year	Primary production ¹	Secondary production	Consumption ²	Year	Primary production ¹	Secondary production	Consumption ²
1854 ...	14,970	NA	NA	1912 ...	414,915	60,934	357,533
1855 ...	14,330	NA	NA	1913 ...	453,763	66,074	375,831
1856 ...	14,520	NA	NA	1914 ...	474,360	55,395	409,380
1857 ...	14,330	NA	NA	1915 ...	509,512	71,577	390,318
1858 ...	13,890	NA	NA	1916 ...	565,154	87,362	418,428
1859 ...	14,880	NA	NA	1917 ...	590,531	84,822	467,686
1860 ...	14,150	NA	NA	1918 ...	527,668	88,088	492,579
1861 ...	12,790	NA	NA	1919 ...	402,513	110,767	393,848
1862 ...	12,880	NA	NA	1920 ...	450,702	113,081	488,084
1863 ...	13,420	NA	NA	1921 ...	376,020	94,148	403,581
1864 ...	13,880	NA	NA	1922 ...	433,301	144,750	446,975
1865 ...	13,330	NA	NA	1923 ...	496,427	176,438	520,310
1866 ...	14,600	NA	NA	1924 ...	540,744	185,519	546,984
1867 ...	13,790	NA	NA	1925 ...	620,913	205,822	594,800
1868 ...	14,880	NA	NA	1926 ...	620,439	251,562	651,044
1869 ...	15,880	NA	NA	1927 ...	603,722	250,383	762,897
1870 ...	16,175	NA	NA	1928 ...	568,944	279,957	844,136
1871 ...	18,145	NA	NA	1929 ...	587,851	282,135	860,465
1872 ...	23,480	NA	NA	1930 ...	506,493	232,058	683,655
1873 ...	38,590	NA	NA	1931 ...	367,067	212,916	515,009
1874 ...	47,245	NA	NA	1932 ...	265,776	179,895	378,024
1875 ...	54,105	NA	NA	1933 ...	247,368	203,663	407,780
1876 ...	58,125	NA	NA	1934 ...	260,670	189,057	442,706
1877 ...	74,300	NA	NA	1935 ...	300,372	245,303	488,882
1878 ...	82,610	NA	NA	1936 ...	338,307	238,499	574,792
1879 ...	84,170	NA	NA	1937 ...	421,743	249,567	615,706
1880 ...	88,745	NA	NA	1938 ...	335,410	204,025	495,323
1881 ...	106,218	NA	NA	1939 ...	375,556	219,085	605,092
1882 ...	120,556	NA	NA	1940 ...	414,939	236,182	709,419
1883 ...	130,596	NA	NA	1941 ...	418,599	360,530	952,544
1884 ...	126,912	NA	NA	1942 ...	450,181	293,022	946,194
1885 ...	117,401	NA	NA	1943 ...	411,239	310,343	1,009,697
1886 ...	123,041	NA	NA	1944 ...	378,170	300,656	1,014,777
1887 ...	132,177	NA	145,785	1945 ...	354,556	329,344	953,996
1888 ...	137,819	NA	136,581	1946 ...	304,338	356,330	867,722
1889 ...	141,881	NA	165,985	1947 ...	348,560	464,452	1,063,221
1890 ...	130,299	NA	146,741	1948 ...	354,234	453,657	1,028,653
1891 ...	161,982	NA	181,170	1949 ...	371,862	373,926	868,787
1892 ...	157,220	NA	181,789	1950 ...	390,840	437,513	1,123,078
1893 ...	148,762	NA	176,296	1951 ...	352,137	470,022	1,074,826
1894 ...	147,586	NA	174,516	1952 ...	353,949	427,551	1,025,840
1895 ...	154,220	NA	218,672	1953 ...	310,841	441,561	1,090,077
1896 ...	170,550	NA	194,048	1954 ...	295,215	436,288	993,251
1897 ...	192,320	NA	198,898	1955 ...	306,651	455,453	1,100,092
1898 ...	201,400	NA	206,341	1956 ...	320,078	459,721	1,097,437
1899 ...	190,960	NA	205,310	1957 ...	306,824	443,821	1,032,481
1900 ...	245,687	NA	244,307	1958 ...	242,560	364,495	894,836
1901 ...	245,575	NA	244,854	1959 ...	231,864	409,492	989,974
1902 ...	244,940	NA	301,624	1960 ...	223,774	426,289	926,392
1903 ...	255,825	NA	272,307	1961 ...	237,611	410,766	931,875
1904 ...	278,500	NA	289,885	1962 ...	214,963	402,973	1,006,644
1905 ...	273,970	NA	314,807	1963 ...	229,853	447,669	1,055,381
1906 ...	317,654	NA	341,374	1964 ...	259,464	491,315	1,090,562
1907 ...	340,206	23,131	350,818	1965 ...	273,196	522,374	1,126,254
1908 ...	305,191	16,813	305,079	1966 ...	296,983	519,666	1,201,001
1909 ...	361,092	37,818	334,618	1967 ...	287,515	502,374	1,143,521
1910 ...	358,622	50,278	360,845	1968 ...	325,821	499,749	1,205,458
1911 ...	400,214	49,246	320,479	1969 ...	461,769	547,854	1,260,405

See footnotes at end of table.

Table 1.—U.S. salient lead statistics—Continued
(Metric tons)

Year	Primary production ¹	Secondary production	Consumption ²	Year	Primary production ¹	Secondary production	Consumption ²
1970 ..	518,698	541,943	1,234,272	1981 ...	445,535	641,105	1,167,101
1971 ..	524,852	541,405	1,298,648	1982 ...	512,516	571,276	1,075,408
1972 ..	561,470	559,368	1,347,400	1983 ...	449,295	503,501	1,148,487
1973 ..	547,054	593,558	1,398,162	1984 ...	322,677	633,374	1,207,033
1974 ..	602,253	633,848	1,450,976	1985 ...	413,955	615,695	1,148,298
1975 ..	563,783	597,341	1,176,708	1986 ...	339,793	624,769	1,125,521
1976 ..	552,971	659,132	1,351,771	1987 ...	311,381	710,067	1,230,373
1977 ..	537,499	757,592	1,435,473	1988 ...	384,983	736,401	1,245,170
1978 ..	529,661	769,236	1,432,744	1989 ...	410,915	891,341	1,277,604
1979 ..	525,569	801,368	1,358,335	1990 ...	483,704	922,197	1,275,226
1980 ..	550,366	675,578	1,070,303				

NA Not available.

¹Recovered from domestic ores 1830-1906. Recoverable mine production 1907-90.

²Data for 1887-1926 is primary consumption. Data for 1927-90 is total consumption.

Table 2.—Lead supply-demand relationships
(Thousand metric tons, unless otherwise specified)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Components of U.S. supply:										
Refinery production (domestic ore)	226	275	283	299	243	334	481	489	534	531
Refinery production (foreign ore)	141	141	103	111	110	107	113	126	70	94
Refinery production (old scrap)	424	426	450	440	433	428	468	459	444	452
Imports—metal, excluding scrap	202	193	202	260	331	307	253	222	175	223
Industry stocks, Jan. 1, pigs and bars	214	160	137	122	102	117	85	138	210	161
Government stockpile releases	4	36	49	58	25	26	20	11	9	41
Total U.S. supply	1,211	1,231	1,224	1,290	1,244	1,319	1,420	1,445	1,442	1,502
Distribution of U.S. supply:										
Industry stocks, Dec. 31, pigs and bars	160	137	122	102	117	85	138	210	161	166
Exports—metal, excluding scrap	1	9	7	5	6	8	4	7	5	8
Industrial demand	1,050	1,085	1,095	1,183	1,121	1,226	1,278	1,228	1,276	1,328
U.S. DEMAND PATTERN										
Ammunition	45	51	52	71	71	75	72	66	79	77
Construction	130	131	122	118	108	112	105	90	90	80
Electrical	78	80	84	93	88	85	84	80	117	116
Gasoline additives	175	203	204	225	225	238	246	253	240	253
Oxides and chemicals	90	94	99	109	94	100	93	90	74	82
Transportation	440	430	430	460	440	520	580	560	590	630
Other	92	96	104	107	95	96	98	89	86	90
Total U.S. demand	1,050	1,085	1,095	1,183	1,121	1,226	1,278	1,228	1,276	1,328
Total U.S. primary demand (industrial demand less old scrap)	626	659	645	743	688	798	810	769	832	876
PRICES										
Average annual, based on constant 1987 dollars (cents per pound)	40.40	48.60	55.70	50.90	45.90	41.30	44.10	44.00	36.80	38.00
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Components of U.S. supply:										
Refinery production (domestic ore)	527	535	483	520	490	504	532	509	443	465
Refinery production (foreign ore)	97	85	96	76	62	64	46	39	55	52
Refinery production (old scrap)	489	545	512	564	637	650	673	581	578	521
Imports—metal, excluding scrap	162	107	90	129	231	227	183	82	100	95
Industry stocks, Jan. 1, pigs and bars	166	136	185	195	157	135	143	199	181	203
Government stockpile releases	191	241	6	—	—	—	—	—	—	—
Total U.S. supply	1,632	1,649	1,372	1,484	1,577	1,580	1,577	1,410	1,357	1,336

See footnote at end of table.

Table 2.—Lead supply-demand relationships—Continued
(Thousand metric tons, unless otherwise specified)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Distribution of U.S. supply:										
Industry stocks, Dec. 31, pigs and bars	136	185	195	157	135	143	199	181	203	171
Exports—Metal, excluding scrap	60	56	19	5	9	8	11	164	23	56
Industrial demand	1,436	1,408	1,158	1,322	1,433	1,429	1,367	1,065	1,131	1,109
U.S. DEMAND PATTERN										
Ammunition	74	79	88	67	62	56	53	49	49	44
Construction	79	69	63	65	75	60	50	37	37	40
Electrical	122	120	70	75	90	88	86	70	74	75
Gasoline additives	249	227	189	218	211	178	187	128	111	119
Oxides and chemicals	100	106	72	96	91	92	91	78	80	61
Transportation	720	715	625	705	795	855	815	640	720	720
Other	92	92	71	96	109	100	85	63	60	50
Total U.S. demand	1,436	1,408	1,158	1,322	1,433	1,429	1,367	1,065	1,131	1,109
Total U.S. primary demand (industrial demand less old scrap)	947	863	646	758	796	779	694	484	553	588
PRICES										
Average annual, based on constant 1987 dollars (cents per pound)	38.80	49.10	42.60	43.20	53.70	54.90	78.90	58.20	45.60	30.10
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY										
Components of U.S. supply:										
Refinery production (domestic ore)	464	324	423	348	336	371	379	386		
Refinery production (foreign ore)	55	65	71	22	37	21	17	18		
Refinery production (old scrap)	452	586	570	575	658	691	842	874		
Imports—metal, excluding scrap	177	163	133	142	188	152	122	97		
Industry stocks, Jan. 1, pigs and bars	171	154	142	178	104	110	105	98		
Government stockpile releases	—	—	—	—	—	—	—	—		
Total U.S. supply	1,319	1,292	1,339	1,265	1,323	1,345	1,465	1,473		
Distribution of U.S. supply:										
Industry stocks, Dec. 31, pigs and bars	154	142	178	104	110	105	98	112		
Exports—metal, excluding scrap	20	7	27	13	10	14	34	64		
Industrial demand	1,145	1,143	1,134	1,148	1,203	1,226	1,333	1,297		
U.S. DEMAND PATTERN										
Ammunition	44	48	50	44	47	53	57	58		
Construction	44	43	39	34	31	32	31	34		
Electrical	80	93	120	143	138	132	149	143		
Gasoline additives ¹	89	79	46	29	27	24	24	21		
Oxides and chemicals	69	77	73	70	68	63	58	57		
Transportation	770	755	760	785	850	875	980	950		
Other	49	48	46	43	42	47	34	34		
Total U.S. demand	1,145	1,143	1,134	1,148	1,203	1,226	1,333	1,297		
Total U.S. primary demand (industrial demand less old scrap)	693	557	564	573	545	535	491	423		
PRICES										
Average annual, based on constant 1987 dollars, (cents per pound)	24.50	27.90	20.20	22.80	35.90	35.90	37.80	44.00		

¹1987-91 U.S. Department of Commerce estimates (domestic production ceased June 1991).

Table 3—U.S. primary lead refinery production
(Metric tons)

Source material	1929 ¹	1930	1931	1932	1933	1934	1935
Refined lead:							
Domestic ores and base bullion ..	610,080	520,488	354,038	231,638	235,520	272,011	281,685
Foreign ores and base bullion ...	92,655	62,862	47,631	29,959	12,667	10,337	12,750
Total ²	702,735	583,350	401,669	261,597	248,187	282,349	294,436
	1936	1937	1938	1939	1940	1941	1942
Refined lead:							
Domestic ores and base bullion ..	351,714	402,012	301,153	381,895	392,870	426,846	423,988
Foreign ores and base bullion ...	10,395	21,931	46,906	57,214	90,822	91,127	90,240
Total ²	362,108	423,943	348,059	439,109	483,692	517,973	514,228
	1943	1944	1945	1946	1947	1948	1949
Refined lead:							
Domestic ores and base bullion ..	368,811	357,833	323,443	266,086	345,736	307,910	366,910
Foreign ores and base bullion ...	57,214	63,793	78,970	40,722	54,341	61,036	66,124
Total ²	426,025	421,626	402,414	306,807	400,078	368,947	433,034
	1950	1951	1952	1953	1954	1955	1956
Refined lead:							
Domestic ores and base bullion ..	379,937	310,841	347,777	297,568	292,359	291,326	316,778
Foreign ores and base bullion ...	81,198	68,083	81,188	126,896	149,178	143,362	175,196
Total ²	461,135	378,925	428,964	424,464	441,538	434,689	491,974
	1957	1958	1959	1960	1961	1962	1963
Refined lead:							
Domestic ores and base bullion ..	315,406	244,107	204,362	207,654	261,340	222,845	217,416
Foreign ores and base bullion ...	168,608	182,411	104,926	139,286	146,499	118,313	140,679
Total ²	484,013	426,518	309,287	346,940	407,839	341,159	358,095
	1964	1965	1966	1967	1968	1969	1970
Refined lead:							
Domestic ores and base bullion ..	266,943	276,698	289,071	234,514	316,643	466,230	479,072
Foreign ores and base bullion ...	140,772	102,731	110,757	110,120	107,294	113,148	125,776
Total ²	407,715	379,429	399,828	344,634	423,937	579,378	604,847
	1971	1972	1973	1974	1975	1976	1977
Refined lead:							
Domestic ores and base bullion ..	519,837	523,807	514,606	526,238	481,003	515,767	486,659
Foreign ores and base bullion ...	69,847	93,441	97,305	84,319	96,077	76,513	62,041
Total ²	589,684	617,248	611,911	610,557	577,080	592,280	548,700
	1978	1979	1980	1981	1982	1983 ³	1984
Refined lead:							
Domestic ores and base bullion ..	501,643	529,970	508,163	440,238	459,865	463,940	323,989
Foreign ores and base bullion ...	63,530	45,641	39,427	55,085	52,295	55,227	65,409
Total ²	565,173	575,611	547,590	495,323	512,160	519,167	389,398
	1985	1986	1987	1988	1989	1990	
Refined lead:							
Domestic ores and base bullion ..	422,650	348,217	336,471	371,348	379,034	385,637	
Foreign ores and base bullion ...	71,353	22,071	37,139	20,739	17,421	18,020	
Total ²	494,003	370,288	373,610	392,087	396,455	403,657	

¹1929-40 domestic ore only; does not include base bullion.

²Data may not add to totals shown because of independent rounding.

³1983-90 "Total" refined lead: American Bureau of Metal Statistics Inc.; domestic and foreign ores: U.S. Bureau of Mines calculations.

Table 4.—Stocks of lead at consumer and secondary smelters in the United States, December 31
(Metric tons lead content)

Year	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
1970	75,136	38,483	6,662	830	121,111
1971	74,329	32,387	6,331	875	113,922
1972	67,278	32,801	6,329	1,133	107,541
1973	76,452	29,235	6,309	605	112,601
1974	96,384	44,909	8,734	1,100	151,127
1975	77,210	37,711	4,589	1,431	120,941
1976	79,627	30,941	5,443	1,569	117,580
1977	74,004	39,247	6,669	1,467	121,387
1978	72,065	44,417	7,564	1,188	125,234
1979	95,655	49,188	7,346	1,006	153,195
1980	72,601	44,820	7,851	942	126,214
1981	69,636	46,194	6,523	863	123,216
1982	51,036	40,118	5,346	709	97,209
1983	57,881	37,159	5,085	646	100,771
1984	53,802	37,015	5,326	934	97,077
1985	50,475	36,374	5,770	511	93,130
1986	47,589	30,442	5,524	269	83,824
1987	55,278	27,959	5,185	164	88,586
1988	50,850	34,108	4,756	151	89,867
1989	48,592	28,960	4,564	239	82,356
1990	46,478	34,512	5,132	219	86,340

Table 5.—Average annual price of lead¹
(Dollars per pound)

Year	Price	Year	Price	Year	Price	Year	Price	Year	Price
1850	0.05	1878	0.04	1906	0.06	1934	0.04	1962	0.10
1851	.05	1879	.04	1907	.05	1935	.04	1963	.11
1852	.05	1880	.05	1908	.04	1936	.05	1964	.14
1853	.06	1881	.05	1909	.04	1937	.06	1965	.16
1854	.06	1882	.05	1910	.04	1938	.05	1966	.15
1855	.07	1883	.04	1911	.04	1939	.05	1967	.14
1856	.07	1884	.04	1912	.05	1940	.05	1968	.13
1857	.06	1885	.04	1913	.04	1941	.06	1969	.15
1858	.06	1886	.05	1914	.04	1942	.07	1970	.16
1859	.06	1887	.05	1915	.05	1943	.07	1971	.14
1860	.06	1888	.04	1916	.07	1944	.07	1972	.15
1861	.05	1889	.04	1917	.09	1945	.07	1973	.16
1862	.06	1890	.05	1918	.07	1946	.08	1974	.23
1863	.06	1891	.04	1919	.06	1947	.15	1975	.22
1864	.07	1892	.04	1920	.08	1948	.18	1976	.23
1865	.07	1893	.04	1921	.045	1949	.15	1977	.31
1866	.07	1894	.03	1922	.06	1950	.13	1978	.34
1867	.07	1895	.03	1923	.07	1951	.18	1979	.53
1868	.07	1896	.03	1924	.08	1952	.17	1980	.43
1869	.06	1897	.04	1925	.09	1953	.14	1981	.37
1870	.06	1898	.04	1926	.08	1954	.14	1982	.26
1871	.06	1899	.05	1927	.07	1955	.15	1983	.22
1872	.06	1900	.04	1928	.06	1956	.16	1984	.26
1873	.06	1901	.04	1929	.07	1957	.15	1985	.19
1874	.06	1902	.04	1930	.06	1958	.12	1986	.22
1875	.06	1903	.04	1931	.04	1959	.12	1987	.36
1876	.06	1904	.04	1932	.03	1960	.12	1988	.37
1877	.06	1905	.05	1933	.04	1961	.11	1989	.39
								1990	.46

¹1850-1986 primary producer, New York (from 1972, delivered); 1987-88 North American producer, delivered weighted average; 1989-90 includes key U.S. and Canadian secondary producers, weighted.

Sources: U.S. Bureau of Mines Mineral Yearbook, Engineering Mining Journal, Handy & Harman, Metals Week, and others.

Table 6.—U.S. imports for consumption of lead,¹ by country

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1970:				
Australia	46,906	\$13,902	—	—
Belgium ²	617	396	41	\$17
Burma	309	132	—	—
Canada	57,836	19,107	290	169
Denmark	127	64	—	—
France	1,139	357	—	—
Germany, Federal Republic of: ³				
Western states	638	2,037	—	—
Mexico	34,807	10,156	—	—
Netherlands	158	150	79	33
Peru	47,603	16,292	—	—
South Africa, Republic of	11,779	4,164	—	—
United Kingdom	2,656	1,508	32	13
Yugoslavia	17,023	4,930	24	9
Other	321	202	—	—
Total ⁴	221,918	73,397	465	241
1971:				
Australia	39,050	9,512	—	—
Belgium ²	139	100	18	7
Canada	51,546	14,015	74	37
Denmark	255	119	—	—
Germany, Federal Republic of: ³				
Western states	157	411	1	2
Mexico	26,893	6,725	—	—
Netherlands	180	75	66	23
Peru	32,996	9,500	—	—
South Africa, Republic of	12,264	4,083	—	—
United Kingdom	3,320	1,223	56	18
Yugoslavia	7,896	2,258	—	—
Total ⁴	174,697	48,021	216	87
1972:				
Australia	35,051	9,272	—	—
Belgium ²	2,634	822	23	10
Burma	169	46	—	—
Canada	75,304	22,285	69	37
Denmark	765	331	—	—
France	112	45	—	—
Germany, Federal Republic of: ³				
Eastern states	1,000	265	—	—
Western states	1,311	513	—	—
Mexico	32,217	8,069	905	286
Netherlands	2,079	693	40	14
Peru	44,688	13,320	—	—
South Africa, Republic of	7,987	2,698	14	7
Sweden	24	22	—	—
Switzerland	7,252	2,067	—	—
United Kingdom	10,699	3,165	34	16
Yugoslavia	1,498	460	27	8
Other	15	23	—	—
Total ⁴	222,803	64,096	1,111	378

See footnotes at end of table.

Table 6.—U.S. imports for consumption of lead,¹ by country—Continued

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1973:				
Australia	41,322	12,274	—	—
Belgium ²	24	60	16	9
Canada	56,179	18,950	6	5
Denmark	220	125	(⁵)	(⁵)
France	(⁵)	6	—	—
Germany, Federal Republic of: ³				
Western states	103	234	—	—
Japan	—	—	1	(⁵)
Mexico	18,496	5,690	666	285
Netherlands	249	343	11	4
Peru	38,802	12,948	—	—
South Africa, Republic of	5,120	1,718	—	—
Sweden	39	21	—	—
United Kingdom	1,017	561	—	—
Other	12	7	—	—
Total ⁴	161,584	52,937	700	303
1974:				
Australia	3,001	1,537	—	—
Belgium ²	1,214	1,106	—	—
Canada	36,378	18,578	100	71
Denmark	180	226	—	—
France	45	54	—	—
Germany, Federal Republic of: ³				
Eastern states	494	2,847	—	—
Western states	73	169	—	—
Japan	2,366	1,850	10	24
Mexico	25,858	13,795	64	39
Netherlands	321	437	(⁵)	1
Peru	36,275	14,850	—	—
Singapore	59	19	—	—
Sweden	3	10	—	—
Thailand	131	655	—	—
United Kingdom	956	1,523	4	3
Other	32	37	(⁵)	(⁵)
Total	107,386	57,693	178	138
1975:				
Belgium ²	1,867	1,141	—	—
Canada	27,840	14,659	47	54
China	25	111	—	—
Denmark	381	450	—	—
France	26	29	—	—
Germany, Federal Republic of	2,370	1,357	19	28
Japan	71	279	—	—
Mexico	26,062	11,073	65	12
Netherlands	485	701	—	—
New Zealand	37	21	—	—
Peru	18,031	9,022	—	—
South Africa, Republic of ⁶	1,016	549	—	—
Spain	108	162	—	—
Thailand	396	1,609	—	—
United Kingdom	2,393	2,621	2	5
Yugoslavia	8,740	2,880	—	—
Other	11	39	—	—
Total ⁴	89,860	46,703	133	99

See footnotes at end of table.

Table 6.—U.S. Imports for consumption of lead,¹ by country—Continued

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1976:				
Australia	1,473	442	—	—
Belgium ²	152	93	—	—
Canada	43,193	21,660	103	130
Denmark	389	627	17	56
France	30	27	—	—
Germany, Federal Republic of	9	54	34	48
Japan	3	5	—	—
Mexico	40,179	17,090	18	10
Netherlands	2,015	721	—	—
Peru	17,901	7,877	—	—
South Africa, Republic of	76	20	—	—
Spain	84	217	59	205
Thailand	370	1,447	—	—
United Kingdom	1,834	2,352	24	39
Yugoslavia	18,589	6,749	—	—
Other	2,503	864	12	7
Total ⁴	128,802	60,245	267	495
1977:				
Australia	12,906	7,414	—	—
Belgium ²	6,908	5,006	(⁵)	1
Canada	75,436	51,749	613	485
Denmark	175	221	52	232
France	978	544	—	—
Germany, Federal Republic of	18,728	12,495	43	50
Japan	317	271	5	13
Mexico	71,779	44,183	20	18
Netherlands	100	54	—	—
Peru	30,432	18,674	—	—
South Africa, Republic of	2,361	1,273	—	—
Spain	—	—	135	636
Thailand	249	1,397	—	—
United Kingdom	2,585	2,444	21	100
Yugoslavia	6,889	3,576	—	—
Other	226	118	(⁵)	1
Total	230,069	149,419	889	1,516
1978:				
Australia	20,419	13,929	—	—
Belgium ²	7,479	11,424	—	—
Canada	70,378	53,224	1,027	946
Denmark	658	588	—	—
France	1,500	865	—	—
Germany, Federal Republic of	8,458	9,481	42	62
Mexico	80,213	54,818	—	—
Morocco	6,007	3,916	—	—
Netherlands	514	371	—	—
Peru	25,725	17,004	—	—
Poland	101	57	—	—
Spain	1,000	636	366	1,100
Sweden	1,007	605	—	—
Thailand	181	963	—	—
United Kingdom	1,724	1,963	1	4
Other	42	22	2	4
Total	225,406	169,866	1,438	2,116

See footnotes at end of table.

Table 6.—U.S. imports for consumption of lead,¹ by country—Continued

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1979:				
Australia	8,163	6,737	—	—
Belgium ²	1,981	11,026	—	—
Canada	71,342	79,512	201	305
Denmark	521	726	—	—
France	2,000	2,041	—	—
Germany, Federal Republic of	574	5,529	1	8
Mexico	73,643	76,488	—	—
Namibia	3,913	4,231	—	—
Peru	17,903	19,387	—	—
South Africa, Republic of	1299	1,260	—	—
United Kingdom	801	1,979	3	4
Other	410	535	10	11
Total	182,550	209,451	215	328
1980:				
Australia	10,884	11,464	—	—
Belgium ²	846	5,567	—	—
Canada	34,929	31,649	280	544
Denmark	619	591	—	—
Germany, Federal Republic of	446	4,342	57	119
Mexico	28,657	28,009	588	647
Netherlands	56	590	—	—
Peru	3,298	2,974	—	—
Spain	1,036	1,313	—	—
United Kingdom	468	1,085	8	36
Other	61	45	17	162
Total	81,300	87,629	950	1,508
1981:				
Argentina	300	220	—	—
Australia	9,080	6,505	—	—
Belgium ²	286	1,666	—	—
Canada	50,849	39,298	203	343
Denmark	354	341	—	—
Germany, Federal Republic of	1,433	8,899	51	85
Italy	—	—	20	33
Mexico	33,723	25,183	177	164
Peru	2,907	2,146	—	—
United Kingdom	989	2,269	4	17
Other	187	499	19	84
Total	100,108	87,026	474	726
1982:				
Australia	10,882	5,674	—	—
Belgium ²	146	783	27	25
Canada	49,834	27,701	313	335
Denmark	449	351	—	—
Germany, Federal Republic of	927	5,836	40	111
Italy	—	—	24	52
Mexico	23,513	12,444	45	73
Peru	8,296	3,816	—	—
United Kingdom	748	1,903	3	12
Other	60	125	15	86
Total	94,855	58,633	467	694

See footnotes at end of table.

Table 6.—U.S. Imports for consumption of lead,¹ by country—Continued

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1983:				
Australia	14,508	4,604	—	—
Belgium ²	322	2,273	16	32
Canada	72,655	31,578	228	238
Germany, Federal Republic of	1,022	7,020	216	1,189
Italy	113	79	—	—
Mexico	34,861	14,071	10	64
Netherlands	11	84	—	—
Peru	10,096	3,526	—	—
United Kingdom	716	898	3	14
Other	53	92	23	95
Total	134,357	64,225	496	1,632
1984:				
Australia	9,978	4,364	—	—
Belgium ²	231	282	90	107
Canada	94,815	50,062	471	837
Denmark	11	4	—	—
Germany, Federal Republic of	1,528	4,205	315	1,693
India	907	447	—	—
Italy	419	316	(7)	2
Mexico	39,502	19,158	669	853
Netherlands	116	92	—	—
Peru	9,205	4,349	—	—
South Africa, Republic of	496	275	—	—
Spain	3,184	1,635	—	—
United Kingdom	974	943	51	128
Other	121	58	72	424
Total	161,487	86,190	1,668	4,044
1985:				
Australia	91	443	—	—
Belgium ²	15	14	44	57
Canada	90,056	33,783	419	627
France	20	9	—	—
Germany, Federal Republic of	542	3,080	149	576
India	1,361	664	—	—
Italy	—	—	1	13
Japan	—	—	18	197
Mexico	33,771	13,271	164	147
Netherlands	10	23	—	—
Peru	5,150	1,770	121	61
Spain	—	—	36	11
United Kingdom	337	807	1,027	809
Other	—	—	2	19
Total	131,353	53,864	1,981	2,517
1986:				
Belgium ²	—	—	454	418
Canada	105,281	44,080	299	293
China	77	31	—	—
Germany, Federal Republic of	496	658	132	422
Italy	—	—	18	40
Japan	1	2	20	241
Mexico	29,532	11,617	43	22

See footnotes at end of table.

Table 6.—U.S. Imports for consumption of lead,¹ by country—Continued

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1986—Continued				
Peru	1,053	449	100	45
Spain	—	—	13	11
Sweden	2,773	1,055	—	—
Switzerland	21	11	—	—
U.S.S.R.	262	96	—	—
United Kingdom	679	1,153	228	255
Other	46	20	37	78
Total	140,221	59,172	1,344	1,825
1987:				
Australia	63	37	—	—
Belgium	4,950	3,299	18	38
Bolivia	2	12	—	—
Canada	92,643	61,384	352	414
China	574	357	—	—
France	3,193	2,102	—	—
Germany, Federal Republic of	7,325	4,682	256	827
Italy	1,800	1,232	55	110
Japan	906	704	128	2,338
Macao	403	298	—	—
Mexico	42,635	28,457	180	121
Morocco	1,500	1,001	—	—
Mozambique	87	66	—	—
Netherlands	6,317	3,939	—	—
Peru	350	189	622	360
Poland	2,500	1,535	—	—
Spain	5,999	3,887	118	140
Sweden	9,086	5,887	—	—
Switzerland	201	141	—	—
Taiwan	—	—	6	12
United Kingdom	4,039	3,180	1,047	895
Yugoslavia	1,020	634	—	—
Other	80	134	11	46
Total	185,673	123,157	2,793	5,301
1988:				
Australia	6,719	3,981	—	—
Belgium	499	310	32	65
Bolivia	36	22	—	—
Brazil	(²)	2	—	—
Canada	104,815	77,207	283	472
China	653	403	—	—
France	299	94	—	—
Germany, Federal Republic of	2,713	2,519	199	494
Italy	1,800	1,139	39	87
Japan	—	—	3	76
Mexico	30,916	21,562	2,285	1,280
Peru	—	—	40	28
Spain	—	—	45	101
Switzerland	58	40	—	—
Taiwan	—	—	7	18
United Arab Emirates	8	44	—	—
United Kingdom	88	161	478	586
Other	—	—	34	73
Total	148,604	107,484	3,445	3,280

See footnotes at end of table.

Table 6.—U.S. Imports for consumption of lead,¹ by country—Continued

Country	Pigs and bars (lead content)		Wrought lead, all forms, including wire and powders (gross weight)	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1989:				
Belgium	41	25	68	181
Bolivia	52	48	—	—
Brazil	1,510	974	—	—
Canada	90,479	61,951	770	1,257
China	6	5	279	719
Germany	144	269	244	837
Italy	1,731	1,238	50	160
Japan	—	—	37	393
Mexico	18,703	12,900	2,539	1,797
Peru	2,316	1,543	1,284	927
Spain	—	—	7	117
Taiwan	—	—	248	658
United Arab Emirates	296	510	—	—
United Kingdom	277	319	406	989
Other	126	81	136	1,041
Total	115,681	79,863	6,068	9,076
1990:				
Belgium	—	—	1	86
Canada	70,662	58,099	1,152	2,068
China	—	—	278	771
France	—	—	21	140
Germany, Federal Republic of	66	253	258	1,167
India	330	223	—	—
Italy	—	—	330	448
Japan	—	—	37	399
Mexico	18,055	14,005	2,769	2,061
Netherlands	—	—	55	241
Peru	1,000	822	735	628
Spain	—	—	4	96
Taiwan	—	—	178	495
Thailand	—	—	30	120
United Arab Emirates	239	646	40	101
United Kingdom	269	332	88	513
Venezuela	13	11	709	366
Other	—	—	40	245
Total⁴	90,638	74,395	6,723	9,944

¹Because of the implementation of the Harmonized Tariff System in Jan. 1989, import categories for 1989-90 are not necessarily comparable with those years before these periods.

²From 1970-87, country was listed as "Belgium-Luxembourg. From 1988 to present, both countries are listed separately.

³From 1970-74, country was listed as "Germany: West" or "Germany: West and East."

⁴Data may not add to totals shown because of independent rounding and conversion to metric tons.

⁵Less than 1/2 unit.

⁶In 1975, country was listed as "South-West Africa, Territory of."

This page intentionally left blank.

LIME

By M. Michael Miller

Lime is a basic chemical that ranked fifth in total production in the United States in 1990. Its major uses are in steelmaking; pulp and paper manufacturing; construction; and the treatment of water, sewage, and smokestack emissions (flue gas desulfurization).

Lime is manufactured by calcining (burning) high-purity calcitic or dolomitic limestone at temperatures ranging from 980° C to 1,320° C. It is never found in a natural state. The calcination process drives off the carbon dioxide, forming calcium oxide (quicklime). The subsequent addition of water creates calcium hydroxide (hydrated lime). The term "lime" refers primarily to six chemicals produced by the calcination process followed by hydration where necessary. They are (1) quicklime or calcium oxide (CaO), (2) hydrated lime or calcium hydroxide [Ca(OH)₂], (3) dolomitic quicklime (CaO•MgO), (4) type N dolomitic hydrate [Ca(OH)₂•MgO], (5) type S dolomitic hydrate [Ca(OH)₂•Mg(OH)₂], and (6) dead-burned dolomite.

Lime can also be produced from other calcareous materials such as aragonite, chalk, coral, marble, and shell.

The last 20 years have witnessed three major market shifts and a tremendous increase in prices. The synthetic soda ash industry disappeared, decreasing annual lime consumption by more than 3 million metric tons. The steel industry expanded in the 1970's reaching a peak consumption rate of more than 8 million metric tons per year, but then shrank in the 1980's, causing a dramatic drop in consumption to current levels of about 4.6 million metric tons per year. Passage of the Clean Air Act in 1970 created the flue gas desulfurization market, which has grown steadily until it is the second largest market for lime in the United States. The large jump in prices during the 1970's was the result of the energy crisis. Fuel is generally the largest cost of operation in a lime plant utilizing rotary kilns.

Table 1.—U.S. historical salient lime statistics
(Thousand metric tons unless otherwise specified)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
United States: ¹										
Number of plants	187	185	175	172	171	163	161	155	154	153
Sold or used by producers:										
Quicklime	13,733	15,069	15,631	16,143	14,402	15,353	14,770	15,282	15,924	14,490
Hydrated lime	3,126	2,362	2,368	2,298	2,126	2,085	2,448	2,342	2,358	2,308
Dead-burned dolomite	914	975	1,134	1,159	829	914	878	922	719	448
Total ²	17,773	18,407	19,133	19,601	17,357	18,351	18,096	18,546	19,001	17,246
Value ³ . . thousands . .	\$308,100	\$339,304	\$365,849	\$473,685	\$523,805	\$609,010	\$666,472	\$749,667	\$862,459	\$842,922
Average value per ton	\$17.39	\$18.50	\$19.20	\$24.27	\$30.27	\$33.28	\$36.93	\$40.52	\$45.48	\$49.05
Lime sold	11,192	12,114	13,058	13,281	11,648	12,722	12,884	13,664	13,992	12,527
Lime used	6,581	6,293	6,075	6,319	5,708	5,629	5,211	4,882	5,009	4,718
Exports ⁴	60	34	34	29	49	51	30	41	41	38
Imports for consumption ⁴	220	225	303	377	235	331	384	553	581	435
Consumption, apparent ⁵	17,932	18,597	19,402	19,949	17,543	18,632	18,449	19,058	19,541	17,643
World production	96,767	102,079	107,457	110,261	104,929	114,782	116,523	119,118	117,630	120,466
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
United States: ¹										
Number of plants	150	147	139	129	115	116	116	115	115	113
Sold or used by producers:										
Quicklime	14,644	10,615	11,234	11,915	11,791	10,750	11,774	12,760	13,154	13,392
Hydrated lime	2,067	1,848	1,874	2,088	2,099	1,995	2,239	2,296	2,040	2,098
Dead-burned dolomite	395	306	379	442	343	385	259	413	365	342
Total ²	17,106	12,769	13,487	14,444	14,234	13,131	14,273	15,469	15,560	15,832
Value ³ . . thousands . .	\$884,197	\$696,207	\$757,611	\$811,183	\$809,000	\$757,867	\$786,125	\$817,893	\$852,113	\$901,549
Average value per ton	\$51.82	\$54.53	\$56.33	\$56.35	\$56.98	\$57.87	\$55.24	\$53.04	\$54.93	\$57.07
Lime sold	12,946	9,848	10,962	11,851	12,164	10,974	11,889	13,368	13,622	14,014

See footnotes at end of table.

Table 1.—U.S. historical salient lime statistics—Continued
(Thousand metric tons unless otherwise specified)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Sold or used by producers—Continued										
Lime used	4,159	2,920	2,526	2,593	2,069	2,156	2,384	2,102	1,937	1,818
Exports ⁴	25	21	25	23	17	15	12	14	29	40
Imports for consumption ⁴	457	316	257	224	176	182	161	191	198	157
Consumption, apparent ⁵	17,538	13,063	13,718	14,646	14,393	13,298	14,422	15,647	15,728	15,949
World production	116,955	109,110	110,101	117,049	122,875	123,690	126,808	134,147	138,660	136,215

¹Excludes regenerated lime. Excludes Puerto Rico.

²Data may not add to totals shown because of independent rounding.

³Selling value, f.o.b. plant, excluding cost of containers.

⁴Bureau of the Census.

⁵Calculated by sold or used plus imports minus exports.

Table 2.—Time-value relationships for lime^{1,2}

Year	Average annual value, dollars per ton	
	Actual value ³	Based on constant 1990 dollars
1971	14.32	42.40
1972	15.22	43.12
1973	15.80	41.98
1974	19.98	48.64
1975	24.91	55.24
1976	27.39	57.08
1977	30.39	59.38
1978	33.35	60.74
1979	37.43	62.62
1980	40.37	61.94
1981	42.65	59.66
1982	44.88	59.01
1983	46.36	58.67
1984	46.38	56.63
1985	46.89	55.60
1986	47.63	55.04
1987	45.46	50.92
1988	43.65	47.33
1989	45.21	47.06
1990	46.96	46.96

¹Includes Puerto Rico.

²Includes quicklime, hydrated lime, and dead-burned dolomite.

³The average value of lime sold or used by producers, f.o.b. plant, excluding cost of containers.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹
(Thousand metric tons)

	1971			1972			1973		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	300	75	376	280	69	349	306	70	375
Alaska	W	W	W	W	W	W	W	W	2
Arizona	232	25	258	294	19	312	W	W	290
Arkansas	W	W	135	116	23	138	132	20	152
California	575	165	740	621	101	720	694	97	791
Colorado	146	51	197	187	16	203	169	21	190
Connecticut	W	W	61	W	W	45	55	16	73
Delaware	10	5	15	14	11	25	18	14	32
District of Columbia	—	1	1	—	2	2	28	5	34

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1971			1972			1973		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Florida	241	40	281	241	46	288	272	49	321
Georgia	88	21	109	78	24	102	123	22	145
Hawaii	W	W	8	W	W	6	1	6	6
Idaho	W	W	W	W	W	114	120	5	124
Illinois	752	128	881	808	120	928	953	139	1,090
Indiana	W	W	1,186	W	W	1,392	1,501	67	1,569
Iowa	57	30	86	56	16	73	55	23	78
Kansas	38	37	74	40	26	66	40	24	64
Kentucky	445	15	459	424	17	440	300	18	318
Louisiana	W	W	865	736	98	834	734	99	833
Maine	W	W	W	W	W	W	37	2	39
Maryland	330	15	347	W	W	369	418	20	438
Massachusetts	W	W	55	W	W	63	38	22	60
Michigan	1,418	84	1,502	1,461	40	1,500	1,727	38	1,764
Minnesota	109	47	157	W	W	126	115	17	132
Mississippi	94	13	107	114	20	134	138	15	153
Missouri	W	W	178	W	W	189	164	37	202
Montana	203	4	207	223	4	228	193	3	195
Nebraska	28	21	49	39	14	53	41	12	52
Nevada	W	W	47	W	W	47	51	6	56
New Hampshire	W	W	5	W	W	W	W	W	W
New Jersey	50	80	130	51	81	132	54	78	132
New Mexico	W	W	68	W	W	73	82	14	95
New York	W	W	W	852	54	906	888	49	937
North Carolina	78	24	103	87	27	114	69	31	100
North Dakota	W	W	54	W	W	34	W	W	37
Ohio	2,800	143	2,943	3,164	151	3,316	2,955	152	3,107
Oklahoma	W	W	W	W	W	W	124	61	186
Oregon	104	15	119	93	15	107	93	15	108
Pennsylvania	1,561	224	1,785	1,828	224	2,052	1,998	230	2,227
Rhode Island	W	W	9	W	W	11	5	3	7
South Carolina	31	11	43	33	7	40	36	8	44
South Dakota	W	W	W	W	W	24	10	22	32
Tennessee	95	38	133	85	38	123	93	48	142
Texas	802	712	1,514	937	538	1,475	916	579	1,495
Utah	W	W	110	W	W	127	90	21	111
Vermont	W	W	W	W	W	W	W	W	W
Virginia	138	27	165	101	35	136	109	34	142
Washington	64	14	78	132	17	150	109	20	129
West Virginia	320	19	339	283	28	312	280	16	297
Wisconsin	100	48	149	96	43	138	109	44	153
Wyoming	W	W	W	W	W	W	28	3	30
Exports:									
Canada	31	10	41	9	10	19	7	12	19
Other countries ³ ..	29	17	45	W	W	33	3	44	48
Total ²	14,647	3,165	17,813	16,045	2,400	18,445	16,765	2,406	19,171
	1974			1975			1976		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	354	62	415	445	54	499	443	58	501
Alaska	W	W	W	W	W	W	W	W	W
Arizona	W	W	372	435	2	436	438	13	451
Arkansas	144	23	167	125	17	142	151	23	173
California	662	63	725	674	64	738	705	77	782
Colorado	204	15	219	183	5	188	253	15	269
Connecticut	48	13	61	38	9	47	40	10	50

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1974			1975			1976		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Delaware	16	16	33	15	6	21	15	5	21
District of Columbia	W	W	2	(¹)	(¹)	1	—	1	1
Florida	303	44	347	298	47	346	281	43	324
Georgia	132	23	155	121	22	142	153	24	178
Hawaii	1	5	5	1	4	5	3	5	7
Idaho	81	10	92	92	5	97	124	6	131
Illinois	943	113	1,057	666	130	796	816	99	914
Indiana	1,622	73	1,696	1,575	62	1,637	1,739	64	1,803
Iowa	70	23	93	49	18	67	64	18	82
Kansas	71	15	85	63	24	87	70	19	89
Kentucky	371	15	386	239	15	255	335	15	350
Louisiana	640	93	734	337	96	434	142	105	248
Maine	18	2	20	19	1	20	21	2	23
Maryland	417	20	437	357	17	374	415	16	432
Massachusetts	38	18	56	27	13	41	38	11	49
Michigan	1,580	42	1,621	1,617	39	1,656	1,770	43	1,813
Minnesota	111	16	127	123	14	137	164	15	180
Mississippi	122	11	133	107	16	124	112	23	134
Missouri	173	37	210	145	31	176	148	36	184
Montana	206	1	207	201	3	204	204	4	208
Nebraska	48	13	61	54	7	63	53	8	61
Nevada	40	7	47	32	5	37	15	9	24
New Hampshire	W	W	9	6	1	7	7	1	7
New Jersey	50	58	108	52	51	103	62	50	112
New Mexico	77	9	86	75	6	82	86	11	97
New York	851	44	894	791	33	825	908	33	941
North Carolina	112	26	138	100	24	124	124	27	152
North Dakota	83	11	94	55	14	70	46	6	53
Ohio	3,127	134	3,262	2,398	107	2,506	2,450	102	2,553
Oklahoma	143	32	175	106	17	123	70	21	91
Oregon	87	41	128	89	27	116	89	13	102
Pennsylvania	1,906	227	2,132	1,574	223	1,797	1,827	243	2,070
Rhode Island	9	3	12	5	2	7	W	W	8
South Carolina	65	8	73	68	7	75	73	11	85
South Dakota	10	20	30	8	14	22	25	16	42
Tennessee	124	55	179	116	64	180	116	63	179
Texas	1,021	647	1,667	966	644	1,609	777	570	1,346
Utah	93	7	100	78	9	86	91	18	110
Vermont	W	W	W	W	W	W	W	W	W
Virginia	149	37	186	121	19	139	145	26	172
Washington	122	59	181	112	45	158	146	18	164
West Virginia	327	27	354	312	18	329	351	18	369
Wisconsin	103	49	152	98	44	142	104	46	151
Wyoming	27	5	32	25	5	31	31	7	38
Exports:									
Canada	9	8	18	18	14	31	9	13	22
Other countries ³ ..	16	4	21	15	34	50	12	24	36
Total ²	17,303	2,333	19,636	15,231	2,151	17,381	16,267	2,110	18,377
	1977			1978			1979		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	482	78	559	498	51	550	497	59	555
Alaska	W	W	2	W	W	2	W	W	1
Arizona	355	15	370	345	19	365	447	24	472
Arkansas	140	21	160	137	20	157	152	22	173
California	691	86	777	630	83	714	714	102	815

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1977			1978			1979		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Colorado	227	17	244	222	15	237	192	15	209
Connecticut	39	11	50	39	15	54	43	15	58
Delaware	13	4	16	19	15	34	36	5	42
District of Columbia	W	W	4	W	W	5	W	W	1
Florida	290	44	334	323	55	378	347	54	400
Georgia	179	29	207	172	38	210	178	28	206
Hawaii	W	W	4	1	4	4	2	5	6
Idaho	119	6	124	79	6	85	88	3	91
Illinois	850	85	935	913	138	1,051	826	142	969
Indiana	1,627	64	1,692	1,918	69	1,988	1,835	67	1,902
Iowa	65	19	84	80	19	99	77	21	98
Kansas	79	17	97	73	15	89	88	22	109
Kentucky	336	15	351	355	25	380	362	18	380
Louisiana	159	100	259	198	104	302	190	127	317
Maine	W	W	27	30	1	31	31	1	32
Maryland	430	16	446	463	17	479	407	22	429
Massachusetts	53	12	65	56	15	72	54	14	67
Michigan	1,665	37	1,702	1,635	42	1,676	1,421	34	1,454
Minnesota	217	21	239	188	21	209	208	16	224
Mississippi	122	18	140	120	21	141	132	23	155
Missouri	149	44	193	157	51	208	156	46	202
Montana	W	W	207	186	5	191	206	10	215
Nebraska	56	7	64	57	7	64	63	6	69
Nevada	13	10	23	18	12	30	18	—	18
New Hampshire	W	W	11	W	W	1	W	W	1
New Jersey	64	49	113	94	54	148	74	53	127
New Mexico	83	5	87	70	9	79	81	9	90
New York	989	38	1,026	797	51	848	1,000	46	1,046
North Carolina	137	28	164	117	27	144	149	25	174
North Dakota	W	W	41	70	8	77	94	7	101
Ohio	2,097	97	2,194	2,087	144	2,231	2,029	131	2,159
Oklahoma	94	38	132	73	17	91	93	21	114
Oregon	84	14	98	93	15	107	99	18	118
Pennsylvania	1,777	245	2,022	2,072	196	2,268	2,189	226	2,415
Rhode Island	W	W	6	6	2	8	6	9	15
South Carolina	78	19	97	107	19	126	110	10	120
South Dakota	8	15	24	5	16	20	10	17	27
Tennessee	122	53	174	135	71	206	149	64	212
Texas	818	695	1,512	726	611	1,337	786	610	1,394
Utah	92	24	116	103	30	133	127	20	146
Vermont	W	W	8	W	W	1	W	W	1
Virginia	171	24	196	126	63	189	127	60	187
Washington	120	21	141	119	17	136	233	16	249
West Virginia	292	26	318	312	38	350	351	38	389
Wisconsin	116	51	167	117	51	169	114	46	161
Wyoming	35	7	43	28	8	35	31	15	45
Exports:									
Canada	14	9	23	18	9	28	17	9	26
Other countries ³ ..	6	4	10	6	4	10	8	5	13
Total ²	15,823	2,309	18,132	16,205	2,378	18,583	16,646	2,390	19,035
	1980			1981			1982		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	438	42	481	533	49	582	335	43	377
Alaska	W	W	1	W	W	1	W	W	21

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1980			1981			1982		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Arizona	332	21	353	315	16	331	187	15	202
Arkansas	160	24	184	135	24	160	85	27	112
California	657	85	743	587	74	661	406	56	464
Colorado	220	14	233	226	13	239	122	12	134
Connecticut	30	15	44	15	12	26	23	10	33
Delaware	35	5	39	33	5	37	27	5	32
District of Columbia	W	W	1	W	W	8	W	W	9
Florida	350	48	398	387	53	440	260	34	294
Georgia	169	35	204	162	24	187	175	33	208
Hawaii	2	5	5	1	6	7	1	5	5
Idaho	105	4	108	109	4	112	105	2	107
Illinois	705	106	810	671	106	777	438	93	532
Indiana	1,478	64	1,541	1,672	44	1,715	1,154	38	1,192
Iowa	61	17	78	91	15	106	64	15	78
Kansas	79	16	95	67	14	81	59	14	72
Kentucky	402	15	417	411	21	432	351	15	366
Louisiana	174	146	320	165	115	280	131	92	222
Maine	33	1	34	28	(⁴)	29	14	(⁴)	14
Maryland	338	21	359	331	21	352	287	15	302
Massachusetts	52	15	66	76	15	92	45	12	57
Michigan	1,209	20	1,229	1,182	22	1,204	889	25	914
Minnesota	230	15	246	215	14	228	199	11	210
Mississippi	107	26	133	101	40	141	101	50	151
Missouri	141	94	235	132	57	190	112	30	142
Montana	219	8	227	216	6	222	61	5	66
Nebraska	109	5	114	85	5	90	51	5	55
Nevada	39	8	47	47	6	54	66	5	72
New Hampshire	W	W	1	W	W	2	W	W	3
New Jersey	80	47	127	93	40	133	74	37	112
New Mexico	95	12	107	103	25	129	62	27	89
New York	929	49	977	679	44	722	542	40	582
North Carolina	148	27	175	128	22	151	148	21	169
North Dakota	100	6	106	79	5	84	91	5	95
Ohio	1,631	146	1,777	1,751	136	1,887	1,176	93	1,268
Oklahoma	93	15	107	91	18	108	72	14	85
Oregon	124	10	134	81	9	90	77	7	84
Pennsylvania	1,875	217	2,092	1,892	187	2,079	1,193	177	1,369
Rhode Island	5	3	7	4	3	6	4	2	6
South Carolina	99	17	116	109	19	128	72	14	86
South Dakota	28	15	44	6	14	20	10	9	19
Tennessee	142	64	206	144	59	203	133	60	193
Texas	782	611	1,393	807	523	1,330	557	500	1,057
Utah	139	11	151	159	11	170	156	8	164
Vermont	W	W	1	W	W	3	W	W	1
Virginia	120	69	189	124	65	190	110	74	183
Washington	238	15	251	225	13	238	205	12	218
West Virginia	263	34	297	386	24	411	298	24	322
Wisconsin	98	47	145	107	46	153	99	41	141
Wyoming	32	13	44	48	11	59	56	8	64
Exports:									
Canada	18	9	28	11	6	17	6	5	12
Other countries ³ ..	22	15	38	5	9	15	4	11	15
Total ²	14,930	2,340	17,270	15,040	2,097	17,137	10,922	1,880	12,802

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1983			1984			1985		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	333	52	385	336	49	385	396	45	442
Alaska	W	W	7	(¹)	2	2	(¹)	1	1
Arizona	191	23	213	221	29	249	191	55	247
Arkansas	89	33	122	71	25	96	72	29	101
California	396	65	461	362	76	438	347	79	426
Colorado	73	18	92	86	13	100	57	15	73
Connecticut	30	12	42	31	9	39	27	9	36
Delaware	36	5	41	34	5	38	27	5	32
District of Columbia	W	W	12	12	31	43	15	30	45
Florida	302	16	318	338	59	397	340	37	377
Georgia	195	67	262	193	55	249	211	54	265
Hawaii	1	5	5	4	2	5	5	1	5
Idaho	86	3	88	92	3	94	90	3	93
Illinois	508	93	602	501	102	602	471	124	594
Indiana	1,372	37	1,409	1,379	37	1,417	1,345	33	1,377
Iowa	56	15	72	66	16	83	68	15	83
Kansas	58	14	72	59	15	73	56	18	74
Kentucky	415	20	435	427	17	445	484	20	504
Louisiana	151	91	240	216	115	331	220	107	327
Maine	10	1	12	14	1	15	13	3	15
Maryland	238	16	254	219	18	237	241	16	258
Massachusetts	59	11	70	61	13	73	56	9	65
Michigan	901	26	927	1,057	29	1,086	901	30	931
Minnesota	164	15	180	172	17	190	166	15	181
Mississippi	87	29	117	106	25	132	114	25	140
Missouri	134	32	166	134	36	171	128	44	171
Montana	56	9	65	56	10	66	30	12	42
Nebraska	46	5	52	60	5	64	32	5	37
Nevada	45	5	51	65	7	73	78	5	83
New Hampshire	W	W	3	3	1	3	2	(¹)	2
New Jersey	96	36	133	114	55	169	101	47	148
New Mexico	56	17	73	23	25	48	121	28	149
New York	551	36	587	572	41	613	575	35	611
North Carolina	154	21	175	174	22	196	185	27	212
North Dakota	73	7	80	93	10	103	96	4	100
Ohio	1,334	100	1,433	1,345	122	1,468	1,364	110	1,474
Oklahoma	80	14	93	83	11	94	100	13	112
Oregon	79	7	86	116	14	130	94	11	105
Pennsylvania	1,333	177	1,510	1,452	212	1,665	1,413	191	1,604
Rhode Island	5	2	6	5	2	5	5	2	6
South Carolina	80	14	93	99	13	112	98	17	116
South Dakota	55	15	70	11	8	19	23	3	25
Tennessee	111	48	158	171	70	240	110	109	219
Texas	532	467	999	566	497	1,063	540	518	1,058
Utah	218	10	228	245	10	255	191	10	200
Vermont	W	W	W	(¹)	1	1	(¹)	1	1
Virginia	100	67	166	86	50	136	175	19	195
Washington	200	15	216	238	13	250	228	11	239
West Virginia	350	26	376	445	24	468	368	33	400
Wisconsin	99	41	140	84	44	128	90	42	132
Wyoming	46	16	63	39	14	53	51	16	67
Exports:									
Canada	15	6	21	16	6	23	16	7	24
Other countries ³	3	13	15	4	14	17	4	23	26
Total ²	11,613	1,886	13,519	12,356	2,119	14,475	12,135	2,120	14,255

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1986			1987			1988		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	386	41	428	417	44	461	435	41	475
Alaska	(^d)	1	1	(^d)	1	1	1	1	2
Arizona	212	58	270	206	79	284	337	83	420
Arkansas	79	22	101	183	17	200	89	19	108
California	368	87	455	432	97	529	525	100	625
Colorado	65	8	74	59	10	69	89	7	97
Connecticut	14	9	23	5	8	13	14	5	18
Delaware	29	5	34	11	5	15	13	6	19
District of Columbia	20	24	44	21	13	34	15	25	40
Florida	327	31	358	279	27	306	375	20	395
Georgia	207	43	249	218	47	265	239	73	312
Hawaii	2	4	5	(^d)	3	3	(^d)	3	3
Idaho	88	3	91	93	2	95	107	3	109
Illinois	445	121	566	460	90	550	488	100	588
Indiana	1,199	30	1,230	1,417	28	1,445	1,419	24	1,442
Iowa	71	14	84	79	15	94	103	15	117
Kansas	56	15	72	54	21	75	64	16	80
Kentucky	444	16	461	406	20	426	428	18	447
Louisiana	222	87	309	213	94	308	229	101	329
Maine	12	1	12	(^d)	1	1	(^d)	1	1
Maryland	258	14	271	253	14	267	321	20	341
Massachusetts	35	14	49	2	14	15	122	10	134
Michigan	853	32	885	865	26	893	990	75	1,065
Minnesota	208	16	224	214	16	230	159	135	294
Mississippi	100	11	112	131	7	138	163	7	171
Missouri	113	44	158	127	46	173	165	57	222
Montana	38	7	45	40	9	49	110	15	126
Nebraska	46	5	52	52	5	55	52	5	55
Nevada	91	16	107	40	13	54	121	23	143
New Hampshire	2	(^d)	2	1	(^d)	1	1	1	2
New Jersey	97	49	145	91	44	134	102	24	125
New Mexico	142	34	176	161	32	192	86	14	100
New York	59	35	94	23	26	49	80	34	113
North Carolina	225	37	262	215	39	255	217	28	245
North Dakota	141	6	147	122	43	164	115	82	197
Ohio	1,168	107	1,274	1,245	140	1,384	1,513	140	1,652
Oklahoma	71	12	83	87	15	102	112	7	120
Oregon	70	11	82	106	18	123	112	23	134
Pennsylvania	1,285	184	1,469	1,470	217	1,686	1,530	212	1,742
Rhode Island	3	2	5	(^d)	1	2	(^d)	1	1
South Carolina	99	19	118	113	19	132	140	15	154
South Dakota	13	1	14	14	1	15	17	1	19
Tennessee	176	61	237	179	58	238	161	52	213
Texas	508	534	1,042	584	459	1,043	650	455	1,104
Utah	161	9	171	367	166	533	182	7	190
Vermont	(^d)	1	1	(^d)	1	1	(^d)	1	1
Virginia	144	13	157	121	76	197	121	79	200
Washington	240	12	251	221	11	233	227	16	243
West Virginia	396	20	416	427	35	463	397	32	429
Wisconsin	88	43	131	124	39	163	104	45	150
Wyoming	35	20	56	50	15	65	64	18	82
Exports:									
Canada	17	7	25	24	7	31	28	5	33
Other countries ³ ..	5	22	26	12	25	37	41	24	64
Total ²	11,135	2,017	13,152	12,033	2,259	14,295	13,169	2,322	15,492

See footnotes at end of table.

Table 3.—Destination of shipments of lime sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons)

	1989			1990		
	Quicklime	Hydrated lime	Total ²	Quicklime	Hydrated lime	Total ²
Alabama	438	43	480	534	34	569
Alaska	3	1	3	3	—	3
Arizona	233	64	296	230	54	283
Arkansas	166	28	194	154	24	179
California	435	115	550	473	109	581
Colorado	55	10	65	73	14	86
Connecticut	16	9	24	14	5	19
Delaware	11	4	15	13	2	15
District of Columbia	14	24	37	15	34	50
Florida	356	16	372	335	17	352
Georgia	285	73	358	216	64	279
Hawaii	—	—	—	—	—	—
Idaho	124	2	126	112	2	114
Illinois	522	131	652	580	166	746
Indiana	1,385	27	1,412	1,373	28	1,402
Iowa	64	20	83	72	26	97
Kansas	65	22	87	66	16	83
Kentucky	437	24	463	455	41	496
Louisiana	247	89	336	295	95	391
Maine	(⁴)	1	1	—	—	—
Maryland	298	17	315	122	17	140
Massachusetts	134	11	145	132	8	140
Michigan	1,032	36	1,069	946	37	984
Minnesota	142	132	273	223	15	238
Mississippi	159	5	165	181	5	186
Missouri	166	50	215	178	61	239
Montana	120	12	132	187	12	198
Nebraska	60	69	129	55	12	67
Nevada	192	34	226	244	52	297
New Hampshire	—	1	1	—	—	—
New Jersey	92	20	112	96	22	118
New Mexico	170	30	200	151	19	170
New York	64	37	102	66	38	104
North Carolina	173	33	207	182	39	221
North Dakota	112	80	191	170	4	174
Ohio	1,242	126	1,368	1,318	133	1,451
Oklahoma	94	5	101	110	13	122
Oregon	104	23	128	94	30	123
Pennsylvania	1,657	211	1,868	1,724	240	1,964
Rhode Island	2	2	4	6	1	7
South Carolina	198	21	219	173	23	196
South Dakota	22	2	24	41	2	43
Tennessee	166	50	216	194	55	249
Texas	859	335	1,194	916	282	1,198
Utah	203	16	220	133	8	142
Vermont	—	1	1	—	—	—
Virginia	137	36	173	136	81	217
Washington	227	19	246	276	20	297
West Virginia	427	46	474	412	55	467
Wisconsin	102	43	144	116	43	159
Wyoming	62	17	79	86	20	105
Exports:						
Canada	32	12	44	35	15	51
Other countries ³ ..	25	24	49	15	26	42
Total ²	13,327	2,257	15,584	13,733	2,119	15,859

W Withheld to avoid disclosing company proprietary data; included with "Total."

¹Excludes regenerated lime.

²Data may not add to totals shown because of independent rounding.

³Includes U.S. possessions.

⁴Less than 1/2 unit.

Table 4.—Lime sold or used by producers in the United States, by major use¹
(Thousand metric tons and thousand dollars)

Major use	1971				1972			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	73	—	73	1,449	124	—	124	2,711
Chemical and industrial:								
Acid water, mine or plant	W	W	W	W	W	W	44	791
Alkalies	W	W	3,141	52,391	9	2,923	2,933	52,700
Aluminum and bauxite	W	W	330	5,012	W	W	334	5,998
Copper ore concentration	196	244	440	6,639	239	257	497	8,923
Glass	315	—	315	5,126	337	—	337	6,064
Magnesia from seawater or brine	W	W	270	4,385	W	W	W	W
Ore concentration, other	33	—	33	404	W	W	24	424
Paper and pulp	W	W	787	13,792	W	W	714	12,830
Sewage treatment	248	69	317	5,305	303	91	394	7,074
Steel, basic oxygen furnace	3,795	894	4,687	76,352	4,464	1,021	5,486	98,570
Steel, electric	W	W	508	8,221	W	W	582	10,450
Steel, open-hearth	W	W	485	7,788	W	W	603	10,840
Sugar refining	35	679	714	14,625	37	651	689	12,370
Sulfur removal from stack gases	W	W	W	W	W	W	1	23
Water purification	W	W	1,155	19,638	W	W	1,273	22,870
Other chemical	4,302	W	W	38,685	W	W	1,998	35,858
Total ²	8,923	W	W	258,363	W	W	15,907	285,785
Construction:								
Road and soil stabilization	755	—	755	15,982	802	—	802	17,046
Finishing lime	201	—	201	4,257	W	W	373	7,924
Mason's lime	376	W	W	9,055	W	W	208	4,415
Other construction	28	—	28	604	54	—	54	1,157
Total ²	1,360	W	W	29,898	W	W	1,439	30,542
Refractory dolomite (dead-burned dolomite)	875	38	914	20,103	913	63	975	22,042
Grand total ²	11,231	6,581	17,813	309,813	12,152	6,293	18,445	341,080
	1973				1974			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	127	—	127	2,796	99	—	99	3,104
Chemical and industrial:								
Acid water, mine or plant	64	3	66	1,202	W	W	76	1,810
Alkalies	5	2,430	2,434	48,811	W	W	2,349	55,700
Aluminum and bauxite	W	W	354	6,639	W	W	348	8,260
Copper ore concentration	249	322	572	10,901	254	391	645	15,300
Glass	334	—	334	5,947	279	—	279	6,630
Magnesia from seawater or brine	W	W	W	W	W	W	W	W
Ore concentration, other	22	—	22	388	7	—	7	172
Paper and pulp	755	68	823	14,809	W	W	965	22,900
Sewage treatment	399	11	410	7,239	485	28	514	12,200
Steel, basic oxygen furnace	5,091	1,319	6,409	117,138	5,143	1,504	6,647	158,000
Steel, electric	522	59	581	10,474	657	73	730	17,300
Steel, open-hearth	538	74	612	11,074	W	W	601	14,300
Sugar refining	72	631	703	13,937	61	641	702	16,700
Sulfur removal from stack gases	1	—	1	16	4	—	4	86
Water purification	1,323	9	1,333	23,743	W	W	1,235	29,300
Other chemical	1,137	1,012	1,795	34,425	3,969	3,553	1,948	45,726
Total ²	10,510	5,938	16,448	306,743	10,859	6,192	17,051	404,384
Construction:								
Road and soil stabilization	793	4	797	17,705	W	W	723	20,202
Finishing lime	199	—	199	4,422	204	—	204	5,700
Mason's lime	403	56	459	10,216	W	W	341	9,520

See footnotes at end of table.

Table 4.—Lime sold or used by producers in the United States, by major use¹—Continued
(Thousand metric tons and thousand dollars)

Major use	1973				1974			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Construction—Continued								
Other construction	8	—	8	182	W	W	58	1,620
Total ²	1,403	60	1,461	32,525	1,275	53	1,327	37,042
Refractory dolomite (dead-burned dolomite)	1,058	76	1,134	25,999	1,084	74	1,158	32,078
Grand total ²	13,096	6,075	19,171	368,063	13,317	6,319	19,636	476,608
	1975				1976			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	88	—	88	3,371	123	—	123	4,759
Chemical and Industrial:								
Acid water, mine or plant	44	1	45	1,350	52	(³)	53	1,715
Alkalies	6	1,899	1,905	56,700	6	1,880	1,885	61,434
Aluminum and bauxite	127	140	267	7,940	130	138	269	8,751
Copper ore concentration	297	323	620	18,400	350	258	608	19,808
Glass	237	—	237	7,050	193	—	193	6,297
Magnesia from seawater or brine	W	W	W	W	W	W	215	7,007
Ore concentration, other	6	—	6	190	3	—	3	89
Paper and pulp	743	93	836	24,900	858	98	956	31,160
Sewage treatment	554	64	618	18,400	497	82	579	18,862
Steel, basic oxygen furnace	4,558	1,377	5,935	177,000	5,262	1,468	6,730	219,306
Steel, electric	529	72	601	17,900	641	64	706	23,001
Steel, open-hearth	424	40	464	13,800	308	75	384	12,506
Sugar refining	70	759	829	24,700	69	825	894	29,121
Sulfur removal from stack gases	3	—	3	80	27	—	27	887
Water purification	1,265	8	1,273	37,900	1,374	7	1,382	45,026
Other chemical	814	843	1,653	48,788	858	641	1,284	41,831
Total ²	9,676	5,617	15,293	455,098	10,629	5,536	16,165	526,801
Construction:								
Road and soil stabilization	679	1	680	21,165	673	(³)	674	24,597
Finishing lime	178	—	178	5,520	120	—	120	4,363
Mason's lime	256	1	257	7,970	318	1	318	11,616
Other construction	25	31	55	1,720	32	32	64	2,310
Total ²	1,139	33	1,171	36,375	1,143	33	1,175	42,886
Refractory dolomite (dead-burned dolomite)	770	58	829	31,193	851	62	914	37,079
Grand total ²	11,674	5,708	17,381	526,036	12,748	5,631	18,377	611,523
	1977				1978			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	83	—	83	3,124	71	—	71	3,324
Chemical and Industrial:								
Acid water, mine or plant	56	(³)	56	2,039	171	69	239	9,501
Alkalies	11	1,584	1,595	57,883	5	1,168	1,172	46,493
Aluminum and bauxite	142	98	239	8,691	139	103	242	9,609
Copper ore concentration	297	280	577	20,939	268	297	564	22,385
Glass	197	—	197	7,143	204	5	210	8,314
Magnesia from seawater or brine	W	W	238	8,625	W	W	564	22,385
Ore concentration, other	13	—	13	459	9	—	9	360
Paper and pulp	996	54	1,050	38,094	959	99	1,058	41,964
Sewage treatment	533	24	556	20,182	590	8	598	23,717
Steel, basic oxygen furnace	4,825	1,486	6,312	229,103	5,357	1,598	6,954	275,848
Steel, electric	684	81	765	27,755	675	18	693	27,496
Steel, open-hearth	493	34	527	19,128	456	43	499	19,794

See footnotes at end of table.

Table 4.—Lime sold or used by producers in the United States, by major use¹—Continued
(Thousand metric tons and thousand dollars)

Major use	1977				1978			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Chemical and industrial—Continued								
Sugar refining	61	770	831	30,159	50	631	681	27,028
Sulfur removal from stack gases	121	—	121	4,377	299	48	348	13,820
Water purification	1,492	6	1,499	54,393	1,472	7	1,480	58,699
Other chemical	971	652	1,388	50,339	1,097	607	1,139	45,201
Total ²	10,893	5,068	15,962	579,309	11,750	4,700	16,451	652,614
Construction:								
Road and soil stabilization	644	(³)	644	26,118	569	—	569	25,529
Finishing lime	144	—	144	5,854	161	—	161	7,205
Mason's lime	313	37	350	14,204	316	37	353	15,838
Other construction	33	38	71	2,878	23	34	56	2,524
Total ²	1,134	75	1,210	49,054	1,069	71	1,139	51,096
Refractory dolomite (dead-burned dolomite)	809	68	878	37,992	811	111	922	45,881
Grand total ²	12,920	5,212	18,132	669,479	13,701	4,882	18,583	752,915
	1979				1980			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	64	—	64	3,286	72	—	72	3,727
Chemical and industrial:								
Acid water, mine or plant	195	64	259	11,515	380	64	445	21,467
Alkalies	5	1,136	1,141	50,804	5	1,059	1,064	51,407
Aluminum and bauxite	147	101	248	11,031	145	103	249	12,036
Copper ore concentration	387	312	699	31,133	308	288	597	28,859
Glass	173	—	173	7,715	163	—	163	7,910
Magnesia from seawater or brine	W	W	619	27,544	W	W	588	28,414
Ore concentration, other	14	—	14	620	16	—	16	773
Paper and pulp	1,042	99	1,141	50,788	943	105	1,049	50,658
Sewage treatment	725	15	739	32,902	769	11	780	37,705
Steel, basic oxygen furnace	5,090	1,548	6,638	295,493	4,000	1,307	5,307	256,469
Steel, electric	875	25	900	40,066	685	31	716	34,556
Steel, open-hearth	547	44	591	26,321	512	34	546	26,407
Sugar refining	43	660	702	31,277	53	825	877	42,414
Sulfur removal from stack gases	548	—	548	24,393	674	—	674	32,566
Water purification	1,480	8	1,488	66,225	1,349	8	1,357	65,603
Other chemical	927	816	1,127	50,133	1,075	751	1,238	59,901
Total ²	12,198	4,829	17,027	757,960	11,078	4,589	15,666	757,145
Construction:								
Road and soil stabilization	630	—	630	32,340	657	—	657	35,071
Finishing lime	177	—	177	9,093	90	—	90	4,777
Mason's lime	318	37	355	18,209	261	36	298	15,916
Other construction	31	32	63	3,203	15	24	40	2,111
Total ²	1,156	69	1,225	62,845	1,021	62	1,083	57,872
Refractory dolomite (dead-burned dolomite)	608	112	719	41,676	381	68	448	28,308
Grand total ²	14,026	5,009	19,035	865,766	12,552	4,718	17,270	847,052
	1981				1982			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	67	—	67	3,595	43	—	43	2,541
Chemical and industrial:								
Acid water, mine or plant	211	—	211	10,799	215	—	215	12,567
Alkalies	3	758	761	38,886	13	587	600	33,051
Aluminum and bauxite	148	93	241	12,309	88	79	167	10,217

See footnotes at end of table.

Table 4.—Lime sold or used by producers in the United States, by major use¹—Continued
(Thousand metric tons and thousand dollars)

Major use	1981				1982			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Chemical and industrial—Continued								
Copper ore concentration	341	252	593	30,301	218	111	329	18,866
Glass	152	—	152	7,734	127	—	127	6,375
Magnesia from seawater or brine	W	W	510	26,029	W	W	378	19,610
Ore concentration, other	57	—	57	2,904	41	—	41	1,910
Paper and pulp	979	100	1,079	55,117	898	95	994	55,644
Sewage treatment	770	6	776	39,640	532	5	537	30,983
Steel, basic oxygen furnace	4,360	1,179	5,540	282,974	2,575	726	3,300	165,870
Steel, electric	972	133	1,105	56,453	648	55	703	38,814
Steel, open-hearth	447	50	496	25,365	307	19	326	16,799
Sugar refining	49	806	854	43,618	45	652	698	38,267
Sulfur removal from stack gases	824	—	824	42,090	904	—	904	48,787
Water purification	1,290	5	1,295	66,119	1,196	11	1,207	65,435
Other chemical	970	651	1,114	56,881	777	497	894	45,716
Total ²	11,573	4,034	15,607	797,220	8,582	2,838	11,421	608,911
Construction:								
Road and soil stabilization	688	—	688	40,884	682	—	682	41,030
Finishing lime	144	—	144	8,556	125	—	125	10,863
Mason's lime	168	29	197	11,695	162	30	192	13,432
Other construction	15	24	39	2,343	19	15	34	2,199
Total ²	1,014	54	1,067	63,478	989	44	1,034	67,523
Refractory dolomite (dead-burned dolomite)	323	72	395	23,789	269	37	306	19,136
Grand total ²	12,977	4,159	17,137	888,081	9,882	2,920	12,802	698,112
1983								
	Sold	Used	Total ²	Value		Used	Total ²	Value
Agriculture	55	—	55	3,246	72	—	72	4,848
Chemical and industrial:								
Acid water, mine or plant	W	W	243	14,365	W	W	245	14,507
Alkalies	W	W	508	26,852	W	W	587	31,657
Aluminum and bauxite	W	W	184	11,423	142	—	142	8,261
Copper ore concentration	W	W	354	19,529	W	W	333	18,288
Glass	142	—	142	6,947	116	—	116	6,172
Magnesia from seawater or brine	W	W	505	27,084	W	W	512	27,586
Ore concentration, other	73	—	73	3,963	64	—	64	3,606
Paper and pulp	W	W	831	44,619	W	W	1,030	53,811
Sewage treatment	W	W	524	31,847	W	W	607	36,901
Steel, basic oxygen furnace	3,140	755	3,895	193,552	3,260	723	3,983	202,015
Steel, electric	W	W	733	38,937	W	W	843	44,167
Steel, open-hearth	W	W	265	13,265	W	W	232	11,043
Sugar refining	39	474	513	38,320	40	520	560	41,869
Sulfur removal from stack gases	924	—	924	50,817	1,100	—	1,100	56,371
Water purification	W	W	1,350	76,932	W	W	1,271	71,978
Other chemical	5,224	1,223	950	60,676	5,485	1,260	1,087	67,501
Total ²	9,542	2,452	11,994	659,128	10,208	2,503	12,711	695,733
Construction:								
Road and soil stabilization	732	—	732	46,044	772	—	772	47,124
Finishing lime	145	—	145	13,243	214	—	214	20,424
Mason's lime	W	W	198	14,166	W	W	213	14,894
Other construction	15	—	15	1,216	51	—	51	3,299
Total ²	W	W	1,090	74,668	W	W	1,251	85,741
Refractory dolomite (dead-burned dolomite)	W	W	379	24,454	W	W	442	29,391
Grand total ²	10,993	2,526	13,519	761,496	11,883	2,592	14,475	815,714

See footnotes at end of table.

Table 4.—Lime sold or used by producers in the United States, by major use¹—Continued
(Thousand metric tons and thousand dollars)

Major use	1985				1986			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	75	—	75	5,524	46	(³)	46	3,169
Chemical and Industrial:								
Acid water, mine or plant	W	W	257	14,098	W	W	259	14,715
Alkalies	W	W	585	32,121	W	W	107	7,015
Aluminum and bauxite	102	—	102	5,600	158	—	158	7,752
Copper ore concentration	W	W	279	15,282	W	W	304	13,978
Glass	118	—	118	6,463	129	—	129	7,020
Magnesia from seawater or brine	W	W	370	10,673	W	W	361	19,574
Ore concentration, other	74	—	74	4,106	118	—	118	6,155
Paper and pulp	W	W	1,009	55,354	W	W	1,087	58,331
Sewage treatment	W	W	769	42,491	W	W	490	29,567
Steel, basic oxygen furnace	3,056	729	3,786	207,795	2,556	783	3,338	175,332
Steel, electric	W	W	857	47,057	W	W	801	41,527
Steel, open-hearth	W	W	229	12,534	W	W	111	5,939
Sugar refining	38	466	505	27,778	62	563	625	42,667
Sulfur removal from stack gases	1,195	—	1,195	65,587	1,217	—	1,217	69,947
Water purification	W	W	1,369	75,273	W	W	1,461	83,003
Other chemical	5,808	996	1,080	69,447	5,180	691	892	55,231
Total ²	10,391	2,192	12,583	691,660	9,419	2,038	11,457	637,753
Construction:								
Road and soil stabilization	784	—	784	56,712	815	—	815	52,499
Finishing lime	185	—	185	13,403	200	—	200	20,899
Mason's lime	W	W	235	18,987	W	W	194	15,610
Other construction	48	—	48	3,509	55	—	55	3,440
Total ²	W	W	1,253	90,611	W	W	1,265	92,448
Refractory dolomite (dead-burned dolomite)	W	W	343	24,454	W	W	385	27,788
Grand total ²	11,901	2,353	14,255	812,249	10,996	2,156	13,152	761,158
	1987				1988			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	81	—	81	6,877	45	—	45	2,956
Chemical and Industrial:								
Acid water, mine or plant	W	W	310	16,294	361	—	361	18,788
Alkalies	W	W	107	7,790	W	W	92	5,370
Aluminum and bauxite	W	—	W	W	155	—	155	7,617
Copper ore concentration	W	W	614	20,340	W	W	619	28,988
Glass	117	—	117	6,221	119	—	119	6,420
Magnesia from seawater or brine	W	W	W	20,083	W	W	437	22,190
Ore concentration, other	128	—	128	6,906	330	—	330	17,377
Paper and pulp	972	—	972	49,385	W	W	1,143	59,781
Sewage treatment	W	W	450	25,501	385	1	385	21,965
Steel, basic oxygen furnace	W	W	3,705	189,733	W	W	3,846	182,911
Steel, electric	W	W	689	35,242	860	—	860	44,534
Steel, open-hearth	W	W	132	6,733	45	—	45	2,190
Sugar refining	23	580	602	41,399	34	589	622	31,254
Sulfur removal from stack gases	W	W	1,307	68,052	1,189	—	1,189	67,046
Water purification	W	W	1,080	59,583	957	—	957	49,571
Other chemical	9,285	1,688	2,579	129,180	6,916	1,350	2,131	120,913
Total ²	10,522	2,269	12,792	682,442	11,491	1,940	13,431	686,915
Construction:								
Road and soil stabilization	679	—	679	37,565	754	—	754	40,265
Finishing lime	184	—	184	20,121	166	—	166	17,479
Mason's lime	W	W	176	13,874	W	W	145	16,842
Other construction	123	—	123	7,037	409	—	272	11,982

See footnotes at end of table.

Table 4.—Lime sold or used by producers in the United States, by major use¹—Continued
(Thousand metric tons and thousand dollars)

Major use	1987				1988			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Total ²	W	W	1,163	78,598	W	W	1,337	86,568
Refractory dolomite (dead-burned dolomite)	W	W	259	21,766	W	W	679	45,256
Grand total ²	11,910	2,384	14,295	789,683	13,390	2,102	15,492	821,695
	1989				1990			
	Sold	Used	Total ²	Value	Sold	Used	Total ²	Value
Agriculture	51	—	51	3,077	44	—	44	2,898
Chemical and industrial:								
Acid water, mine or plant	228	—	228	11,332	259	—	259	16,120
Alkalies	W	W	149	8,452	W	W	96	5,170
Aluminum and bauxite	153	—	153	8,383	141	—	141	8,122
Copper ore concentration	W	W	380	18,821	W	W	338	17,540
Glass	118	—	118	6,418	90	—	90	5,022
Magnesia from seawater or brine	W	W	586	32,214	W	W	592	31,987
Ore concentration, other	W	—	W	W	300	—	300	15,940
Paper and pulp	W	W	1,069	56,997	W	W	1,148	64,901
Sewage treatment	413	—	413	21,365	424	—	424	22,014
Steel, basic oxygen furnace	W	W	3,675	187,567	W	W	3,660	193,254
Steel, electric	W	W	926	48,654	W	W	884	50,698
Steel, open-hearth	58 ³	—	58	2,877	111	—	111	5,856
Sugar refining	36	582	619	34,214	27	569	596	35,596
Sulfur removal from stack gases	1,347	—	1,347	70,792	1,518	—	1,518	89,694
Water purification	934	—	934	49,134	973	—	973	50,271
Other chemical	8,721	1,218	3,309	185,359	8,732	1,078	3,092	181,912
Total ²	12,008	1,801	13,963	742,579	12,573	1,647	14,219	794,099
Construction:								
Road and soil stabilization	605	—	606	33,999	610	—	610	36,188
Finishing lime	188	—	188	22,372	145	—	145	14,708
Mason's lime	W	W	101	8,320	W	W	230	17,932
Other construction	403	—	310	16,667	454	—	268	12,217
Total ²	W	W	1,204	81,358	W	W	1,253	81,046
Refractory dolomite (dead-burned dolomite)	W	W	365	28,899	W	W	342	26,988
Grand total ²	13,646	1,937	15,584	855,913	14,040	1,818	15,859	905,032

W Withheld to avoid disclosing company proprietary data.

¹Excludes regenerated lime. Includes Puerto Rico.

²Data may not add to totals shown because of independent rounding.

³Less than 1/2 unit.

Page Intentionally Left Blank

MAGNESIUM

By Deborah A. Kramer

Magnesium is the eighth most abundant element in the Earth's crust and the third most plentiful element dissolved in seawater. Magnesium and magnesium compounds are recovered from seawater, well and lake brines, and bitterns, as well as from minerals such as magnesite, dolomite, and olivine.

The United States has been the world's largest producer of metallic magnesium since World War II, and, in most years since then, it has been a net exporter of magnesium. Magnesium's principal use is as an alloying addition to aluminum, and these aluminum-magnesium alloys are used in products such as beverage cans, automobiles, aircraft, and machinery. Magnesium alloys also are used as structural components of automobiles and machinery. In recent years, magnesium has become an important material used for desulfurization of iron and steel.

Aluminum beverage cans have become a significant component in the supply-demand relationship for magnesium. In the mid-1970's, aluminum alloys began to be used in substantial quantities for beverage cans, and they have garnered nearly 100% of the beverage can market. This had a marked impact on magnesium consumption because aluminum cans contain about 2.5% magnesium. The advent of the aluminum can also had a significant

impact on secondary magnesium. As aluminum cans were recycled by the consumer, some of the magnesium content also was recycled; consequently, recycled magnesium has become an essential portion of U.S. supply.

Magnesium compounds, primarily magnesium oxide, are used mainly as a refractory material in furnace linings for producing iron and steel, nonferrous metals, glass, and cement. Magnesium oxide and other compounds also are used in agricultural, chemical, and construction industries. Because on average about 75% of the magnesium compounds in the United States is used as refractories, overall production and demand for magnesium compounds are influenced heavily by trends in the consuming industries, particularly the iron and steel industry. The change from open-hearth to electric arc and basic oxygen steelmaking furnaces created a demand for higher quality refractories, and the actual tonnage of refractories consumed per ton of steel produced declined. At the same time, production of steel throughout the world declined, also reducing the need for refractory furnace lining replacement. These two factors contributed to a decline in the production of magnesium compounds in the United States. Also in the mid-1980's, less costly imports supplied a more significant portion of U.S. demand for magnesium compounds, replacing a portion of U.S. production.

Table 1.—U.S. historical salient magnesium statistics
(Thousand metric tons)

Year	Primary production	New scrap	Old scrap	Imports	Exports	Government stockpile releases	Stocks, yearend	Apparent consumption	Net import reliance as a percent of apparent consumption
1954 ..	63	5	3	1	3	—	21	58	(¹)
1955 ..	55	5	4	2	8	—	27	47	(¹)
1956 ..	62	5	5	1	4	—	30	61	(¹)
1957 ..	74	5	5	1	1	—	63	46	(¹)
1958 ..	27	4	4	1	1	—	53	41	24
1959 ..	28	5	4	1	2	—	37	47	32
1960 ..	36	5	4	(²)	5	—	24	48	17
1961 ..	37	3	4	1	6	—	8	52	21
1962 ..	63	6	3	2	6	(²)	9	61	(¹)
1963 ..	69	6	2	2	15	3	17	53	(¹)
1964 ..	72	7	4	2	15	4	20	64	(¹)
1965 ..	74	9	3	3	17	2	14	71	(¹)
1966 ..	72	10	4	4	14	21	10	91	16
1967 ..	88	8	4	9	12	—	12	87	(¹)
1968 ..	89	11	3	4	18	3	9	84	(¹)
1969 ..	91	10	3	4	25	24	11	95	1
1970 ..	102	8	3	3	32	13	12	88	(¹)
1971 ..	112	10	3	3	22	1	13	96	(¹)

See footnotes at end of table.

Table 1.—U.S. historical salient magnesium statistics—Continued
(Thousand metric tons)

Year	Primary production	New scrap	Old scrap	Imports	Exports	Government stockpile releases	Stocks, yearend	Apparent consumption	Net import reliance as a percent of apparent consumption
1972 ..	110	11	3	4	16	7	21	100	(¹)
1973 ..	111	12	4	3	36	60	17	146	21
1974 ..	W	8	5	5	42	19	W	92	(¹)
1975 ..	³ 109	16	9	7	30	—	36	60	(¹)
1976 ..	³ 109	17	10	14	12	(²)	51	105	(¹)
1977 ..	³ 114	18	11	5	25	—	47	109	(¹)
1978 ..	³ 136	20	13	6	38	—	46	118	(¹)
1979 ..	³ 147	21	13	4	49	—	40	121	(¹)
1980 ..	³ 154	21	16	3	51	—	45	117	(¹)
1981 ..	140	20	22	6	32	—	57	124	(¹)
1982 ..	93	18	21	4	36	—	43	96	(¹)
1983 ..	105	20	22	6	42	—	25	109	(¹)
1984 ..	144	20	24	9	44	—	31	127	(¹)
1985 ..	136	18	24	8	37	—	39	123	(¹)
1986 ..	126	19	23	8	40	—	39	117	(¹)
1987 ..	124	22	23	11	44	—	28	125	(¹)
1988 ..	142	23	28	14	50	—	25	137	(¹)
1989 ..	152	23	28	12	57	—	26	134	(¹)
1990 ..	139	23	31	27	52	—	26	145	(¹)

W Withheld to avoid disclosing company proprietary data.

¹Net exporter.

²Less than 1/2 unit.

³Derived from production reported by the International Magnesium Association and the Canadian Department of Energy, Mines and Resources.

Table 2.—Magnesium recovered from scrap processed in the United States, by kind of scrap and form of recovery
(Metric tons)

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
KIND OF SCRAP										
New scrap:										
Magnesium-base	3,381	2,295	3,579	2,998	3,368	2,811	3,048	2,068	2,788	2,884
Aluminum-base	1,487	1,552	1,766	1,535	1,797	1,879	2,029	1,500	1,910	2,563
Total	4,868	3,847	5,345	4,533	5,165	4,690	5,077	3,568	4,698	5,447
Old scrap:										
Magnesium-base	4,868	5,914	4,893	2,433	3,561	4,230	3,946	3,770	3,749	3,230
Aluminum-base	720	651	585	518	569	632	645	561	706	711
Total	5,588	6,565	5,478	2,951	4,130	4,862	4,591	4,331	4,455	3,941
Grand total	10,456	10,412	10,823	7,484	9,295	9,552	9,668	7,899	9,153	9,388
FORM OF RECOVERY										
Magnesium alloy ingot ¹	5,136	5,816	6,087	3,249	3,032	3,694	3,810	2,700	3,521	3,473
Magnesium alloy castings	1,519	650	396	262	232	187	68	71	199	94
Magnesium alloy shapes	23	1	3	3	4	5	—	3	2	3
Aluminum alloys	3,078	2,741	2,824	2,360	2,700	2,892	3,069	2,450	3,181	2,910
Zinc and other alloys	50	36	4	7	43	77	20	27	19	49
Chemical and other dissipative uses ..	92	13	78	2	1	10	26	48	544	231
Cathodic protection	558	1,155	1,431	1,601	3,283	2,687	2,675	2,600	1,687	2,628
Total	10,456	10,412	10,823	7,484	9,295	9,552	9,668	7,899	9,153	9,388
KIND OF SCRAP										
New scrap:										
Magnesium-base	1,728	4,263	3,795	4,087	5,720	5,862	4,592	6,356	4,325	4,140
Aluminum-base	1,361	1,606	2,584	2,882	3,305	3,744	3,870	4,581	5,182	4,262
Total	3,089	5,869	6,379	6,969	9,025	9,606	8,462	10,937	9,507	8,402

See footnotes at end of table.

Table 2—Magnesium recovered from scrap processed in the United States, by kind of scrap and form of recovery—Continued
(Metric tons)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Old scrap:										
Magnesium-base	3,865	2,377	1,043	2,720	2,025	3,013	2,697	1,917	1,542	1,377
Aluminum-base	417	472	947	1,007	1,303	1,106	1,037	1,230	1,171	1,145
Total	4,282	2,849	1,990	3,727	3,328	4,119	3,734	3,147	2,713	2,522
Grand total	7,371	8,718	8,369	10,696	12,353	13,725	12,196	14,084	12,220	10,924
FORM OF RECOVERY										
Magnesium alloy ingot ¹	989	1,007	2,020	2,608	1,939	4,719	3,411	2,270	2,931	1,820
Magnesium alloy castings	327	590	366	34	13	24	35	14	10	12
Magnesium alloy shapes	317	177	68	45	53	64	93	74	135	171
Aluminum alloys	1,733	1,678	3,483	4,053	7,209	5,746	5,586	8,981	7,600	6,430
Zinc and other alloys	993	508	395	21	21	15	16	16	12	22
Chemical and other dissipative uses ..	1,225	236	684	534	492	255	23	58	59	72
Cathodic protection	1,787	4,522	1,353	3,401	2,626	2,902	3,032	2,671	1,473	2,397
Total	7,371	8,718	8,369	10,696	12,353	13,725	12,196	14,084	12,220	10,924
KIND OF SCRAP										
1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
New scrap:										
Magnesium-base	6,098	6,344	6,729	3,045	3,698	2,574	3,051	4,204	4,559	5,379
Aluminum-base	4,389	5,122	5,550	5,260	12,713	14,684	15,247	15,877	16,615	15,402
Total	10,487	11,466	12,279	8,305	16,411	17,258	18,298	20,081	21,174	20,781
Old scrap:										
Magnesium-base	1,559	1,311	2,294	3,775	4,421	4,990	4,767	5,009	4,334	4,785
Aluminum-base	1,292	1,400	1,426	1,413	4,454	5,469	6,595	7,775	8,259	11,140
Total	2,851	2,711	3,720	5,188	8,875	10,459	11,362	12,784	12,593	15,925
Grand total	13,338	14,177	15,999	13,493	25,286	27,717	29,660	32,865	33,767	36,706
FORM OF RECOVERY										
Magnesium alloy ingot ¹	3,543	3,277	2,364	2,452	2,567	3,238	3,434	3,875	3,392	3,815
Magnesium alloy castings	13	8	11	13	680	758	779	867	717	758
Magnesium alloy shapes	453	249	153	4	1,145	304	846	1,732	1,974	2,852
Aluminum alloys	6,734	7,974	8,352	8,451	18,441	21,405	22,871	24,767	26,178	26,864
Zinc and other alloys	15	13	28	14	11	14	19	17	12	12
Chemical and other dissipative uses ..	434	720	514	40	40	25	39	44	43	8
Cathodic protection	2,146	1,936	4,577	2,519	2,432	1,973	1,672	1,563	1,451	2,397
Total	13,338	14,177	15,999	13,493	25,316	27,717	29,660	32,865	33,767	36,706
KIND OF SCRAP										
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
New scrap:										
Magnesium-base	2,570	2,227	2,606	2,896	1,510	991	845	2,641	3,951	3,992
Aluminum-base	17,454	15,736	16,981	16,694	16,252	17,822	20,867	19,926	19,278	19,464
Total	20,024	17,963	19,587	19,590	17,762	18,813	21,712	22,567	23,229	23,456
Old scrap:										
Magnesium-base	5,074	4,821	4,818	4,746	4,630	3,958	3,857	3,882	4,269	4,277
Aluminum-base	16,865	16,435	17,624	19,533	18,906	19,036	19,595	23,758	23,702	26,796
Total	21,939	21,256	22,442	24,279	23,536	22,994	23,452	27,640	27,971	31,073
Grand total	41,963	39,219	42,029	43,869	41,298	41,807	45,164	50,207	51,200	54,529
FORM OF RECOVERY										
Magnesium alloy ingot ¹	3,838	3,835	3,839	3,837	3,838	3,925	4,001	3,930	4,494	4,290
Magnesium alloy castings	731	677	864	889	438	551	447	438	795	857
Magnesium alloy shapes	12	—	—	—	—	31	—	1,065	635	301
Aluminum alloys	35,158	33,191	35,789	37,260	35,797	37,293	40,711	43,827	43,125	46,528
Zinc and other alloys	8	10	18	11	8	3	W	W	W	W
Chemical and other dissipative uses ..	50	3	4	8	3	W	W	943	W	W
Cathodic protection	2,166	1,503	1,515	1,864	1,214	W	—	W	W	W
Total	41,963	39,219	42,029	43,869	41,298	41,807	45,164	50,207	51,200	54,529

W Withheld to avoid disclosing company proprietary data; included in "FORM OF RECOVERY: Total."

¹Includes secondary magnesium content of both secondary and primary alloy ingot.

Table 3.—U.S. consumption of primary magnesium, by use
(Metric tons)

Use	1944	1945	1946	1947	1948	1949	1950	1951
For structural products:								
Castings:								
Die	1,057	728	309	165	193	115	220	902
Permanent mold	53,688	7,536	34	8	11	40	520	586
Sand	40,617	16,697	835	809	1,751	2,801	2,803	9,234
Wrought products:								
Extrusions	4,340	2,225	2,440	1,469	2,294	3,052	3,085	3,683
Sheet and plate	1,400	1,376	1,805	955	1,144	1,955	3,045	4,525
Other ¹	312	142	90	95	94	182	94	667
Total	101,414	28,704	5,513	3,501	5,487	8,145	9,767	19,597
For distributive or sacrificial purposes:								
Alloys:								
Aluminum	6,231	5,070	2,170	1,756	1,970	1,596	3,377	5,437
Other	11	22	37	36	39	35	231	364
Cathodic protection (anodes)	(²)	(²)	(²)	85	349	213	1,757	2,145
Chemicals	142	165	136	241	369	203	339	406
Iron and steel desulfurization	—	—	—	—	—	—	—	—
Nodular iron	—	—	—	—	—	—	(²)	(²)
Reducing agent for titanium, zirconium, hafnium, uranium, and beryllium	NA	NA	NA	(²)	NA	(²)	(²)	(²)
Other	³ 12,584	³ 5,943	1,101	³ 612	³ 584	³ 646	⁴ 905	⁴ 2,674
Total	18,968	11,200	3,444	2,730	3,311	2,693	6,609	11,026
Grand total	120,382	39,904	8,957	6,231	8,798	10,838	16,376	30,623
	1952	1953	1954	1955	1956	1957	1958	1959
For structural products:								
Castings:								
Die	2,519	2,178	1,581	2,376	1,701	1,496	1,409	1,608
Permanent mold	1,012	1,003	712	795	938	518	806	890
Sand	13,166	12,978	8,659	6,234	5,877	5,512	5,169	4,327
Wrought products:								
Extrusions	2,463	4,304	2,751	3,725	4,986	4,460	2,380	2,789
Sheet and plate	4,672	4,938	2,233	5,828	5,645	4,609	3,684	5,559
Other ¹	11	22	100	279	429	6	128	1,735
Total	23,843	25,423	16,036	19,237	19,576	16,601	13,576	16,908
For distributive or sacrificial purposes:								
Alloys:								
Aluminum	7,800	9,387	7,313	10,074	12,087	10,193	9,749	13,408
Other	871	379	93	330	89	533	405	762
Cathodic protection (anodes)	1,905	2,303	4,971	3,575	2,754	2,719	1,840	2,726
Chemicals	513	329	57	112	57	295	134	319
Iron and steel desulfurization	—	—	—	—	—	—	—	—
Nodular iron	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Reducing agent for titanium, zirconium, hafnium, uranium, and beryllium	(²)	(²)	5,793	7,308	12,068	8,795	5,400	2,880
Other	⁴ 3,521	⁴ 4,674	⁴ 1,315	⁴ 1,515	⁴ 2,003	⁴ 1,181	⁴ 966	⁴ 691
Total	14,610	17,072	19,542	22,914	29,058	23,716	18,494	20,786
Grand total	38,453	42,495	35,578	42,151	48,634	40,317	32,070	37,694
	1960	1961	1962	1963	1964	1965	1966	1967
For structural products:								
Castings:								
Die	1,386	1,205	3,320	5,062	4,316	5,079	4,518	7,590
Permanent mold	676	421	817	1,270	664	738	573	503
Sand	2,323	2,184	3,143	2,976	2,022	2,684	3,593	3,491

See footnotes at end of table.

Table 3.—U.S. consumption of primary magnesium, by use—Continued
(Metric tons)

Use	1960	1961	1962	1963	1964	1965	1966	1967
For structural products—Continued								
Wrought products:								
Extrusions	2,341	3,620	5,661	3,057	4,009	5,439	6,441	9,541
Sheet and plate	3,730	4,022	5,763	5,126	4,442	4,479	5,511	(⁶)
Other ¹	810	696	376	199	266	—	—	—
Total	11,266	12,148	19,080	17,690	15,719	18,419	20,636	21,125
For distributive or sacrificial purposes:								
Alloys:								
Aluminum	11,350	17,921	16,697	19,758	19,849	23,828	27,998	28,344
Other	382	947	904	1,352	1,637	2,134	1,882	2,198
Cathodic protection (anodes)	2,961	2,183	1,836	2,708	4,520	4,170	4,236	4,404
Chemicals	250	269	390	426	2,435	3,453	4,177	4,730
Iron and steel desulfurization	—	—	—	—	—	—	—	—
Nodular iron	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	6,330	7,212	2,579	2,785	3,415	7,681	7,647	6,082
Other	⁴ 1,117	⁶ 627	⁴ 1,442	⁴ 1,765	⁴ 2,092	³ 3,475	⁴ 8,642	⁴ 15,512
Total	22,390	29,159	23,848	28,794	33,948	44,741	54,582	61,270
Grand total	33,656	41,307	42,928	46,484	49,667	63,160	75,218	82,395
	1968	1969	1970	1971	1972	1973	1974	1975
For structural products:								
Castings:								
Die	6,656	6,789	8,166	6,776	8,460	9,071	10,708	5,799
Permanent mold	551	367	236	129	668	736	907	1,038
Sand	3,393	2,324	1,574	694	635	1,203	1,245	1,771
Wrought products:								
Extrusions	10,233	11,893	11,113	5,068	7,030	6,746	6,643	5,638
Sheet and plate	(⁵)	(⁵)	(⁵)	2,647	3,463	(⁵)	(⁵)	(⁵)
Other ¹	(⁵)	(⁵)	(⁵)	2,007	1,253	5,016	5,466	3,130
Total	20,833	21,373	21,089	17,321	21,509	22,772	24,969	17,376
For distributive or sacrificial purposes:								
Alloys:								
Aluminum	31,283	33,906	33,151	33,974	39,424	47,131	56,383	42,339
Other	47	48	32	203	158	496	54	35
Cathodic protection (anodes)	5,183	5,522	5,242	6,619	5,936	9,009	9,470	4,266
Chemicals	(³)	(³)	7,607	8,129	8,829	8,922	8,350	7,875
Iron and steel desulfurization	—	—	—	—	—	—	—	—
Nodular iron	2,250	2,154	4,282	5,978	6,897	7,914	9,619	6,146
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	5,633	6,680	5,715	8,213	5,524	6,683	6,867	6,357
Other	⁷ 13,176	⁷ 16,619	⁷ 7,699	⁷ 3,175	⁷ 5,790	⁷ 2,101	⁷ 2,266	⁷ 1,033
Total	57,572	64,929	63,728	66,291	72,558	82,256	93,009	68,051
Grand total	78,405	86,302	84,817	83,612	94,067	105,028	117,978	85,427
	1976	1977	1978	1979	1980	1981	1982	1983
For structural products:								
Castings:								
Die	4,317	4,546	5,058	4,701	2,894	2,551	1,452	1,757
Permanent mold	961	951	918	970	836	832	601	15
Sand	1,119	1,036	965	1,097	1,574	1,109	1,213	1,259
Wrought products:								
Extrusions	5,850	(⁵)	5,716	5,824	6,219	5,249	6,404	6,435
Sheet and plate	(⁵)	(⁵)	3,969	4,467	4,268	4,125	(⁵)	(⁵)
Other ¹	3,440	11,460	362	197	55	39	2,784	3,939
Total	15,687	17,993	16,988	17,256	15,846	13,905	12,454	13,405

See footnotes at end of table.

Table 3.—U.S. consumption of primary magnesium, by use—Continued
(Metric tons)

Use	1976	1977	1978	1979	1980	1981	1982	1983
For distributive or sacrificial purposes:								
Alloys:								
Aluminum	49,278	50,880	53,341	54,929	49,433	45,829	36,177	41,754
Other	48	37	37	29	22	19	12	6
Cathodic protection (anodes)	7,084	3,704	5,987	6,141	3,565	5,850	5,410	5,158
Chemicals	9,199	9,018	8,339	8,205	5,695	4,822	4,375	5,138
Iron and steel desulfurization	—	—	—	—	—	—	—	—
Nodular iron	6,880	6,620	7,217	3,933	3,788	3,406	2,305	1,996
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	5,430	4,749	5,652	6,745	7,218	8,229	5,353	4,274
Other	⁷ 1,152	⁷ 962	⁷ 1,284	⁷ 1,504	⁷ 1,330	⁷ 912	⁷ 1,589	⁷ 2,636
Total	79,071	75,970	81,857	81,486	71,051	69,067	55,221	60,962
Grand total	94,758	93,963	98,845	98,742	86,897	82,972	67,675	74,367
	1984	1985	1986	1987	1988	1989	1990	
For structural products:								
Castings:								
Die	540	2,229	3,646	3,710	4,383	5,627	7,479	
Permanent mold	1,511	825	748	1,121	943	811	875	
Sand	1,753	1,482	1,373	1,454	1,743	1,017	724	
Wrought products:								
Extrusions	5,287	7,036	6,285	6,804	6,907	6,712	7,848	
Sheet and plate	(⁹)	(⁹)	(⁹)	(⁹)	(⁹)	(⁹)	(⁹)	
Other ¹	4,008	3,804	1,452	1,496	3,231	2,941	3,096	
Total	13,099	15,376	13,504	14,585	17,207	17,108	20,022	
For distributive or sacrificial purposes:								
Alloys:								
Aluminum	44,155	37,059	39,290	52,172	53,671	53,821	45,060	
Other	7	7	5	8	7	9	8	
Cathodic protection (anodes)	4,334	4,307	6,342	5,537	6,234	5,474	5,421	
Chemicals	4,990	3,469	1,449	1,047	780	594	800	
Iron and steel desulfurization	⁶ 7,500	⁶ 8,000	⁶ 9,000	⁶ 10,000	W	10,463	9,853	
Nodular iron	2,185	1,540	1,622	1,811	2,037	1,635	1,424	
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	6,068	7,372	5,235	5,286	8,467	10,798	8,989	
Other	⁷ 6,706	⁷ 6,622	⁷ 2,514	⁷ 4,174	⁷ 12,390	⁷ 5,324	⁷ 4,531	
Total	75,945	68,376	65,457	80,035	83,586	88,118	76,086	
Grand total	89,044	83,752	78,961	94,620	100,793	105,226	96,108	

⁶Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data; included in other distributive or sacrificial purposes.

¹Prior to 1965, forgings only.

²Included in other distributive or sacrificial purposes.

³Includes primary metal consumed in making secondary alloy, powder, and scavenger and deoxidizer.

⁴Includes primary metal consumed for experiment purposes, debismuthizing lead, production of nodular iron and secondary alloy, powder, scavenger, and deoxidizer.

⁵Included with "Extrusions."

⁶Included in other structural products.

⁷Includes magnesium used for powder, scavenger and deoxidizer, and experimental purposes.

Table 4.—U.S. exports and imports for consumption of magnesium¹
(Metric tons and thousand dollars)

	1919 ²		1920		1921		1922		1923		1924	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Imports for consumption	6	14	13	25	18	31	83	54	6	12	4	7
	1925		1926		1927		1928		1929		1930	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	NA	NA	NA	NA	NA	NA	^c 2	NA	^c 52	NA	^c 38	NA
Imports for consumption	4	7	5	5	3	8	5	12	2	7	3	20
	1931		1932		1933		1934		1935		1936	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	^c 58	NA	^c 77	NA	^c 199	NA	^c 291	NA	^c 953	NA	^c 390	NA
Imports for consumption	1	3	(^b)	1	(^b)	1	(^b)	1	(^b)	1	1	1
	1937		1938		1939		1940		1941		1942	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	^c 276	NA	^c 1,132	NA	^c 2,015	NA	779	583	1,405	860	3,670	2,111
Imports for consumption	1	1	(^b)	(^b)	(^b)	(^b)	—	—	—	—	1	1
	1943		1944		1945		1946		1947		1948	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	36,678	18,958	21,952	13,088	1,250	1,089	278	140	322	220	403	272
Imports for consumption	(^b)	(^b)	55	55	52	17	219	112	183	99	615	185
	1949		1950		1951		1952		1953		1954	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	642	399	824	459	690	537	1,094	923	2,694	2,531	2,986	2,417
Imports for consumption	2,322	537	787	261	3,610	1,218	272	172	2,224	913	673	382
	1955		1956		1957		1958		1959		1960	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	7,693	5,105	3,566	3,240	1,448	1,929	954	1,296	2,167	2,059	4,656	3,719
Imports for consumption	1,685	1,111	595	515	930	780	510	416	585	579	393	551
	1961		1962		1963		1964		1965		1966	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	6,061	4,597	6,387	4,712	14,703	9,874	15,258	10,231	16,620	11,525	14,014	10,240
Imports for consumption	944	734	2,220	1,269	2,135	1,505	2,487	1,670	2,704	1,989	3,592	3,305
	1967		1968		1969		1970		1971		1972	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	11,950	9,115	17,651	13,049	24,831	17,961	32,416	22,542	22,055	15,692	15,927	11,702
Imports for consumption	8,819	6,871	4,362	4,256	3,915	4,256	2,989	2,503	3,330	2,316	4,063	2,557
	1973		1974		1975		1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	35,911	28,242	42,092	48,511	29,566	48,191	12,196	26,902	25,457	51,848	37,927	75,787
Imports for consumption	3,016	2,670	4,813	5,226	7,169	11,547	13,523	22,662	5,410	7,976	6,049	10,078

See footnotes at end of table.

Table 4.—U.S. exports and imports for consumption of magnesium¹—Continued
(Metric tons and thousand dollars)

	1979		1980		1981		1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	49,242	113,828	51,493	127,706	31,620	90,853	35,936	104,845	42,356	124,714	43,851	136,661
Imports for consumption	4,313	9,042	3,408	8,261	6,257	17,638	4,340	15,603	5,761	16,264	8,510	25,671
	1985		1986		1987		1988		1989		1990	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports	36,580	113,600	39,909	122,378	44,182	130,730	49,802	145,312	56,631	170,374	51,834	164,413
Imports for consumption	8,411	25,087	8,355	24,574	10,851	30,964	14,407	39,257	12,289	37,859	26,755	80,308

¹Estimated. NA Not available.

²Owing to changes in items included in each classification, data are not strictly comparable over the years.

³Exports and imports not separately recorded prior to 1919.

⁴Less than 1/2 unit.

Source: Bureau of the Census.

Table 5.—Yearend primary magnesium prices
(Dollars per pound)

Year	Yearend price	Year	Yearend price	Year	Yearend price
1915	5.03	1941	0.23	1966	0.3625
1916	4.13	1942	.23	1967	.3625
1917	2.02	1943	.21	1968	.3625
1918	¹ 1.81	1944	.21	1969	.3625
1919	1.83	1945	.21	1970	.3625
1920	1.60	1946	.21	1971	.3625
1921	1.60	1947	.21	1972	.3725
1922	1.60	1948	.21	1973	.3825
1923	1.25	1949	.21	1974	.7500
1924	1.07	1950	.25	1975	.8200
1925	.86	1951	.25	1976	.9200
1926	.80	1952	.27	1977	.9900
1927	.68	1953	.2700	1978	1.0100
1928	.55	1954	.2800	1979	1.0900
1929	.57	1955	.3250	1980	1.2500
1930	.48	1956	.3525	1981	1.3400
1931	.30	1957	.3625	1982	1.3400
1932	.29	1958	.3625	1983	1.3800
1933	.28	1959	.3625	1984	1.4800
1934	.26	1960	.3625	1985	1.5300
1935	² .26	1961	.3625	1986	1.5300
1936	.26	1962	.3625	1987	1.5300
1937	.30	1963	.3625	1988	1.6300
1938	.30	1964	.3625	1989	1.6300
1939	.30	1965	.3625	1990	1.4300
1940	.27				

¹From 1918-34, 99%-pure magnesium bars.

²From 1935-90, 99.8%-pure magnesium ingot.

Sources: Producers' average selling prices (1915-34), Engineering and Mining Journal (1935-56), and American Metal Market (1957-90).

**Table 6.—Magnesium: World primary production, by country
(Metric tons)**

Country	1986	1987	1988	1989	1990
Brazil	4,356	5,488	5,865	6,200	6,500
Canada ^c	5,100	8,800	7,600	7,200	26,726
China ^c	3,000	3,000	3,200	3,600	5,800
France	13,361	13,601	13,776	14,600	14,600
Italy	12,417	7,626	5,436	5,469	5,700
Japan	8,116	8,180	9,012	8,381	12,843
Norway	56,522	56,907	50,317	49,827	48,222
U.S.S.R. ^c	89,000	90,000	91,000	91,000	88,000
United States	125,639	124,396	141,983	152,066	139,333
Yugoslavia	4,897	5,932	6,176	6,105	5,788
Total	322,408	323,930	334,365	344,448	353,512
U.S. market share of world production (percent)	39	38	42	44	39

^cEstimated.

**Table 7.—Magnesium: World secondary production, by country
(Metric tons)**

Country	1986	1987	1988	1989	1990
Brazil	1,767	1,376	1,519	1,500	^c 1,600
Japan	13,400	10,124	15,099	20,270	23,308
U.S.S.R. ^c	8,000	8,000	8,000	8,000	7,500
United Kingdom ^c	1,000	1,000	1,000	1,000	1,000
United States	41,807	45,165	50,207	51,200	54,529
Total	65,974	65,665	75,825	81,970	87,937

^cEstimated.

**Table 8.—U.S. historical salient magnesium compounds statistics
(Thousand metric tons)**

Year	Production	Imports	Exports	Apparent consumption	Net import reliance as a percent of apparent consumption
1954	570	39	NA	NA	NA
1955	821	58	NA	NA	NA
1956	927	56	NA	NA	NA
1957	936	44	NA	NA	NA
1958	728	45	29	744	2
1959	893	85	47	931	4
1960	873	65	50	888	2
1961	957	31	67	921	(¹)
1962	902	58	39	921	2
1963	1,002	53	42	1,013	1
1964	1,070	38	43	1,065	(¹)
1965	1,108	76	42	1,142	3
1966	1,123	102	44	1,181	5
1967	955	70	39	986	3
1968	943	72	35	980	4
1969	1,007	62	35	1,034	3
1970	933	76	54	955	2
1971	797	77	33	841	5
1972	860	79	33	906	5
1973	871	93	33	931	6
1974	862	90	34	918	6
1975	792	89	50	831	5
1976	839	52	45	846	1
1977	836	45	48	833	(¹)

See footnotes at end of table.

Table 8.—U.S. historical salient magnesium compounds statistics—Continued
(Thousand metric tons)

Year	Production	Imports	Exports	Apparent consumption	Net import reliance as a percent of apparent consumption
1978 ...	871	52	59	864	(¹)
1979 ...	909	54	55	908	(¹)
1980 ...	727	46	59	714	(¹)
1981 ...	690	50	32	708	3
1982 ...	512	39	20	531	4
1983 ...	567	61	15	613	8
1984 ...	574	115	27	662	13
1985 ...	420	134	25	529	21
1986 ...	412	160	25	547	25
1987 ...	464	164	20	608	24
1988 ...	573	198	34	737	22
1989 ...	513	171	26	658	22
1990 ...	499	147	59	587	15

NA Not available.

¹Net exporter.

Table 9.—U.S. magnesium compounds shipped and used¹

	1942		1943		1944		1945	
	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)
Caustic-calcined and specified (USP and technical) magnesias ²	38,001	\$2,028	173,991	\$11,498	126,319	\$6,482	39,254	\$2,504
Magnesium hydroxide [100% Mg(OH) ₂]	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium sulfate (anhydrous and hydrous) ..	18,325	1,030	23,964	1,320	23,192	1,289	24,623	1,377
Magnesium chloride	190,509	7,469	588,339	22,270	479,403	19,961	NA	NA
Precipitated magnesium carbonate ²	59,912	5,597	50,128	4,857	47,865	4,885	45,598	4,824
Refractory magnesia	248,261	7,824	273,409	9,341	252,642	8,426	231,327	7,414
	1946		1947		1948		1949	
	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)
Caustic-calcined and specified (USP and technical) magnesias ²	40,985	\$2,855	24,341	\$2,509	30,127	\$3,381	29,488	\$3,109
Magnesium hydroxide [100% Mg(OH) ₂]	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium sulfate (anhydrous and hydrous) ..	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium chloride	NA	NA	NA	NA	NA	NA	NA	NA
Precipitated magnesium carbonate ²	42,910	4,707	52,422	6,359	54,534	7,719	50,724	7,106
Refractory magnesia	222,101	7,232	285,692	10,128	299,434	13,445	227,149	10,478
	1950		1951		1952		1953	
	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)	Quantity (metric tons)	Value (thou-sands)
Caustic-calcined and specified (USP and technical) magnesias ²	37,600	\$4,137	45,342	\$4,810	34,523	\$3,769	39,027	\$3,991
Magnesium hydroxide [100% Mg(OH) ₂]	NA	NA	NA	NA	NA	NA	3,932	304
Magnesium sulfate (anhydrous and hydrous) ..	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium chloride	NA	NA	NA	NA	NA	NA	NA	NA
Precipitated magnesium carbonate ²	49,480	8,374	54,796	8,456	39,247	6,996	36,993	6,067
Refractory magnesia	304,306	14,916	392,083	18,400	350,966	17,256	362,087	19,061

See footnotes at end of table.

Table 9.—U.S. magnesium compounds shipped and used¹—Continued

	1954		1955		1956		1957	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	29,260	\$2,155	49,923	\$5,688	70,301	\$7,971	73,384	\$6,525
Magnesium hydroxide [100% Mg(OH) ₂]	41,778	2,527	70,291	5,675	81,899	5,905	141,936	11,455
Magnesium sulfate (anhydrous and hydrous)	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium chloride	NA	NA	NA	NA	NA	NA	³ 316,805	³ 16,581
Precipitated magnesium carbonate ²	41,643	11,986	32,715	7,294	29,979	6,499	26,923	6,935
Refractory magnesia	276,500	13,851	379,894	20,305	390,651	22,663	424,312	26,319
	1958		1959		1960		1961	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	60,539	\$6,154	71,021	\$6,230	78,417	\$8,066	96,310	\$9,402
Magnesium hydroxide [100% Mg(OH) ₂]	176,632	5,731	251,785	7,210	285,022	8,044	345,784	10,412
Magnesium sulfate (anhydrous and hydrous)	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium chloride	³ 121,103	³ 7,361	³ 121,997	³ 7,240	³ 147,459	³ 8,888	³ 145,286	³ 9,820
Precipitated magnesium carbonate ²	23,506	4,813	20,256	4,723	16,015	3,714	13,323	3,246
Refractory magnesia	376,368	23,375	469,869	31,458	458,955	30,863	543,376	35,408
	1962		1963		1964		1965	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	96,980	\$9,629	127,500	\$10,698	76,288	\$8,556	81,659	\$9,163
Magnesium hydroxide [100% Mg(OH) ₂]	321,729	10,042	389,830	11,507	37,688	1,740	61,075	2,577
Magnesium sulfate (anhydrous and hydrous)	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium chloride	³ 241,240	³ 18,173	³ 262,488	³ 20,093	277,461	25,025	277,407	25,023
Precipitated magnesium carbonate ²	12,492	3,064	10,873	2,587	6,617	NA	7,456	NA
Refractory magnesia	522,288	35,186	646,582	44,378	⁴ 763,862	49,220	⁴ 813,820	56,100
	1966		1967		1968		1969	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	90,146	\$9,686	103,643	\$11,250	122,896	\$12,226	139,981	\$14,698
Magnesium hydroxide [100% Mg(OH) ₂]	67,705	3,138	59,387	2,688	70,979	2,888	80,402	3,540
Magnesium sulfate (anhydrous and hydrous)	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium chloride	277,119	21,385	347,388	26,396	357,692	27,147	371,647	28,307
Precipitated magnesium carbonate ²	8,534	NA	7,768	NA	7,975	NA	7,076	NA
Refractory magnesia	⁴ 773,039	52,290	⁴ 623,876	43,148	⁴ 599,551	44,535	⁴ 668,812	51,843
	1970		1971		1972		1973	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	111,054	\$19,301	114,961	\$18,621	116,356	\$15,856	143,034	\$26,929
Magnesium hydroxide [100% Mg(OH) ₂]	78,971	3,655	64,742	2,030	60,483	3,606	75,590	4,857
Magnesium sulfate (anhydrous and hydrous)	NA	NA	NA	NA	^c 55,800	^c 4,400	57,163	4,551
Magnesium chloride	465,413	36,002	522,243	35,744	NA	NA	NA	NA
Precipitated magnesium carbonate ²	6,150	NA	4,999	1,251	4,603	1,476	4,569	1,746
Refractory magnesia	⁴ 727,347	60,333	⁴ 568,364	50,359	631,494	60,331	731,689	69,904

See footnotes at end of table.

Table 9.—U.S. magnesium compounds shipped and used¹—Continued

	1974		1975		1976		1977	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	135,014	\$27,916	108,455	\$17,207	121,978	\$28,277	116,887	\$29,574
Magnesium hydroxide [100% Mg(OH) ₂]	84,426	5,584	54,743	5,410	55,392	7,784	84,653	11,879
Magnesium sulfate (anhydrous and hydrous)	5,899	6,281	43,053	6,406	50,796	9,835	51,812	11,953
Magnesium chloride	NA	NA	NA	NA	NA	NA	NA	NA
Precipitated magnesium carbonate ²	5,355	2,161	6,334	1,605	5,021	1,496	3,670	1,020
Refractory magnesia	728,174	77,044	643,624	103,839	696,362	106,522	625,819	94,799
	1978		1979		1980		1981	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	141,695	\$43,008	148,384	\$50,047	142,703	\$51,282	145,210	\$58,420
Magnesium hydroxide [100% Mg(OH) ₂]	462,505	40,520	463,908	47,475	447,538	50,791	376,490	47,922
Magnesium sulfate (anhydrous and hydrous)	47,261	11,885	43,840	10,271	38,898	11,280	30,160	8,120
Magnesium chloride	NA	NA	NA	NA	NA	NA	NA	NA
Precipitated magnesium carbonate ²	3,570	1,131	3,647	1,224	4,667	1,456	3,631	900
Refractory magnesia	721,753	125,082	768,034	125,289	662,704	162,697	558,519	146,903
	1982		1983		1984		1985	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	133,833	\$56,363	129,502	\$57,416	128,488	\$42,257	90,280	\$33,772
Magnesium hydroxide [100% Mg(OH) ₂]	323,920	41,597	326,381	47,231	323,852	41,400	237,916	64,075
Magnesium sulfate (anhydrous and hydrous)	42,206	11,326	34,858	10,769	45,156	13,214	50,678	14,813
Magnesium chloride	NA	NA	NA	NA	NA	NA	NA	NA
Precipitated magnesium carbonate ²	3,629	900	5,446	1,101	4,712	875	3,398	702
Refractory magnesia	411,103	112,101	413,526	98,473	339,542	87,945	263,330	81,149
	1986		1987		1988		1989	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Caustic-calcined and specified (USP and technical) magnesias ²	86,515	\$33,969	102,929	\$27,565	123,905	\$36,500	134,661	\$39,529
Magnesium hydroxide [100% Mg(OH) ₂]	207,670	56,305	238,760	52,578	392,743	76,031	341,933	70,260
Magnesium sulfate (anhydrous and hydrous)	46,534	15,388	55,605	19,447	61,505	19,185	63,432	19,819
Magnesium chloride	NA	NA	NA	NA	NA	NA	NA	NA
Precipitated magnesium carbonate ²	4,418	765	2,566	660	2,877	655	2,332	641
Refractory magnesia	248,958	73,172	295,411	80,760	371,296	103,400	348,316	97,673
	1990							
	Quantity (metric tons)	Value (thou- sands)						
Caustic-calcined and specified (USP and technical) magnesias ²	134,727	\$37,850						
Magnesium hydroxide [100% Mg(OH) ₂]	366,016	69,280						
Magnesium sulfate (anhydrous and hydrous)	55,411	17,366						
Magnesium chloride	NA	NA						
Precipitated magnesium carbonate ²	2,821	703						
Refractory magnesia	335,341	94,962						

^cEstimated. NA Not available.¹Prior to 1964, value data for magnesium chloride, magnesium hydroxide, and precipitated magnesium carbonate used by producer were calculated based on the average value, published for the compound that was shipped.²Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.³Includes magnesium chloride used in production of magnesium metal.⁴Includes both single-burned and double-burned.

Table 10.—U.S. exports and imports for consumption of magnesium compounds
(Metric tons and thousand dollars)

	1950		1951		1952		1953		1954	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesias . . .	NA	NA	NA	NA	NA	2,846	NA	3,785	NA	2,223
Dead-burned magnesias	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Imports for consumption:										
Caustic-calcined magnesias . . .	1,929	87	3,803	171	1,833	74	2,461	106	2,212	92
Dead-burned magnesias	12,809	818	26,113	1,396	22,198	1,162	35,650	2,468	61,881	4,158
Oxide or calcined magnesias . .	—	—	—	—	6	(¹)	—	—	1	(¹)
Magnesium carbonate (precipitated)	212	51	176	60	165	54	230	72	181	60
Magnesium chloride (anhydrous)	7	1	3	(¹)	2	(¹)	289	10	230	8
Magnesium chloride (other) . .	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Magnesium sulfate (epsom salts and kieserite) ³	1,780	45	2,311	59	4,178	114	6,153	167	8,714	227
	1955		1956		1957		1958		1959	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesias . . .	NA	1,884	NA	1,953	NA	1,427	NA	884	NA	667
Dead-burned magnesias	NA	NA	NA	NA	24,639	1,436	48,209	2,838	78,244	5,160
Imports for consumption:										
Caustic-calcined magnesias . . .	3,221	144	7,023	350	5,111	265	2,174	115	4,806	264
Dead-burned magnesias	93,161	6,729	86,077	6,093	68,043	4,033	71,919	5,095	136,352	9,606
Oxide or calcined magnesias . .	103	49	179	59	374	152	322	119	248	71
Magnesium carbonate (precipitated)	256	59	239	64	279	60	296	66	318	94
Magnesium chloride (anhydrous)	200	6	318	9	391	12	621	28	861	28
Magnesium chloride (other) . .	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Magnesium sulfate (epsom salts and kieserite) ³	10,535	260	10,071	256	9,589	249	8,988	238	11,204	302
	1960		1961		1962		1963		1964	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesias . . .	NA	686	NA	535	NA	427	NA	678	NA	1,654
Dead-burned magnesias	83,631	5,988	111,258	7,988	65,196	5,363	70,424	5,620	71,958	5,554
Imports for consumption:										
Caustic-calcined magnesias . . .	3,748	213	4,041	226	7,022	395	9,010	500	8,513	493
Dead-burned magnesias	103,989	7,576	47,182	3,611	88,684	5,520	78,590	4,593	54,518	3,180
Oxide or calcined magnesias . .	241	66	225	61	165	48	84	39	115	50
Magnesium carbonate (precipitated)	314	84	310	74	361	94	565	119	1,009	210
Magnesium chloride (anhydrous)	1,065	54	918	31	1,337	127	606	23	682	24
Magnesium chloride (other) . .	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Magnesium sulfate (epsom salts and kieserite) ³	9,182	241	10,000	231	8,434	210	7,750	186	8,663	212
	1965		1966		1967		1968		1969	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesias . . .	5,227	1,637	6,461	1,627	7,065	2,095	6,517	2,301	7,922	2,687
Dead-burned magnesias	64,999	5,912	66,470	6,208	58,395	5,889	51,852	4,706	50,879	4,973

See footnotes at end of table.

Table 10.—U.S. exports and imports for consumption of magnesium compounds—Continued
(Metric tons and thousand dollars)

	1965		1966		1967		1968		1969	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Imports for consumption:										
Caustic-calcined magnesia . . .	10,796	592	12,066	743	8,318	585	10,694	758	13,824	983
Dead-burned magnesia	115,414	6,599	156,569	10,177	107,464	7,003	108,728	7,731	88,301	6,841
Oxide or calcined magnesia . .	134	47	69	35	58	31	485	183	93	47
Magnesium carbonate (precipitated)	1,134	225	989	213	816	173	1,151	222	758	157
Magnesium chloride (anhydrous)	682	24	160	29	409	81	435	92	334	70
Magnesium chloride (other) . .	(²)	(²)	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium sulfate (epsom salts and kieserite) ³	6,024	127	50,757	651	29,279	404	40,153	605	39,630	617
	1970		1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesia . . .	9,153	3,200	6,396	2,840	6,384	3,377	8,440	4,196	9,737	5,088
Dead-burned magnesia	80,602	9,133	48,487	5,897	49,132	5,903	46,049	6,104	46,509	7,749
Imports for consumption:										
Caustic-calcined magnesia . . .	10,411	702	10,449	736	9,413	675	9,949	734	8,156	692
Dead-burned magnesia	116,295	9,032	117,050	10,014	121,322	9,695	143,539	13,911	141,885	18,455
Oxide or calcined magnesia . .	473	200	570	222	626	256	611	292	324	231
Magnesium carbonate (precipitated)	733	192	125	60	126	73	125	88	106	109
Magnesium chloride (anhydrous)	—	—	24	2	20	1	110	45	280	190
Magnesium chloride (other) . .	748	26	395	15	227	8	273	16	221	12
Magnesium sulfate (epsom salts and kieserite) ³	31,696	617	41,365	378	19,539	378	47,617	962	23,264	702
	1975		1976		1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesia . . .	8,254	4,538	9,182	5,422	10,923	6,336	42,051	7,741	62,029	16,433
Dead-burned magnesia	74,983	14,146	64,749	13,466	69,390	16,477	55,342	10,617	29,969	8,183
Imports for consumption:										
Caustic-calcined magnesia . . .	5,185	502	7,433	808	5,251	566	6,554	793	6,155	1,169
Dead-burned magnesia	141,822	24,668	78,864	14,518	68,605	12,995	79,343	16,131	84,302	18,580
Oxide or calcined magnesia . .	327	148	271	332	381	536	640	795	2,918	1,772
Magnesium carbonate (precipitated)	57	97	73	117	61	117	73	149	86	187
Magnesium chloride (anhydrous)	93	42	197	158	48	26	44	12	24	15
Magnesium chloride (other) . .	45	9	388	108	82	14	195	55	149	73
Magnesium sulfate (epsom salts and kieserite) ³	29,929	1,070	20,991	1,109	32,749	1,388	26,294	1,650	23,541	1,530
	1980		1981		1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesia . . .	46,904	17,692	33,278	14,559	20,979	10,925	15,078	8,426	29,078	14,026
Dead-burned magnesia	50,837	13,279	18,984	4,727	11,675	2,721	9,848	1,955	15,672	3,641
Imports for consumption:										
Caustic-calcined magnesia . . .	11,255	2,122	10,945	2,177	12,663	2,055	28,512	5,476	49,798	9,594
Dead-burned magnesia	65,966	16,830	69,681	23,114	53,995	14,588	72,964	14,340	140,761	26,186
Oxide or calcined magnesia . .	1,332	1,871	1,394	2,419	2,918	3,766	6,101	5,355	5,553	4,918

See footnotes at end of table.

Table 10.—U.S. exports and imports for consumption of magnesium compounds—Continued
(Metric tons and thousand dollars)

	1980		1981		1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Imports for consumption—										
Continued										
Magnesium carbonate (precipitated)	106	211	192	362	157	270	168	235	258	395
Magnesium chloride (anhydrous)	55	20	36	20	24	11	14	11	57	17
Magnesium chloride (other)	322	93	537	161	985	197	1,598	282	2,710	347
Magnesium sulfate (epsom salts and kieserite) ³	27,244	1,674	27,427	1,852	34,115	2,184	35,748	2,539	31,076	2,621
	1985		1986		1987		1988		1989 ⁴	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports:										
Caustic-calcined magnesia	19,565	9,773	20,685	13,295	20,317	14,167	21,049	13,322	20,218	11,476
Dead-burned magnesia	22,503	5,529	21,542	5,488	12,819	3,240	36,756	9,262	22,525	10,685
Imports for consumption:										
Caustic-calcined magnesia	59,610	10,407	71,434	11,493	38,112	4,575	20,729	2,371	75,584	13,657
Dead-burned magnesia	162,574	32,075	193,353	38,906	202,806	43,539	252,205	46,667	202,790	38,555
Oxide or calcined magnesia	4,437	5,638	5,173	5,804	31,638	13,768	55,238	19,293	5,874	9,194
Magnesium carbonate (precipitated)	224	351	197	346	503	713	386	592	NA	NA
Magnesium chloride (anhydrous)	113	21	14	5	431	102	132	47	5,994	1,202
Magnesium chloride (other)	2,699	368	3,296	381	6,464	935	6,143	1,028	(²)	(²)
Magnesium sulfate (epsom salts and kieserite) ³	23,307	1,902	24,652	1,711	22,143	1,581	30,410	1,865	21,216	2,649
	1990 ⁴									
	Quantity	Value								
Exports:										
Caustic-calcined magnesia	40,060	17,514								
Dead-burned magnesia	58,610	19,709								
Imports for consumption:										
Caustic-calcined magnesia	83,885	13,957								
Dead-burned magnesia	155,010	32,858								
Oxide or calcined magnesia	5,037	8,573								
Magnesium carbonate (precipitated)	NA	NA								
Magnesium chloride (anhydrous)	6,914	1,477								
Magnesium chloride (other)	(²)	(²)								
Magnesium sulfate (epsom salts and kieserite) ³	22,584	2,305								

NA Not available.

¹Less than 1/2 unit.

²Data included in "Magnesium chloride (anhydrous)."

³Prior to 1966, data include only magnesium sulfate in epsom salts.

⁴Beginning in 1989, the United States changed its trade classification system. Data for 1989 and 1990 may not be comparable with those of the previous years.

Table 11.—Yearend prices of magnesium compounds

	1970	1971	1972	1973	1974	1975	1976
DOLLARS PER SHORT TON							
Magnesia, natural, technical, heavy, 85%, f.o.b., Nevada	NA	NA	50.00	50.00	85.00	85.00	120.00
Magnesia, natural, technical, heavy, 90%, f.o.b., Nevada	53.00	53.00	60.00	60.00	105.00	105.00	140.00
Magnesium chloride, hydrous, 99%, flake	60.00	72.80	72.80	80.00	120.00	120.00	140.00
DOLLARS PER POUND							
Magnesium carbonate, light technical, (freight equalized)	0.16-0.185	0.16-0.185	0.16-0.185	0.16-0.185	0.16-0.185	0.22-0.23	0.220-0.23
Magnesium hydroxide, National Formulary, powder (freight equalized)	.21- .295	.21- .295	.21- .295	.30	.30	.35- .36	.350- .36
Magnesium sulfate, technical	NA	NA	NA	NA	.05	.06	.085- .090
	1977	1978	1979	1980	1981	1982	1983
DOLLARS PER SHORT TON							
Magnesia, natural, technical, heavy, 85%, f.o.b., Nevada	120.00	120.00	120.00	184.00	184.00	222.00	222.00
Magnesia, natural, technical, heavy, 90%, f.o.b., Nevada	140.00	140.00	140.00	210.00	210.00	255.00	255.00
Magnesium chloride, hydrous, 99%, flake	140.00	140.00	140.00	240.00	290.00	290.00	290.00
DOLLARS PER POUND							
Magnesium carbonate, light technical, (freight equalized)	0.220-0.23	0.220-0.23	0.52-0.55	0.52-0.54	0.52-0.54	0.73-0.78	0.73-0.78
Magnesium hydroxide, National Formulary, powder (freight equalized)	6.350- .36	.49 - .53	.54- .58	6.54- .58	.54- .58	.78	.78
Magnesium sulfate, technical	.085- .091	.121	.121	.121	.121	.121	.115
	1984	1985	1986	1987	1988	1989	1990
DOLLARS PER SHORT TON							
Magnesia, natural, technical, heavy, 85%, f.o.b., Nevada	232.00	232.00	232.00	232.00	232.00	232.00	232.00
Magnesia, natural, technical, heavy, 90%, f.o.b., Nevada	265.00	265.00	265.00	265.00	265.00	265.00	265.00
Magnesium chloride, hydrous, 99%, flake	290.00	290.00	290.00	290.00	290.00	290.00	290.00
DOLLARS PER POUND							
Magnesium carbonate, light technical, (freight equalized)	0.73-0.83	0.73-0.83	0.73-0.83	0.73-0.83	0.73-0.78	0.73-0.78	0.73-0.78
Magnesium hydroxide, National Formulary, powder (freight equalized)	.78	.78	.78	.78	.78	.78	.78
Magnesium sulfate, technical	.115	.115	.14	.14	.14	.14	.15

NA Not available.

Source: Chemical Marketing Reporter.

Table 12.—Magneisite: World production, by country
(Metric tons unless otherwise specified)

Country	1986	1987	1988	1989	1990
Australia	41,441	53,941	56,446	55,000	^c 60,000
Austria	1,084,360	946,943	1,121,585	1,024,942	1,179,162
Brazil ¹	296,792	390,182	404,126	259,508	257,159
Canada ^{a,2}	144,000	150,000	150,000	150,000	150,000
China ^a	2,000,000	2,630,000	2,610,000	2,600,000	2,600,000
Colombia	14,936	15,444	17,760	20,425	20,425
Czechoslovakia	666,000	671,000	630,786	642,000	561,000
Greece	944,000	841,604	847,911	903,593	^c 900,000
India	422,000	430,000	507,873	479,530	491,000
Iran ³	^c 2,240	5,261	2,777	6,967	1,405
Korea, North ^c	1,900,000	1,500,000	1,500,000	1,500,000	1,500,000
Mexico	7,530	7,351	5,384	4,229	579
Nepal	63,190	38,388	45,000	27,978	^c 25,000
Pakistan	1,757	3,824	3,081	8,750	4,274
Philippines	^c 650	^c 650	—	4,796	^c 700
Poland	20,900	22,300	23,867	24,133	23,000
South Africa, Republic of	61,186	74,961	74,088	75,695	114,182
Spain	^c 700,000	^c 710,000	624,216	620,000	600,000
Turkey	1,306,645	1,189,667	1,125,844	1,343,893	812,660
U.S.S.R. ^a	1,925,000	1,875,000	1,825,000	1,825,000	1,700,000
United States	W	W	W	W	W
Yugoslavia	428,791	402,976	382,606	292,302	194,119
Zimbabwe	22,649	28,991	30,121	33,423	32,639
Total	12,054,067	11,988,483	11,988,471	11,902,164	11,227,304
U.S. market share of world production (percent)	W	W	W	W	W

^aEstimated. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Series reflects output of marketable concentrates. Production of crude ore was as follows, in metric tons: 1986—648,752; 1987—860,183; 1988—810,837; 1989—1,385,565; and 1990—1,000,000 (estimated).

²Magnesian dolomite and brucite. Figure estimated on the basis of reported tonnage dollar value.

³Year beginning Mar. 21 of that stated.

Page Intentionally Left Blank

MANGANESE

By Thomas Jones

Manganese is essential to iron and steel production by virtue of its sulfur-fixing, deoxidizing, and alloying properties. Currently, no practical approaches exist for replacing it with other materials or for obtaining the bulk of U.S. requirements from domestic sources. Strategic concerns of the United States for manganese largely apply also to Japan and Western Europe.

Ironmaking and steelmaking have steadily accounted for about 90% of manganese demand, so that the state of the manganese industry is largely determined by the level of activity in the steel industry. U.S. apparent consumption of manganese in the 1980's was significantly lower than that in the 1970's. This stemmed from the dual effects of

technological change and/or economic factors that not only reduced domestic steel production but also lowered the rate of consumption of manganese in steel production. Manganese ore was the dominant form in which manganese was imported until 1977. In that year, a crossover occurred because of a declining trend in importing ore for domestic conversion into manganese ferroalloys and a related rising trend in imports of ferroalloys and metal. The actual price of metallurgical-grade manganese ore rose to record levels in the late 1980's, for which at least part of the cause was the importing by China and the former U.S.S.R. of substantial quantities of high-grade ore.

Table 1.—U.S. Government stockpile goals and yearend physical inventories for manganese materials
(Metric tons gross weight)

Year	Natural battery ore		Synthetic		Chemical ore		Metallurgical ore	
	Stockpile goal	Inventory, Dec. 31	manganese dioxide		Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31
			Stockpile goal	Inventory, Dec. 31				
1969 ¹	122,470	281,079	² 1,724	21,367	63,503	224,757	2,363,761	9,240,775
1970	122,470	281,079	1,724	19,882	63,503	224,757	2,363,761	8,914,627
1971	122,470	280,679	1,724	17,815	63,503	224,757	2,363,761	8,669,796
1972	122,470	279,730	1,724	15,439	63,503	224,757	2,363,761	8,221,189
1973 ³	9,707	279,730	—	13,189	23,224	224,308	680,842	7,826,209
1974	9,707	279,730	—	7,383	23,224	223,285	680,842	6,868,378
1975	9,707	278,479	—	5,296	23,224	219,206	680,842	6,309,588
1976 ⁴	11,554	277,000	17,332	2,727	224,198	209,435	1,861,544	5,704,885
1977	11,554	259,341	17,332	2,732	224,198	200,316	1,861,544	4,987,298
1978	11,554	237,399	17,332	2,732	224,198	200,333	1,861,544	3,885,092
1979	11,554	237,399	17,332	2,732	224,198	200,333	1,861,544	3,885,092
1980 ⁵	56,245	232,573	22,680	2,732	154,221	200,529	2,449,400	3,613,022
1981	56,245	220,247	22,680	2,732	154,221	200,529	2,449,400	3,359,325
1982	56,245	210,842	22,680	2,732	154,221	200,529	2,449,400	3,312,705
1983	56,245	199,250	22,680	2,732	154,221	188,984	2,449,400	3,269,067
1984	56,245	197,874	22,680	2,732	154,221	174,648	2,449,400	3,225,567
1985	56,245	192,144	22,680	2,732	154,221	157,432	2,449,400	3,075,491
1986	56,245	190,692	22,680	2,732	154,221	156,449	2,449,400	2,941,749
1987	56,245	186,574	22,680	2,732	154,221	156,238	2,449,400	2,739,348
1988	56,245	184,767	22,680	2,732	154,221	156,238	2,449,400	2,670,401
1989	56,245	184,814	22,680	2,732	154,221	156,238	2,449,400	2,599,461
1990	⁶ 22,680	184,814	22,680	2,732	154,221	157,089	2,449,400	2,466,270
	High-carbon ferromanganese		Medium-carbon ferromanganese		Silicomanganese		Electrolytic metal	
	Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31
1969 ¹	1,088,622	1,066,905	65,317	16,928	74,298	11,186	20,412	19,514
1970	1,088,622	1,066,905	65,317	26,237	74,298	21,386	20,412	19,514
1971	1,088,622	1,066,905	65,317	26,237	74,298	21,386	20,412	19,514
1972	1,088,622	1,066,905	65,317	26,237	74,298	21,386	20,412	19,514
1973 ³	181,437	1,008,359	9,525	26,236	14,424	21,386	4,309	16,468
1974	181,437	600,596	9,525	26,236	14,424	21,386	4,309	12,878

See footnotes at end of table.

Table 1.—U.S. Government stockpile goals and yearend physical inventories for manganese materials—Continued
(Metric tons gross weight)

Year	High-carbon ferromanganese		Medium-carbon ferromanganese		Silicomanganese		Electrolytic metal	
	Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31	Stockpile goal	Inventory, Dec. 31
1975	181,437	551,095	9,525	26,236	14,424	21,386	4,309	12,856
1976 ¹	398,254	544,091	89,811	26,236	73,482	21,386	13,608	12,856
1977	398,254	544,097	89,811	26,236	73,482	21,386	13,608	12,856
1978	398,254	544,097	89,811	26,237	73,482	21,386	13,608	12,856
1979	398,254	544,097	89,811	26,237	73,482	21,386	13,608	12,856
1980 ²	398,254	544,291	—	26,236	—	21,386	—	12,857
1981	398,254	544,291	—	26,236	—	21,386	—	12,857
1982	398,254	544,291	—	26,236	—	21,386	—	12,857
1983	398,254	544,291	—	26,236	—	21,386	—	12,857
1984	398,254	566,365	—	26,236	—	21,386	—	12,857
1985	398,254	566,365	—	26,360	—	21,386	—	12,857
1986	398,254	639,522	—	26,360	—	21,386	—	12,857
1987	398,254	639,522	—	26,360	—	21,386	—	12,857
1988	398,254	686,851	—	26,360	—	21,386	—	12,857
1989	398,254	736,777	—	26,360	—	21,386	—	12,857
1990	398,254	787,926	—	26,374	—	21,386	—	12,857

¹New stockpile goals as of May 13, 1969; ferroalloys and metal expressed as ore equivalent.

²New stockpile goal as of Mar. 27, 1969; no change made on May 13, 1969.

³New stockpile goals as of Apr. 12, 1973.

⁴New stockpile goals as of Oct. 1, 1976.

⁵New stockpile goals as of May 2, 1980.

⁶New stockpile goal as of June 26, 1990.

NOTE.—Inventories for natural battery ore and metallurgical ore are computed by adding stockpile grade and nonstockpile grade. Inventories for chemical ore are computed by adding type A and type B.

Source: U.S. Bureau of Mines, (Manganese Minerals Yearbooks 1969-90).

Table 2.—U.S. consumption and industry stocks of manganese ore,¹ by use
(Metric tons gross weight)

Year	Consumption, by use				Total stocks, Dec. 31
	Mn alloys and metal	Pig iron and steel	Dry cells, chemicals, miscellaneous ²	Total	
1969	1,815,037	45,502	118,334	1,978,873	1,637,526
1970	1,904,568	97,734	142,227	2,144,528	1,603,977
1971	1,667,118	169,871	118,406	1,955,396	1,823,562
1972	1,746,980	191,558	176,526	2,115,065	1,628,204
1973	1,527,815	215,735	197,879	1,941,429	1,400,053
1974	1,284,178	201,802	219,688	1,705,667	1,669,793
1975	1,306,567	159,816	183,771	1,650,154	1,872,882
1976	1,146,256	130,418	175,614	1,452,288	2,046,285
1977	840,629	182,165	209,898	1,232,693	1,474,702
1978	754,940	199,275	208,323	1,162,539	1,064,174
1979	828,705	209,326	206,799	1,244,830	995,959
1980	660,004	119,309	192,077	971,391	934,842
1981	675,700	134,093	166,910	976,703	940,031
1982	374,014	76,118	102,108	552,241	681,691
1983	248,823	95,713	136,871	481,406	560,176
1984	W	106,098	W	558,201	528,224
1985	W	^a 82,000	W	^a 494,000	533,980
1986	W	^a 67,000	W	^a 454,000	413,207
1987	W	^a 104,000	W	^a 484,000	413,669
1988	W	^a 125,000	W	^a 503,000	415,905
1989	W	122,000	W	559,000	470,000
1990	W	82,000	W	497,000	379,000

^aEstimated. W Withheld to avoid disclosing company proprietary data; included in "Total."

¹Containing 35% or more manganese (natural).

²Natural ore, including that consumed in making synthetic manganese dioxide.

Source: U.S. Bureau of Mines, (Manganese Minerals Yearbooks 1969-90).

Table 3.—U.S. consumption and industry stocks of manganese ferroalloys and metal¹
(Metric tons gross weight unless otherwise specified)

	1969			1970		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	971,633	138,247	25,413	907,739	125,645	22,210
Of which:						
Total steel	902,738	123,643	16,417	860,497	111,645	12,234
Carbon steel ²	770,222	87,661	6,598	730,493	79,692	4,388
Other ³	68,895	14,604	8,996	47,243	14,000	9,975
Unit consumption in steelmaking ⁴	5.70	0.65	0.13	5.75	0.65	0.10
Stocks, Dec. 31:						
Consumers and producers ...	248,707	30,505	7,768	252,094	36,531	8,321
	1971			1972		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	815,569	111,505	24,968	878,126	112,720	27,169
Of which:						
Total steel	766,939	100,659	13,613	854,238	102,973	14,366
Carbon steel ²	637,287	67,319	4,863	688,822	64,471	6,421
Other ³	48,631	10,846	11,355	23,888	9,748	12,803
Unit consumption in steelmaking ⁴	5.60	0.65	0.13	5.50	0.60	0.13
Stocks, Dec. 31:						
Consumers and producers ...	275,933	55,991	7,355	366,962	49,010	6,082
	1973			1974		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	1,012,965	144,260	31,972	1,011,870	160,722	31,523
Of which:						
Total steel	985,109	132,659	17,124	986,272	142,893	16,196
Carbon steel ²	803,441	85,847	7,378	768,908	91,399	7,400
Other ³	27,855	11,601	14,848	25,597	17,830	15,327
Unit consumption in steelmaking ⁴	5.55	0.65	0.13	5.75	0.70	0.13
Stocks, Dec. 31:						
Consumers and producers ...	232,631	39,002	4,350	294,481	54,984	5,460
	1975			1976		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	799,708	145,657	20,329	813,541	140,185	25,515
Of which:						
Total steel	775,926	129,942	11,120	790,223	121,171	13,851
Carbon steel ²	611,109	88,255	5,902	640,336	79,731	6,564
Other ³	23,782	15,714	9,209	23,317	19,015	11,665
Unit consumption in steelmaking ⁴	5.70	0.80	0.10	5.30	0.70	0.10
Stocks, Dec. 31:						
Consumers and producers ...	359,288	62,188	10,272	274,404	56,362	10,472
	1977			1978		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	804,037	134,045	24,470	894,142	149,058	25,613
Of which:						
Total steel	780,759	114,725	12,172	868,098	130,284	12,574
Carbon steel ²	623,593	73,748	7,191	701,966	85,678	7,477

See footnotes at end of table.

Table 3.—U.S. consumption and industry stocks of manganese ferroalloys and metal¹—Continued
(Metric tons gross weight unless otherwise specified)

	1977			1978		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Of which—Continued						
Other ³	23,278	19,319	12,299	26,044	18,773	13,039
Unit consumption in steelmaking ⁴	5.30	0.65	0.10	5.45	0.70	0.10
Stocks, Dec. 31:						
Consumers and producers ...	268,948	45,944	8,154	215,044	37,551	6,113
	1979			1980		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	885,850	155,946	25,507	715,838	141,355	22,763
Of which:						
Total steel	862,759	137,444	11,816	695,145	126,979	9,160
Carbon steel ²	679,684	86,355	6,727	540,299	83,639	5,176
Other ³	23,091	18,502	13,691	20,693	14,376	13,603
Unit consumption in steelmaking ⁴	5.50	0.75	0.10	5.40	0.80	0.10
Stocks, Dec. 31:						
Consumers and producers ...	204,411	35,925	5,901	186,945	48,480	6,424
	1981			1982		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	744,727	141,286	21,573	398,433	95,840	15,550
Of which:						
Total steel	725,960	129,430	10,695	381,058	86,953	7,630
Carbon steel ²	563,444	86,213	5,859	298,842	60,419	4,613
Other ³	18,767	11,856	10,878	17,375	8,887	7,920
Unit consumption in steelmaking ⁴	5.15	0.75	0.10	4.45	0.85	0.10
Stocks, Dec. 31:						
Consumers and producers ...	182,869	51,086	7,342	220,385	32,686	6,727
	1983			1984		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	404,877	75,653	16,557	446,483	93,308	25,305
Of which:						
Total steel	386,527	67,091	8,491	428,391	87,939	7,939
Carbon steel ²	304,296	45,540	5,122	346,146	65,003	4,254
Other ³	18,350	8,562	8,066	18,092	5,369	17,366
Unit consumption in steelmaking ⁴	4.35	0.85	0.10	3.90	0.60	0.10
Stocks, Dec. 31:						
Consumers and producers ...	177,179	18,791	3,522	144,659	11,285	3,945
	1985			1986		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	422,333	95,053	22,231	340,966	93,231	21,899
Of which:						
Total steel	399,039	90,288	5,572	327,986	88,322	4,816
Carbon steel ²	324,618	69,257	2,634	259,563	63,153	2,266
Other ³	23,294	4,765	16,659	12,980	4,910	17,083
Unit consumption in steelmaking ⁴	3.85	0.75	0.05	3.45	0.80	0.05
Stocks, Dec. 31:						
Consumers and producers ...	90,595	12,888	4,782	84,189	11,819	2,904

See footnotes at end of table.

Table 3.—U.S. consumption and industry stocks of manganese ferroalloys and metal¹—Continued
(Metric tons gross weight unless otherwise specified)

	1987			1988		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	371,382	103,914	23,196	424,288	107,869	21,760
Of which:						
Total steel	359,070	98,714	5,902	408,780	104,640	3,787
Carbon steel ²	281,188	74,219	2,769	320,366	77,641	1,017
Other ³	12,312	5,200	17,294	15,507	3,229	17,973
Unit consumption in steelmaking ⁴	3.50	0.80	0.05	3.50	0.75	0.05
Stocks, Dec. 31:						
Consumers and producers ...	43,602	12,480	2,706	82,381	16,836	2,728
	1989			1990		
	FeMn	SiMn	Mn	FeMn	SiMn	Mn
Consumption, by end use:						
Total	399,078	94,663	21,265	413,091	97,931	23,064
Of which:						
Total steel	380,879	90,556	3,711	393,870	93,849	5,159
Carbon steel ²	298,241	65,031	857	311,322	67,241	W
Other ³	18,199	4,107	17,554	19,221	4,081	17,905
Unit consumption in steelmaking ⁴	3.35	0.65	0.05	3.40	0.70	0.05
Stocks, Dec. 31:						
Consumers and producers ...	68,117	9,428	3,707	55,829	7,555	3,454

W Withheld to avoid disclosing company proprietary data.

¹FeMn, ferromanganese, all grades; SiMn, silicomanganese; Mn, manganese metal. Data not listed for spiegeleisen, reported annual consumption of which was about 18,000 metric tons in 1969-74, averaged 5,800 metric tons in 1975-78, and was negligible thereafter.

²Included in "Total steel."

³Mostly in cast irons and miscellaneous for FeMn and SiMn; mostly in aluminum alloys for Mn.

⁴Kilograms of manganese per metric ton of raw steel; multiply by 2.0 to convert to pounds of manganese per short ton of raw steel.

Source: U.S. Bureau of Mines, (Manganese Minerals Yearbooks 1969-90).

Table 4.—U.S. exports of manganese ore, ferroalloys, and metal
(Gross weight)

Year	Ore ¹		Ferromanganese		Silicomanganese		Metal, including alloys and waste and scrap	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)
1969 ..	17,446	\$1,627	1,596	\$483	(²)	(²)	2,241	\$1,410
1970 ..	18,410	2,461	19,729	4,356	(²)	(²)	2,695	2,042
1971 ..	50,270	2,683	4,106	1,205	(²)	(²)	1,091	912
1972 ..	22,778	3,137	6,207	1,512	(²)	(²)	1,364	1,021
1973 ..	52,116	4,535	7,778	2,137	(²)	(²)	4,227	3,189
1974 ..	202,382	13,656	6,360	2,204	(²)	(²)	2,103	2,119
1975 ..	185,540	13,886	29,302	10,601	(²)	(²)	2,954	3,318
1976 ..	116,093	7,510	6,159	3,462	(²)	(²)	4,222	3,434
1977 ..	125,418	9,221	5,489	3,391	(²)	(²)	2,679	3,208
1978 ..	181,553	13,123	8,557	4,769	4,338	\$1,568	5,568	5,165
1979 ..	52,910	5,698	22,992	19,252	4,756	2,627	6,018	7,463
1980 ..	47,661	6,328	10,601	7,657	4,756	3,468	11,177	11,460
1981 ..	59,025	5,132	13,540	12,477	3,575	2,172	2,289	3,980
1982 ..	25,909	2,510	9,354	7,517	2,678	1,532	2,674	3,861
1983 ..	17,521	1,972	7,650	5,765	5,830	1,746	5,798	8,531

See footnotes at end of table.

Table 4.—U.S. exports of manganese ore, ferroalloys, and metal—Continued
(Gross weight)

Year	Ore ¹		Ferromanganese		Silicomanganese		Metal, including alloys and waste and scrap	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1984 ..	215,553	15,643	6,136	4,397	4,838	2,237	3,703	5,915
1985 ..	50,839	4,286	6,284	4,762	2,802	1,359	4,683	7,242
1986 ..	38,071	3,278	3,922	2,650	1,818	687	4,668	7,892
1987 ..	57,398	4,225	2,586	2,144	632	493	5,239	9,748
1988 ..	61,680	5,496	3,123	2,950	6,774	4,975	8,944	16,242
1989 ..	51,883	5,014	8,177	7,310	5,314	4,068	5,141	10,632
1990 ..	69,945	9,297	7,287	6,565	1,791	1,666	6,144	14,043

¹Content for 1989-90 is 20% or more manganese, 5% or more manganese for 1978-88, and 10% or more manganese for 1969-77 (Minerals Yearbooks 1969-90, Foreign Trade).

²Reportable under ferroalloys, not elsewhere classified (Minerals Yearbook 1977, Foreign Trade).

Source: Bureau of the Census, adjusted by the U.S. Bureau of Mines, (Manganese Minerals Yearbooks 1969-90).

Table 5.—U.S. imports for consumption of manganese ore, ferroalloys, metal, and dioxide

Country	1969			1970		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES¹						
Australia	140,409	68,844	\$3,105	61,337	29,732	\$1,301
Brazil	608,101	310,515	13,069	554,244	265,279	11,879
Gabon ²	477,917	240,003	10,535	435,759	219,190	8,841
South Africa, Republic of	53,731	26,325	904	126,159	60,284	1,809
Other ³	476,312	243,090	11,523	396,516	193,634	10,433
Total	1,756,469	888,776	39,136	1,574,016	768,119	34,263
FERROMANGANESE, ALL GRADES						
France	58,442	44,884	5,571	90,751	70,529	10,285
South Africa, Republic of	110,070	86,011	12,589	108,220	85,057	13,161
Other ³	110,803	86,053	14,121	64,971	50,326	8,117
Total	279,314	216,948	32,281	263,942	205,912	31,563
SILICOMANGANESE						
Australia	—	NA	NA	—	NA	NA
Brazil	—	NA	NA	—	NA	NA
Mexico	2,499	NA	NA	253	NA	NA
Norway	18,853	NA	NA	11,223	NA	NA
South Africa, Republic of	1,014	NA	NA	593	NA	NA
Yugoslavia	3,978	NA	NA	—	NA	NA
Other ³	2,722	NA	NA	1,120	NA	NA
Total	29,066	19,266	NA	13,190	8,731	NA
METAL, UNWROUGHT						
South Africa, Republic of	1,153	NAp	NA	1,070	NAp	NA
Other ³	91	NAp	NA	87	NAp	NA
Total	1,244	NAp	NA	1,158	NAp	NA
MANGANESE DIOXIDE						
Japan	NA	NAp	NA	NA	NAp	NA
Other ³	NA	NAp	NA	NA	NAp	NA
Total	NA	NAp	NA	NA	NAp	NA

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

Country	1971			1972		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	97,607	47,745	\$2,629	74,922	36,524	\$1,575
Brazil	636,637	303,772	14,852	367,385	174,930	8,217
Gabon ²	541,682	277,226	13,409	459,637	230,045	10,733
South Africa, Republic of	168,406	79,250	3,705	129,141	59,640	2,715
Other ³	292,260	143,058	7,589	438,784	217,982	11,075
Total	1,736,592	851,050	42,184	1,469,868	719,121	34,315
FERROMANGANESE, ALL GRADES						
France	83,752	64,846	10,944	90,795	71,107	14,067
South Africa, Republic of	81,717	64,312	12,089	138,292	109,422	20,866
Other ³	54,775	42,535	9,359	87,102	68,690	14,913
Total	220,245	171,694	32,392	316,189	249,219	49,846
SILICOMANGANESE						
Australia	—	NA	NA	—	NA	NA
Brazil	—	NA	NA	—	NA	NA
Mexico	2,303	NA	NA	3,959	NA	NA
Norway	21,372	NA	NA	24,313	NA	NA
South Africa, Republic of	—	NA	NA	—	NA	NA
Yugoslavia	2,128	NA	NA	1,961	NA	NA
Other ³	1,346	NA	NA	4,851	NA	NA
Total	27,150	18,116	NA	35,084	23,497	NA
METAL, UNWROUGHT						
South Africa, Republic of	1,796	NAp	NA	1,487	NAp	NA
Other ³	807	NAp	NA	2,252	NAp	NA
Total	2,604	NAp	NA	3,739	NAp	NA
MANGANESE DIOXIDE						
Japan	NA	NAp	NA	NA	NAp	NA
Other ³	NA	NAp	NA	NA	NAp	NA
Total	NA	NAp	NA	NA	NAp	NA
1973						
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	112,321	55,754	\$2,760	211,786	103,449	\$8,136
Brazil	571,375	271,613	15,767	420,719	201,395	15,105
Gabon ²	356,557	177,912	10,007	274,451	136,184	12,712
South Africa, Republic of	107,989	50,730	2,002	66,771	29,855	3,222
Other ³	221,418	99,555	6,867	137,605	66,913	5,916
Total	1,369,662	655,564	37,403	1,111,332	537,796	45,091
FERROMANGANESE, ALL GRADES						
France	124,930	96,446	17,803	192,721	149,593	42,340
South Africa, Republic of	126,005	99,013	18,200	115,309	90,461	23,098
Other ³	103,403	80,221	17,334	74,096	57,389	22,988
Total	354,338	275,680	53,337	382,126	297,442	88,426
SILICOMANGANESE						
Australia	—	NA	NA	—	NA	NA
Brazil	—	NA	NA	2,250	NA	NA
Mexico	4,384	NA	NA	—	NA	NA
Norway	25,294	NA	NA	21,469	NA	NA

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

Country	1973			1974		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
SILICOMANGANESE—Continued						
South Africa, Republic of	—	NA	NA	2,814	NA	NA
Yugoslavia	4,882	NA	NA	5,100	NA	NA
Other ³	6,045	NA	NA	⁴ 29,829	NA	NA
Total	40,605	27,271	NA	61,463	40,569	NA
METAL, UNWROUGHT						
South Africa, Republic of	1,905	NAp	NA	1,926	NAp	NA
Other ³	319	NAp	NA	347	NAp	NA
Total	2,224	NAp	NA	2,273	NAp	NA
MANGANESE DIOXIDE						
Japan	NA	NAp	NA	NA	NAp	NA
Other ³	NA	NAp	NA	NA	NAp	NA
Total	NA	NAp	NA	NA	NAp	NA
1975						
1976						
ORE AND CONCENTRATES ¹						
Australia	155,261	78,509	\$8,443	212,858	106,474	\$12,048
Brazil	574,317	278,839	30,012	302,527	146,155	18,033
Gabon ²	442,773	222,075	26,526	489,562	244,666	33,969
South Africa, Republic of	186,892	83,652	9,663	124,571	55,305	5,890
Other ³	68,707	31,402	2,459	65,073	36,386	3,687
Total	1,427,950	694,477	77,103	1,194,592	588,985	73,627
FERROMANGANESE, ALL GRADES						
France	126,098	97,121	45,127	108,646	83,965	38,314
South Africa, Republic of	110,183	86,078	34,304	158,016	123,013	46,636
Other ³	124,064	94,989	48,950	220,867	171,710	79,748
Total	360,345	278,188	128,381	487,529	378,689	164,698
SILICOMANGANESE						
Australia	—	NA	NA	—	NA	NA
Brazil	—	NA	NA	9,974	NA	NA
Mexico	166	NA	NA	1,610	NA	NA
Norway	14,631	NA	NA	28,871	NA	NA
South Africa, Republic of	7,733	NA	NA	2,503	NA	NA
Yugoslavia	4,350	NA	NA	12,365	NA	NA
Other ³	⁴ 22,764	NA	NA	17,358	NA	NA
Total	49,644	31,893	NA	72,682	48,709	NA
METAL, UNWROUGHT						
South Africa, Republic of	3,023	NAp	NA	5,607	NAp	NA
Other ³	949	NAp	NA	817	NAp	NA
Total	3,972	NAp	NA	6,425	NAp	NA
MANGANESE DIOXIDE						
Japan	NA	NAp	NA	NA	NAp	NA
Other ³	NA	NAp	NA	NA	NAp	NA
Total	NA	NAp	NA	NA	NAp	NA

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

Country	1977			1978		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	23,179	12,550	\$1,699	49,370	55,754	\$3,063
Brazil	210,233	101,277	11,943	93,322	271,613	5,660
Gabon ²	444,922	222,461	34,032	243,695	177,912	17,859
South Africa, Republic of	31,256	15,315	1,928	20,321	50,730	1,288
Other ³	134,951	59,559	6,755	90,266	99,555	5,711
Total	844,541	411,162	56,357	496,974	655,564	33,581
FERROMANGANESE, ALL GRADES						
France	127,362	98,555	40,690	133,023	96,446	40,826
South Africa, Republic of	128,253	100,517	40,596	274,178	99,013	77,513
Other ³	229,206	178,391	74,376	210,047	80,221	59,506
Total	484,821	377,462	155,662	617,248	275,680	177,845
SILICOMANGANESE						
Australia	—	NA	NA	2,001	NA	NA
Brazil	16,012	NA	NA	15,622	NA	NA
Mexico	6,914	NA	NA	8,191	NA	NA
Norway	19,836	NA	NA	22,399	NA	NA
South Africa, Republic of	11,120	NA	NA	2,761	NA	NA
Yugoslavia	6,315	NA	NA	17,450	NA	NA
Other ³	19,545	NA	NA	17,435	NA	NA
Total	79,742	52,915	NA	85,860	57,329	NA
METAL, UNWROUGHT						
South Africa, Republic of	5,499	NAp	NA	7,084	NAp	NA
Other ³	707	NAp	NA	1,183	NAp	NA
Total	6,206	NAp	NA	8,267	NAp	NA
MANGANESE DIOXIDE						
Japan	NA	NAp	NA	3,676	NAp	NA
Other ³	NA	NAp	NA	2,520	NAp	NA
Total	NA	NAp	NA	6,196	NAp	NA
1979						
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	99,341	50,182	\$5,413	186,325	96,201	\$14,467
Brazil	94,921	46,865	5,471	63,204	30,525	3,663
Gabon ²	130,483	65,029	9,284	145,112	72,446	13,610
South Africa, Republic of	104,719	47,280	4,951	189,574	78,356	11,296
Other ³	23,931	11,592	2,366	48,561	21,616	3,377
Total	453,395	220,948	27,485	632,776	299,144	46,413
FERROMANGANESE, ALL GRADES						
France	136,643	106,345	50,553	197,960	154,393	78,410
South Africa, Republic of	329,983	257,240	106,213	203,316	158,661	73,176
Other ³	278,366	215,866	98,077	148,208	116,406	59,778
Total	744,992	579,450	254,843	549,485	429,460	211,364
SILICOMANGANESE						
Australia	562	NA	NA	—	NA	NA
Brazil	26,191	NA	NA	11,047	NA	NA
Mexico	1,852	NA	NA	—	NA	NA
Norway	23,149	NA	NA	13,038	NA	NA

See footnotes at end of table.

Table 5.—U.S. imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

Country	1979			1980		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
SILICOMANGANESE—Continued						
South Africa, Republic of	8,000	NA	NA	21,785	NA	NA
Yugoslavia	16,205	NA	NA	11,720	NA	NA
Other ³	9,926	NA	NA	10,426	NA	NA
Total	85,884	56,797	NA	68,016	44,595	29,291
METAL, UNWROUGHT						
South Africa, Republic of	5,547	NAp	NA	6,803	NAp	NA
Other ³	516	NAp	NA	8	NAp	NA
Total	6,063	NAp	NA	6,811	NAp	NA
MANGANESE DIOXIDE						
Japan	3,715	NAp	NA	5,485	NAp	NA
Other ³	5,068	NAp	NA	4,959	NAp	NA
Total	8,783	NAp	NA	10,444	NAp	NA
1981						
1982						
ORE AND CONCENTRATES ¹						
Australia	59,658	31,079	\$5,028	33,461	17,093	\$2,667
Brazil	69,175	35,298	6,291	5,595	2,687	344
Gabon ²	162,865	82,217	13,582	41,784	21,007	3,514
South Africa, Republic of	206,122	88,483	10,522	119,551	52,502	8,169
Other ³	81,999	35,749	7,220	15,301	7,458	1,466
Total	579,819	272,827	42,643	215,691	100,747	16,160
FERROMANGANESE, ALL GRADES						
France	171,910	134,389	65,729	93,308	73,236	35,710
South Africa, Republic of	249,006	192,366	87,118	219,914	171,196	70,269
Other ³	187,967	146,638	73,771	133,755	103,657	48,511
Total	608,883	473,394	226,618	446,977	348,089	154,490
SILICOMANGANESE						
Australia	12,406	NA	NA	10,780	7,081	3,617
Brazil	35,328	NA	NA	11,700	7,906	4,496
Mexico	1,250	NA	NA	4,726	3,197	1,854
Norway	15,701	NA	NA	3,122	2,051	1,302
South Africa, Republic of	23,185	NA	NA	11,201	7,480	4,467
Yugoslavia	14,793	NA	NA	11,350	7,442	4,189
Other ³	14,370	NA	NA	3,454	2,147	1,546
Total	117,031	77,020	49,754	56,332	37,304	21,471
METAL, UNWROUGHT						
South Africa, Republic of	7,480	NAp	NA	4,593	NAp	5,099
Other ³	78	NAp	NA	119	NAp	104
Total	7,558	NAp	NA	4,712	NAp	5,203
MANGANESE DIOXIDE						
Japan	10,737	NAp	NA	14,436	NAp	21,407
Other ³	4,059	NAp	NA	3,477	NAp	4,112
Total	14,796	NAp	NA	17,913	NAp	25,519

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

	1983			1984		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	26,598	13,715	\$1,740	36,005	19,055	\$2,670
Brazil	71,602	35,482	3,742	80,134	40,151	3,135
Gabon ²	155,145	77,572	9,628	120,642	59,997	6,898
South Africa, Republic of	23,048	11,524	1,170	32,821	15,682	1,178
Other ³	57,721	23,240	3,587	37,111	14,822	2,143
Total	334,114	161,533	19,867	306,714	149,706	16,024
FERROMANGANESE, ALL GRADES						
France	106,269	83,108	32,494	111,612	87,493	33,271
South Africa, Republic of	79,509	61,678	22,841	121,298	94,798	34,599
Other ³	124,123	96,852	37,748	138,410	109,549	49,808
Total	309,902	241,638	93,083	371,320	291,841	117,678
SILICOMANGANESE						
Australia	14,721	9,665	4,286	12,865	8,477	4,096
Brazil	27,944	18,388	8,582	42,267	27,728	14,190
Mexico	5,199	3,483	1,695	14,013	9,354	5,002
Norway	6,013	3,827	2,926	10,754	6,967	5,137
South Africa, Republic of	47,351	31,483	14,564	21,251	14,237	7,138
Yugoslavia	14,119	9,237	4,408	13,122	8,581	4,711
Other ³	11,348	7,371	3,656	11,368	7,517	4,472
Total	126,695	83,454	40,117	125,640	82,861	44,746
METAL, UNWROUGHT						
South Africa, Republic of	4,804	NAp	5,034	12,061	NAp	12,951
Other ³	—	NAp	—	17	NAp	27
Total	4,804	NAp	5,034	12,078	NAp	12,978
MANGANESE DIOXIDE						
Japan	16,487	NAp	23,283	18,038	NAp	25,165
Other ³	2,394	NAp	3,027	4,186	NAp	5,213
Total	18,881	NAp	26,310	22,224	NAp	30,378
	1985			1986		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	75,249	39,103	\$4,490	61,807	32,240	\$3,305
Brazil	111,335	54,264	5,423	75,026	35,133	3,221
Gabon ²	117,353	58,144	8,240	216,937	108,017	11,435
South Africa, Republic of	—	—	—	28,464	12,690	1,219
Other ³	47,015	19,801	4,408	38,012	16,588	3,942
Total	350,953	171,313	22,561	420,246	204,668	23,122
FERROMANGANESE, ALL GRADES						
France	106,783	83,375	33,196	78,678	62,208	27,546
South Africa, Republic of	115,749	89,921	34,013	132,040	102,551	35,944
Other ³	110,291	86,834	37,180	148,210	117,416	56,992
Total	332,823	260,130	104,389	358,928	282,175	120,482
SILICOMANGANESE						
Australia	13,392	8,867	4,420	15,751	10,455	5,310
Brazil	18,429	12,221	6,204	17,747	11,657	5,675
Mexico	8,760	5,768	2,855	17,544	11,730	5,649
Norway	12,369	8,117	5,075	15,061	9,904	5,596

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

Country	1985			1986		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
SILICOMANGANESE—Continued						
South Africa, Republic of	65,078	43,666	21,365	80,415	53,627	24,931
Yugoslavia	24,817	16,172	8,545	20,460	13,405	6,491
Other ³	7,315	4,725	2,959	13,229	8,448	5,187
Total	150,160	99,535	51,423	180,208	119,227	58,839
METAL, UNWROUGHT						
South Africa, Republic of	7,622	NAp	8,890	8,746	NAp	9,760
Other ³	149	NAp	162	24	NAp	40
Total	7,771	NAp	9,052	8,771	NAp	9,800
MANGANESE DIOXIDE						
Japan	17,626	NAp	23,805	9,376	NAp	12,440
Other ³	5,663	NAp	6,349	8,200	NAp	9,585
Total	23,288	NAp	30,154	17,576	NAp	22,025
1987				1988		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES ¹						
Australia	84,554	17,093	\$3,819	68,689	35,674	\$3,440
Brazil	57,065	2,687	2,196	52,189	24,498	2,700
Gabon ²	159,388	21,007	8,282	263,581	133,042	16,972
South Africa, Republic of	—	—	—	—	—	—
Other ³	7,925	59,959	782	79,743	32,281	5,962
Total	308,932	100,747	15,079	464,202	225,495	29,074
FERROMANGANESE, ALL GRADES						
France	110,511	73,236	38,426	130,460	103,305	56,361
South Africa, Republic of	131,004	171,196	35,180	177,562	137,771	63,171
Other ³	92,035	103,657	40,024	173,947	136,184	92,689
Total	333,549	348,089	113,630	481,970	377,260	212,221
SILICOMANGANESE						
Australia	15,551	7,081	4,527	30,080	19,549	10,033
Brazil	6,653	7,906	2,541	20,051	13,200	8,776
Mexico	36,019	3,197	11,072	31,261	20,493	13,806
Norway	23,710	2,051	8,877	3,727	2,354	2,863
South Africa, Republic of	59,969	7,480	19,625	92,265	61,432	40,147
Yugoslavia	23,014	7,442	7,884	29,580	19,275	13,415
Other ³	8,734	2,147	3,935	3,698	2,390	2,888
Total	173,652	37,304	58,461	210,661	138,694	91,928
METAL, UNWROUGHT						
South Africa, Republic of	8,097	NAp	9,600	10,641	NAp	14,946
Other ³	—	NAp	—	—	NAp	—
Total	8,097	NAp	9,600	10,641	NAp	14,946
MANGANESE DIOXIDE						
Japan	12,047	NAp	14,719	17,141	NAp	19,559
Other ³	3,235	NAp	3,973	3,331	NAp	4,172
Total	15,282	NAp	18,692	20,472	NAp	23,731

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of manganese ore, ferroalloys, metal, and dioxide—Continued

Country	1989			1990		
	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Value (thousands)
ORE AND CONCENTRATES¹						
Australia	105,092	54,827	\$9,492	62,583	32,543	\$9,201
Brazil	196,429	84,625	10,481	47,078	20,662	3,170
Gabon ²	197,802	99,461	19,196	136,131	67,827	20,928
South Africa, Republic of	49,733	19,612	2,988	25,858	9,958	1,871
Other ³	30,204	12,257	1,637	35,159	17,951	4,884
Total	579,259	270,781	43,794	306,810	148,942	40,054
FERROMANGANESE, ALL GRADES						
France	133,109	104,523	72,988	102,664	80,787	64,147
South Africa, Republic of	164,565	126,341	83,496	130,907	101,618	73,708
Other ³	134,204	105,233	90,056	146,256	115,471	96,474
Total	431,877	336,097	246,540	379,827	297,876	234,329
SILICOMANGANESE						
Australia	37,450	27,181	16,057	40,655	26,809	19,004
Brazil	22,368	14,648	15,596	22,275	14,568	11,051
Mexico	38,877	25,589	24,053	38,729	25,501	19,651
Norway	5,244	3,298	4,956	—	—	—
South Africa, Republic of	74,325	48,026	50,948	50,987	33,870	27,664
Yugoslavia	35,122	22,873	25,281	22,220	14,107	11,115
Other ³	18,302	9,417	14,350	49,607	32,664	29,362
Total	231,687	151,032	151,241	224,473	147,519	117,847
METAL, UNWROUGHT						
South Africa, Republic of	10,954	NAp	16,354	9,138	NAp	13,852
Other ³	91	NAp	143	354	NAp	555
Total	11,045	NAp	16,497	9,492	NAp	14,407
MANGANESE DIOXIDE						
Japan	155	NAp	253	—	NAp	—
Other ³	5,924	NAp	6,959	6,974	NAp	9,877
Total	6,079	NAp	7,212	6,974	NAp	9,877

¹Revised. NA Not available. NAp Not applicable.

²35% or more manganese, except 20% or more manganese for 1989-90.

³Includes Congo (Brazzaville), if any. In 1969-73, additional quantities apparently were received from Gabon but identified as if received from Congo (Kinshasa), later identified as Zaire; Angola; and Western Africa, n.e.c.

⁴Figure includes data for countries of lesser quantities.

⁵Includes data for Japan in 1974 and 1975: 16,888 and 18,061, respectively.

Source: Bureau of the Census, adjusted by the U.S. Bureau of Mines, (Manganese Minerals Yearbooks 1969-90)

Table 6.—Manganese ore: world production, by country
(Thousand metric tons gross weight unless otherwise specified)¹

Country	1986	1987	1988	1989	1990
Australia	1,649	1,853	1,986	2,124	1,988
Brazil	2,697	2,067	1,990	2,080	1,996
China	2,722	2,631	3,175	3,175	3,175
Gabon	2,510	2,403	2,254	2,593	2,631
India	1,213	1,302	1,333	1,334	1,385
South Africa, Republic of ²	3,719	2,892	3,454	3,623	3,672
U.S.S.R.	9,344	9,435	9,072	9,072	8,800
Other, by difference	1,114	1,009	1,064	1,060	1,321
Total ³	24,968	23,592	24,328	³ 25,062	24,668
Total manganese content ⁴	8,827	8,157	8,415	8,759	8,606

¹Converted from short ton equivalents; may differ from quantities originally stated in metric units.

²These data and the totals below do not reflect revisions by the South African Minerals Bureau received in February 1992.

³Data may not add to totals shown because of independent rounding.

⁴Based on estimated content for those countries for which data were not reported.

Source: U.S. Bureau of Mines (Manganese Minerals Yearbook 1990).

Table 7.—U.S. manganese supply-demand relationships and prices
(Thousand metric tons manganese content unless otherwise specified)

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
COMPONENTS AND DISTRIBUTION OF SUPPLY											
Components of supply:											
Domestic mines ¹	84	60	34	26	28	32	17	28	24	34	28
Shipments of Government stockpile excesses	45	127	107	198	220	732	280	267	325	253	239
Imports, ore	900	768	851	719	655	538	695	589	412	252	221
Imports, ferroalloy and metal	233	216	192	277	305	341	314	434	436	548	642
Industry stocks, Jan. 1	1,070	1,126	1,066	1,162	1,126	887	1,073	1,233	1,246	991	736
Total supply	2,333	2,297	2,251	2,382	2,333	2,530	2,380	2,550	2,443	2,078	1,867
Distribution of supply:											
Industry stocks, Dec. 31	1,126	1,066	1,162	1,126	887	1,073	1,233	1,246	991	736	679
Exports, ore	9	9	23	11	26	97	113	58	63	91	26
Exports, ferroalloy and metal	4	18	5	6	10	6	5	9	8	15	27
Industrial demand (apparent consumption)	1,195	1,204	1,061	1,239	1,410	1,354	1,028	1,237	1,382	1,236	1,134
DEMAND PATTERN											
Appliances and equipment	46	46	46	46	62	62	43	46	48	53	54
Batteries	18	18	17	16	16	16	15	16	16	16	15
Cans and containers	56	66	64	53	65	72	54	57	54	54	55
Chemicals	34	34	32	45	49	59	47	43	55	55	54
Construction	243	236	229	214	295	288	226	216	218	253	264
Machinery	185	176	175	171	230	245	185	185	190	216	217
Oil and gas industries	43	42	46	44	65	70	65	55	65	74	70
Transportation	253	226	261	239	340	315	260	300	300	317	296
Other ²	361	401	236	453	349	287	182	372	490	254	163
Total primary demand	1,195	1,204	1,061	1,239	1,410	1,354	1,028	1,237	1,382	1,236	1,134
AVERAGE ANNUAL MANGANESE-IN-ORE PRICE³											
Actual price	0.49	0.53	0.59	0.59	0.64	0.89	1.36	1.43	1.46	1.38	1.38
Based on constant 1982 dollars	1.24	1.27	1.33	1.27	1.29	1.64	2.29	2.26	2.16	1.91	1.75
	1980	1981	1982	1983	1984 ⁴	1985	1986	1987	1988	1989	1990
COMPONENTS AND DISTRIBUTION OF SUPPLY											
Components of supply:											
Domestic mines ¹	21	22	4	4	10	2	1	2	1	1	1
Shipments of Government stockpile excesses	144	116	25	32	9	83	7	95	-2	-5	20
Imports, ore	299	273	101	161	163	185	215	164	238	275	153
Imports, ferroalloy and metal	481	558	390	330	386	367	410	383	527	502	458
Industry stocks, Jan. 1	679	644	637	523	420	381	345	286	253	287	294
Total supply	1,625	1,613	1,157	1,050	989	1,018	978	930	1,017	1,059	926
Distribution of supply:											
Industry stocks, Dec. 31	644	637	523	419	381	345	286	253	287	294	241
Exports, ore	24	29	13	9	28	28	21	34	32	26	42
Exports, ferroalloy and metal	24	15	12	15	12	12	9	8	16	15	13
Industrial demand (apparent consumption)	933	932	610	606	569	633	662	634	682	723	630
DEMAND PATTERN⁵											
Appliances and equipment	44	46	27	30	33	29	24	28	17	11	9
Batteries	15	15	19	23	31	35	39	39	44	41	42
Cans and containers	44	42	28	25	34	32	28	32	28	21	22
Chemicals ⁶	45	45	26	20	31	20	21	40	42	39	36
Construction	220	229	138	137	154	149	134	150	221	138	138
Machinery	167	171	92	90	97	78	65	77	110	83	83
Oil and gas industries	79	89	40	28	36	34	25	30	21	10	10
Transportation	214	214	115	129	139	124	95	105	102	54	54
Other ²	146	125	147	147	39	154	248	153	119	340	250
Total primary demand	933	932	610	606	569	633	662	634	682	723	630

See footnotes at end of table.

Table 7.—U.S. manganese supply-demand relationships and prices—Continued
 (Thousand metric tons manganese content unless otherwise specified)

Year	1980	1981	1982	1983	1984 ⁴	1985	1986	1987	1988	1989	1990
	AVERAGE ANNUAL MANGANESE-IN-ORE PRICE ³										
Actual price	1.67	1.69	1.56	1.36	1.40	1.41	1.32	1.27	1.75	2.76	3.78
Based on constant 1982 dollars	1.95	1.80	1.56	1.31	1.30	1.27	1.16	1.08	1.44	2.18	2.87

¹Mainly maganiferous ore.

²Not specifically based on reported data; includes processing losses. Through 1988, the distribution within this category is approximately the same as for end uses above. Beginning in 1989, includes nonidentified uses of steel corresponding to about one-third of total steel shipments.

³Metallurgical ore, 48% manganese, dollars per metric ton unit.

⁴Where available, data for manganese dioxide included beginning in 1984.

⁵New series for steel-related end uses beginning in 1989.

⁶Includes miscellaneous nonmetallurgical uses of ore beginning in 1987.

Source: U.S. Bureau of Mines (Manganese Minerals Yearbooks 1980-90 and Manganese Chapter from Minerals Facts and Problems 1980)

Page Intentionally Left Blank

NICKEL

By William Kirk

Nickel is vital to the stainless steel industry and has played a key role in the development of the chemical and aerospace industries. Furthermore, through the use of nickel, the sophisticated industrial complexes that provide our high standard of living and superior military

technology and armament are made possible. Nickel's greatest value is in alloys with other elements, where it adds strength and corrosion resistance over a wide range of temperatures.

Table 1.—Salient nickel statistics
(Metric tons, contained nickel)

Year	U.S. production						World production ¹	
	Primary				Secondary		Mine	Plant
	Mine	Smelter	Refined imported concentrate	Byproduct of copper refining	Ferrous	Non-ferrous		
1950 ..	828	NA	—	828	NA	7,979	144,243	NA
1951 ..	686	NA	—	686	NA	7,804	158,758	NA
1952 ..	574	NA	—	574	NA	6,785	146,057	NA
1953 ..	10	—	—	536	NA	7,577	197,767	NA
1954 ..	1,820	—	—	579	NA	7,806	215,910	NA
1955 ..	4,002	2,934	—	409	NA	10,469	239,497	NA
1956 ..	6,706	5,165	—	565	NA	13,481	258,548	NA
1957 ..	11,703	8,208	—	455	NA	10,920	285,764	NA
1958 ..	12,238	9,605	—	455	NA	6,723	224,075	NA
1959 ..	12,133	9,432	—	447	NA	8,562	284,856	NA
1960 ..	12,772	10,082	1,608	565	NA	8,556	320,237	NA
1961 ..	11,914	9,367	—	567	NA	9,696	361,060	NA
1962 ..	11,893	9,588	—	588	NA	10,077	357,431	NA
1963 ..	12,151	9,707	—	641	NA	17,233	339,275	NA
1964 ..	13,989	13,989	—	861	NA	20,969	370,975	NA
1965 ..	12,256	11,490	—	766	NA	17,606	424,877	NA
1966 ..	12,008	11,096	—	913	NA	24,292	412,277	NA
1967 ..	13,259	11,826	—	1,432	NA	18,807	448,907	NA
1968 ..	13,826	11,906	—	1,842	NA	12,756	497,102	NA
1969 ..	14,343	11,881	—	2,286	NA	17,032	486,803	NA
1970 ..	14,114	11,475	—	2,422	NA	21,010	628,417	601,488
1971 ..	14,201	11,860	—	2,341	NA	26,904	636,869	620,183
1972 ..	14,271	11,998	—	2,273	NA	32,592	611,277	593,329
1973 ..	12,605	11,736	—	869	NA	29,601	709,953	662,466
1974 ..	12,785	11,993	205	792	NA	18,987	770,434	742,151
1975 ..	13,012	13,012	7,238	(²)	NA	16,220	807,878	753,536
1976 ..	12,582	12,582	18,207	(²)	NA	12,041	792,297	746,954
1977 ..	11,700	11,700	22,459	(²)	NA	11,294	828,147	713,593
1978 ..	10,249	10,249	23,587	(²)	NA	11,162	658,071	602,884
1979 ..	10,606	10,334	29,484	(²)	NA	11,976	686,256	779,659
1980 ..	10,183	10,183	29,937	(²)	27,939	16,777	779,137	731,360
1981 ..	9,349	9,349	34,927	(²)	31,261	15,982	725,778	691,619
1982 ..	3,135	3,135	37,648	(²)	27,246	11,734	621,442	585,503
1983 ..	—	W	30,300	NA	27,285	17,941	673,243	645,887
1984 ..	3,992	8,713	31,968	NA	32,441	17,606	772,683	731,380
1985 ..	4,990	4,730	28,275	NA	33,285	15,381	812,609	762,236
1986 ..	1,066	1,498	—	NA	32,042	7,626	852,138	852,138
1987 ..	—	—	—	NA	24,718	7,613	890,539	857,103
1988 ..	—	—	—	NA	37,682	3,357	917,717	929,631
1989 ..	—	347	—	NA	32,293	7,491	970,493	933,730
1990 ..	330	3,701	—	NA	27,398	6,317	937,173	883,015

See footnotes at end of table.

PRECEEDING PAGE
BLANK

Table 1.—Salient nickel statistics—Continued
(Metric tons, contained nickel)

Year	Yearend stocks				Imports for consumption	
	Government ³	Consumer			Primary	Secondary
		Primary	Secondary	Producer		
1950 ..	39,688	5,359	NA	NA	87,670	NA
1951 ..	47,787	5,178	NA	NA	92,188	NA
1952 ..	52,698	7,381	NA	NA	98,747	NA
1953 ..	67,358	8,984	NA	NA	107,717	NA
1954 ..	99,213	9,926	NA	NA	119,749	NA
1955 ..	136,422	8,166	NA	NA	128,820	NA
1956 ..	147,004	11,496	NA	NA	129,728	NA
1957 ..	160,145	22,935	NA	NA	127,006	NA
1958 ..	198,102	12,101	NA	NA	81,647	NA
1959 ..	220,612	12,814	NA	NA	101,605	NA
1960 ..	208,716	10,314	NA	NA	93,440	NA
1961 ..	199,609	16,600	NA	NA	115,213	NA
1962 ..	202,499	12,202	NA	NA	111,584	NA
1963 ..	199,458	15,595	NA	NA	107,955	NA
1964 ..	196,861	15,590	NA	NA	117,027	NA
1965 ..	182,069	12,743	NA	NA	147,871	NA
1966 ..	88,089	28,384	NA	NA	127,913	NA
1967 ..	66,976	28,129	NA	NA	129,728	NA
1968 ..	64,124	24,917	NA	NA	134,218	NA
1969 ..	60,215	15,036	NA	NA	117,328	NA
1970 ..	58,294	22,415	NA	NA	141,750	NA
1971 ..	44,824	14,520	NA	NA	104,516	606
1972 ..	43,029	23,823	NA	NA	130,267	1,046
1973 ..	41,947	26,090	NA	NA	143,223	1,199
1974 ..	37,748	41,087	NA	NA	167,886	1,678
1975 ..	37,340	32,191	NA	NA	126,858	959
1976 ..	36,859	28,749	NA	NA	128,913	1,070
1977 ..	36,537	16,856	NA	NA	130,639	1,440
1978 ..	35,436	18,546	NA	NA	172,599	1,676
1979 ..	33,226	17,706	NA	NA	134,158	1,633
1980 ..	30,660	13,817	NA	54,431	137,280	1,623
1981 ..	29,347	20,419	10,275	90,719	145,918	2,372
1982 ..	29,347	17,103	9,075	56,246	92,701	1,951
1983 ..	29,346	18,550	9,348	34,927	112,037	2,753
1984 ..	29,346	18,991	5,915	33,838	126,050	2,811
1985 ..	33,894	17,333	5,717	15,785	115,388	2,517
1986 ..	33,767	15,020	4,236	9,344	112,631	3,081
1987 ..	33,760	9,506	3,969	6,191	134,909	3,419
1988 ..	33,760	10,440	4,618	6,960	140,038	7,301
1989 ..	33,760	9,189	4,813	6,326	118,592	9,137
1990 ..	33,760	8,419	4,236	8,065	131,115	11,634
	Exports		U.S. reported consumption ⁴		U.S. apparent consumption	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
1950 ..	2,722	NA	89,801	NA	82,476	7,979
1951 ..	3,629	NA	78,638	NA	81,327	7,804
1952 ..	5,443	NA	91,986	NA	86,765	6,785
1953 ..	12,701	NA	95,872	NA	79,299	7,577
1954 ..	11,628	NA	85,940	NA	76,077	7,806
1955 ..	17,524	NA	99,881	NA	79,302	10,469
1956 ..	13,713	NA	115,737	NA	108,200	13,481
1957 ..	10,832	NA	111,099	NA	100,729	10,920
1958 ..	10,847	NA	71,683	NA	54,327	6,723
1959 ..	5,177	NA	102,204	NA	83,733	8,562
1960 ..	8,936	NA	98,120	NA	111,876	24,449

See footnotes at end of table.

Table 1.—Salient nickel statistics—Continued
(Metric tons, contained nickel)

Year	Exports		U.S. reported consumption ⁴		U.S. apparent consumption	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
1961 ..	6,486	NA	107,515	NA	121,686	26,490
1962 ..	7,257	NA	107,662	NA	116,010	28,350
1963 ..	9,072	NA	112,925	NA	108,902	37,784
1964 ..	10,886	NA	133,284	NA	119,797	46,176
1965 ..	5,080	NA	156,112	NA	172,686	46,629
1966 ..	1,633	NA	170,399	NA	216,628	57,243
1967 ..	7,257	NA	157,667	NA	157,096	47,446
1968 ..	5,897	NA	144,520	NA	148,212	33,203
1969 ..	2,123	NA	128,581	NA	143,337	64,410
1970 ..	5,937	NA	141,266	NA	144,469	44,180
1971 ..	6,519	2,743	116,847	NA	160,335	57,267
1972 ..	3,888	3,828	144,501	NA	161,872	61,233
1973 ..	5,696	2,836	179,371	NA	179,601	59,748
1974 ..	5,467	2,840	189,065	NA	198,272	58,523
1975 ..	8,298	3,157	132,898	NA	161,231	37,764
1976 ..	15,960	7,234	147,806	NA	173,244	47,354
1977 ..	16,918	3,809	140,850	NA	185,531	45,714
1978 ..	17,325	2,117	163,949	NA	207,203	40,081
1979 ..	24,083	4,609	178,076	NA	152,688	52,076
1980 ..	19,257	9,354	141,792	39,719	142,034	44,716
1981 ..	19,611	4,880	131,314	39,706	139,701	47,243
1982 ..	35,192	5,000	94,330	32,377	125,221	38,980
1983 ..	22,628	5,892	115,980	38,133	136,875	45,225
1984 ..	26,567	5,962	131,778	45,041	140,972	50,047
1985 ..	18,834	19,231	103,613	39,369	116,447	32,150
1986 ..	3,564	16,017	93,774	39,668	143,005	7,806
1987 ..	5,802	16,956	115,188	32,331	140,146	15,642
1988 ..	6,834	22,355	110,412	41,039	133,683	25,336
1989 ..	5,144	26,617	95,406	39,784	115,679	19,539
1990 ..	6,034	28,184	108,741	33,715	127,813	15,756

NA Not available.

¹Includes U.S. production.

²Included in smelter production.

³The decrease in nickel in the National Defense Stockpile from 1987 to 1988 was the result of an inventory adjustment.

⁴Figures may differ slightly in other tables as a result of rounding.

Table 2.—U.S. reported consumption of primary nickel, by use¹
(Metric tons nickel content)

Use	1976	1977	1978	1979	1980	1981	1982	1983
Cast irons	3,636	3,381	3,882	4,265	3,671	3,353	1,764	987
Chemicals and chemical uses	2,360	2,261	1,711	1,057	1,338	1,807	1,838	1,773
Electric, magnet, and expansion alloys	5,253	660	742	629	488	439	368	589
Electroplating (sales to platers)	26,023	19,737	24,783	25,897	17,011	20,248	18,950	20,517
Nickel-copper and copper-nickel alloys	6,668	6,321	6,368	7,676	7,961	9,643	16,215	5,687
Other nickel and nickel alloys	29,509	28,927	35,954	37,277	24,897	18,586	3,870	22,617
Steel:								
Stainless steel and heat-resistant	44,106	48,251	54,860	63,162	48,657	45,949	29,213	42,681
Alloys (excludes stainless)	17,348	16,175	15,574	18,300	15,364	14,951	9,084	8,880
Superalloys	8,267	10,307	14,229	15,929	17,375	12,236	9,935	10,429
Other	4,636	4,830	5,846	3,882	4,030	4,102	3,093	1,820
Total ²	147,806	140,850	163,949	178,076	141,792	131,314	94,330	115,980
	1984	1985	1986	1987	1988	1989	1990	
Cast irons	1,226	1,380	1,286	1,256	1,279	957	954	
Chemicals and chemical uses	2,009	1,664	1,487	1,601	1,591	1,241	1,156	

See footnotes at end of table.

Table 2.—U.S. reported consumption of primary nickel, by use¹—Continued
(Metric tons nickel content)

Use	1984	1985	1986	1987	1988	1989	1990
Electric, magnet, and expansion alloys	211	666	307	187	196	127	W
Electroplating (sales to platers)	17,968	17,549	14,423	16,234	15,651	12,954	12,466
Nickel-copper and copper-nickel alloys	7,548	3,839	3,893	4,203	5,001	5,114	3,662
Other nickel and nickel alloys	30,710	18,317	16,509	16,290	17,930	15,594	14,780
Steel:							
Stainless steel and heat-resistant	45,926	38,031	34,875	49,146	45,602	40,732	46,174
Alloys (excludes stainless)	12,718	8,449	7,141	7,766	7,293	6,315	7,024
Superalloys	11,747	12,397	11,996	16,390	13,285	9,654	15,739
Other	1,715	1,321	1,857	2,115	2,584	2,718	6,786
Total ²	131,778	103,613	93,774	115,188	110,412	95,406	108,741

W Withheld to avoid disclosing company proprietary data; included with "Other."

¹Data prior to 1976 were not included because they were not available in terms of nickel content.

²Data may not add to totals shown because of independent rounding.

Table 3.—Reported U.S. consumption of nickel, by form
(Metric tons contained nickel)

Form	1968	1969	1970	1971	1972	1973	1974	1975	1976
Primary:									
Ferronickel	13,762	16,152	13,816	10,446	23,910	32,995	41,423	22,974	28,313
Metal	105,087	89,898	102,353	86,762	100,173	110,514	112,487	90,440	94,687
Oxide and oxide sinter	22,101	17,357	19,386	15,018	17,522	30,170	30,497	15,087	20,138
Salts ¹	3,570	2,401	3,440	2,155	353	3,328	1,838	1,588	2,211
Other	—	2,773	2,271	2,466	2,544	2,364	2,820	2,809	2,457
Total primary	144,520	128,581	141,266	116,847	144,501	179,371	189,065	132,898	147,806
Secondary scrap	—	—	—	—	—	—	—	—	—
Grand total	144,520	128,581	141,266	116,847	144,501	179,371	189,065	132,898	147,806
	1977	1978	1979	1980	1981	1982	1983	1984	1985
Primary:									
Ferronickel	38,834	30,184	36,267	27,142	23,850	13,994	14,148	16,710	16,324
Metal	87,142	111,558	123,365	101,250	92,395	71,697	87,981	102,640	78,228
Oxide and oxide sinter	20,363	17,978	12,872	7,704	8,478	3,807	8,772	8,140	5,574
Salts ¹	2,173	1,838	3,578	3,021	3,775	3,514	3,993	1,050	1,250
Other	2,338	2,391	1,994	2,675	2,816	1,318	1,086	3,238	2,237
Total primary	140,850	163,949	178,076	141,792	131,314	94,330	115,980	131,778	103,613
Secondary scrap	—	—	—	39,719	39,706	32,377	38,133	45,041	39,369
Grand total	140,850	163,949	178,076	181,511	171,020	126,707	154,113	176,819	142,982
	1986	1987	1988	1989	1990				
Primary:									
Ferronickel	12,027	15,801	11,741	10,161	17,355				
Metal	73,279	87,854	88,694	75,828	80,037				
Oxide and oxide sinter	6,676	9,005	7,028	5,882	5,578				
Salts ¹	749	663	755	1,260	1,269				
Other	1,043	1,865	2,194	2,275	4,502				
Total primary	93,774	115,188	110,412	95,406	108,741				
Secondary scrap	39,668	32,331	41,039	39,784	33,715				
Grand total	133,442	147,519	151,451	135,190	142,456				

¹Metallic nickel salts consumed by plating industry are estimated.

Table 4.—U.S. Imports of unwrought nickel products, by class¹
(Metric tons, nickel content²)

Class	1971	1972	1973	1974	1975	1976	1977	1978
Unwrought:								
Primary:								
Cathodes, pellets, briquets, and shot	91,200	113,728	108,937	124,569	97,145	100,929	93,684	133,959
Ferronickel	6,837	12,015	23,287	30,322	17,868	14,659	21,024	18,982
Powder	2,457	57	6,528	8,451	8,844	9,114	12,350	15,211
Flakes	1	300	86	50	21	122	132	194
Oxide and oxide sinter ³	4,021	4,167	4,385	4,494	2,980	4,089	3,449	4,253
Chemicals:								
Catalysts and nickel compounds	NA	NA	NA	NA	NA	NA	NA	NA
Salts	NA	NA	NA	NA	NA	NA	NA	NA
Total ⁴	104,516	130,267	143,223	167,886	126,858	128,913	130,639	172,599
Secondary:								
Stainless steel scrap	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap	606	1,046	1,199	1,678	959	1,070	1,440	1,676
Total	606	1,046	1,199	1,678	959	1,070	1,440	1,676
Grand total ⁴	105,122	131,313	144,422	169,564	127,817	129,983	132,079	174,275
	1979	1980	1981	1982	1983	1984	1985	1986
Unwrought:								
Primary:								
Cathodes, pellets, briquets, and shot	102,766	105,409	111,712	74,659	82,408	93,455	88,704	89,287
Ferronickel	17,260	15,120	18,368	4,849	15,145	14,375	11,559	11,843
Powder	12,150	13,725	12,618	10,844	11,457	13,671	11,350	8,828
Flakes	711	104	195	162	87	689	220	544
Oxide and oxide sinter ³	1,271	2,922	3,025	2,187	2,940	3,860	3,555	1,579
Chemicals:								
Catalysts and nickel compounds	NA	NA	NA	NA	NA	NA	NA	NA
Salts	NA	NA	NA	NA	NA	NA	NA	NA
Total ⁴	134,158	137,280	145,918	92,701	112,037	126,050	115,388	112,631
Secondary:								
Stainless steel scrap	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap	1,633	1,623	2,372	1,951	2,753	2,811	2,517	3,081
Total	1,633	1,623	2,372	1,951	2,753	2,811	2,517	3,081
Grand total ⁴	135,791	138,903	148,290	94,652	114,790	128,861	117,905	115,712
	1987	1988	1989	1990				
Unwrought:								
Primary:								
Cathodes, pellets, briquets, and shot	102,738	102,127	93,362	104,501				
Ferronickel	18,969	14,575	11,476	14,273				
Powder	10,015	9,302	10,442	9,126				
Flakes	850	662	56	8				
Oxide and oxide sinter ³	2,337	2,669	224	873				
Chemicals:								
Catalysts and nickel compounds	NA	NA	NA	901				
Salts	NA	10,703	3,032	1,433				
Total ⁴	134,909	140,038	118,592	131,115				
	1987	1988	1989	1990				
Secondary:								
Stainless steel scrap	NA	5,209	3,997	7,661				
Waste and scrap	3,419	2,092	5,140	3,973				
Total	3,419	7,301	9,137	11,634				
Grand total ⁴	138,328	147,339	127,729	142,749				

NA Not available.

¹Ore and slurry are not included in this table because they are no longer imported and there is no way to determine their nickel content.

²The nickel contents are as follows: oxide sinter from Australia, 90%; elsewhere, 77%. The salts category contains the following: chemical grade oxide, 77%; chloride, 25%; and sulfate, 22%. Catalysts and nickel compounds and waste and scrap are assumed to be 50% nickel and stainless steel scrap, 7.5% nickel.

³From 1988 onward, this category contains metallurgical-grade oxide only; chemical-grade oxide is included with "Salts."

⁴Data may not add to totals shown because of independent rounding.

Table 5.—U.S. Exports of unwrought nickel products, by class
(Metric tons contained nickel¹)

Class	1971	1972	1973	1974	1975	1976	1977	1978
Unwrought:								
Primary:								
Cathodes, pellets, briquets, and shot	3,889	1,976	3,415	2,879	6,056	13,220	13,778	10,561
Electroplating anodes	303	436	691	493	249	282	230	131
Ferronickel	NA	NA	NA	NA	NA	NA	NA	—
Powder and flakes	631	309	466	518	389	443	1,067	4,367
Chemicals, catalysts	1,696	1,167	1,124	1,577	1,604	2,015	1,843	2,266
Total	6,519	3,888	5,696	5,467	8,298	15,960	16,918	17,325
Secondary:								
Stainless steel scrap	NA	NA	NA	NA	NA	NA	NA	—
Waste and scrap	2,743	3,828	2,836	2,840	3,157	7,234	3,809	2,117
Total	2,743	3,828	2,836	2,840	3,157	7,234	3,809	2,117
Grand total	9,262	7,716	8,532	8,307	11,455	23,194	20,727	19,442
	1979	1980	1981	1982	1983	1984	1985	1986
Unwrought:								
Primary:								
Cathodes, pellets, briquets, and shot	17,925	12,597	14,785	30,637	20,108	23,584	16,113	1,756
Electroplating anodes	98	126	85	115	161	127	120	98
Ferronickel	—	—	—	—	—	—	—	167
Powder and flakes	3,703	4,933	2,977	3,136	923	1,624	1,003	530
Chemicals, catalysts	2,357	1,601	1,764	1,304	1,436	1,232	1,598	1,013
Total	24,083	19,257	19,611	35,192	22,628	26,567	18,834	3,564
Secondary:								
Stainless steel scrap	—	NA	—	—	—	—	12,247	11,254
Waste and scrap	4,609	9,354	4,880	5,000	5,892	5,962	6,984	4,763
Total	4,609	9,354	4,880	5,000	5,892	5,962	19,231	16,017
Grand total	28,692	28,611	24,491	40,192	28,520	32,529	38,065	19,581
	1987	1988	1989	1990				
Primary:								
Cathodes, pellets, briquets, and shot	1,403	1,760	885	887				
Electroplating anodes	193	187	NA	NA				
Ferronickel	64	—	604	1,725				
Powder and flakes	528	522	600	691				
Chemicals, catalysts	3,614	4,365	3,055	2,731				
Total	5,802	6,834	5,144	6,034				
Secondary:								
Stainless steel scrap	11,721	16,557	19,841	17,472				
Waste and scrap	5,235	5,798	6,776	10,712				
Total	16,956	22,355	26,617	28,184				
Grand total	22,758	29,189	31,761	34,218				

NA Not available.

¹The nickel contents are as follows: catalysts and waste and scrap are assumed to be 50% nickel; stainless steel scrap is assumed to be 50% nickel.

Table 6.—Average annual nickel prices

Year	\$/lb	Year	\$/lb	Year	\$/lb	Year	\$/lb
1840	1.700	1880	0.950	1920	0.423	1960	0.740
1841	1.700	1881	.910	1921	.420	1961	.777
1842	2.090	1882	.990	1922	.383	1962	.799
1843	2.400	1883	1.110	1923	.355	1963	.790
1844	2.750	1884	.700	1924	.303	1964	.790
1845	3.050	1885	.650	1925	.328	1965	.787
1846	3.050	1886	.480	1926	.356	1966	.789
1847	2.890	1887	.620	1927	.354	1967	.878
1848	2.190	1888	.580	1928	.370	1968	.950
1849	1.930	1889	.650	1929	.350	1969	1.054
1850	1.930	1890	.650	1930	.350	1970	1.290
1851	1.930	1891	.550	1931	.350	1971	1.235
1852	1.930	1892	.750	1932	.350	1972	1.345
1853	1.700	1893	.520	1933	.350	1973	1.490
1854	1.700	1894	.570	1934	.350	1974	2.000
1855	1.570	1895	.300	1935	.350	1975	1.865
1856	1.570	1896	.325	1936	.350	1976	2.080
1857	1.450	1897	.330	1937	.350	1977	2.035
1858	1.200	1898	.325	1938	.350	1978	1.885
1859	1.200	1899	.320	1939	.350	1979	2.958
1860	1.200	1900	.500	1940	.350	1980	2.960
1861	1.200	1901	.560	1941	.350	1981	2.709
1862	1.080	1902	.450	1942	.315	1982	2.183
1863	1.650	1903	.400	1943	.315	1983	2.180
1864	2.290	1904	.400	1944	.315	1984	2.164
1865	1.680	1905	.400	1945	.315	1985	2.258
1866	1.550	1906	.400	1946	.350	1986	1.761
1867	1.520	1907	.450	1947	.350	1987	2.193
1868	1.140	1908	.450	1948	.356	1988	6.252
1869	1.390	1909	.400	1949	.400	1989	6.050
1870	1.280	1910	.400	1950	.448	1990	4.021
1871	1.320	1911	.400	1951	.540		
1872	2.250	1912	.400	1952	.565		
1873	3.840	1913	.418	1953	.599		
1874	3.100	1914	.414	1954	.605		
1875	2.960	1915	.413	1955	.655		
1876	2.520	1916	.419	1956	.652		
1877	1.600	1917	.415	1957	.740		
1878	.950	1918	.408	1958	.740		
1879	.890	1919	.404	1959	.740		

NOTES.—Prices from 1840-1912 (refined nickel) were furnished by Inco Ltd. Prices from 1913-27 are from Historical Statistics of the United States, Colonial Times to 1970, U.S. Department of Commerce, Bureau of the Census. Prices from 1928-69 are from the nickel chapter of the U.S. Bureau of Mines Minerals Yearbook. Prices from 1970 onward are from the London Metal Exchange.

Page Intentionally Left Blank

PHOSPHATE ROCK

By David E. Morse

The principal commercial deposits of phosphate rock exist in Florida, North Carolina, and Idaho, and to a lesser degree in Montana and Utah. Production of phosphate rock in Tennessee ended in 1991. Phosphate rock is mined, beneficiated, and either solubilized to produce wet-process phosphoric acid or smelted to produce elemental phosphoric acid or smelted to produce elemental phosphorous. Phosphoric acid is reacted with phosphate rock to produce the fertilizer triple superphosphate or with anhydrous ammonia to produce the ammonium phosphate fertilizers. Elemental phosphorus is the base for furnace-grade phosphoric acid, phosphorus pentasulfide, phosphorus pentoxide, and phosphorus trichloride. Approximately 90% of phosphate rock production is used for fertilizers and animal feed supplements and the balance for industrial chemicals.

U.S. phosphate rock production increased from 18 million metric tons in 1960 to 35 million metric tons in 1970 and peaked at 54 million metric tons in 1980. Consumption in 1990 was 44 million metric tons. Increasing tonnage of phosphate rock is used to produce higher value

phosphatic fertilizers for the export market. Phosphate rock exports peaked in 1980 at 14 million metric tons and has declined to 6 million metric tons in 1990. Phosphate rock imports have historically been a minor factor in supply; however, in addition to small quantities of low-fluorine materials, phosphate rock imports in recent years increased to the .5-million-metric-ton level.

Phosphate rock prices in the 1960's were in the \$5 to \$6 per metric ton range, f.o.b. mine, and increased to the \$20 to \$25 per metric ton range, f.o.b. mine, in the 1980's.

The demand for phosphate rock as a nutrient for food production will vary throughout the world. The overall demand is forecast to increase in the 1%-to-2%-per-year range; however, in the agriculturally mature countries, the increase in demand will be closer to 1% per year.

The supply of phosphate rock is forecast to decline in the United States as existing mines in Florida are mined out and unfavorable economics discourage new mine development. World supply will be maintained from quality deposits in North Africa.

Table 1.—U.S. phosphate rock historical data
(Thousand metric tons per year unless otherwise specified)

Year	Production	Consumption	Exports	Imports	Value ¹
1970	35,144	24,643	9,884	123	5.80
1971	35,277	25,209	11,419	76	5.80
1972	37,042	26,794	12,950	50	5.62
1973	38,227	28,335	12,587	59	6.24
1974	41,446	31,498	12,165	165	12.04
1975	44,286	31,029	10,270	34	25.00
1976	44,671	31,142	9,435	46	21.15
1977	47,256	34,365	13,230	158	17.48
1978	50,037	36,812	12,870	908	18.48
1979	51,611	39,591	14,358	886	20.04
1980	54,415	40,791	14,276	486	22.78
1981	53,624	35,144	10,395	13	26.63
1982	37,414	28,760	9,842	31	25.50
1983	42,573	34,840	12,010	9	23.97
1984	49,197	41,758	11,528	9	23.99
1985	50,835	37,532	9,136	34	22.25
1986	40,320	34,456	7,848	528	22.67
1987	40,954	35,683	8,454	464	19.37
1988	45,389	41,022	8,092	673	19.56
1989	49,817	42,142	7,842	705	21.76
1990	46,343	43,967	6,238	451	23.20

¹Dollars per metric ton, f.o.b. mine.

Source: U.S. Bureau of Mines Minerals Yearbooks.

PRECEDING PAGE
BLANK

Page Intentionally Left Blank

PLATINUM-GROUP METALS

By J. Roger Loebenstein

The platinum-group metals (PGM) comprise six closely related metals: platinum, palladium, rhodium, ruthenium, iridium, and osmium, which commonly occur together in nature and are among the scarcest of the metallic elements. Along with gold and silver, they are known as precious or noble metals. They occur as native alloys in placer deposits or, more commonly, in lode deposits associated with nickel and copper. Nearly all of the world's supply of these metals are extracted from lode deposits in four countries—the Republic of South Africa, the U.S.S.R., Canada, and the United States. The Republic of South

Africa is the only country that produces all six PGM in substantial quantities.

PGM have become critical to industry because of their extraordinary physical and chemical properties—the most important of which is their catalytic activity. Since the mid-1970's and continuing today, automobile manufacturers have used catalytic converters containing platinum, palladium, and rhodium to reduce automobile emissions. Similarly, the chemical and petroleum-refining industries have relied on PGM catalysts to produce a wide variety of chemicals and petroleum products.

Table 1.—Platinum-group metals recovered in the U.S. from secondary sources
(Kilograms)

Year	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total ¹
NONTOLL-REFINED							
1970	3,679	6,487	60	4	417	245	10,892
1971	3,217	5,011	68	11	275	71	8,652
1972	2,362	5,061	137	5	354	33	7,951
1973	2,951	4,666	211	1	360	82	8,270
1974	2,986	6,638	109	(²)	346	37	10,115
1975	3,223	4,652	72	1	426	28	8,401
1976	2,019	4,191	122	(²)	251	116	6,698
1977	1,581	4,171	45	(²)	156	119	6,072
1978	2,351	5,175	49	(²)	257	168	7,999
1979	2,334	6,863	51	—	248	116	9,612
1980	4,792	5,051	99	(²)	314	35	10,292
1981	5,844	5,778	103	2	352	102	12,181
1982	5,917	4,332	90	—	352	13	10,705
1983	3,688	5,531	73	—	114	23	9,429
1984	2,790	7,569	23	1	114	64	10,560
1985	1,629	6,263	8	—	97	46	8,043
1986	2,204	8,627	9	—	134	41	11,015
1987	1,180	3,743	4	19	123	49	5,118
1988	1,133	3,545	4	—	104	2	4,788
1989	1,134	2,664	6	—	94	35	3,933
1990	1,928	3,672	7	—	178	34	5,819
TOLL-REFINED							
1970	27,883	15,389	81	25	1,489	281	45,148
1971	19,460	16,403	298	125	1,343	286	37,915
1972	24,500	13,413	240	47	1,371	160	39,732
1973	18,071	11,614	106	40	1,147	145	31,123
1974	20,347	11,377	108	45	1,126	214	33,216
1975	19,755	13,617	305	47	1,526	777	36,027
1976	15,367	9,673	202	44	1,059	385	26,731
1977	19,311	10,185	155	61	1,312	203	31,226
1978	19,625	10,700	205	21	1,117	118	31,787
1979	18,225	13,878	171	—	1,209	427	33,909
1980	16,581	15,518	153	43	1,038	228	33,561
1981	16,196	18,892	243	58	1,085	575	37,049
1982	12,250	13,392	314	28	830	196	27,010
1983	13,490	14,206	181	29	1,295	180	29,380
1984	16,303	17,682	243	2	1,169	600	35,999
1985	15,259	15,270	218	(²)	1,130	415	32,293

See footnotes at end of table.

PRECEDING PAGE
BLANK

Table 1.—Platinum-group metals recovered in the U.S. from secondary sources—Continued
(Kilograms)

Year	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total ¹
TOLL-REFINED							
1986	20,977	12,388	111	44	1,792	613	35,924
1987	22,580	19,169	102	25	1,895	1,164	44,935
1988	22,884	20,923	252	19	1,826	499	46,403
1989	24,058	20,037	219	1	1,565	373	46,253
1990	38,475	23,297	130	—	3,094	433	65,429

¹Data may not add to total shown because of independent rounding.

²Less than 1/2 unit.

Table 2.—U.S. exports of platinum-group metals
(Kilograms and thousand dollars)

Year	Platinum	Palladium, rhodium, iridium, osmium, ruthenium	Waste and scrap	Ores and concentrates	Total	
					Quantity ¹	Value
1970	5,807	4,453	2,349	260	12,870	43,012
1971	5,308	2,605	4,206	465	12,585	1,041
1972	8,813	3,793	3,173	985	16,765	161,041
1973	10,220	5,850	3,298	150	19,518	312,037
1974	10,459	11,236	2,884	1,415	25,995	117,421
1975	8,858	8,816	2,610	241	20,525	87,514
1976	4,322	5,804	5,634	178	15,938	52,753
1977	4,635	4,271	3,829	534	13,269	46,490
1978	5,166	11,103	5,134	448	21,852	102,065
1979	6,464	15,631	5,452	433	27,981	202,157
1980	9,003	9,407	5,296	87	23,793	341,206
1981	12,168	8,079	6,351	256	26,854	301,890
1982	5,468	8,173	12,082	276	25,999	182,460
1983	5,742	8,124	23,363	990	38,219	309,917
1984	6,870	11,751	16,249	1,273	36,143	274,775
1985	5,817	10,552	11,148	123	27,640	187,161
1986	3,240	8,640	10,556	914	23,349	201,807
1987	2,806	10,618	8,435	172	22,031	224,969
1988	7,972	12,329	8,330	156	28,787	309,839
1989	8,414	14,668	15,046	173	38,301	398,109
1990	7,510	12,638	34,487	409	55,044	415,605

¹Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 3.—U.S. Imports for consumption of platinum-group metals
(Kilograms and thousand dollars)

Year	Platinum ¹	Palladium	Rhodium	Ruthenium	Iridium	Osmium ²	Waste and scrap	Ores	Total	
									Quantity	Value
1970	15,247	24,068	1,276	³ 647	³ 263	382	1,997	NA	43,880	104,823
1971	14,641	20,632	1,078	³ 873	³ 445	517	2,334	NA	40,520	93,674
1972	19,172	28,062	1,580	³ 1,903	³ 772	3,288	2,339	NA	57,117	144,092
1973	28,415	35,903	2,899	2,091	731	550	2,629	4,671	77,889	269,702
1974	41,891	41,619	3,067	1,999	913	6,340	4,117	1,181	101,127	504,619
1975	28,716	17,235	2,551	527	478	3,485	3,624	1	56,617	272,823
1976	37,868	34,939	1,994	2,385	655	549	4,565	—	82,955	291,536
1977	28,962	35,821	2,486	1,672	273	1,007	7,709	150	78,081	273,044
1978	39,144	38,074	3,202	³ 2,287	1,118	875	5,860	308	90,866	450,152
1979	47,261	46,793	3,391	³ 3,884	1,052	614	4,873	345	108,213	840,533
1980	48,188	40,950	3,430	³ 3,063	814	741	11,710	21	108,918	1,176,747
1981	34,305	38,284	2,347	³ 5,612	353	365	7,321	45	88,633	800,256

See footnotes at end of table.

Table 3.—U.S. imports for consumption of platinum-group metals—Continued
(Kilograms and thousand dollars)

Year	Platinum ¹	Palladium	Rhodium	Ruthenium	Iridium	Osmium ²	Waste and scrap	Ores	Total	
									Quantity	Value
1982	25,567	34,213	2,176	³ 4,162	632	223	10,547	43	77,563	553,935
1983	35,497	41,436	4,081	³ 5,089	730	209	12,984	66	100,092	752,756
1984	50,282	60,775	4,916	³ 6,166	572	66	16,383	—	139,160	1,118,088
1985	49,003	46,074	6,257	³ 5,066	767	408	16,507	7	124,090	1,025,692
1986	57,198	46,709	5,570	³ 5,492	945	336	22,949	58	139,256	1,346,715
1987	36,780	52,274	6,603	³ 2,625	369	252	19,437	56	118,397	1,240,080
1988	46,824	52,879	7,359	³ 3,744	643	100	12,761	13	124,324	1,347,927
1989	49,238	51,135	7,105	2,883	688	58	2,159	12	113,278	1,381,693
1990	52,277	51,992	13,098	2,586	603	75	4,614	109	125,354	1,905,830

NA Not available.

¹Platinum includes platinum sponge and grains and nuggets and, for 1973-88, "Unspecified combinations" that contain not less than 90% platinum by weight.

²May include unwrought osmium and osmiridium and semimanufactured osmium, iridium, ruthenium, and osmiridium, which were all classed as part of "Other platinum-group metals" (1970-72); does include osmiridium, unwrought and semimanufactured, and "Platinum-group metals in materials not elsewhere specified" (1973-88) and semimanufactured ruthenium (1978-88).

³Unwrought only; any imports of semimanufactures were classed as part of "Other platinum-group metals" or as part of "Platinum-group metals in materials not elsewhere specified."

Source: Bureau of the Census.

Table 4.—U.S. platinum-group metals stocks¹
(Kilograms)

Year	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total ²
1970 . . .	9,068	10,349	416	58	1,486	708	22,085
1971 . . .	12,001	9,833	511	19	1,603	817	24,784
1972 . . .	13,269	12,622	466	3	1,772	822	28,954
1973 . . .	13,888	15,336	461	10	1,602	836	32,133
1974 . . .	17,095	14,874	565	27	1,665	921	35,147
1975 . . .	13,087	10,439	568	20	1,675	624	26,413
1976 . . .	16,681	14,300	632	14	1,486	656	33,769
1977 . . .	13,625	14,785	488	13	1,505	1,086	31,502
1978 . . .	11,503	11,506	506	22	1,596	1,660	26,793
1979 . . .	9,505	10,073	569	46	1,545	1,939	23,679
1980 . . .	15,620	10,980	468	6	1,434	1,765	30,272
1981 . . .	12,485	12,408	523	1	1,348	1,793	28,559
1982 . . .	18,806	11,949	415	4	1,262	1,983	34,420
1983 . . .	13,482	12,820	527	15	1,590	901	29,335
1984 . . .	20,159	16,327	610	40	1,652	2,226	41,015
1985 . . .	17,554	14,878	631	9	1,896	2,087	37,054
1986 . . .	20,426	16,958	611	12	1,475	705	40,187
1987 . . .	19,004	17,356	506	1	996	549	38,412
1988 . . .	18,438	14,837	432	8	1,165	634	35,514
1989 . . .	14,791	15,182	522	36	1,096	916	32,543
1990 . . .	13,421	14,425	483	55	1,089	851	30,324

¹Includes platinum and palladium metal held in depositories of the New York Mercantile Exchange (NYMEX).

²Data may not add to totals shown because of independent rounding.

Table 5.—Platinum-group metals¹ sold to consuming industries in the United States
(Kilograms)

Year	Automotive ²	Chemical	Dental and medical	Electrical	Glass	Jewelry and decorative	Petroleum	Miscellaneous	Total ³
1970	—	11,811	2,101	16,989	2,345	1,762	4,988	1,409	41,403
1971	—	12,098	2,681	15,536	1,398	1,529	4,384	1,606	39,231
1972	—	18,332	3,918	16,669	1,344	1,555	4,050	2,724	48,591
1973	—	17,824	5,107	20,791	2,824	1,913	4,477	4,104	57,041
1974	15,552	13,275	4,703	17,144	2,865	1,812	5,151	1,114	61,616
1975	11,508	9,818	4,136	7,052	1,751	1,630	3,529	1,281	40,706
1976	21,021	7,411	5,204	8,920	1,520	1,188	2,077	2,519	49,861
1977	14,936	8,740	4,386	10,723	2,339	1,766	2,749	3,886	49,525
1978	24,862	10,456	7,841	14,087	3,662	1,580	3,967	3,825	70,280
1979	32,706	11,306	8,461	17,828	3,291	1,532	6,155	4,443	85,722
1980	22,747	8,851	8,449	16,365	1,950	2,288	5,312	2,649	68,612
1981	18,889	7,171	8,539	15,551	1,124	1,470	3,460	3,535	59,739
1982	19,364	8,216	10,417	13,635	710	891	1,347	3,684	58,265
1983	21,783	5,137	11,254	12,613	532	652	2,772	4,787	59,531
1984	24,922	5,668	11,434	17,169	474	639	3,757	4,359	68,421
1985	27,039	5,369	11,339	14,774	738	896	3,413	7,082	70,650
1986	26,674	4,763	9,009	14,302	591	656	2,847	5,863	64,705
1987	25,754	3,203	11,005	12,701	342	656	1,829	4,789	60,280
1988	26,532	7,683	7,231	17,923	779	792	2,587	7,471	70,998
1989	25,643	4,645	9,233	23,464	1,489	814	5,429	7,766	78,483
1990	26,957	4,654	6,974	23,698	810	818	4,762	8,814	77,487

¹Comprises primary and nontoll-refined secondary materials.

²For 1985-90, sales to automotive industry are estimated based on U.S. light truck sales and U.S. automotive production.

³Data may not add to totals shown because of independent rounding.

Table 6.—Platinum¹ sold to consuming industries in the United States
(Kilograms)

Year	Automotive ²	Chemical	Dental and medical	Electrical	Glass	Jewelry and decorative	Petroleum	Miscellaneous	Total ³
1970	—	4,612	569	3,214	1,452	908	4,499	577	15,832
1971	—	4,202	718	1,616	1,266	578	4,273	618	13,271
1972	—	7,026	947	2,873	839	642	3,074	1,558	16,961
1973	—	7,433	867	3,650	2,256	698	3,846	1,732	20,483
1974	10,886	6,708	794	3,067	2,314	714	4,340	529	29,352
1975	8,491	4,629	532	2,290	1,052	712	3,359	663	21,727
1976	14,960	2,599	835	2,778	1,296	727	1,838	1,438	26,472
1977	11,021	2,626	842	2,806	1,866	1,078	2,326	2,002	24,566
1978	18,586	4,656	1,373	3,310	3,051	801	3,371	2,063	37,210
1979	24,983	3,067	841	3,601	2,756	862	5,288	2,424	43,822
1980	16,085	3,700	803	4,667	1,645	1,586	4,480	1,814	34,781
1981	13,893	2,430	583	3,474	910	859	2,747	2,246	27,142
1982	14,860	1,978	709	2,799	641	498	671	2,109	24,265
1983	15,816	2,033	521	2,324	464	321	1,183	2,119	24,781
1984	17,698	2,286	580	3,084	379	297	872	2,058	27,254
1985	19,253	2,651	762	3,603	642	499	895	3,599	31,905
1986	19,440	2,417	645	3,219	496	352	951	2,992	30,513
1987	18,818	1,920	479	1,821	285	177	543	1,430	25,471
1988	19,346	3,184	581	3,494	681	385	1,072	2,383	31,125
1989	18,774	2,424	632	3,894	1,130	418	2,859	3,566	33,698
1990	20,967	2,080	687	3,907	431	431	3,274	4,280	36,055

¹Comprises primary and nontoll-refined secondary materials.

²For 1985-90, sales to automotive industry are estimated based on U.S. light truck sales and U.S. automotive production.

³Data may not add to totals shown because of independent rounding.

Table 7.—Palladium¹ sold to consuming industries in the United States
(kilograms)

Year	Automotive ²	Chemical	Dental and medical	Electrical	Glass	Jewelry and decorative	Petroleum	Miscellaneous	Total ³
1970	—	5,742	1,480	13,344	658	539	482	751	22,996
1971	—	6,801	1,916	13,421	7	583	91	823	23,642
1972	—	9,104	2,932	13,222	70	603	451	866	27,247
1973	—	8,086	4,201	16,300	45	717	117	2,027	31,492
1974	4,666	5,076	3,859	12,138	297	675	463	386	27,560
1975	3,017	4,447	3,576	4,113	548	716	55	371	16,844
1976	6,050	3,988	4,332	4,737	93	177	227	833	20,437
1977	3,888	5,015	3,498	6,959	28	484	265	1,649	21,787
1978	6,184	4,552	6,417	8,913	86	391	588	1,420	28,551
1979	6,910	6,213	7,578	12,204	54	366	765	1,140	35,228
1980	5,490	3,729	7,598	9,728	36	420	685	679	28,365
1981	4,019	2,808	7,935	10,742	91	459	649	953	27,657
1982	3,684	4,005	9,666	9,716	7	245	648	841	28,811
1983	5,351	1,241	10,685	7,778	5	209	1,551	1,853	28,672
1984	5,568	2,445	10,794	12,121	(⁴)	214	2,866	1,777	35,784
1985	5,630	1,967	10,516	9,352	13	248	2,518	2,736	32,980
1986	5,132	1,384	8,309	8,908	—	149	1,896	1,903	27,681
1987	4,977	1,079	10,376	9,900	—	221	1,286	3,118	30,956
1988	5,101	3,669	6,622	13,049	11	196	1,438	4,156	34,241
1989	4,886	1,923	8,424	17,352	181	179	2,543	3,786	39,273
1990	2,995	2,369	6,133	17,997	346	177	1,488	3,612	35,116

¹Comprises primary and nontoll-refined secondary materials.

²For 1985-90, sales to automotive industry are estimated based on U.S. light truck sales and U.S. automotive production.

³Data may not add to totals shown because of independent rounding.

⁴Less than 1/2 unit.

Table 8.—Iridium¹ sold to consuming industries in the United States
(Kilograms)

Year	Automotive	Chemical	Dental and medical	Electrical	Glass	Jewelry and decorative	Petroleum	Miscellaneous	Total ²
1970	—	173	24	70	13	53	—	7	339
1971	—	259	19	81	20	34	14	55	482
1972	—	387	12	126	2	49	520	80	1,174
1973	—	331	5	109	2	37	416	55	954
1974	—	228	10	88	11	27	310	33	708
1975	—	80	2	61	6	12	112	11	284
1976	—	42	7	198	9	32	12	14	315
1977	—	90	8	117	4	35	159	4	419
1978	1	122	18	260	6	69	—	47	524
1979	—	115	18	252	3	63	64	23	538
1980	—	129	15	351	2	96	126	15	734
1981	3	31	5	110	—	17	58	37	262
1982	1	31	3	170	(³)	33	28	65	330
1983	1	18	4	32	1	24	32	43	156
1984	7	23	12	47	3	36	—	93	221
1985	9	30	20	57	6	59	—	151	332
1986	3	29	12	51	3	32	—	253	382
1987	—	27	101	27	2	19	—	72	250
1988	(³)	117	2	190	(³)	20	75	89	495
1989	—	95	105	112	—	7	—	81	400
1990	—	22	104	111	1	11	—	199	448

¹Comprises primary and nontoll-refined secondary materials.

²Data may not add to totals shown because of independent rounding.

³Less than 1/2 unit.

Table 9.—Osmium¹ sold to consuming industries in the United States
(Kilograms)

Year	Chemical	Dental and medical	Electrical	Miscellaneous	Total ²
1970	31	21	(³)	2	53
1971	46	20	—	(³)	66
1972	62	12	—	1	75
1973	31	19	—	—	51
1974	31	21	2	—	54
1975	13	21	—	(³)	34
1976	2	23	—	(³)	25
1977	6	23	—	(³)	28
1978	1	24	—	—	25
1979	16	14	—	—	30
1980	10	15	—	—	25
1981	13	8	—	—	21
1982	10	32	—	—	42
1983	11	32	—	—	43
1984	(³)	33	—	—	33
1985	1	27	—	—	28
1986	1	21	—	—	21
1987	—	29	—	—	29
1988	—	21	—	2	23
1989	—	57	—	—	57
1990	—	40	—	1	40

¹Comprises primary and nontoll-refined secondary materials.

²Data may not add to totals shown because of independent rounding.

³Less than 1/2 unit.

Table 10.—Rhodium¹ sold to consuming industries in the United States
(Kilograms)

Year	Automotive ²	Chemical	Dental and medical	Electrical	Glass	Jewelry and decorative	Petro-leum	Miscellaneous	Total ³
1970	—	823	2	282	222	166	2	25	1,521
1971	—	464	1	283	105	169	5	43	1,069
1972	—	478	1	245	433	205	5	67	1,434
1973	—	739	9	410	519	390	95	124	2,287
1974	—	726	12	483	232	325	39	100	1,916
1975	—	480	1	257	139	153	4	112	1,146
1976	12	598	2	282	119	161	(⁴)	97	1,271
1977	27	630	9	335	435	156	—	127	1,717
1978	91	603	7	446	516	309	9	184	2,166
1979	813	363	1	526	478	232	38	144	2,596
1980	1,151	164	1	461	267	169	21	53	2,287
1981	933	277	1	375	123	113	—	110	1,932
1982	819	214	(⁴)	292	62	105	(⁴)	60	1,552
1983	614	124	5	263	63	70	—	236	1,376
1984	1,617	144	13	232	91	66	(⁴)	207	2,371
1985	2,115	127	11	176	77	69	1	169	2,745
1986	2,084	158	19	212	92	99	—	242	2,906
1987	1,960	107	10	180	55	230	—	150	2,692
1988	2,084	109	2	123	85	177	1	710	3,292
1989	1,982	177	1	177	177	205	27	273	3,019
1990	2,995	169	2	274	31	195	—	520	4,187

¹Comprises primary and nontoll-refined secondary materials.

²For 1985-90, sales to automotive industry are estimated based on U.S. light truck sales and U.S. automotive production.

³Data may not add to totals shown because of independent rounding.

⁴Less than 1/2 unit.

Table 11.—Ruthenium¹ sold to consuming industries in the United States
(Kilograms)

Year	Automotive	Chemical	Dental and medical	Electrical	Glass	Jewelry and decorative	Petroleum	Miscellaneous	Total ²
1970	—	430	6	79	—	95	5	47	662
1971	—	325	7	135	—	165	(³)	68	700
1972	—	1,275	14	203	—	56	—	152	1,701
1973	—	1,204	5	322	3	72	3	167	1,775
1974	—	507	7	1,366	11	70	—	66	2,027
1975	—	170	4	331	6	36	—	123	670
1976	—	181	4	925	3	92	—	136	1,341
1977	—	374	6	506	5	12	—	105	1,008
1978	—	521	2	1,158	3	10	—	111	1,804
1979	—	1,532	9	1,245	—	10	—	711	3,506
1980	21	1,119	16	1,158	—	17	—	88	2,419
1981	40	1,612	7	850	—	22	5	189	2,726
1982	—	1,978	7	659	—	11	—	609	3,264
1983	—	1,710	7	2,216	—	28	6	537	4,503
1984	32	770	2	1,684	—	25	19	224	2,756
1985	32	594	3	1,585	(³)	21	—	427	2,662
1986	16	775	3	1,913	1	23	—	473	3,203
1987	—	70	11	773	1	8	—	20	882
1988	—	604	3	1,067	1	14	—	132	1,821
1989	—	26	15	1,929	1	6	—	61	2,037
1990	—	16	7	1,406	1	8	—	202	1,641

¹Comprises primary and nontoll-refined secondary materials.

²Data may not add to totals shown because of independent rounding.

³Less than 1/2 unit.

Table 12.—Average producer and dealer prices of platinum-group metals¹
(Dollars per troy ounce)

Year	Platinum		Palladium		Rhodium		Iridium		Ruthenium		Osmium	
	Pro-ducer	Dealer	Pro-ducer	Dealer	Pro-ducer	Dealer	Pro-ducer	Dealer	Pro-ducer	Dealer	Pro-ducer	Dealer
1970	133	NA	38	NA	215	NA	156	NA	53	45	215	220
1971	121	NA	37	NA	200	195	152	NA	52	NA	210	NA
1972	121	NA	42	NA	197	NA	162	NA	52	NA	212	NA
1973	150	155	78	75	222	268	223	358	59	115	200	144
1974	181	192	133	126	329	628	391	700	60	55	200	140
1975	164	150	93	66	338	278	477	395	60	45	200	136
1976	162	153	51	47	348	310	325	271	60	37	200	129
1977	163	157	60	49	441	409	298	258	60	35	163	130
1978	237	261	71	63	510	524	300	240	56	33	150	130
1979	352	445	113	120	733	770	257	280	45	32	150	130
1980	439	677	214	201	766	729	505	666	45	35	150	130
1981	475	446	130	95	641	498	600	529	45	32	150	130
1982	475	327	110	67	600	323	600	359	45	26	137	130
1983	475	424	130	136	600	312	600	309	45	28	110	132
1984	475	357	147	148	625	607	600	424	NA	103	NA	455
1985	475	291	127	107	915	929	600	438	NA	101	NA	915
1986	519	461	131	116	1,196	1,157	600	414	NA	73	NA	704
1987	600	553	150	130	1,239	1,222	532	363	NA	70	NA	633
1988	600	523	150	123	1,275	1,218	420	306	NA	61	NA	592
1989	600	507	150	144	1,275	1,300	NA	303	NA	62	NA	549
1990	600	467	150	114	1,275	3,565	NA	307	NA	61	NA	416

NA Not available.

¹Average prices calculated at the low end of the range and rounded to the nearest dollar.

Page Intentionally Left Blank.

RARE EARTHS

By James B. Hedrick

The rare-earth elements are defined as a group of chemical elements composed of scandium, yttrium, and the lanthanides. The lanthanides are a group of 15 chemically similar elements with atomic numbers 57 through 71, inclusive. Although not a lanthanide, yttrium, atomic number 39, is included in the rare earths because it often occurs with them in nature, having similar chemical properties. Scandium, atomic number 21, is also included in the group, although it typically occurs in rare-earth ores only in minor amounts because of its smaller atomic and ionic size.

Rare-earth production is derived from the rare-earth ores bastnasite, monazite, xenotime, and ion-adsorption clay. Bastnasite is the world's principal source of rare earths and is produced in China and the United States. Significant quantities of rare earths are also recovered from the mineral monazite. Xenotime and ion-adsorption clays account for a much smaller part of the total production but are important sources of yttrium and other heavy-group rare earths.

In 1990, rare earths were produced by at least 14 countries. The United States was the largest rare-earth-producing country, followed by China, Australia, India, and Malaysia. Except for one primary mine in the United

States, essentially all rare earths are produced as byproduct during processing for titanium and zirconium minerals, iron minerals, or the tin mineral cassiterite.

Domestic mine production of bastnasite during the 1970's and 1980's showed an overall increase. Most companies increased their ore and separated product capacities during the period to meet growing demand. Price increases during the two decades were tied primarily to adjustments for inflation and increased operating costs. In the 1980's, demand shifted away from mixed rare-earth products, such as mischmetal and mixed compounds, to higher value individual high-purity products. Consumption and production of rare earths decreased significantly in 1985 because of decreased demand for rare-earth-containing petroleum cracking catalysts. The rare-earth industry rebounded during the next 5 years as a result of stable demand in traditional markets and strong demand in new applications.

Principal uses for the rare earths are in petroleum fluid cracking catalysts; metallurgical applications; glass polishing compounds; glass additives; permanent magnets; catalytic converter materials; and television, lighting, and X-ray intensifying phosphors.

Table 1.—U.S. rare-earth mine production¹
(Metric tons, rare-earth oxide equivalent)

Year	Bastnasite concentrate
1970	9,105
1971	9,823
1972	10,707
1973	17,554
1974	19,913
1975	14,969
1976	13,038
1977	15,359
1978	14,148
1979	16,515
1980	15,986
1981	17,082
1982	17,501
1983	17,083
1984	25,311
1985	13,428
1986	11,094
1987	16,710
1988	11,533
1989	20,787
1990	22,713

¹Includes only the rare earth derived from bastnasite, as reported in the Unocal Corp. and Union Oil of California annual reports.

PRECEDING PAGE
BLANK

Table 2.—Yearend rare-earth concentrate prices
(Dollars per kilogram rare-earth oxide contained)

Year	Bastnasite concentrate, 60% rare-earth oxide ¹		Monazite concentrate, 55% rare-earth oxide plus thorium	
	Actual dollars	1990 dollars ²	Actual dollars	1990 dollars ²
1970	0.77	2.41	0.37	1.16
1971	.77	2.28	.38	1.13
1972	.77	2.18	.35	.99
1973	.77	2.05	.40	1.06
1974	.84	2.05	.42	1.02
1975	1.10	2.44	.41	.91
1976	1.21	2.52	.36	.75
1977	1.59	3.11	.35	.68
1978	1.72	3.13	.58	1.06
1979	2.09	3.50	.76	1.27
1980	2.09	3.21	.81	1.24
1981	2.25	3.15	.83	1.16
1982	2.43	3.20	.75	.99
1983	2.43	3.08	.71	.90
1984	2.43	2.97	.64	.78
1985	2.54	3.01	1.09	1.29
1986	2.54	2.94	1.06	1.22
1987	2.54	2.85	.90	1.01
1988	2.54	2.75	1.15	1.25
1989	2.76	2.87	1.19	1.24
1990	2.87	2.87	1.19	1.19

¹Pricing for standard package quantities.

²From final 1990 implicit price deflators for gross national product by the Council of Economic Advisors, based on 1982 = 100.

Table 3.—U.S. Imports for consumption of rare-earths¹
(Metric tons and thousand dollars)

	1970		1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cerium compounds	NA	NA	NA	NA	NA	NA	8	35	16	74
Mixtures of rare-earth oxides and chlorides ²	NA	NA	NA	NA	NA	NA	6	25	14	101
Cerium salts	—	—	—	—	—	—	—	—	—	—
Rare-earth oxide excluding cerium oxide ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rare-earth alloys	—	—	—	—	—	—	—	—	4	—
Rare-earth metals including scandium and yttrium	(³)	21	(³)	22	2	66	5	210	4	193
Other rare-earth metals	—	—	—	—	—	—	—	—	—	—
Ferrocenium and other pyrophoric alloys	4	54	7	82	13	94	17	127	26	238
Total ⁴	4	75	7	104	15	160	36	397	64	606
	1975		1976		1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cerium compounds	3	29	6	26	5	—	—	—	—	—
Mixtures of rare-earth oxides and chlorides ²	(³)	5	(³)	7	1	10	3	40	6	116
Cerium salts	4	10	—	—	—	—	—	—	—	—
Rare-earth oxide excluding cerium oxide	NA	NA	NA	NA	NA	NA	169	6,506	385	15,153

See footnotes at end of table.

Table 3.—U.S. Imports for consumption of rare-earths¹—Continued
(Metric tons and thousand dollars)

	1975		1976		1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Rare-earth alloys	9	112	20	71	226	1,445	372	2,390	66	577
Rare-earth metals including scandium and yttrium	1	88	(³)	9	(³)	12	6	260	4	186
Other rare-earth metals	(³)	(³)	(³)	2	1	11	(³)	2	(³)	(³)
Ferrocenium and other pyrophoric alloys	15	187	18	167	21	262	59	641	56	680
Total ⁴	33	431	44	281	254	1,740	609	9,839	517	16,712
	1980		1981		1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cerium compounds	NA	NA	NA	NA	5	71	4	25	1	25
Mixtures of rare-earth oxides and chlorides ²	6	101	8	53	27	93	26	99	708	843
Cerium salts	—	—	—	—	—	—	2	7	—	—
Rare-earth oxide excluding cerium oxide	524	17,955	196	13,178	193	12,510	609	13,671	935	17,485
Rare-earth alloys	318	2,918	182	1,651	63	658	75	642	144	1,072
Rare-earth metals including scandium and yttrium	4	307	2	168	3	139	1	182	4	619
Other rare-earth metals	8	73	(³)	14	(³)	3	(³)	14	1	13
Ferrocenium and other pyrophoric alloys	65	902	83	1,249	86	1,092	105	1,185	138	1,651
Total ⁴	926	22,256	470	16,313	377	14,567	822	15,826	1,932	21,708
	1985		1986		1987		1988		1989	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cerium compounds	2	46	260	395	(³)	38	695	1,697	251	1,940
Mixtures of rare-earth oxides and chlorides ²	5	86	40	145	NA	NA	NA	NA	7,391	30,709
Cerium salts	—	—	5	16	5	15	NA	NA	NA	NA
Rare-earth oxide excluding cerium oxide	203	14,386	288	18,942	283	19,470	145	11,538	502	6,986
Rare-earth alloys	186	1,031	66	409	140	822	146	1,049	NA	NA
Rare-earth metals including scandium and yttrium	3	285	20	1,837	13	1,350	20	907	294	4,181
Other rare-earth metals	1	34	7	158	22	712	32	965	1,402	8,086
Ferrocenium and other pyrophoric alloys	113	1,302	95	1,154	95	1,294	101	1,348	84	1,220
Total ⁴	514	17,169	781	23,056	559	23,702	1,140	17,504	9,924	53,122
	1990									
	Quantity	Value								
Cerium compounds	359	2,040								
Mixtures of rare-earth oxides and chlorides ²	4,990	37,325								
Cerium salts	NA	NA								
Rare-earth oxide excluding cerium oxide	151	8,018								
Rare-earth alloys	NA	NA								
Rare-earth metals including scandium and yttrium	199	3,050								
Other rare-earth metals	1,363	12,813								
Ferrocenium and other pyrophoric alloys	93	1,495								
Total ⁴	7,155	64,741								

NA Not available.

¹Because of the implementation of the Harmonized Tariff System in Jan. 1989, import categories for 1989 and 1990 are not necessarily comparable with those of previous years.

²Years prior to 1989, rare-earth oxides and chlorides are combined.

³Less than 1/2 unit.

⁴Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 4.—U.S. exports of rare-earths¹
(Metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Thorium ore and concentrates .	2,041	2,268	2,268	4,403	4,264	3,084	2,449	NA	494	4,334	4,741
Ferrocenium and other pyro- phoric alloys	35	27	92	50	87	45	54	236	17	38	16
Cerium compounds	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Rare-earth metals including scandium and yttrium ³	(²)	346	687	1,836	2,262	665	286	876	(²)	(²)	(²)
Total	2,076	2,641	3,047	6,289	6,613	3,794	2,789	1,112	511	4,372	4,757
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Thorium ore and concentrates .	5,056	2,565	2,684	4,304	4,419	3,433	4,534	7,358	2	NA	
Ferrocenium and other pyro- phoric alloys	9	22	59	27	23	29	72	32	31	18	
Cerium compounds	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	1,433	1,730	
Rare-earth metals including scandium and yttrium	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	425	241	
Total	5,065	2,587	2,743	4,331	4,442	3,462	4,606	7,390	1,891	1,989	

NA Not available.

¹Because of the implementation of the Harmonized Tariff System in Jan. 1989, import categories for 1989 and 1990 are not necessarily comparable with those of previous years.

²Data not available owing to category not being separately listed.

³1971-77 includes rare-earth compounds and mixtures.

Source: Bureau of the Census.

Table 5.—Monazite concentrate: world production, by country¹
(Metric tons gross weight)

Country ²	1986	1987	1988	1989	1990
Australia	14,822	12,813	11,872	^c 13,000	^c 11,000
Brazil	3,618	4,332	2,817	1,900	^e 2,000
India ^{e,3}	4,000	4,000	4,000	4,300	4,500
Malaysia	5,959	2,908	2,920	2,948	3,323
Mozambique	(⁴)	—	—	—	—
South Africa, Republic of ^e	1,000	1,200	1,200	1,200	⁵ 1,317
Sri Lanka ^e	200	200	200	200	200
Thailand	1,609	458	590	631	377
United States	W	W	W	W	W
Zaire	7	97	168	175	124
Total	31,215	26,008	23,767	24,354	22,841

^cEstimated. W Withheld to avoid disclosing company proprietary data; excluded from "Total."

¹Consumption of domestic processors in rare-earth oxide equivalent.

²In addition to the countries listed, China, Indonesia, Nigeria, North Korea, and the U.S.S.R. may produce monazite, but output if any, is not reported quantitatively, and available general information is inadequate for formulation of reliable estimates of output levels.

³Data are for years beginning Apr. 1 of that stated.

⁴Less than 1/2 unit.

⁵Reported figure.

Table 6.—Apparent consumption of rare-earths by
processors in the United States
(Metric tons rare-earth oxide equivalent)

Year	Quantity ^c	Year	Quantity ^c
1970	10,500	1981	20,000
1971	9,300	1982	17,100
1972	12,200	1983	19,600
1973	14,800	1984	21,400
1974	14,100	1985	12,100
1975	11,500	1986	10,900
1976	12,300	1987	11,100
1977	16,800	1988	16,800
1978	15,800	1989	27,700
1979	16,000	1990	30,000
1980	18,100		

^cEstimated.

SALT

By Dennis Kostick

The salt industry during the 1970's encountered several expansions, closures, and consolidations of salt operations. Higher energy costs because of the Arab oil embargo in October 1973 and the cost of implementing pollution abatement equipment to comply with antipollution legislation contributed to the closure of seven of the eight remaining synthetic soda ash plants in the United States that used significant quantities of salt brine. Small rock salt and solar salt producers were acquired by medium-sized companies in order to be competitive with the major salt companies, all of which had foreign subsidiaries to rely on to supply less expensive imported salt.

During the 1980's, salt was criticized by the environmental and medical communities. Several studies indicated that the excessive use of salt for highway deicing caused damage to roadside vegetation and contributed to high levels of sodium measured in ground water supplies. Salt also contributed to the corrosion of automobiles and metal bridge surfaces and road reinforcement rods. A nationwide campaign was initiated by the salt industry to educate snow equipment operators on when and how much salt to apply to highways. Salt was also reported to

be the cause of hypertension in humans, and efforts were made to reduce the quantity of salt added to food by the food processing industry. Although salt for human consumption is only about 3% of total domestic demand, only about 200,000 metric tons of the 2.1 million metric tons used annually in food processing was lost because of changes made by the food processing industry. By the late 1980's, more thorough studies were made to show that only a small segment of the population was "salt sensitive" and that the balance of the population was not necessarily at risk. Rather than reversing their earlier findings, medical researchers took the position that anything in excess was unhealthy.

The environmental issue pertaining to using chlorine-base compounds began in 1990. Chlorine used in pulp bleaching and in treating municipal water supplies reportedly produced carcinogenic compounds. Its use in chlorofluorocarbons contributed to ozone depletion in the upper stratosphere. Because chlorine is produced from salt, the problem will reduce the quantities of salt used. The remainder of the decade will continue to emphasize concern for the environment.

Table 1.—U.S. historical salient salt statistics
(Thousand metric tons unless otherwise specified)

	1970	1971	1972	1973	1974	1975	1976	1977
United States:								
Production ¹	42,424	40,551	39,925	40,187	42,114	37,839	39,736	38,938
Sold or used by producers ¹ ..	41,636	39,986	40,843	39,835	42,217	37,222	40,089	39,383
Value thousands ..	\$304,759	\$303,687	\$296,772	\$306,103	\$360,763	\$368,063	\$430,959	\$451,579
Exports	384	608	788	552	473	1,208	914	914
Value thousands ..	\$3,657	\$4,182	\$5,544	\$4,400	\$4,276	\$9,070	\$10,326	\$10,881
Imports for consumption	3,208	3,497	3,142	2,909	3,046	2,917	3,948	4,109
Value thousands ..	\$13,329	\$14,429	\$11,979	\$12,554	\$14,428	\$15,272	\$23,476	\$26,694
Consumption, apparent ²	44,460	42,875	43,197	42,173	44,790	38,930	43,124	42,577
World production	146,130	144,340	146,374	154,660	166,229	161,667	160,667	157,040
	1978	1979	1980	1981	1982	1983	1984	1985
United States:								
Production ¹	38,898	42,018	37,633	35,289	34,169	29,913	35,544	35,577
Sold or used by producers ¹ ..	38,890	41,543	36,607	35,296	34,377	31,364	35,584	36,348
Value thousands ..	\$499,345	\$538,352	\$656,164	\$637,568	\$671,424	\$597,081	\$675,099	\$739,609
Exports	704	632	754	949	908	469	744	820
Value thousands ..	\$9,795	\$9,025	\$12,829	\$17,429	\$16,647	\$12,368	\$15,299	\$15,988
Imports for consumption	4,881	4,785	4,775	3,918	4,945	5,440	6,845	5,631
Value thousands ..	\$34,247	\$40,860	\$44,071	\$44,523	\$56,184	\$60,195	\$73,913	\$65,593
Consumption, apparent ²	43,067	45,696	40,627	38,265	38,414	36,336	41,685	41,159
World production	168,248	173,370	168,878	171,415	164,265	158,847	172,599	172,936

See footnotes at end of table.

Table 1.—U.S. historical salient salt statistics—Continued
(Thousand metric tons unless otherwise specified)

	1986	1987	1988	1989	1990
United States:					
Production ¹	33,822	33,514	35,534	35,632	36,794
Sold or used by producers ¹ ..	33,260	33,106	35,326	35,250	36,916
Value thousands ..	\$665,400	\$684,170	\$699,323	\$776,846	\$826,659
Exports	1,057	491	802	1,422	2,266
Value thousands ..	\$16,928	\$8,217	\$10,858	\$20,211	\$32,944
Imports for consumption	6,046	5,185	4,966	5,519	5,969
Value thousands ..	\$79,709	\$66,936	\$77,357	\$74,474	\$88,419
Consumption, apparent ²	38,250	37,801	39,490	39,347	40,619
World production	174,735	177,669	183,882	190,463	^c 183,559

^aEstimated.

¹Excludes Puerto Rico.

²Sold or used plus imports minus exports.

Table 2.—Salt production¹ in the United States
(Thousand metric tons)

Year	Vacuum pans and open pans ²	Solar ²	Rock ³	Brine ⁴	Total ⁵
1970	3,391	1,598	12,855	23,794	41,636
1971	3,537	1,841	12,428	22,180	39,986
1972	3,590	1,717	13,094	22,441	40,843
1973	3,490	1,848	11,201	23,297	39,835
1974	3,540	1,833	13,458	23,386	42,217
1975	3,315	1,535	12,957	19,415	37,222
1976	3,405	1,683	14,214	20,790	40,089
1977	3,422	1,728	13,570	20,663	39,383
1978	3,401	1,901	13,325	20,263	38,890
1979	3,646	1,998	13,509	22,390	41,543
1980	3,522	2,206	10,710	20,168	36,607
1981	3,450	2,176	10,769	18,901	35,296
1982	3,376	2,581	12,033	16,180	34,169
1983	3,354	1,862	8,572	16,124	29,913
1984	3,292	2,454	12,386	17,413	35,544
1985	3,278	2,312	12,692	17,295	35,577
1986	3,299	2,430	12,096	15,996	33,822
1987	3,426	2,830	11,095	16,163	33,514
1988	3,469	3,065	11,567	17,434	35,534
1989	3,606	2,849	12,682	16,496	35,632
1990	3,662	2,985	12,772	17,374	36,794

¹Production data for 1970-81 represent sold or used because actual production statistics were not collected by type. Production data for 1982-90 represent actual production data.

²Includes bulk, packaged, compressed pellet, and pressed block.

³Includes bulk, packaged, and pressed block.

⁴Anhydrous salt contained on a bulk basis.

⁵Data may not add to totals shown because of independent rounding.

**Table 3.—Comparison of U.S. salt production and demand
(Thousand metric tons)**

Year	U.S. demand	U.S. production	Year	U.S. demand	U.S. production
1970	44,460	42,424	1981	38,265	35,289
1971	42,875	40,551	1982	38,414	34,169
1972	43,197	39,925	1983	36,336	29,913
1973	42,191	40,187	1984	41,685	35,544
1974	44,790	42,114	1985	41,159	35,577
1975	38,930	37,839	1986	38,250	33,822
1976	43,124	39,736	1987	37,801	33,514
1977	42,577	38,938	1988	39,490	35,534
1978	43,067	38,898	1989	39,347	35,632
1979	45,696	42,018	1990	40,619	36,794
1980	40,627	37,633			

**Table 4.—U.S. exports of salt¹
(Thousand metric tons and thousand dollars)**

Year	Quantity	Value	Year	Quantity	Value
1970	384	3,657	1981	949	17,429
1971	608	4,182	1982	908	16,647
1972	788	5,544	1983	469	12,368
1973	552	4,400	1984	744	15,299
1974	473	4,276	1985	820	15,988
1975	1,208	9,070	1986	1,057	16,928
1976	914	10,326	1987	491	8,217
1977	914	10,881	1988	802	10,858
1978	704	9,795	1989	1,422	20,211
1979	632	9,025	1990	2,266	32,944
1980	754	12,829			

¹Prior to 1989, the Schedule B export code no. was 4209500. In 1989, it was changed to HTS code No. 2501000000.

Source: Bureau of the Census.

**Table 5.—U.S. Imports for consumption of salt
(Thousand metric tons and thousand dollars)**

Year	Salt in brine ¹		In bags, sacks, barrels, or other packages		Bulk		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970	—	—	41	625	3,167	12,704	3,208	13,329
1971	27	199	24	574	3,445	13,656	3,497	14,429
1972	—	—	24	535	3,118	11,444	3,142	11,979
1973	—	—	24	559	2,885	11,995	2,909	12,554
1974	8	5	25	746	3,013	13,577	3,046	14,428
1975	(²)	4	9	580	2,908	14,688	2,917	15,272
1976	(²)	12	17	691	3,931	22,762	3,948	23,476
1977	33	187	21	883	4,055	25,624	4,109	26,694
1978	(²)	72	1	1,209	4,880	32,966	4,881	34,247
1979	(²)	51	1	1,760	4,784	39,049	4,785	40,860
1980	11	63	1	1,478	4,763	42,530	4,775	44,071
1981	3	53	24	1,483	3,891	42,987	3,918	44,523
1982	(²)	50	43	1,613	4,902	54,521	4,945	56,184
1983	(²)	4	27	1,826	4,513	58,365	5,440	60,195
1984	(²)	5	64	2,386	6,781	71,522	6,845	73,913
1985	4	117	60	3,794	5,567	61,682	5,631	65,593

See footnotes at end of table.

Table 5.—U.S. Imports for consumption of salt—Continued
(Thousand metric tons and thousand dollars)

Year	Salt in brine ¹		In bags, sacks, barrels, or other packages		Bulk		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1986	(²)	34	64	3,170	5,983	76,505	6,046	79,709
1987	1	67	40	5,122	5,145	61,747	5,185	66,936
1988	2	125	71	6,682	4,893	70,550	4,966	77,357
1989	(³)	(³)	(³)	(³)	5,519	74,474	5,519	74,474
1990	(³)	(³)	(³)	(³)	5,969	88,419	5,969	88,419

¹Anhydrous salt content.

²Less than 1/2 unit.

³Included in bulk because categories were merged under HTS code No. 2501000000 in 1989. Before 1989, salt imports were listed under TSUS code Nos. 4209200 for salt in brine, 4209400 for bulk salt, and 4209600 for other salts.

Source: Bureau of the Census.

Table 6.—Salt sold or used¹ by producers in the United States, by State
(Thousand metric tons and thousand dollars)

Year	California		Kansas		Louisiana		Michigan		New Mexico	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970	1,502	15,053	1,116	18,206	12,323	64,854	4,444	49,963	W	W
1971	1,712	21,142	1,125	18,712	12,113	67,950	4,044	49,007	132	1,130
1972	1,471	14,860	1,242	20,562	12,260	67,464	3,954	50,761	W	W
1973	1,367	15,533	1,267	23,460	11,931	66,211	4,371	53,732	W	W
1974	W	W	1,240	27,007	12,286	76,960	4,032	62,055	152	W
1975	W	W	1,312	31,214	11,037	77,116	3,647	68,353	133	1,048
1976	W	W	1,188	35,291	12,239	91,952	3,827	79,740	W	W
1977	W	W	1,297	41,154	11,976	96,878	3,573	78,808	W	W
1978	W	W	1,507	48,087	12,939	110,472	3,394	83,872	W	W
1979	W	W	1,724	61,184	12,888	113,167	2,794	82,540	W	W
1980	W	W	1,426	64,276	11,487	132,182	2,183	104,842	W	W
1981	W	W	1,279	60,148	11,399	114,476	2,106	103,293	W	W
1982	W	W	1,452	72,145	11,041	117,569	1,816	106,303	W	W
1983	W	W	1,559	67,195	10,473	100,936	1,229	93,306	W	W
1984	W	W	1,553	71,558	11,885	112,142	1,353	93,860	W	W
1985	W	W	1,624	71,970	11,132	137,273	841	71,224	W	W
1986	W	W	1,502	68,887	10,531	103,611	W	W	W	W
1987	W	W	1,532	70,148	11,338	108,999	W	W	W	W
1988	W	W	1,613	72,965	12,949	108,982	W	W	W	W
1989	W	W	1,767	82,212	11,991	115,203	W	W	W	W
1990	W	W	2,168	92,119	13,016	120,827	W	W	W	W

	New York		Ohio		Oklahoma		Texas		Utah	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970	5,434	47,254	4,834	47,498	W	W	9,239	45,000	408	4,192
1971	4,811	43,601	5,179	46,651	W	W	8,362	40,838	557	5,213
1972	5,084	43,866	5,576	47,710	W	W	8,840	36,544	599	4,955
1973	4,719	42,364	4,225	41,643	5	36	9,393	45,350	650	6,913
1974	5,864	57,705	4,562	49,089	W	W	10,323	51,296	699	7,321
1975	5,423	57,344	4,611	54,651	W	W	7,766	42,119	572	7,717
1976	5,892	66,441	4,583	66,332	W	W	8,816	48,875	640	10,090
1977	5,853	72,623	3,357	63,485	W	W	9,926	53,264	765	10,831
1978	5,333	77,236	3,535	74,572	W	W	8,255	49,153	867	13,532
1979	5,794	77,751	3,751	79,598	W	W	10,236	67,602	1,092	14,723

See footnotes at end of table.

Table 6.—Salt sold or used¹ by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

Year	New York		Ohio		Oklahoma		Texas		Utah	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1980	4,998	99,395	2,928	87,371	W	W	9,052	93,414	1,050	19,373
1981	5,078	103,668	3,273	90,254	W	W	7,618	84,240	973	21,775
1982	5,629	117,718	3,188	90,572	W	W	6,732	82,805	1,113	23,210
1983	4,408	100,119	2,327	85,988	W	W	7,283	65,670	849	23,184
1984	5,120	123,755	W	W	W	W	7,424	69,672	1,130	28,651
1985	6,390	142,318	3,927	130,964	W	W	7,611	84,249	959	30,013
1986	4,600	122,601	3,733	126,757	W	W	7,729	62,996	1,009	31,830
1987	4,462	119,962	2,972	104,099	W	W	7,085	60,857	1,005	34,264
1988	4,186	127,994	3,443	115,860	W	W	7,441	64,425	957	35,730
1989	4,921	161,427	3,874	142,978	W	W	7,127	69,935	1,073	40,421
1990	4,900	162,900	W	W	W	W	7,450	75,149	1,062	50,436
	West Virginia		Other ²		Total ³					
	Quantity	Value	Quantity	Value	Quantity	Value				
1970	1,080	5,171	1,256	7,568	41,636	304,759				
1971	1,065	4,778	885	4,667	39,986	303,687				
1972	1,118	5,963	699	4,087	40,843	296,772				
1973	1,104	6,082	803	4,788	39,835	306,103				
1974	1,090	6,296	1,968	23,035	42,217	360,763				
1975	882	4,671	1,838	23,830	37,222	368,063				
1976	1,014	W	1,890	32,239	40,089	430,959				
1977	951	W	1,685	34,538	39,383	451,579				
1978	934	W	2,125	42,411	38,890	499,345				
1979	978	W	2,286	41,787	41,543	538,352				
1980	865	W	2,619	55,311	36,607	656,164				
1981	874	W	3,605	59,713	35,296	637,568				
1982	855	W	2,549	61,100	34,377	671,424				
1983	931	W	2,305	60,683	31,364	597,081				
1984	911	W	6,209	175,461	35,584	675,099				
1985	812	W	3,052	71,598	36,348	739,609				
1986	W	W	4,156	148,718	33,260	665,400				
1987	W	W	4,712	185,841	33,106	684,170				
1988	W	W	4,737	173,367	35,326	699,323				
1989	W	W	4,496	164,214	35,250	776,846				
1990	W	W	8,320	325,248	36,916	826,659				

W Withheld to avoid disclosing company proprietary data; included in "Other."

¹The term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by the plant or company.

²Includes Alabama (1970-90), Colorado (1970-82), Hawaii (1970-73), Kansas (brine only, 1970-90), North Dakota (1970-87), Virginia (1970-71), and all withheld data for States shown.

³Data may not add to totals shown because of independent rounding.

Table 7.—Time-value relationships for various types of Salt¹
(Average annual value and 1989 constant dollars,² dollars per metric ton)

Year	Salt in brine		Rock salt		Solar salt		Vacuum pan and open pan salt	
	Annual value	Based on constant 1990 dollars	Annual value	Based on constant 1990 dollars	Annual value	Based on constant 1990 dollars	Annual value	Based on constant 1990 dollars
1970 ...	4.05	12.17	7.28	21.88	7.30	21.95	28.12	84.56
1971 ...	3.94	11.20	7.07	20.10	11.06	34.68	28.97	82.41
1972 ...	3.63	9.85	6.82	18.53	9.26	25.15	29.50	80.12
1973 ...	3.94	10.04	6.82	17.41	9.91	25.29	32.68	83.39
1974 ...	4.07	9.51	7.87	18.41	10.25	23.98	38.03	88.95
1975 ...	4.31	9.18	9.85	20.99	15.66	33.37	47.41	100.97

See footnotes at end of table.

Table 7.—Time-value relationships for various types of salt¹—Continued
(Average annual value and 1989 constant dollars,² dollars per metric ton)

Year	Salt in brine		Rock salt		Solar salt		Vacuum pan and open pan salt	
	Annual value	Based on constant 1990 dollars	Annual value	Based on constant 1990 dollars	Annual value	Based on constant 1990 dollars	Annual value	Based on constant 1990 dollars
1976 ...	4.19	8.39	8.62	17.25	15.83	31.68	55.92	111.93
1977 ...	4.31	8.09	9.85	18.50	15.66	29.40	57.33	107.60
1978 ...	4.67	8.19	11.13	19.48	16.17	28.29	64.88	113.49
1979 ...	4.97	7.99	11.02	17.71	13.40	21.54	67.95	109.18
1980 ...	7.17	10.56	16.15	23.80	17.25	25.42	84.26	124.18
1981 ...	6.51	8.75	15.17	20.38	20.23	27.18	87.83	118.01
1982 ...	6.85	8.64	15.31	19.33	19.72	24.91	95.59	120.74
1983 ...	5.75	7.00	14.80	18.00	23.67	28.77	96.33	117.10
1984 ...	5.57	6.53	15.19	17.81	21.68	25.43	102.27	119.93
1985 ...	6.77	7.71	16.70	19.01	25.46	29.00	102.14	116.33
1986 ...	5.68	6.31	15.99	17.75	26.19	29.07	100.61	111.66
1987 ...	5.43	5.84	15.81	17.01	28.00	30.13	100.54	111.72
1988 ...	3.95	4.11	15.94	16.60	29.31	30.52	107.71	112.15
1989 ...	6.25	6.25	18.06	18.06	30.73	30.73	102.22	102.22
1990 ...	5.39	5.39	17.76	17.76	34.61	34.61	110.58	110.58

¹Values are based on the average of all salt producers' valuations reported to the Bureau of Mines of the finished salt in bulk, compressed pellets, and packaged, f.o.b. plant, and includes all processing costs, depreciation of equipment, taxes, and profit.

²From final 1990 implicit price deflators for gross national product by the Council of Economic Advisors, based on 1982 = 100.

Table 8.—U.S. salt supply-demand relationships
(Thousand metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
WORLD PRODUCTION											
Production:											
United States	42,424	40,551	39,925	40,187	42,114	37,839	39,736	38,938	38,898	42,018	37,633
Rest of world	103,707	103,788	106,449	114,473	124,115	123,828	120,931	118,102	129,350	131,351	131,245
Total ¹	146,130	144,340	146,374	154,660	166,229	161,667	160,667	157,040	168,248	173,370	168,878
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY											
Components of U.S. supply:											
Domestic sources	42,424	40,551	39,925	40,187	42,114	37,839	39,736	38,938	38,898	42,018	37,633
Sold or used ²	41,636	39,986	40,843	39,835	42,217	37,222	40,089	39,383	38,890	41,543	36,607
Imports	3,208	3,497	3,142	2,909	3,046	2,917	3,948	4,109	4,881	4,785	4,775
Industry stocks, Jan. 1 ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total U.S. supply ¹	44,844	43,483	43,985	42,744	45,263	40,138	44,038	43,491	43,771	46,328	41,381
Distribution of U.S. supply:											
Industry stocks, Dec. 31 ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exports	384	608	788	552	473	1,208	914	914	704	632	754
Industrial demand	44,460	42,875	43,197	42,191	44,790	38,930	43,124	42,577	43,067	45,696	40,627
U.S. DEMAND PATTERN ⁴											
Agriculture	1,746	1,761	1,781	1,890	1,799	1,689	1,746	1,656	1,679	1,739	1,664
Akalies and chlorine ...	25,327	23,655	24,245	25,713	25,946	21,912	23,560	22,780	22,236	24,460	22,447
Deicing	9,155	8,944	10,204	6,628	8,265	8,020	9,247	9,449	9,698	10,104	6,782
Food products	2,324	2,669	2,679	2,677	2,694	2,480	2,509	2,500	2,554	2,292	2,148
Metal production	236	165	206	207	229	240	310	318	314	323	247
Other chemicals	1,278	1,167	964	1,272	1,573	926	1,051	1,018	1,051	1,109	925
Paper products	345	253	182	190	150	156	193	201	200	176	209

See footnotes at end of table.

Table 8.—U.S. salt supply-demand relationships—Continued
(Thousand metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
U.S. DEMAND PATTERN⁴—Continued											
Petroleum	194	149	183	195	220	237	283	327	409	499	643
Textiles and dyeing	179	175	188	182	186	163	185	178	165	171	161
Water treatment	824	717	764	740	933	821	653	737	807	869	785
Other ⁵	2,521	2,785	2,570	2,646	3,019	2,952	3,316	3,284	3,179	3,201	2,971
Undistributed ⁶	331	436	-769	-149	-223	-667	71	128	774	755	1,646
Total U.S. primary demand ¹	44,460	42,875	43,197	42,191	44,790	38,930	43,124	42,577	43,067	45,696	40,627
VALUES⁷											
Average annual value (dollars/tons):											
Salt in brine	4.05	3.94	3.63	3.94	4.07	4.31	4.19	4.31	4.67	4.97	7.17
Rock salt	7.28	7.07	6.82	6.82	7.87	9.85	8.62	9.85	11.13	11.02	16.15
Solar salt	7.30	11.06	9.26	9.91	10.25	15.66	15.83	15.66	16.17	13.40	17.25
Vacuum pan and open pan salt	28.12	28.97	29.50	32.68	38.03	47.41	55.92	57.33	64.88	67.95	84.26
WORLD PRODUCTION											
Production:											
United States	35,289	34,169	29,913	35,544	35,577	33,822	33,514	35,534	35,632	36,794	
Rest of world	136,127	130,096	128,935	137,055	137,359	140,913	144,155	148,348	154,830	^c 146,765	
Total ¹	171,415	164,265	158,847	172,599	172,936	174,735	177,669	183,882	190,463	^c 183,559	
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY											
Components of U.S. supply:											
Domestic sources	35,289	34,169	29,913	35,544	35,577	33,822	33,514	35,534	35,632	36,794	
Sold or used ²	35,296	34,377	31,364	35,584	36,348	33,260	33,106	35,326	35,250	36,916	
Imports	3,918	4,945	5,440	6,845	5,631	6,046	5,185	4,966	5,519	5,969	
Industry stocks, Jan. 1 ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total U.S. supply ¹	39,214	39,322	36,805	42,429	41,979	39,307	38,291	40,292	40,769	42,885	
Distribution of U.S. supply:											
Industry stocks, Dec. 31 ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Exports	949	908	469	744	820	1,057	491	802	1,422	2,266	
Industrial demand	38,265	38,414	36,336	41,685	41,159	38,250	37,801	39,490	39,347	40,619	
U.S. DEMAND PATTERN⁴											
Agriculture	1,622	1,421	1,456	1,562	1,559	1,498	1,592	1,657	1,746	2,105	
Alkalies and chlorine	20,613	17,374	18,361	18,273	18,539	17,221	16,289	18,115	17,037	17,402	
Deicing	7,491	9,833	6,250	9,726	10,142	9,563	8,961	10,092	10,397	10,253	
Food products	1,999	2,134	2,079	1,973	1,913	1,970	2,112	2,075	2,154	2,282	
Metal production	267	267	220	296	347	276	282	339	363	314	
Other chemicals	1,028	785	864	1,141	697	742	689	695	1,068	1,856	
Paper products	224	190	249	306	282	279	351	341	338	257	
Petroleum	759	939	833	789	875	569	542	743	653	719	
Textiles and dyeing	200	150	155	173	169	205	215	208	212	206	
Water treatment	913	731	721	1,767	1,307	1,409	1,320	1,373	1,349	1,468	
Other ⁵	3,406	3,587	3,673	3,799	3,068	2,779	3,696	3,452	4,423	4,017	
Undistributed ⁶	-255	1,005	1,475	1,880	2,261	1,741	1,752	399	-393	-259	
Total U.S. primary demand ¹	38,265	38,414	36,336	41,685	41,159	38,250	37,801	39,490	39,347	40,619	
VALUES⁷											
Average annual value (dollars/ton):											
Salt in brine	6.51	6.85	5.75	5.57	6.77	5.68	5.43	3.95	6.25	5.39	
Rock salt	15.17	15.31	14.80	15.19	16.70	15.99	15.81	15.94	18.06	17.76	

See footnotes at end of table.

Table 8.—U.S. salt supply-demand relationships—Continued
(Thousand metric tons)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	VALUES—Continued									
Average annual value (dollars/ton)—Continued										
Solar salt	20.23	19.72	23.67	21.68	25.46	26.19	28.00	29.31	30.73	34.61
Vacuum pan and open pan salt	87.83	95.59	96.33	102.27	102.14	100.61	100.54	107.71	102.22	110.58

⁶Estimated. NA Not applicable.

¹Data may not add to totals shown because of independent rounding.

²Represents that amount sold or used captively within the industry from the quantity produced and any sold from inventory. Accurate data on beginning and yearend inventories of salt are unavailable and often are underreported because of additional storage underground at mines, warehouses, terminals, etc. However, about 2.5 million metric tons is estimated to be stored annually nationwide.

³The total quantities of salt in inventory are underreported and are excluded in determining the supply-demand balance relationship for salt. However, the difference between production and sold or used is assumed to be because of changes in inventory.

⁴Includes imports for consumption.

⁵Includes salt used in rubber, tanning, other industrial, institutional wholesales and/or retailers, U.S. Government resale, other wholesalers, some exports for consumption in overseas territories administered by the United States and other various minor uses.

⁶Represents the difference between the quantity reported to the U.S. Bureau of Mines and total U.S. primary demand. The amount of discrepancy is attributed to variances in inventory and import statistics.

⁷Values are based on the average of all salt producers' valuations reported for bulk, f.o.b. plant, and include all processing costs, depreciation of equipment, taxes, and profit.

CONSTRUCTION SAND AND GRAVEL

By Valentin V. Tepordei

Sand and gravel, as one of the most accessible natural resources, has been used since the earliest days of civilization mostly as a construction material. At the beginning of the 20th century, the U.S. production of construction sand and gravel, the sand and gravel used mostly for construction purposes, was relatively small and its uses limited. Today, annual sand and gravel production tonnage ranks second in the nonfuel minerals industry after crushed stone, and sand and gravel is the only mineral commodity produced in all 50 States. The United States is, in general, self-sufficient in sand and gravel, producing enough to meet all domestic needs and to be a small net exporter mainly to consumption points along the United States-Canadian and United States-Mexican borders.

The demand for construction sand and gravel is determined mostly by the level of construction activity and therefore the demand for construction materials. U.S. production of construction sand and gravel recorded a significant growth in the last 40 years, from 320 million metric tons in 1950 to 810 million metric tons in 1971 and 826 million metric tons in 1990. The highest level of production was reached in 1978—874 million metric tons. Between 1950 and 1966, mainly because of the construction of the Interstate Highway System, the growth in the production of construction sand and gravel was almost continuous, paralleling the increased demand for construction aggregates. Following the reduction in the volume of work in the Interstate Highway Program in the late 1960's, the construction sand and gravel industry became more sensitive to the ups and downs of the economy. The 1974-75 and 1982 recessions are reflected by low levels of production of construction sand and gravel in those years. Future demand for construction sand and gravel will continue to be dependent mostly on the growth of construction activity.

Construction sand and gravel is a high-volume, low-value commodity. The industry is highly competitive and is characterized by thousands of operations serving local or regional markets. Production costs vary widely depending on geographic location, the nature of the deposit, and the number and type of products produced. Constant dollar unit values have been quite steady during the past 20 years. As a result of rising costs of labor, energy, and mining and processing equipment, the average unit price of construction sand and gravel increased from \$1.10 per metric ton, f.o.b. plant, in 1970 to \$3.57 in 1990. However, the unit price in constant 1982 dollars fluctuated between

\$2.64 and \$2.71 per metric ton for the same period. Increased productivity achieved through increased use of automation and more efficient equipment was mainly responsible for maintaining the prices at this level. Constant dollar prices are expected to rise in the future because of decreased deposit quality and more stringent environmental and land use regulations.

Transportation is a major factor in the delivered price of construction sand and gravel. The cost of moving construction sand and gravel from the plant to the market often exceeds the sales price of the product at the plant. Because of the high cost of transportation, construction sand and gravel continues to be marketed locally. Economies of scale, which might be realized if fewer, larger operations served larger marketing areas, would probably not offset the increased transportation costs. Truck haulage is the main form of transportation used in the construction sand and gravel industry. Rail and water transportation combined account for about 10% to 20% of total construction sand and gravel shipments.

The industry also faces increasing competition from crushed stone that can substitute for sand and gravel in most of its applications. Stone operations are generally longer lived, can afford greater capital investment for higher efficiency, and are often located where competing land use pressures are less severe. The topographically rugged stone-bearing areas are usually less desirable for construction purposes than sand-and-gravel-bearing areas, which are generally flatter.

Although construction sand and gravel resources are widespread and in adequate supply nationally, local shortages exist. Land use conflicts and environmental problems associated with rapid urban expansion are major factors contributing to these shortages. Demand pressures, land use regulations, and the cost of meeting environmental and reclamation requirements are factors that will cause a rising price trend. Larger operations with more efficient equipment, more automation, and better planning and design will be the trend of the industry in the future. This will permit increased use of less accessible and lower quality deposits and will keep prices at competitive levels.

Construction sand and gravel remains an abundant material, and, despite environmental, zoning, and regulatory restrictions, no major shortages at the national level are expected to occur in the future. At the same time, shortages in and near urban and industrialized areas, which usually represent major markets, are expected to continue to increase.

Table 1.—U.S. historical salient construction sand and gravel statistics¹
(Thousand metric tons unless otherwise specified)

	1971	1972	1973	1974	1975	1976
Construction sand and gravel:						
Quantity	810,511	802,673	866,049	794,310	691,414	775,863
Value	\$1,057,602	\$1,088,315	\$1,249,305	\$1,278,331	\$1,190,341	\$1,603,794
Exports:						
Quantity ²	1,568	1,652	1,582	2,047	2,920	1,032
Value ²	\$6,745	\$7,178	\$8,597	\$11,664	\$15,047	\$2,436
Imports for consumption:						
Quantity	649	690	726	357	339	265
Value	\$1,228	\$1,379	\$1,576	\$839	\$777	\$624
	1977	1978	1979	1980	1981	1982
Construction sand and gravel:						
Quantity	814,562	873,892	857,744	692,273	^c 625,958	538,868
Value	\$1,817,000	\$2,053,000	\$2,144,000	\$1,996,000	^c \$1,928,000	\$1,674,000
Exports:						
Quantity ²	1,118	3,865	807	1,156	1,148	1,023
Value ²	\$2,808	\$29,270	\$4,924	\$8,141	\$8,752	\$8,077
Imports for consumption:						
Quantity	318	567	319	455	302	168
Value	\$623	\$2,084	\$721	\$1,143	\$1,987	\$1,479
	1983	1984	1985	1986	1987	1988
Construction sand and gravel:						
Quantity	^c 594,297	702,071	^c 725,839	801,045	^c 813,020	837,695
Value	^c \$1,935,000	\$2,244,000	^c \$2,438,000	\$2,747,200	^c \$3,002,500	\$3,126,000
Exports:						
Quantity	1,182	1,674	1,370	1,059	1,031	876
Value	\$6,430	\$10,325	\$8,936	\$7,838	\$10,533	\$11,048
Imports for consumption:						
Quantity	112	137	223	186	257	318
Value	\$1,047	\$1,603	\$1,572	\$1,412	\$2,367	\$3,163
	1989	1990				
Construction sand and gravel:						
Quantity	^c 814,018	826,083				
Value	^c \$3,429,100	\$3,249,400				
Exports:						
Quantity	1,021	425				
Value	\$13,591	\$11,880				
Imports for consumption:						
Quantity	542	1,580				
Value	\$9,624	\$22,912				

^cEstimated.

¹In 1981, sand and gravel became a biennial survey. Data are estimated for odd-numbered years.

²Information on exports of sand and gravel between 1971-75 and 1978 includes construction and industrial sand and gravel.

Table 2.—Construction sand and gravel sold or used in the United States, by geographic region
(Thousand metric tons and thousand dollars unless otherwise specified)

Geographic region	1971 ¹				1972 ¹			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	42,613	5	52,548	4	44,330	5	57,266	5
Middle Atlantic	55,701	7	102,769	9	57,296	7	111,776	9
Midwest:								
East North Central ...	187,168	22	238,181	21	188,069	23	251,687	21
West North Central ...	112,066	13	122,863	11	98,630	12	114,933	10

See footnotes at end of table.

Table 2.—Construction sand and gravel sold or used in the United States, by geographic region—Continued
(Thousand metric tons and thousand dollars unless otherwise specified)

Geographic region	1971 ¹				1972 ¹			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
South:								
South Atlantic	74,891	9	110,344	10	74,044	9	113,615	10
East South Central . . .	31,010	4	43,945	4	35,466	4	51,958	4
West South Central . . .	62,922	8	100,168	9	66,720	8	111,020	9
West:								
Mountain	101,989	12	130,330	11	101,940	12	147,670	12
Pacific	165,882	20	247,821	21	162,965	20	240,776	20
Total ^{2,3}	834,242	100	1,148,969	100	829,462	100	1,200,701	100
	1973 ¹				1974 ¹			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	49,348	5	65,275	5	39,678	5	64,926	5
Middle Atlantic	62,741	7	127,324	9	60,427	7	139,125	10
Midwest:								
East North Central . . .	202,324	22	284,645	21	180,541	22	289,674	20
West North Central . . .	106,962	12	135,566	10	94,058	12	134,982	9
South:								
South Atlantic	77,905	9	135,957	10	75,575	9	155,394	11
East South Central . . .	42,091	5	66,025	5	42,007	5	70,970	5
West South Central . . .	69,774	8	117,437	9	71,116	9	152,839	11
West:								
Mountain	114,300	13	166,049	12	83,802	10	145,803	10
Pacific	166,885	19	261,094	19	173,477	21	267,524	19
Total ^{2,3}	892,334	100	1,359,370	100	820,682	100	1,421,237	100
	1975 ¹				1976			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	34,901	5	63,839	5	40,097	5	74,946	5
Middle Atlantic	47,692	7	132,446	9	50,168	6	123,489	8
Midwest:								
East North Central . . .	158,707	22	301,278	21	153,591	20	271,291	17
West North Central . . .	84,642	12	137,443	10	91,282	12	144,560	9
South:								
South Atlantic	55,882	8	132,780	9	55,737	7	118,218	7
East South Central . . .	39,405	5	77,042	6	38,990	5	75,204	5
West South Central . . .	68,258	9	165,639	12	83,665	11	181,425	11
West:								
Mountain	69,864	10	146,805	10	74,811	10	149,338	9
Pacific	156,813	22	259,074	18	187,524	24	465,325	29
Total ^{2,3}	716,165	100	1,416,346	100	775,863	100	1,603,794	100
	1977				1978			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	44,145	6	95,518	5	49,795	6	114,200	6
Middle Atlantic	49,405	6	117,208	7	50,648	6	130,000	6
Midwest:								
East North Central . . .	157,101	19	327,228	18	165,924	19	363,100	18
West North Central . . .	92,817	11	187,804	11	98,158	11	204,000	10

See footnotes at end of table.

Table 2.—Construction sand and gravel sold or used in the United States, by geographic region—Continued
(Thousand metric tons and thousand dollars unless otherwise specified)

	1977				1978			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
South:								
South Atlantic	60,901	8	141,056	8	66,388	7	158,200	8
East South Central . . .	43,499	5	96,920	5	49,823	6	113,000	5
West South Central . . .	92,010	11	216,067	12	94,892	11	239,800	12
West:								
Mountain	85,324	11	191,578	11	94,982	11	229,600	11
Pacific	189,356	23	443,976	23	203,300	23	500,800	24
Total ^{2,3}	814,562	100	1,817,000	100	873,892	100	2,053,000	100
	1979				1980			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	47,174	5	109,600	5	35,153	5	93,540	5
Middle Atlantic	48,516	6	137,400	6	38,374	6	127,700	6
Midwest:								
East North Central . . .	169,462	20	385,200	18	125,192	18	339,800	17
West North Central . . .	93,349	11	200,500	9	70,751	10	170,500	8
South:								
South Atlantic	67,340	8	172,900	8	49,623	7	151,900	8
East South Central . . .	47,990	6	116,800	5	35,262	5	95,750	5
West South Central . . .	88,723	10	248,000	12	77,664	11	256,500	13
West:								
Mountain	94,347	11	233,900	12	84,777	12	242,300	12
Pacific	200,851	23	539,400	25	175,540	26	518,100	26
Total ^{2,3}	857,744	100	2,144,000	100	692,273	100	1,996,000	100
	1981 ^e				1982			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	32,296	5	90,300	5	29,290	5	89,062	5
Middle Atlantic	38,102	6	132,700	7	34,799	6	129,049	7
Midwest:								
East North Central . . .	108,499	17	308,400	16	86,995	16	254,355	16
West North Central . . .	64,682	10	160,800	8	56,513	11	146,533	8
South:								
South Atlantic	43,726	7	132,300	7	41,237	8	134,904	7
East South Central . . .	32,477	5	92,800	5	25,423	5	76,195	5
West South Central . . .	73,845	12	247,600	13	69,410	13	232,670	13
West:								
Mountain	71,305	12	257,100	13	61,685	11	192,799	13
Pacific	161,025	26	506,100	26	133,475	25	418,034	26
Total ^{2,3}	625,958	100	1,928,000	100	538,868	100	1,674,000	100
	1983 ^e				1984			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	25,583	4	86,900	4	36,010	5	113,590	5
Middle Atlantic	37,467	6	140,500	7	45,346	6	177,028	8
Midwest:								
East North Central . . .	90,628	15	262,000	14	115,796	17	336,715	15
West North Central . . .	68,493	12	181,600	9	72,853	10	183,146	8

See footnotes at end of table.

Table 2.—Construction sand and gravel sold or used in the United States, by geographic region—Continued
(Thousand metric tons and thousand dollars unless otherwise specified)

	1983 ^c				1984			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
South:								
South Atlantic	44,815	8	148,000	8	57,705	8	187,397	8
East South Central . . .	28,304	5	89,800	5	33,291	5	99,225	4
West South Central . .	79,016	13	291,500	15	89,583	13	304,493	14
West:								
Mountain	71,758	12	240,600	12	97,370	14	314,833	14
Pacific	148,270	25	494,200	26	154,095	22	527,528	24
Total ^{2,3}	594,297	100	1,935,000	100	702,071	100	2,244,000	100
	1985 ^c				1986			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	34,745	5	117,900	5	45,855	5	154,857	6
Middle Atlantic	50,440	7	199,200	8	54,925	7	226,374	8
Midwest:								
East North Central . . .	119,930	17	370,800	16	137,658	17	421,712	15
West North Central . . .	74,934	10	196,400	8	80,235	10	205,825	8
South:								
South Atlantic	61,598	8	203,400	8	76,196	10	276,964	10
East South Central . . .	35,562	5	115,000	5	36,664	5	115,193	4
West South Central . .	85,185	12	302,700	12	84,179	11	307,573	11
West:								
Mountain	102,421	14	338,400	14	107,023	13	356,615	13
Pacific	161,025	22	594,200	24	178,313	22	682,060	25
Total ^{2,3}	725,839	100	2,438,000	100	801,045	100	2,747,200	100
	1987 ^c				1988			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	50,167	6	189,400	6	52,267	6	202,413	7
Middle Atlantic	55,701	7	247,000	8	65,342	8	290,490	9
Midwest:								
East North Central . . .	136,350	17	457,700	15	163,911	20	528,057	17
West North Central . . .	86,636	11	255,000	9	82,150	10	222,723	7
South:								
South Atlantic	81,737	10	297,300	10	74,559	9	292,308	9
East South Central . . .	36,287	4	126,700	4	34,669	4	118,810	4
West South Central . .	70,851	9	270,300	9	74,025	9	272,842	9
West:								
Mountain	106,776	13	399,800	14	103,995	12	377,300	12
Pacific	188,513	23	759,300	25	186,742	22	821,055	26
Total ^{2,3}	813,020	100	3,002,500	100	837,695	100	3,126,000	100
	1989 ^c				1990			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
Northeast:								
New England	38,374	5	156,500	5	38,540	4	165,532	3
Middle Atlantic	60,146	7	281,500	9	58,721	7	283,922	9
Midwest:								
East North Central . . .	160,300	20	545,200	17	167,025	20	573,815	18
West North Central . . .	85,910	11	256,800	8	88,646	11	244,166	8

See footnotes at end of table.

Table 2.—Construction sand and gravel sold or used in the United States, by geographic region—Continued
(Thousand metric tons and thousand dollars unless otherwise specified)

	1989 ^c				1990			
	Quantity	Percent of total	Value	Percent of total	Quantity	Percent of total	Value	Percent of total
South:								
South Atlantic	69,581	9	288,500	9	73,253	9	320,469	10
East South Central . . .	34,110	4	125,000	4	39,512	5	149,115	5
West South Central . .	66,678	8	255,700	8	72,195	9	271,450	8
West:								
Mountain	110,132	13	443,000	13	103,299	13	376,671	12
Pacific	188,785	23	896,900	27	184,873	22	864,254	27
Total ^{2,3}	814,018	100	3,249,100	100	826,083	100	3,249,400	100

^cEstimated.

¹Includes industrial sand and gravel.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

³Value totals published in rounded form after 1976.

Table 3.—Construction sand and gravel sold or used by producers in the United States, by State¹
(Thousand metric tons and thousand dollars)

State	1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	6,055	7,513	5,762	8,530	8,895	13,870	11,298	19,120
Alaska	21,425	32,806	12,870	15,214	13,607	19,913	39,593	22,954
Arizona	17,954	24,391	22,536	32,420	24,893	38,503	21,244	41,906
Arkansas	10,551	15,603	10,500	16,558	11,308	20,625	13,497	29,922
California	104,751	157,683	106,402	162,619	106,567	176,286	95,428	176,213
Colorado	24,494	30,155	25,690	34,631	30,633	45,493	21,585	39,674
Connecticut	6,279	10,262	6,135	11,270	7,081	12,788	5,756	11,272
Delaware	2,000	2,231	2,048	2,660	3,092	3,678	2,174	3,783
Florida	21,072	18,836	20,287	17,009	18,295	21,415	22,110	33,400
Georgia	3,354	5,310	3,462	4,729	4,514	6,781	4,526	9,639
Hawaii	758	1,967	552	1,893	683	2,012	898	2,379
Idaho	10,232	11,437	6,982	10,294	7,614	10,246	6,954	10,484
Illinois	41,154	59,397	36,223	61,696	39,598	62,029	38,741	68,566
Indiana	22,663	29,094	25,381	33,290	25,157	35,015	23,657	35,656
Iowa	16,582	20,530	15,519	20,140	18,098	25,541	15,505	26,104
Kansas	10,761	11,351	10,515	10,920	12,030	12,663	10,602	13,388
Kentucky	7,441	11,061	7,697	11,967	9,372	14,627	7,902	12,887
Louisiana	17,443	24,492	17,164	26,996	12,472	21,165	11,196	27,781
Maine	7,522	5,881	10,721	7,535	12,322	10,304	7,942	10,673
Maryland	11,650	23,201	11,425	26,557	11,653	29,625	10,605	29,386
Massachusetts	15,733	23,058	17,130	25,655	17,003	26,910	15,725	26,565
Michigan	51,359	62,898	53,948	65,445	56,615	73,972	54,456	82,617
Minnesota	40,747	37,645	33,377	33,454	34,414	39,438	33,312	42,370
Mississippi	10,241	13,526	12,174	16,133	12,928	17,383	13,099	19,487
Missouri	9,369	15,109	9,146	14,806	9,869	16,950	9,918	19,462
Montana	14,316	25,207	9,177	17,149	10,609	13,819	3,848	6,126
Nebraska	11,997	13,626	12,447	15,063	14,430	18,366	12,003	17,727
Nevada	8,508	12,225	9,145	12,636	11,293	14,614	7,925	14,515
New Hampshire	7,624	6,777	5,461	6,256	7,072	8,597	5,557	8,223
New Jersey	16,793	38,279	16,038	38,020	17,273	43,098	16,260	47,292
New Mexico	8,046	7,975	6,895	8,553	9,653	15,753	6,725	10,605
New York	21,066	28,328	24,242	36,952	26,802	41,396	27,773	46,652
North Carolina	12,918	14,690	11,633	13,812	14,422	19,327	11,597	20,844
North Dakota	7,435	6,210	6,061	5,757	5,453	6,021	4,528	6,211
Ohio	37,010	54,044	39,468	59,932	44,440	69,982	37,515	68,258

See footnotes at end of table.

Table 3.—Construction sand and gravel sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Oklahoma	5,183	8,259	7,168	11,138	11,026	14,941	7,899	13,772
Oregon	18,352	28,707	22,216	34,981	20,686	32,751	16,836	30,948
Pennsylvania	17,843	36,162	17,016	36,804	18,666	42,830	16,394	45,181
Rhode Island	2,043	3,052	1,886	3,336	2,204	3,095	2,526	4,605
South Carolina	5,840	9,119	7,181	12,121	7,420	12,628	6,695	13,054
South Dakota	15,174	18,392	11,565	14,793	12,667	16,587	8,190	9,720
Tennessee	7,274	11,845	9,833	15,328	10,895	20,145	9,709	19,476
Texas	29,745	51,814	31,888	56,328	34,968	60,706	38,525	81,364
Utah	9,530	10,190	13,262	17,071	13,980	15,986	10,503	12,985
Vermont	3,412	3,518	2,996	3,214	3,666	3,581	2,172	3,588
Virginia	11,608	20,201	12,778	21,696	13,164	26,246	12,985	29,270
Washington	20,595	26,658	20,924	26,069	25,342	30,132	20,722	35,030
West Virginia	6,447	16,756	5,230	15,031	5,346	16,257	4,882	16,018
Wisconsin	34,982	32,748	33,049	31,324	36,514	43,647	26,172	34,577
Wyoming	8,909	8,750	8,254	14,916	5,625	11,635	5,019	9,508
Total ²	834,242	1,148,969	829,462	1,200,701	892,334	1,359,370	820,682	1,421,237
	1975		1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	8,375	17,376	10,545	19,683	11,675	28,201	13,182	31,716
Alaska	43,676	25,780	67,320	204,738	60,261	134,251	62,863	145,271
Arizona	15,624	36,490	16,448	40,184	20,168	49,064	25,557	67,896
Arkansas	11,263	25,794	13,368	25,848	14,122	29,897	14,814	33,371
California	80,236	168,248	85,969	190,918	97,354	236,392	102,357	259,984
Colorado	18,161	34,850	18,289	32,900	21,691	50,527	23,782	56,241
Connecticut	4,445	10,040	5,819	12,978	7,750	18,316	9,928	25,417
Delaware	885	1,900	1,013	1,829	1,226	2,084	1,315	2,468
Florida	12,008	20,199	11,715	17,750	17,436	33,816	18,803	30,720
Georgia	4,631	8,818	4,100	6,484	4,363	10,496	4,624	10,309
Hawaii	609	2,460	520	1,634	699	2,452	640	1,582
Idaho	6,242	12,768	5,941	11,504	7,031	15,282	7,235	17,677
Illinois	35,380	83,515	31,116	61,759	30,197	68,353	34,162	83,676
Indiana	19,632	35,234	23,150	44,348	23,502	48,881	24,748	53,030
Iowa	13,980	26,844	13,795	26,277	15,059	33,290	16,032	37,312
Kansas	9,857	13,467	11,150	14,940	12,676	23,299	12,934	24,329
Kentucky	8,096	14,466	8,265	14,989	8,803	19,091	11,954	23,900
Louisiana	13,233	35,990	20,104	49,109	19,689	48,635	19,718	53,049
Maine	8,958	11,403	9,355	13,950	9,514	19,023	10,456	22,467
Maryland	10,692	29,477	11,741	31,914	10,616	29,562	12,071	34,947
Massachusetts	12,048	24,556	14,515	29,046	14,987	33,395	16,198	37,460
Michigan	42,684	73,397	38,163	58,257	36,627	72,595	38,858	78,939
Minnesota	30,298	45,214	30,378	44,503	27,243	54,297	28,195	54,967
Mississippi	13,038	23,098	10,916	20,394	12,114	25,375	14,471	33,515
Missouri	8,847	18,216	13,131	20,954	11,792	24,435	13,334	27,281
Montana	3,744	6,963	4,342	7,336	4,241	9,789	5,798	14,230
Nebraska	10,668	16,901	12,909	21,483	15,284	30,566	15,167	31,906
Nevada	7,308	16,848	8,270	16,519	8,985	19,542	9,104	22,622
New Hampshire	4,672	9,077	5,606	10,409	6,201	13,888	7,130	16,295
New Jersey	11,804	39,640	8,710	20,309	6,959	15,551	7,204	19,485
New Mexico	5,643	13,798	6,987	16,671	7,805	17,685	7,474	17,853
New York	20,101	44,064	25,152	55,326	26,366	56,804	26,104	59,275
North Carolina	7,411	15,610	7,538	14,344	8,013	17,267	9,484	22,246
North Dakota	5,113	8,133	4,691	8,345	5,281	12,102	6,720	17,166
Ohio	33,743	68,552	34,283	71,176	41,230	92,224	41,580	100,724
Oklahoma	8,701	16,749	7,947	11,975	9,303	18,465	9,839	19,056
Oregon	14,993	29,596	15,925	33,473	14,365	33,127	17,357	44,510

See footnotes at end of table.

Table 3.—Construction sand and gravel sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1975		1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Pennsylvania	15,786	48,742	16,307	47,854	16,082	44,482	17,359	51,243
Rhode Island	2,640	5,070	2,644	4,805	2,605	5,059	2,702	6,176
South Carolina	6,680	14,128	6,450	11,802	6,239	12,823	6,767	15,356
South Dakota	5,879	8,668	5,228	8,057	5,482	9,815	5,810	11,104
Tennessee	9,896	22,102	9,263	20,138	10,907	24,253	10,219	24,017
Texas	35,062	87,106	42,249	94,496	48,896	119,069	50,479	134,305
Utah	9,216	14,342	9,568	13,442	10,791	18,622	11,417	21,835
Vermont	2,137	3,693	2,158	3,758	3,089	5,837	3,380	6,425
Virginia	8,977	24,776	9,245	23,089	9,477	24,605	10,366	29,073
Washington	17,299	32,990	17,790	34,562	16,652	37,693	20,094	49,442
West Virginia	4,598	17,872	3,934	11,006	3,530	10,402	2,961	13,053
Wisconsin	27,267	40,580	26,880	35,750	25,545	45,176	26,538	46,721
Wyoming	3,926	10,746	4,962	10,782	4,612	11,026	4,628	11,242
Total ^{2,3}	716,165	1,416,346	775,863	1,603,794	814,562	1,817,000	873,892	2,053,000
	1979		1980		1981 ^e		1982	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	12,203	29,944	9,720	23,683	8,621	23,340	6,368	17,226
Alaska	46,176	104,905	40,743	85,214	37,195	75,600	37,042	74,895
Arizona	27,687	74,716	21,980	71,838	19,042	63,340	17,349	58,375
Arkansas	14,482	32,594	11,356	30,599	8,297	22,400	6,292	18,700
California	115,418	326,109	102,052	336,045	97,250	352,100	73,615	270,995
Colorado	23,144	56,263	24,887	74,452	21,319	73,300	16,865	58,465
Connecticut	9,063	23,612	6,444	18,692	5,897	15,400	4,433	16,237
Delaware	1,519	3,281	975	2,398	1,093	2,959	1,179	3,197
Florida	18,726	31,145	13,074	28,766	13,526	30,600	12,352	30,081
Georgia	4,549	10,792	4,407	11,898	3,052	8,308	2,872	8,361
Hawaii	981	3,063	939	2,855	416	1,198	407	1,221
Idaho	7,003	18,149	4,807	14,203	2,779	7,329	2,123	6,258
Illinois	36,317	87,016	24,579	78,510	22,816	68,970	19,556	59,149
Indiana	24,539	55,842	19,751	51,738	14,397	41,330	11,881	34,579
Iowa	15,692	37,867	11,506	32,722	9,371	29,080	9,130	25,618
Kansas	12,777	24,780	10,999	23,817	9,525	21,000	8,818	20,612
Kentucky	10,638	23,721	7,046	17,637	6,295	16,070	5,896	15,936
Louisiana	18,548	54,081	16,467	62,568	15,640	53,550	15,021	50,966
Maine	9,999	20,534	6,330	15,434	6,804	19,400	6,079	15,118
Maryland	12,690	39,033	9,736	33,625	8,618	31,800	8,818	32,386
Massachusetts	15,155	37,164	12,633	34,459	11,340	31,300	10,889	34,438
Michigan	40,457	86,635	29,516	73,166	25,492	68,050	18,658	47,726
Minnesota	28,067	55,427	22,779	49,180	21,727	49,770	18,394	44,222
Mississippi	15,368	37,797	10,623	31,606	9,507	29,260	8,577	27,115
Missouri	10,613	24,201	7,419	19,255	6,804	16,900	5,769	14,477
Montana	6,361	15,106	6,023	16,057	5,117	12,910	4,843	12,794
Nebraska	14,694	33,001	9,538	22,798	10,678	28,310	8,811	23,851
Nevada	9,524	21,387	7,656	18,360	6,409	15,770	5,468	11,724
New Hampshire	6,428	15,301	5,746	15,837	4,108	12,990	3,930	12,593
New Jersey	7,509	21,590	5,288	18,578	8,851	26,050	7,203	25,722
New Mexico	6,478	18,245	6,396	17,676	5,893	19,780	5,095	17,670
New York	23,806	55,889	19,884	53,276	16,583	45,560	15,729	46,871
North Carolina	8,740	21,618	7,110	20,910	5,710	18,330	4,716	15,395
North Dakota	6,031	15,128	4,693	14,457	2,722	6,500	2,129	4,873
Ohio	40,114	104,888	32,171	97,690	29,248	95,570	23,732	83,015
Oklahoma	9,522	20,372	9,339	23,395	8,165	21,700	6,795	17,733
Oregon	16,215	45,829	14,519	47,300	10,886	35,100	8,630	30,629
Pennsylvania	17,279	60,031	13,203	55,883	12,701	61,100	11,867	55,527

See footnotes at end of table.

Table 3.—Construction sand and gravel sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1979		1980		1981 ^c		1982	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Rhode Island	3,209	6,737	2,273	4,945	1,208	3,985	1,040	3,671
South Carolina	6,651	16,273	4,297	13,227	4,655	13,240	4,288	13,170
South Dakota	5,444	10,119	3,818	8,243	3,887	9,224	3,462	8,604
Tennessee	9,778	25,300	7,871	22,824	8,010	24,130	4,582	15,917
Texas	46,169	140,955	40,507	139,892	41,731	150,000	41,301	154,515
Utah	9,401	18,621	8,079	17,234	7,450	54,550	6,876	14,920
Vermont	3,320	6,240	1,724	4,171	2,899	7,254	2,919	6,854
Virginia	10,708	32,268	7,497	29,508	6,449	24,470	6,330	28,522
Washington	22,007	59,382	17,254	46,731	15,304	42,130	13,780	40,295
West Virginia	3,754	18,501	2,475	11,454	591	2,601	681	3,392
Wisconsin	28,013	50,824	19,112	38,025	16,520	34,522	13,168	29,218
Wyoming	4,776	11,419	4,948	12,523	3,338	10,120	3,068	10,279
Total ^{2,3}	857,744	2,144,000	692,273	1,996,000	625,958	1,928,000	538,868	1,674,000
	1983 ^c		1984		1985 ^c		1986	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	7,802	23,500	9,388	26,188	9,979	32,000	9,780	30,807
Alaska	41,005	97,200	27,997	66,883	26,308	63,000	25,185	61,954
Arizona	21,047	75,000	27,614	101,959	33,566	118,000	36,712	140,004
Arkansas	6,260	19,600	7,560	23,786	7,711	24,400	7,775	26,999
California	82,554	308,700	92,914	360,427	102,331	430,000	116,489	498,456
Colorado	19,232	81,600	25,423	87,324	24,948	88,000	21,077	70,095
Connecticut	4,536	17,900	6,094	22,817	5,443	21,000	6,581	25,984
Delaware	1,270	3,200	910	2,795	1,179	4,000	1,403	4,156
Florida	13,517	31,500	19,080	48,494	20,412	49,500	25,613	67,898
Georgia	3,447	9,400	4,851	13,623	4,536	13,400	7,372	23,222
Hawaii	399	1,000	396	2,031	454	2,100	549	2,666
Idaho	2,722	9,800	4,286	13,509	3,629	11,400	5,178	14,830
Illinois	19,142	58,400	23,559	72,477	24,131	77,000	25,281	82,523
Indiana	13,063	37,900	14,579	44,744	16,874	55,800	17,819	61,232
Iowa	10,705	32,800	12,594	37,027	10,886	30,500	13,164	40,418
Kansas	11,249	26,600	10,701	26,358	11,975	31,800	14,160	33,721
Kentucky	4,990	13,000	7,111	18,252	6,895	19,000	6,526	16,986
Louisiana	12,882	46,600	15,458	54,664	13,608	48,000	12,965	46,134
Maine	4,354	12,100	7,153	19,228	6,532	18,000	7,776	22,843
Maryland	9,616	37,800	12,913	46,671	15,422	58,000	16,486	86,925
Massachusetts	9,435	36,200	12,853	42,139	13,517	47,500	17,418	60,464
Michigan	20,865	52,300	32,723	76,540	34,473	93,000	38,568	91,886
Minnesota	22,317	53,000	20,513	49,087	22,680	55,500	21,822	53,116
Mississippi	9,979	34,600	11,072	34,955	12,156	42,000	13,680	42,809
Missouri	6,985	17,700	7,228	19,364	6,804	20,000	8,841	24,065
Montana	4,536	10,200	7,054	21,269	8,165	26,000	7,317	19,391
Nebraska	9,163	25,000	10,740	27,791	10,523	28,800	8,777	23,912
Nevada	6,804	16,200	7,441	20,505	8,618	24,800	11,065	35,692
New Hampshire	3,629	12,100	5,114	16,054	5,715	19,800	7,637	26,089
New Jersey	9,798	34,300	8,659	31,878	9,616	36,700	12,700	53,746
New Mexico	6,350	20,000	7,587	22,389	7,620	22,800	7,685	25,862
New York	16,964	54,200	23,558	80,866	25,401	88,500	28,279	103,748
North Carolina	5,080	16,900	5,726	18,159	5,534	19,500	6,843	23,127
North Dakota	3,447	15,000	5,830	11,351	6,260	13,800	4,658	10,741
Ohio	24,675	84,600	28,801	104,709	29,937	109,000	33,390	126,747
Oklahoma	6,804	17,300	9,965	26,582	11,431	32,300	9,404	24,585
Oregon	9,979	37,000	11,590	37,117	11,340	36,800	12,193	42,597
Pennsylvania	10,705	52,000	13,129	64,285	15,422	74,000	13,946	68,880

See footnotes at end of table.

Table 3.—Construction sand and gravel sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1983 ^c		1984		1985 ^c		1986	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Rhode Island	907	2,400	1,345	5,282	1,089	4,600	2,058	8,252
South Carolina	4,717	15,000	5,303	17,097	4,445	14,000	6,532	19,783
South Dakota	4,627	11,500	5,249	12,168	5,806	16,000	8,811	19,853
Tennessee	5,534	18,700	5,719	19,830	6,532	22,000	6,677	24,592
Texas	53,070	208,000	56,598	199,461	52,435	198,000	54,034	209,855
Utah	8,890	19,800	13,805	34,507	12,701	36,400	14,925	39,763
Vermont	2,722	6,200	3,449	8,071	2,449	7,000	4,385	11,226
Virginia	6,532	30,800	8,038	37,359	9,253	42,000	10,587	46,488
Washington	14,334	50,300	21,200	61,070	20,593	62,300	23,897	76,387
West Virginia	635	3,400	885	3,198	816	3,000	1,362	5,365
Wisconsin	12,882	28,800	16,134	38,245	14,515	36,000	22,601	59,325
Wyoming	2,177	8,000	4,160	13,372	3,175	11,000	3,064	10,977
Total ^{2,3}	594,297	1,935,000	702,071	2,244,000	725,839	2,438,000	801,045	2,747,200
	1987 ^c		1988		1989 ^c		1990	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	9,344	35,600	10,652	41,417	9,435	36,500	12,794	50,243
Alaska	24,675	73,400	15,604	48,749	15,422	48,500	13,699	41,800
Arizona	34,564	141,300	29,392	123,854	30,754	133,900	25,324	92,166
Arkansas	6,532	23,900	7,005	26,201	6,804	25,500	8,766	35,475
California	128,458	561,300	128,771	622,074	125,464	670,800	119,943	626,000
Colorado	20,684	84,300	19,564	69,882	22,952	104,000	22,623	86,541
Connecticut	7,620	37,000	7,507	32,102	5,262	24,700	7,749	37,943
Delaware	2,087	6,400	1,754	5,988	1,724	6,200	1,981	6,967
Florida	27,216	74,900	16,923	53,083	16,239	55,500	16,758	59,123
Georgia	8,165	26,900	8,642	30,185	5,534	18,900	4,679	16,644
Hawaii	635	3,500	591	3,173	544	3,200	397	2,459
Idaho	6,532	28,000	6,272	19,897	5,262	18,900	8,366	25,590
Illinois	25,673	93,300	27,304	93,504	29,937	108,900	29,375	104,728
Indiana	17,146	65,200	23,517	79,985	26,853	99,200	21,663	76,886
Iowa	17,237	63,800	10,777	36,087	11,612	37,800	13,565	46,432
Kansas	14,152	37,800	9,761	25,329	11,793	33,200	9,855	24,170
Kentucky	6,441	15,200	5,738	15,243	4,990	15,100	7,985	29,581
Louisiana	11,068	43,600	12,912	52,820	12,338	54,400	13,235	55,902
Maine	7,802	22,100	9,238	33,007	7,802	30,100	7,135	29,349
Maryland	17,781	92,900	17,478	95,169	15,331	84,500	16,575	104,023
Massachusetts	19,777	75,300	20,110	79,364	12,610	57,000	11,588	51,466
Michigan	38,828	105,300	48,542	138,171	43,545	132,000	48,742	153,057
Minnesota	22,861	67,400	30,635	72,678	30,572	82,600	30,725	77,502
Mississippi	13,336	47,000	12,078	38,806	14,152	51,500	11,822	45,817
Missouri	9,888	30,400	10,176	32,941	9,072	32,500	8,385	25,097
Montana	6,169	18,800	7,243	20,225	5,262	13,900	4,639	14,319
Nebraska	9,344	26,300	10,187	28,928	13,789	41,800	10,390	30,056
Nevada	9,616	30,700	14,269	50,928	18,144	70,000	16,680	59,019
New Hampshire	8,255	33,300	8,245	32,614	5,443	20,400	6,947	25,784
New Jersey	13,789	61,200	16,618	74,183	13,789	68,400	12,575	64,245
New Mexico	7,802	31,000	7,971	31,367	10,705	45,400	9,400	39,708
New York	28,486	112,900	30,739	124,341	28,667	118,500	27,201	122,330
North Carolina	7,802	30,100	10,048	38,459	10,160	43,700	10,644	44,872
North Dakota	4,445	10,200	3,422	8,079	3,266	8,100	6,935	17,219
Ohio	33,022	136,900	41,825	156,318	40,279	148,700	40,417	165,394
Oklahoma	9,525	24,200	8,412	22,654	7,711	20,000	8,378	21,993
Oregon	11,793	42,200	13,499	52,657	13,063	49,700	14,320	60,928
Pennsylvania	13,426	72,900	17,986	91,966	17,690	94,600	18,945	97,348
Rhode Island	2,449	10,900	1,681	7,847	998	3,900	1,786	9,042
South Carolina	6,804	19,500	6,830	20,751	6,804	23,300	7,826	24,941

See footnotes at end of table.

Table 3.—Construction sand and gravel sold or used by producers in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1987 ^c		1988		1989 ^c		1990	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
South Dakota	8,709	19,100	7,193	18,681	5,806	20,800	8,790	23,689
Tennessee	7,167	28,900	6,202	23,343	5,534	21,900	6,912	23,474
Texas	43,726	178,600	45,695	171,167	39,825	155,800	41,815	158,080
Utah	19,051	56,700	16,187	49,796	12,973	41,500	12,339	44,881
Vermont	4,264	10,800	5,486	17,478	6,260	20,400	3,334	11,948
Virginia	10,977	43,400	11,386	42,573	11,703	49,700	11,881	48,950
Washington	22,952	78,900	28,277	94,402	34,292	124,700	36,515	133,067
West Virginia	907	3,200	1,500	6,099	2,087	6,700	2,910	14,950
Wisconsin	21,682	57,000	22,723	60,080	19,686	56,400	26,827	73,750
Wyoming	2,359	9,000	3,096	11,351	4,082	15,400	3,927	14,446
Total ^{2,3}	813,020	3,002,500	837,695	3,126,000	814,018	3,249,100	826,083	3,249,400

^cEstimated.

¹Individual States for years 1971-75 may include industrial sand and gravel.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

³Value totals published in rounded form after 1976.

Table 4.—Construction sand and gravel sold or used in the United States, by major use, 1971-73
(Thousand metric tons and thousand dollars)

Use	1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value
Building:						
Sand	161,174	225,278	169,929	247,784	174,901	271,039
Gravel	131,725	218,046	138,980	237,782	142,230	256,229
Paving:						
Sand	121,845	152,747	120,170	158,806	128,148	185,464
Gravel	282,588	357,278	254,134	335,142	280,551	399,400
Fill:						
Sand	42,317	26,904	44,477	33,089	50,858	39,495
Gravel	31,836	23,382	39,424	29,913	37,708	31,189
Railroad ballast:						
Sand	1,696	2,224	948	1,186	795	1,032
Gravel	2,129	2,570	2,022	2,332	2,488	3,663
Other:						
Sand	12,794	18,220	8,673	10,274	10,946	14,757
Gravel	13,236	18,271	11,685	14,247	17,885	20,157
Miscellaneous gravel ¹	9,201	12,682	12,231	17,759	19,538	26,880
Total ²	810,511	1,057,602	802,673	1,088,315	866,049	1,249,305

¹Miscellaneous gravel for years 1971-73 may include industrial gravel.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 5.—Construction sand and gravel sold or used in the United States, by major use, 1974-77
(Thousand metric tons and thousand dollars)

Use	1974			1975		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Concrete aggregate (including concrete sand)	288,461	550,985	1.91	246,712	540,549	2.19
Concrete products (blocks, bricks, decorative, etc.)	65,102	131,467	2.02	55,606	119,970	2.16
Asphaltic concrete aggregates and other bituminous mixtures	125,882	222,783	1.77	104,775	216,391	2.07
Road base and covering	191,019	249,493	1.31	170,074	202,632	1.19
Fill	110,338	103,707	.94	95,056	81,143	.85

See footnote at end of table.

Table 5.—Construction sand and gravel sold or used in the United States, by major use, 1974-77—Continued
(Thousand metric tons and thousand dollars)

Use	1974			1975		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Railroad ballast	—	—	—	—	—	—
Other	13,506	19,896	1.47	19,191	29,656	1.55
Total or average ¹	794,310	1,278,331	1.61	691,414	1,190,341	1.72
	1976			1977		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Concrete aggregate (including concrete sand)	253,185	579,781	2.29	315,199	811,866	2.58
Concrete products (blocks, bricks, decorative, etc.)	70,814	164,540	2.32	48,119	129,260	2.69
Asphaltic concrete aggregates and other bituminous mixtures	115,735	251,210	2.17	119,964	284,204	2.37
Road base and covering	189,205	352,970	1.87	171,316	343,666	2.01
Fill	124,152	216,468	1.74	143,962	210,805	1.46
Railroad ballast	—	—	—	1,091	2,751	2.52
Other	22,772	38,825	1.70	14,911	34,804	2.33
Total or average ¹	775,863	1,603,794	2.07	814,562	1,817,000	2.23

¹Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 6.—Construction sand and gravel sold or used in the United States, by major use, 1978-80 and 1982¹
(Thousand metric tons and thousand dollars)

Use	1978			1979		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Concrete aggregate (including concrete sand)	335,205	898,600	2.68	323,956	923,000	2.85
Plaster and gunite sands	8,226	23,760	2.89	9,934	30,400	3.06
Concrete products (blocks, bricks, decorative, etc.)	38,056	104,000	2.73	29,738	86,940	2.92
Asphaltic concrete aggregates and other bituminous mixtures	128,548	323,800	2.52	128,820	343,000	2.66
Road base and covering	192,777	412,900	2.14	201,758	458,800	2.27
Road stabilization (cement)	—	—	—	—	—	—
Road stabilization (lime)	—	—	—	—	—	—
Fill	148,869	232,800	1.56	141,113	240,500	1.70
Snow and ice control	6,327	13,990	2.21	7,445	16,670	2.24
Railroad ballast	1,341	3,460	2.58	1,080	2,849	2.64
Other	14,515	39,350	2.71	13,998	41,500	2.96
Total or average ²	873,892	2,053,000	2.35	857,744	2,144,000	2.50
	1980			1982		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Concrete aggregate (including concrete sand)	260,906	847,100	3.25	206,893	728,359	3.52
Plaster and gunite sands	7,629	28,140	3.69	7,336	28,585	3.90
Concrete products (blocks, bricks, decorative, etc.)	28,100	87,130	3.10	24,079	87,180	3.62
Asphaltic concrete aggregates and other bituminous mixtures	101,423	321,800	3.17	78,123	263,622	3.37
Road base and covering	164,291	436,100	2.65	118,794	342,312	2.88
Road stabilization (cement)	—	—	—	1,021	2,658	2.60
Road stabilization (lime)	—	—	—	310	609	1.96
Fill	110,677	217,100	1.96	89,216	178,551	2.00
Snow and ice control	6,007	14,500	2.41	6,280	15,983	2.54
Railroad ballast	858	2,499	2.91	960	3,383	3.52
Other	12,384	41,631	3.36	5,826	22,758	3.91
Total or average ²	692,273	1,996,000	2.88	538,868	1,674,000	3.11

¹Sand and gravel became a biennial survey in 1981. No table by end use for the odd-numbered years is therefore available.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 7.—Construction sand and gravel sold or used in the United States, by major use, 1984 and 1986¹
(Thousand metric tons and thousand dollars)

Use	1984			1986		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Concrete aggregate (including concrete sand)	178,638	678,617	3.80	198,682	814,860	4.10
Plaster and gunite sands	7,882	33,487	4.25	9,116	39,972	4.38
Concrete products (blocks, bricks, decorative, etc.)	9,934	40,066	4.03	14,764	55,648	3.77
Asphaltic concrete aggregates and other bituminous mixtures	62,262	218,758	3.51	79,297	322,666	4.07
Road base and covering	101,246	287,521	2.84	116,221	354,740	3.05
Road stabilization (cement)	1,281	3,282	2.56	1,369	3,928	2.87
Road stabilization (lime)	1,171	2,445	2.09	817	3,342	4.09
Fill	46,769	104,619	2.24	59,960	128,780	2.15
Snow and ice control	5,098	14,317	2.81	5,259	17,210	3.27
Railroad ballast	1,178	4,044	3.43	1,372	5,662	4.13
Roofing granules	363	1,833	5.05	512	3,102	6.06
Other	8,154	28,246	3.46	12,683	55,706	4.39
Unspecified:						
Actual and estimated	278,074	826,721	2.97	300,997	941,558	3.13
Total or average ²	702,071	2,244,000	3.20	801,045	2,747,200	3.43

¹Sand and gravel became a biennial survey in 1981. No table by end use for the odd-numbered years is therefore available.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 8.—Construction sand and gravel sold or used in the United States, by major use, 1988 and 1990¹
(Thousand metric tons and thousand dollars)

Use	1988			1990		
	Quantity	Value	Value per ton	Quantity	Value	Value per ton
Concrete aggregate (including concrete sand)	209,175	887,422	4.24	217,794	947,843	4.35
Plaster and gunite sands	8,371	43,226	5.16	9,078	43,599	4.80
Concrete products (blocks, bricks, decorative, etc.)	9,437	38,916	4.12	10,134	45,840	4.52
Asphaltic concrete aggregates and other bituminous mixtures	74,768	318,662	4.26	69,392	326,590	4.71
Road base and covering	123,919	413,330	3.34	123,052	428,314	3.48
Road stabilization (cement)	2,168	6,452	2.98	1,650	5,198	3.15
Road stabilization (lime)	893	2,592	2.90	700	2,638	3.77
Fill	56,800	134,709	2.37	66,362	173,624	2.62
Snow and ice control	5,420	20,086	3.71	6,629	24,971	3.77
Railroad ballast	579	2,849	4.92	787	3,590	4.56
Roofing granules	565	2,517	4.45	513	2,876	5.60
Filtration	63	372	5.94	1,007	6,113	6.07
Other	18,668	72,443	3.88	14,938	58,322	3.90
Unspecified:						
Actual	216,748	828,733	3.82	199,484	837,118	4.20
Estimated	110,089	353,689	3.21	104,541	342,757	3.28
Total or average ²	837,695	3,126,000	3.73	826,083	3,249,400	3.93

¹Sand and gravel became a biennial survey in 1981. No table by end use for the odd-numbered years is therefore available.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 9.—Transportation of construction sand and gravel in the United States to site of first sale or use,^{1,2}
(Thousand metric tons unless otherwise specified)

Method of shipment	1971		1972		1973	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Truck	767,979	92	759,056	91	820,880	92
Rail	39,268	4	40,246	5	37,776	4
Waterway	24,764	3	24,539	3	29,652	3
Not shipped, used at site	—	—	—	—	—	—
Unspecified	2,233	1	5,620	1	4,026	1
Total ³	834,242	100	829,462	100	892,334	100
	1974		1975		1976	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Truck	710,225	86	619,494	86	693,867	86
Rail	49,131	6	35,329	5	35,401	4
Waterway	22,154	3	27,501	4	30,097	4
Not shipped, used at site	33,005	4	28,220	4	31,952	4
Unspecified	6,166	1	5,621	1	11,685	2
Total ³	820,682	100	716,165	100	803,001	100
	1977		1978		1979	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Truck	NA	NA	776,914	86	769,566	87
Rail	NA	NA	25,456	3	23,151	3
Waterway	NA	NA	17,745	2	23,904	3
Not shipped, used at site	NA	NA	75,369	8	69,935	8
Unspecified	NA	NA	8,215	1	1,598	(^d)
Total ³	897,900	100	903,739	100	888,135	100
	1980		1982		1984	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Truck	648,003	90	468,007	87	624,814	89
Rail	13,662	2	6,194	1	3,626	1
Waterway	10,478	1	12,279	2	15,241	2
Not shipped, used at site	45,441	6	50,404	9	54,864	8
Unspecified	3,094	(^d)	1,984	(^d)	3,504	(^d)
Total ³	720,668	100	538,868	100	702,071	100
	1986		1988		1990	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Truck	412,150	52	363,377	43	363,781	44
Rail	8,899	1	6,442	1	5,262	1
Waterway	18,025	2	20,147	3	13,063	2
Not shipped, used at site	304,398	38	18,795	2	135,715	16
Unspecified	57,495	7	428,901	51	308,261	37
Total ³	801,045	100	837,695	100	826,083	100

NA Not available.

¹Includes industrial sand and gravel for years 1971-80.

²Sand and gravel became a biennial survey in 1981. No table by method of transportation for the odd-numbered years is therefore available.

³Data may not add to totals shown because of independent rounding and conversions to metric tons.

⁴Less than 1/2 unit.

Table 10.—Construction sand and gravel production in the United States, by size of operation^{1,2}

Size range	1971				1972			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999	1,835	32	19,095	3	1,630	30	15,913	2
25,000 to 49,999	949	17	33,787	5	850	16	27,676	4
50,000 to 99,999	984	17	67,145	10	957	18	62,403	9
100,000 to 199,999 . . .	908	16	120,565	17	849	16	110,045	15
200,000 to 299,999 . . .	415	7	91,994	13	400	7	88,077	12
300,000 to 399,999 . . .	240	4	77,250	11	217	4	68,181	10
400,000 to 499,999 . . .	112	2	45,676	7	134	3	54,211	8
500,000 to 599,999 . . .	76	1	38,177	5	79	2	38,940	6
600,000 to 699,999 . . .	59	1	36,086	5	70	1	41,763	6
700,000 to 799,999 . . .	36	1	24,382	4	56	1	37,975	5
800,000 to 899,999 . . .	33	1	25,453	4	26	1	20,239	3
900,000 to 999,999 . . .	21	0	18,107	3	27	1	23,284	3
1,000,000 to 1,499,999	70	1	102,976	15	89	2	124,148	17.6
1,500,000 to 1,999,999	—	—	—	—	—	—	—	—
2,000,000 to 2,499,999	—	—	—	—	—	—	—	—
2,500,000 and over . . .	—	—	—	—	—	—	—	—
Total ⁴	5,738	100	⁵ 700,694	100	5,384	100	⁵ 712,855	100

	1973				1974			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999	2,149	32	19,402	2	2,211	33	19,388	3
25,000 to 49,999	1,141	17	37,593	5	1,140	17	37,549	5
50,000 to 99,999	1,262	19	82,041	10	1,257	19	81,722	11
100,000 to 199,999 . . .	1,085	16	138,715	17	1,070	16	136,727	18
200,000 to 299,999 . . .	436	7	95,322	11	416	6	90,900	12
300,000 to 399,999 . . .	208	3	64,341	8	198	3	61,000	8
400,000 to 499,999 . . .	135	2	54,916	7	133	2	54,100	7
500,000 to 599,999 . . .	97	1	48,093	6	95	1	47,145	6
600,000 to 699,999 . . .	59	1	34,512	4	57	1	33,309	4
700,000 to 799,999 . . .	44	1	29,778	4	43	1	29,105	4
800,000 to 899,999 . . .	21	0	16,058	2	20	0	15,265	2
900,000 to 999,999 . . .	31	1	25,789	3	31	1	25,789	3
1,000,000 to 1,499,999	779	1	189,869	23	77	1	141,636	18
1,500,000 to 1,999,999	—	—	—	—	—	—	—	—
2,000,000 to 2,499,999	—	—	—	—	—	—	—	—
2,500,000 and over . . .	—	—	—	—	—	—	—	—
Total ⁴	7,447	100	⁵ 836,430	100	6,748	100	⁵ 773,637	100

	1975				1976			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999	2,453	36	22,562	4	2,726	37	24,098	3
25,000 to 49,999	1,164	17	38,475	6	1,161	16	37,714	5
50,000 to 99,999	1,224	18	78,113	12	1,335	18	83,967	11
100,000 to 199,999 . . .	1,030	15	129,865	20	1,151	16	145,325	19
200,000 to 299,999 . . .	383	6	83,784	13	436	6	93,402	12
300,000 to 399,999 . . .	182	3	57,077	9	208	3	64,434	8
400,000 to 499,999 . . .	124	2	49,543	8	108	1	43,617	6
500,000 to 599,999 . . .	74	1	35,539	6	85	1	41,769	6
600,000 to 699,999 . . .	33	1	19,295	3	49	1	28,965	4
700,000 to 799,999 . . .	38	1	25,591	4	40	1	27,188	4

See footnotes at end of table.

Table 10.—Construction sand and gravel production in the United States, by size of operation^{1,2}—Continued

Size range	1975				1976			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
800,000 to 899,999 . . .	29	0	22,321	4	24	0	18,380	2
900,000 to 999,999 . . .	15	0	12,987	2	19	0	16,487	2
1,000,000 to 1,499,999	50	1	64,306	10	54	1	136,089	18
1,500,000 to 1,999,999	—	—	—	—	—	—	—	—
2,000,000 to 2,499,999	—	—	—	—	—	—	—	—
2,500,000 and over . . .	—	—	—	—	—	—	—	—
Total ⁴	6,799	100	⁵ 639,459	100	7,396	100	⁵ 761,432	100
	1977				1978			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999 . . .	2,489	34.5	20,972	2.6	2,337	33	20,303	2.3
25,000 to 49,999 . . .	1,014	14.1	32,206	4.0	1,032	15	32,876	3.8
50,000 to 99,999 . . .	1,301	18.0	79,391	9.7	1,247	18	77,374	8.9
100,000 to 199,999 . .	1,359	18.8	168,340	20.7	1,303	18	161,116	18.4
200,000 to 299,999 . .	412	5.7	89,529	11.0	467	7	102,421	11.7
300,000 to 399,999 . .	213	3.0	65,988	8.1	244	3	76,113	8.7
400,000 to 499,999 . .	119	1.7	47,239	5.8	139	2	55,592	6.4
500,000 to 599,999 . .	82	1.1	40,285	4.9	102	1	50,213	5.7
600,000 to 699,999 . .	57	.8	33,344	4.1	58	1	33,666	3.9
700,000 to 799,999 . .	46	.6	31,149	3.8	46	1	31,253	3.6
800,000 to 899,999 . .	32	.5	24,487	3.0	33	1	25,301	2.9
900,000 to 999,999 . .	20	.3	17,227	2.1	23	0	19,813	2.3
1,000,000 to 1,499,999	48	.7	51,790	6.4	60	1	65,118	7.4
1,500,000 to 1,999,999	17	.2	26,073	3.2	16	0	24,294	2.8
2,000,000 to 2,499,999	6	(²)	12,230	1.5	5	0	10,052	1.1
2,500,000 and over . .	7	(²)	74,288	9.1	11	0	88,324	10.0
Total ⁴	7,222	100	814,562	100	7,123	100.0	873,892	100.0
	1979				1980			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999 . . .	2,132	31.9	18,924	2.2	2,080	34.3	19,441	2.8
25,000 to 49,999 . . .	1,009	15.1	33,058	3.9	961	15.9	31,770	4.6
50,000 to 99,999 . . .	1,229	18.4	78,617	9.2	1,141	18.8	74,235	10.7
100,000 to 199,999 . .	1,077	16.1	135,896	15.8	895	14.8	115,303	16.6
200,000 to 299,999 . .	450	6.7	98,248	11.5	373	6.2	81,674	11.8
300,000 to 399,999 . .	258	3.9	79,769	9.0	226	3.7	70,434	10.2
400,000 to 499,999 . .	152	2.3	60,954	7.1	116	1.9	46,403	6.7
500,000 to 599,999 . .	103	1.5	50,585	5.9	71	1.2	34,981	5.0
600,000 to 699,999 . .	53	.9	31,107	3.6	54	.9	31,987	4.6
700,000 to 799,999 . .	54	.8	36,342	4.2	31	.5	20,938	3.0
800,000 to 899,999 . .	33	.5	25,066	2.9	22	.4	16,837	2.4
900,000 to 999,999 . .	21	.3	17,944	2.1	21	.3	18,162	2.6
1,000,000 to 1,499,999	66	1.1	71,786	8.4	44	.7	47,074	6.8
1,500,000 to 1,999,999	19	.3	28,531	3.3	9	.1	14,070	2.0
2,000,000 to 2,499,999	10	.1	20,294	2.4	3	(²)	5,927	0.9
2,500,000 and over . .	10	.1	70,624	8.2	10	.2	63,857	9.2
Total ⁴	6,676	100	857,744	100	6,057	100.0	⁷ 693,089	100

See footnotes at end of table.

Table 10.—Construction sand and gravel production in the United States, by size of operation^{1,2}—Continued

Size range	1982				1984			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999	1,681	34.3	15,641	2.9	1,933	33	18,214	3
25,000 to 49,999	829	16.9	27,734	5.1	912	15	30,061	4
50,000 to 99,999	897	18.3	59,453	11.0	1,129	19	72,817	10
100,000 to 199,999 . . .	737	15.0	96,322	17.8	963	16	122,127	17
200,000 to 299,999 . . .	294	6.0	66,154	12.2	390	7	85,001	12
300,000 to 399,999 . . .	178	3.6	55,996	10.3	183	3	56,617	8
400,000 to 499,999 . . .	78	1.6	30,603	5.6	110	2	44,377	6
500,000 to 599,999 . . .	61	1.2	29,730	5.5	82	1	40,298	6
600,000 to 699,999 . . .	43	.9	24,686	4.6	54	1	31,348	5
700,000 to 799,999 . . .	28	.6	19,002	3.5	44	1	29,641	4
800,000 to 899,999 . . .	23	.5	17,779	3.3	30	1	22,969	3
900,000 to 999,999 . . .	11	.2	9,442	1.7	27	1	23,093	3
1,000,000 to 1,499,999	24	.5	25,784	4.8	43	1	47,356	7
1,500,000 to 1,999,999	9	.2	14,539	2.7	14	0	21,184	3
2,000,000 to 2,499,999	4	.1	8,069	1.5	7	0	13,478	2
2,500,000 and over . . .	4	.1	40,815	7.5	8	0	43,475	6
Total ⁴	4,901	100	541,771	100	5,929	100	702,071	100

Size range	1986				1988			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 24,999	1,817	31	17,035	2	1,725	31	16,531	2
25,000 to 49,999	919	16	30,340	4	854	15	28,295	3
50,000 to 99,999	1,027	18	66,658	8	990	17	64,513	8
100,000 to 199,999 . . .	891	15	114,759	14	888	16	114,401	14
200,000 to 299,999 . . .	383	7	83,645	11	420	7	93,534	11
300,000 to 399,999 . . .	243	4	75,198	9	239	4	74,736	9
400,000 to 499,999 . . .	124	2	49,960	6	147	3	58,488	7
500,000 to 599,999 . . .	100	2	48,873	6	98	2	48,428	6
600,000 to 699,999 . . .	58	1	33,857	4	64	1	37,678	5
700,000 to 799,999 . . .	53	1	35,924	5	48	1	32,309	4
800,000 to 899,999 . . .	39	1	29,820	4	44	1	33,755	4
900,000 to 999,999 . . .	26	0	22,169	3	49	1	42,005	5
1,000,000 to 1,499,999	75	1	80,444	10	71	1	77,490	9
1,500,000 to 1,999,999	23	0	34,716	4	24	0	35,839	4
2,000,000 to 2,499,999	19	0	77,655	10	12	0	23,719	3
2,500,000 and over . . .	—	—	—	—	14	0	55,941	7
Total ⁴	5,797	100	801,045	100	5,687	100	837,695	100

Size range	1990			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
Less than 25,000	1,720	30	15,709	2
25,000 to 49,999	844	15	28,125	3
50,000 to 99,999	1,000	18	65,471	8
100,000 to 199,999 . . .	888	16	116,337	14
200,000 to 299,999 . . .	415	7	91,904	11
300,000 to 399,999 . . .	233	4	72,599	9
400,000 to 499,999 . . .	157	3	63,221	8
500,000 to 599,999 . . .	103	2	51,082	6
600,000 to 699,999 . . .	73	1	42,723	5
700,000 to 799,999 . . .	47	1	31,934	4

See footnotes at end of table.

Table 10.—Construction sand and gravel production in the United States, by size of operation^{1,2}—Continued

Size range	1990			
	Number of operations ³	Percent of total	Quantity (thousand metric tons)	Percent of total
800,000 to 899,999 . . .	40	1	30,703	4
900,000 to 999,999 . . .	26	1	22,352	3
1,000,000 to 1,499,999	74	1	81,868	10
1,500,000 to 1,999,999	18	0	27,805	3
2,000,000 to 2,499,999	9	0	17,868	2
2,500,000 and over . . .	18	0	66,364	8
Total ⁴	5,665	100	826,083	100

¹Excludes American Samoa, Panama Canal Zone, and Puerto Rico.²Sand and gravel became a biennial survey in 1981. No table by size of operation for the odd-numbered years is therefore available.³Includes a few companies operating more than one plant but not submitting returns for individual plants.⁴Data may not add to totals shown because of independent rounding and conversions to metric tons.⁵U.S. totals represent data for commercial operations only (1971-76).⁶Less than 1/2 unit.⁷U.S. total was revised the following year, but no data are available by size of operation; therefore, data may show difference in U.S. totals published.Table 11.—U.S. exports of construction sand and gravel, 1971-75 and 1978
(Thousand metric tons and thousand dollars)

Year	Construction sand and gravel ¹	
	Quantity	F.a.s. value
1971	1,568	6,745
1972	1,652	7,178
1973	1,582	8,597
1974	2,047	11,664
1975	2,920	15,047
1978	3,865	29,270

¹Information on exports of sand and gravel between 1971-75 and 1978 includes construction and industrial sand and gravel and was reported as totals only.Table 12.—U.S. exports of construction sand and gravel, by continent, 1976-90
(Thousand metric tons and thousand dollars)

Continent	1976					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	(²)	17	35	56	35	73
Asia	(²)	42	(²)	2	(²)	44
Europe	(²)	15	(²)	3	(²)	18
North America	505	1,101	487	1,016	992	2,117
Oceania	—	—	—	—	—	—
South America	1	66	(²)	1	1	67
Other	1	96	(²)	21	4	117
Total	507	1,337	522	1,099	1,032	2,436

See footnotes at end of table.

Table 12.—U.S. exports of construction sand and gravel, by continent, 1976-90—Continued
(Thousand metric tons and thousand dollars)

Continent	1977					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	(²)	9	1	56	1	65
Asia	1	74	(²)	5	1	79
Europe	(²)	29	(²)	1	(²)	30
North America	571	1,285	543	1,007	1,114	2,292
Oceania	—	—	—	—	—	—
South America	1	122	(²)	8	1	130
Other	1	186	(²)	26	1	212
Total ³	573	1,705	544	1,087	1,118	2,808
	1979					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	—	—	—	—	—	—
Asia	—	—	—	—	—	—
Europe	28	296	—	—	28	296
North America	248	1,675	—	—	248	1,675
Oceania	—	—	—	—	—	—
South America	8	659	506	1,083	514	1,742
Other	10	1,123	7	88	17	1,211
Total	294	3,753	513	1,171	807	4,924
	1980					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	—	—	—	—	—	—
Asia	—	—	—	—	—	—
Europe	—	—	—	—	—	—
North America	507	3,637	620	1,323	1,127	4,960
Oceania	—	—	—	—	—	—
South America	—	—	—	—	—	—
Other	25	3,024	4	157	29	3,181
Total ³	533	6,661	623	1,480	1,156	8,141
	1981					
	Construction sand		Gravel		Total ³	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	4	392	1	40	5	432
Asia	—	—	—	—	—	—
Europe	4	281	—	—	4	281
North America	533	3,008	583	2,168	1,116	5,176
Oceania	—	—	—	—	—	—
South America	1	206	(²)	2	1	208
Other	15	2,411	7	244	23	2,655
Total ³	556	6,298	591	2,454	1,148	8,752

See footnotes at end of table.

Table 12.—U.S. exports of construction sand and gravel, by continent, 1976-90—Continued
(Thousand metric tons and thousand dollars)

Continent	1982					
	Construction sand		Gravel		Total ³	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	2	164	5	504	6	668
Asia	—	—	—	—	—	—
Europe	—	—	—	—	—	—
North America	553	2,612	422	1,506	975	4,118
Oceania	—	—	—	—	—	—
South America	9	654	2	77	11	731
Other	8	1,967	23	593	31	2,560
Total ³	572	5,397	451	2,680	1,023	8,077
	1983					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	—	—	—	—	—	—
Asia	—	—	—	—	—	—
Europe	—	—	—	—	—	—
North America	793	2,705	317	1,347	1,110	4,052
Oceania	—	—	—	—	—	—
South America	—	—	—	—	—	—
Other	54	1,915	18	463	72	2,378
Total	847	4,620	335	1,810	1,182	6,430
	1984					
	Construction sand		Gravel		Total ³	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	—	—	—	—	—	—
Asia	—	—	—	—	—	—
Europe	—	—	—	—	—	—
North America	1,077	4,752	561	1,671	1,637	6,423
Oceania	—	—	—	—	—	—
South America	—	—	—	—	—	—
Other	21	3,342	15	560	36	3,902
Total ³	1,098	8,094	576	2,231	1,674	10,325
	1985					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	10	64	(²)	7	10	71
Asia	—	—	—	—	—	—
Europe	4	657	—	—	4	657
North America	881	3,832	458	1,911	1,339	5,743
Oceania	—	—	—	—	—	—
South America	—	—	—	—	—	—
Other	10	1,659	10	806	18	2,465
Total ³	904	6,212	468	2,724	1,370	8,208

See footnotes at end of table.

Table 12.—U.S. exports of construction sand and gravel, by continent, 1976-90—Continued
(Thousand metric tons and thousand dollars)

Continent	1986					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	(²)	53	(²)	17	(²)	70
Asia	3	489	—	—	3	489
Europe	(²)	77	(²)	8	(²)	85
North America	600	3,283	446	2,259	1,046	5,542
Oceania	—	—	—	—	—	—
South America	5	264	—	—	5	264
Other	5	1,280	(²)	108	5	1,388
Total ³	611	5,446	446	2,392	1,059	7,838
	1987					
	Construction sand		Gravel		Total	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	(²)	13	—	—	(²)	13
Asia	7	253	—	—	7	253
Europe	4	743	3	37	7	780
North America	503	4,095	489	2,761	992	6,856
Oceania	1	69	—	—	1	69
South America	18	1,295	—	—	18	1,295
Other	4	1,143	1	126	5	1,269
Total ³	537	7,611	493	2,924	1,031	10,533
	1988					
	Construction sand		Gravel		Total ⁴	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	(²)	446	1	4	1	451
Asia	7	1,760	12	291	19	2,050
Europe	33	1,084	6	112	40	1,196
North America	400	3,537	396	3,131	796	6,667
Oceania	1	38	—	—	1	38
South America	15	612	1	35	16	646
Other	—	—	—	—	—	—
Total ³	459	7,476	417	3,572	876	11,048
	1989					
	Construction sand		Gravel		Total ⁴	
	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹	Quantity	F.a.s. value ¹
Africa	6	365	2	49	8	414
Asia	50	1,941	13	474	63	2,415
Europe	4	621	21	375	24	996
North America	185	2,624	736	6,642	921	9,266
Oceania	2	36	2	91	4	127
South America	2	301	1	71	3	372
Other	—	—	—	—	—	—
Total ³	248	5,888	773	7,703	1,021	13,591

See footnotes at end of table.

Table 12.—U.S. exports of construction sand and gravel, by continent, 1976-90—Continued
(Thousand metric tons and thousand dollars)

Continent	1990 ⁴	
	Construction sand	
	Quantity	F.a.s. value
Africa	11	275
Asia	20	2,417
Europe	6	651
North America	355	6,846
Oceania	14	408
South America	19	1,006
Other	1	277
Total³	425	11,880

¹Value of material at U.S. port of export; based on transaction price, including all charges incurred in placing material alongside ship.

²Less than 1/2 unit.

³Data may not add to totals shown because of independent rounding and conversions to metric tons.

⁴Data on exports of gravel was not available for 1990.

Source: Bureau of the Census.

Table 13.—U.S. imports for consumption of construction sand and gravel, 1971-75¹
(Thousand metric tons and thousand dollars)

	1971		1972		1973		1974		1975	
	Quantity	C.i.f. value ²	Quantity	C.i.f. value ²	Quantity	C.i.f. value ²	Quantity	C.i.f. value ²	Quantity	C.i.f. value ²
Total	649	1,228	690	1,379	726	1,576	357	839	339	777

¹Designation breakdown not available for years 1971-75.

²Value at port of entry; based on purchase price and includes all charges (except U.S. import duties) in bringing materials from foreign country to alongside carrier in the United States.

Table 14.—U.S. imports for consumption of construction sand and gravel, by continent,¹ 1976-90
(Thousand metric tons and thousand dollars)

Continent	1976		1977		1978		1979	
	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹
Africa	—	—	—	—	—	—	—	—
Asia	—	—	—	—	—	—	—	—
Australia	—	—	—	—	—	—	(²)	3
Europe	2	49	—	—	—	—	(²)	21
North America	262	502	318	586	467	NA	319	668
South America	—	—	—	—	—	—	—	—
Other	1	73	1	37	100	NA	(²)	29
Total³	265	624	318	623	567	2,084	319	721
	1980		1981		1982		1983	
	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹
Africa	—	—	—	—	—	—	—	—
Asia	(²)	21	—	—	—	—	—	—
Australia	(²)	41	—	—	4	476	—	—
Europe	(²)	3	—	—	(²)	53	—	—
North America	455	1,027	249	1,112	164	901	103	684
South America	—	—	51	812	—	—	—	—
Other	—	51	(²)	63	(²)	49	9	363
Total³	455	1,143	302	1,987	168	1,479	112	1,047

See footnotes at end of table.

Table 14.—U.S. Imports for consumption of construction sand and gravel, by continent,¹ 1976-90—Continued
(Thousand metric tons and thousand dollars)

Continent	1984		1985		1986		1987	
	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹
Africa	—	—	—	—	—	—	—	—
Asia	—	—	—	—	4	88	—	—
Australia	—	—	—	—	—	—	2	470
Europe	—	—	10	297	—	—	—	—
North America	129	1,317	212	1,144	173	810	229	1,310
South America	—	—	—	—	—	—	—	—
Other	8	287	1	131	5	514	26	587
Total ³	137	1,603	223	1,572	186	1,412	257	2,367
	1988		1989		1990			
	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹	Quantity	C.i.f. value ¹		
Africa	—	—	—	—	1	210		
Asia	(²)	41	64	411	45	558		
Australia	3	493	2	433	118	5,945		
Europe	—	—	18	5,420	78	6,406		
North America	310	1,886	459	2,758	1,338	9,273		
South America	—	—	—	—	1	8		
Other	7	743	1	602	1	511		
Total ³	318	3,163	542	9,624	1,580	22,912		

NA Not available.

¹Value at port of entry; based on purchase price and includes all charges (except U.S. import duties) in bringing material from foreign country to alongside carrier in United States.

²Less than 1/2 unit.

³Data may not add to totals shown because of independent rounding.

This page intentionally left blank.

INDUSTRIAL SAND AND GRAVEL

By Wallace P. Bolen

Probably no other nonmetallic mineral has more diversified uses than silica (industrial) sand mainly because of its common occurrence around the world and its distinctive physical characteristics, including hardness, resistance to high temperature and chemical action, and relatively low price. Silica sand is the major component of common glasses, foundry molding and cores, abrasive blast sand, and hydraulic fracturing sand. Industrial sand and gravel is also important in ceramics, in chemicals and fillers for rubber and plastics, on golf courses, as a flux in smelting and chemical production, as filter media, and in many other uses.

Demand for silica sand was affected mostly by the fortunes of the glass and foundries industries. The highest production year, 1979, totaled more than 30.4 million metric tons. Since then, production has ranged between 24.5 million to 26.3 million metric tons. In 1978, exports peaked at 4.2 million metric tons. Imports are usually minor, remaining less than 100,000 metric tons since 1984. Decreased production since 1979 can be attributed to

decreased demand for glass and foundry sand. Glass sand demand has ranged from 9 million to 12 million metric tons except for the high-demand years of 1978 and 1979. Demand in the flat glass sector has risen since 1985 while demand from the container glass segment has stagnated.

Foundry sand demand remained between 6 million and 7 million metric tons since 1987. Demand for abrasive and hydraulic fracturing sand has generally risen through the late 1980's.

Illinois has produced the greatest amount of silica since 1975, producing more than 4 million metric tons annually. Other major producing States throughout the period included California, Michigan, New Jersey, Texas, and Wisconsin. On a regional level, the East North Central region (ENC), including Illinois, Indiana, Michigan, Ohio, and Wisconsin, was the largest production area. The smallest amount was produced in New England. Production was greatest in the ENC region because of its vast silica deposits and proximity to consuming industries, especially glass and foundry consumers.

Table 1.—Salient U.S. industrial sand and gravel statistics¹
(Thousand metric tons and thousand dollars)

	1970	1971	1972	1973	1974	1975	1976
Sold or used:							
Sand: ²							
Quantity	26,437	23,736	26,789	26,285	25,422	24,244	26,917
Value	101,191	91,377	112,387	110,065	135,354	146,983	169,127
Gravel: ²							
Quantity	—	—	—	—	949	508	222
Value	—	—	—	—	3,342	2,996	1,109
Total industrial:							
Quantity	26,437	23,736	26,789	26,285	26,371	24,752	27,139
Value	101,191	91,377	112,387	110,065	138,696	149,979	170,236
Exports:							
Quantity	1,098	1,568	1,652	1,582	2,047	2,920	3,349
Value	5,944	6,745	7,178	8,597	11,664	15,047	19,516
Imports for consumption:							
Quantity	797	649	690	726	357	339	320
Value	1,600	1,228	1,379	1,576	839	777	909
	1977	1978	1979	1980	1981	1982	1983
Sold or used:							
Sand: ²							
Quantity	26,864	28,858	29,140	26,067	26,536	23,904	23,659
Value	201,880	243,239	275,192	286,683	326,334	316,900	329,545
Gravel: ²							
Quantity	1,583	944	1,260	785	660	929	487
Value	8,704	5,554	8,574	6,458	5,997	6,846	5,667
Total industrial:							
Quantity	28,447	29,802	30,400	26,852	27,196	24,833	24,146
Value	210,584	248,793	283,766	293,141	332,331	323,746	335,212

See footnotes at end of table.

Table 1.—Salient U.S. industrial sand and gravel statistics¹—Continued
(Thousand metric tons and thousand dollars)

	1970	1971	1972	1973	1974	1975	1976
Exports:							
Quantity	3,347	3,865	1,883	2,224	2,175	1,765	2,132
Value	21,515	29,270	32,440	40,660	36,736	34,397	32,487
Imports for consumption:							
Quantity	350	567	384	491	306	249	164
Value	1,278	2,084	2,321	2,718	2,608	4,002	2,666
	1984	1985	1986	1987	1988	1989	1990
Sold or used:							
Sand: ²							
Quantity	26,018	26,372	24,440	24,839	24,682	25,237	24,454
Value	370,372	370,730	354,460	357,660	376,202	395,807	420,871
Gravel: ²							
Quantity	640	324	439	572	1,154	1,257	1,315
Value	6,844	3,340	4,853	6,424	11,796	14,388	15,284
Total industrial:							
Quantity	26,658	26,696	24,879	25,411	25,836	26,494	25,769
Value	377,216	374,070	359,313	364,084	387,998	410,195	436,155
Exports:							
Quantity	1,082	786	770	688	962	1,869	1,048
Value	27,656	22,580	20,363	21,253	30,843	78,308	83,826
Imports for consumption:							
Quantity	24	73	80	94	39	32	66
Value	926	1,513	1,014	1,071	1,918	2,057	3,148

¹Puerto Rico excluded from all industrial sand and gravel statistics.

²Gravel data not available for 1970-73.

Table 2.—Industrial sand and gravel sold or used in the United States, by geographic region¹
(Thousand metric tons and thousand dollars)

Geographic region	1976		1977		1978		1979		1980	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:										
New England	133	963	157	2,043	168	2,100	161	2,173	144	2,134
Middle Atlantic	3,663	27,693	2,976	22,636	3,302	32,210	3,343	35,370	3,509	39,900
Midwest:										
East North Central	11,359	58,569	11,558	76,579	12,773	91,940	12,882	102,400	10,349	96,360
West North Central	1,594	10,904	1,674	13,526	1,481	12,240	1,498	13,320	1,234	13,120
South:										
South Atlantic	3,485	22,942	3,931	30,077	4,239	38,755	4,872	49,700	4,001	41,350
East South Central	1,217	6,583	2,113	12,602	1,346	8,708	704	5,511	585	4,375
West South Central	3,102	23,741	3,483	31,062	3,364	32,150	3,947	43,130	4,077	53,260
West:										
Mountain	738	6,029	769	6,068	903	7,536	887	8,692	796	12,240
Pacific	1,843	12,811	1,786	15,989	2,230	23,160	2,109	23,470	2,157	30,401
Total ²	27,139	170,236	28,447	210,584	29,802	248,793	30,400	283,766	26,852	293,141
	1981		1982		1983		1984		1985	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:										
New England	128	2,677	204	3,413	134	3,250	169	3,781	149	3,879
Middle Atlantic	3,017	39,790	2,861	42,252	2,962	44,257	3,138	43,725	3,213	41,352
Midwest:										
East North Central	10,777	114,200	8,218	96,385	8,710	96,840	9,308	119,035	9,155	120,162
West North Central	1,221	13,893	1,667	19,209	1,350	22,683	1,509	25,983	1,432	25,523
South:										
South Atlantic	3,597	47,300	3,242	45,980	3,733	55,328	4,852	65,126	5,406	67,060
East South Central	1,231	6,891	1,337	13,554	879	9,583	1,023	10,939	1,017	11,113
West South Central	4,244	63,570	3,875	59,303	3,310	51,906	3,521	52,655	3,309	52,004

See footnotes at end of table.

Table 2.—Industrial sand and gravel sold or used in the United States, by geographic region¹—Continued
(Thousand metric tons and thousand dollars)

Geographic region	1981		1982		1983		1984		1985	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
West:										
Mountain	753	12,380	1,241	13,338	787	12,258	743	11,595	677	9,950
Pacific	2,226	31,630	2,185	30,312	2,282	39,107	2,393	44,377	2,337	43,022
Total ²	27,196	332,331	24,833	323,746	24,146	335,212	26,658	377,216	26,696	374,070
	1986		1987		1988		1989		1990	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:										
New England	117	3,541	146	3,921	144	4,254	140	4,193	140	3,755
Middle Atlantic	2,801	41,132	2,567	38,155	2,340	36,052	2,245	36,478	2,253	37,315
Midwest:										
East North Central	9,063	116,698	9,009	105,815	9,477	124,020	9,515	124,955	8,675	124,665
West North Central	1,216	16,011	1,375	20,263	1,447	22,701	1,706	27,108	1,767	31,688
South:										
South Atlantic	4,946	71,292	5,030	75,505	4,004	65,770	4,277	71,242	3,718	66,430
East South Central	857	9,198	996	10,719	1,252	14,688	1,312	16,571	1,391	17,761
West South Central	2,868	42,929	3,216	49,065	3,524	55,595	3,623	62,589	3,999	81,075
West:										
Mountain	630	9,251	768	13,980	1,154	17,607	1,193	17,657	1,340	19,803
Pacific	2,378	49,257	2,300	46,658	2,493	47,311	2,483	49,402	2,490	53,663
Total ²	24,879	359,313	25,411	364,084	25,836	387,998	26,494	410,195	25,769	436,155

¹Regional data not available prior to 1976.

²Data may not add to totals shown because of independent rounding.

Table 3.—Industrial sand and gravel sold or used by U.S. producers, by major use
(Thousand metric tons and thousand dollars)

Major use	1970		1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Sand:								
Glassmaking (ground and unground):	10,126	41,572	9,098	37,702	10,768	46,955	9,874	45,164
Containers	NA	NA	NA	NA	NA	NA	NA	NA
Flat (plate and window)	NA	NA	NA	NA	NA	NA	NA	NA
Specialty	NA	NA	NA	NA	NA	NA	NA	NA
Fiberglass (unground)	NA	NA	NA	NA	NA	NA	NA	NA
Fiberglass (ground)	NA	NA	NA	NA	NA	NA	NA	NA
Foundry:								
Molding and core	7,336	24,544	6,624	21,763	6,824	24,827	6,755	25,540
Molding and core facing (ground)	187	1,485	643	3,710	2,103	6,288	2,656	6,917
Refractory	NA	NA	NA	NA	NA	NA	NA	NA
Metallurgical:								
Silicon carbide	NA	NA	NA	NA	NA	NA	NA	NA
Flux for metal smelting	NA	NA	NA	NA	NA	NA	NA	NA
Abrasives:								
Blasting	1,001	5,489	809	5,361	973	6,278	1,084	6,133
Scouring cleansers (ground)	236	2,196	155	1,706	185	1,938	213	2,142
Sawing and sanding	284	744	220	688	238	731	326	1,152
Chemicals (ground)	70	651	24	220	128	568	69	508
Fillers (ground):								
Rubber, paints, putty, etc.	138	1,281	154	1,411	156	1,648	149	1,707
Silica flour	781	3,912	243	2,291	328	2,623	230	1,353
Ceramic (ground):								
Pottery, brick, tile, etc.	278	3,618	202	2,300	248	2,786	191	2,112
Filtration	233	618	181	612	212	1,176	257	1,368
Traction (engine)	766	2,062	642	1,685	545	1,387	758	2,042
Coal washing	NA	NA	NA	NA	NA	NA	NA	NA
Roofing granules and fillers	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 3.—Industrial sand and gravel sold or used by U.S. producers, by major use—Continued
(Thousand metric tons and thousand dollars)

Major use	1970		1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Sand—Continued								
Hydraulic fracturing	269	2,360	274	1,883	256	1,071	319	1,773
Other uses, specified	4,734	10,659	4,464	10,045	3,826	14,111	3,405	12,154
Other uses, unspecified ¹	—	—	—	—	—	—	—	—
Total ²	26,437	101,191	23,736	91,377	26,789	112,387	26,285	110,065
Gravel:								
Metallurgical:	NA	NA	NA	NA	NA	NA	NA	NA
Silicon, ferrosilicon	NA	NA	NA	NA	NA	NA	NA	NA
Filtration	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetallurgical flux	NA	NA	NA	NA	NA	NA	NA	NA
Other uses	NA	NA	NA	NA	NA	NA	NA	NA
Total ²	NA	NA	NA	NA	NA	NA	NA	NA
Grand total ²	26,437	101,191	23,736	91,377	26,789	112,387	26,285	110,065
	1974		1975		1976		1977	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Sand:								
Glassmaking (ground and unground):	9,879	51,636	9,749	58,166	11,199	71,845	10,870	74,341
Containers	NA	NA	NA	NA	NA	NA	NA	NA
Flat (plate and window)	NA	NA	NA	NA	NA	NA	NA	NA
Specialty	NA	NA	NA	NA	NA	NA	NA	NA
Fiberglass (unground)	NA	NA	NA	NA	NA	NA	NA	NA
Fiberglass (ground)	NA	NA	NA	NA	NA	NA	NA	NA
Foundry:								
Molding and core	6,769	33,328	5,856	32,371	6,256	37,264	7,845	50,196
Molding and core facing (ground)	1,901	8,627	1,410	6,467	1,579	8,455	1,506	8,089
Refractory	NA	NA	NA	NA	NA	NA	NA	NA
Metallurgical:	330	1,286	1,404	4,572	1,947	7,365	366	2,242
Silicon carbide	NA	NA	NA	NA	NA	NA	NA	NA
Flux for metal smelting	NA	NA	NA	NA	NA	NA	NA	NA
Abrasives:								
Blasting	1,938	11,281	1,244	11,812	1,359	9,946	1,695	13,645
Scouring cleansers (ground)	295	2,823	340	3,616	227	2,925	366	4,994
Sawing and sanding	90	558	79	299	69	304	191	1,710
Chemicals (ground)	367	1,719	104	869	36	611	117	1,386
Fillers (ground):								
Rubber, paints, putty, etc.	189	2,865	112	2,474	168	2,001	213	3,961
Silica flour	169	1,944	187	2,646	152	2,094	185	2,417
Ceramic (ground):								
Pottery, brick, tile, etc.	123	1,552	77	1,173	162	2,589	256	4,389
Filtration	277	1,639	173	1,381	166	1,060	202	1,714
Traction (engine)	475	2,073	622	2,624	682	2,315	454	2,684
Coal washing	NA	NA	NA	NA	NA	NA	NA	NA
Roofing granules and fillers	NA	NA	NA	NA	NA	NA	NA	NA
Hydraulic fracturing	347	3,447	337	4,279	599	4,759	811	11,184
Other uses, specified	2,273	10,576	2,550	14,234	2,315	15,594	1,788	18,928
Other uses, unspecified ¹	—	—	—	—	—	—	—	—
Total ²	25,422	135,354	24,244	146,983	26,917	169,127	26,864	201,880
Gravel:								
Metallurgical:	911	3,141	406	2,180	122	577	1,366	7,760
Silicon, ferrosilicon	NA	NA	NA	NA	NA	NA	NA	NA
Filtration	NA	NA	NA	NA	—	—	59	438
Nonmetallurgical flux	NA	NA	NA	NA	NA	NA	NA	NA
Other uses	39	201	102	816	100	532	158	507
Total ²	949	3,342	508	2,996	222	1,109	1,583	8,704
Grand total ²	26,371	138,696	24,752	149,979	27,139	170,236	28,447	210,584

See footnotes at end of table.

Table 3.—Industrial sand and gravel sold or used by U.S. producers, by major use—Continued
(Thousand metric tons and thousand dollars)

Major use	1982		1983		1984		1985	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Abrasives:								
Blasting	1,704	26,206	1,619	28,411	1,642	31,099	1,298	22,762
Scouring cleansers (ground)	145	3,461	150	3,769	176	4,548	211	5,358
Sawing and sanding	154	1,546	W	W	24	431	15	355
Chemicals (ground)	304	4,610	246	3,400	386	5,303	343	4,924
Fillers (ground):								
Rubber, paints, putty, etc.	174	6,350	128	7,693	111	2,153	124	7,360
Silica flour	NA	NA	NA	NA	71	5,867	19	542
Ceramic (ground):								
Pottery, brick, tile, etc.	205	4,627	162	6,067	167	4,944	136	5,295
Filtration	271	3,202	93	1,422	197	2,729	313	3,981
Traction (engine)	408	3,765	177	2,398	223	2,479	265	2,763
Coal washing	36	396	W	W	23	274	16	199
Roofing granules and fillers	469	4,886	269	3,778	262	3,881	366	5,056
Hydraulic fracturing	1,344	31,651	898	22,376	1,866	37,806	1,907	42,417
Other uses, specified	W	W	259	3,002	W	W	W	W
Other uses, unspecified ¹	W	W	W	W	3,290	32,283	2,219	15,885
Total ²	23,904	316,900	23,659	329,545	26,018	370,372	26,372	370,730
Gravel:								
Metallurgical:								
Silicon, ferrosilicon	296	3,169	242	2,441	180	1,715	286	2,771
Filtration	17	103	W	W	W	W	21	383
Nonmetallurgical flux	NA	NA	NA	NA	W	W	NA	NA
Other uses	616	3,574	W	W	460	5,129	18	186
Total ²	929	6,846	487	5,667	640	6,844	324	3,340
Grand total²	24,833	323,746	24,146	335,212	26,658	377,216	26,696	374,070
	1986		1987		1988		1989	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Sand:								
Glassmaking (ground and unground):								
Containers	6,877	93,738	7,553	102,344	7,320	99,844	7,129	96,782
Flat (plate and window)	1,765	22,449	1,956	22,821	2,133	28,136	2,349	30,198
Specialty	527	8,095	464	6,996	584	9,569	691	12,049
Fiberglass (unground)	466	5,867	488	6,005	591	7,116	759	15,539
Fiberglass (ground)	337	10,646	309	10,398	386	11,600	224	6,463
Foundry:								
Molding and core	4,974	56,282	6,054	64,227	6,503	75,575	6,123	72,776
Molding and core facing (ground)	137	2,432	W	W	5	246	W	W
Refractory	130	1,422	235	1,437	396	3,695	305	2,002
Metallurgical:								
Silicon carbide	W	W	118	831	W	W	W	W
Flux for metal smelting	42	322	103	2,593	106	2,609	41	285
Abrasives:								
Blasting	1,695	32,073	1,620	28,708	1,869	37,936	2,075	42,190
Scouring cleansers (ground)	36	1,061	56	1,563	48	1,330	W	W
Sawing and sanding	35	356	W	W	—	—	—	—
Chemicals (ground)	288	4,568	465	7,438	594	9,692	741	10,580
Fillers (ground):								
Rubber, paints, putty, etc.	196	11,479	133	8,470	129	9,956	144	10,454
Silica flour	46	1,341	224	7,093	75	2,070	62	1,781
Ceramic (ground):								
Pottery, brick, tile, etc.	180	6,736	204	8,606	254	9,236	216	7,537
Filtration	448	5,577	393	5,989	369	7,326	281	6,033
Traction (engine)	161	1,685	422	4,081	277	2,690	282	2,902
Coal washing	W	W	41	228	W	W	W	W
Roofing granules and fillers	237	4,133	356	7,782	522	12,452	717	13,453
Hydraulic fracturing	1,025	20,371	1,266	26,742	1,178	27,697	1,389	34,494
Other uses, specified	W	W	W	W	W	W	W	W

See footnotes at end of table.

Table 3.—Industrial sand and gravel sold or used by U.S. producers, by major use—Continued
(Thousand metric tons and thousand dollars)

Major use	1986		1987		1988		1989	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Sand—Continued								
Other uses, unspecified ¹	4,271	53,664	1,943	26,273	734	9,304	735	10,940
Total ²	24,440	354,460	24,839	357,660	24,682	376,202	25,237	395,807
Gravel:								
Metallurgical:								
Silicon, ferrosilicon	385	3,916	412	4,436	630	7,223	688	8,295
Filtration	W	W	W	W	23	126	44	59
Nonmetallurgical flux	W	W	W	W	W	W	461	4,311
Other uses	W	W	W	W	W	W	63	1,191
Total ²	439	4,853	572	6,424	1,154	11,796	1,257	14,388
Grand total ²	24,879	359,313	25,411	364,084	25,836	387,998	26,494	410,195
	1990							
	Quantity	Value						
Sand:								
Glassmaking (ground and unground):								
Containers	6,670	96,266						
Flat (plate and window)	2,430	31,496						
Specialty	678	11,650						
Fiberglass (unground)	507	6,451						
Fiberglass (ground)	355	13,684						
Foundry:								
Molding and core	5,625	65,891						
Molding and core facing (ground)	W	W						
Refractory	120	1,995						
Metallurgical:								
Silicon carbide	173	2,961						
Flux for metal smelting	21	171						
Abrasives:								
Blasting	2,085	45,248						
Scouring cleansers (ground)	W	W						
Sawing and sanding	—	—						
Chemicals (ground)	591	10,010						
Fillers (ground):								
Rubber, paints, putty, etc.	165	18,948						
Silica flour	170	7,306						
Ceramic (ground):								
Pottery, brick, tile, etc.	130	5,545						
Filtration	333	6,985						
Traction (engine)	285	2,879						
Coal washing	—	—						
Roofing granules and fillers	519	7,985						
Hydraulic fracturing	1,668	46,655						
Other uses, specified	W	W						
Other uses, unspecified ¹	1,100	21,756						
Total ²	24,454	420,871						
Gravel:								
Metallurgical:								
Silicon, ferrosilicon	637	7,385						
Filtration	68	1,106						
Nonmetallurgical flux	543	5,272						
Other uses	67	1,521						
Total ²	1,315	15,284						
Grand total ²	25,769	436,155						

NA Not available. Through the years, industry demands and trends have introduced changes in collection surveys; therefore, all uses for all years are not always available.

W Withheld to avoid disclosing company proprietary data; included with "Total."

¹Estimated total production plus other uses (small quantities) as reported by producers.

²Data may not add to totals shown because of independent rounding.

Table 4.—Industrial sand and gravel sold or used in the United States, by State¹
(Thousand metric tons and thousand dollars)

State	1973 ²		1974		1975		1976		1977	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	332	809	456	1,395	751	2,271	362	1,250	1,364	7,003
Arizona	W	W	162	897	W	W	W	W	74	881
Arkansas	W	W	W	W	433	5,558	W	W	493	6,194
California	1,940	10,931	1,982	12,231	1,136	8,592	1,657	11,354	1,651	14,558
Colorado	W	W	W	W	125	1,580	W	W	W	W
Connecticut	W	W	—	—	—	—	—	—	W	W
Florida	636	2,837	660	3,940	644	4,131	263	1,414	904	5,172
Georgia	W	W	325	2,430	311	1,875	286	1,903	301	2,711
Idaho	83	329	293	764	116	1,205	W	W	W	W
Illinois	1,757	5,852	1,891	8,738	3,992	23,551	4,068	25,393	3,944	32,078
Indiana	W	W	241	804	300	953	332	1,173	309	1,208
Kansas	W	W	184	918	219	856	W	W	W	W
Kentucky	W	W	44	202	20	232	39	282	55	595
Louisiana	241	1,388	256	1,648	309	2,069	333	2,184	258	2,155
Maryland	W	W	—	—	—	—	—	—	—	—
Massachusetts	181	798	W	W	57	528	76	620	108	951
Michigan	4,658	11,152	4,687	14,039	3,966	13,099	4,841	20,198	5,546	28,947
Minnesota	W	W	W	W	W	W	W	W	620	5,332
Mississippi	W	W	W	W	W	W	W	W	W	W
Missouri	932	4,440	1,261	5,991	748	4,456	817	5,596	911	7,039
Montana	6	10	—	—	W	W	—	—	174	633
Nebraska	W	W	45	266	43	270	W	W	W	W
Nevada	296	1,613	269	1,381	W	W	503	3,587	W	W
New Jersey	3,858	19,466	2,946	17,272	2,477	16,321	2,557	19,130	1,838	13,775
New York	239	1,178	112	544	122	732	142	806	122	766
North Carolina	628	2,104	952	3,869	489	2,691	671	3,943	777	4,003
North Dakota	—	—	—	—	—	—	—	—	—	—
Ohio	525	2,635	777	3,954	707	4,059	985	5,554	973	8,513
Oklahoma	826	3,783	823	4,572	978	5,640	1,158	7,075	1,283	8,362
Pennsylvania	1,774	6,619	997	6,508	912	7,120	964	7,757	1,016	8,095
Rhode Island	W	W	W	W	W	W	W	W	—	—
South Carolina	550	3,084	701	3,884	552	4,036	705	5,352	806	6,458
Tennessee	806	3,443	688	3,606	629	3,591	803	4,991	680	4,945
Texas	1,010	4,652	1,262	8,595	1,196	11,009	1,158	8,721	1,449	14,351
Utah	W	W	W	W	W	W	W	W	W	W
Virginia	269	1,486	367	2,072	434	2,757	W	W	W	W
Washington	W	W	217	1,966	W	W	184	1,455	W	W
West Virginia	W	W	W	W	W	W	W	W	W	W
Wisconsin	1,097	4,218	1,248	5,813	1,183	6,165	1,133	6,251	786	5,034
Other	3,641	17,238	2,524	20,400	1,903	14,631	3,098	24,247	2,005	20,823
Total ³	26,285	110,065	26,371	138,696	24,752	149,979	27,139	170,236	28,447	210,584
	1978		1979		1980		1981		1982	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	692	3,976	269	1,375	327	1,821	165	864	871	8,096
Arizona	130	1,200	W	W	154	1,936	162	2,455	97	1,617
Arkansas	513	3,135	455	2,605	454	3,964	582	8,236	427	5,625
California	2,052	21,379	1,925	21,276	1,968	27,859	1,950	28,269	1,966	27,528
Colorado	253	2,355	153	W	W	W	W	W	201	3,266
Connecticut	61	1,140	W	W	W	W	W	W	73	1,746
Florida	1,023	6,226	967	8,375	W	W	317	4,419	309	4,257
Georgia	255	2,242	W	W	W	W	W	W	491	6,793
Idaho	124	1,617	W	W	W	W	W	W	W	W
Illinois	5,253	44,238	4,913	47,174	4,201	43,822	4,215	49,186	3,619	45,665
Indiana	292	1,345	W	W	235	1,201	233	1,179	W	W
Kansas	W	W	178	1,710	W	W	W	W	300	3,635
Kentucky	W	W	W	W	W	W	W	247	6	116
Louisiana	248	3,032	W	W	320	3,845	266	4,026	343	4,590
Maryland	—	—	—	—	—	—	—	—	—	—

See footnotes at end of table.

Table 4.—Industrial sand and gravel sold or used in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1978		1979		1980		1981		1982	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Massachusetts	W	W	W	W	W	W	79	W	127	1,615
Michigan	4,924	28,635	5,055	29,962	3,685	25,188	3,985	29,787	2,649	21,934
Minnesota	W	W	W	W	W	W	W	W	630	5,903
Mississippi	W	W	W	W	W	W	W	W	W	W
Missouri	785	6,378	779	7,109	655	7,498	706	8,602	680	8,997
Montana	W	W	—	—	W	W	W	W	W	W
Nebraska	—	—	—	—	22	183	17	144	13	105
Nevada	W	W	W	W	W	W	W	W	W	W
New Jersey	2,254	21,354	2,272	23,092	2,509	26,957	2,091	26,438	1,941	28,151
New York	W	W	W	W	W	W	50	W	41	512
North Carolina	900	5,834	1,423	8,155	1,335	7,825	1,121	10,440	650	4,878
North Dakota	—	—	—	—	—	—	—	—	—	—
Ohio	1,193	11,433	1,566	16,160	1,370	16,601	1,349	20,893	1,109	17,816
Oklahoma	W	W	1,456	12,129	1,440	13,767	1,361	14,317	1,109	13,114
Pennsylvania	W	W	1,000	11,709	952	12,374	W	W	879	13,589
Rhode Island	—	—	—	—	—	—	W	W	5	52
South Carolina	803	7,173	897	10,392	743	9,628	728	10,531	653	10,902
Tennessee	633	4,613	391	3,755	221	2,106	1,036	5,610	425	4,826
Texas	1,162	15,294	1,772	26,121	1,863	31,684	2,034	36,992	1,997	35,974
Utah	W	W	W	W	W	W	20	286	W	W
Virginia	W	W	W	W	W	W	W	W	W	W
Washington	W	W	W	W	W	W	276	3,358	220	2,809
West Virginia	W	W	W	W	W	W	W	W	W	W
Wisconsin	1,109	6,291	1,058	7,752	859	9,546	998	13,180	715	9,662
Other	5,147	49,903	3,876	44,915	3,539	45,336	3,453	52,872	2,287	29,973
Total ³	29,802	248,793	30,400	283,766	26,852	293,141	27,196	332,331	24,833	323,746
	1983		1984		1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	379	3,256	401	3,600	475	4,533	393	3,388	526	5,025
Arizona	W	W	W	W	W	W	W	W	W	W
Arkansas	350	4,796	416	6,207	374	5,414	363	3,975	458	5,147
California	1,950	34,066	2,069	39,176	2,046	37,434	2,145	44,813	2,033	41,472
Colorado	192	3,233	135	2,213	W	W	W	W	W	W
Connecticut	W	W	W	W	W	W	W	W	W	W
Florida	298	3,447	1,391	9,815	1,926	12,642	1,331	14,930	1,709	19,713
Georgia	489	7,298	434	6,795	518	6,675	W	W	W	W
Idaho	W	W	W	W	W	W	W	W	W	W
Illinois	3,683	42,871	3,719	52,197	3,680	56,915	3,664	52,133	3,943	45,547
Indiana	W	W	176	1,129	165	1,209	175	1,490	209	1,357
Kansas	181	2,184	W	W	122	1,124	120	1,155	115	1,400
Kentucky	9	124	W	W	W	W	W	W	W	W
Louisiana	264	4,252	241	3,757	242	3,838	232	4,225	262	3,997
Maryland	—	—	W	W	W	W	W	W	W	W
Massachusetts	W	W	W	W	W	W	41	739	51	922
Michigan	3,216	27,577	3,084	33,060	3,035	25,469	3,033	29,493	2,533	22,451
Minnesota	621	12,932	W	W	802	16,910	W	W	W	W
Mississippi	W	W	W	W	W	W	W	W	W	W
Missouri	544	7,541	557	8,129	485	7,330	469	6,230	564	7,786
Montana	W	W	W	W	W	W	W	W	W	W
Nebraska	4	W	W	W	W	W	W	W	W	W
Nevada	W	W	444	W	435	5,944	470	W	524	W
New Jersey	2,165	31,819	2,460	32,287	2,558	31,119	2,124	29,878	1,916	27,872
New York	W	W	23	260	W	W	54	1,164	53	651
North Carolina	967	11,689	1,051	12,864	1,174	13,086	1,328	16,656	1,074	15,329
North Dakota	—	—	—	—	—	—	W	W	W	W
Ohio	1,112	17,848	1,366	20,829	1,190	21,945	1,108	21,183	1,133	21,292

See footnotes at end of table.

Table 4.—Industrial sand and gravel sold or used in the United States, by State¹—Continued
(Thousand metric tons and thousand dollars)

State	1983		1984		1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Oklahoma	1,074	13,221	W	W	W	W	1,091	16,454	1,128	17,078
Pennsylvania	W	W	W	W	629	9,846	624	10,091	W	W
Rhode Island	—	—	W	W	W	W	20	143	W	W
South Carolina	764	13,169	800	14,889	720	14,092	726	14,081	766	15,188
Tennessee	438	5,455	590	6,903	516	6,156	443	5,523	W	W
Texas	1,622	29,637	1,840	29,282	1,785	29,095	1,181	18,274	1,369	22,843
Utah	22	W	10	W	7	144	5	123	5	111
Virginia	W	W	W	W	W	W	W	W	W	W
Washington	306	4,581	323	5,201	292	5,589	W	W	267	5,186
West Virginia	W	W	W	W	W	W	W	W	W	W
Wisconsin	563	7,208	962	11,821	1,086	14,624	1,083	12,399	1,192	15,168
Other	2,932	47,010	4,161	76,803	2,437	42,934	2,655	50,768	3,579	68,545
Total ³	24,146	335,212	26,658	377,216	26,696	374,070	24,879	359,313	25,411	364,084
	1988		1989		1990					
	Quantity	Value	Quantity	Value	Quantity	Value				
Alabama	790	8,507	730	8,092	797	9,075				
Arizona	108	3,045	W	W	W	W				
Arkansas	607	6,784	494	5,507	673	7,209				
California	2,217	42,078	2,201	43,863	2,224	48,055				
Colorado	W	W	W	W	W	W				
Connecticut	W	W	W	W	W	W				
Florida	577	6,928	618	7,768	472	7,024				
Georgia	W	W	487	7,013	W	W				
Idaho	438	5,089	416	5,037	501	6,234				
Illinois	3,926	56,142	4,157	52,935	4,070	62,531				
Indiana	328	1,829	W	W	W	W				
Kansas	W	W	209	2,690	W	W				
Kentucky	—	—	W	W	W	W				
Louisiana	288	4,786	519	9,664	507	10,003				
Maryland	W	W	W	W	W	W				
Massachusetts	W	W	31	601	27	401				
Michigan	2,762	27,150	2,599	24,577	2,096	19,285				
Minnesota	W	W	W	W	W	W				
Mississippi	W	W	W	W	W	W				
Missouri	675	9,876	680	9,972	W	W				
Montana	W	W	W	W	W	W				
Nebraska	W	W	W	W	W	W				
Nevada	546	W	651	W	551	W				
New Jersey	1,687	25,437	1,630	26,138	1,598	26,190				
New York	48	625	48	633	W	W				
North Carolina	1,130	15,953	1,476	19,902	1,068	15,338				
North Dakota	—	—	—	—	—	—				
Ohio	1,235	23,441	1,265	24,662	1,224	24,205				
Oklahoma	1,150	17,381	1,103	18,310	1,141	22,984				
Pennsylvania	W	W	W	W	W	W				
Rhode Island	W	W	W	W	W	W				
South Carolina	779	15,271	764	16,635	766	15,972				
Tennessee	W	W	W	W	W	W				
Texas	1,480	26,645	1,507	29,107	1,677	40,880				
Utah	3	60	3	60	2	42				
Virginia	W	W	W	W	W	W				
Washington	W	W	W	W	W	W				
West Virginia	W	W	W	W	W	W				
Wisconsin	1,226	15,458	1,373	22,399	W	W				
Other	3,836	75,513	3,530	74,630	6,376	120,728				
Total ³	25,836	387,998	26,494	410,195	25,769	436,155				

W Withheld to avoid disclosing company proprietary data; included with "Other."

¹Industrial sand and gravel included with construction sand and gravel statistics for 1970-72.

²Data represents industrial sand only.

³Data may not add to totals shown because of independent rounding.

SILICON

By Larry D. Cunningham

Silicon is a light chemical element with both metallic and nonmetallic characteristics. In nature, silicon combines with oxygen and other elements to form silicates. Silicon, in the form of silicates, constitutes more than 25% of the Earth's crust. The United States has an abundance of silica deposits for the production of ferrosilicon and silicon metal. Silicon is used primarily in the form of ferrosilicon for deoxidation and as an alloying agent in the production of iron and steel. Several grades of ferrosilicon are produced and sold in the United States. Most of the ferrosilicon consumed domestically is either 50%- or 75%-grade material, the majority being the 50%- grade.

Domestic ferrosilicon production accounts for almost all of the U.S. reported consumption of ferrosilicon. Most ferrosilicon products are consumed by the iron and steel industries. Silicon metal is used primarily in the aluminum and chemical industries. The products sold to these industries vary considerably in their specifications. The silicon industry, from mining and smelting to refining and manufacturing, involves a wide spectrum of producers from large companies with a broad product line operating several plants to smaller producers operating a single plant or active in only one phase of the industry.

Table 1.—Production of silvery pig iron, ferrosilicon and silicon metal in the United States
(Metric tons gross weight)

Year	Material and percent silicon content				
	Silvery pig iron	Ferro- silicon ¹		Silicon metal ²	Miscellaneous silicon alloys ³
	5% to 24%	25% to 55%	56% to 95%	96% to 99%	32% to 65%
1969 ⁴	⁵ 196,484	⁶ 422,771	126,303	91,526	33,405
1970 ⁴	W	384,441	135,460	98,893	50,771
1971 ⁴	W	362,487	147,326	97,438	54,651
1972	W	446,305	162,134	105,575	60,845
1973	W	462,571	172,730	121,134	82,828
1974	W	426,391	201,460	127,461	92,822
1975	W	420,085	116,349	93,473	70,954
1976	W	475,806	116,620	128,473	81,755
1977	W	469,270	120,469	113,099	94,052
1978	W	447,802	148,860	109,436	101,447
1979	W	511,981	161,000	134,085	88,940
1980	W	410,159	109,265	117,597	66,087
1981	W	424,125	84,090	119,003	64,273
1982	W	211,075	68,632	70,433	45,749
1983	W	215,720	72,638	112,130	47,345
1984	W	312,354	117,053	130,639	71,405
1985	W	317,053	82,595	111,391	59,337
1986	W	232,072	59,327	114,274	55,004
1987	W	283,341	43,167	136,150	66,701
1988	W	365,181	80,254	149,662	70,545
1989	W	342,892	124,822	139,950	82,156
1990	W	321,385	109,566	145,744	72,442

W Withheld to avoid disclosing company proprietary data.

¹Includes briquets.

²Exclusive of semiconductor grades.

³Exclusive of silicomanganese.

⁴Excludes ferrosilicon used to make other silicon alloys.

⁵Material classified as 5% to 20% silicon content.

⁶Material classified as 21% to 55% silicon content.

**Table 2.—Producer stocks of silvery pig iron, ferrosilicon and silicon metal in the United States
(Metric tons gross weight)**

Year	Material and percent silicon content				
	Silvery pig iron	Ferro- silicon ¹		Silicon metal ²	Miscellaneous silicon alloys ³
	5% to 24%	25% to 55%	56% to 95%	96% to 99%	32% to 65%
1969 ⁴	⁵ W	⁶ 29,278	⁷ 15,162	3,559	5,966
1970 ⁴	W	57,118	30,709	5,524	10,520
1971 ⁴	W	59,996	40,496	11,819	11,574
1972 ⁴	W	51,939	33,071	6,759	13,650
1973	W	15,861	11,197	4,322	6,216
1974	W	21,214	8,554	7,590	10,905
1975	W	52,168	24,582	12,595	16,269
1976	W	49,261	24,684	16,840	15,699
1977	W	59,250	21,872	20,114	15,850
1978	W	61,310	25,848	6,729	10,859
1979	W	60,890	18,851	7,820	14,091
1980	W	63,816	21,910	10,053	13,805
1981	W	100,091	20,970	15,705	12,350
1982	W	85,326	25,359	11,763	15,126
1983	W	54,242	20,594	10,685	10,760
1984	W	54,956	26,451	9,464	12,973
1985	W	90,168	27,440	9,026	14,434
1986	W	51,901	20,620	4,711	13,978
1987	W	35,887	15,289	4,752	10,947
1988	W	46,890	12,653	6,237	13,708
1989	W	51,563	20,994	8,716	20,002
1990	W	69,119	21,673	13,746	17,645

W Withheld to avoid disclosing company proprietary data.

¹Includes briquets.

²Exclusive of semiconductor grades.

³Exclusive of silicomanganese.

⁴Excludes ferrosilicon used to make other silicon alloys.

⁵Material classified as 5% to 20% silicon content. Amount withheld to avoid disclosing company proprietary data.

⁶Material classified as 21% to 55% silicon content.

⁷Excludes 56% to 70% ferrosilicon production.

**Table 3.— U.S. exports and imports for consumption of ferrosilicon and silicon metal
(Metric tons unless otherwise specified)**

Year	Exports						Imports for consumption					
	Silicon metal			Ferrosilicon			Silicon metal			Ferrosilicon		
	Gross	Con- tent	Value (thousands)	Gross	Con- tent	Value (thousands)	Gross	Con- tent	Value (thousands)	Gross	Con- tent	Value (thousands)
1969	()	NA	()	5,885	NA	\$1,666	—	—	—	30,494	15,371	\$4,577
1970	()	NA	()	40,546	NA	11,887	430	395	\$3,747	20,325	9,126	4,117
1971	()	NA	()	23,139	NA	5,603	208	205	2,004	22,196	11,506	5,750
1972	()	NA	()	6,683	NA	2,196	3,896	3,833	5,466	35,925	21,005	8,815
1973	()	NA	()	14,500	NA	4,051	7,853	7,531	11,955	91,155	57,809	21,316
1974	()	NA	()	5,965	NA	3,338	5,443	5,365	16,700	129,228	84,487	66,501
1975	()	NA	()	34,883	NA	15,281	3,545	3,494	6,591	63,899	42,969	41,950
1976	()	NA	()	11,264	NA	7,449	8,736	NA	11,703	89,171	57,770	39,648
1977	()	NA	()	9,569	NA	6,035	24,318	NA	26,158	104,134	68,269	44,371
1978	2,181	NA	\$21,974	10,796	NA	7,871	32,230	NA	35,116	123,032	77,947	49,881
1979	4,524	NA	45,752	20,282	NA	14,740	25,076	NA	47,702	103,014	67,561	57,621
1980	13,038	NA	65,478	24,937	NA	18,572	19,812	NA	53,117	64,548	42,708	42,640

See footnotes at end of table.

Table 3.— U.S. exports and imports for consumption of ferrosilicon and silicon metal—Continued
(Metric tons unless otherwise specified)

Year	Exports						Imports for consumption					
	Silicon metal			Ferrosilicon			Silicon metal			Ferrosilicon		
	Gross	Con- tent	Value (thousands)	Gross	Con- tent	Value (thousands)	Gross	Con- tent	Value (thousands)	Gross	Con- tent	Value (thousands)
1981	7,868	NA	57,001	14,304	NA	12,136	26,885	NA	58,034	141,202	99,789	80,317
1982	2,187	NA	34,335	13,546	NA	11,996	23,893	NA	52,195	69,610	47,489	40,343
1983	2,510	NA	47,826	12,100	NA	10,712	25,558	NA	52,026	144,644	96,172	67,445
1984	4,010	NA	88,543	26,639	NA	21,135	22,880	NA	55,381	130,318	87,114	72,874
1985	1,923	NA	61,647	11,765	NA	12,671	46,993	NA	83,367	140,996	93,128	74,019
1986	4,879	NA	65,157	10,279	NA	8,306	37,059	NA	65,180	202,330	138,613	100,578
1987	8,389	NA	106,213	13,652	NA	11,647	33,502	NA	74,298	209,249	138,729	108,749
1988	9,348	NA	184,205	26,229	NA	25,379	56,291	NA	108,717	209,466	136,946	158,063
1989	5,045	NA	84,074	49,054	27,336	40,883	43,196	42,709	80,388	177,895	114,359	131,631
1990	8,980	8,791	92,229	50,079	26,794	43,993	66,383	65,651	114,385	238,983	151,605	134,993

NA Not available.

¹Included with ferrosilicon.

This page intentionally left blank.

SILVER

By Robert G. Reese Jr.

Silver has been known and used for thousands of years. In ancient times, silver was used for jewelry, ornaments, utensils, and as a substance that could be bartered for other goods and services. This belief that silver had an underlying "value" led eventually to its use as the basis for monetary systems such as that of the Roman Empire and as a means of paying for international trade. The discovery during the 18th and 19th centuries of large silver deposits in the New World, however, resulted in the conversion of most monetary systems to the gold standard. Despite the loss of its status as the basis for the world's monetary systems, the belief in the value of silver remained.

In 1990, silver was produced by at least 55 countries. Mexico was the largest silver producing country, followed by the United States, Peru, the former U.S.S.R., Canada, and Australia. In essentially all producing countries, the primary source of silver is its recovery as a byproduct of copper, gold, lead, or zinc production.

During the 1980's, domestic mine production of silver increased to its highest level in nearly 50 years, and was

due, in part, to a number of factors. During the early years of the decade, precious metal prices remained higher in constant dollars than they were during the previous decade. Additionally, during 1979-80, silver and gold prices were unusually high, while the prices of other base metals were relatively low. In response, companies spent their exploration budgets in search of precious metals. Many of the resultant discoveries were developed into producing mines. Later in the decade, rising prices for metals such as copper, lead, and zinc indirectly contributed to increased domestic silver production. The higher prices allowed some mines to reopen. Other companies increased the capacity of their operations. As noted previously, nearly all base metal mines contain some silver.

Silver has many uses, ranging from decorative to utilitarian. The most important use for silver is in the manufacture of photographic materials. Among the applications for silver are electrical and electronic products, including some types of batteries, brazing alloys and solders, catalysts, dental and medical products, jewelry, sterlingware, electroplated ware, bearings, and mirrors.

Table 1.—Silver: world mine production, by country¹
(Metric tons)

Country ²	1986	1987	1988	1989	1990
Argentina	66	60	79	83	80
Australia	1,023	1,119	1,118	1,075	³ 1,273
Bolivia	95	142	232	267	311
Brazil ⁴	58	61	61	60	60
Bulgaria ⁵	72	77	85	95	100
Burma	14	26	9	7	³ 7
Canada	1,197	1,452	1,484	1,371	³ 1,501
Chile	500	500	507	545	³ 655
China ⁶	90	100	110	125	130
Dominican Republic	41	36	40	23	³ 22
Finland	37	44	31	31	29
France	26	25	24	22	20
Germany, Federal Republic of:					
Eastern States ⁵	⁶ 60	⁶ 60	⁶ 60	60	20
Western States	28	31	31	9	8
Greece	54	52	61	⁶ 60	62
Greenland	12	13	13	15	9
Honduras	54	23	58	50	36
India	35	38	41	35	33
Indonesia	47	50	58	74	³ 67
Ireland	8	7	6	7	7
Italy ^{6,7}	56	82	92	96	98
Japan	351	281	252	156	³ 150
Korea, North ⁶	50	50	50	50	50
Korea, Republic of	157	209	227	239	³ 238

See footnotes at end of table.

PRECEDING PAGE
BLANK

Table 1.—Silver: world mine production, by country¹
(Metric tons)

Country ²	1986	1987	1988	1989	1990
Malaysia	14	16	11	13	13
Mexico	2,303	2,415	2,359	2,306	³ 2,346
Morocco	225	170	226	237	241
Namibia	108	103	108	108	92
Papua New Guinea	56	61	70	94	130
Peru	1,926	2,054	1,552	^e 1,840	³ 1,762
Philippines	54	52	52	48	50
Poland	829	831	1,063	1,003	832
Romania ^e	23	20	23	26	12
South Africa, Republic of	222	208	200	180	³ 161
Spain	327	350	353	^e 450	500
Sweden	263	254	208	228	243
Turkey ^e	7	9	23	29	33
U.S.S.R. ^e	1,500	1,510	1,520	1,520	1,400
United States	1,074	1,241	1,661	2,007	³ 2,170
Yugoslavia ⁶	177	165	139	127	³ 105
Zaire	34	37	74	70	84
Zambia	26	28	24	^e 25	25
Zimbabwe ⁸	26	25	22	22	21
Other	25	25	24	33	33
Total	13,290	14,052	14,381	14,921	13,063

^eEstimated.

¹Recoverable content of ores and concentrates produced unless otherwise specified. Table includes data available through June 21, 1991.

²In addition to the countries listed, Botswana produces silver, and Austria and Thailand may produce silver, but information is inadequate to make reliable estimates of output levels.

³Reported figure.

⁴Of total production, the following quantities, in kilograms, are identified as placer silver (the balance being silver content of other ores and concentrates): 1986–20 (estimated), 1987–20 (estimated), 1988–22 (estimated), 1989–22 (estimated), and 1990–22 (estimated).

⁵Official name of the Eastern states of the Federal Republic of Germany from 1949–90 was the Democratic Republic of Germany; official name of Namibia from 1963–79 was the Territory of South-West Africa; official name of the Republic of Zaire until Oct. 27, 1971, was the Democratic Republic of the Congo (Kinshasa).

⁶Smelter and/or refinery production.

⁷Includes production from imported ores.

⁸The official name of Zimbabwe until Mar. 1980 was Southern Rhodesia.

Table 2.—U.S. Imports for consumption of silver¹

Year	Ores and concentrates ²		Waste and scrap		Doré and precipitates		Refined bullion		Total ³	
	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)
1970	22,725	\$1,219	15,026	\$841	93,361	\$5,239	919,712	\$52,637	1,050,824	\$59,936
1971	160,945	8,042	25,581	1,129	40,440	2,114	696,348	33,979	923,314	45,265
1972	113,207	5,965	31,951	1,788	153,385	8,234	798,726	41,579	1,097,269	57,567
1973	126,308	9,743	132,675	11,727	348,556	28,105	2,530,997	216,153	3,138,535	265,728
1974	81,272	11,820	188,764	29,646	73,352	10,996	2,783,140	432,864	3,126,527	485,326
1975	98,515	13,652	168,227	24,232	67,046	9,391	1,915,890	274,254	2,249,678	321,529
1976	134,224	17,847	101,259	13,734	37,262	5,089	2,089,753	289,032	2,362,498	325,702
1977	219,933	30,460	49,455	5,184	32,223	4,966	2,160,138	315,343	2,461,749	355,953
1978	300,522	45,535	49,921	7,253	93,777	12,824	1,908,480	323,404	2,352,700	389,016
1979	308,796	83,266	46,780	13,849	80,154	23,915	2,437,644	840,731	2,873,372	961,761
1980	301,704	187,019	60,838	37,567	70,947	49,547	2,017,342	1,331,877	2,450,831	1,606,010

See footnotes at end of table.

Table 2.—U.S. imports for consumption of silver¹

Year	Ores and concentrates ²		Waste and scrap		Doré and precipitates		Refined bullion		Total ³	
	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)
1981	303,850	100,422	63,793	16,414	198,254	74,439	2,361,409	837,174	2,927,306	1,028,450
1982	389,727	91,638	88,241	11,979	160,898	37,308	3,014,458	786,154	3,653,324	927,079
1983	432,681	145,419	38,599	13,010	110,106	39,038	5,013,853	1,926,102	5,595,240	2,123,569
1984	404,905	105,587	28,086	7,871	233,245	64,901	2,909,608	784,838	3,575,845	963,198
1985	109,892	20,180	55,076	10,854	307,919	65,364	4,244,107	849,471	4,716,995	945,869
1986	171,556	30,926	58,066	10,854	377,638	68,590	3,899,300	688,296	4,506,560	798,183
1987	83,401	18,019	105,881	22,514	242,017	53,858	2,113,765	460,235	2,545,064	554,627
1988	191,324	35,508	60,470	12,995	245,122	52,840	2,260,049	476,181	2,756,964	577,524
1989	7,013	2,301	90,753	96,254	142,739	27,943	3,061,548	578,781	3,302,054	705,278
1990	90,202	23,203	507,649	86,421	48,449	8,741	2,697,926	437,380	3,344,229	555,744

¹Because of the implementation of the Harmonized Tariff System in Jan. 1989, import data may not be comparable with previous years' data.

²Includes silver content of base metal ores, concentrates, and matte imported for refining.

³Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 3.—U.S. exports of silver¹

Year	Ores and concentrates ²		Waste and scrap		Doré and precipitates		Refined bullion		Total ²	
	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)	Quantity (kilo-grams)	Value (thou-sands)
1970 . . .	31,508	\$1,836	291,191	\$16,266	NA	NA	536,193	\$31,037	³ 858,892	³ 49,139
1971 . . .	5,412	279	110,542	5,885	NA	NA	264,255	13,634	³ 380,209	³ 19,798
1972 . . .	1,586	107	90,604	4,792	NA	NA	830,246	44,361	³ 922,436	³ 49,260
1973 . . .	4,261	293	89,267	7,029	NA	NA	255,298	20,316	³ 348,826	³ 27,638
1974 . . .	1,648	218	393,335	53,738	NA	NA	177,010	27,695	³ 571,993	³ 81,651
1975 . . .	1,960	192	309,231	43,289	NA	NA	703,592	104,086	³ 1,014,783	³ 147,567
1976 . . .	4,883	582	212,841	28,267	NA	NA	236,262	32,586	³ 453,987	³ 61,435
1977 . . .	2,706	324	414,081	45,156	NA	NA	279,745	39,165	³ 696,532	³ 84,645
1978 . . .	1,058	132	305,747	50,194	79,221	\$14,205	810,693	54,594	696,718	119,125
1979 . . .	1,369	237	528,169	212,323	68,614	21,060	507,982	237,542	1,106,134	471,162
1980 . . .	9,549	5,925	655,475	526,577	70,418	50,353	1,779,307	1,326,878	2,514,749	1,909,733
1981 . . .	6,625	1,510	303,135	115,106	87,494	34,474	470,627	181,380	867,881	332,470
1982 . . .	1,462	368	340,179	87,644	50,077	14,756	400,489	105,977	792,206	208,748
1983 . . .	2,084	554	535,944	197,996	30,979	9,516	424,812	169,383	993,819	377,449
1984 . . .	32,596	8,335	375,077	102,452	31,135	9,178	321,610	86,339	760,417	206,306
1985 . . .	8,394	1,651	321,147	67,884	38,112	9,551	392,246	81,746	759,899	160,832
1986 . . .	8,840	1,630	401,715	72,729	56,148	11,436	314,440	56,785	781,142	142,581
1987 . . .	472	150	425,325	96,738	67,286	16,294	349,610	79,123	842,693	192,305
1988 . . .	25,450	1,416	475,481	99,797	53,733	10,844	443,831	94,029	998,495	206,086
1989 . . .	607	166	770,788	145,340	78,664	15,478	430,110	77,812	1,280,169	238,797
1990 . . .	21,861	3,994	1,077,421	159,194	13,184	2,353	735,993	119,892	1,848,458	285,434

NA Not available.

¹Because of the implementation of the Harmonized Tariff System in Jan. 1989, export data may not be comparable with previous years' data.

²Data may not add to total shown because of independent rounding.

³Data totals do not include Doré and precipitates.

Source: Bureau of the Census.

**Table 4.—U.S. yearend stocks of silver in the United States
(Metric tons)**

Year	Industry	Futures exchanges ¹	Treasury Department ²	Defense Department	National Defense Stockpile
1970	2,556	3,981	781	NA	NA
1971	1,771	3,996	1,493	NA	4,339
1972	1,613	3,123	1,425	277	4,339
1973	1,195	2,852	1,403	190	4,339
1974	1,532	2,715	1,369	188	4,339
1975	1,061	3,863	1,275	249	4,339
1976	952	3,602	1,235	236	4,339
1977	1,118	4,025	1,225	208	4,339
1978	896	3,673	1,218	201	4,339
1979	498	4,141	1,213	176	4,339
1980	537	3,757	1,210	140	4,339
1981	649	3,002	1,205	119	4,277
1982	637	3,303	1,144	54	4,277
1983	543	4,704	1,075	3	4,277
1984	660	4,281	992	11	4,277
1985	574	5,385	1,015	14	4,277
1986	550	5,042	1,052	78	3,960
1987	471	5,279	1,229	75	3,517
1988	480	5,862	1,201	81	3,310
1989	544	7,795	997	81	2,973
1990	534	8,636	840	31	2,830

NA Not available.

¹Stocks in warehouses of the Commodity Exchange, Inc., New York, and stocks of the Chicago Board of Trade.

²Consists of bullion, coin bars, and coinage metal fund silver.

**Table 5.—U.S. silver prices
(Dollars per troy ounce)**

Year	Low	High	Average
1970	1.57	1.93	1.77
1971	1.29	1.75	1.55
1972	1.39	2.05	1.68
1973	1.97	3.28	2.56
1974	3.27	6.70	4.71
1975	3.91	5.23	4.42
1976	3.82	5.10	4.35
1977	4.32	4.96	4.62
1978	4.83	6.30	5.40
1979	5.96	28.00	11.09
1980	10.80	48.00	20.63
1981	7.95	16.45	10.52
1982	4.88	11.21	7.95
1983	8.34	14.74	11.44
1984	6.26	10.04	8.14
1985	5.57	6.74	6.14
1986	4.87	6.20	5.47
1987	5.36	10.20	7.01
1988	6.01	7.99	6.54
1989	5.02	6.17	5.50
1990	3.93	5.39	4.82

Source: Handy & Harman daily quotation.

Table 6.—U.S. refinery production of silver
(Metric tons)

Year	Concentrates and ores			Old scrap	New scrap	Total production ¹
	Domestic	Foreign	Total ¹			
1970	1,538	993	2,531	1,743	746	5,021
1971	1,158	978	2,137	935	514	3,586
1972	1,193	1,218	2,411	967	990	4,368
1973	1,135	1,209	2,344	1,075	1,286	4,705
1974	1,007	963	1,970	1,744	1,551	5,265
1975	1,029	840	1,869	1,590	1,571	5,030
1976	1,069	622	1,691	1,562	1,651	4,904
1977	1,142	259	1,401	1,489	1,610	4,499
1978	1,369	322	1,691	1,153	1,281	4,125
1979	1,212	366	1,579	1,236	1,142	3,956
1980	1,125	99	1,224	1,653	2,042	4,918
1981	1,384	78	1,462	1,215	1,392	4,069
1982	NA	NA	1,512	933	1,095	3,540
1983	NA	NA	1,797	915	1,187	3,898
1984	NA	NA	1,845	866	1,309	4,021
1985	NA	NA	1,674	866	1,389	3,928
1986	NA	NA	1,319	762	1,448	3,529
1987	NA	NA	1,415	810	1,316	3,541
1988	NA	NA	1,474	852	1,505	3,832
1989	NA	NA	1,718	735	1,495	3,948
1990	NA	NA	1,611	433	1,185	3,229

NA Not available.

¹Data may not add to totals shown because of independent rounding.

Page Intentionally Left Blank

SODA ASH

By Dennis Kostick

The U.S. soda ash industry consisted of several synthetic soda ash plants situated primarily in the South and East and natural soda ash operations located in the West. Most of domestic soda ash consumption was centered in the Midwest and East, providing the synthetic producers a geographic advantage over their natural competitors. The Arab oil embargo in 1973 and the enforcement of environmental legislation to reduce pollution caused the closure of all but one synthetic facility by 1979. Higher energy costs contributed to a higher selling price for synthetic soda ash. The energy crisis did not affect the natural soda ash industry as much, which permitted those producers to sell at below synthetic soda ash price levels.

In the 1980's, U.S. soda ash consumption was affected by the competition of glass containers with plastic, especially polyethylene terephthalate, and the increased use

of cullet. Excess production capacity and stagnant domestic consumption contributed to a drop in the soda ash value for most of the decade. Soda ash exports began to increase with the formation of an industry export association. Most of the exports were to China and to several other developing nations that had expanding glass, chemical, and detergent industries.

Although the United States had become a major supplier of soda ash to the world, certain foreign investors regarded U.S. soda ash to be a stable business to be involved in. Worldwide concern regarding the environment prompted the shutdowns of a few synthetic soda ash plants that caused pollution. Trade barriers with certain countries were reduced or eliminated, thereby providing an opportunity for additional future U.S. soda ash exports.

Table 1.—Salient soda ash statistics
(Thousand metric tons and thousand dollars)

	1970	1971	1972	1973	1974	1975	1976
United States:							
Production ¹	6,435	6,476	6,828	6,858	6,864	6,468	6,767
Value ^{1,c}	149,165	151,418	167,702	191,712	256,260	300,886	370,712
Production, Wyoming trona	—	—	—	5,643	6,610	7,101	8,462
Exports ²	305	396	435	386	512	480	585
Value ²	12,007	15,400	18,914	16,064	34,156	45,822	47,004
Imports for consumption	—	—	—	9	29	2	(³)
Value	—	—	—	756	3,258	341	2
Stocks, Dec. 31, producers'	51	24	48	47	33	49	93
Consumption:							
Apparent ⁴	6,137	6,107	6,369	6,482	6,395	5,974	6,138
Reported	NA	NA	NA	NA	NA	NA	NA
World production	19,133	19,815	20,463	21,368	22,435	23,365	26,082
	1977	1978	1979	1980	1981	1982	1983
United States:							
Production ¹	7,292	7,521	7,487	7,507	7,513	7,093	7,681
Value ^{1,c}	435,579	451,881	476,711	768,168	787,469	721,257	685,100
Production, Wyoming trona	10,043	10,227	11,608	11,708	11,301	9,826	10,442
Exports ²	689	707	904	992	953	1,006	1,484
Value ²	52,943	61,454	86,663	121,945	121,107	140,616	154,584
Imports for consumption	1	7	36	16	11	16	18
Value	145	734	4,292	2,389	1,625	2,410	2,704
Stocks, Dec. 31, producers'	92	69	62	121	239	294	279
Consumption:							
Apparent ⁴	6,605	6,844	6,626	6,472	6,453	6,048	6,230
Reported	NA	NA	NA	NA	NA	NA	NA
World production	26,443	27,210	28,188	28,346	28,014	26,807	27,892
	1984	1985	1986	1987	1988	1989	1990
United States:							
Production ¹	7,721	7,721	7,655	8,066	8,738	8,995	9,156
Value ^{1,c}	611,000	622,253	553,517	593,685	644,973	764,146	836,188
Production, Wyoming trona	10,618	10,726	12,008	12,582	13,713	14,774	14,665
Exports ²	1,495	1,584	1,859	2,018	2,238	2,648	2,392

See footnotes at end of table.

Table 1.—Salient soda ash statistics—Continued
(Thousand metric tons and thousand dollars)

	1984	1985	1986	1987	1988	1989	1990
United States—Continued							
Value ²	160,774	173,937	241,238	253,200	286,945	365,469	346,693
Imports for consumption	15	51	96	136	121	129	146
Value	2,301	8,089	15,023	18,334	15,999	17,396	20,495
Stocks, Dec. 31, producers'	292	355	267	235	261	221	287
Consumption:							
Apparent ⁴	6,228	6,125	5,980	6,216	6,595	6,516	6,844
Reported	NA	NA	NA	6,100	6,494	6,469	6,527
World production	29,234	29,142	29,823	30,659	31,645	32,560	32,565

^cEstimated. NA Not available.

¹Includes natural and synthetic. Natural only and soda liquors and mine water converted to soda ash equivalent in 1987 and thereafter: 63,469 metric tons in 1987; 73,365 metric tons in 1988; 95,027 metric tons in 1989; and 111,894 metric tons in 1990.

²Export data for 1986-88 were adjusted by the U.S. Bureau of Mines to reconcile data discrepancies among the Bureau of the Census, the American Natural Soda Ash Corp, and Statistics Canada.

³Less than 1/2 unit.

⁴Defined as production minus exports plus imports plus or minus industry stock changes.

Table 2.—U.S. Imports for consumption of soda ash
(Metric tons and thousand dollars)

Year	Disodium carbonate ¹	
	Quantity	Value ²
1970	NA	NA
1971	NA	NA
1972	NA	NA
1973	9,072	756
1974	29,030	3,258
1975	1,814	341
1976	(³)	2
1977	1	145
1978	7,257	734
1979	36,287	4,292
1980	16,329	2,389
1981	10,886	1,625
1982	16,418	2,410
1983	18,136	2,704
1984	15,422	2,301
1985	50,802	8,089
1986 ⁴	96,130	15,023
1987 ⁴	136,171	18,334
1988 ⁴	120,609	15,999
1989	128,790	17,396
1990	145,534	20,495

NA Not available.

¹Beginning in 1989, import data were reclassified under the Harmonized Commodity Description and Coding System (HTS Code No. 2836200000). Prior years were classified under the Tariff Schedule of the United States, Annotated, TSUSA No. 4208400 (calcined) and No. 4208600 (hydrated and sesquicarbonate).

²Customs, insurance, and freight (c.i.f.) value at U.S. ports.

³Less than 1/2 unit.

⁴Also contains sodium carbonate, hydrated and sesquicarbonate.

Source: Bureau of the Census.

Table 3.—U.S. exports of soda ash
(Thousand metric tons and thousand dollars)

Year	Disodium carbonate ¹	
	Quantity	Value ²
1970	305	12,007
1971	396	15,400
1972	435	18,914
1973	386	16,064
1974	512	34,156
1975	480	45,822
1976	585	47,004
1977	689	52,943
1978	707	61,454
1979	904	86,663
1980	992	121,945
1981	953	121,107
1982	1,006	140,616
1983	1,484	154,584
1984	1,495	160,774
1985	1,584	173,937
1986 ³	1,859	241,238
1987 ³	2,018	253,200
1988 ³	2,238	286,945
1989	2,648	365,469
1990	2,392	346,693

¹Beginning in 1989, export data were reclassified under the Harmonized Commodity Description and Coding System (HTS Code No. 2836200000). Prior years were classified under Schedule B No. 4208400.

²Free alongside ship (f.a.s.) value at U.S. ports.

³Adjusted by the U.S. Bureau of Mines to account for discrepancies in data.

Source: Bureau of the Census, as adjusted by the U.S. Bureau of Mines.

Table 4.—Soda ash supply-demand relationships,¹
(Thousand metric tons unless otherwise specified)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
WORLD PRODUCTION									
United States	6,435	6,476	6,828	6,858	6,864	6,468	6,767	7,292	7,521
Rest of world	12,698	13,339	13,635	14,510	15,571	16,897	19,315	19,151	19,689
Total	19,133	19,815	20,463	21,368	22,435	23,365	26,082	26,443	27,210
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY									
U.S. production capacity	7,185	6,822	7,893	7,348	7,348	7,784	8,691	8,691	8,727
Wyoming trona ore production	NA	NA	NA	5,643	6,610	7,101	8,462	10,043	10,227
Domestic sources	6,435	6,476	6,828	6,858	6,864	6,468	6,767	7,292	7,521
Imports	—	—	—	9	29	2	(²)	(²)	7
Industry stocks, Jan. 1 ³	58	51	24	48	47	33	49	93	92
Total U.S. supply	6,493	6,527	6,852	6,915	6,940	6,503	6,816	7,385	7,620
Distribution of U.S. supply:									
Industry stocks, Dec. 31 ³	51	24	48	47	33	49	93	92	69
Exports	305	396	435	386	512	480	585	689	707
Industrial demand ⁴	6,137	6,107	6,369	6,482	6,395	5,974	6,138	6,605	6,844
U.S. DEMAND PATTERNS ⁵									
Glass	3,048	3,084	3,239	3,248	3,257	3,257	3,257	3,611	3,783
Container	NA	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 4.—Soda ash supply-demand relationships,¹—Continued
(Thousand metric tons unless otherwise specified.)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
U.S. DEMAND PATTERNS ⁵									
Flat	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fiber	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemicals	1,796	1,669	1,706	1,678	1,715	1,479	1,506	1,515	1,560
Soaps and detergents	172	272	290	299	299	299	308	308	318
Pulp and paper	272	254	236	245	244	218	236	236	236
Water treatment	181	181	191	191	200	181	200	200	200
Flue gas desulfurization	NA	NA	NA	NA	NA	NA	NA	NA	NA
Distributors	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other ⁶	647	667	705	799	680	721	723	738	747
Total U.S. consumption ...	6,116	6,127	6,367	6,460	6,395	6,155	6,230	6,608	6,844
Undistributed ⁷	21	(20)	2	22	—	(181)	(92)	(2)	—
Total U.S. primary demand	6,137	6,107	6,369	6,482	6,395	5,974	6,138	6,605	6,844
VALUES ⁸									
Average annual value dollars per metric tons ..	23.18	23.38	24.56	27.95	37.34	46.52	54.78	59.73	60.09
	1979	1980	1981	1982	1983	1984	1985	1986	1987
WORLD PRODUCTION									
United States	7,487	7,507	7,513	7,093	7,681	7,721	7,721	7,655	8,066
Rest of world	20,701	20,839	20,501	19,714	20,211	21,513	21,421	22,168	22,593
Total	28,188	28,346	28,014	26,807	27,892	29,234	29,142	29,823	30,659
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY									
U.S. production capacity	8,001	8,727	9,398	10,124	10,124	10,124	10,124	9,580	9,512
Wyoming trona ore production	11,608	11,708	11,301	9,826	10,442	10,618	10,726	12,008	12,582
Domestic sources	7,487	7,507	7,513	7,093	7,681	7,721	7,721	7,655	8,066
Imports	36	16	11	16	18	15	51	96	136
Industry stocks, Jan. 1 ³	69	62	121	239	294	279	292	355	267
Total U.S. supply	7,592	7,585	7,645	7,348	7,993	8,015	8,064	8,106	8,469
Distribution of U.S. supply:									
Industry stocks, Dec. 31	62	121	239	294	279	292	355	267	235
Exports	904	992	953	1,006	1,484	1,495	1,584	1,859	2,018
Industrial demand ⁴	6,626	6,472	6,453	6,048	6,230	6,228	6,125	5,980	6,217
U.S. DEMAND PATTERN ⁵									
Glass (total)	3,624	3,494	3,357	3,176	3,130	3,085	3,084	3,152	3,343
Container	NA	2,516	2,383	2,268	2,177	2,087	1,996	1,951	2,107
Flat	NA	559	504	454	522	544	635	680	821
Fiber	NA	175	236	200	209	227	249	272	249
Other	NA	244	234	254	222	227	204	249	166
Chemicals	1,530	1,294	1,288	1,179	1,270	1,406	1,361	1,179	1,238
Soaps and detergents	327	453	454	454	562	544	544	590	684
Pulp and paper	229	227	191	249	181	227	318	181	63
Water treatment	193	227	227	209	209	272	272	227	72
Flue gas desulfurization	NA	NA	NA	NA	NA	272	159	181	183
Distributors	NA	NA	NA	NA	NA	NA	NA	NA	349
Other ⁶	723	777	936	781	878	422	387	470	168
Total U.S. consumption ⁶ ..	6,626	6,472	6,453	6,048	6,230	6,228	6,125	5,980	6,100
Undistributed ⁷	—	—	—	—	—	—	—	—	117
Total U.S. primary demand	6,626	6,472	6,453	6,048	6,230	6,228	6,125	5,980	6,217

See footnotes at end of table.

Table 4.—Soda ash supply-demand relationships,¹—Continued
(Thousand metric tons unless otherwise specified.)

	1979	1980	1981	1982	1983	1984	1985	1986	1987
VALUES ⁸									
Average annual value dollars per metric ton . .	63.67	99.04	100.52	97.39	84.82	73.85	74.76	72.31	73.61
	1988	1989	1990						
WORLD PRODUCTION									
United States	8,738	8,995	9,156						
Rest of world	22,907	23,565	23,409						
Total	31,645	32,560	32,565						
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY									
U.S. production capacity	9,512	9,580	9,950						
Wyoming trona ore production	13,713	14,774	14,665						
Domestic sources	8,738	8,995	9,156						
Imports	121	129	146						
Industry stocks, Jan. 1 ³	235	261	221						
Total U.S. supply	9,094	9,385	9,523						
Distribution of U.S. supply:									
Industry stocks, Dec. 31 ³ . . .	261	221	287						
Exports	2,238	2,648	2,392						
Industrial demand ⁴	6,595	6,516	6,844						
U.S. DEMAND PATTERN ⁵									
Glass (total)	3,390	3,294	3,177						
Container	2,128	1,961	1,909						
Flat	852	907	851						
Fiber	246	241	228						
Other	164	185	189						
Chemicals	1,445	1,412	1,573						
Soaps and detergents	718	781	835						
Pulp and paper	111	114	132						
Water treatment	110	92	91						
Flue gas desulfurization	200	208	207						
Distributors	373	380	376						
Other ⁶	148	188	136						
Total U.S. consumption ⁶ . .	6,495	6,469	6,527						
Undistributed ⁷	100	47	317						
Total U.S. primary demand	6,595	6,516	6,844						
VALUES ⁸									
Average annual value dollars per metric ton . .	73.81	84.96	91.33						

NA Not available; included in "Other."

¹Natural and synthetic except where noted.

²Less than 1/2 unit.

³Natural soda ash only for 1980 and 1987 and thereafter; natural and synthetic from yearend 1981-86.

⁴Also known as apparent consumption (production plus imports minus exports plus or minus stock changes) and is equal to "Total U.S. primary demand."

⁵Estimated consumption for 1980-86 was based on industry sources; reported consumption in 1987 and thereafter was from quantitative and qualitative quarterly surveys of producers' sales. Other end-use categories were incorporated in the survey.

⁶Includes soda ash used in petroleum and metal refining, leather tanning, enamels, etc. Also includes data in categories indicated by "NA."

⁷Because end-use data prior to 1987 were estimated, industrial demand and U.S. primary demand calculations (both based on production, trade, and inventory data) were assumed to be equal to total U. S. consumption. Beginning with 1987, reported consumption data by end use often disagreed with derived apparent consumption calculations, which necessitated including "Undistributed" category to account for the discrepancies. These discrepancies are because of the fluctuating balance of inventory in transit from plants to domestic or export destinations.

⁸Values are the combined total revenue of California and Wyoming natural, bulk, dense soda ash sold on an f.o.b. plant basis, at list prices, spot prices, discount, long-term contracts, and, for export, divided by quantity of soda ash sold. This value may not be synonymous with the posted list prices of the commodity.

Table 5.—Time-value relationships for soda ash

Year	Average annual value, dollars per ton	
	Natural soda ash	
	Actual value ¹	Based on constant 1990 dollars ²
1970	23.18	72.58
1971	23.38	69.25
1972	24.56	69.46
1973	27.95	74.26
1974	37.34	90.92
1975	46.52	103.15
1976	54.78	114.17
1977	59.73	116.71
1978	60.09	109.44
1979	63.67	119.04
1980	99.04	151.98
1981	100.52	140.62
1982	97.39	128.07
1983	84.82	107.35
1984	73.85	90.18
1985	74.76	88.65
1986	72.31	83.16
1987	73.61	82.45
1988	73.81	80.02
1989	84.96	88.45
1990	91.33	91.33

¹Values are the combined total revenue of California and Wyoming natural soda ash sold at list prices, spot prices, discount, long-term contracts, and, for export, divided by the quantity of soda ash sold. The average annual value may not necessarily correspond to posted list prices for soda ash.

²Final 1990 implicit price deflators for gross national product, by the Council of Economic Advisors. Based on 1982 = 100.

Table 6.—World soda ash production¹
(Metric tons)

Country	1986	1987	1988	1989	1990
Albania ^e	33,000	31,000	22,000	27,000	27,000
Australia ^e	300,000	300,000	300,000	300,000	300,000
Austria ^e	150,000	150,000	145,000	150,000	150,000
Belgium	481,656	447,972	378,960	^e 380,000	^e 380,000
Brazil	201,000	170,000	184,416	196,526	^e 200,000
Bulgaria	1,054,214	1,070,188	^e 1,100,000	^e 1,100,000	1,046,000
Canada ^e	350,000	325,000	325,000	325,000	315,000
China	2,146,000	2,363,000	2,609,000	3,042,000	² 3,746,00
Colombia	112,920	116,864	114,087	113,513	120,615
Czechoslovakia	113,000	102,659	112,217	^e 110,000	104,360
Denmark ³	117,000	120,000	134,000	^e 140,000	92,000
Egypt ^e	50,000	45,000	³ 47,711	47,000	³ 52,180
France ^e	1,245,000	1,270,000	1,270,000	1,300,000	1,200,000
Germany, Federal Republic of:					
Eastern states	1,442,000	1,448,000	1,404,000	1,443,000	1,436,000
Western states	885,000	893,000	914,000	^e 900,000	^e 850,000
Total	2,327,000	2,341,000	2,318,000	2,343,000	2,286,000
India	873,600	969,600	1,098,200	1,343,500	^e 1,400,000
Italy ^e	590,000	612,000	612,000	615,000	610,000
Japan	1,020,849	1,098,465	1,083,121	1,105,308	1,134,825
Kenya ⁴	237,650	228,650	220,000	240,880	244,480
Korea, Republic of ^e	² 264,213	² 288,500	280,000	280,000	280,000

See footnotes at end of table.

Table 6.—World soda ash production¹—Continued
(Metric tons)

Country	1986	1987	1988	1989	1990
Mexico ⁵	405,344	417,329	421,158	456,466	448,072
Netherlands ⁶	380,000	380,000	400,000	400,000	400,000
Pakistan	130,894	133,133	134,106	⁶ 135,000	⁶ 135,000
Poland	963,000	930,000	956,000	1,005,000	⁶ 1,000,000
Portugal ⁶	155,000	160,000	155,000	150,000	150,000
Romania ⁶	895,000	894,000	918,000	890,000	700,000
Spain ⁶	525,000	550,000	560,000	560,000	550,000
Switzerland ⁶	43,000	23,000	—	—	—
Taiwan	133,358	127,332	126,828	115,572	⁶ 120,000
Tanzania	300,000	300,000	300,000	300,000	300,000
Turkey ⁶	330,000	376,000	379,000	381,000	385,000
U.S.S.R. ⁶	5,032,000	5,051,000	4,989,000	4,809,000	4,359,000
United Kingdom ⁶	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
United States ⁷	7,655,001	8,065,559	8,738,042	8,994,717	² 9,156,039
Yugoslavia	207,968	201,539	213,891	204,050	173,158
World Total	29,822,667	30,658,790	31,644,737	32,559,532	32,564,729

⁶Estimated.

¹Table includes data on production of both natural and manufactured sodium carbonate; includes data available through Apr. 20, 1992. Synthetic unless otherwise specified.

²Reported figure.

³Production for sale only; excludes output consumed by producers.

⁴Natural only.

⁵Includes natural and synthetic. In 1988 and 1989, Mexico produced an estimated 180,000 metric tons per year of natural soda ash. The new series listed is as reported by Asociacion Nacional de la Industria Quimica, beginning with 1986.

⁶Excludes potash for 1987.

⁷Natural and synthetic for 1986; natural only thereafter.

Page Intentionally Left Blank.

SODIUM SULFATE

By Dennis Kostick

Sodium sulfate is obtained from natural deposits and as a byproduct from various manufacturing and chemical processes. Each process represents approximately one-half of domestic production. Since 1950, production from natural sources has been a marginal enterprise. Less expensive imports and an abundance of byproduct sodium sulfate have affected the natural sodium sulfate industry. Although there are several natural sodium sulfate deposits in the United States, the only economic resources are in California, Texas, and Utah.

Byproduct sodium sulfate recovery has been derived from the primary production of ascorbic acid, cellulose, flue gas desulfurization, hydrochloric acid, lithium carbonate, rayon, resorcinol, silica, and sodium dichromate manufacture. Virtually all the locations are in the Midwest, South, and the East. Sodium sulfate has been recovered as a waste product from these manufacturing processes and has competed with sodium sulfate produced from natural sources.

Historically, sodium sulfate has been used in pulp and paper, detergents, glass, textiles, and several other miscellaneous end uses. Imports, primarily from Canada, tended to be greater than exports.

Because synthetic sodium sulfate was a byproduct and considered a waste product, it was sold at any price to

dispose of it. The smaller natural sodium sulfate industry, which was concentrated more in the West, based its price around the market price of synthetic sodium sulfate.

Sodium sulfate was mainly used in the Kraft pulping process throughout the 1960's and 1970's. However, around 1986, the trend reversed, with soap and detergents becoming the primary end use. In this sector, sodium sulfate was used as a filler in powdered home laundry detergents because of its whiteness. However, in the late 1980's, liquid detergents and superconcentrates, which do not use sodium sulfate in their formulation, became the preferred choices of laundry detergents. The pulp and paper industry strived to recycle as much sodium sulfate as it could and prevent any discharges to the environment from waste water effluent.

By 1990, the U.S. sodium sulfate industry had excess capacity to supply a declining domestic market. Several companies that recovered sodium sulfate considered modifying their technology to produce nonsodium sulfate byproducts that may have more market potential. U.S. sodium sulfate exports have increased to supply material to foreign textile and detergent industries that still manufacture powdered detergents.

Table 1.—U.S. historical salient sodium sulfate statistics
(Thousand metric tons and thousand dollars)

	1970	1971	1972	1973	1974	1975	1976
United States:							
Production ¹	1,246	1,231	1,204	1,305	1,223	1,113	1,117
Value ²	25,107	21,715	21,577	24,834	32,336	50,886	60,641
Exports	50	60	26	41	46	70	52
Value	1,668	1,825	926	2,049	3,250	6,144	3,636
Imports for consumption	244	243	271	290	340	258	287
Value	4,753	4,667	5,357	5,656	10,382	12,624	16,111
Stocks, Dec. 31, producers ¹	31	35	39	13	23	28	51
Apparent consumption	1,452	1,410	1,446	1,577	1,508	1,295	1,330
World production	3,844	3,752	3,757	4,028	4,132	4,443	4,462
	1977	1978	1979	1980	1981	1982	1983
United States:							
Production ¹	1,088	1,060	1,017	1,033	1,008	784	829
Value ²	55,281	53,816	62,435	71,081	79,926	71,728	85,263
Exports	39	76	93	117	112	101	83
Value	2,801	5,475	8,516	12,740	12,980	12,162	11,380
Imports for consumption	202	123	171	209	249	357	311
Value	11,230	6,591	9,511	13,242	19,135	28,758	27,921
Stocks, Dec. 31, producers ¹	84	52	26	30	60	27	44
Apparent consumption	1,218	1,140	1,121	1,121	1,115	1,073	987
World production	4,086	5,237	5,503	4,529	4,602	4,381	4,307

See footnotes at end of table.

Table 1.—U.S. historical salient sodium sulfate statistics—Continued
(Thousand metric tons and thousand dollars)

	1984	1985	1986	1987	1988	1989	1990
United States:							
Production ¹	817	736	763	725	743	685	665
Value ²	82,999	74,792	72,424	70,545	64,544	62,711	64,260
Exports	69	108	101	111	77	62	62
Value	9,587	11,899	10,183	10,554	8,737	6,241	6,704
Imports for consumption	240	177	171	125	136	173	162
Value	21,198	14,492	13,829	10,363	11,962	13,990	13,155
Stocks, Dec. 31, producers'	54	28	65	50	54	24	39
Apparent consumption	1,040	978	796	767	798	826	750
World production	4,420	4,462	4,628	4,887	4,879	4,844	4,782

¹Includes natural and synthetic. Total production data for synthetic sodium sulfate, obtained from the Bureau of the Census, was revised in Dec. 1990 M28A Inorganic Chemicals, Current Industrial Report.

²The value for synthetic sodium sulfate is based upon the average value for natural sodium sulfate.

Table 2.—Synthetic and natural sodium sulfate¹ produced in the United States
(Thousand metric tons and thousand dollars)

Year ¹	Synthetic and natural ² (quantity)			Synthetic (quantity)	Natural	
	Lower purity ³ (99% or less)	High purity	Total ⁴		Quantity	Value
1970	509	737	1,246	703	543	10,932
1971	466	765	1,231	607	624	11,008
1972	477	727	1,204	568	636	11,396
1973	481	824	1,305	695	610	11,597
1974	513	710	1,223	602	621	16,411
1975	391	722	1,113	508	605	27,667
1976	422	695	1,117	516	601	32,655
1977	614	474	1,088	511	577	29,313
1978	599	461	1,060	511	549	27,865
1979	555	462	1,017	533	484	29,689
1980	613	421	1,033	504	529	36,389
1981	604	404	1,008	456	552	43,186
1982	420	364	784	W	W	W
1983	418	411	829	445	384	39,425
1984	386	431	817	422	395	40,125
1985	340	396	736	383	353	35,860
1986	328	435	763	404	359	34,102
1987	312	414	725	379	346	33,086
1988	312	431	743	382	361	31,377
1989	291	394	685	345	340	31,104
1990	305	360	665	364	349	33,748

W Withheld.

¹All quantities converted to 100% Na₂SO₄ basis.

²Current Industrial Reports, Inorganic Chemicals, Bureau of the Census. Revisions from 1988 Annual (Preliminary), MA28A, Nov. 1989, p. 11.

³Includes Glauber's salt.

⁴Data may not add to totals shown because of independent rounding.

Table 3.—U.S. exports of sodium sulfate
(Thousand metric tons and thousand dollars)

Year	Disodium sulfate, salt cake ¹		Disodium sulfate, other ³		Total	
	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²
1970	NA	NA	NA	NA	50	1,668
1971	NA	NA	NA	NA	60	1,825
1972	NA	NA	NA	NA	26	926
1973	NA	NA	NA	NA	41	2,049
1974	NA	NA	NA	NA	46	3,250
1975	NA	NA	NA	NA	70	6,144
1976	52	3,636	NA	NA	52	3,636
1977	39	2,801	NA	NA	39	2,801
1978	42	2,483	35	2,993	76	5,475
1979	73	5,296	20	3,220	93	8,516
1980	75	6,593	42	6,147	117	12,740
1981	80	7,820	34	5,159	112	12,980
1982	64	6,714	36	5,448	101	12,162
1983	56	6,960	26	4,420	83	11,380
1984	44	5,325	25	4,262	69	9,587
1985	96	8,816	12	3,083	108	11,899
1986	97	8,218	5	1,965	101	10,183
1987	96	8,882	15	1,672	111	10,554
1988	62	5,128	15	3,609	77	8,737
1989	60	5,409	2	832	62	6,241
1990	61	6,092	1	612	62	6,704

NA Not available.

¹Prior to 1989, salt cake was Schedule B No. 4214200. In 1989, it was reclassified under the Harmonized Tariff System as HTS No. 2833.11.1000.

²Customs, insurance, and freight (c.i.f.) value at U.S. port.

³Prior to 1989, other sodium sulfate was Schedule B No. 4214500. In 1989, it is listed as HTS No. 2833.11.5000.

Source: Bureau of the Census.

Table 4.—U.S. Imports for consumption of sodium sulfate
(Thousand metric tons and thousand dollars)

Year	Disodium sulfate, salt cake ^{1,2}		Disodium sulfate, other ⁴		Total ^{2,5}	
	Quantity	Value ³	Quantity	Value ³	Quantity	Value ³
1970	220	4,224	24	529	244	4,753
1971	214	4,108	29	559	243	4,667
1972	205	4,082	66	1,275	271	5,357
1973	218	4,054	73	1,602	290	5,656
1974	251	7,162	89	3,220	340	10,382
1975	184	8,305	74	4,319	258	12,624
1976	194	10,360	93	5,751	287	16,111
1977	110	5,702	93	5,528	202	11,230
1978	37	1,701	87	4,890	123	6,591
1979	77	3,763	94	5,748	171	9,511
1980	88	4,872	121	8,370	209	13,242
1981	123	8,038	126	11,097	249	19,135
1982	191	13,820	167	14,938	357	28,758
1983	131	10,312	181	17,609	311	27,921
1984	55	4,223	185	16,975	240	21,198
1985	36	2,549	141	11,943	177	14,492
1986	29	1,885	142	11,944	171	13,829
1987	34	2,189	92	8,173	125	10,363

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of sodium sulfate—Continued
(Thousand metric tons and thousand dollars)

Year	Disodium sulfate, salt cake ^{1,2}		Disodium sulfate, other ⁴		Total ^{2,5}	
	Quantity	Value ³	Quantity	Value ³	Quantity	Value ³
1988	27	1,930	109	10,034	136	11,962
1989	41	3,350	132	10,641	173	13,990
1990	40	3,277	122	9,879	162	13,155

¹Beginning in 1989, import data were reclassified under the Harmonized Tariff System. Salt cake is HTS No. 2833.11.1000. In prior years, salt cake was under TSUSA No. 4214200.

²Includes Glauber's salt as follows: 1985—none, 1986—38 tons (\$9,175), 1987—666 tons (\$38,318), and 1988—604 tons (\$16,963). TSUSA No. was 4214600.

³Customs, insurance, and freight (c.i.f.) value at U.S. port.

⁴Harmonized Tariff System No. 2833.11.5000 beginning in 1989; TSUSA No. 4214400 for prior years.

⁵Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 5.—Sodium sulfate supply-demand relationship¹
(Thousand metric tons)

	1970	1971	1972	1973	1974	1975	1976
WORLD PRODUCTION							
United States	1,246	1,231	1,204	1,305	1,223	1,113	1,117
Rest of world	2,598	2,521	2,553	2,723	2,909	3,330	3,345
Total	3,844	3,752	3,757	4,028	4,132	4,443	4,462
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY							
Domestic sources	1,246	1,231	1,204	1,305	1,223	1,113	1,118
Imports	244	243	271	290	340	258	287
Industry stocks, Jan. 1 ²	43	31	35	38	13	23	28
Total U.S. supply	1,533	1,505	1,510	1,633	1,576	1,394	1,433
Distribution of U.S. supply:							
Industry stocks, Dec. 31 ²	31	35	38	13	23	28	51
Exports	50	60	26	41	46	70	52
Industrial demand	1,452	1,410	1,446	1,579	1,507	1,296	1,330
U.S. DEMAND PATTERN ⁶							
Glass	72	71	68	68	66	64	63
Pulp and paper	980	973	962	943	925	907	862
Soaps and detergents	259	254	256	259	259	259	281
Other ³	141	112	159	307	257	67	124
Total U.S. primary demand	1,452	1,410	1,445	1,577	1,507	1,297	1,330
VALUES ⁴							
Average annual value	20	18	18	19	26	46	54
WORLD PRODUCTION							
United States	1,088	1,060	1,017	1,033	1,008	784	829
Rest of world	2,998	4,177	4,486	3,496	3,594	3,597	3,478
Total	4,086	5,237	5,503	4,529	4,602	4,381	4,307

See footnotes at end of table.

Table 5.—Sodium sulfate supply-demand relationship¹—Continued
(Thousand metric tons)

	1977	1978	1979	1980	1981	1982	1983
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY							
Domestic sources	1,088	1,060	1,017	1,033	1,008	784	829
Imports	202	123	171	209	249	357	311
Industry stocks, Jan.1 ²	51	84	52	26	30	60	27
Total U.S. supply	1,341	1,267	1,240	1,268	1,287	1,201	1,167
Distribution of U.S. supply:							
Industry stocks, Dec. 31 ² ..	84	52	26	30	60	27	44
Exports	39	76	93	117	112	101	83
Industrial demand	1,218	1,139	1,121	1,121	1,115	1,073	1,040
U.S. DEMAND PATTERN⁶							
Glass	61	63	65	67	62	54	50
Pulp and paper	791	680	590	538	508	490	464
Soaps and detergents	305	363	408	437	435	426	425
Other ³	61	34	58	79	110	103	101
Total U.S. primary demand	1,218	1,140	1,121	1,121	1,115	1,073	1,040
VALUES⁴							
Average annual value	51	51	61	69	79	91	103
WORLD PRODUCTION							
United States	817	736	763	725	743	685	665
Rest of world	3,603	3,726	3,865	4,162	4,136	4,159	4,117
Total	4,420	4,462	4,628	4,887	4,879	4,844	4,782
COMPONENTS AND DISTRIBUTION OF U.S. SUPPLY							
Domestic sources	817	736	763	738	743	685	665
Imports	240	177	171	125	136	173	162
Industry stocks, Jan.1 ²	44	54	28	65	50	54	24
Total U.S. supply	1,101	967	962	928	929	912	851
Distribution of U.S. supply:							
Industry stocks, Dec. 31 ² ..	54	28	65	50	54	24	39
Exports	69	108	101	111	77	62	62
Industrial demand	978	831	796	767	798	826	750
U.S. DEMAND PATTERN⁶							
Glass	49	48	48	45	48	33	30
Pulp and paper	454	445	239	226	239	231	210
Soaps and detergents	363	318	414	392	415	495	450
Other ³	112	20	95	104	96	67	60
Total U.S. primary demand	978	831	796	767	798	826	750
VALUES⁴							
Average annual value	102	102	95	96	87	92	97

⁶Estimated using data from "Chemical Profile" issues on sodium sulfate by Chemical Marketing Reporter for 1971, 1975, 1978, 1980, 1983, 1986, and 1989.

¹Natural and synthetic except where noted. Synthetic sodium sulfate data obtained from the Bureau of the Census are revised periodically and may differ from previous published reports by the U.S. Bureau of Mines. World production data also are periodically revised on receipts of updated information.

²Natural sodium sulfate only.

³Includes ceramics, chemicals (potassium sulfate, sodium hyposulfite, sodium sulfide, sodium silicate, and sodium aluminum sulfate), feed supplements, printing inks, sulfonated oils, textile dyeing, veterinary medicines, and viscose sponges.

⁴Dollars per ton for natural sodium sulfate, f.o.b. mine or plant.

Table 6.—Sodium sulfate: world production
(Thousand metric tons)

Country ¹	1986	1987	1988	1989	1990
Natural:					
Argentina	32	27	15	10	11
Canada	371	342	331	327	347
Chile ²	5	12	16	10	10
China ²	14	18	27	27	27
Egypt	19	42	43	46	45
Iran	123	264	214	185	177
Mexico	458	486	422	478	545
Netherlands ²	18	22	22	22	22
South Africa, Republic of	(³)	(³)	(³)	(³)	(³)
Spain	451	475	450	450	460
Turkey ²	59	83	79	68	70
U.S.S.R. ⁴	360	360	375	375	350
United States ⁵	359	346	361	340	349
Total⁶	2,268	2,477	2,355	2,338	2,413
Synthetic:²					
Austria ²	55	109	118	120	120
Belgium ²	265	260	255	255	250
Brazil ²	7	7	9	9	9
Chile ²	59	60	63	66	50
Finland ²	35	35	35	33	33
France	110	115	154	155	120
Germany, Federal Republic of:					
Eastern states	181	179	180	175	170
Western states	163	164	175	172	167
Greece ²	8	7	7	6	6
Hungary	8	9	9	9	9
Italy ²	75	80	127	130	130
Japan ⁸	253	255	247	256	253
Netherlands ²	15	15	15	15	15
Pakistan	1	1	1	1	1
Portugal	52	55	54	55	55
Spain ⁸	150	165	165	165	160
Sweden	100	100	100	100	100
Turkey	27	27	27	27	27
U.S.S.R. ^{2,4}	260	260	270	270	250
United Kingdom ²	90	90	90	90	90
United States ⁹	404	379	382	345	316
Yugoslavia	42	38	41	51	38
Total⁶	2,360	2,410	2,524	2,505	2,369
Grand total⁶	4,628	4,887	4,879	4,844	4,782

²Estimated.

¹In addition to the countries listed, China, Poland, Romania, and the United Kingdom are assumed to have manufactured sodium sulfate. Other unlisted countries may have produced this commodity, but production figures are not reported, and available general information is inadequate for the formulation of reliable estimates of output levels.

²Natural mine output, excluding byproduct output from the nitrate industry, which is reported under "Manufactured."

³Less than 1/2 unit.

⁴Conjectural estimates based on 1968 information on natural sodium sulfate only.

⁵Sold or used by producers.

⁶Data may not add to totals shown because of independent rounding.

⁷Byproduct of nitrate industry, natural sodium sulfate, and anhydrous sodium sulfate.

⁸Derived approximate figure—difference between reported total sodium sulfate production (natural and manufactured, undifferentiated) and reported quantity of natural sodium sulfate sold or used by producers.

⁹Quantities of manufactured sodium sulfate credited to Spain are reported in official sources in such a way as to indicate that they are in addition to the quantities reported as mined (reported in this table under "Natural"), but some duplication may exist.

**Table 7.—Time-value relationships for sodium sulfate
(Average annual value, dollars per ton)**

Year	Natural sodium sulfate	
	Actual value ¹	Based on constant 1990 dollars ²
1970 ..	20.15	63.09
1971 ..	17.64	52.24
1972 ..	17.92	50.68
1973 ..	19.03	50.54
1974 ..	26.44	64.40
1975 ..	45.72	101.39
1976 ..	54.29	113.14
1977 ..	50.81	99.27
1978 ..	50.77	92.47
1979 ..	61.39	102.70
1980 ..	68.81	105.58
1981 ..	79.29	110.92
1982 ..	91.49	120.32
1983 ..	102.85	130.16
1984 ..	101.59	124.04
1985 ..	101.62	120.49
1986 ..	94.92	109.68
1987 ..	95.59	107.08
1988 ..	86.87	94.18
1989 ..	91.55	95.32
1990 ..	96.63	96.63

¹Based on the average valuation by producers of their annual total production and reported sales. The values incorporate the price differences charged by producers for the same finished product sold in bulk at the plant.

²From final 1990 implicit price deflators for gross national product by the Council of Economic Advisors. Based on 1982 = 100.

Page Intentionally Left Blank.

CRUSHED STONE

By Valentin V. Tepordei

Stone, in its multitude of forms, represents a very significant part of the Earth's crust and one of the most accessible natural resources. Stone has been used since the earliest days of our civilization, first as a tool or weapon, then as construction material, and later, in its crushed form, as one of the basic raw materials for a wide variety of uses ranging from agriculture and chemicals to complex industrial processes. At the beginning of the 20th century, the U.S. production of crushed stone was relatively small, and its uses limited. Today, crushed stone is being produced in 48 of the 50 States, and its annual production tonnage ranks first in the nonfuel minerals industry. The United States is, in general, self-sufficient in crushed stone, producing enough to meet most of the domestic needs. Small quantities of crushed stone, used mainly as construction aggregates, are being imported mostly by water from the Bahamas, Canada, and Mexico to compensate for local shortages that exist in some areas of the country.

The demand for crushed stone is determined mostly by the level of construction activity, and, therefore, the demand for construction materials. U.S. production of crushed stone recorded a significant growth in the past 40 years, from 229 million metric tons in 1950 to 1.1 billion metric tons in 1990. The highest level of production was reached in 1988—1.13 billion metric tons. Between 1950 and 1973, because of the construction of the Interstate Highway System, the growth from year to year in the production of crushed stone was almost continuous, paralleling the increased demand for construction aggregates. Following the reduction in the volume of work in the Interstate Highway Program in the late 1960's, the crushed stone industry, while still growing, became more sensitive to the ups and downs of the economy. The 1974-75 and 1982 recessions are well reflected by low levels of production of crushed stone in those years. Future demand for crushed stone will continue to be dependent mostly on the growth of construction activity.

Most crushed stone is used for construction purposes, mainly as aggregate with or without a binder. Road base or road surfacing material, macadam, riprap, and railroad ballast are the major uses without a binder. Aggregate for cement and bituminous concrete in highway and road construction and repair and in residential and nonresidential construction are the major uses for aggregates with a binder. Other uses include cement and lime manufacture, agriculture, metallurgical flux, and fillers and extenders.

Crushed stone is a high-volume, low-value commodity. The industry is highly competitive and is characterized by

thousands of operations serving local or regional markets. Production costs are determined mainly by the cost of labor, equipment, energy, and water, in addition to the costs of compliance with environmental and safety regulations. These costs vary depending on geographic location, the nature of the deposit, and the number and type of products produced. Despite having one of the lowest average-per-ton values of all mineral commodities, the constant dollar price of crushed stone has changed relatively little during the past 20 years. As a result of rising costs of labor, energy, and mining and processing equipment, the average unit price of crushed stone increased from \$1.58 per metric ton, f.o.b. plant, in 1970 to \$4.39 in 1990. However, the unit price in constant 1982 dollars fluctuated between \$3.48 and \$3.91 per metric ton for the same period. Increased productivity achieved through increased use of automation and more efficient equipment was mainly responsible for maintaining the prices at this level.

Underground operations are becoming more common, especially for limestone mining in the central and eastern parts of the United States, as the advantages of such operations are increasingly recognized by the producers. By operating underground, a variety of problems usually connected with surface mining such as environmental impacts and community acceptance are significantly reduced.

Transportation is a major factor in the delivered price of crushed stone. The cost of moving crushed stone from the plant to the market often equals or exceeds the sale price of the product at the plant. Because of the high cost of transportation and the large quantities of bulk material that have to be shipped, crushed stone is usually marketed locally. The high cost of transportation is responsible for the wide dispersion of quarries around the country, usually located near highly populated areas. However, increasing land values combined with local environmental concerns are moving crushed stone quarries farther from the end-use locations, increasing the price of delivered material. Economies of scale, which might be realized if fewer, larger operations served larger marketing areas, would probably not offset the increased transportation costs.

Although crushed stone resources are widespread and in adequate supply nationally, local shortages exist. Land use conflicts and environmental problems associated with rapid urban expansion are major factors contributing to these shortages. The local shortages that occasionally exist are caused less by a lack of stone than by urban encroachment or zoning regulations that force closure of operating quarries or prevent the development of new

ones. Demand pressures, land use regulations, and the cost of meeting environmental and reclamation requirements are factors that will cause a rising price trend.

Sand and gravel and to a lesser extent iron-blast-furnace slag are the predominant substitutes for crushed stone used as construction aggregate. Steel slag is another substitute for crushed stone in road bases and asphaltic

concrete, but not in cement concretes because of chemical interaction. Blast-furnace slag is also used as a stone substitute in cement manufacturing.

Stone remains an abundant material, and, despite environmental, zoning, and regulatory restrictions, no shortages on a large scale are expected to occur in the future.

Table 1.—U.S. historical salient crushed stone statistics in the United States^{1,2}
(Thousand metric tons and thousand dollars)

	1971	1972	1973	1974
Sold or used by producers:				
Crushed stone	793,331	833,643	960,293	944,916
Value	1,500,933	1,581,530	1,904,464	2,085,800
Exports (value)	11,489	11,107	13,063	18,159
Imports for consumption (value)	4,745	6,026	7,135	8,459
	1975	1976	1977	1978
Sold or used by producers:				
Crushed stone	816,454	816,700	865,414	952,150
Value	2,022,000	2,117,000	2,353,000	2,773,000
Exports (value)	22,100	24,000	22,600	31,400
Imports for consumption (value)	8,054	9,379	11,376	14,249
	1979	1980	1981	1982
Sold or used by producers:				
Crushed stone	994,522	892,254	791,647	^c 716,704
Value	3,265,300	3,265,800	3,125,000	^c 2,918,300
Exports (value)	23,000	21,239	25,949	19,026
Imports for consumption (value) ³	15,981	13,824	13,473	16,382
	1983	1984	1985	1986
Sold or used by producers:				
Crushed stone	781,672	^c 867,270	907,908	^c 928,233
Value	3,327,000	^c 3,755,600	4,053,000	^c 4,255,000
Exports (value)	23,021	23,970	29,347	36,957
Imports for consumption (value) ³	12,610	17,543	11,640	12,451
	1987	1988	1989	1990
Sold or used by producers:				
Crushed stone	1,088,740	^c 1,131,986	1,100,807	^c 1,108,581
Value	5,248,600	^c 5,558,100	5,325,800	^c 5,591,300
Exports (value)	26,063	30,413	23,345	41,400
Imports for consumption (value) ³	14,024	16,789	36,870	35,310

^cEstimated.

¹In 1981, crushed stone became biennial; data are estimated for even-numbered years.

²Does not include American Samoa, Guam, Puerto Rico, or the Virgin Islands.

³Data excludes precipitated calcium carbonate.

Table 2.—Crushed stone sold or used in the United States, by kind¹
(Thousand metric tons and thousand dollars)

Kind	1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Limestone ²	569,744	1,016,088	609,172	1,090,707	702,522	1,321,932	681,768	1,428,200
Dolomite	—	—	—	—	—	—	—	—
Granite	84,288	156,177	96,403	182,930	109,412	216,874	107,556	238,140
Traprock ³	68,314	160,281	69,884	159,783	76,166	177,671	87,893	217,900
Marble	1,489	17,256	2,038	25,003	1,835	23,595	1,523	30,554
Shell	16,817	30,088	15,068	29,571	18,049	37,650	16,543	43,626
Calcareous marl	3,138	4,504	2,404	3,598	2,111	3,042	3,528	5,956

See footnotes at end of table.

Table 2.—Crushed stone sold or used in the United States, by kind¹—Continued
(Thousand metric tons and thousand dollars)

Kind	1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Volcanic cinder and scoria	—	—	—	—	—	—	—	—
Sandstone, quartz, and quartzite	27,577	74,521	24,328	57,994	27,534	69,647	28,204	77,815
Slate	1,118	13,615	1,447	14,925	1,411	15,980	1,217	8,894
Other stone ⁴	20,846	28,403	12,899	17,019	21,254	38,073	16,693	34,715
Total ⁵	793,331	1,500,933	833,643	1,581,530	960,293	1,904,464	944,916	2,085,800
	1975		1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Limestone ²	603,115	1,418,700	601,355	1,496,200	640,946	1,679,065	712,807	2,007,403
Dolomite	—	—	—	—	—	—	—	—
Granite	85,510	216,990	89,202	239,670	98,479	276,413	110,485	338,038
Traprock ³	71,162	192,600	68,222	192,880	70,223	207,670	76,648	240,818
Marble	1,325	22,626	1,321	20,586	1,397	23,947	1,285	25,146
Shell	14,019	52,671	12,477	37,393	12,240	33,487	11,282	33,346
Calcareous marl	3,179	4,871	3,058	4,446	2,283	3,740	2,345	4,360
Volcanic cinder and scoria	—	—	—	—	—	—	—	—
Sandstone, quartz, and quartzite	24,603	77,237	24,243	78,506	27,385	91,210	25,639	86,295
Slate	691	4,940	801	5,820	811	7,669	873	8,891
Other stone ⁴	12,854	31,000	16,025	41,099	11,651	29,806	10,787	28,317
Total ⁵	816,454	2,022,000	816,700	2,117,000	865,414	2,353,000	952,150	2,773,000
	1979		1980		1981		1983	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Limestone ²	735,937	2,333,275	656,046	2,315,511	586,194	2,227,474	543,683	2,217,216
Dolomite	—	—	—	—	—	—	21,597	99,673
Granite	110,981	385,628	107,002	417,985	91,692	386,322	105,849	487,017
Traprock ³	92,059	326,999	73,841	300,198	63,655	280,997	67,147	305,509
Marble	1,325	25,085	1,223	23,732	972	22,519	1,631	29,613
Shell	11,047	38,572	9,901	40,060	9,769	49,541	7,573	33,314
Calcareous marl	2,404	4,533	3,374	7,901	3,469	8,016	3,131	7,937
Volcanic cinder and scoria	—	—	2,936	11,258	3,327	13,400	1,662	9,149
Sandstone, quartz, and quartzite	28,262	106,520	26,194	102,497	20,694	84,016	19,286	87,945
Slate	1,167	11,504	959	12,014	473	7,740	692	8,383
Other stone ⁴	11,339	33,171	10,779	34,674	11,402	45,110	9,420	41,225
Total ⁵	994,522	3,265,300	892,254	3,265,800	791,647	3,125,000	781,672	3,327,000
	1985		1987		1989			
	Quantity	Value	Quantity	Value	Quantity	Value		
Limestone	621,424	2,618,621	718,898	3,249,713	731,776	3,234,317		
Dolomite	28,438	133,271	44,140	206,904	44,728	216,957		
Granite	131,772	669,807	163,268	900,682	152,800	864,962		
Traprock ³	75,794	388,027	93,815	505,187	89,957	524,271		
Marble	2,211	20,439	5,058	62,335	11,088	137,481		
Shell	8,261	37,951	7,622	51,028	6,280	34,794		
Calcareous marl	3,592	8,083	3,768	7,650	4,643	11,614		
Volcanic cinder and scoria	2,679	12,504	3,318	14,952	3,293	20,206		
Sandstone, quartz, and quartzite	21,000	103,483	29,479	157,934	28,887	148,696		
Slate	701	3,758	2,114	14,258	1,894	12,926		
Other stone ⁴	12,037	56,875	17,261	77,954	25,460	119,538		
Total ⁵	907,908	4,053,000	1,088,740	5,248,600	1,100,807	5,325,800		

¹Crushed stone became a biennial survey in 1981. No table by kind for even-numbered years is therefore available.

²In 1971-79, limestone and dolomite figures were combined.

³Includes gabbro, basalt, diabase, etc.

⁴Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, soapstone sold as dimension stone, etc.

⁵Data may not add to totals shown because of independent rounding and conversion to metric tons.

Table 3.—Crushed stone sold or used in the United States, by region
(Thousand metric tons and thousand dollars)

Region	1971 ¹		1972 ¹		1973 ¹		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:								
New England	17,300	73,939	19,907	76,127	21,029	78,311	18,768	61,212
Middle Atlantic	104,974	227,944	109,468	244,209	125,971	290,624	115,149	291,828
North Central:								
East North Central	173,624	317,019	173,651	315,963	202,985	367,140	195,581	389,331
West North Central	84,919	164,558	88,133	170,537	104,211	213,416	105,817	218,517
South:								
South Atlantic	159,559	326,425	186,565	384,277	209,156	457,718	196,954	455,161
East South Central	75,643	136,083	81,502	158,428	92,306	182,954	92,299	202,687
West South Central	79,789	132,184	85,519	133,003	101,528	173,896	106,055	209,188
West:								
Mountain	19,687	39,160	26,620	53,484	28,224	65,484	26,384	66,267
Pacific	71,015	152,875	62,140	124,461	74,190	149,509	87,911	191,530
Total ²	786,509	1,570,187	833,504	1,660,489	959,599	1,979,052	944,916	2,085,800
	1975		1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:								
New England	16,812	56,107	16,462	64,145	17,634	70,839	18,690	81,300
Middle Atlantic	93,989	265,952	93,336	273,091	96,558	298,782	107,031	343,229
North Central:								
East North Central	177,792	403,115	176,721	423,867	173,658	440,833	190,216	509,318
West North Central	96,965	231,828	98,881	245,150	101,024	260,913	113,138	311,857
South:								
South Atlantic	155,778	396,484	159,307	429,327	184,106	518,478	213,244	654,729
East South Central	85,285	208,587	87,576	227,051	95,633	264,719	104,520	313,163
West South Central	96,123	217,119	92,399	204,286	105,949	241,961	113,248	288,423
West:								
Mountain	22,254	59,775	23,301	67,659	24,068	71,413	24,212	77,154
Pacific	71,454	182,766	68,718	182,036	66,783	185,071	67,852	193,439
Total ²	816,454	2,022,000	816,700	2,117,000	865,414	2,353,000	952,150	2,773,000
	1979		1980		1981		1982 ^e	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:								
New England	20,065	103,076	16,816	89,332	16,633	92,173	14,633	79,700
Middle Atlantic	111,476	401,362	97,483	400,881	85,615	383,329	81,465	391,500
North Central:								
East North Central	192,458	583,215	162,735	550,663	137,584	505,002	113,943	422,200
West North Central	115,028	351,051	97,766	324,562	82,187	286,472	80,195	285,800
South:								
South Atlantic	222,710	799,985	209,823	834,415	186,785	802,184	168,374	744,900
East South Central	103,421	339,573	89,708	324,567	79,781	316,346	75,750	312,600
West South Central	119,815	341,095	120,811	389,550	112,504	389,146	105,687	362,600
West:								
Mountain	27,861	97,305	25,703	103,249	25,285	101,852	21,410	96,000
Pacific	81,689	248,626	71,409	248,609	65,274	248,631	55,248	222,900
Total ²	994,522	3,265,300	892,254	3,265,800	791,647	3,125,000	716,704	2,918,300
	1983		1984 ^e		1985		1986 ^e	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:								
New England	17,722	98,683	19,641	108,300	20,448	112,910	21,500	119,500
Middle Atlantic	86,922	432,121	93,259	438,000	104,866	570,333	108,499	609,100
Midwest:								
East North Central	125,886	485,749	142,972	567,000	134,194	520,118	138,437	544,900
West North Central	85,196	327,832	87,271	347,500	96,193	369,972	97,250	385,700

See footnotes at end of table.

Table 3.—Crushed stone sold or used in the United States, by region—Continued
(Thousand metric tons and thousand dollars)

Region	1983		1984 ^a		1985		1986 ^a	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
South:								
South Atlantic	194,702	905,892	225,708	1,077,800	241,008	1,169,994	250,020	1,252,700
East South Central	78,187	329,166	88,451	375,300	93,916	404,456	94,982	438,000
West South Central	108,318	393,097	121,563	465,300	124,220	495,687	123,740	488,700
West:								
Mountain	24,291	99,509	25,447	108,700	26,282	106,938	28,758	119,000
Pacific	60,450	254,936	62,959	267,700	66,780	302,409	65,045	297,400
Total ²	781,672	3,327,000	867,270	3,755,600	907,908	4,053,000	928,233	4,255,000
	1987		1988 ^a		1989		1990 ^a	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Northeast:								
New England	31,298	203,581	33,112	211,300	27,372	195,607	24,500	181,100
Middle Atlantic	139,509	767,445	149,414	787,700	140,089	801,476	142,900	845,700
Midwest:								
East North Central	177,466	804,954	190,509	851,800	191,941	787,107	198,000	845,180
West North Central	107,736	431,975	106,504	455,000	102,177	407,125	110,900	465,700
South:								
South Atlantic	286,663	1,510,541	294,745	1,588,700	286,948	1,497,971	280,000	1,575,560
East South Central	114,528	556,353	121,654	592,000	122,000	614,623	129,500	662,000
West South Central	117,583	465,909	117,571	462,600	114,301	448,560	118,500	481,500
West:								
Mountain	34,583	147,323	34,382	144,600	29,181	131,292	29,100	130,170
Pacific	79,376	360,517	84,096	450,700	86,799	442,001	75,200	404,390
Total ²	1,088,740	5,248,600	1,131,986	5,558,100	1,100,807	5,325,800	1,108,581	5,591,300

^aEstimated.

¹Individual regions may include dimension stone and exclude any undistributed locations.

²Data may not add to totals shown because of independent rounding.

Table 4.—Crushed stone sold or used by producers in the United States, by State
(Thousand metric tons and thousand dollars)

State	1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	¹ 16,123	¹ 34,413	¹ 16,769	¹ 42,027	¹ 18,183	¹ 40,117
Alaska	2,411	5,066	591	3,012	5,413	12,741
Arizona	2,606	5,848	4,208	8,018	3,869	9,469
Arkansas	16,009	28,776	14,803	25,020	14,717	¹ 26,209
California	39,314	86,255	33,759	65,811	39,769	77,175
Colorado	3,434	7,933	4,089	9,599	5,767	14,003
Connecticut	6,525	15,649	7,910	19,695	8,783	21,305
Florida	38,842	64,332	¹ 47,838	¹ 79,877	¹ 56,005	¹ 103,595
Georgia	27,822	69,897	33,633	82,484	37,050	97,506
Hawaii	¹ 5,494	¹ 14,357	¹ 4,540	¹ 13,494	6,514	18,466
Idaho	3,764	6,118	2,807	7,042	2,696	8,096
Illinois	¹ 56,237	¹ 106,084	¹ 51,038	¹ 94,225	60,467	114,068
Indiana	23,798	48,218	24,958	50,919	¹ 29,291	¹ 57,652
Iowa	¹ 23,033	¹ 44,977	24,909	48,642	28,614	56,918
Kansas	¹ 13,524	¹ 23,697	¹ 13,197	¹ 23,849	¹ 16,632	¹ 33,601
Kentucky	¹ 29,496	¹ 52,296	¹ 31,097	¹ 59,690	¹ 34,659	¹ 70,912
Louisiana	¹ 8,789	¹ 14,139	¹ 8,337	¹ 14,836	¹ 9,799	¹ 21,309
Maine	1,028	2,913	978	2,996	1,100	3,329
Maryland	14,435	34,770	17,628	41,973	16,860	46,732
Massachusetts	7,091	23,582	7,248	23,500	7,784	28,738
Michigan	36,927	49,240	36,064	50,317	41,627	60,494
Minnesota	5,296	14,346	5,223	16,318	6,877	20,411

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value
Mississippi	659	709	1,030	1,199	¹ 689	¹ 809
Missouri	37,284	¹ 64,772	38,531	¹ 63,219	44,728	79,921
Montana	W	W	3,696	5,627	4,585	9,559
Nebraska	3,787	7,892	3,856	7,645	4,870	10,958
Nevada	2,296	3,800	3,020	5,926	3,261	5,429
New Hampshire	389	3,433	479	3,743	1,666	5,416
New Jersey	12,219	36,057	¹ 13,810	¹ 42,044	¹ 14,426	¹ 45,585
New Mexico	¹ 2,643	¹ 5,337	2,511	5,499	2,567	5,894
New York	34,272	73,418	34,598	77,825	40,273	94,693
North Carolina	28,047	58,026	29,299	62,741	35,182	80,065
North Dakota	W	W	W	W	W	W
Ohio	42,539	88,372	43,997	90,821	¹ 49,992	¹ 98,009
Oklahoma	17,644	27,125	17,643	26,574	20,245	34,999
Oregon	12,514	26,708	9,902	18,380	12,166	21,843
Pennsylvania	58,484	118,469	61,060	124,340	71,272	150,346
Rhode Island	¹ 3	¹ 422	¹ 298	¹ 23	W	W
South Carolina	10,022	17,852	11,323	21,819	13,594	24,280
South Dakota	1,995	8,874	2,418	10,864	2,490	11,607
Tennessee	29,365	48,665	32,606	55,512	38,775	71,116
Texas	37,347	¹ 62,144	44,737	¹ 66,573	¹ 56,766	¹ 91,379
Utah	2,319	5,335	3,070	6,005	2,584	6,318
Vermont	2,264	27,940	2,994	26,170	1,697	19,523
Virginia	31,428	63,482	36,276	74,090	39,821	82,719
Washington	11,282	20,489	13,347	¹ 23,764	10,327	19,284
West Virginia	8,963	¹ 18,066	¹ 10,568	¹ 21,293	10,643	22,821
Wisconsin	14,123	25,105	17,594	29,681	21,607	36,917
Wyoming	2,625	4,789	3,220	5,768	2,895	6,716
Undistributed	8,296	23,882	1,487	11,801	2,127	¹ 11,412
Total ^{2,3}	794,806	1,594,065	834,994	1,672,293	961,729	1,990,464
Pacific Island Possessions ⁴	656	1,726	798	2,397	1,188	3,292
Puerto Rico	11,004	29,847	12,251	32,792	14,195	41,857
Virgin Islands	493	W	659	2,255	602	2,860
	1974		1975		1976	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	21,567	60,231	20,162	58,762	21,605	63,195
Alaska	4,975	12,947	8,053	26,649	6,103	20,092
Arizona	4,471	11,363	3,084	10,882	3,758	13,826
Arkansas	18,480	38,652	15,798	38,637	16,058	39,713
California	41,133	89,719	30,065	72,251	29,360	74,548
Colorado	5,953	14,780	4,816	10,773	4,802	12,357
Connecticut	7,648	20,635	6,643	19,893	5,449	17,383
Florida	49,872	101,560	35,445	73,372	35,023	74,412
Georgia	36,362	93,741	27,065	78,812	28,694	85,395
Hawaii	6,929	21,370	6,857	25,217	5,527	21,193
Idaho	3,190	9,309	3,006	8,762	3,141	9,122
Illinois	57,360	121,690	55,009	130,020	56,117	141,440
Indiana	28,032	55,459	26,030	57,846	25,571	59,418
Iowa	29,327	65,728	27,509	73,324	27,462	75,921
Kansas	16,211	34,357	14,415	35,174	14,831	38,228
Kentucky	31,336	66,632	28,789	67,906	30,280	77,060
Louisiana	10,203	24,814	9,515	38,260	8,786	28,127
Maine	1,352	4,220	1,137	3,741	1,309	4,596
Maryland	16,376	47,162	13,401	42,498	14,227	47,000
Massachusetts	7,278	24,748	6,446	23,584	7,126	28,150
Michigan	43,068	72,631	36,231	73,662	37,627	82,202

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1974		1975		1976	
	Quantity	Value	Quantity	Value	Quantity	Value
Minnesota	7,499	14,201	6,180	13,244	6,831	15,948
Mississippi	1,560	2,572	1,478	2,730	1,598	2,968
Missouri	45,920	88,518	42,623	94,529	43,129	97,412
Montana	2,826	6,242	2,839	6,753	3,142	7,842
Nebraska	4,200	10,364	3,848	10,322	3,720	11,054
Nevada	1,982	4,183	1,659	4,524	1,727	5,975
New Hampshire	479	956	1,319	2,981	616	1,759
New Jersey	14,287	52,456	10,724	42,381	10,191	39,012
New Mexico	3,203	8,283	1,985	4,598	1,743	4,289
New York	34,630	84,972	28,738	78,751	25,500	72,829
North Carolina	31,483	71,583	25,638	65,825	27,977	78,632
North Dakota	—	—	27	153	—	—
Ohio	46,910	105,100	41,927	105,550	38,657	104,060
Oklahoma	20,151	35,962	18,225	35,832	17,804	36,630
Oregon	21,184	43,306	19,299	40,221	18,459	42,589
Pennsylvania	66,232	154,400	54,527	144,820	57,644	161,250
Rhode Island	389	1,352	266	1,125	277	1,295
South Carolina	12,870	24,968	12,543	29,587	11,802	29,790
South Dakota	2,661	5,349	2,363	5,082	2,907	6,587
Tennessee	37,836	73,252	34,857	79,189	34,093	83,828
Texas	57,220	109,760	52,584	104,390	49,751	99,816
Utah	2,598	6,118	2,252	5,916	2,489	6,681
Vermont	1,621	9,301	1,002	4,783	1,685	10,962
Virginia	40,054	93,839	32,086	82,058	32,768	89,965
Washington	13,690	24,188	7,180	18,428	9,270	23,614
West Virginia	9,937	22,308	9,601	24,332	8,815	24,133
Wisconsin	20,211	34,451	18,595	36,037	18,749	36,747
Wyoming	2,161	5,989	2,614	7,567	2,499	7,567
Undistributed	—	—	—	—	—	—
Total ²	944,916	2,085,800	816,454	2,022,000	816,700	2,117,000
Pacific Island Possessions ⁴	769	1,566	739	1,983	442	1,594
Puerto Rico	12,827	40,617	12,205	46,608	12,017	45,609
Virgin Islands	579	3,869	230	1,813	253	2,050
	1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	22,905	72,649	24,106	82,767	23,989	83,566
Alaska	3,636	17,493	3,118	14,649	3,317	15,458
Arizona	4,862	16,367	4,814	17,669	5,234	21,401
Arkansas	16,611	45,448	18,107	53,461	18,124	53,723
California	30,854	80,146	34,342	93,377	35,011	103,342
Colorado	5,078	14,169	5,651	15,683	6,201	19,435
Connecticut	6,332	20,319	6,681	22,301	7,503	38,767
Florida	44,051	101,435	52,031	128,905	W	W
Georgia	34,350	106,215	37,714	131,959	37,106	154,021
Hawaii	5,224	19,876	5,468	23,845	6,231	28,969
Idaho	2,791	8,005	2,380	6,670	2,678	8,787
Illinois	51,777	135,964	56,656	160,352	57,653	188,130
Indiana	24,258	61,392	30,295	80,523	30,978	92,630
Iowa	26,474	76,964	28,404	88,618	29,457	103,215
Kansas	15,630	41,807	16,854	48,803	17,516	56,038
Kentucky	32,746	88,941	36,988	107,949	W	W
Louisiana	8,809	26,920	8,283	26,921	W	W
Maine	1,190	4,110	1,501	5,510	1,877	7,492
Maryland	15,183	49,772	17,624	66,263	19,560	80,550
Massachusetts	7,285	30,501	7,619	36,360	7,789	39,570

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value
Michigan	36,756	84,971	36,404	90,981	36,114	99,832
Minnesota	7,104	16,991	8,769	20,734	8,846	22,175
Mississippi	1,974	3,933	2,185	5,176	W	W
Missouri	45,007	104,700	51,950	130,568	51,147	139,944
Montana	3,338	7,923	2,892	7,733	2,292	7,806
Nebraska	3,745	12,974	3,811	14,758	4,531	19,362
Nevada	1,513	5,506	1,294	5,489	1,453	6,439
New Hampshire	652	2,036	829	2,634	786	2,172
New Jersey	11,787	46,621	11,968	50,181	12,655	63,174
New Mexico	1,769	4,786	2,212	6,157	2,349	6,743
New York	27,145	88,509	32,430	98,530	34,019	114,174
North Carolina	29,765	87,254	34,189	108,867	36,164	125,319
North Dakota	—	—	—	—	—	—
Ohio	40,690	116,409	44,739	130,472	46,010	149,819
Oklahoma	21,158	46,809	24,176	57,173	25,684	66,666
Oregon	15,966	39,400	16,044	39,509	23,349	65,074
Pennsylvania	57,626	163,652	62,633	194,518	64,802	224,014
Rhode Island	249	1,238	272	1,316	226	1,148
South Carolina	13,401	36,043	15,419	44,237	15,049	48,352
South Dakota	3,064	7,477	3,350	8,376	3,530	10,317
Tennessee	38,008	99,196	41,241	117,271	41,475	133,727
Texas	59,372	122,784	62,682	150,868	67,687	188,746
Utah	2,508	7,072	2,556	9,716	3,106	11,059
Vermont	1,926	12,635	1,788	13,179	1,884	13,927
Virginia	37,836	109,737	45,760	141,601	46,339	165,223
Washington	11,103	28,156	8,880	22,059	13,782	35,783
West Virginia	9,521	28,022	10,507	32,897	10,626	37,624
Wisconsin	20,177	42,097	22,122	46,990	21,704	52,804
Wyoming	2,208	7,585	2,414	8,037	4,548	15,634
Undistributed	—	—	—	—	104,143	343,136
Total ²	865,414	2,353,000	952,150	2,773,000	994,522	3,265,300
Pacific Island Possessions ⁴	529	1,928	752	3,460	608	2,489
Puerto Rico	10,925	42,648	12,483	47,610	12,737	58,554
Virgin Islands	238	2,076	234	1,816	W	W
	1980		1981		1982 ^c	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	21,258	82,270	18,784	88,377	19,232	89,600
Alaska	3,620	19,978	4,862	26,855	4,627	25,200
Arizona	5,629	24,780	5,729	26,263	4,717	22,200
Arkansas	18,748	61,399	12,550	47,260	11,884	48,500
California	34,255	118,140	31,352	118,698	25,855	105,400
Colorado	5,694	20,068	6,322	24,083	6,260	27,800
Connecticut	7,237	40,283	6,202	36,745	5,534	32,700
Florida	60,064	215,972	59,028	226,192	48,172	182,300
Georgia	37,089	162,642	32,414	153,751	31,570	153,500
Hawaii	5,752	30,634	5,476	31,403	4,082	26,600
Idaho	1,821	7,240	1,304	6,206	1,089	6,000
Illinois	48,361	180,656	40,060	165,218	38,918	148,300
Indiana	28,041	92,106	22,996	79,910	18,416	65,500
Iowa	24,079	92,603	20,343	82,891	20,502	88,800
Kansas	15,783	54,731	12,830	45,738	13,063	41,100
Kentucky	W	W	29,423	108,257	26,762	104,300
Louisiana	W	W	W	W	W	W
Maine	1,025	3,969	1,247	5,532	1,089	4,000
Maryland	17,187	77,431	14,955	74,289	13,699	73,500

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1980		1981		1982 ^e	
	Quantity	Value	Quantity	Value	Quantity	Value
Massachusetts	6,637	36,804	7,255	41,037	6,260	33,500
Michigan	29,140	91,727	27,227	94,324	18,779	67,100
Minnesota	7,807	21,731	6,346	18,438	6,441	20,900
Mississippi	W	W	W	W	W	W
Missouri	43,813	130,254	37,113	116,297	35,017	113,300
Montana	1,780	6,302	1,435	5,139	1,270	4,700
Nebraska	3,425	16,301	2,848	14,024	2,812	14,300
Nevada	1,641	7,407	1,218	5,664	1,179	4,500
New Hampshire	535	2,281	603	2,599	544	3,100
New Jersey	10,732	61,886	9,466	57,819	9,707	57,800
New Mexico	2,341	9,473	3,776	12,485	2,540	13,700
New York	31,282	120,764	27,833	117,689	26,036	132,800
North Carolina	31,537	125,019	26,157	117,092	24,948	117,600
North Dakota	—	—	—	—	—	—
Ohio	38,502	136,929	33,521	125,588	27,488	105,200
Oklahoma	25,558	76,267	27,152	83,407	27,306	84,200
Oregon	17,464	49,606	14,952	46,055	12,882	41,900
Pennsylvania	55,468	218,231	48,315	207,821	45,722	200,900
Rhode Island	184	1,208	128	1,116	118	1,100
South Carolina	14,612	49,207	13,449	49,830	12,701	53,000
South Dakota	2,859	8,942	2,708	9,085	2,359	7,400
Tennessee	35,003	126,993	W	W	W	W
Texas	69,384	220,265	65,729	219,085	61,689	205,000
Utah	2,680	12,123	2,576	12,157	2,268	9,800
Vermont	1,197	4,787	1,197	5,144	1,089	5,300
Virginia	40,474	167,839	33,630	152,630	31,933	142,300
Washington	10,056	29,024	8,633	25,619	7,802	23,800
West Virginia	8,860	36,305	7,153	28,399	5,352	22,700
Wisconsin	18,691	49,245	13,779	39,962	10,342	36,100
Wyoming	3,968	14,835	2,925	9,857	2,087	7,300
Undistributed	40,979	149,171	38,647	159,106	34,564	143,700
Total ²	892,254	3,265,800	791,647	3,125,000	716,704	2,918,300
Pacific Island Possessions ⁴	480	2,330	307	W	NA	NA
Puerto Rico	21,697	101,908	18,573	96,223	NA	NA
Virgin Islands	W	W	W	W	—	—
	1983		1984 ^e		1985	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	18,650	95,374	19,958	98,500	23,453	109,176
Alaska	1,797	9,460	2,268	10,800	1,730	8,535
Arizona	4,314	24,079	4,717	27,300	5,379	23,111
Arkansas	12,200	51,267	13,789	59,800	13,440	60,874
California	32,279	146,289	35,017	158,000	37,375	174,395
Colorado	6,160	22,749	6,532	26,200	6,384	25,930
Connecticut	6,978	45,890	7,530	49,400	6,602	43,937
Florida	51,965	235,700	62,142	290,000	62,837	287,237
Georgia	37,285	186,193	41,640	220,000	47,230	256,588
Hawaii	5,019	29,703	4,899	29,700	5,105	34,183
Idaho	1,755	7,480	1,633	7,100	1,832	6,977
Illinois	38,792	166,860	43,999	191,600	37,235	164,117
Indiana	21,819	82,782	24,222	99,400	21,214	81,117
Iowa	22,538	101,097	21,591	100,000	21,461	94,496
Kansas	11,509	45,121	12,338	48,500	14,200	57,155
Kentucky	30,299	117,842	33,838	133,000	34,493	134,978
Louisiana	5,224	25,702	3,719	19,500	4,373	25,956
Maine	769	2,851	1,179	4,400	1,324	5,114
Maryland	17,494	80,429	20,049	94,000	22,141	98,584

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1983		1984 ^c		1985	
	Quantity	Value	Quantity	Value	Quantity	Value
Massachusetts	7,022	36,002	7,620	39,000	8,486	42,881
Michigan	22,465	82,152	25,492	92,000	27,837	95,953
Minnesota	7,784	25,320	8,074	25,800	7,036	22,601
Mississippi	1,498	4,377	1,814	5,800	1,435	4,282
Missouri	35,792	120,700	37,739	137,000	45,945	162,097
Montana	791	2,320	862	2,400	1,569	5,044
Nebraska	4,030	22,612	4,082	23,400	3,788	19,134
Nevada	1,151	5,358	998	4,700	1,210	6,218
New Hampshire	858	2,853	771	2,700	1,462	6,434
New Jersey	11,159	70,421	12,247	75,000	14,236	94,339
New Mexico	4,291	15,118	4,264	17,000	3,303	15,232
New York	29,022	134,752	30,028	135,000	31,878	165,136
North Carolina	30,567	145,001	34,564	168,000	37,894	194,818
North Dakota	—	—	—	—	W	W
Ohio	29,880	114,059	34,927	139,000	34,754	136,544
Oklahoma	21,650	76,941	23,133	86,000	28,280	98,811
Oregon	11,874	39,873	11,340	37,500	13,913	54,244
Pennsylvania	46,741	226,948	50,984	228,000	58,754	310,859
Rhode Island	881	5,507	907	5,800	1,030	7,016
South Carolina	14,321	61,054	16,239	72,500	15,494	72,520
South Dakota	3,543	12,982	3,447	12,800	3,693	14,412
Tennessee	27,740	111,573	32,840	138,000	34,418	155,760
Texas	69,244	239,187	80,921	300,000	77,804	306,821
Utah	3,998	14,636	4,717	16,400	4,225	14,180
Vermont	1,215	5,579	1,633	7,000	1,532	7,468
Virginia	34,506	159,553	42,819	196,000	46,889	221,900
Washington	9,481	29,607	9,435	31,700	8,657	31,052
West Virginia	8,563	37,962	8,255	37,300	8,521	38,348
Wisconsin	12,929	39,896	14,334	45,000	13,151	42,380
Wyoming	1,832	7,769	1,724	7,600	1,842	7,329
Undistributed	—	—	—	—	1,068	6,545
Total ²	781,672	3,327,000	867,270	3,755,600	907,908	4,053,000
Pacific Island Possessions ⁴	298	2,192	NA	NA	497	3,731
Puerto Rico	3,242	18,373	NA	NA	3,077	16,751
Virgin Islands	—	—	—	—	—	—
	1986 ^c		1987		1988 ^c	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	21,772	120,500	27,232	146,247	26,943	140,100
Alaska	1,814	8,500	1,844	8,945	1,633	8,400
Arizona	5,080	25,100	6,996	33,999	6,713	33,000
Arkansas	14,061	58,500	13,820	63,847	15,513	70,100
California	34,927	159,300	40,202	186,504	44,543	275,000
Colorado	7,257	30,700	7,298	33,465	9,616	42,400
Connecticut	6,985	45,800	10,353	76,668	10,342	76,900
Florida	62,596	288,200	71,660	350,537	75,478	374,400
Georgia	51,437	293,100	55,188	318,903	52,072	317,200
Hawaii	6,441	42,100	5,200	41,548	5,171	41,000
Idaho	3,357	12,700	3,494	15,346	3,084	13,100
Illinois	40,098	179,600	47,266	216,212	52,526	251,200
Indiana	20,502	76,500	28,184	106,770	33,203	130,000
Iowa	21,228	98,000	23,579	110,106	26,490	128,500
Kansas	15,059	60,300	17,526	69,628	15,694	72,700
Kentucky	34,836	137,000	39,308	173,222	45,994	207,900
Louisiana	4,899	25,300	3,983	36,514	3,357	29,200
Maine	1,451	4,400	1,823	7,532	1,270	5,300

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1986 ^e		1987		1988 ^e	
	Quantity	Value	Quantity	Value	Quantity	Value
Maryland	23,950	126,000	27,339	151,579	29,665	167,000
Massachusetts	9,072	50,000	13,523	78,969	15,876	91,900
Michigan	25,220	83,900	34,391	109,514	35,199	120,300
Minnesota	7,530	26,300	8,160	29,246	7,530	28,200
Mississippi	1,451	4,400	1,354	9,621	1,361	9,000
Missouri	46,448	170,500	49,814	184,824	47,264	183,000
Montana	1,996	6,200	1,327	3,585	1,633	4,500
Nebraska	3,629	17,900	3,915	19,461	4,445	22,000
Nevada	1,361	7,000	1,147	5,700	1,179	5,700
New Hampshire	1,633	5,900	2,249	10,386	2,177	9,800
New Jersey	13,880	95,400	15,945	111,951	17,509	123,500
New Mexico	3,538	15,300	4,085	15,919	3,175	13,900
New York	36,832	196,600	34,567	188,694	36,197	193,500
North Carolina	39,463	206,500	44,313	237,181	45,813	250,000
North Dakota	W	W	W	W	W	W
Ohio	35,652	147,300	46,802	300,096	43,545	252,000
Oklahoma	28,032	102,100	22,820	83,732	23,859	92,000
Oregon	13,699	53,400	18,745	73,902	20,140	77,600
Pennsylvania	57,788	317,100	88,190	458,676	94,892	470,700
Rhode Island	907	5,700	1,114	7,797	1,361	9,400
South Carolina	16,511	76,700	22,025	105,387	21,319	105,800
South Dakota	3,266	12,600	4,599	18,515	4,990	20,600
Tennessee	36,922	175,600	46,635	227,263	47,355	235,000
Texas	76,385	301,500	76,518	276,477	74,389	271,300
Utah	4,082	14,100	7,248	23,606	6,622	20,600
Vermont	1,451	7,600	1,959	20,400	1,814	18,000
Virginia	47,174	224,700	54,772	295,903	59,874	326,700
Washington	8,165	34,100	13,385	49,618	12,610	48,700
West Virginia	8,890	37,500	11,302	50,947	10,523	47,600
Wisconsin	16,964	57,600	20,645	71,776	25,855	98,300
Wyoming	1,542	5,900	2,877	15,049	2,268	11,400
Undistributed	998	4,000	2,023	16,831	1,905	13,700
Total ²	928,233	4,255,000	1,088,740	5,248,600	1,131,986	5,558,100
Pacific Island Possessions ⁴	NA	NA	322	2,289	NA	NA
Puerto Rico	NA	NA	4,878	24,221	NA	NA
Virgin Islands	—	—	—	—	—	—
	1989		1990 ^e			
	Quantity	Value	Quantity	Value		
Alabama	28,791	167,332	32,749	202,400		
Alaska	2,631	20,300	2,449	19,800		
Arizona	6,032	28,552	4,808	13,500		
Arkansas	17,047	76,419	16,148	76,900		
California	49,793	238,034	38,555	200,600		
Colorado	6,587	32,435	6,895	36,100		
Connecticut	10,414	78,734	9,253	70,600		
Florida	76,199	341,397	67,495	317,400		
Georgia	45,738	262,805	48,081	317,300		
Hawaii	5,629	46,746	6,350	55,400		
Idaho	2,992	12,609	3,901	12,900		
Illinois	55,183	256,832	56,881	283,100		
Indiana	32,829	136,252	33,294	147,700		
Iowa	25,446	111,182	26,308	118,600		
Kansas	14,379	56,976	18,869	79,200		
Kentucky	43,706	187,849	45,450	182,900		
Louisiana	2,908	24,414	1,905	16,800		

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State—Continued
(Thousand metric tons and thousand dollars)

State	1989		1990 ^a	
	Quantity	Value	Quantity	Value
Maine	1,443	8,801	1,542	8,700
Maryland	27,979	153,375	27,669	163,900
Massachusetts	10,777	67,768	8,346	54,500
Michigan	37,108	123,678	39,100	129,000
Minnesota	7,947	30,218	8,255	31,900
Mississippi	970	3,994	1,270	5,500
Missouri	46,950	171,848	48,172	190,900
Montana	2,582	9,718	3,629	15,300
Nebraska	3,609	20,050	3,629	21,200
Nevada	1,415	4,638	1,451	5,000
New Hampshire	699	4,020	544	2,500
New Jersey	18,869	140,998	19,232	131,700
New Mexico	2,526	11,672	2,177	12,800
New York	36,152	201,749	36,197	207,600
North Carolina	46,737	257,976	47,990	276,200
North Dakota	—	—	907	4,600
Ohio	42,117	183,190	43,908	190,900
Oklahoma	21,408	81,969	22,952	89,500
Oregon	16,699	81,204	16,329	86,600
Pennsylvania	84,480	455,004	86,908	502,700
Rhode Island	1,096	7,170	1,451	8,800
South Carolina	22,162	111,656	23,768	135,400
South Dakota	3,477	14,303	4,354	16,800
Tennessee	48,006	252,785	49,532	268,600
Texas	69,693	252,982	74,208	285,700
Utah	4,248	19,176	4,173	20,200
Vermont	2,830	28,110	3,357	35,000
Virginia	58,115	328,050	53,887	320,000
Washington	12,028	55,624	11,521	41,900
West Virginia	9,892	42,538	10,886	45,200
Wisconsin	24,059	83,664	24,131	91,000
Wyoming	2,712	12,120	1,996	14,000
Undistributed	5,718	26,845	5,715	26,500
Total ²	1,100,807	5,325,800	1,108,581	5,591,300
Pacific Island Possessions ⁴	964	11,133	NA	NA
Puerto Rico	4,612	27,187	NA	NA
Virgin Islands	—	—	—	—

^aEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Undistributed."

¹To avoid disclosing individual company data, certain State totals are incomplete; the portion not included has been combined with "Undistributed." For kind of stone, see the Minerals Yearbook for that year.

²Data may not add to totals shown because of independent rounding.

³Totals for 1971-73 include dimension stone figures.

⁴Includes Guam and American Samoa.

Table 5.—Crushed stone sold or used by producers in the United States, by use, 1971-83¹
(Thousand metric tons and thousand dollars)

Use	1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate (+1/1/2 inch):						
Macadam	30,475	54,666	30,037	54,600	31,351	60,005
Riprap and jetty stone	19,424	36,106	22,170	40,792	25,433	50,948
Filter stone	561	1,320	577	1,353	1,204	2,770
Other coarse aggregate	—	—	—	—	—	—
Coarse aggregate, graded:						
Concrete aggregate, coarse	122,869	227,641	121,486	228,770	141,841	285,633

See footnotes at end of table.

Table 5.—Crushed stone sold or used by producers in the United States, by use, 1971-83¹—Continued
(Thousand metric tons and thousand dollars)

Use	1971		1972		1973	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate, graded—Continued						
Bituminous aggregate, coarse	71,726	146,868	74,656	156,411	93,112	201,656
Bituminous surface-treatment aggregate	41,220	76,164	47,122	89,128	53,130	107,194
Railroad ballast	13,316	20,799	16,348	26,443	16,983	29,642
Other graded coarse aggregate	—	—	—	—	—	—
Fine aggregate (-3/8 inch):						
Stone sand, concrete	5,001	10,367	5,421	12,929	7,029	19,182
Stone sand, bituminous mix or seal	—	—	—	—	—	—
Screening, undesignated	—	—	—	—	—	—
Other fine aggregate	—	—	—	—	—	—
Coarse and fine aggregate:						
Graded road base or subbase	172,676	296,117	189,800	334,455	236,482	432,420
Unpaved road surfacing	—	—	—	—	—	—
Terrazzo and exposed aggregate	306	4,985	365	5,075	513	7,542
Crusher run or fill or waste	2,975	3,351	6,015	6,713	6,588	11,519
Other coarse and fine aggregate	—	—	—	—	—	—
Other construction materials ²	87,969	168,624	101,061	196,455	119,168	229,286
Lightweight aggregate	—	—	—	—	—	—
Roofing granules	—	—	W	W	3,852	10,550
Agricultural:						
Agricultural limestone	—	—	—	—	—	—
Poultry grit and mineral food	—	—	—	—	—	—
Other agricultural uses ³	30,568	69,038	25,140	62,662	26,308	64,815
Chemical and metallurgical:						
Cement manufacture	98,080	129,971	98,754	129,743	104,768	151,225
Lime manufacture ⁴	27,560	56,562	27,262	49,386	30,908	55,348
Dead-burned dolomite manufacture	1,420	2,808	1,515	3,029	3,086	5,775
Refractory stone (includes ganister)	1,092	6,745	549	2,792	778	4,251
Ferrosilicon	1,170	2,899	1,140	2,904	572	1,323
Flux stone	23,194	44,158	23,433	44,571	26,153	53,249
Chemical stone	2,751	7,226	3,809	9,205	2,670	6,529
Glass manufacture	2,195	9,726	2,466	10,142	2,503	11,703
Sulfur oxide removal	—	—	—	—	—	—
Special:						
Mine dusting or acid water treatment	—	—	—	—	—	—
Asphalt fillers or extenders	—	—	1,031	5,075	886	4,404
Whiting or whiting substitute	—	—	1,033	15,728	976	16,654
Other fillers or extenders	4,640	37,148	1,949	19,783	2,633	26,459
Expanded slate	W	W	1,152	5,715	991	5,954
Slate flour	—	—	—	—	—	—
Abrasives	—	—	—	—	—	—
Sugar refining	—	—	—	—	580	2,792
Paper manufacture	—	—	—	—	184	674
Other miscellaneous ⁵	32,143	87,644	29,356	67,669	19,607	44,965
Other unspecified uses	—	—	—	—	—	—
Total ⁶	793,331	1,500,933	833,643	1,581,530	960,293	1,904,464
	1974		1975		1976	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate (+ 1/1/2 inch):						
Macadam	30,987	62,908	25,360	57,977	24,998	61,356
Riprap and jetty stone	32,016	63,692	23,868	52,568	24,562	61,043
Filter stone	1,773	4,300	660	1,888	842	2,510
Other coarse aggregate	—	—	—	—	—	—
Coarse aggregate, graded:						
Concrete aggregate, coarse	126,362	276,560	108,554	261,350	105,234	270,610
Bituminous aggregate, coarse	93,304	225,996	81,240	255,800	78,598	225,330
Bituminous surface-treatment aggregate	53,245	124,520	47,304	119,840	49,630	131,670

See footnotes at end of table.

Table 5.—Crushed stone sold or used by producers in the United States, by use, 1971-83¹—Continued
(Thousand metric tons and thousand dollars)

Use	1974		1975		1976	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate, graded—Continued						
Railroad ballast	19,808	37,802	18,906	42,881	21,050	50,354
Other graded coarse aggregate	—	—	—	—	—	—
Fine aggregate (-3/8 inch):						
Stone sand, concrete	7,834	21,557	6,189	18,219	4,376	14,192
Stone sand, bituminous mix or seal	—	—	—	—	—	—
Screening, undesignated	—	—	—	—	—	—
Other fine aggregate	—	—	—	—	—	—
Coarse and fine aggregate:						
Graded road base or subbase	222,778	440,380	194,882	437,800	173,418	401,710
Unpaved road surfacing	—	—	—	—	—	—
Terrazzo and exposed aggregate	285	4,622	530	7,259	557	7,069
Crusher run or fill or waste	11,640	20,071	4,802	8,080	4,475	8,656
Other coarse and fine aggregate	—	—	—	—	—	—
Other construction materials ²	117,549	265,805	107,100	266,464	119,797	301,379
Lightweight aggregate	892	6,822	463	4,107	474	4,385
Roofing granules	3,949	11,267	3,974	11,236	3,986	11,798
Agricultural:						
Agricultural limestone	31,010	78,860	30,705	87,635	36,283	107,440
Poultry grit and mineral food	2,388	12,749	1,780	11,450	2,211	13,881
Other agricultural uses ³	—	—	530	1,765	425	1,468
Chemical and metallurgical:						
Cement manufacture	104,689	177,100	86,642	167,200	90,000	177,080
Lime manufacture ⁴	31,310	64,058	31,760	76,084	34,252	88,474
Dead-burned dolomite manufacture	1,963	3,890	—	—	—	—
Refractory stone (includes ganister)	870	4,734	875	6,631	703	5,045
Ferrosilicon	435	1,816	845	2,455	914	2,814
Flux stone	28,839	64,153	21,608	54,500	21,561	57,621
Chemical stone	544	1,359	1,081	2,008	993	1,877
Glass manufacture	2,846	15,723	2,722	16,252	2,902	18,772
Sulfur oxide removal	—	—	—	—	594	1,496
Special:						
Mine dusting or acid water treatment	1,148	6,774	1,042	6,008	1,249	8,026
Asphalt fillers or extenders	1,046	5,980	681	3,745	755	4,478
Whiting or whiting substitute	1,340	22,964	920	17,050	885	19,726
Other fillers or extenders	2,343	28,217	2,620	27,459	2,638	30,769
Expanded slate	—	—	—	—	—	—
Slate flour	—	—	—	—	—	—
Abrasives	204	1,290	73	707	90	706
Sugar refining	842	3,014	—	—	—	—
Paper manufacture	171	668	122	611	123	656
Other miscellaneous ⁵	10,506	26,150	8,619	24,471	8,125	24,222
Other unspecified uses	—	—	—	—	—	—
Total ^{6,7}	944,916	2,085,800	816,454	2,051,502	816,700	2,117,000
	1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate (+1 1/2 inch):						
Macadam	22,958	56,384	25,707	68,720	23,668	71,433
Riprap and jetty stone	19,154	50,339	19,661	58,518	22,439	69,415
Filter stone	1,886	5,515	2,768	8,677	3,443	11,630
Other coarse aggregate	—	—	—	—	—	—
Coarse aggregate, graded:						
Concrete aggregate, coarse	112,957	322,372	124,377	377,097	128,403	443,450
Bituminous aggregate, coarse	85,152	252,675	90,399	287,423	90,452	331,837
Bituminous surface-treatment aggregate	40,751	111,632	46,371	140,557	50,327	170,735
Railroad ballast	23,119	57,447	24,953	67,262	27,614	85,305
Other graded coarse aggregate	—	—	—	—	—	—

See footnotes at end of table.

Table 5.—Crushed stone sold or used by producers in the United States, by use, 1971-83¹—Continued
(Thousand metric tons and thousand dollars)

Use	1977		1978		1979	
	Quantity	Value	Quantity	Value	Quantity	Value
Fine aggregate (-3/8 inch):						
Stone sand, concrete	10,706	32,611	15,037	48,712	17,696	66,636
Stone sand, bituminous mix or seal	—	—	—	—	—	—
Screening, undesignated	—	—	—	—	—	—
Other fine aggregate	—	—	—	—	—	—
Coarse and fine aggregate:						
Graded road base or subbase	200,117	494,148	226,700	596,036	230,886	676,769
Unpaved road surfacing	—	—	—	—	—	—
Terrazzo and exposed aggregate	567	7,846	676	9,487	1,099	14,921
Crusher run or fill or waste	4,180	6,649	3,873	6,403	2,725	5,567
Other coarse and fine aggregate	—	—	—	—	—	—
Other construction materials ²	141,804	367,505	158,681	438,626	186,221	588,093
Lightweight aggregate	446	5,404	487	6,452	535	7,635
Roofing granules	4,626	14,702	5,507	18,762	4,775	18,221
Agricultural:						
Agricultural limestone	29,017	95,679	30,326	105,126	29,824	116,319
Poultry grit and mineral food	2,149	12,860	2,488	17,606	2,635	21,110
Other agricultural uses ³	507	1,903	612	2,501	627	3,118
Chemical and metallurgical:						
Cement manufacture	94,247	190,255	98,199	208,596	97,796	229,084
Lime manufacture ⁴	29,200	78,936	29,921	88,213	31,481	99,556
Dead-burned dolomite manufacture	1,654	3,783	1,634	4,067	1,614	4,903
Refractory stone (includes ganister)	766	5,679	967	6,495	443	6,172
Ferrosilicon	308	1,402	354	1,776	423	2,344
Flux stone	20,926	59,049	22,027	68,794	20,304	71,026
Chemical stone	2,692	7,394	1,997	6,443	1,784	6,409
Glass manufacture	2,448	16,683	1,933	14,264	1,987	14,727
Sulfur oxide removal	732	1,962	656	1,897	877	2,942
Special:						
Mine dusting or acid water treatment	1,481	9,534	1,142	7,769	1,150	10,388
Asphalt fillers or extenders	1,026	5,234	960	5,600	1,134	6,012
Whiting or whiting substitute	756	21,711	963	27,586	1,235	32,537
Other fillers or extenders	2,732	36,227	3,303	40,716	3,406	49,250
Expanded slate	—	—	—	—	—	—
Slate flour	W	W	W	W	64	857
Abrasives	142	1,048	168	996	194	1,243
Sugar refining	—	—	838	3,552	1,240	6,507
Paper manufacture	105	411	99	356	116	446
Other miscellaneous uses ⁵	83	301	347	1,259	5,906	18,692
Other unspecified uses ⁶	6,023	17,727	8,019	26,273	—	—
Total^{6,7}	865,414	2,353,000	952,150	2,773,000	994,522	3,265,300
	1980		1981		1983	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate (+1 1/2 inch):						
Macadam	22,798	79,515	17,362	63,901	15,212	58,498
Riprap and jetty stone	21,455	75,808	17,309	68,632	17,964	79,487
Filter stone	5,131	19,453	3,983	15,565	3,212	15,696
Other coarse aggregate	—	—	—	—	1,882	9,040
Coarse aggregate, graded:						
Concrete aggregate, coarse	115,433	456,788	104,267	450,819	87,997	393,840
Bituminous aggregate, coarse	82,112	339,415	73,109	326,398	55,114	259,994
Bituminous surface-treatment aggregate	41,090	156,303	31,568	132,127	20,515	95,917
Railroad ballast	27,505	91,663	25,720	91,021	20,087	81,420
Other graded coarse aggregate	—	—	—	—	9,139	59,708
Fine aggregate (-3/8 inch):						
Stone sand, concrete	18,362	80,078	16,406	73,174	11,838	59,967
Stone sand, bituminous mix or seal	—	—	—	—	10,967	48,586

See footnotes at end of table.

Table 5.—Crushed stone sold or used by producers in the United States, by use, 1971-83¹—Continued
(Thousand metric tons and thousand dollars)

Use	1980		1981		1983	
	Quantity	Value	Quantity	Value	Quantity	Value
Fine aggregate (-3/8 inch)—Continued						
Screening, undesignated	—	—	—	—	12,366	49,926
Other fine aggregate	—	—	—	—	12,487	56,484
Coarse and fine aggregate:						
Graded road base or subbase	201,045	653,799	174,226	611,048	136,900	496,220
Unpaved road surfacing	—	—	—	—	49,666	197,624
Terrazzo and exposed aggregate	1,216	15,519	820	11,082	739	7,004
Crusher run or fill or waste	3,495	8,269	6,100	16,124	34,044	124,334
Other coarse and fine aggregate	—	—	—	—	8,915	39,144
Other construction materials ²	164,418	567,687	143,622	529,023	133	551
Lightweight aggregate	456	8,053	216	4,892	388	4,883
Roofing granules	4,071	17,556	4,069	18,094	1,322	7,973
Agricultural:						
Agricultural limestone	30,175	130,272	26,334	127,075	16,948	89,196
Poultry grit and mineral food	2,378	21,826	1,979	19,388	1,696	18,468
Other agricultural uses ³	620	3,288	670	3,884	632	2,997
Chemical and metallurgical:						
Cement manufacture	89,908	234,576	87,527	247,222	74,904	242,377
Lime manufacture ⁴	27,452	95,051	26,690	100,955	19,452	86,575
Dead-burned dolomite manufacture	1,815	6,329	2,169	7,498	1,377	6,294
Refractory stone (includes ganister)	918	4,749	84	470	40	W
Ferrosilicon	121	965	130	1,016	7,753	39,594
Flux stone	14,627	60,133	13,200	61,577	1,041	4,909
Chemical stone	1,680	5,739	2,008	7,681	1,375	12,085
Glass manufacture	1,936	15,841	1,833	16,284	1,466	6,009
Sulfur oxide removal	605	2,129	511	1,550	—	—
Special:						
Mine dusting or acid water treatment	1,207	10,412	1,053	10,541	821	11,700
Asphalt fillers or extenders	860	7,141	1,270	11,107	1,143	9,729
Whiting or whiting substitute	879	23,286	781	26,912	845	21,208
Other fillers or extenders	3,384	50,511	3,191	48,984	3,282	60,983
Expanded slate	—	—	—	—	—	—
Slate flour	49	1,067	41	709	—	—
Abrasives	62	680	71	975	—	—
Sugar refining	1,377	7,433	1,107	6,704	497	2,785
Paper manufacture	81	397	W	W	—	—
Other miscellaneous uses ⁵	—	—	—	—	—	—
Other unspecified uses ⁶	3,532	14,096	2,221	12,568	138,501	565,795
Total^{6,7}	892,254	3,265,800	791,647	3,125,000	⁹782,658	3,327,000

W Withheld to avoid disclosing company proprietary data; included with "Other."

¹Crushed Stone became a biennial survey in 1981. No table by end use for even-numbered years is therefore available.

²Includes unspecified construction aggregate, roadstone, dam construction, drain field, lightweight aggregate (slate), building products, roofing aggregates, chips and granules, pipe bedding, and waste materials.

³Includes agricultural limestone, agricultural marl and other soil conditioners, and poultry grit and mineral food.

⁴Includes dead-burned dolomite, alkalies, and sugar.

⁵Includes stone used in abrasives, mine dusting, flour (slate), uses not specified (1970-72), uses not listed in smaller quantities, carbon dioxide, stucco, porcelain, disinfectant and animal sanitation, acid neutralization, magnesium metal manufacture, and bedding materials.

⁶Data may not add to totals shown because of independent rounding and conversions to metric tons.

⁷Value data was published in rounded form after 1975.

⁸Includes totals reported without a breakdown by uses.

⁹Total had been revised. Individual use revisions not available.

Table 6.—Crushed stone sold or used by producers in the United States, by use, 1985-89¹
(Thousand metric tons and thousand dollars)

Use	1985		1987		1989	
	Quantity	Value	Quantity	Value	Quantity	Value
Coarse aggregate (+1/1/2 inch):						
Macadam	13,481	57,354	9,696	44,007	8,888	39,575
Riprap and jetty stone	19,458	89,377	22,093	108,056	19,792	111,406
Filter stone	5,626	26,376	5,894	27,579	8,265	38,744
Other coarse aggregate	946	4,795	2,147	9,641	1,782	7,525
Coarse aggregate, graded:						
Concrete aggregate, coarse	96,639	507,642	99,517	504,936	103,302	534,709
Bituminous aggregate, coarse	57,729	287,531	65,885	339,956	65,981	346,788
Bituminous surface-treatment aggregate	23,099	120,831	22,814	116,471	20,099	106,053
Railroad ballast	21,098	91,177	14,942	67,761	16,343	78,129
Other graded coarse aggregate	668	2,698	6,475	31,841	3,919	22,605
Fine aggregate (-3/8 inch):						
Stone sand, concrete	19,528	108,247	17,726	100,339	18,082	94,748
Stone sand, bituminous mix or seal	12,375	54,842	17,270	85,858	17,659	80,851
Screening, undesignated	17,960	81,076	22,977	101,448	29,054	133,535
Other fine aggregate	3,268	12,542	1,083	6,300	1,580	8,955
Coarse and fine aggregate:						
Graded road base or subbase	159,621	647,320	176,785	717,359	162,296	682,472
Unpaved road surfacing	38,033	159,394	27,625	117,108	25,870	109,901
Terrazzo and exposed aggregate	2,976	22,676	2,212	11,956	3,299	22,629
Crusher run or fill or waste	61,591	272,633	57,761	263,986	47,245	201,329
Other coarse and fine aggregate	875	3,632	4,969	16,610	678	2,537
Other construction materials ²	18,289	82,425	25,654	149,892	19,081	97,561
Lightweight aggregate	728	3,158	—	—	—	—
Roofing granules	2,307	14,349	1,517	8,717	2,798	14,063
Agricultural:						
Agricultural limestone	20,348	96,712	18,690	93,869	17,177	89,283
Poultry grit and mineral food	1,789	16,304	1,857	20,511	2,895	25,682
Other agricultural uses ³	440	2,458	355	2,553	826	4,834
Chemical and metallurgical:						
Cement manufacture	87,621	258,953	84,580	270,317	88,389	278,381
Lime manufacture ⁴	15,733	67,385	11,836	64,466	14,667	85,051
Dead-burned dolomite manufacture	876	6,442	590	5,429	1,239	7,441
Flux stone	9,383	41,788	5,441	28,438	5,084	23,743
Chemical stone	548	2,655	188	1,365	415	1,911
Glass manufacture	367	3,500	685	6,642	274	3,605
Sulfur oxide removal	1,324	5,889	1,406	7,458	1,051	4,536
Special:						
Mine dusting or acid water treatment	664	5,194	702	7,185	649	8,077
Asphalt fillers or extenders	736	5,292	1,482	11,827	1,696	13,396
Whiting or whiting substitute	990	17,266	366	12,234	1,490	69,752
Other fillers or extenders	4,112	50,266	4,701	88,149	4,105	81,869
Abrasives	283	1,309	—	—	—	—
Sugar refining	242	781	—	—	—	—
Paper manufacture	621	2,031	—	—	—	—
Other miscellaneous uses ⁵	11,792	66,506	4,302	31,078	1,830	7,039
Other uses not listed	⁶ 173,745	⁶ 752,012	⁶ 346,517	⁶ 1,767,256	1,842	15,929
Unspecified:						
Actual	—	—	—	—	⁷ 302,170	⁷ 1,482,690
Estimated	—	—	—	—	⁸ 78,999	⁸ 388,431
Total ^{9,10}	907,908	4,053,000	1,088,740	5,248,600	1,100,807	5,325,800

W Withheld to avoid disclosing company proprietary data; included with "Other."

¹Crushed Stone became a biennial survey in 1981. No table by end use for even-numbered years is therefore available.

²Includes unspecified construction aggregate, roadstone, dam construction, drain field, lightweight aggregate (slate), building products, roofing aggregates, chips and granules, pipe bedding, and waste materials.

³Includes agricultural limestone, agricultural marl and other soil conditioners, and poultry grit and mineral food.

⁴Includes dead-burned dolomite, alkalies, and sugar.

⁵Includes stone used in abrasives, mine dusting, flour (slate), uses not specified (1970-72), uses not listed in smaller quantities, carbon dioxide, stucco, porcelain, disinfectant and animal sanitation, acid neutralization, magnesium metal manufacture, and bedding materials.

⁶Includes totals reported without a breakdown by uses.

⁷Includes production reported without a breakdown by end use.

⁸Includes production estimated for nonrespondents.

⁹Data may not add to totals shown because of independent rounding and conversions to metric tons.

¹⁰Value data was published in rounded form after 1975.

Table 7.—Crushed stone sold or used by producers in the United States, by method of transportation¹
(Thousand metric tons unless otherwise specified)

Method of transportation	1971		1972		1973		1974	
	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent
Truck	586,892	74	625,760	75	753,302	79	751,622	79
Rail	78,571	10	92,156	11	89,604	9	85,674	9
Water	64,550	8	57,294	7	70,526	7	73,184	8
Other	22,988	3	24,149	3	28,800	3	34,436	4
Unspecified	40,329	5	34,283	4	18,063	2	—	—
Not transported	—	—	—	—	—	—	—	—
Total ²	793,331	100	833,643	100	960,293	100	944,916	100
	1975		1976		1977		1978	
	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent
Truck	655,034	80	655,188	80	699,471	81	774,148	81
Rail	70,654	9	69,136	9	74,629	8	79,366	9
Water	59,071	7	57,373	7	57,553	7	61,082	6
Other	31,699	4	35,004	4	33,762	4	37,555	4
Unspecified	—	—	—	—	—	—	—	—
Not transported	—	—	—	—	—	—	—	—
Total ²	816,454	100	816,700	100	865,414	100	952,150	100
	1979		1980		1981		1983	
	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent
Truck	816,349	82	733,600	82	657,037	83	657,222	84
Rail	78,200	8	74,242	9	63,327	8	48,310	6
Water	56,988	6	46,849	5	39,580	5	34,801	5
Other	42,983	4	37,564	4	31,701	4	42,329	5
Unspecified	—	—	—	—	—	—	—	—
Not transported	—	—	—	—	—	—	—	—
Total ²	994,522	100	892,254	100	791,647	100	³ 782,658	100
	1985		1987		1989			
	Quantity	Percent	Quantity	Percent	Quantity	Percent		
Truck	771,207	85	556,794	51	590,011	54		
Rail	44,298	5	45,754	4	46,049	4		
Water	35,866	4	26,554	3	36,046	3		
Other	56,537	6	24,465	2	109,455	10		
Unspecified	—	—	—	—	319,245	29		
Not transported	—	—	435,173	40	—	—		
Total ²	907,908	100	1,088,740	100	1,100,807	100		

¹Crushed stone became a biennial survey in 1981. No table by transportation for the even-numbered years is therefore available.

²Data may not add to totals shown because of independent rounding and conversion to metric tons.

³Total figure had been revised. Individual method of transportation revisions not available.

Table 8.—U.S. crushed stone sold or used by producers, by size of operation, 1971-76
(Thousand metric tons unless otherwise specified)

Size range	1971			1972			1973		
	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent
Less than 24,999	1,872	14,376	1.8	1,756	13,503	1.6	1,600	12,340	1.3
25,000 to 49,999	597	19,384	2.4	521	17,063	2.0	660	21,973	2.3
50,000 to 74,999	341	19,177	2.4	350	19,414	2.3	339	18,584	1.9
75,000 to 99,999	233	18,056	2.3	245	19,338	2.3	253	19,905	2.1
100,000 to 199,999	518	68,806	8.7	536	69,551	8.3	634	82,530	8.6
200,000 to 299,999	308	69,104	8.7	336	75,178	9.0	308	68,826	7.2
300,000 to 399,999	238	75,204	9.5	225	70,989	8.5	233	73,433	7.6
400,000 to 499,999	147	59,727	7.5	160	65,237	7.8	182	73,442	7.7
500,000 to 599,999	99	48,964	6.2	105	52,400	6.3	126	62,508	6.5
600,000 to 699,999	78	45,623	5.8	84	49,034	5.9	98	56,908	5.9

See footnotes at end of table.

Table 8.—U.S. crushed stone sold or used by producers, by size of operation, 1971-76—Continued
(Thousand metric tons unless otherwise specified)

Size range	1971			1972			1973		
	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent
700,000 to 799,999	49	33,166	4.2	55	37,222	4.5	76	51,432	5.4
800,000 to 899,999	54	41,451	5.2	43	33,183	4.0	51	38,753	4.0
900,000 and over	185	280,293	35.3	211	311,529	37.4	248	379,659	39.5
Total ¹	4,719	793,331	100.0	4,627	833,643	100.0	4,808	960,293	100.0
Size range	1974			1975			1976		
	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent
Less than 24,999	2,156	18,677	2.0	2,150	14,834	2.0	2,030	13,229	2.0
25,000 to 49,999	687	21,909	2.0	718	22,774	3.0	705	22,847	3.0
50,000 to 74,999	374	20,610	2.0	382	21,114	3.0	320	17,914	2.0
75,000 to 99,999	259	20,459	2.0	301	23,708	3.0	253	19,862	2.0
100,000 to 199,999	604	78,522	8.0	624	79,880	10.0	668	84,924	10.0
200,000 to 299,999	332	74,894	8.0	383	85,632	10.0	368	81,265	10.0
300,000 to 399,999	278	87,333	9.0	234	72,999	9.0	215	66,861	8.0
400,000 to 499,999	166	67,167	7.0	168	67,369	8.0	177	70,910	9.0
500,000 to 599,999	129	64,358	7.0	108	54,301	7.0	109	54,348	7.0
600,000 to 699,999	94	55,397	6.0	83	48,471	6.0	92	53,840	7.0
700,000 to 799,999	69	47,033	5.0	64	42,989	5.0	65	44,277	5.0
800,000 to 899,999	55	42,569	5.0	55	42,297	5.0	43	33,044	4.0
900,000 and over	228	345,983	37.0	155	240,087	29.0	169	253,382	31.0
Total ¹	5,431	944,916	100.0	5,425	816,454	100.0	5,214	816,700	100.0

¹Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 9.—U.S. crushed stone sold or used by producers, by size of operation, 1977-80
(Thousand metric tons unless otherwise specified)

Size range	1977			1978			1979		
	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent
Less than 24,999	2,148	13,161	2.0	1,465	11,943	1.0	1,171	9,922	1.0
25,000 to 49,999	587	19,885	2.0	628	21,685	2.0	539	17,228	2.0
50,000 to 74,999	343	18,875	2.0	317	17,673	2.0	328	18,469	2.0
75,000 to 99,999	220	17,205	2.0	200	15,870	2.0	245	19,250	2.0
100,000 to 199,999	618	79,740	9.0	548	72,651	8.0	544	72,286	7.0
200,000 to 299,999	375	82,671	10.0	357	78,921	8.0	338	75,565	8.0
300,000 to 399,999	217	67,972	8.0	213	66,422	7.0	220	69,136	7.0
400,000 to 499,999	171	69,635	8.0	168	68,343	7.0	184	75,052	7.0
500,000 to 599,999	114	56,190	7.0	144	71,682	7.0	134	66,688	7.0
600,000 to 699,999	89	52,018	6.0	100	58,562	6.0	117	68,729	7.0
700,000 to 799,999	68	45,886	5.0	68	46,073	5.0	80	54,436	5.0
800,000 to 899,999	58	44,415	5.0	59	45,631	5.0	73	56,180	6.0
900,000 to 999,999	197	297,763	34.0	252	376,693	40.0	357	391,580	39.0
1,000,000 and over	—	—	—	—	—	—	—	—	—
Total ¹	5,205	865,414	100.0	4,519	952,150	100.0	4,330	994,522	100.0
Size range	1980								
	Number of operations	Quantity	Percent						
Less than 24,999	1,264	9,512	1.0						
25,000 to 49,999	628	20,746	2.0						
50,000 to 74,999	291	16,272	2.0						
75,000 to 99,999	219	17,305	2.0						
100,000 to 199,999	662	81,754	9.0						
200,000 to 299,999	352	78,143	9.0						
300,000 to 399,999	207	64,855	7.0						

See footnotes at end of table.

Table 9.—U.S. crushed stone sold or used by producers, by size of operation, 1977-80—Continued
(Thousand metric tons unless otherwise specified)

Size range	1980		
	Number of operations	Quantity	Percent
400,000 to 499,999	185	74,250	8.0
500,000 to 599,999	149	57,643	6.0
600,000 to 699,999	105	61,810	7.0
700,000 to 799,999	76	51,638	6.0
800,000 to 899,999	56	43,260	5.0
900,000 to 999,999	30	25,894	3.0
1,000,000 and over	171	289,175	33.0
Total ¹	4,395	892,254	100.0

¹Data may not add to totals shown because of independent rounding and conversions to metric tons.

Table 10.—U.S. crushed stone sold or used by producers, by size of operation, 1981-87¹
(Thousand metric tons unless otherwise specified)

Size range	1981			1983			1985		
	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent	Number of operations	Quantity	Percent
Less than 24,999	1,136	9,797	1.0	1,067	9,611	1.2	931	8,376	0.9
25,000 to 49,999	560	18,873	2.0	556	19,205	2.5	463	15,057	1.7
50,000 to 74,999	262	14,544	2.0	283	15,627	2.0	272	15,231	1.7
75,000 to 99,999	355	26,925	3.0	206	16,308	2.1	182	14,363	1.6
100,000 to 199,999	542	70,557	9.0	534	69,471	8.9	506	69,695	7.6
200,000 to 299,999	326	72,477	9.0	308	68,273	8.7	262	58,096	6.4
300,000 to 399,999	205	64,609	8.0	201	62,951	8.0	192	59,718	6.6
400,000 to 499,999	157	63,598	8.0	147	59,373	7.6	156	62,829	6.9
500,000 to 599,999	115	56,964	7.0	109	54,029	6.9	117	58,005	6.4
600,000 to 699,999	88	51,427	7.0	77	45,240	5.8	79	46,053	5.0
700,000 to 799,999	50	33,665	4.0	65	44,266	5.7	76	50,945	5.6
800,000 to 899,999	49	37,798	5.0	42	33,058	4.2	64	48,749	5.4
900,000 to 999,999	30	25,727	3.0	36	30,786	3.9	39	33,330	3.7
1,000,000 to 1,999,999	144	245,058	32.0	160	254,464	32.5	218	367,462	40.5
2,000,000 and over	—	—	—	—	—	—	—	—	—
Total ²	4,019	³ 792,018	100.0	3,791	³ 782,658	100.0	3,557	907,908	100.0

Size range	1987		
	Number of operations	Quantity	Percent
Less than 24,999	764	6,588	0.6
25,000 to 49,999	331	10,986	1.0
50,000 to 74,999	248	14,117	1.3
75,000 to 99,999	197	15,715	1.5
100,000 to 199,999	525	70,104	6.4
200,000 to 299,999	332	74,011	6.8
300,000 to 399,999	192	61,235	5.6
400,000 to 499,999	168	68,348	6.3
500,000 to 599,999	111	55,973	5.1
600,000 to 699,999	116	68,030	6.3
700,000 to 799,999	78	53,457	4.9
800,000 to 899,999	76	59,128	5.4
900,000 to 999,999	44	37,668	3.5
1,000,000 to 1,999,999	207	251,629	23.1
2,000,000 and over	84	241,751	22.2
Total ²	3,473	1,088,740	100.0

¹Crushed stone became a biennial survey in 1981. No table by size of operation for the even-numbered years is therefore available.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

³Total had been revised. Individual size of operation revisions not available.

Table 11.—U.S. crushed stone sold or used by producers, by size of operation, 1989¹
(Thousand metric tons unless otherwise specified)

Size range	1989		
	Number of operations	Quantity	Percent
Less than 24,999	664	5,908	0.5
25,000 to 49,999	341	11,537	1.0
50,000 to 99,999	467	31,253	2.8
100,000 to 199,999	524	69,541	6.3
200,000 to 299,999	337	75,273	6.8
300,000 to 399,999	198	62,820	5.7
400,000 to 499,999	156	64,167	5.8
500,000 to 599,999	127	63,545	5.8
600,000 to 699,999	102	60,121	5.5
700,000 to 799,999	105	70,834	6.4
800,000 to 899,999	63	48,692	4.4
900,000 to 999,999	67	57,805	5.3
1,000,000 to 1,499,999	150	161,066	14.6
1,500,000 to 1,999,999	49	76,406	6.9
2,000,000 to 2,499,999	24	48,223	4.4
2,500,000 to 4,999,999	42	124,236	11.3
5,000,000 and over	10	69,381	6.3
Total ²	³ 3,416	1,100,807	100.0

¹Crushed stone became a biennial survey in 1981. No table by size of operation for the even-numbered years is therefore available.

²Data may not add to totals shown because of independent rounding and conversions to metric tons.

³Data do not add to total shown because of multiple kinds of stone reported by same operation.

Table 12.—Exports of crushed stone, by destination and type
(Thousand metric tons and thousand dollars)

Year	Crushed Stone ¹	
	Quantity	Value
1971	2,495	11,489
1972	2,842	11,107
1973	3,140	13,063
1974	3,504	18,159
1975	4,331	22,100
1976	4,120	24,000

¹Information on exports of crushed stone between 1971-76 was reported as totals only.

Table 13.—Exports of crushed stone, by destination and type
(Thousand metric tons and thousand dollars)

Destination	1977	1978	1979	1980	1981	1982	1983
North America:							
Quartzite	—	—	—	4	4	1	3
Limestone ¹	2,932	3,260	3,299	2,409	2,972	1,696	2,036
Other	622	291	211	179	194	74	87
Total ²	3,554	3,552	3,510	2,591	3,170	1,771	2,126
South America:							
Quartzite	—	—	—	(³)	(³)	(³)	—
Limestone ¹	1	5	274	78	29	39	38
Other	1	2	4	25	2	1	5
Total ²	2	7	278	103	31	40	43

See footnotes at end of table.

Table 13.—Exports of crushed stone, by destination and type—Continued
(Thousand metric tons and thousand dollars)

Destination	1977	1978	1979	1980	1981	1982	1983
Europe:							
Quartzite	—	—	—	4	6	39	3
Limestone ¹	1	(³)	1	2	1	6	4
Other	1	64	45	26	25	9	8
Total ²	2	64	46	32	33	54	15
Asia:							
Quartzite	—	—	—	2	2	3	1
Limestone ¹	(³)	(³)	(³)	(³)	(³)	(³)	—
Other	1	5	7	60	3	4	3
Total ²	1	5	7	62	5	5	5
Oceania:							
Quartzite	—	—	—	—	(³)	(³)	—
Limestone ¹	(³)	(³)	(³)	1	1	1	1
Other	4	(³)	1	8	20	(³)	1
Total ²	4	(³)	1	9	21	2	2
Middle East and Africa:							
Quartzite	—	—	—	(³)	(³)	(³)	—
Limestone ¹	—	—	(³)	(³)	1	(³)	—
Other	—	—	1	1	5	1	—
Total ²	—	—	1	1	5	1	—
Grand total ²	3,564	3,629	3,841	2,798	3,264	1,873	2,189
Total value	22,600	31,400	23,000	21,239	25,949	19,026	23,021
	1984	1985	1986	1987	1988	1989 ^d	1990 ^d
North America:							
Quartzite	1	1	1	2	1	—	—
Limestone ¹	1,904	2,016	2,519	2,818	3,063	3,390	3,452
Other	88	74	78	68	102	107	1,070
Total ²	1,993	2,090	2,598	2,888	3,165	3,496	4,521
South America:							
Quartzite	—	(³)	(³)	(³)	(³)	—	—
Limestone ¹	73	38	19	1	2	1	1
Other	1	4	1	1	2	(³)	2
Total ²	73	41	20	2	4	1	3
Europe:							
Quartzite	73	5	8	3	103	—	—
Limestone ¹	(³)	(³)	(³)	(³)	(³)	6	3
Other	10	6	16	18	5	20	59
Total ²	83	12	25	22	107	25	63
Asia:							
Quartzite	2	2	4	5	8	—	—
Limestone ¹	(³)	(³)	(³)	(³)	2	8	5
Other	2	2	1	3	8	5	33
Total ²	4	4	5	7	19	13	38
Oceania:							
Quartzite	—	—	(³)	(³)	(³)	(³)	—
Limestone ¹	(³)	1	1	1	(³)	(³)	(³)
Other	3	4	(³)	3	9	(³)	(³)
Total ²	3	4	1	4	9	1	(³)

See footnotes at end of table.

Table 13.—Exports of crushed stone, by destination and type—Continued
(Thousand metric tons and thousand dollars)

Destination	1984	1985	1986	1987	1988	1989 ⁴	1990 ⁴
Middle East and Africa:							
Quartzite	—	(¹)	(¹)	(¹)	—	—	—
Limestone ¹	(¹)	(¹)	—	—	(¹)	(¹)	(¹)
Other	1	(¹)	(¹)	(¹)	(¹)	1	(¹)
Total ²	1	1	(¹)	(¹)	(¹)	1	1
Grand total ²	2,157	2,152	2,650	2,922	3,304	3,538	4,627
Total value	23,970	29,347	36,957	26,063	30,413	23,345	41,400

¹Includes ground limestone.

²Data may not add to totals shown because of independent rounding.

³Less than 1/2 unit.

⁴Includes limestone for cement manufacturing.

Table 14.—U.S. Imports for consumption of stone, by type
(Thousand metric tons and thousand dollars)

Type	1971		1972		1973		1974	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Crushed stone and chips:								
Limestone	1,408	2,207	1,678	2,567	1,573	2,466	1,622	2,537
Limestone for cement manufacturing ..	—	—	—	—	—	—	—	—
Marble, breccia	7	142	11	150	5	133	4	123
Quartzite	54	411	58	557	89	973	68	713
Slate	(¹)	2	(¹)	5	—	—	—	—
Other	861	1,320	1,211	1,976	1,395	2,356	1,572	2,997
Total	2,330	4,082	2,958	5,255	3,062	5,928	3,266	6,370
Calcium carbonate fines:								
Natural aragonite ²	—	—	—	—	—	—	—	—
Whiting, dry, ground, or bolted	16	520	19	621	24	875	31	1,638
Chalk, whiting	2	143	2	150	3	332	3	451
Precipitated	—	—	—	—	—	—	—	—
Total ³	18	663	21	771	27	1,207	34	2,089
Grand Total	2,348	4,745	2,979	6,026	3,089	7,135	3,300	8,459
	1975		1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Crushed stone and chips:								
Limestone	1,466	2,432	1,433	2,376	1,852	4,094	1,940	4,800
Limestone for cement manufacturing ..	—	—	—	—	—	—	—	—
Marble, breccia	3	80	3	86	2	61	3	105
Quartzite	111	804	68	744	61	527	83	908
Slate	(¹)	1	(¹)	1	—	2	(¹)	11
Other	1,244	2,764	1,169	2,746	1,028	2,344	1,328	3,088
Total	2,824	6,081	2,673	5,953	2,942	7,028	3,353	8,912
Calcium carbonate fines:								
Natural aragonite ²	447	512	520	620	—	—	—	—
Whiting, dry, ground, or bolted	18	1,219	32	2,227	468	925	495	615
Chalk, whiting	2	242	4	579	30	2,159	30	2,615
Precipitated	—	—	—	—	7	1,264	10	2,107
Total ³	467	1,973	556	3,426	505	4,348	535	5,337
Grand Total	3,291	8,054	3,223	9,379	3,447	11,376	3,888	14,249
	1979		1980		1981		1982	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Crushed stone and chips:								
Limestone	2,088	5,434	2,155	6,966	1,608	4,698	1,255	8,356
Limestone for cement manufacturing ..	—	—	—	—	—	—	—	—

See footnotes at end of table.

Table 14.—U.S. Imports for consumption of stone, by type—Continued
(Thousand metric tons and thousand dollars)

Type	1979		1980		1981		1982	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Crushed stone and chips—Continued								
Marble, breccia	4	210	2	113	8	482	4	318
Quartzite	88	822	14	211	64	825	24	317
Slate	(¹)	4	—	—	1	4	—	4
Other	1,299	3,484	1,087	3,286	1,073	2,887	227	1,575
Total	3,479	9,954	3,257	10,576	2,754	8,896	1,510	10,570
Calcium carbonate fines:								
Natural aragonite ²	—	—	—	—	—	—	—	—
Whiting, dry, ground, or bolted	418	600	254	369	221	344	159	953
Chalk, whiting	31	3,282	7	858	15	1,694	8	1,669
Precipitated	8	2,145	5	2,021	9	2,539	8	1,318
Total ³	457	6,027	267	3,248	245	4,577	174	5,811
Grand Total	3,936	15,981	3,524	13,824	2,999	13,473	1,684	16,382
Crushed stone and chips:								
Limestone	1,240	7,952	1,492	10,646	1,178	5,261	1,319	6,466
Limestone for cement manufacturing ..	—	—	—	—	—	—	—	—
Marble, breccia	26	310	2	181	26	547	3	190
Quartzite	13	245	58	945	30	638	5	335
Slate	—	2	9	47	2	99	5	76
Other	788	2,200	1,090	3,251	1,235	3,664	1,266	3,836
Total	2,067	10,709	2,652	15,071	2,472	10,209	2,598	10,902
Calcium carbonate fines:								
Natural aragonite ²	² 340	943	² 249	710	² 249	716	² 313	948
Whiting, dry, ground, or bolted	—	—	—	—	—	—	—	—
Chalk, whiting	8	958	15	1,761	6	715	5	600
Precipitated	—	—	—	—	—	—	—	—
Total ³	348	1,901	265	2,471	255	1,432	318	1,548
Grand Total	2,416	12,610	2,917	17,543	2,727	11,640	2,917	12,451
Crushed stone and chips:								
Limestone	1,207	4,775	325	1,404	976	6,955	2,139	12,439
Limestone for cement manufacturing ..	—	—	—	—	2,097	19,464	1,974	16,587
Marble, breccia	3	333	2	166	—	—	—	—
Quartzite	61	1,234	91	1,686	13	854	9	845
Slate	1	66	6	167	—	—	—	—
Other	1,989	6,092	2,520	11,393	862	8,359	386	4,571
Total	3,261	12,500	2,943	14,815	3,948	35,631	4,508	34,442
Calcium carbonate fines:								
Natural aragonite ²	² 233	856	² 319	1074	(¹)	284	(¹)	94
Whiting, dry, ground, or bolted	—	—	—	—	—	—	—	—
Chalk, whiting	5	668	5	899	4	950	3	770
Precipitated	—	—	—	—	—	—	—	—
Total ³	239	1,524	325	1,973	4	1,234	3	864
Grand Total	3,500	14,024	3,268	16,789	3,952	36,870	4,511	35,310

¹Less than 1/2 unit.

²Includes some chalk and other calcareous materials.

³Data may not add to totals shown because of independent rounding.

DIMENSION STONE

By Harold A. Taylor, Jr.

Dimension stone is natural stone that has been selected, trimmed, or cut to specified or indicated shapes or sizes, with or without one or more mechanically dressed surfaces. It is quarried as a block or large piece and then usually cut into a panel, slab, tile, tombstone, curb, or other shape according to some specified measurements. Limestone is a rock of sedimentary origin composed principally of calcite or dolomite or some combination of these two minerals. Granite is a visibly granular igneous rock generally ranging in color from pink to light or dark gray and consisting mostly of quartz and feldspars accompanied by one or more dark minerals. Marble is a rock with a variety of compositional and textural types, ranging from pure carbonate to rocks containing very little carbonate, but that are always capable of taking a polish. Slate is a microcrystalline metamorphic rock most commonly derived from shale, composed mostly of micas, chlorite, and quartz, with a strong cleavage imparted by the micas that allows it to be split into thin but tough sheets.

Output of dimension stone was 1.19 million metric tons valued at \$210 million in 1990. The U.S. dimension stone industry consists of approximately 200 companies operating about 300 quarries in 34 States. Granite is the major type of stone produced and accounted for 52% of production in 1990; this was followed, in order of volume, by limestone, sandstone, slate, and marble. Leading areas or States are, in order of production, for granite, New England and Georgia; for limestone, Indiana and Wisconsin; for sandstone, Ohio, Pennsylvania, Maryland, and New York; for marble, Colorado, Georgia, and Vermont; and for slate, Vermont, Pennsylvania, and Virginia. Major current uses for dimension stone are two-thirds in the construction and furnishing of buildings and the balance for monuments and curbing.

In general, dimension stone production has dwindled inexorably from 1950 to the early 1980's, when it bottomed

out. Rough building limestone sold or used by producers dropped because of competition from alternate, cheaper materials, particularly concrete, which has a somewhat similar color and appearance. It has begun to bounce back as the trend toward using more natural materials has taken hold. Ashlar has also bounced back, both in quantity and value, for the same reason.

Rough monumental granite sold or used by producers has been eroding in the last 15 years because of competition from cremation, bronze markers, and the use of smaller granite memorials, aided by an increase in value per ton during this time period. Rough building granite sold or used by producers has risen to a higher level in the last 15 years as the market for building uses expanded. Granite ashlar has grown in use, but not as fast as the overall market, which has been driven by tile and cut-to-order slab. Granite curbing has not grown much, mostly because its increased cost per ton has shifted the market balance in favor of concrete curbing. While granite curbing is more expensive, it lasts much longer than concrete. Slate roofing sold by producers continued to lose ground to asphalt shingles until the early 1980's, when the shift in taste to dimension stone caught up with slate roofing; slate roofing has done much better ever since, and imports have grown even faster.

Imports of dimension stone have all grown in a mind-boggling way since the early 1980's, and all for the same reasons. Automated stone finishing equipment allowed granite and marble to be made into much thinner products. In addition to the savings in labor, the manufacture of thinner products allowed the making of much more square footage of wall covering to be made from the same volume of stone. This cut in cost of product coincided with energy-driven rises in costs of concrete and steel and a shift in architectural taste to natural stone from artificial competing materials.

Table 1.—Dimension stone sold or used by producers, by use, 1970-90
(Thousand metric tons and thousand dollars)

Year	Granite, rough monumental		Granite, rough building		Granite, ashlar, partially squared		Granite, curbing	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970 ...	181	17,160	39	1,255	NA	NA	144	5,762
1971 ...	176	11,067	54	1,987	NA	NA	137	5,579
1972 ...	260	11,266	42	2,139	NA	NA	118	6,217
1973 ...	283	12,260	44	2,030	NA	NA	123	7,688
1974 ...	266	15,336	43	1,550	NA	NA	110	7,844
1975 ...	253	15,530	55	2,206	NA	NA	111	7,761
1976 ...	241	14,925	28	1,082	NA	NA	107	8,015
1977 ...	246	16,748	30	1,419	NA	NA	93	7,465
1978 ...	248	19,297	57	2,310	NA	NA	85	7,637
1979 ...	242	21,511	86	3,600	NA	NA	89	7,572
1980 ...	222	20,832	77	3,504	NA	NA	105	10,473
1981 ...	195	21,535	76	4,628	NA	NA	87	10,336
1982 ^e ...	209	21,262	121	12,674	71	22,627	104	10,138
1983 ...	210	22,760	120	16,411	47	17,722	47	8,709
1984 ^e ...	202	22,189	92	2,815	28	7,361	78	13,977
1985 ...	202	22,881	96	8,968	29	7,878	80	16,171
1986 ^e ...	167	21,836	78	8,037	81	19,561	122	21,509
1987 ...	200	26,003	77	8,621	96	25,275	109	23,082
1988 ^e ...	205	31,064	85	9,194	82	23,570	142	30,984
1989 ...	198	30,789	83	9,727	103	24,015	117	23,707
1990 ...	NA	NA	NA	NA	NA	NA	NA	NA
	Limestone, rough building		Limestone, ashlar, partially squared		Slate, roofing			
	Quantity	Value	Quantity	Value	Quantity	Value		
1970 ...	146	3,406	NA	NA	20	1,842		
1971 ...	199	4,681	NA	NA	23	2,250		
1972 ...	159	4,070	NA	NA	11	1,369		
1973 ...	171	3,040	NA	NA	11	1,478		
1974 ...	187	4,272	NA	NA	13	2,146		
1975 ...	147	4,045	NA	NA	10	2,166		
1976 ...	125	3,713	NA	NA	9	2,045		
1977 ...	135	4,215	NA	NA	9	2,338		
1978 ...	122	4,068	NA	NA	7	2,302		
1979 ...	112	3,891	NA	NA	8	3,114		
1980 ...	81	3,483	NA	NA	6	3,447		
1981 ...	84	3,786	NA	NA	5	2,942		
1982 ^e ...	88	4,408	44	6,790	6	3,588		
1983 ...	101	4,578	45	6,599	8	4,384		
1984 ^e ...	116	5,723	57	16,017	11	5,859		
1985 ...	119	6,816	58	16,413	12	6,342		
1986 ^e ...	120	8,703	60	13,416	17	6,840		
1987 ...	125	9,964	52	11,562	14	7,626		
1988 ^e ...	113	10,054	83	13,171	12	7,926		
1989 ...	124	10,367	62	11,376	10	9,132		
1990 ...	NA	NA	NA	NA	NA	NA		

^eEstimated. Dimension stone became a biennial survey in 1981; therefore, data for even-numbered years have been estimated.

NA Not Available.

Table 2.—U.S. Imports of major categories of dimension stone

Year	Rough granite		Dressed granite		Marble, polished slabs		Marble, other n.s.p.f.
	Quantity (thousand cubic feet)	Value (thou- sands)	Quantity (thousand cubic feet)	Value (thou- sands)	Quantity (thousand cubic feet)	Value (thou- sands)	Value (thousands)
1970	189	\$1,147	443	\$6,807	7,329	\$7,283	NA
1971	766	1,395	746	6,111	6,700	6,732	NA
1972	498	1,576	826	7,610	8,089	8,376	NA
1973	345	2,183	366	6,214	9,165	10,033	NA
1974	185	1,678	370	4,544	8,695	11,007	NA
1975	243	2,369	328	5,617	5,183	7,663	NA
1976	228	2,234	194	4,669	8,020	8,277	NA
1977	215	2,122	231	4,610	7,656	10,324	NA
1978	215	2,549	256	5,672	8,604	14,095	NA
1979	201	2,787	396	9,713	8,382	17,518	NA
1980	260	2,958	456	18,383	9,332	23,725	NA
1981	4,982	6,601	691	33,521	11,553	29,951	\$19,291
1982	771	4,252	1,228	71,637	13,949	34,211	19,165
1983	375	4,993	1,828	79,958	17,318	41,938	28,461
1984	5,217	5,395	3,539	73,070	29,801	60,937	40,936
1985	3,420	6,097	7,928	163,680	56,137	88,579	39,521
1986	2,699	6,707	9,635	142,185	74,069	123,637	47,728
1987	7,333	10,641	6,063	127,594	86,645	179,030	53,109
1988	4,937	10,299	5,974	154,425	71,060	201,315	60,705
1989	15,199	34,907	5,526	159,366	197	187,000	58,189
1990	1,810	19,222	6,235	175,197	125	147,082	80,169

NA Not available.

¹Thousand metric tons.

Source: Bureau of the Census.

Page Intentionally Left Blank.

SULFUR

By Joyce A. Ober

Sulfur, through its major derivative sulfuric acid, ranks as one of the more important elements utilized by humanity as an industrial raw material. It is of prime importance to every sector of the world's industrial and fertilizer complexes. Sulfuric acid consumption has been regarded as one of the best indexes of a nation's industrial development.

Sulfur is one of the few elements that occurs in the native, or elemental, state. It also occurs combined with iron and base metals and sulfide minerals and with the alkali metals and alkali earths as sulfate minerals. In petroleum, sulfur is found in a variety of complex organic compounds and in natural gas as hydrogen sulfide. In coal, sulfur occurs in complex organic compounds and as

"coal brasses" (pyrites-marcasite). Commercial production of sulfur in the United States is accomplished by a variety of methods dictated by the source of the sulfur.

The primary source of elemental sulfur is classified as recovered sulfur. It is recovered during the refining of crude oil and the purification of natural gas. The next largest type of elemental sulfur is Frasch sulfur. With this method, native sulfur is extracted through a hot water process that is named after its inventor. Sulfuric acid is recovered as a byproduct during the smelting of copper, lead, molybdenum, and zinc. Sulfur in other forms is also produced (i.e., pyrites, hydrogen sulfide, and sulfuric dioxide), but on a minor scale.

Table 1.—Salient sulfur statistics
(Million metric tons sulfur content)

	1970	1971	1972	1973	1974	1975	1976
Production:							
Frasch	7.196	7.138	7.407	7.727	8.028	7.327	6.365
Recovered elemental from natural gas	.669	.648	.832	1.063	1.238	1.364	1.298
Recovered from petroleum refining ¹	.811	.973	1.149	1.392	1.436	1.653	1.890
Byproduct sulfuric acid	.546	.526	.555	.610	.664	.779	.957
Pyrites	.344	.321	.288	.215	.165	.241	.291
Other forms ²	.144	.128	.151	.089	.071	.076	.078
Total	9.710	9.734	10.382	11.096	11.602	11.440	10.879
Shipments (sold or used):							
Frasch	6.608	6.846	7.735	7.557	8.025	6.175	5.954
Recovered elemental	1.495	1.608	1.958	2.490	2.588	2.949	3.196
Byproduct sulfuric acid	.546	.526	.555	.610	.664	.779	.957
Pyrites	.344	.321	.288	.215	.165	.241	.291
Other forms ²	.144	.128	.151	.089	.071	.076	.078
Total	9.137	9.429	10.687	10.961	11.513	10.220	10.476
Imports:							
Frasch (Mexico)	.548	.456	.273	.307	.969	.982	.743
Recovered elemental (Canada)	1.014	.864	.882	.920	1.213	.945	.985
Recovered elemental (other)	—	—	.001	.015	.002	(³)	.027
Pyrites (Canada)	.132	.132	.051	—	—	—	—
Total	1.694	1.452	1.207	1.242	2.184	1.927	1.755
Exports:							
Frasch and recovered	1.456	1.561	1.882	1.804	2.706	1.374	1.290
Consumption:⁴							
Frasch:							
Domestic	5.152	5.285	5.853	5.753	5.382	4.859	4.737
Imports	.548	.456	.273	.307	.969	.982	.743
Recovered elemental:							
Domestic	1.495	1.608	1.958	2.490	2.525	2.891	3.123
Imports	1.014	.864	.883	.935	1.215	.945	1.012
Total elemental	8.209	8.213	8.967	9.485	10.091	9.677	9.615
Byproduct sulfuric acid	.546	.526	.555	.610	.664	.779	.957

See footnotes at end of table.

Table 1.—Salient sulfur statistics—Continued
(Million metric tons sulfur content)

	1970	1971	1972	1973	1974	1975	1976
Pyrites:							
Domestic	.344	.321	.288	.215	.165	.241	.291
Imports	.132	.132	.051	—	—	—	—
Other forms ²	.144	.128	.151	.089	.071	.076	.078
Total	9.375	9.320	10.012	10.399	10.991	10.773	10.941
Yearend producers' stocks:⁵							
Frasch	3.804	4.088	3.724	3.877	3.804	4.935	5.382
Recovered	.086	.098	.133	.113	.216	.273	.270
Total	3.890	4.186	3.857	3.990	4.020	5.208	5.652
	1977	1978	1979	1980	1981	1982	1983
Production:							
Frasch	5.915	5.648	6.357	6.390	6.348	4.210	3.202
Recovered elemental from natural gas	1.426	1.753	1.760	1.757	1.971	1.960	2.371
Recovered from petroleum refining ¹	2.198	2.309	2.310	2.316	2.288	2.444	2.584
Byproduct sulfuric acid	.960	1.103	1.167	1.003	1.159	.828	.831
Pyrites	.169	.301	.400	.322	.307	.265	W
Other forms ²	.059	.061	.107	.078	.072	.080	.302
Total	10.727	11.175	12.101	11.866	12.145	9.787	9.290
Shipments (sold or used):							
Frasch	6.030	5.736	7.507	7.400	5.910	3.598	4.111
Recovered elemental	3.627	4.088	4.108	4.115	4.207	4.344	5.041
Byproduct sulfuric acid	.960	1.103	1.167	1.003	1.159	.828	.831
Pyrites	.169	.301	.400	.322	.307	.265	W
Other forms ²	.059	.061	.107	.078	.072	.080	.302
Total	10.845	11.289	13.289	12.918	11.655	9.115	10.285
Imports:							
Frasch (Mexico)	.781	.993	1.229	.990	.856	.690	.604
Recovered elemental (Canada)	1.186	1.185	1.265	1.517	1.666	1.215	1.091
Recovered elemental (other)	.042	(³)	(³)	.016	(³)	(³)	(³)
Pyrites (Canada)	—	—	—	—	—	—	—
Total	2.009	⁴ 2.177	2.494	2.523	2.522	1.905	1.695
Exports:							
Frasch and recovered	1.197	.866	2.044	1.782	1.392	.961	.992
Consumption:⁴							
Frasch:							
Domestic	4.942	4.909	5.544	5.727	4.694	2.867	3.510
Imports	.781	.993	1.229	.990	.856	.690	.604
Recovered elemental:							
Domestic	3.518	4.049	4.027	4.006	4.031	4.114	4.650
Imports	1.228	1.185	1.265	1.533	1.666	1.215	1.091
Total elemental	10.469	11.136	12.065	12.256	11.247	8.886	9.855
Byproduct sulfuric acid	.960	1.103	1.167	1.003	1.159	.828	.831
Pyrites:							
Domestic	.169	.301	.400	.322	.307	.265	W
Imports	—	—	—	—	—	—	—
Other forms ²	.059	.061	.107	.078	.072	.080	.302
Total	11.657	⁴ 12.600	13.739	13.659	12.785	10.059	10.988
Yearend producers' stocks:⁵							
Frasch	5.288	5.123	4.058	2.954	3.442	3.964	3.065
Recovered	.269	.222	.181	.140	.192	.238	.153
Total	5.557	5.345	4.239	3.094	3.634	4.202	3.218

See footnotes at end of table.

Table 1.—Sailent sulfur statistics—Continued
(Million metric tons sulfur content)

	1984	1985	1986	1987	1988	1989	1990
Production:							
Frasch	4.193	5.011	4.043	3.202	3.174	3.888	3.726
Recovered elemental from natural gas	2.407	2.373	2.246	2.536	2.501	2.537	2.335
Recovered from petroleum refining ¹	2.807	2.940	3.570	3.624	3.943	3.973	4.199
Byproduct sulfuric acid	.962	.957	.919	1.003	1.125	1.190	1.294
Pyrites	W	W	W	W	W	W	W
Other forms ²	.283	.328	.309	.173	.003	.004	.004
Total	10.652	11.609	11.087	10.538	10.746	11.592	11.558
Shipments (sold or used):							
Frasch	5.001	4.678	4.108	3.610	4.341	3.780	3.676
Recovered elemental	5.210	5.266	5.798	6.180	6.470	6.475	6.483
Byproduct sulfuric acid	.962	.957	.919	1.003	1.125	1.190	1.294
Pyrites	W	W	W	W	W	W	W
Other forms ²	.283	.328	.309	.173	.003	.004	.004
Total	11.456	11.229	11.134	10.966	11.939	11.449	11.457
Imports:							
Frasch (Mexico)	.722	.724	.726	.793	1.079	1.086	1.129
Recovered elemental (Canada)	1.812	1.354	.605	.764	.913	1.149	1.424
Recovered elemental (other)	.023	.026	.016	.042	.004	.025	.018
Pyrites (Canada)	—	—	—	—	—	—	—
Total	2.557	2.104	1.347	1.599	1.996	2.260	2.571
Exports:							
Frasch and recovered	1.334	1.365	1.895	1.242	1.223	1.024	.972
Consumption:⁴							
Frasch:							
Domestic	4.090	3.692	2.858	3.145	3.877	3.450	3.328
Imports	.722	.724	.726	.793	1.079	1.086	1.129
Recovered elemental:							
Domestic	4.787	4.887	5.153	5.403	5.711	5.781	5.859
Imports	1.835	1.380	.621	.806	.917	1.174	1.442
Total elemental	11.434	10.683	9.358	10.147	11.584	11.491	11.758
Byproduct sulfuric acid	.962	.957	.919	1.003	1.125	1.190	1.294
Pyrites:							
Domestic	W	W	W	W	W	W	W
Imports	—	—	—	—	—	—	—
Other forms ²	.283	.328	.309	.173	.003	.004	.004
Total	12.679	11.968	10.586	11.323	12.712	12.685	13.056
Yearend producers' stocks:⁵							
Frasch	2.279	2.598	2.532	2.122	.954	1.109	1.177
Recovered	.155	.201	.216	.194	.158	.193	.245
Total	2.434	2.799	2.748	2.316	1.112	⁶ 1.301	⁶ 1.423

W Withheld to avoid disclosing company proprietary data; included in "Other forms."

¹Includes small quantity from coking operations.

²Hydrogen sulfide and liquid sulfur dioxide and data indicated by the symbol W.

³Less than 1/2 unit.

⁴Measured as shipments plus imports minus exports.

⁵Reported producers' stocks after inventory adjustments.

⁶Data do not add to total shown because of independent rounding.

Table 2.—U.S. sulfur demand pattern¹
(Thousand metric tons)

End use	1970	1971	1972	1973	1974	1975	1976
Agriculture:							
Phosphoric acid	NAp	NAp	NAp	NAp	NAp	5,552	5,741
Other	NAp	NAp	NAp	NAp	NAp	425	423
Total	4,755	4,877	5,294	5,609	6,076	5,977	6,164
Drugs and food products	—	—	—	—	—	44	42
Soaps, detergents, and water treatment	—	—	—	—	—	196	197
Plastics and synthetic products	420	365	370	380	397	357	314
Paper products	356	325	345	376	396	243	276
Paints	427	386	396	427	447	341	229
Metal mining and processing	510	530	570	585	588	510	656
Explosives	259	259	264	284	294	42	33
Petroleum refining	791	739	778	745	750	732	686
Iron and steel production	122	107	112	112	112	106	97
Storage batteries (acid)	—	—	—	—	—	33	33
Other	1,735	1,732	1,883	1,881	1,931	2,192	2,214
Total Industrial demand	4,620	4,443	4,718	4,790	4,915	4,796	4,777
Total U. S. primary demand	9,375	9,320	10,012	10,399	10,991	10,773	10,941
	1977	1978	1979	1980	1981	1982	1983
Agriculture:							
Phosphoric acid	6,516	6,854	7,581	8,499	7,748	6,415	7,113
Other	709	859	561	634	659	566	703
Total	7,225	7,713	8,142	9,133	8,407	6,981	7,816
Drugs and food products	47	96	101	36	19	15	35
Soaps, detergents, and water treatment	237	301	323	228	284	287	257
Plastics and synthetic products	455	454	454	371	301	347	479
Paper products	345	283	372	348	302	267	262
Paints	324	330	343	257	149	178	128
Metal mining and processing	701	773	869	687	626	448	319
Explosives	20	18	19	13	14	15	20
Petroleum refining	879	876	875	1,023	1,230	935	819
Iron and steel production	130	305	288	103	88	86	94
Storage batteries (acid)	44	58	51	34	57	53	58
Other	1,250	1,393	1,902	1,426	1,308	447	701
Total Industrial demand	4,432	4,887	5,597	4,526	4,378	3,078	3,172
Total U. S. primary demand	11,657	12,600	13,739	13,659	12,785	10,059	10,988
	1984	1985	1986	1987	1988	1989	1990
Agriculture:							
Phosphoric acid	8,621	7,872	6,973	7,556	8,404	8,642	8,664
Other	603	686	683	642	598	431	522
Total	9,224	8,558	7,656	8,198	9,002	9,073	9,186
Drugs and food products	27	56	65	32	27	28	18
Soaps, detergents, and water treatment	167	215	249	204	221	200	215
Plastics and synthetic products	457	314	338	352	458	501	421
Paper products	295	286	266	294	288	328	320
Paints	113	111	119	118	122	138	133
Metal mining and processing	510	442	376	426	567	723	773
Explosives	39	31	30	49	44	17	14
Petroleum refining	954	913	947	973	958	825	504
Iron and steel production	88	69	69	67	74	59	37
Storage batteries (acid)	58	67	50	41	51	46	47
Other	747	906	421	569	900	747	1,388
Total Industrial demand	3,455	3,410	2,930	3,125	3,710	3,612	3,870
Total U. S. primary demand	12,679	11,968	10,586	11,323	12,712	12,685	13,056

NAp Not applicable.

¹Data since 1975 not comparable to prior years.

**Table 3.—World sulfur annual production, sulfur in all forms
(Thousand metric tones sulfur content)**

	1986	1987	1988	1989	1990
North America:					
Canada	8,348	7,148	7,522	6,692	6,849
United States	11,087	10,538	10,746	11,592	11,558
Total	19,435	17,686	18,268	18,284	18,407
Latin America:					
Brazil	271	313	322	301	316
Chile	98	372	454	436	449
Mexico	2,178	2,461	2,378	2,369	2,340
Other	282	338	336	339	331
Total	2,829	3,484	3,490	3,445	3,436
Europe:					
Belgium ^e	300	300	310	320	310
Finland	577	599	600	527	636
France	1,317	1,263	1,181	1,036	1,045
Germany, Federal Republic of	1,773	1,824	1,747	1,885	1,900
Italy	494	504	500	510	490
Netherlands ^e	250	211	340	385	405
Poland ^e	5,207	5,324	5,280	5,150	5,030
Spain	1,415	1,195	1,177	1,058	1,085
Sweden	401	395	456	398	395
Turkey	73	81	126	180	133
U.S.S.R. ^e	8,725	9,750	10,765	9,900	9,025
United Kingdom	163	170	184	185	185
Yugoslavia	494	436	425	428	423
Other	1,867	1,927	1,878	1,835	1,770
Total	23,056	23,979	24,969	23,797	22,832
Africa:					
South Africa, Republic of	717	760	738	682	683
Other	326	270	336	341	335
Total	1,043	1,030	1,074	1,023	1,018
Asia:					
China ^e	3,100	4,500	4,750	5,170	5,370
Iran ^e	280	260	231	500	680
Iraq ^e	800	957	1,050	1,270	1,050
Japan	2,399	2,348	2,432	2,558	2,657
Kuwait	260	310	360	375	300
Saudi Arabia	1,446	1,432	1,378	1,423	1,435
Other	835	874	907	879	909
Total	9,120	10,681	11,108	12,175	12,401
Oceania	185	204	213	211	214
World Total	55,668	57,064	59,122	58,935	58,308

^eEstimated.

Table 4.—U.S. sulfur production and average value
(Thousand metric tons and dollars per long ton, f.o.b. mine and/or plant)

Year	Production		Value			Posted price, Tampa, FL, liquid-terminal
	Frasch	Recovered	Frasch	Recovered	All elemental	
1970	7,196	1,480	23.28	20.56	22.77	27.00
1971	7,138	1,621	17.22	17.10	17.19	26.00
1972	7,407	1,981	17.12	15.35	16.76	25.00
1973	7,727	2,455	18.34	15.21	17.56	31.00
1974	8,028	2,674	30.04	23.41	28.42	57.00
1975	7,327	3,017	49.37	35.57	44.91	65.00
1976	6,365	3,188	50.38	37.02	45.72	61.00
1977	5,915	3,624	48.88	36.91	44.38	61.00
1978	5,648	4,062	48.80	40.07	45.17	68.50
1979	6,357	4,070	59.87	48.23	55.75	95.75
1980	6,390	4,073	97.36	74.13	89.06	140.00
1981	6,348	4,259	121.10	97.96	111.48	147.50
1982	4,210	4,404	120.79	97.89	108.27	135.00
1983	3,202	4,955	100.76	76.22	87.24	132.50
1984	4,193	5,214	109.20	80.02	94.31	147.50
1985	5,011	5,313	122.62	92.11	106.46	147.50
1986	4,043	5,816	123.79	92.06	105.22	142.50
1987	3,202	6,161	107.15	79.63	89.78	128.00
1988	3,174	6,444	99.24	77.03	85.95	142.00
1989	3,888	6,510	100.18	78.70	86.62	117.50
1990	3,726	6,536	91.17	73.89	80.14	135.00

TIN

By James F. Carlin

Tin was one of the earliest metals known to humanity. Because of its hardening effects on copper, tin was used in bronze implements as early as 3500 B.C. Bronze, a copper-tin alloy that could be sharpened and was hard enough to retain a cutting edge, was used for the manufacture of construction tools and hunting and war weapons.

Today, most tin is used as a protective coating or as an alloy with other metals. Tin is used as a coating for steel cans, in solders for joining pipes or electrical conductors, and in bearing and other alloys for widely diversified applications. Tin is essential to an industrial society and in many applications for which there are no completely satisfactory substitutes.

Domestic reserves of tin are small, and significant domestic production has never occurred and seems unlikely to in the next few decades. Virtually all primary tin to meet U.S. requirements is imported largely from Southeast Asia and South America. This supply pattern has long existed and is expected to continue. About 35 countries are engaged in either tin mining or smelting and are dispersed widely throughout the world, in both free market and centrally planned economies. Most tin mining and smelting occurs in developing countries. Historically, it was typical for tin mining to occur in a developing country, and then the tin concentrates were shipped thousands of miles away to a developed country to be smelted and then used. Since the 1950's, however, tin mining and smelting have

been typically performed in the same developing country, and the refined tin is then shipped to the industrialized countries to be consumed.

Following World War II and the start of the U.S. Government stockpile for wartime purposes, tin became a major factor in the stockpile and generally since then has been the largest nonfuel mineral in the stockpile based on value. Since 1960, sales of excess tin have been made from the stockpile.

From 1956 to 1985, tin was the subject of a unique world commodity pact called the International Tin Agreement (ITA). This was a complex agreement involving the world's major tin producing and consuming countries. Through mechanisms such as export quotas and its own tin buffer stockpile, it attempted to stabilize the supply and demand of tin. The ITA collapsed in late 1985 when it exhausted its credit trying to support the market price of tin. As a result of this situation, tin was delisted from trading on the London Metal Exchange (LME), and large lawsuits were brought by creditors against the ITA and the LME.

The United States is the world's largest user of primary tin. Domestically, scrap tin has long been an important factor in meeting domestic needs, supplying about 20% of total tin demand. Scrap tin originates both from detinned tinplate and, more importantly, from the various alloyed forms of tin.

Table 1.—Salient tin statistics
(Metric tons unless otherwise specified)

Year	Production			Imports for consumption			Consumption totals	Price (dollars per pound) ¹	World mine production
	Mine	Smelter	Secondary	Metal	Ore (tin content)	Exports and reexports			
1970 ..	W	—	20,322	51,366	—	4,073	75,022	1.74	232,167
1971 ..	W	4,064	20,419	47,693	—	1,850	71,073	1.67	235,959
1972 ..	W	4,267	20,504	53,292	—	871	70,312	1.78	244,183
1973 ..	W	4,877	20,806	46,535	4,875	2,581	65,780	2.28	237,847
1974 ..	W	6,096	19,200	40,238	5,971	6,003	75,869	3.96	232,880
1975 ..	W	6,500	15,856	44,366	6,415	1,467	55,800	3.40	222,283
1976 ..	W	5,733	16,446	45,055	5,733	540	62,928	3.49	218,412
1977 ..	W	6,724	18,503	47,774	6,724	545	60,732	4.99	230,694
1978 ..	W	5,900	21,100	46,776	3,873	² 498	61,531	5.87	241,108
1979 ..	W	4,600	21,493	48,355	4,529	² 568	62,465	7.11	245,294
1980 ..	W	3,000	18,638	45,982	840	² 595	56,362	7.73	244,726
1981 ..	W	2,000	15,438	45,874	232	² 361	54,373	6.48	238,008
1982 ..	W	3,500	14,293	27,939	1,961	² 579	46,295	5.87	219,463
1983 ..	W	2,500	14,205	34,048	969	² 1,340	45,547	6.01	196,942
1984 ..	W	4,000	15,417	41,224	3,272	² 1,429	48,315	5.68	188,183
1985 ..	W	4,302	14,109	33,830	1,616	² 1,478	48,669	³ 5.26	180,725
1986 ..	W	4,347	14,850	35,768	3,936	² 1,547	43,524	³ 2.94	172,400

See footnotes at end of table.

Table 1.—Salient tin statistics—Continued
(Metric tons unless otherwise specified)

Year	Production			Imports for consumption			Consumption totals	Price (dollars per pound) ¹	World mine production
	Mine	Smelter	Secondary	Metal	Ore (tin content)	Exports and reexports			
1987 ..	W	5,280	16,159	41,150	2,953	² 1,318	44,219	3.09	180,271
1988 ..	W	2,045	^c 15,275	43,493	2,837	² 1,209	45,601	3.31	212,905
1989 ..	W	1,569	^c 14,340	33,988	216	² 904	46,371	3.97	233,777
1990 ..	W	W	^c 17,275	33,810	—	² 658	44,363	2.88	219,412

^cEstimated. W Withheld to avoid disclosing company proprietary data.

¹New York dealer price.

²Excluding reexports.

³Prices quoted for 10 months only because the funds used by the International Tin Council to support the tin price were exhausted.

Table 2.—Tin: world mine production, by country¹
(Metric tons)

Country	1986	1987	1988	1989	1990
Argentina	379	186	446	405	400
Australia	8,508	7,691	7,009	7,709	7,377
Bolivia	10,462	8,128	10,504	15,849	17,249
Brazil	26,246	30,405	44,102	50,232	39,149
Burma	1,495	939	529	501	634
Burundi	—	5	50	106	150
Cameroon	9	6	3	3	3
Canada	2,450	3,390	3,300	3,300	3,464
China ^c	15,000	20,000	38,000	40,000	42,000
Czechoslovakia	200	550	515	562	550
Germany Federal Republic of:					
Eastern states ^c	2,200	2,400	2,500	2,360	1,500
Indonesia	24,497	26,093	29,500	31,263	30,200
Japan	500	86	—	—	—
Korea, Republic of	1	3	—	—	—
Laos ^c	550	450	300	² 281	275
Malaysia	29,135	30,388	28,866	32,034	28,468
Mexico	585	369	274	159	7
Mongolia ^c	1,000	1,200	1,200	1,200	320
Namibia	880	1,097	1,182	1,120	900
Niger	80	94	119	71	38
Nigeria	460	603	300	254	165
Peru	4,817	5,263	4,378	5,053	5,134
Portugal	196	64	81	63	1,404
Rwanda	29	—	1	762	734
South Africa, Republic of	2,054	1,438	1,377	1,306	1,140
Spain	296	71	66	64	49
Tanzania ^c	5	2	2	15	15
Thailand	16,800	14,852	14,225	14,922	14,635
Uganda ^c	18	10	10	10	10
U.S.S.R. ^c	14,500	16,000	16,000	16,000	15,000
United Kingdom	4,276	4,003	3,454	3,846	4,200
United States	W	W	W	W	W
Vietnam ^c	650	680	700	850	900
Zaire ³	2,650	2,378	2,771	2,346	2,221
Zambia	^c 2	17	1	1	1
Zimbabwe ^c	1,470	1,410	1,140	1,300	1,120
Total	172,400	180,271	212,905	233,777	219,412

^cEstimated. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Contained tin basis. Data derived in part from the Monthly Statistical Bulletin of the International Tin Council, London. Table includes data available through June 28, 1991.

²Reported figure.

³Nonduplicated total of content of concentrates plus smelter production.

Table 3.—Tin: world smelter production, by country¹
(Metric tons)

Country	1986	1987	1988	1989	1990 ^e
Argentina:					
Primary	230	240	280	^e 280	200
Secondary ^e	135	100	100	100	100
Total ^e	365	340	380	380	300
Australia:					
Primary	1,399	563	439	424	450
Secondary	320	320	300	^e 300	300
Total	1,719	883	739	724	750
Belgium, secondary	2,712	3,900	4,972	5,000	6,000
Bolivia, primary	7,673	2,667	5,373	9,448	13,400
Brazil:					
Primary	25,147	29,446	41,857	44,240	40,000
Secondary ^e	200	200	250	250	250
Total ^e	25,347	29,646	42,107	44,490	40,250
Burma, primary	649	309	110	500	400
Canada, secondary ^e	200	200	200	200	200
China, primary ^e	15,000	30,000	29,500	30,000	35,000
Czechoslovakia, primary	240	545	515	562	550
Denmark, secondary ^e	100	100	100	100	100
Germany, Federal Republic of:					
Eastern states, total	3,300	3,400	3,300	3,300	3,500
Western states, secondary ..	350	250	150	300	300
Greece, secondary ^e	40	40	40	40	40
India, secondary	100	100	200	200	200
Indonesia, primary	22,083	24,200	28,365	29,916	² 30,389
Japan, primary	1,280	895	846	808	² 816
Korea, Republic of, primary ^e ..	300	400	400	800	800
Malaysia, primary	43,788	44,363	49,945	50,874	49,002
Mexico, primary	1,488	2,103	1,812	4,752	5,004
Netherlands:					
Primary	5,104	3,834	3,478	4,529	5,500
Secondary ^e	200	180	180	190	200
Total ^e	5,304	4,014	3,658	4,719	5,700
Nigeria, primary	91	560	566	258	310
Norway, secondary ^e	60	60	55	100	100
Portugal, primary	184	48	22	62	1,400
Singapore, primary ^e	500	1,000	900	600	800
South Africa, Republic of:					
Primary	2,001	1,508	1,389	1,307	² 1,152
Secondary ^e	350	350	400	400	350
Total ^e	2,351	1,858	1,789	1,707	1,502
Spain:					
Primary	1,965	1,671	806	1,767	1,800
Secondary ^e	200	200	200	200	200
Total ^e	2,165	1,871	1,006	1,967	2,000
Thailand, primary	19,672	15,438	14,675	14,571	² 15,512
U.S.S.R.: ^e					
Primary	16,000	18,500	18,500	18,000	16,000
Secondary	3,800	4,000	4,000	4,000	3,700
Total	19,800	22,500	22,500	22,000	19,700
United Kingdom:					
Primary	9,227	12,135	9,014	3,584	² 6,100
Secondary	5,676	4,871	7,757	7,184	² 5,900
Total	14,903	17,006	16,771	10,768	² 12,000

See footnotes at end of table.

Table 3.—Tin: world smelter production, by country¹—Continued
(Metric tons)

Country	1986	1987	1988	1989	1990 ²
United States:					
Primary	3,213	3,927	1,467	1,000	—
Secondary	1,134	1,353	578	569	W
Total	4,347	5,280	2,045	1,569	W
Vietnam, primary ²	620	645	600	800	800
Zaire, primary	56	90	118	100	90
Zimbabwe, primary	1,079	1,038	855	848	838
Grand total	197,866	215,749	234,614	242,463	247,753
Of which:					
Primary	178,989	196,125	211,832	220,030	226,313
Secondary	15,577	16,224	19,482	19,133	17,940

²Estimated. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Data derived from International Tin Council Monthly Statistical Bulletin 1986 and 1987; data in 1988-90 from UNCTAD. Wherever possible, total smelter output has been separated into primary (from ores and concentrates) and secondary (tin recovered from old scrap).

²Reported figure.

Table 4.—U.S. imports for consumption of tin, by country

Country	1970		1971		1972		1973	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Concentrates (tin content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	—	—	—	—	—	—	4,859	\$18,465
Canada	—	—	—	—	—	—	—	—
China	—	—	—	—	—	—	—	—
Indonesia	—	—	—	—	—	—	—	—
Mexico	—	—	—	—	—	—	—	—
Peru	—	—	—	—	—	—	—	—
Singapore	—	—	—	—	—	—	—	—
South Africa, Republic of	—	—	—	—	—	—	(¹)	(¹)
Thailand	—	—	—	—	—	—	—	—
United Kingdom	—	—	—	—	—	—	16	46
Zaire	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	4,875	18,511
Metal: ²								
Argentina	—	—	51	\$176	—	—	—	—
Australia	448	\$1,505	1,134	3,500	2,219	\$7,468	1,995	8,261
Austria	—	—	—	—	—	—	—	—
Belgium ³	11	42	16	64	72	277	120	521
Belize	—	—	—	—	—	—	—	—
Bolivia	—	—	878	3,095	1,122	4,172	845	3,821
Brazil	394	1,452	170	583	707	2,620	604	2,676
British Indian Ocean Territory	—	—	—	—	—	—	—	—
Burma	—	—	—	—	—	—	—	—
Canada	2	15	244	864	278	1,067	25	109
Chad	—	—	—	—	—	—	—	—
Chile	—	—	273	980	94	354	—	—
China ⁴	—	—	—	—	163	639	1,755	7,801
Colombia	—	—	—	—	—	—	—	—
Denmark	—	—	—	—	—	—	—	—
France	—	—	—	—	20	73	—	—
Germany, Federal Republic of	(¹)	1	—	—	101	359	—	—

See footnotes at end of table.

Table 4.—U.S. imports for consumption of tin, by country—Continued

Country	1974		1975		1976		1977	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Metal: ²								
Argentina	—	—	—	—	—	—	—	—
Australia	402	\$2,487	325	\$2,176	198	\$1,417	36	\$347
Austria	—	—	—	—	18	123	—	—
Belgium ³	10	92	—	—	—	—	—	—
Belize	—	—	—	—	—	—	—	—
Bolivia	1,153	8,571	149	1,185	1,978	14,181	3,358	34,029
Brazil	1,258	8,360	615	4,193	1,242	9,025	2,380	24,199
British Indian Ocean Territory	—	—	—	—	—	—	—	—
Burma	—	—	—	—	—	—	—	—
Canada	31	227	7	59	7	60	8	94
Chad	—	—	—	—	—	—	—	—
Chile	—	—	—	—	—	—	—	—
China ⁴	3,336	9,396	6,378	39,761	1,727	13,195	381	4,345
Colombia	—	—	—	—	—	—	97	1,112
Denmark	25	206	—	—	—	—	—	—
France	10	95	—	—	—	—	—	—
Germany, Federal Republic of	—	—	45	310	200	1,590	100	1,107
Greece	—	—	—	—	—	—	—	—
Hong Kong	25	209	200	170	84	491	—	—
India	—	—	—	—	100	868	483	4,861
Indonesia	4,186	30,340	4,371	29,823	4,972	35,160	5,294	46,410
Iran	—	—	—	—	—	—	—	—
Israel	—	—	—	—	—	—	—	—
Italy	—	—	—	—	—	—	—	—
Japan	205	1,692	31	203	—	—	50	451
Korea, Republic of	—	—	—	—	21	124	—	—
Macao	—	—	—	—	—	—	—	—
Malaysia	21,000	164,154	23,920	177,359	26,981	196,454	27,084	261,073
Mexico	—	—	—	—	—	—	—	—
Netherlands	197	1,737	—	—	(¹)	2	1	17
Nigeria	529	4,521	59	454	—	—	2	19
Norway	—	—	—	—	—	—	—	—
Paraguay	—	—	—	—	—	—	—	—
Peru	—	—	145	1,520	—	—	—	—
Philippines	—	—	—	—	—	—	—	—
Poland	—	—	—	—	—	—	—	—
Rhodesia	—	—	—	—	—	—	—	—
Seychelles	—	—	—	—	—	—	—	—
Singapore	—	—	46	484	15	102	207	2,339
Somalia	—	—	—	—	—	—	—	—
South Africa, Republic of	—	—	—	—	—	—	—	—
Spain	—	—	—	—	—	—	—	—
Sweden	—	—	—	—	—	—	—	—
Switzerland	31	247	20	179	—	—	—	—
Taiwan	117	663	182	1,241	100	637	—	—
Thailand	5,859	41,500	7,422	50,290	6,885	47,903	7,780	75,729
Turkey	—	—	—	—	—	—	—	—
United Arab Emirates	—	—	—	—	—	—	—	—
United Kingdom	1,864	15,095	451	2,939	284	2,149	513	3,412
Uruguay	—	—	—	—	193	1,588	—	—
Venezuela	—	—	—	—	—	—	—	—
Vietnam	—	—	—	—	50	384	—	—
Zaire	—	—	—	—	—	—	—	—
Zimbabwe	—	—	—	—	—	—	—	—
Total	40,238	289,592	44,366	312,346	45,055	325,453	47,774	459,544

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of tin, by country—Continued

Country	1978		1979		1980		1981	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Concentrates (tin content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	3,541	\$40,089	3,745	\$48,493	528	\$7,505	—	—
Canada	—	—	583	2,968	13	85	—	—
China	—	—	—	—	—	—	—	—
Indonesia	165	1,616	—	—	27	376	—	—
Mexico	—	—	—	—	1	2	—	—
Peru	82	943	169	2,218	—	—	232	\$2,975
Singapore	85	863	—	—	—	—	—	—
South Africa, Republic of	—	—	32	339	125	1,536	—	—
Thailand	—	—	—	—	146	1,585	—	—
United Kingdom	—	—	—	—	—	—	—	—
Zaire	—	—	—	—	—	—	—	—
Total	3,873	43,511	4,529	54,018	840	11,089	232	2,975
Metal:²								
Argentina	—	—	—	—	—	—	—	—
Australia	20	220	135	2,030	145	2,400	552	8,121
Austria	—	—	—	—	—	—	—	—
Belgium ³	155	2,092	100	1,532	190	3,365	—	—
Belize	—	—	—	—	—	—	—	—
Bolivia	5,768	69,258	5,387	77,595	5,597	90,730	8,277	110,520
Brazil	1,810	22,123	933	13,423	2,031	34,211	1,129	15,463
British Indian Ocean Territory	—	—	—	—	—	—	—	—
Burma	—	—	—	—	—	—	—	—
Canada	3	55	58	116	113	1,939	22	384
Chad	—	—	—	—	—	—	—	—
Chile	—	—	276	3,865	—	—	5	59
China ⁴	1,571	15,494	185	2,686	858	13,855	2,033	22,263
Colombia	—	—	—	—	—	—	—	—
Denmark	—	—	—	—	—	—	—	—
France	—	—	—	—	—	—	—	—
Germany, Federal Republic of	148	1,856	25	405	—	—	—	—
Greece	—	—	—	—	—	—	—	—
Hong Kong	—	—	1	17	—	—	50	631
India	—	—	40	591	—	—	1	16
Indonesia	5,664	70,609	5,429	78,917	6,477	104,383	7,096	99,791
Iran	—	—	—	—	—	—	—	—
Israel	—	—	—	—	—	—	—	—
Italy	—	—	—	—	—	—	—	—
Japan	—	—	—	—	10	158	—	—
Korea, Republic of	5	62	—	—	20	350	—	—
Macao	—	—	20	300	20	332	—	—
Malaysia	23,928	291,189	23,448	343,814	15,548	265,819	13,163	193,432
Mexico	1	17	5	89	—	—	70	666
Netherlands	50	604	—	—	—	—	—	—
Nigeria	—	—	—	—	770	13,092	520	6,935
Norway	—	—	—	—	—	—	—	—
Paraguay	—	—	—	—	—	—	—	—
Peru	20	239	—	—	260	3,496	99	1,490
Philippines	20	306	—	—	—	—	—	—
Poland	—	—	—	—	—	—	—	—
Rhodesia	—	—	—	—	63	1,092	—	—
Seychelles	—	—	—	—	—	—	—	—
Singapore	230	2,914	1,070	16,451	864	14,685	656	9,516
Somalia	—	—	—	—	—	—	—	—
South Africa, Republic of	—	—	253	883	181	3,113	34	466

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of tin, by country—Continued

Country	1978		1979		1980		1981	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Metal²—Continued								
Spain	—	—	—	—	—	—	—	—
Sweden	—	—	—	—	—	—	—	—
Switzerland	—	—	—	—	5	\$85	—	—
Taiwan	50	\$595	—	—	—	—	—	—
Thailand	6,865	85,693	10,440	\$148,803	12,414	205,515	11,967	\$163,331
Turkey	—	—	—	—	—	—	—	—
United Arab Emirates	—	—	—	—	—	—	—	—
United Kingdom	468	5,274	550	8,533	416	7,562	46	665
Uruguay	—	—	—	—	—	—	—	—
Venezuela	—	—	—	—	—	—	—	—
Vietnam	—	—	—	—	—	—	—	—
Zaire	—	—	—	—	—	—	—	—
Zimbabwe	—	—	—	—	—	—	154	2,131
Total	46,776	568,600	48,355	700,050	45,982	766,182	45,874	635,880
	1982		1983		1984		1985	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Concentrates (tin content):								
Australia	—	—	—	—	—	—	(¹)	\$22
Bolivia	192	\$1,817	257	\$2,812	271	\$1,782	22	97
Canada	187	845	—	—	1	1	24	102
China	—	—	—	—	—	—	—	—
Indonesia	—	—	—	—	—	—	—	—
Mexico	—	—	—	—	17	78	32	102
Peru	1,416	17,473	341	3,474	2,502	14,308	1,506	9,966
Singapore	—	—	101	887	46	475	—	—
South Africa, Republic of	144	1,183	270	2,376	3	28	32	351
Thailand	—	—	—	—	—	—	—	—
United Kingdom	—	—	—	—	403	3,883	—	—
Zaire	22	226	—	—	29	306	—	—
Total ⁵	1,961	21,544	969	9,549	3,272	20,862	1,616	10,640
Metal:²								
Argentina	—	—	—	—	—	—	—	—
Australia	334	4,083	390	4,879	288	4,179	266	3,060
Austria	—	—	—	—	—	—	—	—
Belgium ³	10	119	45	592	137	1,688	—	—
Belize	—	—	—	—	—	—	—	—
Bolivia	4,340	54,388	5,739	73,798	5,438	67,742	1,815	21,187
Brazil	2,409	31,675	5,604	70,885	10,220	126,190	11,021	127,128
British Indian Ocean Territory	—	—	—	—	—	—	—	—
Burma	—	—	56	754	64	776	—	—
Canada	2	49	2	41	8	66	18	233
Chad	—	—	—	—	—	—	20	245
Chile	116	1,589	71	905	218	3,713	673	7,392
China ⁴	2,632	35,495	1,938	23,617	1,640	20,596	4,513	60,126
Colombia	—	—	—	—	—	—	—	—
Denmark	—	—	—	—	40	489	—	—
France	—	—	—	—	—	—	167	1,803
Germany, Federal Republic of	(¹)	14	181	2,335	(¹)	11	147	1,574
Greece	—	—	—	—	—	—	—	—
Hong Kong	5	75	—	—	—	—	258	2,954
India	20	309	—	—	—	—	450	5,012
Indonesia	5,744	75,278	6,004	77,354	4,985	62,224	4,586	53,753

See footnotes at end of table.

Table 4.—U.S. imports for consumption of tin, by country—Continued

Country	1982		1983		1984		1985	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Metal²—Continued								
Iran	—	—	—	—	—	—	—	—
Israel	—	—	—	—	—	—	—	—
Italy	—	—	—	—	—	—	—	—
Japan	—	—	—	—	20	\$242	188	\$2,131
Korea, Republic of	—	—	—	—	—	—	3	41
Macao	—	—	—	—	—	—	—	—
Malaysia	2,364	\$30,981	4,704	\$62,396	6,622	80,546	379	4,503
Mauritania	—	—	18	223	—	—	—	—
Mexico	—	—	—	—	—	—	—	—
Netherlands	—	—	9	117	140	1,743	45	499
Nigeria	124	1,383	265	3,529	60	788	—	—
Norway	—	—	—	—	—	—	149	1,838
Paraguay	—	—	—	—	1	6	—	—
Peru	—	—	—	—	—	—	—	—
Philippines	—	—	—	—	20	258	—	—
Poland	—	—	—	—	—	—	—	—
Rwanda	—	—	—	—	30	367	—	—
Seychelles	—	—	—	—	—	—	—	—
Singapore	600	7,848	1,029	13,701	781	4,128	1,886	22,156
Somalia	—	—	—	—	—	—	—	—
South Africa, Republic of	38	473	18	228	10	121	105	1,282
Spain	—	—	—	—	—	—	—	—
Sweden	—	—	—	—	—	—	280	2,948
Switzerland	—	—	—	—	—	—	50	589
Taiwan	—	—	135	1,705	—	—	120	1,423
Thailand	9,116	118,463	7,436	95,768	9,531	104,657	6,373	75,423
Turkey	—	—	—	—	—	—	—	—
United Arab Emirates	—	—	—	—	—	—	129	1,225
United Kingdom	55	737	18	268	583	7,253	48	600
Uruguay	—	—	—	—	—	—	—	—
Venezuela	—	—	—	—	—	—	—	—
Vietnam	—	—	—	—	—	—	—	—
Zaire	—	—	10	126	89	787	—	—
Zimbabwe	30	370	376	4,931	296	3,462	140	1,283
Total⁵	27,939	363,329	34,048	438,152	41,224	492,030	33,830	400,408
	1986		1987		1988		1989	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Concentrates (tin content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	259	\$2,344	732	\$1,755	923	\$2,313	—	—
Canada	1	1	—	—	—	—	—	—
China	—	—	—	—	—	—	67	\$459
Indonesia	—	—	—	—	—	—	—	—
Mexico	—	—	—	—	—	—	—	—
Peru	3,676	11,348	2,165	7,596	1,914	5,600	149	1,479
Singapore	—	—	—	—	—	—	—	—
South Africa, Republic of	—	—	—	—	—	—	—	—
Thailand	—	—	—	—	—	—	—	—
United Kingdom	—	—	—	—	—	—	—	—
Zaire	—	—	56	158	—	—	—	—
Total	3,936	13,693	2,953	9,509	2,837	7,913	216	1,938

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of tin, by country—Continued

Country	1986		1987		1988		1989	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Metal: ²								
Argentina	—	—	—	—	—	—	—	—
Australia	94	\$691	1,406	\$9,596	1,342	\$9,460	1,420	\$11,079
Austria	—	—	60	389	—	—	100	773
Belgium ³	—	—	³ 302	2,005	—	—	—	—
Belize	99	505	—	—	—	—	—	—
Bolivia	4,893	28,943	3,476	10,579	3,926	27,643	4,795	40,019
Brazil	9,456	62,334	13,089	87,306	16,213	114,411	10,572	86,827
British Indian Ocean Territory	—	—	20	136	—	—	—	—
Burma	—	—	20	119	—	—	—	—
Canada	32	252	43	197	101	758	123	1,060
Chad	—	—	—	—	—	—	—	—
Chile	1,776	11,291	39	118	238	1,771	464	4,100
China ⁴	2,955	19,681	8,044	52,152	6,223	34,838	4,793	42,485
Colombia	—	—	—	—	—	—	81	763
Denmark	—	—	90	609	—	—	—	—
France	35	190	40	267	—	—	—	—
Germany, Federal Republic of	18	62	(¹)	4	1	7	1	6
Greece	—	—	3	3	—	—	—	—
Hong Kong	422	2,593	714	4,227	98	754	467	3,810
India	850	6,006	220	1,432	100	706	100	736
Indonesia	4,149	27,973	4,001	27,339	5,334	38,147	5,162	45,537
Iran	60	365	—	—	—	—	—	—
Israel	2	20	—	—	—	—	—	—
Italy	75	630	—	—	—	—	120	1,133
Japan	100	651	60	394	70	480	360	2,681
Korea, Republic of	—	—	1	5	—	—	—	—
Macao	—	—	—	—	—	—	—	—
Malaysia	6,230	43,221	4,959	32,499	5,317	36,786	2,392	20,193
Mexico	432	2,075	727	5,018	583	4,125	1,860	16,727
Netherlands	471	2,578	379	2,555	—	—	20	181
Nigeria	—	—	79	527	41	286	—	—
Norway	—	—	—	—	—	—	—	—
Paraguay	—	—	—	—	—	—	—	—
Peru	—	—	—	—	—	—	—	—
Philippines	—	—	—	—	—	—	—	—
Poland	—	—	—	—	98	684	—	—
Seychelles	—	—	20	41	—	—	—	—
Singapore	691	5,163	743	5,036	1,342	9,954	456	3,726
Somalia	—	—	122	799	—	—	—	—
South Africa, Republic of	35	332	—	—	—	—	10	95
Spain	—	—	—	—	—	—	—	—
Sweden	—	—	—	—	—	—	—	—
Switzerland	—	—	490	3,234	379	3,015	60	447
Taiwan	135	851	—	—	—	—	—	—
Thailand	1,901	13,965	1,460	9,452	670	8,466	180	1,803
Turkey	—	—	—	—	20	129	—	—
United Arab Emirates	—	—	40	257	40	266	22	182
United Kingdom	730	4,363	467	3,178	1,354	10,304	391	3,559
Uruguay	—	—	—	—	—	—	—	—
Venezuela	—	—	—	—	—	—	39	195
Vietnam	—	—	—	—	—	—	—	—
Zaire	5	98	—	—	—	—	—	—
Zimbabwe	123	669	35	226	—	—	—	—
Total ⁵	35,768	235,506	41,150	259,699	43,493	302,991	33,988	288,118

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of tin, by country—Continued

Country	1990	
	Quantity (metric tons)	Value (thou- sands)
Concentrates (tin content):		
Australia	—	—
Bolivia	—	—
Canada	—	—
China	—	—
Indonesia	—	—
Mexico	—	—
Peru	—	—
Singapore	—	—
South Africa, Republic of	—	—
Thailand	—	—
United Kingdom	—	—
Zaire	—	—
Total	—	—
Metal: ²		
Argentina	—	—
Australia	1,660	\$10,352
Austria	—	—
Belgium ³	—	—
Belize	—	—
Bolivia	8,472	52,581
Brazil	6,535	41,558
British Indian Ocean Territory	—	—
Burma	—	—
Canada	43	273
Chad	—	—
Chile	628	4,662
China ⁴	4,339	26,280
Colombia	—	—
Denmark	—	—
France	—	—
Germany, Federal Republic of	60	374
Greece	—	—
Hong Kong	284	1,688
India	280	1,918
Indonesia	4,695	28,872
Iran	—	—
Israel	—	—
Italy	—	—
Japan	(¹)	1
Korea, Republic of	—	—
Macao	—	—
Malaysia	3,873	24,474
Mexico	2,614	20,630
Netherlands	—	—
Nigeria	—	—
Norway	—	—
Paraguay	—	—
Peru	—	—
Philippines	—	—
Poland	—	—
Seychelles	—	—
Singapore	40	247
Somalia	—	—
South Africa, Republic of	—	—
Spain	—	—
Sweden	—	—
Switzerland	(¹)	3

See footnotes at end of table.

Table 4.—U.S. Imports for consumption of tin, by country—Continued

Country	1990	
	Quantity (metric tons)	Value (thou- sands)
Metals ² —Continued		
Taiwan	—	—
Thailand	60	\$382
Turkey	—	—
United Arab Emirates	—	—
United Kingdom	227	1,568
Uruguay	—	—
Venezuela	—	—
Vietnam	—	—
Zaire	—	—
Zimbabwe	—	—
Total ⁵	33,810	215,863

¹Less than 1/2 unit.²Bars, blocks, pigs, or granulated.³1970-87 Belgium-Luxembourg combined; data not available to separate; 1988-90 data for Belgium only.⁴People's Republic of China 1970-77; China Mainland, 1978-79; 1980-90 data for China only.⁵Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 5.—U.S. exports of tin

Year	Ingots, pigs, bars ¹		Year	Ingots, pigs, bars ¹		Year	Ingots, pigs, bars ¹	
	Quantity (metric tons)	Value (thou- sands)		Quantity (metric tons)	Value (thou- sands)		Quantity (metric tons)	Value (thou- sands)
1916 ...	314	NA	1941 ...	1,112	NA	1966 ...	1,896	\$6,985
1917 ...	187	NA	1942 ...	³ 248	\$291	1967 ...	2,083	6,962
1918 ...	18	NA	1943 ...	³ 404	464	1968 ...	3,874	12,734
1919 ...	276	NA	1944 ...	³ 412	489	1969 ...	2,400	8,459
1920 ...	604	NA	1945 ...	719	891	1970 ...	4,073	15,222
1921 ...	1,047	NA	1946 ...	872	1,154	1971 ...	1,850	6,648
1922 ...	817	NA	1947 ...	422	650	1972 ...	871	2,915
1923 ...	762	NA	1948 ...	79	163	1973 ...	2,581	12,099
1924 ...	425	NA	1949 ...	77	177	1974 ...	6,003	47,774
1925 ...	367	NA	1950 ...	292	595	1975 ...	1,467	10,457
1926 ...	686	NA	1951 ...	268	763	1976 ...	540	2,998
1927 ...	1,026	NA	1952 ...	305	581	1977 ...	545	5,176
1928 ...	355	NA	1953 ...	130	298	1978 ...	498	5,926
1929 ...	803	NA	1954 ...	275	475	1979 ...	568	8,074
1930 ...	85	NA	1955 ...	258	504	1980 ...	595	10,194
1931 ...	(²)	NA	1956 ...	678	1,018	1981 ...	2,361	31,053
1932 ...	(²)	NA	1957 ...	1,130	1,526	1982 ...	5,769	84,454
1933 ...	(²)	NA	1958 ...	932	1,336	1983 ...	1,340	17,305
1934 ...	(²)	NA	1959 ...	958	1,890	1984 ...	1,429	14,409
1935 ...	2,329	NA	1960 ...	618	1,294	1985 ...	1,478	16,744
1936 ...	392	NA	1961 ...	552	1,264	1986 ...	1,547	9,742
1937 ...	318	NA	1962 ...	340	840	1987 ...	1,318	9,456
1938 ...	208	NA	1963 ...	1,569	4,225	1988 ...	1,209	9,838
1939 ...	2,029	NA	1964 ...	2,770	9,241	1989 ...	904	8,915
1940 ...	2,707	NA	1965 ...	2,647	10,078	1990 ...	658	3,344

NA Not available.

¹Imported as ore and exported as pigs, bars, etc.²1931-34 not separately recorded.³In addition, 244 metric tons of ingots, pigs, etc., was exported in 1942, 398 metric tons in 1943, and 405 metric tons in 1944; accounted for as domestic exports in "exports of miscellaneous manufactures."

Table 6.—Department of Defense stockpile disposals of tin

Year	Quantity of disposals (metric tons)	Value of disposals (dollars)	Total of disposals (metric tons)	Cumulative value of disposals (dollars)	Yearend inventory ¹ (metric tons)
1970	3,123	11,693,000	3,123	11,693,000	256,682
1971	1,764	6,411,000	4,887	18,104,000	254,892
1972	367	1,500,000	5,254	19,604,000	254,544
1973	19,824	105,555,000	25,078	125,159,000	234,720
1974	23,932	196,944,000	49,010	322,103,000	210,788
1975	594	4,276,000	49,604	326,379,000	210,193
1976	3,644	26,282,000	53,248	352,661,000	206,550
1977	2,373	27,958,000	55,621	380,619,000	204,146
1978	330	4,019,000	55,951	384,638,000	203,697
1979	—	—	55,951	384,638,000	203,697
1980	25	378,530	55,976	385,016,530	203,669
1981	5,920	88,291,584	61,896	473,308,114	197,438
1982	4,172	60,426,932	66,068	533,735,046	193,528
1983	2,865	38,058,781	68,933	571,793,828	190,623
1984	2,397	29,756,875	71,330	601,550,703	188,214
1985	3,005	33,081,125	74,335	634,631,828	185,220
1986	5,490	33,853,066	79,825	668,484,894	180,889
1987	4,080	28,216,234	83,905	696,701,128	177,053
1988	2,385	17,465,723	86,290	714,166,851	174,269
1989	2,775	23,138,710	89,065	737,305,561	171,233
1990	2,145	13,321,406	91,210	750,626,967	169,252

¹Inventory amounts may not agree with sales figures because of reporting time lags.

Table 7.—Domestic primary and secondary consumption of tin
(Metric tons)

Consumption	1935	1936	1937	1938	1939	1940	1941
Primary	56,826	69,327	74,098	48,888	¹ 67,652	² 73,485	¹ 104,741
Secondary	15,495	15,056	17,478	11,845	16,099	25,229	32,116
Total	72,321	84,383	91,576	60,733	83,751	98,714	136,857
	1942	1943	1944	1945	1946	1947	1948
Primary	57,191	46,995	60,105	56,535	55,504	60,116	60,823
Secondary	29,871	34,624	27,588	28,389	26,738	29,398	31,421
Total	87,062	81,619	87,693	84,924	82,242	89,514	92,244
	1949	1950	1951	1952	1953	1954	1955
Primary	47,920	72,334	57,797	46,050	54,825	55,301	60,788
Secondary	25,648	33,807	31,787	28,398	32,189	28,921	31,147
Total	73,568	106,141	89,584	74,448	87,014	84,222	91,935
	1956	1957	1958	1959	1960	1961	1962
Primary	61,441	55,303	48,768	46,569	52,357	51,095	55,478
Secondary	30,333	28,529	24,982	32,046	29,496	28,411	24,876
Total	91,774	83,832	73,750	78,615	81,853	79,506	80,354
	1963	1964	1965	1966	1967	1968	1969
Primary	56,095	59,526	59,490	61,151	58,776	59,804	58,657
Secondary	23,465	24,694	25,870	25,683	23,156	23,473	23,430
Total	79,560	84,220	85,360	86,834	81,932	83,277	82,087
	1970	1971	1972	1973	1974	1975	1976
Primary	53,807	53,662	55,232	59,075	52,439	43,620	51,767
Secondary	21,215	18,522	15,952	16,763	13,341	12,180	11,161
Total	75,022	72,184	71,184	75,838	65,780	55,800	62,928

See footnotes at end of table.

Table 7.—Domestic primary and secondary consumption of tin—Continued
(Metric tons)

Consumption	1977	1978	1979	1980	1981	1982	1983
Primary	47,596	48,403	49,496	44,342	40,229	33,019	34,301
Secondary	13,136	13,128	12,969	12,020	14,144	13,276	11,246
Total	60,732	61,531	62,465	56,362	54,373	46,295	45,547
	1984	1985	1986	1987	1988	1989	1990
Primary	37,201	36,524	33,327	35,620	37,529	36,518	36,616
Secondary	11,114	12,145	10,197	8,599	8,072	9,853	7,747
Total	48,315	48,669	43,524	44,219	45,601	46,371	44,363

¹Does not include 316 tons in transit or warehouse.

²Includes small tonnage of secondary pig tin.

Table 8.—Tin prices
(Average dollars per pound)

	1880	1881	1882	1883	1884	1885	1886	1887
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.21	.21	.23	.21	.18	.20	.22	.25
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1888	1889	1890	1891	1892	1893	1894	1895
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.26	.21	.21	.21	.21	.20	.18	.14
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1896	1897	1898	1899	1900	1901	1902	1903
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.13	.14	.16	.25	.30	.17	.27	.28
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1904	1905	1906	1907	1908	1909	1910	1911
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.28	.31	.40	.38	.30	.30	.30	.42
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1912	1913	1914	1915	1916	1917	1918	1919
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.46	.44	.34	.39	.44	.62	.89	.63
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1920	1921	1922	1923	1924	1925	1926	1927
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.48	.30	.33	.43	.50	.58	.65	.64
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1928	1929	1930	1931	1932	1933	1934	1935
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.50	.45	.32	.25	.22	.39	.52	.50
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1936	1937	1938	1939	1940	1941	1942	1943
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.46	.54	.42	.50	.50	.52	.53	.43
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 8.—Tin prices—Continued
(Average dollars per pound)

	1944	1945	1946	1947	1948	1949	1950	1951
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	.52	.52	.55	.56	1.00	1.00	.96	1.27
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1952	1953	1954	1955	1956	1957	1958	1959
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	1.21	.96	.92	.95	1.01	.96	.95	1.02
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1960	1961	1962	1963	1964	1965	1966	1967
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer	1.01	1.13	1.15	1.17	1.58	1.79	1.64	1.53
Kuala Lumpur	NA	NA	NA	NA	NA	NA	NA	NA
London Metal Exchange	NA	NA	NA	NA	NA	NA	NA	NA
	1968	1969	1970	1971	1972	1973	1974	1975
Composite price	NA	NA	NA	NA	NA	NA	NA	NA
New York dealer ²	1.48	1.64	1.74	1.67	1.78	2.28	3.96	3.40
Kuala Lumpur ³	NA	NA	NA	1.67	1.68	2.14	3.56	3.04
London Metal Exchange	NA	NA	NA	NA	1.71	2.19	3.71	3.11
	1976	1977	1978	1979	1980	1981	1982	1983
Composite price ¹	3.80	5.35	6.30	7.54	8.46	7.33	6.54	6.55
New York dealer ²	3.49	4.99	5.87	7.11	7.73	6.48	5.87	6.01
Kuala Lumpur ³	3.39	4.86	5.68	6.72	7.46	6.38	5.87	5.91
London Metal Exchange	3.48	4.91	5.84	7.02	7.63	6.50	5.81	5.91
	1984	1985	1986	1987	1988	1989	1990	
Composite price ¹	6.24	⁴ 5.96	⁴ 3.83	4.19	4.41	5.20	3.86	
New York dealer ²	5.68	⁴ 5.26	⁴ 2.94	3.09	3.31	3.97	2.88	
Kuala Lumpur ³	5.65	⁴ 5.41	⁴ 2.72	3.03	3.20	3.87	2.76	
London Metal Exchange	5.58	⁴ 5.57	NA	NA	NA	3.82	2.81	

NA Not available.

¹Metals Week composite price (1976-90).

²Average New York price for Straits tin (1970-90).

³Straits tin, ex-works Penang started being quoted in Metals Week in 1971 and continued until 1985 when Kuala Lumpur replaced Penang as the reference market.

⁴Prices quoted for 10 months only because the funds used by the International Tin Council to support the tin price were exhausted.

Source: Metals Week.

Table 9.—U.S. Industry yearend tin stocks
(Metric tons)

	1942	1943	1944	1945	1946	1947	1948	1949	1950
Plant raw materials:									
Pig tin:									
Virgin ¹	31,562	23,228	17,615	14,328	14,765	13,897	14,579	13,992	20,906
Secondary	—	—	—	—	—	—	—	—	—
In process ²	—	—	—	—	—	—	—	11,024	11,461
Total	31,562	23,228	17,615	14,328	14,765	13,897	14,579	25,016	32,367
Additional pig tin:									
In transit in United States ..	79	321	1,972	1,626	1,016	955	333	62	1,376
Jobbers-importers	85	51	48	70	126	160	102	297	390
Afloat to United States	914	1,676	1,829	—	1,595	6,320	25	8,636	3,556
Total	1,078	2,048	3,849	1,696	2,737	7,435	460	8,995	5,322
Grand total	32,640	25,276	21,464	16,024	17,502	21,332	15,039	34,011	37,689

See footnotes at end of table.

Table 9.—U.S. Industry yearend tin stocks—Continued
(Metric tons)

	1951	1952	1953	1954	1955	1956	1957	1958	1959
Plant raw materials:									
Pig tin:									
Virgin ¹	10,204	12,009	13,900	12,357	16,465	16,551	20,449	18,465	23,196
Secondary	—	—	—	—	—	309	332	286	274
In process ²	10,893	11,467	11,019	11,343	11,737	12,042	11,763	11,734	12,620
Total	21,097	23,476	24,919	23,700	28,202	28,902	32,544	30,485	30,090
Additional pig tin:									
In transit in United States ..	987	533	244	1,362	2,037	1,844	1,331	1,971	1,930
Jobbers-Importers	83	540	264	1,219	264	630	671	1,067	1,976
Afloat to United States	909	5,385	2,743	5,283	5,426	5,588	1,763	1,687	1,885
Total	1,979	6,458	3,251	7,864	7,727	8,062	3,765	4,725	5,791
Grand total	23,076	29,934	28,170	31,564	35,929	36,964	36,309	35,210	41,881
	1960	1961	1962	1963	1964	1965	1966	1967	1968
Plant raw materials:									
Pig tin:									
Virgin ¹	21,216	24,059	19,509	18,120	21,262	25,725	20,861	17,318	16,231
Secondary	261	253	196	224	251	205	280	288	218
In process ²	12,519	12,281	11,666	11,678	11,601	11,954	12,102	12,965	12,145
Total	33,996	36,593	31,371	30,022	33,114	37,884	33,243	30,571	28,603
Additional pig tin:									
In transit in United States ..	2,611	432	117	178	224	137	91	20	1,204
Jobbers-importers	1,107	2,718	2,179	11,314	2,997	2,032	1,819	336	1,200
Afloat to United States	3,038	3,221	4,206	5,141	1,768	1,905	3,470	4,968	5,477
Total	6,756	6,371	³ 6,503	16,633	4,989	4,074	5,380	5,324	7,881
Grand total	40,752	42,964	³ 37,873	46,655	38,103	41,958	38,623	35,895	36,484
	1969	1970	1971	1972	1973	1974	1975	1976	1977
Plant raw materials:									
Pig tin:									
Virgin ¹	12,478	9,603	7,904	8,283	7,658	8,784	7,160	6,647	6,173
Secondary	257	226	259	258	343	312	317	243	645
In process ²	11,082	11,676	10,692	10,246	10,533	11,132	12,033	10,004	10,040
Total	23,817	21,505	18,855	18,787	18,534	20,228	19,510	16,894	16,858
Additional pig tin:									
In transit in United States ..	81	10	142	452	986	823	—	—	—
Jobbers-importers	1,229	1,661	1,656	2,763	1,153	691	2,059	1,009	1,436
Afloat to United States	5,959	3,556	4,583	3,785	3,688	4,409	4,115	3,582	3,072
Total	7,269	5,227	6,381	7,000	5,827	5,923	6,174	4,591	4,508
Grand total	31,086	26,732	25,236	25,787	24,361	26,151	25,684	21,485	21,366
	1978	1979	1980	1981	1982	1983	1984	1985	1986
Plant raw materials:									
Pig tin:									
Virgin ¹	4,129	5,727	7,359	6,857	6,269	6,326	5,490	5,712	5,754
Secondary	694	181	229	411	265	732	1,562	2,342	3,021
In process ²	8,761	1,167	1,247	1,449	1,015	682	1,124	1,342	1,377
Total	13,584	7,075	8,835	8,717	7,549	7,740	8,176	9,396	10,152
Additional pig tin:									
In transit in United States ..	—	—	—	—	—	—	—	—	—
Jobbers-importers	275	258	564	1,943	1,386	608	802	1,642	1,272
Afloat to United States	3,358	3,371	2,702	471	1,316	1,511	701	1,321	2,433
Total	3,633	3,629	3,266	2,414	2,702	2,119	1,503	2,963	3,705
Grand total	17,217	10,704	12,101	11,131	10,251	9,859	9,679	12,359	13,857

See footnotes at end of table.

Table 9.—U.S. Industry yearend tin stocks—Continued
(Metric tons)

	1987	1988	1989	1990
Plant raw materials:				
Pig tin:				
Virgin ¹	6,466	7,013	6,807	10,671
Secondary	2,333	1,440	2,253	1,219
In process ²	1,289	1,056	1,032	1,044
Total	10,088	9,509	10,092	12,934
Additional pig tin:				
In transit in United States ..	—	—	—	—
Jobbers-Importers	1,890	3,387	3,536	2,467
Afloat to United States	2,486	2,127	1,040	2,270
Total	4,376	5,514	4,576	4,737
Grand total	14,464	15,023	14,668	17,671

¹Includes tin in transit in the United States.

²Data represent scrap only, tin content.

³Data do not add to total shown because of independent rounding.

Page Intentionally Left Blank.

TITANIUM

By Joseph Gambogi

Titanium is the ninth most abundant element, making up about 0.6% of the Earth's crust. It occurs in nature only in chemical combination, usually with oxygen and iron. Because of the high strength-to-weight ratio of its alloys and their resistance to corrosion, titanium metal is an important strategic and critical material and is used widely for high-performance military and civilian aircraft in both engines and airframes.

Mineral sources for titanium are rutile, ilmenite, and leucoxene, an alteration product of ilmenite. Rutile is 93% to 96% titanium oxide (TiO_2), ilmenite may contain between 44% and 70% TiO_2 , and leucoxene concentrates may contain up to 90% TiO_2 . In addition, a high- TiO_2 slag is produced from ilmenite in Canada, Norway, and the Republic of South Africa that contains 75% to 85% TiO_2 .

Only about 5% of the world's annual production of titanium minerals goes to make titanium metal. The other 95% of such production is used primarily to make white TiO_2 pigment. Because of its whiteness, high refractive index, and resulting light-scattering ability, TiO_2 is the predominant white pigment for paints, paper, plastics, rubber, and various other materials.

The United States has become highly dependent on imports of the minerals used to make titanium and TiO_2 , which come primarily from Australia and Canada. In

1980, ilmenite import reliance, including high- TiO_2 slag made from ilmenite, was 35% but increased to about 80% in the 1982-84 period because of cessation of production at two U.S. ilmenite mines. Ilmenite import reliance through 1990 has generally been in the 70% to 80% range. Import reliance for rutile declined from about 90% in 1980 to about 60% in 1983, and, in later years, it has remained in the 60% to 70% range because of increased production of synthetic rutile. However, this decline was at the expense of increased import reliance for ilmenite, because domestic synthetic rutile was made from imported ilmenite.

A major problem affecting the titanium metal industry is the wide fluctuations on demand caused by changes in requirements for both military and commercial aircraft programs. Titanium sponge producers have repeatedly increased capacity in response to anticipated demand and have then been left with excess capacity when these programs were canceled or cut back. The most recent example of such a fluctuation was the historic peak in demand and price reached in 1980-81 and the subsequent collapse in 1982-84. The sharp rise and fall of demand and prices were believed to be aggravated by overestimation of aircraft orders that did not materialize or were later canceled.

Table 1.—U.S. production of titanium materials
(Metric tons)

Material	1970	1971	1972	1973	1974	1975	1976
Concentrates:							
Ilmenite	787,396	619,676	615,021	703,988	675,464	650,707	591,852
Rutile	—	—	W	8,464	5,848	W	W
Metal:							
Sponge	NA	NA	NA	NA	NA	NA	NA
Ingot	22,073	16,680	18,386	26,247	32,778	23,188	19,608
Titanium dioxide pigment:							
Gross weight	NA	NA	NA	NA	NA	NA	646,769
TiO_2 content	594,473	614,846	628,935	712,137	713,658	547,422	NA
	1977	1978	1979	1980	1981	1982	1983
Concentrates:							
Ilmenite	579,241	535,014	579,957	504,981	492,019	238,945	W
Rutile	W	W	W	W	W	W	W
Metal:							
Sponge	NA	NA	¹ 19,142	¹ 20,412	¹ 23,950	¹ 14,152	12,670
Ingot	23,861	28,472	33,941	38,886	41,945	24,073	23,985
Titanium dioxide pigment:							
Gross weight	623,330	635,715	673,205	659,746	690,541	598,480	689,810
TiO_2 content	NA	NA	NA	603,468	635,618	556,586	641,524

See footnotes at end of table.

Table 1.—U.S. production of titanium materials—Continued
(Metric tons)

Material	1984	1985	1986	1987	1988	1989	1990
Concentrates:							
Ilmenite	W	W	W	W	W	W	W
Rutile	W	W	W	W	W	W	W
Metal:							
Sponge	22,068	21,098	15,787	17,849	22,270	25,225	24,679
Ingot	36,255	32,103	31,836	33,762	38,856	41,306	36,809
Titanium dioxide pigment:							
Gross weight	757,399	783,394	844,274	878,558	926,746	1,006,581	978,659
TiO ₂ content	704,912	728,313	784,880	820,810	858,166	935,919	913,275

NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Calculated sponge production equals sponge consumption plus sponge exports minus sponge imports and adjustments for Government and industry stock changes.

Table 2.—U.S. shipments of titanium materials
(Metric tons)

	1970	1971	1972	1973	1974	1975	1976
Ilmenite:							
Gross weight	835,485	647,377	671,137	729,699	685,232	637,073	560,546
TiO ₂ content	442,070	352,716	378,798	415,982	394,267	366,747	340,185
Metal:							
Mill products	13,136	10,198	11,455	13,181	15,824	14,178	13,152
Castings	NA	NA	NA	NA	NA	219	233
Titanium dioxide pigment:¹							
Gross weight	583,997	621,148	657,763	720,297	688,616	522,627	645,711
TiO ₂ content	NA	NA	NA	NA	NA	NA	NA
	1977	1978	1979	1980	1981	1982	1983
Ilmenite:							
Gross weight	491,997	526,964	586,404	538,600	475,076	211,431	W
TiO ₂ content	300,405	320,093	353,381	324,937	282,002	132,200	W
Metal:							
Mill products	14,031	16,010	20,968	24,615	23,126	16,584	14,469
Castings	171	163	169	173	190	236	218
Titanium dioxide pigment:¹							
Gross weight	631,902	648,227	686,686	663,648	705,896	641,448	738,411
TiO ₂ content ^e	NA	NA	NA	618,033	660,299	600,999	692,018
	1984	1985	1986	1987	1988	1989	1990
Ilmenite:							
Gross weight	W	W	W	W	W	W	W
TiO ₂ content	W	W	W	W	W	W	W
Metal:							
Mill products	20,607	20,648	18,908	20,218	22,558	24,997	23,923
Castings	241	348	385	431	473	485	482
Titanium dioxide pigment:¹							
Gross weight	821,351	862,404	984,372	1,043,129	1,097,481	1,126,622	1,116,431
TiO ₂ content ^e	766,482	802,640	919,050	977,424	1,020,517	1,046,633	1,045,748

^eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Includes interplant transfers.

Table 3.—U.S. consumption of titanium materials
(Metric tons)

Material	1970		1971		1972		1973		1974	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Concentrates:										
Ilmenite	882,069	471,524	815,363	441,138	713,396	418,595	732,764	434,752	772,901	454,750
Rutile ¹	171,614	164,565	204,569	195,876	220,227	210,677	251,206	238,921	265,498	251,944
Titanium slag	117,251	83,134	130,230	92,307	239,583	170,195	255,637	180,790	233,260	165,341
Metal:										
Sponge	14,891	NAp	11,018	NAp	11,855	NAp	18,301	NAp	24,400	NAp
Ingot	21,489	NAp	15,475	NAp	17,689	NAp	23,051	NAp	28,634	NAp
Scrap	6,570	NAp	5,578	NAp	7,078	NAp	9,106	NAp	9,615	NAp
Titanium dioxide pigment	641,217	NA	666,707	NA	691,814	NA	767,031	NA	665,684	NA
	1975		1976		1977		1978		1979	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Concentrates:										
Ilmenite	678,413	392,275	745,942	451,790	² 786,080	² 472,820	718,753	431,320	717,641	442,006
Rutile ¹	209,950	198,604	215,654	202,858	168,209	157,705	238,757	222,427	284,640	265,726
Titanium slag	134,232	94,878	185,033	131,094	135,583	96,344	116,869	82,998	131,277	96,476
Metal:										
Sponge	15,990	NAp	12,079	NAp	14,729	NAp	18,011	NAp	21,715 ¹	NAp
Ingot	22,213	NAp	19,055	NAp	22,898	NAp	27,892	NAp	34,353	NAp
Scrap	7,544	NAp	8,356	NAp	9,878	NAp	11,175	NAp	12,688	NAp
Titanium dioxide pigment	542,677	NA	683,970	NA	712,144	NA	727,316	NA	759,353	NA
	1980		1981		1982		1983		1984	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Concentrates:										
Ilmenite	769,844	465,672	776,656	463,592	529,116	319,686	662,770	430,264	710,681	452,665
Rutile ¹	269,962	252,091	258,885	241,852	216,760	204,219	240,910	227,176	288,396	270,921
Titanium slag	164,729	121,502	229,360	168,755	204,608	152,800	150,957	115,455	182,216	138,377
Metal:										
Sponge	24,442	NAp	^a 28,666	NAp	15,720	NAp	14,580	NAp	22,419	NAp
Ingot	39,336	NAp	39,730	NAp	25,020	NAp	23,797	NAp	35,436	NAp
Scrap	13,976	NAp	^c 13,422	NAp	7,736	NAp	9,496	NAp	14,106	NAp
Titanium dioxide pigment	683,546	623,156	731,228	673,204	672,284	627,840	773,837	718,324	831,162	775,347
	1985		1986		1987		1988		1989	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Concentrates:										
Ilmenite	685,896	436,366	731,436	465,136	744,266	463,072	679,008	429,736	659,584	419,743
Rutile ¹	276,944	259,898	298,601	280,669	320,505	301,534	352,356	331,376	366,143	345,989
Titanium slag	228,635	181,083	250,677	201,358	251,423	202,688	300,013	242,594	414,830	335,395
Metal:										
Sponge	19,601	NAp	17,680	NAp	17,973	NAp	21,003	NAp	24,927	NAp
Ingot	31,770	NAp	30,664	NAp	32,260	NAp	35,556	NAp	31,396	NAp
Scrap	13,354	NAp	14,957	NAp	16,363	NAp	18,058	NAp	17,596	NAp
Titanium dioxide pigment	893,196	830,989	908,055	845,176	966,169	904,322	991,536	920,805	947,259	884,562
	1990									
	Gross weight	TiO ₂ content ^c								
Concentrates:										
Ilmenite	688,948	446,228								
Rutile ¹	369,454	347,057								

See footnotes at end of table.

Table 3.—U.S. Consumption of Titanium Materials—Continued
(Metric tons)

Material	1990	
	Gross weight	TiO ₂ content ^c
Concentrates—		
Continued		
Titanium slag	390,537	313,648
Metal:		
Sponge	23,207	NAp
Ingot	35,320	NAp
Scrap	14,973	NAp
Titanium dioxide pigment	925,447	863,196

^cEstimated. NA Not available. NAp Not applicable.

¹From 1970-75, natural rutile only; 1976 and 1978-90 include natural and synthetic rutile.

²Includes an estimate of ilmenite used for domestic production of synthetic rutile.

Table 4.—U.S. distribution of domestic titanium pigment shipments, titanium dioxide content, by Industry
(Percentage)

	1970	1971	1972	1973	1974	1975	1976
Ceramics	2.1	2.3	2.4	2.7	2.2	1.9	2.0
Coated fabrics and textiles	1.4	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Floor coverings	2.1	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Paint, varnish, and lacquer	55.8	56.2	52.6	53.7	54.6	60.3	52.6
Paper	19.3	20.4	21.2	20.3	19.5	19.5	22.0
Plastics	7.6	7.3	8.0	10.0	11.8	7.6	10.9
Printing ink	2.5	(¹)	(¹)	(¹)	(¹)	(¹)	2.1
Roofing granules	1.0	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Rubber	3.0	3.1	3.8	3.3	2.8	2.9	2.8
Other	² 5.2	10.7	12.0	10.0	9.1	7.8	7.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	1977	1978	1979	1980	1981	1982	1983
Ceramics	1.9	2.2	2.0	1.8	1.5	1.2	1.0
Coated fabrics and textiles	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Floor coverings	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Paint, varnish, and lacquer	53.3	51.0	50.0	47.0	47.0	48.1	48.9
Paper	21.2	22.2	23.0	25.9	25.9	27.4	27.3
Plastics	12.0	12.4	12.4	11.3	12.4	12.7	13.2
Printing ink	2.0	2.1	2.0	3.0	1.4	1.0	1.1
Roofing granules	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Rubber	3.2	3.0	3.1	2.2	2.4	2.6	1.8
Other	6.4	7.1	7.5	8.8	9.4	7.0	6.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	1984	1985	1986 ³	1987	1988	1989	1990
Ceramics	1.0	W	W	W	0.4	0.4	W
Coated fabrics and textiles	(¹)	0.4	0.4	0.3	W	.4	.2
Floor coverings	(¹)	W	.9	1.2	1.2	1.1	1.0
Paint, varnish, and lacquer	54.8	54.3	52.6	49.5	48.1	50.0	48.9
Paper	19.9	20.5	20.7	24.3	24.2	25.8	26.5
Plastics	15.4	16.2	15.8	17.0	17.0	16.3	16.6
Printing ink	1.2	1.0	1.4	1.2	1.7	.8	1.6
Roofing granules	(¹)	W	.4	.4	.4	.3	.4
Rubber	2.0	1.7	2.0	1.8	1.7	1.4	1.5
Other	5.7	5.9	5.8	4.3	5.3	3.5	3.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

W Withheld to avoid disclosing company proprietary data; included in "Other."

¹Included in "Other."

²Includes exports.

³Data coverage extended beginning in 1986 to include additional importers.

Table 5.—U.S. exports of titanium
(Metric tons and thousand dollars)

	1970		1971		1972	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	960	201	1,597	299	1,635	394
Metal:						
Ingot, slab, sheet, bar, etc.	¹ 1,579	¹ 10,435	¹ 390	¹ 4,788	¹ 510	¹ 6,265
Scrap	² 2,633	² 2,588	² 1,552	² 1,139	² 3,184	² 2,165
Sponge	NA	NA	NA	NA	NA	NA
Other unwrought	NA	NA	NA	NA	NA	NA
Other wrought	NA	NA	NA	NA	NA	NA
Titanium dioxide pigments	³ 23,763	³ 7,950	³ 24,275	³ 9,378	³ 9,376	³ 4,882
Titanium compounds, except pigment grade	NA	NA	NA	NA	NA	NA
	1973		1974		1975	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	1,355	353	2,961	727	2,855	505
Metal:						
Ingot, slab, sheet, bar, etc.	¹ 676	¹ 8,748	¹ 559	¹ 19,600	¹ 724	¹ 24,726
Scrap	² 3,758	² 3,601	² 4,291	² 9,288	² 3,924	² 7,630
Sponge	NA	NA	NA	NA	NA	NA
Other unwrought	NA	NA	NA	NA	NA	NA
Other wrought	NA	NA	NA	NA	NA	NA
Titanium dioxide pigments	³ 18,841	³ 14,021	³ 27,559	³ 24,575	³ 14,340	³ 12,110
Titanium compounds, except pigment grade	NA	NA	NA	NA	NA	NA
	1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	4,356	477	20,574	743	NA	NA
Metal:						
Ingot, slab, sheet, bar, etc.	¹ 966	¹ 15,039	¹ 953	¹ 14,254	1,216	11,290
Scrap	² 5,574	² 8,547	² 3,079	² 5,643	4,947	8,777
Sponge	NA	NA	NA	NA	88	351
Other unwrought	NA	NA	NA	NA	191	1,141
Other wrought	NA	NA	NA	NA	625	11,768
Titanium dioxide pigments	18,647	16,155	14,719	12,506	34,303	26,967
Titanium compounds, except pigment grade	23	74	101	122	1,387	2,505
	1979		1980		1981	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	8,984	2,057	16,175	3,444	6,620	2,099
Metal:						
Ingot, slab, sheet, bar, etc.	1,800	26,456	2,974	61,962	3,813	105,647
Scrap	4,506	18,265	2,994	12,681	2,976	6,811
Sponge	163	1,019	103	1,088	53	451
Other unwrought	141	1,125	312	2,891	233	2,244
Other wrought	1,194	25,912	1,674	51,589	1,675	53,807
Titanium dioxide pigments	44,787	43,940	38,216	43,352	55,433	63,398
Titanium compounds, except pigment grade	1,893	4,211	3,328	6,005	1,205	3,004
	1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	19,670	1,280	3,983	1,006	7,848	1,936
Metal:						
Ingot, slab, sheet, bar, etc.	1,992	60,240	1,244	29,232	1,879	40,993
Scrap	3,889	6,718	4,880	7,074	3,728	7,168
Sponge	33	256	35	203	155	967
Other unwrought	157	1,218	234	1,896	185	1,224
Other wrought	1,274	40,368	710	22,965	706	20,509
Titanium dioxide pigments	66,064	77,657	83,191	86,900	96,274	97,804
Titanium compounds, except pigment grade	1,178	4,411	1,650	5,232	1,926	5,024

See footnotes at end of table.

Table 5.—U.S. exports of titanium—Continued
(Metric tons and thousand dollars)

	1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	25,183	6,953	4,821	1,414	4,023	1,395
Metal:						
Ingot, slab, sheet, bar, etc.	2,039	40,942	1,922	38,754	2,467	44,203
Scrap	6,133	14,533	5,809	10,652	5,083	9,721
Sponge	46	338	63	461	85	746
Other unwrought	164	2,604	188	1,757	204	2,254
Other wrought	1,041	29,481	1,027	31,413	1,801	40,534
Titanium dioxide pigments	92,491	108,384	101,811	145,920	108,889	181,707
Titanium compounds, except pigment grade	1,131	4,486	2,921	10,415	11,819	28,478
	1988		1989 ⁴		1990	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	9,368	3,729	19,832	5,900	18,765	7,398
Metal:						
Ingot, slab, sheet, bar, etc.	2,083	33,312	3,882	104,835	4,067	102,977
Scrap	5,989	23,374	5,474	22,909	5,487	22,443
Sponge	80	574	136	910	331	2,073
Other unwrought	210	1,480	1,173	8,906	3,102	20,502
Other wrought	2,679	71,958	2,009	60,542	2,829	94,046
Titanium dioxide pigments	118,422	219,237	⁵ 212,197	437,645	⁵ 202,288	434,560
Titanium compounds, except pigment grade	4,478	14,885	NA	NA	NA	NA

NA Not available.

¹May include other wrought metal.

²May include sponge.

³May include oxides.

⁴Because of the implementation of the Harmonized Tariff System in Jan. 1989, export categories for 1989 and 1990 are not necessarily comparable with those in prior years.

⁵Includes material classified as titanium oxide.

Source: Bureau of the Census.

Table 6.—U.S. imports for consumption of titanium
(Metric tons and thousand dollars)

	1970		1971		1972	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	87,201	976	25,486	358	13,459	155
Titanium slag	122,466	5,455	138,492	6,561	270,576	13,124
Rutile	¹ 220,527	¹ 19,796	¹ 206,642	¹ 24,254	191,718	23,260
Synthetic rutile	NA	NA	NA	NA	8,346	814
Metal:						
Ingot	NA	NA	NA	NA	NA	NA
Sponge	5,381	⁶ 8,986	2,542	4,194	3,405	² 6,350
Mill products	501	NA	249	NA	NA	NA
Scrap	³ 555	³ 1,517	³ 200	³ 806	³ 381	³ 604
Titanium dioxide pigment	54,619	22,185	38,857	15,709	78,362	33,400
	1973		1974		1975	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	63,177	875	74,796	1,448	110,686	2,059
Titanium slag	215,228	10,981	214,343	12,267	192,942	13,844
Rutile	156,222	24,094	176,554	32,862	150,986	35,552
Synthetic rutile	49,582	4,427	47,058	5,911	52,677	10,810
Metal:						
Ingot	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 6.—U.S. Imports for consumption of titanium—Continued
(Metric tons and thousand dollars)

	1973		1974		1975	
	Quantity	Value	Quantity	Value	Quantity	Value
Metal—Continued						
Sponge	4,692	² 9,064	6,317	² 14,948	3,801	² 14,168
Mill products	166	918	176	1,633	189	2,221
Scrap	³ 1,333	³ 1,407	³ 2,608	³ 2,939	³ 795	³ 1,943
Titanium dioxide pigment	54,811	27,489	31,721	24,437	23,512	18,131
	1976		1977		1978	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	152,772	2,646	303,898	5,677	280,022	4,466
Titanium slag	155,695	13,291	136,590	13,514	135,327	14,858
Rutile	177,840	42,037	88,214	20,940	230,452	47,499
Synthetic rutile	77,725	12,812	24,096	3,541	32,285	5,375
Metal:						
Ingot	NA	NA	NA	NA	509	2,681
Sponge	1,613	6,977	2,165	8,976	1,339	6,088
Mill products	293	2,939	321	2,958	1,021	9,044
Scrap	1,687	2,774	4,077	6,575	3,437	8,139
Titanium dioxide pigment	62,429	50,341	104,154	84,712	106,783	90,741
	1979		1980		1981	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	167,356	2,846	324,308	6,674	214,293	5,887
Titanium slag	100,888	11,100	176,896	20,414	243,874	30,328
Rutile	150,060	30,454	184,469	49,745	146,077	47,790
Synthetic rutile	107,108	19,105	70,999	12,874	37,513	11,234
Metal:						
Ingot	307	2,859	173	4,854	221	5,139
Sponge	2,257	14,580	4,334	60,214	5,888	93,515
Mill products	855	10,144	858	15,269	1,012	21,573
Scrap	5,570	22,267	3,754	28,440	3,436	19,574
Titanium dioxide pigment	95,225	88,310	88,532	91,986	113,313	127,396
	1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	316,033	8,765	235,259	9,262	371,588	11,063
Titanium slag	224,841	32,865	125,834	20,161	190,363	32,783
Rutile	126,218	36,131	82,547	19,836	143,757	41,100
Synthetic rutile	21,948	3,479	18,675	3,696	19,997	3,810
Metal:						
Ingot	192	3,560	73	1,228	160	2,447
Sponge	1,228	17,232	1,088	7,856	⁴ 2,419	15,815
Mill products	789	16,240	848	14,354	762	11,504
Scrap	1,158	3,648	1,426	4,461	1,678	5,703
Titanium dioxide pigment	126,028	146,569	158,628	165,495	175,541	186,952
	1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	459,765	14,590	422,401	16,837	307,515	11,981
Titanium slag	264,742	52,231	328,285	64,726	408,785	83,006
Rutile	132,995	40,509	129,433	45,865	145,812	57,412
Synthetic rutile	29,992	3,458	29,161	6,349	52,125	14,701
Metal:						
Ingot	162	2,131	96	1,747	69	1,111
Sponge	⁴ 1,558	10,164	1,475	9,583	924	6,321
Mill products	1,315	21,038	986	16,946	891	15,747
Scrap	1,936	6,075	2,155	5,927	2,218	6,579
Titanium dioxide pigment	178,001	206,809	183,863	240,058	174,219	236,945

See footnotes at end of table.

Table 6.—U.S. Imports for consumption of titanium—Continued
(Metric tons and thousand dollars)

	1988		1989 ⁵		1990	
	Quantity	Value	Quantity	Value	Quantity	Value
Concentrates:						
Ilmenite	394,170	19,489	411,751	25,500	345,907	22,962
Titanium slag	434,641	92,889	386,146	85,111	373,623	89,450
Rutile	154,348	66,899	188,625	91,715	218,026	111,627
Synthetic rutile	76,776	27,050	76,270	28,213	56,579	16,037
Metal:						
Ingot	237	3,163	190	2,102	162	47
Sponge	1,364	10,523	903	8,181	1,093	10,398
Mill products	822	15,739	1,250	34,085	1,266	35,746
Scrap	4,235	22,863	5,308	41,898	3,037	17,550
Titanium dioxide pigment	185,468	291,832	⁶ 166,346	219,211	⁶ 147,592	259,083

⁵Estimated. NA Not available.

¹Includes synthetic rutile.

²Calculated value.

³May include unwrought titanium.

⁴Excludes sponge imported by Government Services Administration for the national stockpile.

⁵Because of the implementation of the Harmonized Tariff System in Jan. 1989, import categories for 1989 and 1990 are not necessarily comparable with those of recent years.

⁶Includes material classified as titanium oxide.

Source: Bureau of the Census.

Table 7.—Yearend stocks of titanium metal (sponge)
(Metric tons)

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Government stockpile	2,625	6,030	8,451	17,981	20,378	20,388	20,388	20,376	20,376	20,295
Industry	NA	775	2,722	2,540	907	998	907	1,089	1,179	998
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Government stockpile	20,189	20,266	19,428	18,789	18,789	18,493	18,138	18,138	31,765	29,499
Industry	726	816	726	2,631	2,359	1,732	2,282	2,471	1,647	1,761
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Government stockpile	28,217	28,751	29,328	29,330	29,330	29,330	29,330	29,330	29,330	29,330
Industry	3,467	5,143	3,281	3,217	2,397	1,955	2,160	⁶ 3,375	3,039	2,845
	1984	1985	1986	1987	1988	1989	1990			
Government stockpile	29,456	33,413	33,413	33,413	33,413	33,413	33,413			
Industry	2,855	4,314	2,885	2,272	2,439	2,114	3,267			

⁶Estimated. NA Not available.

Table 8.—Yearend prices of titanium concentrates and products
(Per metric ton unless otherwise specified)

	1960	1961	1962
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	\$23.00 - \$26.00	\$23.00 - \$26.00	\$23.00 - \$26.00
Ilmenite, f.o.b. Australian ports	NA	NA	NA
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Rutile, f.o.b. eastern U.S. ports	88.00	88.00	105.00
Rutile, bagged, f.o.b. Australian ports	NA	NA	NA
Rutile, bulk, f.o.b. Australian ports	NA	NA	NA
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Synthetic rutile, f.o.b. Mobile, AL	NA	NA	NA
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec	NA	NA	NA
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA	NA	NA
Metal, sponge, reported sales	per pound		
	1.50 - 1.60	1.50 - 1.60	1.32 - 1.60

See footnotes at end of table.

Table 8.—Yearend prices of titanium concentrates and products—Continued
(Per metric ton unless otherwise specified)

	1960		1961		1962	
Pigment:						
Titanium dioxide pigment, f.o.b. U.S. plants, anatase . . . per pound . .	.255 -	.265	.255 -	.265	.255 -	.265
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound . .	.255 -	.265	.255 -	.265	.255 -	.265
	1963		1964		1965	
Concentrates:						
Ilmenite, f.o.b. eastern U.S. ports	\$23.00 - \$26.00		\$23.00 - \$26.00		\$21.00 - \$24.00	
Ilmenite, f.o.b. Australian ports	NA		NA		NA	
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA		NA		NA	
Rutile, f.o.b. eastern U.S. ports	115.00		115.00		118.00 - 122.00	
Rutile, bagged, f.o.b. Australian ports	NA		NA		NA	
Rutile, bulk, f.o.b. Australian ports	NA		NA		NA	
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA		NA		NA	
Synthetic rutile, f.o.b. Mobile, AL	NA		NA		NA	
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec	NA		NA		NA	
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA		NA		NA	
Metal, sponge, reported sales per pound . .	1.27	1.60	1.32		1.32	
Pigment:						
Titanium dioxide pigment, f.o.b. U.S. plants, anatase . . . per pound . .	.255 -	.265	.255 -	.265	.255 -	.265
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound . .	.275 -	.285	.275 -	.285	.275 -	.285
	1966		1967		1968	
Concentrates:						
Ilmenite, f.o.b. eastern U.S. ports	\$39.00		\$39.00		\$33.00 - \$39.00	
Ilmenite, f.o.b. Australian ports	NA		NA		NA	
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA		NA		NA	
Rutile, f.o.b. eastern U.S. ports	131.00 - 133.00		131.00 - 133.00		133.00 - 138.00	
Rutile, bagged, f.o.b. Australian ports	NA		NA		NA	
Rutile, bulk, f.o.b. Australian ports	NA		NA		NA	
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA		NA		NA	
Synthetic rutile, f.o.b. Mobile, AL	NA		NA		NA	
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec	NA		42.00		42.00	
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA		NA		NA	
Metal, sponge, reported sales per pound . .	1.32		1.32		1.32	
Pigment:						
Titanium dioxide pigment, f.o.b. U.S. plants, anatase . . . per pound . .	.255 -	.265	.255 -	.265	.255 -	.265
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound . .	.275 -	.285	.275 -	.285	.285 -	.295
	1969		1970		1971	
Concentrates:						
Ilmenite, f.o.b. eastern U.S. ports	\$33.00 - \$39.00		\$33.00 - \$39.00		\$33.00 - \$39.00	
Ilmenite, f.o.b. Australian ports	NA		NA		NA	
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA		NA		NA	
Rutile, f.o.b. eastern U.S. ports	176.00		204.00		204.00	
Rutile, bagged, f.o.b. Australian ports	NA		NA		NA	
Rutile, bulk, f.o.b. Australian ports	NA		NA		NA	
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA		NA		NA	
Synthetic rutile, f.o.b. Mobile, AL	NA		NA		NA	
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec	44.00		44.00		44.00	
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA		NA		NA	
Metal, sponge, reported sales per pound . .	1.32		1.32		1.32	
Pigment:						
Titanium dioxide pigment, f.o.b. U.S. plants, anatase . . . per pound . .	.265 -	.270	.26 -	.275	.26 -	.27
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound . .	.285 -	.295	.26 -	.285	.26 -	.28
	1972		1973		1974	
Concentrates:						
Ilmenite, f.o.b. eastern U.S. ports	NA		\$37.00		\$54.00	
Ilmenite, f.o.b. Australian ports	13.00 - 14.00		15.00 - 17.00		17.00 - 19.00	

See footnotes at end of table.

Table 8.—Yearend prices of titanium concentrates and products—Continued
(Per metric ton unless otherwise specified)

	1972	1973	1974
Concentrates—Continued			
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Rutile, f.o.b. eastern U.S. ports	193.00	342.00	783.00
Rutile, bagged, f.o.b. Australian ports	NA	NA	NA
Rutile, bulk, f.o.b. Australian ports	NA	147.00 - 152.00	290.00 - 330.00
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Synthetic rutile, f.o.b. Mobile, AL	NA	NA	NA
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec	49.00	59.00	59.00
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA	NA	NA
Metal, sponge, reported sales	1.32	1.42 - 1.45	2.75
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase .. per pound ..	.23 - .285	.24 - .295	.305 - .385
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound ..	.26 - .295	.275 - .30	.35 - .43
	1975	1976	1977
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	\$54.00	\$54.00	\$54.00
Ilmenite, f.o.b. Australian ports	19.00 - 23.00	18.00 - 21.00	19.00 - 21.00
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Rutile, f.o.b. eastern U.S. ports	783.00	562.00	397.00
Rutile, bagged, f.o.b. Australian ports	NA	NA	NA
Rutile, bulk, f.o.b. Australian ports	313.00 - 350.00	269.00 - 275.00	202.00 - 213.00
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Synthetic rutile, f.o.b. Mobile, AL	NA	¹ 209.00	¹ 168.00
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec	74.00	87.00	² 101.00
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA	NA	NA
Metal, sponge, reported sales	2.70	2.70 - 2.75	2.98
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase .. per pound ..	.385	.41	.435
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound ..	.435	.465	.435
	1978	1979	1980
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	\$49.00	\$54.00	\$54.00
Ilmenite, f.o.b. Australian ports	17.00 - 19.00	18.00 - 19.00	21.00 - 23.00
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Rutile, f.o.b. eastern U.S. ports	358.00 - 386.00	468.00 - 496.00	468.00 - 496.00
Rutile, bagged, f.o.b. Australian ports	NA	354.00 - 388.00	409.00 - 468.00
Rutile, bulk, f.o.b. Australian ports	254.00 - 276.00	321.00 - 366.00	340.00 - 386.00
Rutile, large lots, bulk, f.o.b. U.S. east coast	NA	NA	NA
Synthetic rutile, f.o.b. Mobile, AL	² 186.00	² 200.00	342.00
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec ²	108.00	108.00	113.00
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	NA	NA	135.00
Metal, sponge, reported sales	3.28	3.98	7.02
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase .. per pound ..	.46	.53	.57
Titanium dioxide pigment, f.o.b. U.S. plants, rutile per pound ..	.51	.59	.636
	1981	1982	1983
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	\$69.00 - \$74.00	\$69.00 - \$74.00	\$69.00 - \$74.00
Ilmenite, f.o.b. Australian ports	25.00 - 27.00	28.00 - 31.00	30.00 - 33.00
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	38.00	43.00 - 44.00	43.00 - 44.00
Rutile, f.o.b. eastern U.S. ports	496.00 - 524.00	496.00 - 524.00	441.00 - 474.00
Rutile, bagged, f.o.b. Australian ports	338.00 - 360.00	265.00 - 276.00	294.00 - 313.00
Rutile, bulk, f.o.b. Australian ports	304.00 - 327.00	255.00 - 265.00	285.00 - 303.00
Rutile, large lots, bulk, f.o.b. U.S. east coast	386.00	342.00	342.00
Synthetic rutile, f.o.b. Mobile, AL	375.00	386.00	386.00
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec ²	133.00	148.00	159.00

See footnotes at end of table.

Table 8.—Yearend prices of titanium concentrates and products—Continued
(Per metric ton unless otherwise specified)

	1981	1982	1983
Concentrates—Continued			
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	\$167.00 - 177.00	\$167.00 - 177.00	\$187.00 - 198.00
Metal, sponge, reported sales	7.65	5.55 - 5.85	5.55 - 5.85
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase	.69	.69	.69
Titanium dioxide pigment, f.o.b. U.S. plants, rutile	.75	.75	.75
	1984	1985	1986
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	\$70.00 - \$75.00	⁽³⁾	⁽³⁾
Ilmenite, f.o.b. Australian ports	36.00 - 38.00	\$38.00 - \$42.00	\$47.00 - \$53.00
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	44.00 - 45.00	50.00 - 56.00	50.00 - 56.00
Rutile, f.o.b. eastern U.S. ports	507.00 - 540.00	⁽³⁾	⁽³⁾
Rutile, bagged, f.o.b. Australian ports	374.00 - 396.00	409.00 - 425.00	50.00 - 56.00
Rutile, bulk, f.o.b. Australian ports	352.00 - 369.00	347.00 - 362.00	50.00 - 56.00
Rutile, large lots, bulk, f.o.b. U.S. east coast	352.00 - 375.00	386.00 - 397.00	50.00 - 56.00
Synthetic rutile, f.o.b. Mobile, AL	386.00	386.00	386.00
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec ²	\$185.00	\$196.00	\$210.00 - 215.00
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	\$200.00	\$212.00	\$225.00 - 230.00
Metal, sponge, reported sales	4.00 - 4.25	3.50 - 4.00	3.90 - 4.30
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase	.69	.72 - .73	.75 - .77
Titanium dioxide pigment, f.o.b. U.S. plants, rutile	.75	.78	.80 - .82
	1987	1988	1989
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	⁽³⁾	⁽³⁾	⁽³⁾
Ilmenite, f.o.b. Australian ports	\$46.00 - \$52.00	\$64.00 - \$77.00	\$67.00 - \$75.00
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	50.00 - 56.00	NA	NA
Rutile, f.o.b. eastern U.S. ports	⁽³⁾	⁽³⁾	⁽³⁾
Rutile, bagged, f.o.b. Australian ports	439.00 - 461.00	547.00 - 572.00	553.00 - 632.00
Rutile, bulk, f.o.b. Australian ports	410.00 - 432.00	499.00 - 542.00	514.00 - 553.00
Rutile, large lots, bulk, f.o.b. U.S. east coast	391.00 - 413.00	NA	540.00 - 550.00
Synthetic rutile, f.o.b. Mobile, AL	386.00	NA	NA
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec ²	\$215.00 - 225.00	\$235.00 - 255.00	\$260.00 - 280.00
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	\$235.00 - 245.00	\$250.00 - 275.00	\$275.00 - 300.00
Metal, sponge, reported sales	4.00 - 4.20	4.25 - 4.75	4.80 - 5.30
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase	.75 - .77	.92 - .95	1.01 - 1.02
Titanium dioxide pigment, f.o.b. U.S. plants, rutile	.80 - .82	.95 - .97	1.04 - 1.05
	1990		
Concentrates:			
Ilmenite, f.o.b. eastern U.S. ports	⁽³⁾		
Ilmenite, f.o.b. Australian ports	\$69.00 - \$75.00		
Ilmenite, large lots, bulk, f.o.b. U.S. east coast	NA		
Rutile, f.o.b. eastern U.S. ports	⁽³⁾		
Rutile, bagged, f.o.b. Australian ports	693.00 - 770.00		
Rutile, bulk, f.o.b. Australian ports	732.00 - 847.00		
Rutile, large lots, bulk, f.o.b. U.S. east coast	550.00 - 580.00		
Synthetic rutile, f.o.b. Mobile, AL	NA		
Titanium slag, 80% TiO ₂ , f.o.b. Sorel, Quebec ²	\$270.00 - 290.00		
Titanium slag, 85% TiO ₂ , f.o.b. Richards Bay, Republic of South Africa	\$285.00 - 310.00		
Metal, sponge, reported sales	4.50 - 5.00		
Pigment:			
Titanium dioxide pigment, f.o.b. U.S. plants, anatase	.99		
Titanium dioxide pigment, f.o.b. U.S. plants, rutile	1.01		

⁰Estimated. NA Not available.

¹Average declared valuations of synthetic rutile imports at foreign ports of shipments, c.i.f.

²Titanium slag from Sorel, Quebec, contained 72% TiO₂ from 1977-81, 74% TiO₂ from 1982-83, and 80% TiO₂ from 1984-90.

³List price suspended effective Jan. 1, 1985.

Source: U.S. Bureau of Mines Minerals Yearbooks.

Table 9.—Titanium: world production of concentrates (ilmenite, leucoxene, rutile, and titaniferous slag), by country (Metric tons)

Concentrate type and country	1986	1987	1988	1989	1990
Ilmenite and leucoxene:¹					
Australia:					
Ilmenite	1,237,694	1,498,087	1,610,175	1,696,000	1,600,000
Leucoxene	14,143	11,290	11,742	18,000	19,000
Brazil	75,472	169,627	143,681	146,800	150,000
China ^c	140,000	140,000	150,000	150,000	150,000
India	^c 140,000	^c 140,000	^c 140,000	^c 160,000	160,000
Malaysia	414,941	509,202	486,305	520,787	501,585
Norway	803,622	852,322	898,035	929,830	814,000
Portugal	232	141	59	111	45
Sierra Leone	—	5,600	42,118	62,310	54,639
Sri Lanka	129,907	128,500	74,305	^c 75,000	75,000
Thailand	14,295	27,078	18,254	16,985	10,674
U.S.S.R. ^c	450,000	455,000	460,000	460,000	432,000
United States	W	W	W	W	W
Total ²	3,420,000	3,437,000	4,035,000	4,236,000	3,966,943
Rutile:					
Australia	215,774	246,263	230,637	243,000	226,000
Brazil	495	324	1,514	2,600	2,600
India	^c 7,000	^c 7,000	^c 5,000	^c 5,000	5,000
Sierra Leone	97,100	113,300	126,332	128,198	144,284
South Africa, Republic of ^c	55,000	55,000	55,000	^c 60,000	64,056
Sri Lanka	8,443	7,200	5,255	^c 5,200	5,000
Thailand	48	92	128	—	—
U.S.S.R. ^c	10,000	10,000	10,000	10,000	9,500
United States	W	W	W	W	W
Total ²	394,000	439,000	433,866	453,998	456,440
Titaniferous slag:					
Canada ³	^c 850,000	^c 925,000	^c 1,025,000	^c 1,040,000	760,000
South Africa, Republic of ^{c,4}	435,000	650,000	700,000	725,000	840,000
Total ²	1,285,000	1,575,000	1,725,000	1,765,000	1,600,000

^cEstimated. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Ilmenite is also produced in Canada and in the Republic of South Africa, but the output is not included here because nearly all of it is duplicative of output reported under "Titaniferous slag."

²Data may not add to totals shown because of independent rounding.

³Contains 80% TiO₂.

⁴Contains 85% TiO₂.

Table 10.—Yearend stocks of titanium concentrates and pigment in the United States (Metric tons)

	1941		1942		1943		1944		1945	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	319,384	178,150	156,590	83,686	115,715	56,290	152,122	68,812	247,297	123,160
Titanium slag	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rutile	3,299	3,077	5,381	5,026	5,657	5,296	6,354	5,929	9,190	8,545
TiO ₂ pigment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1946		1947		1948		1949		1950	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	345,843	179,903	411,356	211,402	481,316	230,578	633,985	307,666	618,898	303,191
Titanium slag	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rutile	13,434	12,391	12,643	11,832	8,356	7,838	7,814	7,323	7,556	7,065
TiO ₂ pigment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 10.—Yearend stocks of titanium concentrates and pigment in the United States—Continued
(Metric tons)

	1951		1952		1953		1954		1955	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	614,659	303,500	603,748	303,877	553,633	280,344	575,951	299,428	596,470	305,521
Titanium slag	2,722	NA	15,075	10,978	70,693	49,897	74,042	52,032	58,471	41,314
Rutile	5,801	5,491	12,463	11,864	15,302	14,556	15,308	14,535	14,210	13,546
TiO ₂ pigment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1956		1957		1958		1959		1960	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	543,973	282,325	666,550	344,430	720,799	367,825	646,965	336,539	707,137	366,421
Titanium slag	101,647	72,001	162,714	114,971	139,248	98,226	140,624	99,343	120,312	85,009
Rutile	24,264	23,131	53,498	50,976	62,934	59,724	69,300	65,589	70,562	66,766
TiO ₂ pigment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1961		1962		1963		1964		1965	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	640,281	355,258	545,623	297,593	592,624	326,518	620,159	346,543	692,309	387,344
Titanium slag	118,765	84,710	127,144	90,805	95,980	68,495	108,132	77,039	98,966	70,273
Rutile	71,811	67,822	68,390	64,916	84,180	80,348	126,773	121,879	148,418	142,984
TiO ₂ pigment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1966		1967		1968		1969		1970	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	723,136	408,059	776,326	438,172	808,314	457,301	768,966	431,784	733,480	415,533
Titanium slag	124,528	88,017	118,287	83,742	108,632	76,878	93,805	66,504	104,559	74,172
Rutile	157,345	151,263	168,991	162,351	198,236	190,366	176,327	169,810	215,507	206,556
TiO ₂ pigment	NA	NA	93,703	NA	85,504	NA	91,490	NA	96,940	NA
	1971		1972		1973		1974		1975	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	585,232	347,555	484,894	285,386	515,124	298,897	519,452	295,668	577,769	343,080
Titanium slag	98,216	69,618	129,093	91,395	100,710	71,350	52,555	37,046	79,545	56,363
Rutile	214,962	204,956	143,432	136,805	133,983	126,680	97,814	91,983	126,618	119,514
TiO ₂ pigment	81,052	NA	43,772	NA	30,955	NA	83,117	NA	78,342	NA
	1976		1977		1978		1979		1980	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	641,741	389,909	730,303	448,747	^c 735,507	463,055	661,224	419,496	845,081	530,051
Titanium slag	89,909	63,723	56,773	40,337	95,876	68,127	68,120	51,634	155,943	116,103
Rutile	138,120	129,948	132,631	124,225	^c 166,734	156,657	^c 115,614	108,814	142,327	133,964
TiO ₂ pigment	64,915	NA	NA	103,825	NA	84,704	NA	48,995	NA	75,511
	1981		1982		1983		1984		1985	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	775,139	492,705	673,716	427,081	361,862	230,640	182,427	116,580	215,393	133,680
Titanium slag	184,786	136,718	123,164	94,045	71,103	55,362	60,418	47,534	96,218	76,041
Rutile	147,920	139,498	159,736	150,377	117,966	110,848	92,649	87,259	105,209	99,173
TiO ₂ pigment	NA	92,704	78,919	NA	70,275	65,317	75,780	^c 70,528	51,488	^c 47,211
	1986		1987		1988		1989		1990	
	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c	Gross weight	TiO ₂ content ^c
Ilmenite	253,201	153,970	198,094	120,016	173,372	98,772	236,679	137,643	341,891	196,645
Titanium slag	73,378	59,160	119,554	96,994	129,537	105,429	96,067	78,078	85,960	68,605
Rutile	103,408	97,514	107,642	99,987	117,751	108,339	155,024	144,618	171,085	161,026
TiO ₂ pigment	69,759	^c 64,851	47,478	^c 44,358	49,734	^c 46,053	63,205	^c 57,597	61,721	^c 57,597

^cEstimated. NA Not available.

Page Intentionally Left Blank

TUNGSTEN

By Gerald Smith

Tungsten, a silver-gray metal, exhibits important physical properties, including a high melting point and density, as well as good thermal and electrical conductivity, a low coefficient of expansion, and exceptional strength at elevated temperatures. It is consumed predominantly as the extremely hard carbide in cutting and wear-resistant components and as the metal or alloy for lamp and lighting filaments and electrodes, electrical and electronic contact surfaces, heat and radiation shielding in high-temperature furnaces and X-ray equipment, and electrodes in certain welding methods. Some nonmetallurgical applications of tungsten are as phosphorescent chemicals in pigments, X-ray screens, television picture tubes, and fluorescent lighting. Tungsten is also used militarily as a heavy-metal alloy in armor-piercing ordnance and tank shielding.

Tungsten appears in nature combined with calcium, iron, or manganese in four major mineral forms. Although found in numerous deposits throughout the world, nearly 42% of the world's tungsten resources are in China. Other significant tungsten deposits are in Australia, Austria, Bolivia, Brazil, Burma, Canada, North Korea, Peru, Portugal, the Republic of Korea, Spain, Thailand, Turkey, the former U.S.S.R., and the United States.

The U.S. reliance on foreign sources of tungsten materials (table 1) has increased by nearly 40% since 1984 compared with the average for the previous 10 years. Much of this increase was the direct result of a steady decline in domestic mine production and an increase in the production of concentrate for the world market by the Chinese (table 4). Prices for concentrates reached record levels in the late 1970's amid strong demand for tungsten products, but then began to decline as a result of a gradual increase in supply over demand, attributed by many Western World consumers to an overproduction by the Chinese. By 1990, the estimated production of concentrate by China represented about 52% of the world market share compared with 25% in 1978. In addition to concentrate, the United States also imported a steadily increasing quantity of ammonium paratungstate (APT), most of it from China, during the period 1978 to 1987 (table 2). APT is a major intermediate material from which tungsten metal, carbides, and chemicals are produced. In 1987, the United States and China signed an Orderly Marketing Agreement limiting such imports during a period of 4 years.

Table 1.—U.S. historical salient tungsten statistics
(Metric tons tungsten content)

Year	Concentrate shipments		Imports for consumption		Exports	
	Mine	Defense stockpile	Concentrate	Primary metal ¹	Concentrate	Primary metal ¹
1970 ...	4,224	6,834	582	108	⁶ 8,831	449
1971 ...	3,097	626	190	145	910	456
1972 ...	3,196	1	2,603	641	43	511
1973 ...	3,202	576	4,914	909	41	1,074
1974 ...	3,554	2,902	5,033	1,080	538	1,864
1975 ...	2,490	1,347	2,890	734	597	765
1976 ...	2,662	1,816	2,405	642	784	937
1977 ...	2,732	2,275	3,138	735	582	1,205
1978 ...	3,130	2,522	4,145	1,168	841	1,417
1979 ...	3,014	2,351	5,149	1,450	875	1,724
1980 ...	2,738	1,703	5,158	1,041	920	1,785
1981 ...	3,545	958	5,331	1,280	79	2,279
1982 ...	1,575	344	3,528	1,844	305	1,713
1983 ...	1,016	259	2,861	1,230	1	952
1984 ...	1,173	1,368	5,807	2,285	129	1,571
1985 ...	983	902	4,746	2,372	124	2,568
1986 ...	817	301	2,522	2,229	34	1,568
1987 ...	34	708	4,414	2,596	2	1,666
1988 ...	W	524	8,045	3,053	172	1,874
1989 ...	W	466	7,896	2,619	203	2,585
1990 ...	W	—	6,429	2,412	139	2,795
Year	Scrap, reported consumption	Apparent consumption ²	Net import reliance (percent) ²			
1970 ...	⁶ 680	³ 6,963	()			
1971 ...	598	³ 5,061	()			
1972 ...	668	6,505	41			

See footnotes at end of table.

Table 1.—U.S. historical salient tungsten statistics—Continued
(Metric tons tungsten content)

Year	Scrap, reported consumption	Apparent consumption ²	Net import reliance (percent) ²
1973 ...	963	9,932	58
1974 ...	1,048	10,731	57
1975 ...	944	6,328	55
1976 ...	958	7,766	52
1977 ...	1,393	8,524	52
1978 ...	1,353	10,139	56
1979 ...	1,498	10,792	58
1980 ...	1,920	9,939	53
1981 ...	1,638	10,316	50
1982 ...	1,921	6,050	42
1983 ...	2,076	6,478	52
1984 ...	1,883	10,164	70
1985 ...	1,622	8,211	68
1986 ...	1,508	7,767	70
1987 ...	1,607	7,951	79
1988 ...	2,259	11,065	76
1989 ...	1,942	10,474	77
1990 ...	1,961	8,287	73

²Estimated. W Withheld to avoid disclosing company proprietary data.

¹Tungsten content of intermediate processed materials including ammonium paratungstate, ferrotungsten, tungsten metal powder, tungsten carbide powder, other chemicals, and wrought and unwrought metal.

²Net import reliance is expressed as a percent of apparent consumption. Net import reliance is calculated as imports minus exports plus adjustments for changes in industry and Government stocks. Apparent consumption equals mine shipments plus reported scrap consumption plus net import reliance.

³Reported consumption.

⁴Net exporter.

Table 2.—U.S. historical ammonium paratungstate statistics
(Metric tons tungsten content)

Year	Production	Consumption	Imports for consumption	Exports
1970	NA	NA	NA	NA
1971	NA	NA	NA	26
1972	NA	NA	NA	43
1973	5,902	6,325	NA	133
1974	6,671	7,136	NA	28
1975	4,664	4,696	NA	61
1976	5,810	7,222	NA	85
1977	6,777	7,141	NA	66
1978	7,286	7,971	233	99
1979	8,055	8,491	198	2
1980	7,664	8,430	202	3
1981	8,855	9,165	474	1
1982	4,914	5,873	759	1
1983	5,021	5,655	762	6
1984	8,326	8,474	1,172	8
1985	6,777	7,413	1,351	72
1986	5,604	6,475	1,156	7
1987	5,336	6,363	1,402	285
1988	7,183	8,323	635	174
1989	7,831	8,493	431	178
1990	¹ 6,142	8,787	462	356

NA Not available.

¹Excludes 2 months of data withheld to avoid disclosing company proprietary data.

Table 3.—Historical tungsten concentrate price statistics
(U.S. dollars per metric ton unit WO₃)¹

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Metal Bulletin (London):											
Wolframite ²	83.74	53.67	43.64	48.74	92.52	91.70	114.29	170.89	143.77	138.84	144.48
Scheelite ³	—	—	—	—	—	—	—	—	—	—	—
International Tungsten Indicator ⁴	—	—	47.58	48.87	94.50	91.11	103.84	158.87	142.94	139.00	142.64
Metals Week ⁵	—	—	—	—	—	—	—	164.08	141.31	140.34	143.16
U.S. mine shipments ⁶	44.67	51.69	44.94	47.44	83.48	92.65	111.00	159.87	143.62	146.75	146.49
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Metal Bulletin (London):											
Wolframite ²	143.58	106.12	80.67	81.28	67.61	47.54	49.00	55.94	56.57	46.42	
Scheelite ³	—	—	—	92.27	74.03	55.16	57.15	60.65	65.10	62.61	
International Tungsten Indicator ⁴	143.48	113.19	80.19	82.75	73.10	55.56	51.36	58.78	60.79	54.27	
Metals Week ⁵	142.37	107.32	84.93	85.08	68.00	46.46	50.34	59.46	53.69	41.87	
U.S. mine shipments ⁶	139.21	111.06	82.17	90.63	73.77	56.04	NA	W	W	W	

NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Annual average. A metric ton unit contains 7.93 kilograms (17.48 pounds) of tungsten.

²European market, 65% WO₃ basis.

³European market, 70% WO₃ basis.

⁴Weighted average, 60% to 79% WO₃ basis. International Tungsten Indicator was called Tungsten Users Index from Apr. 1972 through June 1978.

⁵U.S. spot quotations, 65% WO₃ basis, c.i.f. U.S. ports. Reporting began in 1977.

⁶Reported value, f.o.b. mine.

Table 4.—World tungsten concentrate production, by country
(Metric tons tungsten content)

Country	1986	1987	1988	1989	1990
Argentina	20	14	13	20	^a 16
Australia	1,600	1,150	1,616	1,371	1,086
Austria	1,387	1,250	1,235	1,517	1,378
Bolivia	1,095	638	900	1,118	1,014
Brazil	875	800	738	679	422
Burma	715	493	307	^c 300	311
Canada	1,959	—	—	—	—
China ^e	15,000	21,000	30,000	30,200	32,000
Czechoslovakia ^e	50	45	50	¹ 74	¹ 83
France	987	—	—	—	—
India	23	26	19	12	^c 13
Japan	579	259	266	296	254
Korea, North ^c	1,000	500	500	500	1,000
Korea, Republic of	2,455	2,375	2,029	1,701	1,361
Malaysia	4	—	—	—	—
Mexico	294	213	206	170	183
Mongolia ^e	1,500	1,500	1,000	1,000	500
New Zealand ^e	(²)	5	5	5	—
Peru	742	205	432	970	1,536
Portugal	1,637	1,207	1,382	1,381	1,405
Rwanda	13	11	22	105	156
Spain	495	81	80	58	49
Sweden	357	574	420	80	—
Thailand	475	705	651	603	^c 290
Turkey	206	163	125	^c 100	—
Uganda ^e	4	4	4	4	4
U.S.S.R. ^e	9,200	9,200	9,200	9,200	8,800
United Kingdom	—	—	3	28	42
United States	780	34	W	W	W
Zaire	27	21	20	16	^c 14
Zimbabwe ^e	1	1	1	(²)	(²)
Total	43,480	42,474	50,824	50,941	51,926

^aEstimated. W Withheld to avoid disclosing company proprietary data.

¹Reported figure.

²Less than 1/2 unit.

Page Intentionally Left Blank

ZINC

By James H. Jolly

Zinc is the fourth most widely used metal after iron, aluminum, and copper. Zinc is used as corrosion-protection coatings on steel (galvanized metal), as die-castings, as an alloying metal with copper to make brass, and as chemical compounds in rubber, ceramics, paints, and agriculture. It is also a necessary element for proper growth and development of humans, animals, and plants.

Zinc is mined in more than 50 countries and is produced as metal and compounds in about 40 countries. In 1990, the leading ore-producing countries were Canada, Australia, and the U.S.S.R., in order of mine production; the leading metal-producing countries were the U.S.S.R., Japan, and Canada, in order of primary smelter production. The United States accounted for only about 7% of world mine output and about 5% of world smelter production in the same year. This was not always so; during most of the 1900-70 period, the United States was the

world's leading mine and smelter producer of zinc and, in the 1950's, accounted for more than one-half of world metal production. From the late 1960's to the mid-1980's, U.S. mine and smelter output declined by one-half and two-thirds, respectively. Mine production rose to former levels in 1989 and 1990 owing to the opening of a large zinc mine in Alaska. Smelter capacity, however, only marginally increased and, in 1990, was only about 40% of that of 1968.

The United States has been the leading world consumer of zinc since the early 1900's and currently consumes about one-seventh of world output. As a result of the substantial decline in domestic zinc smelter capacity, reliance on metal imports remains high. Ironically, the United States has become a major world exporter of zinc concentrate, but continues to be the world's largest importer of refined zinc.

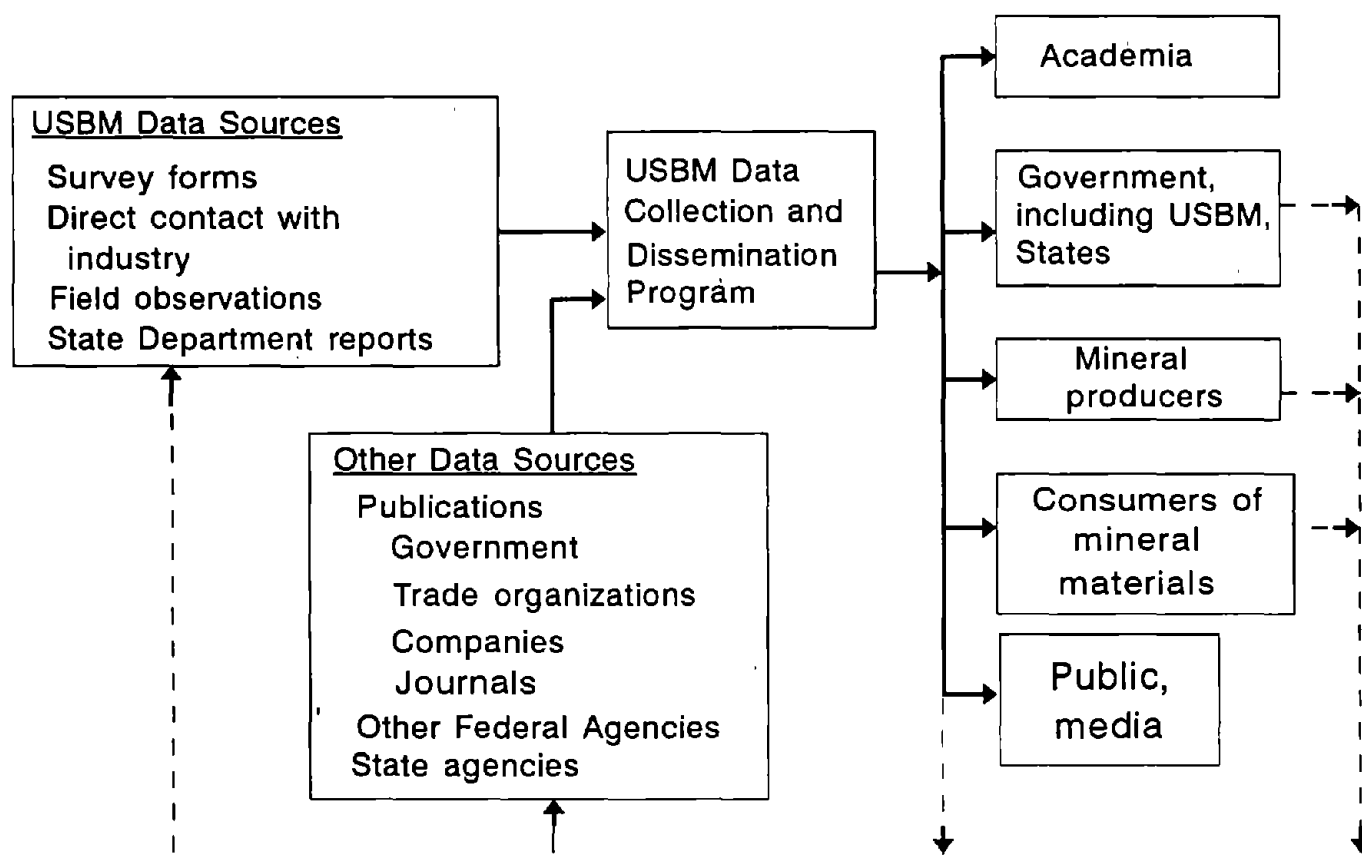


Figure 1.—Relationship of U.S. Bureau of Mines (USBM) Domestic Data Collection and Dissemination Program to data sources and users.

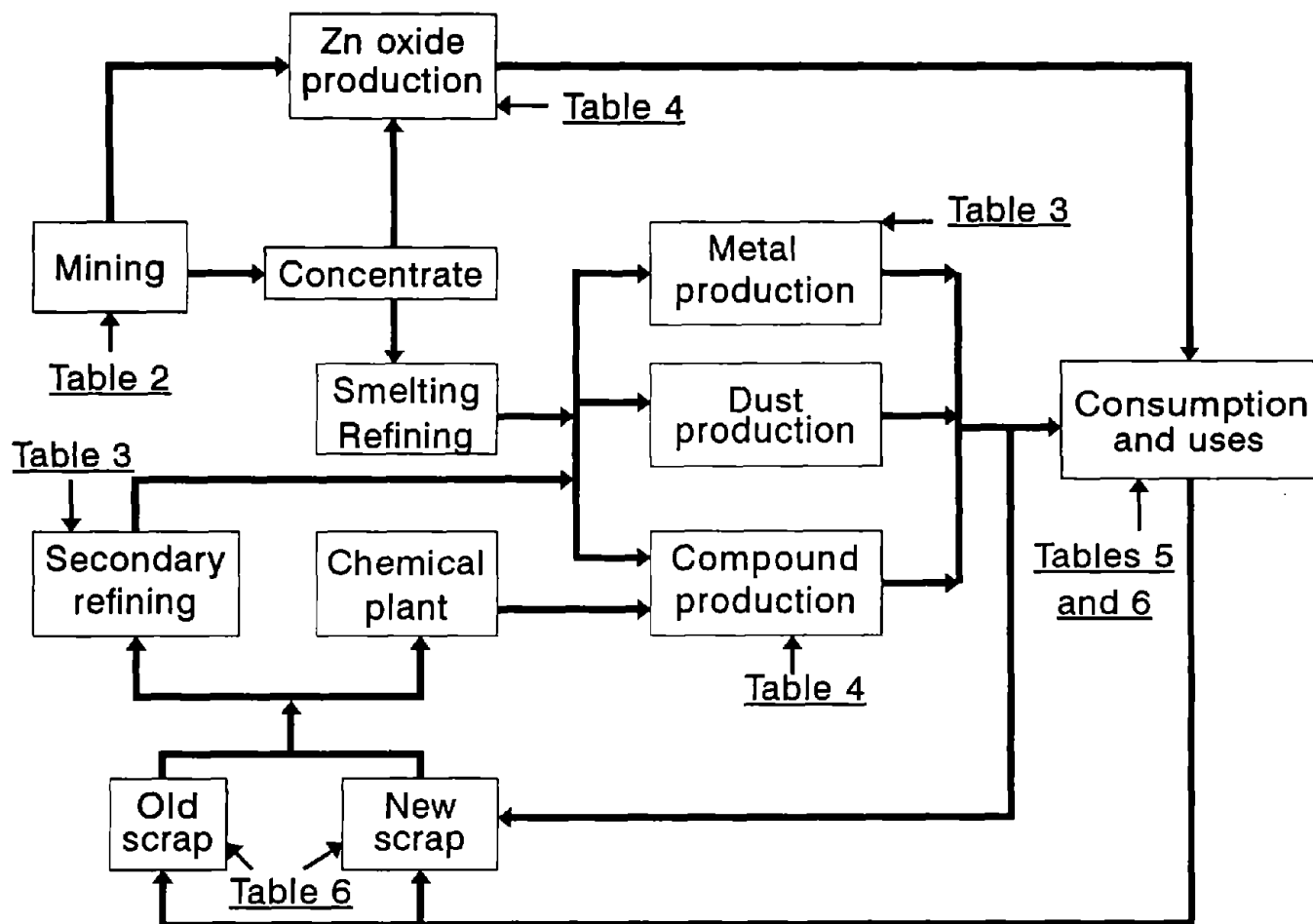


Figure 2.—Zinc flow diagram.

Table 1.—U.S. historical salient zinc statistics
(Metric tons unless otherwise specified)

Year	Slab zinc production		Mine ¹ production (Recoverable)	Imports for consumption		Exports		Consumption			Net import reliance (per- cent) ⁷	Price, dollars per pound ⁸
	Pri- mary	Sec- ondary		Slab zinc	Ore, zinc content ²	Slab zinc	Ore, zinc content ³	Slab zinc ⁴	Consumed as ore ⁵	All classes ⁶		
1859	45	NA	245	NA	NA	NA	NA	NA	NA	NA	NA	NA
1860	725	NA	925	NA	NA	NA	NA	NA	NA	NA	NA	NA
1861	1,350	NA	1,650	NA	NA	NA	NA	NA	NA	NA	NA	NA
1862	1,350	NA	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA
1863	1,550	NA	1,800	NA	NA	NA	NA	NA	NA	NA	NA	NA
1864	1,630	NA	1,900	NA	NA	43	671	NA	NA	NA	NA	13.90
1865	1,900	NA	2,200	NA	NA	83	450	NA	NA	NA	NA	NA
1866	1,800	NA	2,000	NA	NA	63	203	NA	NA	NA	NA	NA
1867	2,900	NA	3,300	NA	NA	141	166	7,700	NA	⁹ 7,700	NA	NA
1868	3,350	NA	3,800	NA	NA	463	378	8,731	NA	⁹ 8,731	NA	NA
1869	3,900	NA	4,500	NA	NA	NA	NA	13,660	NA	⁹ 13,660	NA	NA
1870	4,900	NA	5,400	NA	NA	49	693	13,362	NA	⁹ 13,362	NA	NA
1871	6,250	NA	7,000	NA	NA	34	436	14,746	NA	⁹ 14,746	NA	NA
1872	7,070	NA	8,200	NA	NA	28	167	17,251	NA	⁹ 17,251	NA	NA
1873	6,661	NA	8,000	NA	NA	33	10	16,627	NA	⁹ 16,627	NA	NA
1874	11,900	NA	13,500	NA	NA	19	115	16,240	NA	⁹ 16,240	NA	NA
1875	14,363	NA	17,200	NA	NA	17	139	19,376	NA	⁹ 19,376	NA	7.00
1876	15,400	NA	18,500	NA	NA	61	461	17,860	NA	⁹ 17,860	NA	7.20
1877	14,150	NA	16,900	NA	NA	644	291	14,684	NA	⁹ 14,684	NA	6.00
1878	17,800	NA	19,700	NA	NA	1,154	728	17,791	NA	⁹ 17,791	NA	4.90
1879	19,300	NA	23,000	NA	NA	967	483	19,481	NA	⁹ 19,481	NA	5.20
1880	21,082	NA	28,400	NA	NA	620	590	27,646	7,335	¹⁰ 34,981	NA	5.50
1881	27,450	NA	34,800	NA	NA	676	516	29,308	7,257	¹⁰ 36,565	NA	5.20
1882	30,631	NA	38,000	NA	NA	675	494	40,306	7,257	¹⁰ 47,563	NA	5.30
1883	33,451	NA	42,000	NA	NA	386	138	42,315	8,709	¹⁰ 51,024	NA	4.50
1884	34,967	NA	44,000	NA	NA	57	216	38,004	9,435	¹⁰ 47,439	NA	4.40
1885	36,911	NA	47,000	NA	NA	46	310	39,294	10,886	¹⁰ 50,180	NA	4.30
1886	38,683	NA	52,000	NA	NA	349	396	40,445	13,063	¹⁰ 53,508	NA	4.40
1887	45,667	NA	58,000	NA	NA	164	54	49,217	13,063	¹⁰ 62,280	NA	4.60
1888	50,714	NA	65,000	NA	NA	28	206	52,555	14,515	¹⁰ 67,070	NA	4.90
1889	53,397	NA	66,000	NA	NA	399	1,213	54,388	12,316	¹⁰ 66,704	NA	5.00
1890	57,772	NA	75,000	NA	NA	1,494	3,508	57,538	17,200	¹⁰ 57,538	NA	5.50
1891	73,367	NA	90,000	NA	NA	1,948	171	71,327	17,200	¹⁰ 88,527	NA	5.00
1892	79,161	NA	99,000	NA	NA	5,667	41	73,465	19,958	¹⁰ 93,423	NA	4.60
1893	71,515	NA	89,000	NA	NA	3,301	44	69,058	17,461	¹⁰ 86,519	NA	4.00
1894	68,336	NA	82,000	NA	NA	1,636	—	64,028	14,506	¹⁰ 78,534	NA	3.50
1895	81,361	NA	96,000	NA	NA	1,388	21	79,557	15,030	¹⁰ 94,587	NA	3.60
1896	73,934	NA	88,000	NA	NA	9,189	1,882	63,609	14,515	¹⁰ 78,124	NA	3.90
1897	90,700	NA	109,000	NA	NA	12,923	3,746	80,541	18,144	¹⁰ 98,685	NA	4.10
1898	104,688	NA	129,000	NA	NA	9,524	4,771	98,157	23,950	¹⁰ 122,107	NA	4.60
1899	117,073	NA	146,000	NA	NA	6,127	11,429	113,021	29,135	¹⁰ 142,156	NA	5.80
1900	112,388	NA	150,546	NA	NA	20,322	19,079	90,173	35,446	¹⁰ 125,619	NA	4.40
1901	127,752	NA	167,646	NA	NA	3,075	20,029	128,529	35,198	¹⁰ 163,727	NA	4.10
1902	142,362	NA	192,922	406	NA	2,937	25,280	138,511	40,591	¹⁰ 179,102	NA	4.80
1903	144,441	NA	180,194	183	NA	1,380	17,876	140,052	48,308	¹⁰ 188,360	NA	5.40
1904	169,378	NA	201,951	309	727	9,205	16,289	164,120	49,343	¹⁰ 213,463	NA	5.10
1905	184,929	NA	213,003	388	7,301	5,004	14,037	181,834	53,724	¹⁰ 235,558	NA	5.90
1906	203,908	NA	201,147	926	17,816	4,237	12,574	200,289	58,915	¹⁰ 259,204	NA	6.10
1907	226,669	6,396	235,824	1,550	33,168	511	9,234	205,903	59,944	272,538	NA	5.80
1908	190,893	6,495	212,758	704	17,614	1,119	11,842	194,289	43,549	244,104	NA	4.60
1909	232,022	8,412	277,075	8,545	37,356	303	5,650	245,602	49,114	310,094	NA	5.40
1910	244,200	11,597	297,295	897	23,078	8,386	8,941	223,062	45,896	296,733	NA	5.40
1911	259,932	12,740	302,856	293	14,454	13,023	16,584	254,065	41,841	330,140	NA	5.70
1912	307,360	23,645	349,578	9,724	15,937	6,808	21,182	308,752	58,089	408,701	NA	6.90

See footnotes at end of table.

Table 1.—U.S. historical salient zinc statistics—Continued
(Metric tons unless otherwise specified)

Year	Slab zinc production		Mine ¹ production (Recoverable)	Imports for consumption		Exports		Consumption			Net import reliance (per-cent) ⁷	Price, dollars per pound ⁸
	Pri- mary	Sec- ondary		Slab zinc	Ore, zinc content ²	Slab zinc	Ore, zinc content ³	Slab zinc ⁴	Consumed as ore ⁵	All classes ⁶		
1913	314,499	23,579	374,697	4,686	12,244	12,234	16,069	267,955	64,067	361,587	NA	5.60
1914	320,281	18,638	377,082	177	11,006	67,594	10,079	272,140	64,064	364,877	NA	5.10
1915	444,084	27,001	533,057	57	52,316	119,213	755	330,991	72,187	459,036	NA	14.20
1916	605,506	26,105	638,039	19	134,397	137,211	71	416,685	81,897	577,969	NA	13.60
1917	607,427	15,272	647,159	16	65,747	199,639	1,197	375,251	88,517	564,368	NA	8.90
1918	469,856	8,997	577,052	10	22,506	96,751	56	384,458	93,239	537,589	NA	8.00
1919	422,515	17,915	498,264	29	15,430	132,718	—	293,895	90,909	475,194	NA	7.00
1920	420,369	19,387	532,993	—	20,400	103,661	—	293,060	106,122	497,362	NA	7.80
1921	181,891	15,942	232,820	5,986	2,454	4,495	—	184,703	51,917	295,881	NA	4.70
1922	321,395	29,926	428,220	36	1,750	31,571	1,538	338,462	86,104	513,990	NA	5.70
1923	463,058	35,774	554,009	1	2,924	29,885	2,544	405,071	106,633	609,178	NA	6.70
1924	469,322	32,192	578,763	10	4,218	69,165	334	406,652	99,207	602,735	NA	6.30
1925	519,768	35,544	644,870	—	12,280	69,264	62,551	453,680	100,698	647,160	NA	7.66
1926	561,023	37,012	702,672	—	13,215	38,936	86,411	505,326	117,934	723,867	NA	7.37
1927	537,522	38,813	651,850	35	8,630	41,454	42,380	468,446	110,677	679,990	NA	6.25
1928	546,652	44,149	630,648	—	1,512	22,942	4,099	568,351	112,491	788,199	NA	6.03
1929	567,396	42,953	657,236	205	13,073	13,073	64	575,427	125,192	808,952	NA	6.49
1930	451,819	31,614	540,161	255	23,441	4,203	—	409,050	95,254	582,693	NA	4.56
1931	264,894	19,618	372,234	249	708	583	12	335,658	68,039	470,783	NA	3.64
1932	187,922	13,352	258,757	281	1,727	5,870	—	234,961	49,895	339,731	NA	2.88
1933	278,671	27,294	348,613	1,715	1,935	1,039	734	317,787	65,317	453,193	NA	4.03
1934	329,843	17,863	398,006	1,565	12,952	4,631	3,285	326,496	68,946	458,948	NA	4.16
1935	381,593	25,991	469,834	4,032	9,544	1,467	418	429,099	78,018	581,967	NA	4.33
1936	446,455	38,291	522,152	10,578	156	34	222	527,982	87,090	709,871	NA	4.90
1937	505,215	46,769	568,226	33,755	3,035	226	285	553,383	101,605	758,104	NA	6.52
1938	404,914	28,679	468,742	6,559	4,409	—	122	381,925	62,596	522,944	NA	4.61
1939	460,157	45,748	529,621	28,086	30,393	4,096	275	567,898	77,111	798,679	NA	5.12
1940	612,599	44,376	603,340	9,204	40,494	71,750	406	665,018	87,090	907,883	NA	6.34
1941	745,724	53,980	679,595	36,549	140,178	81,020	—	750,637	122,470	1,086,368	NA	7.48
1942	809,093	48,258	696,741	32,978	256,885	121,507	—	660,584	104,326	1,031,676	NA	8.25
1943	854,849	43,740	675,123	50,943	468,694	88,395	1	740,968	104,326	1,157,226	NA	8.25
1944	788,618	44,486	651,941	57,721	376,485	19,573	—	806,148	128,820	1,223,677	NA	8.25
1945	693,598	44,672	557,336	87,779	300,762	7,060	—	773,204	118,841	1,191,969	NA	8.25
1946	660,668	40,384	521,478	94,406	151,396	42,841	81	726,876	121,563	1,101,486	24	8.73
1947	728,011	54,016	578,428	65,374	176,740	96,769	1,274	713,374	132,449	1,087,273	25	10.50
1948	714,648	56,536	571,506	83,910	121,394	59,454	3,218	741,837	120,656	1,114,419	(¹¹)	13.58
1949	739,158	49,932	538,145	113,910	99,369	53,260	2,654	645,771	79,832	900,135	1	12.15
1950	765,181	60,754	565,516	140,915	215,514	11,718	1,034	877,369	121,563	1,247,865	39	13.88
1951	799,804	44,141	617,964	79,871	179,618	33,121	2,803	847,284	121,422	1,203,002	24	17.99
1952	820,530	49,996	604,186	102,560	491,979	52,357	3,057	773,632	99,134	1,099,189	39	16.21
1953	831,077	47,967	496,620	206,524	407,990	16,301	2,679	894,418	107,269	1,217,795	47	10.86
1954	727,948	61,700	429,526	145,275	436,282	22,674	—	802,223	90,035	1,071,106	49	10.69
1955	874,076	59,912	466,902	176,955	348,947	16,392	—	1,015,877	107,170	1,332,727	43	12.30
1956	892,316	65,433	492,003	222,012	419,463	7,995	775	915,159	102,864	1,200,226	45	13.49
1957	894,299	65,764	482,387	243,873	616,356	9,784	6	848,780	100,072	1,117,283	47	11.40
1958	708,735	42,279	373,765	168,458	487,792	1,881	—	787,733	86,126	1,036,155	56	10.31
1959	724,538	52,452	385,829	149,197	384,768	10,550	1	867,448	98,039	1,159,724	53	11.46
1960	725,309	62,352	395,013	109,701	347,396	68,170	12	796,403	80,082	1,051,371	46	12.95
1961	768,200	50,110	421,288	113,567	324,457	45,409	1,515	844,782	88,225	1,095,398	46	11.55
1962	797,774	53,415	458,574	123,373	351,372	32,751	123	936,053	92,154	1,209,560	47	11.63
1963	809,739	54,706	480,131	120,050	337,399	30,711	15	1,002,542	94,987	1,282,956	49	12.01
1964	865,531	64,951	521,503	121,670	282,529	24,054	35	1,095,215	96,114	1,393,210	44	13.57
1965	902,107	75,858	554,429	139,667	365,537	5,388	NA	1,228,412	111,486	1,580,377	51	14.50
1966	929,924	75,535	519,416	254,290	359,585	1,276	NA	1,291,528	114,937	1,651,088	54	14.50

See footnotes at end of table.

Table 1.—U.S. historical salient zinc statistics—Continued
(Metric tons unless otherwise specified)

Year	Slab zinc production		Mine ¹ production (Recoverable)	Imports for consumption		Exports		Consumption			Net import reliance (per-cent) ⁷	Price, dollars per pound ⁸
	Pri- mary	Sec- ondary		Slab zinc	Ore, zinc content ²	Slab zinc	Ore, zinc content ³	Slab zinc ⁴	Consumed as ore ⁵	All classes ⁶		
1967	851,692	66,683	498,419	201,397	391,286	15,249	NA	1,134,592	103,692	1,456,814	52	13.85
1968	926,137	72,452	480,305	276,407	439,806	29,947	NA	1,225,295	112,590	1,583,362	58	13.50
1969	944,014	64,005	501,786	294,616	512,772	8,435	NA	1,256,796	114,951	1,645,785	59	14.65
1970	796,337	69,995	484,560	235,988	408,932	261	NA	1,076,785	113,199	1,425,728	53	15.32
1971	695,297	73,412	455,899	294,159	423,989	12,107	NA	1,137,664	108,185	1,497,485	60	16.13
1972	574,411	66,876	433,924	468,691	157,907	3,923	NA	1,286,705	107,325	1,672,870	61	17.75
1973	529,323	75,466	434,408	535,920	139,864	13,214	NA	1,364,350	117,617	1,752,613	65	20.66
1974	503,658	71,246	453,477	493,333	121,321	17,293	NA	1,168,178	115,315	1,517,732	60	35.95
1975	397,394	52,513	425,792	340,124	388,769	6,257	NA	839,445	75,053	1,117,484	63	38.96
1976	452,554	62,192	439,543	630,612	141,342	3,187	NA	1,028,876	91,844	1,394,268	59	37.01
1977	408,364	45,914	407,889	503,621	109,277	215	NA	999,505	86,490	1,367,704	58	34.39
1978	406,698	34,774	302,669	622,470	106,315	723	10,973	1,050,585	89,959	1,441,810	67	30.97
1979	472,481	53,212	267,341	524,130	87,499	279	20,095	1,000,606	79,710	1,394,314	63	37.30
1980	340,456	29,396	317,103	410,163	182,370	302	54,457	811,146	58,986	1,142,409	60	37.43
1981	346,563	50,192	312,418	612,007	245,710	323	54,232	840,875	60,643	1,189,369	65	44.56
1982	228,176	74,288	303,160	456,233	66,809	341	77,289	795,000	35,515	1,038,600	58	38.47
1983	235,694	69,390	275,294	617,679	63,156	427	60,168	934,000	36,912	1,246,300	65	41.39
1984	253,132	78,113	252,768	639,228	86,172	760	30,579	980,000	45,487	1,344,000	68	48.60
1985	261,209	72,563	226,545	610,900	90,186	1,011	23,264	961,000	39,886	1,257,000	70	40.37
1986	253,369	62,912	202,983	665,126	75,786	1,938	3,269	999,000	19,236	1,274,000	73	38.00
1987	261,345	82,589	216,327	705,985	46,464	1,082	16,921	1,052,000	2,536	1,324,000	69	41.92
1988	241,294	88,492	244,314	749,130	62,966	482	33,590	1,089,000	2,412	1,340,000	70	60.20
1989	260,305	97,904	275,883	711,554	40,974	5,532	78,877	1,060,000	2,107	1,311,000	61	82.02
1990	262,704	95,708	515,355	631,742	46,684	1,238	220,446	991,000	2,178	1,239,000	40	74.59

NA Not available.

¹Recoverable mine production is estimated for 1859-99.

²Imports Ore: 1904-09 were estimated (Minerals Yearbook 1926) and for 1910-36 were zinc content of general imports.

³Exports Ore: 1897-1915 zinc content estimated at 50% of ore shipped; 1907-15 virtually all willemite concentrate (50% zinc).

⁴Data through 1981 are reported consumption of slab zinc; 1982 forward, data are apparent consumption of slab zinc.

⁵1880-1900 data for zinc oxide from ore; 1901-07 data for zinc oxide and zinc lead from ore; 1908-18 data for pigments from ore; 1919-24 data for pigments and salts from ore; 1925-56 data for zinc oxide from ore; 1957-88 includes ore directly for galvanizing.

⁶Based on apparent consumption of slab zinc plus zinc content of ores and concentrates and secondary materials used to make zinc dust and chemicals.

⁷Net import reliance is expressed as a percent of apparent consumption. Net import reliance is defined as exports minus imports plus adjustments for changes in industry and Government stocks. Apparent consumption in U.S. equals mine production plus old scrap plus net import reliance.

⁸Source: U.S. Bureau of Mines. Nonferrous Metal Prices in the United States through 1988. Spec. Publ. 1989, pp. 125-130.

⁹Data does not include ores and secondary consumed, data not available.

¹⁰Data does not include secondary consumed, data not available.

¹¹Net exporter.

Table 2.—Mine production of recoverable zinc in the United States, by State
(Metric tons unless otherwise specified)

State	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
Alaska	—	—	—	—	—	—	—	—	—	—	—
Arizona	308	2,712	2,488	2,069	3,973	4,276	4,442	8,264	8,926	9,477	1,030
Arkansas	549	463	902	602	679	434	552	2,911	6,182	6,070	863
California	—	—	—	1,274	1,971	480	177	5,939	6,920	4,931	2,523
Colorado	13,667	23,228	34,967	42,913	59,975	54,134	43,896	47,443	60,911	54,574	40,431
Idaho	17	613	2,542	3,783	6,308	10,512	19,056	31,821	39,238	36,221	20,485
Illinois	1,558	1,962	3,220	3,827	3,688	2,028	4,364	5,020	3,088	3,871	3,440
Iowa	358	32	87	—	—	—	—	—	19	16	—

See footnotes at end of table.

Table 2.—Mine production of recoverable zinc in the United States, by State—Continued
(Metric tons unless otherwise specified)

State	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
Kansas	12,809	10,383	12,001	9,319	9,646	9,152	10,237	13,032	11,293	18,370	27,394
Kentucky	—	51	5	143	445	297	209	693	994	681	286
Maine	—	—	—	—	—	—	—	—	—	—	—
Missouri	97,435	118,081	116,654	111,144	123,877	113,365	96,156	123,649	141,485	120,581	50,795
Montana	744	4,246	14,351	19,872	12,210	40,222	50,612	84,888	103,991	84,486	94,918
Nevada	506	1,367	1,228	1,609	6,043	6,541	5,888	11,057	14,716	10,119	7,586
New Hampshire	—	—	—	—	—	14	5	22	33	41	13
New Jersey	60,931	74,852	62,304	59,899	69,203	71,731	75,256	106,796	101,623	109,630	89,331
New Mexico	1,622	5,936	8,205	4,644	6,153	7,495	8,348	11,523	16,588	13,698	10,909
New York	—	—	—	73	—	—	—	2,227	4,089	4,710	3,426
North Carolina	—	—	—	—	129	9	—	—	—	—	—
Oklahoma	4,109	7,081	5,801	4,672	5,234	10,581	12,693	12,985	26,085	77,868	146,421
Oregon	—	—	—	—	—	—	—	—	—	—	—
Pennsylvania	—	—	—	—	—	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—	—	—	—	—	—
Tennessee	312	541	876	1,013	1,988	5,065	9,457	14,933	23,975	25,853	19,115
Texas	16	—	—	—	108	296	98	14	105	10	—
Utah	662	4,472	7,424	8,092	7,742	8,554	7,253	11,019	13,414	9,655	8,346
Virginia	640	53	720	936	226	2,467	158	1,149	2,065	1,545	863
Washington	—	—	—	9	—	—	—	111	768	542	17
Wisconsin	16,516	21,003	23,521	26,962	29,982	27,315	28,225	37,560	51,531	54,197	45,372
Other	—	—	—	—	—	—	—	—	—	—	—
Total ¹	212,758	277,075	297,295	302,856	349,578	374,967	377,082	533,057	638,039	647,149	573,561
Employment, mine and mill, Dec. 31 ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Alaska	—	—	—	—	—	—	—	—	—	—	—
Arizona	779	661	—	95	236	—	3,326	5,872	1,029	580	1,115
Arkansas	171	298	14	122	134	4	39	79	116	78	8
California	214	529	384	1,366	—	1,388	5,212	9,269	3,657	—	—
Colorado	16,883	22,131	1,070	10,550	24,563	25,731	27,951	29,484	32,536	32,415	26,699
Idaho	7,255	12,670	15	1,864	12,679	6,958	14,169	23,865	24,293	28,361	41,436
Illinois	6,158	4,282	2,201	2,834	1,148	2,279	2,471	2,338	473	15	28
Iowa	—	—	—	—	—	—	—	—	—	—	—
Kansas	43,215	55,405	33,560	51,006	91,598	95,610	107,754	114,584	99,271	97,296	99,654
Kentucky	33	8	200	129	245	446	389	1,667	780	83	—
Maine	—	—	—	—	—	—	—	—	—	—	—
Missouri	28,613	22,234	9,838	14,670	16,570	11,721	13,421	23,603	16,998	11,770	9,994
Montana	76,550	83,614	10,558	54,009	64,165	58,276	52,306	66,860	72,784	75,142	61,848
Nevada	4,084	4,853	32	1,188	6,426	4,990	6,723	4,907	2,878	3,083	7,675
New Hampshire	—	—	—	—	—	—	—	—	—	—	—
New Jersey	84,288	71,224	51,208	66,821	68,245	76,539	80,976	73,145	86,813	90,601	94,111
New Mexico	3,445	4,542	103	2,039	7,482	9,417	8,388	10,933	27,036	28,307	31,257
New York	4,645	5,129	1,426	4,369	7,678	4,231	4,679	4,573	3,402	10,212	9,299
North Carolina	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	161,851	199,333	110,107	190,220	219,921	244,157	257,070	247,269	187,434	163,522	174,218
Oregon	—	—	—	—	—	—	—	—	—	—	—
Pennsylvania	—	—	—	—	—	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—	—	—	—	—	—
Tennessee	21,089	17,433	8,792	14,123	14,424	13,042	14,747	10,975	9,435	² 29,862	² 36,794
Texas	—	—	—	—	—	—	—	—	—	—	—
Utah	2,010	3,700	32	2,322	5,139	8,420	23,864	43,173	44,990	42,573	46,729
Virginia	—	—	—	—	—	2,417	2,478	5,289	7,552	NA	NA
Washington	—	193	204	557	1,372	413	552	474	581	39	961
Wisconsin	36,981	24,753	3,075	9,935	11,985	12,725	18,352	24,313	29,793	16,703	15,409
Other	—	—	—	—	—	—	—	—	—	—	—
Total ¹	498,264	532,993	232,820	428,220	554,009	578,763	644,870	702,672	651,850	630,648	657,236
Employment, mine and mill, Dec. 31 ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 2.—Mine production of recoverable zinc in the United States, by State—Continued
(Metric tons unless otherwise specified)

State	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Alaska	—	—	—	—	—	—	—	—	—	—	—
Arizona	739	—	—	5	821	3,027	3,256	4,560	5,274	6,088	14,021
Arkansas	—	—	—	10	62	139	165	219	138	112	399
California	—	73	—	132	327	146	7	18	—	5	72
Colorado	32,894	14,685	99	1,166	700	1,090	1,063	3,853	4,130	1,660	4,590
Idaho	34,155	17,753	9,300	19,022	22,497	28,171	44,543	49,169	39,943	43,136	64,048
Illinois	8	—	—	—	—	—	—	—	—	303	4,371
Iowa	—	—	—	—	—	—	—	—	—	—	—
Kansas	67,407	35,426	23,838	37,147	34,710	49,088	71,683	72,847	66,246	62,569	51,739
Kentucky	—	—	42	207	113	115	216	245	292	825	1,159
Maine	—	—	—	—	—	—	—	—	—	—	—
Missouri	9,808	2,908	894	4,574	6,404	6,589	16,973	18,688	9,277	13,695	11,524
Montana	23,969	6,121	1,993	18,801	27,870	49,697	45,103	35,533	8,023	31,569	47,706
Nevada	13,230	9,463	115	5,794	12,646	14,094	12,226	12,915	8,110	5,650	10,735
New Hampshire	—	—	—	—	—	—	—	—	—	—	—
New Jersey	88,565	85,534	73,899	68,152	69,448	77,753	81,541	91,996	77,872	80,482	82,922
New Mexico	29,724	25,280	23,218	28,054	24,060	20,072	18,750	21,706	25,615	26,631	27,499
New York	20,385	21,863	15,235	16,087	21,036	21,518	24,440	29,656	27,121	32,671	32,374
North Carolina	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	123,516	70,880	57,549	82,613	97,769	117,719	117,186	123,101	102,443	127,350	147,812
Oregon	5	—	5	5	34	—	55	22	—	—	—
Pennsylvania	—	—	—	—	—	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—	—	—	—	—	—
Tennessee	² 43,678	² 34,756	² 16,796	² 29,728	² 43,284	² 44,300	² 40,747	² 50,127	² 51,497	29,370	31,566
Texas	—	—	—	—	—	—	—	—	—	—	—
Utah	40,365	33,830	26,913	26,984	25,581	28,220	32,833	43,546	30,534	31,321	39,724
Virginia	NA	NA	NA	NA	NA	NA	NA	NA	NA	21,636	15,356
Washington	319	4,512	2,037	3,056	1,747	1	3,994	3,734	10,344	9,191	10,487
Wisconsin	11,392	9,152	6,824	7,076	8,897	8,095	7,372	6,294	1,881	5,356	5,234
Other	—	—	—	—	—	—	—	—	—	—	—
Total ¹	540,161	372,234	258,757	348,613	398,006	469,834	522,152	568,226	468,742	529,621	603,340
Employment, mine and mill, Dec. 31 ^c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
Alaska	—	—	—	—	—	—	23	20	2	5	1
Arizona	14,962	16,803	17,851	26,378	36,492	39,612	49,572	49,422	64,100	54,867	48,080
Arkansas	187	164	87	17	275	77	16	28	1	7	45
California	399	556	1,684	7,670	9,002	6,239	4,912	4,831	6,540	6,850	8,711
Colorado	14,263	29,225	40,001	36,247	32,453	32,792	35,149	40,972	43,275	41,527	50,543
Idaho	71,744	79,157	78,659	82,891	75,716	64,870	75,359	78,260	69,450	79,732	70,870
Illinois	8,344	8,518	5,308	6,588	7,539	7,981	9,138	11,775	16,472	24,478	19,755
Iowa	—	—	—	—	—	—	—	—	—	—	—
Kansas	64,776	50,688	51,659	57,790	43,902	43,275	37,645	32,275	26,701	24,654	26,221
Kentucky	387	369	845	309	165	285	461	580	848	663	3,136
Maine	—	—	—	—	—	—	—	—	—	—	—
Missouri	19,896	33,016	27,590	33,227	20,117	20,170	15,489	5,863	5,362	7,429	10,411
Montana	55,075	49,637	34,116	32,774	15,788	15,213	41,439	53,610	49,165	61,396	77,611
Nevada	13,725	9,251	12,380	18,778	19,465	20,547	15,395	18,405	18,546	19,601	15,824
New Hampshire	—	—	—	—	—	—	—	—	—	—	—
New Jersey	85,077	85,312	84,245	72,836	73,838	58,472	69,736	69,247	46,252	49,921	57,077
New Mexico	34,348	42,149	53,999	46,019	36,555	32,752	40,010	37,650	26,622	26,547	41,203
New York	34,878	41,555	41,731	32,242	22,660	29,497	30,950	31,358	34,449	34,764	36,334
North Carolina	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	151,139	132,912	103,496	82,961	62,868	63,097	46,323	39,754	39,946	42,401	48,489
Oregon	—	—	—	—	1	—	1	—	5	19	3
Pennsylvania	—	—	—	—	—	—	—	—	—	—	—
South Dakota	—	104	42	51	—	—	17	26	—	—	—
Tennessee	32,813	39,890	37,889	37,041	30,685	22,328	28,315	26,784	27,023	32,047	35,053
Texas	—	—	—	—	—	40	20	—	—	—	22
Utah	38,146	41,316	42,543	35,375	30,509	25,666	39,619	37,639	36,895	28,738	31,132

See footnotes at end of table.

Table 2.—Mine production of recoverable zinc in the United States, by State—Continued
(Metric tons unless otherwise specified)

State	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
Virginia	20,786	14,507	16,876	17,842	14,583	15,336	15,230	14,408	11,944	11,245	6,651
Washington	12,991	13,062	11,070	10,799	10,608	10,277	12,519	11,465	9,743	13,433	16,501
Wisconsin	5,659	8,551	13,052	14,106	14,117	12,951	11,089	7,134	4,804	5,191	14,292
Other	—	—	—	—	—	—	—	—	—	—	—
Total ¹	679,595	696,741	675,123	651,941	557,336	521,478	578,428	571,506	538,145	565,516	617,964
Employment, mine and mill, Dec. 31 ^e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Alaska	—	—	—	—	—	—	—	—	—	—	—
Arizona	42,767	24,975	19,469	20,579	23,206	30,758	25,884	33,861	32,487	26,839	29,836
Arkansas	24	—	—	—	—	—	—	44	45	34	191
California	8,545	4,861	1,284	6,202	7,302	2,693	46	71	422	276	292
Colorado	48,265	34,300	31,888	32,069	36,511	42,638	33,686	32,103	28,375	38,689	39,327
Idaho	67,419	65,456	55,817	48,366	44,961	52,463	45,110	50,529	33,385	52,884	57,030
Illinois	17,070	13,205	13,088	19,686	21,808	20,126	22,625	24,326	26,807	24,308	24,869
Iowa	—	—	—	—	—	—	—	—	—	—	—
Kansas	23,117	14,075	17,336	25,048	26,004	14,387	4,011	923	1,921	2,219	3,577
Kentucky	2,976	444	415	—	378	759	1,141	611	788	1,041	1,063
Maine	—	—	—	—	—	—	—	—	—	—	—
Missouri	12,688	9,055	4,726	4,061	3,973	2,677	328	83	2,559	5,304	2,533
Montana	74,557	72,821	55,295	62,222	63,975	45,831	30,153	25,263	11,386	9,310	34,181
Nevada	13,932	5,273	939	2,422	6,793	4,801	83	197	381	411	255
New Hampshire	—	—	—	—	—	—	—	—	—	—	—
New Jersey	53,696	41,458	33,943	10,562	4,234	11,367	551	—	—	102	13,888
New Mexico	46,244	12,132	5	13,859	31,761	29,647	8,196	4,206	12,492	20,775	19,972
New York	29,607	46,746	48,261	48,095	53,625	58,658	48,094	39,430	60,204	49,680	48,674
North Carolina	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	49,819	30,312	39,164	37,687	24,961	13,563	4,778	952	2,116	2,856	9,084
Oregon	1	—	—	—	—	—	—	—	—	3	—
Pennsylvania	—	—	—	—	—	—	9,808	15,166	12,470	21,254	22,052
South Dakota	—	—	—	—	—	—	—	—	—	—	—
Tennessee	34,491	34,895	27,511	36,483	41,751	52,674	53,642	81,585	82,911	74,148 ¹	64,907
Texas	3	—	—	—	—	—	—	—	—	—	—
Utah	29,889	26,475	30,872	39,513	38,441	37,055	40,807	31,954	32,183	33,783	31,128
Virginia	12,164	15,128	15,184	16,628	17,414	20,945	16,758	18,447	18,039	26,456	24,021
Washington	18,236	29,743	20,234	26,795	23,232	21,772	17,052	15,523	19,338	18,341	19,635
Wisconsin	18,677	15,268	14,092	16,625	21,673	19,573	11,013	10,555	16,701	12,578	12,058
Other	—	—	—	—	—	—	—	—	—	—	—
Total ¹	604,186	496,620	429,526	466,902	492,003	482,387	373,765	385,829	395,013	421,288	458,574
Employment, mine and mill, Dec. 31 ^e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Alaska	—	—	—	—	—	—	—	—	—	—	—
Arizona	23,060	22,398	19,738	14,501	13,000	4,936	8,200	8,725	7,041	9,173	7,645
Arkansas	—	—	—	—	—	—	—	—	—	—	—
California	92	130	204	304	400	3,198	3,018	3,188	2,724	1,090	18
Colorado	43,644	48,700	48,870	49,734	47,575	45,593	48,729	51,432	55,502	57,879	52,924
Idaho	57,395	53,794	52,648	55,336	51,281	51,935	50,712	37,242	40,894	35,060	41,828
Illinois	18,449	12,519	16,614	13,782	18,521	16,494	12,487	15,238	11,527	10,322	4,763
Iowa	—	—	—	—	—	—	—	—	—	—	—
Kansas	3,182	4,232	5,904	4,326	4,323	2,732	1,724	1,076	—	—	—
Kentucky	1,325	1,872	5,129	5,975	5,731	W	W	3,800	4,779	1,615	248
Maine	—	—	—	—	—	—	—	8,268	5,307	5,280	17,817
Missouri	291	1,362	3,912	3,600	6,740	11,159	37,284	46,013	43,740	56,176	74,707
Montana	29,884	26,362	30,650	26,417	3,031	3,427	5,573	1,295	327	11	66
Nevada	518	528	3,500	5,286	2,753	1,909	854	115	64	—	—
New Hampshire	—	—	—	—	—	—	—	—	—	—	—
New Jersey	29,699	29,870	34,742	22,895	23,624	23,286	22,749	26,021	27,195	34,560	29,962
New Mexico	11,737	27,064	33,076	26,577	19,396	16,952	22,052	15,060	12,663	11,553	11,183

See footnotes at end of table.

Table 2.—Mine production of recoverable zinc in the United States, by State—Continued
(Metric tons unless otherwise specified)

State	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
New York	48,530	55,115	63,394	66,636	64,006	60,050	53,277	53,140	57,534	55,111	73,895
North Carolina	12	—	—	—	—	—	—	—	—	—	—
Oklahoma	12,016	11,030	11,535	10,194	9,680	6,279	2,489	—	—	—	—
Oregon	3	(³)	(³)	—	—	—	(⁴)	—	—	—	—
Pennsylvania	24,847	27,900	25,070	25,474	31,812	27,562	29,969	26,811	24,891	16,641	17,107
South Dakota	—	—	—	—	—	—	—	1	—	—	—
Tennessee	86,951	105,182	111,028	93,546	102,571	112,526	112,974	107,284	108,223	92,281	58,216
Texas	—	—	—	—	—	—	—	—	—	—	—
Utah	32,821	28,511	25,172	33,859	31,072	30,076	31,663	31,468	23,316	19,825	15,241
Virginia	21,762	19,055	18,589	16,026	17,097	17,470	16,968	16,386	15,267	15,231	15,135
Washington	20,203	22,041	20,167	22,473	19,541	12,595	8,834	10,846	5,245	5,881	5,786
Wisconsin	13,711	23,839	24,488	22,476	26,266	23,325	20,775	18,719	9,657	6,235	7,867
Other	—	—	—	—	—	8,802	11,455	2,432	3	—	—
Total ¹	480,131	521,503	554,429	519,416	498,419	480,305	501,786	484,560	455,899	433,924	434,408
Employment, mine and mill, Dec. 31 ^c	NA	NA	NA	NA	NA	NA	NA	8,700	8,200	6,800	6,700
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Alaska	—	—	—	—	—	—	—	—	—	—	—
Arizona	8,799	7,852	8,619	3,973	W	W	W	138	—	—	—
Arkansas	—	—	—	—	—	—	—	—	—	—	—
California	7	187	154	2	W	W	—	W	—	—	—
Colorado	44,896	43,962	45,923	36,530	22,208	9,910	13,823	W	W	W	W
Idaho	35,806	37,127	42,262	28,121	32,353	29,660	27,722	W	W	W	W
Illinois	3,723	W	W	W	W	W	W	W	W	W	W
Iowa	—	—	—	—	—	—	—	—	—	—	—
Kansas	—	—	—	—	—	—	—	—	—	—	—
Kentucky	—	37	54	—	52	—	—	W	W	W	W
Maine	9,457	7,546	7,085	6,594	—	—	—	—	—	—	—
Missouri	83,449	67,918	75,777	74,107	59,038	61,682	62,886	52,904	63,680	57,044	45,458
Montana	123	100	58	72	79	104	71	25	W	—	—
Nevada	3,089	4,986	1,305	1,517	1,371	W	2	W	—	—	—
New Hampshire	—	—	—	—	—	—	—	—	—	—	—
New Jersey	29,799	28,218	30,633	30,358	28,915	31,118	28,859	16,198	16,800	16,475	W
New Mexico	12,505	9,993	W	W	W	W	W	W	—	—	—
New York	84,438	69,501	66,833	64,264	26,463	12,133	33,629	36,889	52,237	56,748	W
North Carolina	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	—	—	—	—	—	—	—	—	—	—	—
Oregon	—	—	—	—	—	—	—	—	—	—	—
Pennsylvania	18,405	19,133	20,212	20,706	19,099	21,447	22,556	24,732	24,762	16,792	—
South Dakota	—	—	—	—	—	—	—	—	—	—	—
Tennessee	77,719	75,562	74,854	82,044	87,906	85,119	111,754	117,684	121,306	109,958	116,526
Texas	—	—	—	—	W	—	—	—	—	—	—
Utah	11,448	17,817	20,394	16,111	3,505	W	W	1,576	—	—	W
Virginia	15,599	13,745	10,198	12,040	10,974	11,406	12,038	9,731	—	—	—
Washington	6,268	W	W	5,055	W	—	—	—	—	—	—
Wisconsin	7,926	W	W	W	W	W	—	—	—	—	—
Other	21	22,108	35,182	26,395	10,703	4,762	3,763	52,541	24,375	18,277	90,784
Total ¹	453,477	425,792	439,543	407,889	302,669	267,341	317,103	312,418	303,160	275,294	252,768
Employment, mine and mill, Dec. 31 ^c	6,700	6,700	6,700	6,600	5,700	4,600	5,500	4,200	3,200	2,900	2,800
	1985	1986	1987	1988	1989	1990					
Alaska	—	—	—	—	W	W					
Arizona	—	—	—	—	—	—					
Arkansas	—	—	—	—	—	—					
California	—	—	—	—	—	—					
Colorado	W	W	W	W	W	W					
Idaho	W	351	W	W	W	W					
Illinois	W	W	W	W	W	W					
Iowa	—	—	—	—	—	—					

See footnotes at end of table.

Table 2.—Mine production of recoverable zinc in the United States, by State—Continued
(Metric tons unless otherwise specified)

State	1985	1986	1987	1988	1989	1990
Kansas	—	—	—	—	—	—
Kentucky	W	—	10	W	—	W
Maine	—	—	—	—	—	—
Missouri	49,340	37,919	34,956	41,322	50,790	48,864
Montana	—	—	W	18,935	W	W
Nevada	—	—	—	—	—	—
New Hampshire	—	—	—	—	—	—
New Jersey	W	W	—	—	—	—
New Mexico	—	—	—	—	W	W
New York	W	W	W	W	W	W
North Carolina	—	—	—	—	—	—
Oklahoma	—	—	—	—	—	—
Oregon	—	—	—	—	—	—
Pennsylvania	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—
Tennessee	104,471	102,118	115,699	119,954	W	W
Texas	—	—	—	—	—	—
Utah	—	—	—	—	—	—
Virginia	—	—	—	—	—	—
Washington	—	—	—	—	—	—
Wisconsin	—	—	—	—	—	—
Other	72,734	62,595	65,662	64,103	225,093	458,602
Total ¹	226,545	202,983	216,327	244,314	275,883	515,355
Employment, mine and mill, Dec. 31 ²	2,600	2,000	2,000	2,100	2,100	2,100

¹Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Other."

²Data may not add to totals shown because of independent rounding.

³Includes Tennessee and Virginia figures; not available separately.

⁴Withheld to avoid disclosing proprietary data; not included in "Total."

⁵Less than 1/2 unit.

Table 3.—Primary and secondary slab zinc produced in the United States
(Metric tons unless otherwise specified)

	1911	1912	1913	1914	1915	1916	1917	1918
Primary:								
From domestic ores	246,410	293,844	305,950	311,544	415,613	511,154	530,338	446,702
From foreign ores	13,522	13,516	8,549	8,737	28,471	94,352	77,089	23,153
Total ¹	259,932	307,360	314,499	320,281	444,084	605,506	607,427	469,856
Secondary:								
At primary smelters	NA	NA	NA	NA	NA	NA	NA	NA
At secondary smelters	NA	NA	NA	NA	NA	NA	NA	NA
Total ¹	12,740	23,645	23,579	18,638	27,001	26,105	15,272	8,997
Grand total (excludes zinc recovered by remelting) ¹	272,672	331,005	338,078	338,919	471,086	631,611	622,699	478,853
Employment, smelters, Dec. 31 ²	NA	NA	NA	NA	NA	NA	NA	NA
	1919	1920	1921	1922	1923	1924	1925	1926
Primary:								
From domestic ores	410,294	408,274	179,833	320,485	461,154	467,954	504,060	555,189
From foreign ores	12,221	12,095	2,057	910	1,904	1,368	15,708	5,834
Total ¹	422,515	420,369	181,891	321,395	463,058	469,322	519,768	561,023
Secondary:								
At primary smelters	NA	NA	NA	NA	NA	NA	NA	NA
At secondary smelters	NA	NA	NA	NA	NA	NA	NA	NA
Total ¹	17,915	19,387	15,942	29,926	35,774	32,192	35,544	37,012
Grand total (excludes zinc recovered by remelting) ¹	440,430	439,756	197,833	351,321	498,832	501,515	555,312	598,035
Employment, smelters, Dec. 31 ²	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at the end of table.

Table 3.—Primary and secondary slab zinc produced in the United States—Continued
(Metric tons unless otherwise specified)

	1927	1928	1929	1930	1931	1932	1933	1934
Primary:								
From domestic ores	523,409	536,623	555,321	443,941	264,894	187,922	277,608	322,383
From foreign ores	14,112	10,030	12,076	² 7,878	—	—	³ 1,063	² 7,461
Total ¹	537,522	546,652	567,396	451,819	264,894	187,922	278,671	329,843
Secondary:								
At primary smelters	NA	NA	NA	⁴ 7,711	⁵ 4,847	1,448	12,909	4,501
At secondary smelters	NA	NA	NA	23,903	14,771	11,904	14,385	13,362
Total ¹	38,813	44,149	42,953	⁶ 31,614	⁶ 19,618	13,352	27,294	17,863
Grand total (excludes zinc recovered by remelting) ¹	576,335	590,802	610,350	483,433	284,512	201,274	305,965	347,707
Employment, smelters, Dec. 31 ^e	NA	NA	NA	NA	NA	NA	NA	NA
	1935	1936	1937	1938	1939	1940	1941	1942
Primary:								
From domestic ores	373,927	446,156	500,009	395,539	445,480	535,228	592,028	571,488
From foreign ores	² 7,666	³ 298	³ 5,206	9,375	14,676	77,371	153,696	237,605
Total ¹	381,593	446,455	505,215	404,914	460,157	612,599	745,724	809,093
Secondary:								
At primary smelters	12,192	20,087	21,891	12,703	21,293	18,146	25,314	19,031
At secondary smelters	13,799	18,204	24,878	15,976	24,455	26,230	28,666	29,227
Total ¹	25,991	38,291	46,769	28,679	45,748	44,376	53,980	48,258
Grand total (excludes zinc recovered by remelting) ¹	407,584	484,746	551,984	433,593	505,904	656,976	799,704	857,351
Employment, smelters, Dec. 31 ^e	NA	NA	NA	NA	NA	NA	NA	NA
	1943	1944	1945	1946	1947	1948	1949	1950
Primary:								
From domestic ores	539,095	521,135	423,732	416,584	462,717	488,035	536,558	533,689
From foreign ores	315,754	267,483	269,867	244,084	265,294	226,613	202,600	⁷ 231,492
Total ¹	854,849	788,618	693,598	660,668	728,011	714,648	739,158	765,181
Secondary:								
At primary smelters	22,122	22,383	19,237	16,699	20,042	25,465	20,667	25,774
At secondary smelters	21,618	22,103	25,435	23,685	33,973	31,071	29,265	34,980
Total ¹	43,740	44,486	44,672	40,384	54,016	56,536	49,932	60,754
Grand total (excludes zinc recovered by remelting) ¹	898,589	833,103	738,270	701,053	782,027	771,183	789,090	825,935
Employment, smelters, Dec. 31 ^e	NA	NA	NA	NA	NA	NA	NA	NA
	1951	1952	1953	1954	1955	1956	1957	1958
Primary:								
From domestic ores	564,111	522,383	⁷ 449,452	⁷ 345,013	528,810	⁷ 426,461	489,600	⁷ 314,104
From foreign ores	235,693	⁷ 298,147	⁷ 381,625	⁷ 382,935	⁷ 345,266	⁷ 465,855	404,699	394,631
Total ¹	799,804	820,530	831,077	727,948	874,076	892,316	894,299	⁸ 708,735
Secondary:								
At primary smelters	14,743	17,110	16,007	28,720	22,450	27,416	31,947	22,042
At secondary smelters	29,398	32,885	31,960	32,981	37,462	38,016	33,807	20,237
Total ¹	44,141	49,996	47,967	61,700	59,912	65,433	65,754	42,279
Grand total (excludes zinc recovered by remelting) ¹	843,945	870,526	879,044	789,648	933,989	957,749	960,053	⁸ 751,014
Employment, smelters, Dec. 31 ^e	NA	NA	NA	NA	NA	NA	NA	NA
	1959	1960	1961	1962	1963	1964	1965	1966
Primary:								
From domestic ores	316,102	⁸ 303,091	374,923	406,505	430,012	482,592	500,054	474,984
From foreign ores	408,436	⁸ 422,218	393,276	391,269	379,727	382,938	402,053	454,941
Total ¹	⁸ 724,538	725,309	768,200	797,774	809,739	865,531	902,107	929,924

See footnotes at end of table.

Table 3.—Primary and secondary slab zinc produced in the United States—Continued
(Metric tons unless otherwise specified)

	1959	1960	1961	1962	1963	1964	1965	1966
Secondary:								
At primary smelters	25,810	36,296	32,041	37,859	42,832	52,205	63,781	64,918
At secondary smelters	26,641	26,056	18,069	15,556	11,874	12,746	12,077	10,617
Total ¹	52,452	62,352	50,110	53,415	54,706	64,951	75,858	75,535
Grand total (excludes zinc recovered by remelting) ¹	² 776,989	² 787,661	² 818,310	851,189	864,445	930,482	977,964	1,005,459
Employment, smelters, Dec. 31 ^c	NA	NA	NA	NA	NA	NA	NA	NA
	1967	1968	1969	1970	1971	1972	1973	1974
Primary:								
From domestic ores	397,849	453,131	416,175	366,460	366,276	363,753	362,075	314,787
From foreign ores	453,844	473,006	527,839	429,877	329,021	210,658	167,249	188,871
Total ¹	851,692	926,137	944,014	796,337	695,297	574,411	529,323	503,658
Secondary:								
At primary smelters	52,926	60,873	54,982	59,671	62,244	57,184	61,469	51,113
At secondary smelters	13,757	11,579	9,023	10,324	11,168	9,692	13,997	20,133
Total ¹	66,683	72,452	64,005	69,995	73,412	66,876	75,466	71,246
Grand total (excludes zinc recovered by remelting) ¹	918,375	998,589	1,008,019	866,332	768,709	641,287	604,789	574,904
Employment, smelters, Dec. 31 ^c	NA	NA	NA	5,900	5,400	4,500	4,500	4,500
	1975	1976	1977	1978	1979	1980	1981	1982
Primary:								
From domestic ores	279,376	346,429	322,208	267,350	255,344	231,850	259,835	193,284
From foreign ores	118,018	106,125	86,156	139,348	217,137	108,606	86,728	34,892
Total ¹	397,394	452,554	408,364	406,698	472,481	340,456	346,563	228,176
Secondary:								
At primary smelters	31,689	34,132	26,448	24,085	40,343	13,113	14,438	42,418
At secondary smelters	20,824	28,060	19,465	10,689	12,868	16,283	35,754	31,870
Total ¹	52,513	62,192	45,914	34,774	53,212	29,396	50,192	74,288
Grand total (excludes zinc recovered by remelting) ¹	449,907	514,746	454,278	441,472	525,693	369,852	396,755	302,464
Employment, smelters, Dec. 31 ^c	4,100	4,100	4,100	4,100	4,000	1,300	2,100	1,600
	1983	1984	1985	1986	1987	1988	1989	1990
Primary:								
From domestic ores	210,315	197,912	198,005	191,079	205,275	196,476	229,870	230,470
From foreign ores	25,379	55,220	63,204	62,290	56,070	44,818	30,435	32,234
Total ¹	235,694	253,132	261,209	253,369	261,345	241,294	260,305	262,704
Secondary:								
At primary smelters	40,545	44,930	39,720	49,852	W	W	W	W
At secondary smelters	28,845	33,183	32,843	13,060	W	W	W	W
Total ¹	69,390	78,113	72,563	62,912	82,589	88,492	97,904	95,708
Grand total (excludes zinc recovered by remelting) ¹	305,084	331,245	333,772	316,281	343,934	329,786	358,209	358,412
Employment, smelters, Dec. 31 ^c	1,600	2,000	1,600	1,600	1,500	1,500	1,500	1,500

^cEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Data do not add to total shown because of independent rounding.

²Since 1926, all foreign zinc smelted in the United States has been derived from Mexican ores.

³All foreign zinc smelted in the United States in 1933-36 was derived from Mexican ores; in 1937-38, most of it originated in Peru; in 1939, it came from Argentina, Mexico, and Peru; and in 1940-41, from Canada, Mexico, Newfoundland, and Peru.

⁴Includes 22 metric tons of secondary electrolytic zinc.

⁵Includes 312 metric tons of secondary electrolytic zinc.

⁶Includes 22 metric tons of secondary electrolytic zinc in 1930 and 312 metric tons in 1931.

⁷Includes a small tonnage of slab zinc further refined into high-grade metal.

⁸Includes production of zinc used directly in alloying operations.

Table 4.—U.S. production of selected zinc compounds, zinc content
(Metric tons)

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Zinc oxide ¹	152,730	132,564	161,606	138,128	147,555	158,844	157,371	163,305	187,829	202,806
Zinc sulfate	33,752	34,513	41,353	27,628	29,269	30,539	40,109	46,314	53,104	53,328
Zinc chloride ²	61,186	63,593	58,797	55,802	52,479	53,733	49,728	50,977	52,635	58,436
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Zinc oxide ¹	187,208	209,963	220,358	162,343	156,092	174,502	192,247	185,525	120,048	141,189
Zinc sulfate	48,847	57,131	68,482	14,909	14,487	12,150	13,213	12,588	5,545	12,335
Zinc chloride ²	50,853	57,914	47,909	NA	NA	NA	NA	NA	W	9,647
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Zinc oxide ¹	150,008	149,501	138,207	113,548	116,462	98,849	103,928	120,560	109,866	96,318
Zinc sulfate	10,905	12,475	10,858	14,240	15,666	17,388	15,910	15,150	17,138	22,363
Zinc chloride ²	9,179	10,628	8,931	5,666	6,043	5,675	10,207	12,453	6,961	7,690
	1987	1988	1989	1990						
Zinc oxide ¹	112,420	93,527	103,642	98,047						
Zinc sulfate	19,752	15,374	14,427	14,947						
Zinc chloride ²	12,035	8,482	7,269	7,436						

NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Excludes leaded zinc oxide.

²Includes zinc content of zinc ammonium chloride.

Table 5.—Consumption of slab zinc,¹ by Industry
(Metric tons)

	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917
Galvanizing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brass and bronze ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc-base alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rolled zinc ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc oxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	194,289	245,602	223,062	254,065	308,752	267,955	272,140	330,991	416,685	375,251
	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Galvanizing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brass and bronze ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc-base alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rolled zinc ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc oxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	384,458	293,895	293,060	184,703	338,462	405,071	406,652	453,680	505,326	488,446
	1928	1929	1930	1931	1932	1933	1934 ^c	1935 ^c	1936 ^c	1937 ^c
Galvanizing	263,991	263,084	196,859	152,407	98,883	134,263	137,892	176,901	219,539	232,239
Brass and bronze ...	157,860	167,829	108,862	88,904	59,874	85,275	88,904	112,491	149,686	153,314
Zinc-base alloys	27,216	32,659	19,504	18,144	15,422	23,587	29,030	50,349	65,317	79,832
Rolled zinc ²	66,678	61,961	46,629	44,724	36,287	37,467	37,104	51,256	49,895	52,617
Zinc oxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other ³	52,617	49,895	37,195	31,479	24,494	37,195	33,566	38,102	43,545	35,380
Total	568,351	575,427	409,050	335,658	234,961	317,787	326,496	429,099	527,982	553,383
	1938 ^c	1939 ^c	1940	1941	1942	1943	1944	1945	1946	1947
Galvanizing	179,623	249,476	300,464	318,289	224,520	229,700	286,663	305,886	290,081	327,790
Brass and bronze ...	92,533	158,757	147,521	206,873	290,250	380,182	346,478	235,303	135,263	101,920
Zinc-base alloys	43,545	76,204	133,103	137,779	72,706	69,241	76,676	118,692	192,515	194,563
Rolled zinc ²	41,731	56,245	54,608	65,131	59,915	44,025	69,421	88,531	83,821	64,120
Zinc oxide	NA	NA	22,992	14,631	7,237	10,429	18,323	16,432	17,391	16,670
Other ³	24,494	27,216	6,330	7,933	5,956	7,391	8,587	8,360	7,805	8,311
Total	381,925	567,898	665,018	750,637	660,584	740,958	806,148	773,204	726,876	713,374

See footnotes at end of table.

Table 5.—Consumption of slab zinc,¹ by Industry—Continued
(Metric tons)

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957
Galvanizing	336,538	318,313	400,691	363,127	342,633	369,213	366,016	409,268	398,387	333,624
Brass and bronze ...	99,010	77,595	126,437	129,992	141,165	161,644	98,219	132,669	112,495	101,959
Zinc-base alloys	212,851	183,416	262,655	268,920	214,721	278,909	263,851	390,822	327,047	341,137
Rolled zinc ²	69,556	50,077	62,091	58,137	46,555	49,577	43,079	46,801	42,963	37,439
Zinc oxide	14,204	9,337	16,499	16,532	15,608	18,756	16,965	20,351	17,382	18,532
Other ³	9,679	7,034	8,997	10,576	12,950	16,318	14,093	15,966	16,886	16,091
Total	741,837	645,771	877,369	847,284	773,632	894,418	802,223	1,015,877	915,159	848,780
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Galvanizing	345,845	327,518	337,100	346,615	352,505	381,278	413,981	437,645	462,153	428,618
Brass and bronze ...	91,966	117,279	89,832	116,594	117,757	116,335	122,556	115,075	168,330	119,328
Zinc-base alloys	287,423	353,195	306,967	310,045	384,291	425,124	475,893	578,757	549,787	485,451
Rolled zinc ²	36,846	38,963	35,104	37,380	38,313	38,252	40,080	41,623	47,729	41,225
Zinc oxide	12,094	16,554	14,146	16,454	16,798	14,549	18,136	23,388	25,799	27,011
Other ³	13,559	13,938	13,254	17,696	26,388	27,004	24,569	31,924	37,732	32,959
Total	787,733	867,448	796,403	844,782	936,053	1,002,542	1,095,215	1,228,412	1,291,528	1,134,592
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Galvanizing	452,480	447,588	430,232	430,688	470,107	511,504	474,702	341,906	392,886	396,438
Brass and bronze ...	146,879	162,812	115,890	136,519	174,313	179,305	164,711	104,622	150,814	128,310
Zinc-base alloys	510,696	522,893	420,604	468,208	525,950	553,933	399,396	303,173	387,396	367,130
Rolled zinc ²	44,400	44,135	37,254	35,246	41,019	36,980	35,737	24,773	27,088	27,406
Zinc oxide	31,694	37,600	39,761	36,326	47,166	56,004	59,308	35,398	35,405	38,514
Other ³	39,145	41,769	33,044	30,677	28,150	26,624	34,324	29,573	35,287	41,707
Total	1,225,295	1,256,796	1,076,785	1,137,664	1,286,705	1,364,350	1,168,178	839,445	1,028,876	999,505
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Galvanizing	454,014	452,803	379,227	411,047	380,000	460,000	465,000	480,000	530,000	550,000
Brass and bronze ...	141,488	141,404	98,826	112,986	105,000	130,000	150,000	120,000	135,000	140,000
Zinc-base alloys	354,134	314,056	254,227	243,365	200,000	215,000	240,000	225,000	230,000	229,000
Rolled zinc ²	24,869	22,044	21,100	23,156	39,000	46,000	44,000	46,000	30,000	36,000
Zinc oxide	37,202	35,513	27,047	25,657	32,400	36,200	37,000	44,000	43,000	64,000
Other ³	38,878	34,786	30,719	24,664	38,600	46,800	44,000	46,000	31,000	33,000
Total	1,050,585	1,000,606	811,146	840,875	795,000	934,000	980,000	961,000	999,000	1,052,000
	1988	1989	1990							
Galvanizing	559,000	552,000	505,900							
Brass and bronze ...	146,000	130,000	141,700							
Zinc-base alloys	254,000	220,000	205,000							
Rolled zinc ²	W	W	W							
Zinc oxide	65,900	71,000	68,100							
Other ³	64,100	87,000	70,300							
Total	1,089,000	1,060,000	991,000							

²Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Other."

¹Data through 1981 are reported consumption of slab zinc; 1982 forward, data are estimated distribution of apparent consumption of slab zinc.

²Starting in 1982, includes zinc used in penny production, and, in addition, 8,066 metric tons in 1932 and 6,342 metric tons in 1933 were rerolled from scrap originating in fabricating plants operated in connection with zinc-rolling mills.

³Includes zinc used in making zinc dust, wet batteries, desilverizing lead, powder, alloys, anodes, chemicals, castings, light metal alloys, and miscellaneous uses not elsewhere specified; and also includes zinc for french oxide from 1928 to 1939.

Source: American Bureau of Metal Statistics Year Book for information from 1928 to 1939.

Table 6.—U.S. consumption of zinc
(Metric tons)

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Slab zinc (rounded) ¹ ..	254,000	308,800	268,000	272,100	331,000	416,700	375,300	384,500	293,900	293,100
Ores and concentrates (zinc content) ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Secondary (zinc content) ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (rounded) ¹ ..	54,000	308,800	268,000	272,100	331,000	416,700	375,300	384,500	293,900	293,100
	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Slab zinc (rounded) ¹ ..	184,700	338,500	405,100	406,700	453,700	505,300	468,400	568,400	575,400	409,100
Ores and concentrates (zinc content) ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Secondary (zinc content) ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (rounded) ¹ ..	184,700	338,500	405,100	406,700	453,700	505,300	468,400	568,400	575,400	409,100
	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Slab zinc (rounded) ¹ ..	335,700	235,000	317,800	^c 326,500	^c 429,100	^c 528,000	^c 553,400	^c 381,900	^c 567,900	665,000
Ores and concentrates (zinc content) ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Secondary (zinc content) ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (rounded) ¹ ..	335,700	235,000	317,800	326,500	429,100	528,000	553,400	381,900	567,900	665,000
	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
Slab zinc (rounded) ¹ ..	750,600	660,600	741,000	806,100	773,200	726,900	713,400	741,800	645,800	877,400
Ores and concentrates (zinc content) ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Secondary (zinc content) ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (rounded) ¹ ..	750,600	660,600	741,000	806,100	773,200	726,900	713,400	741,800	645,800	877,400
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Slab zinc (rounded) ¹ ..	847,300	773,600	894,400	802,200	1,015,900	915,200	848,800	787,700	867,400	796,400
Ores and concentrates (zinc content) ²	121,422	99,134	107,269	90,035	107,170	102,864	100,072	86,126	98,039	80,082
Secondary (zinc content) ³	234,295	226,422	216,108	178,848	209,680	182,203	168,430	162,295	194,236	174,886
Total (rounded) ¹ ..	1,203,000	1,099,200	1,217,800	1,071,100	1,332,700	1,200,200	1,117,300	1,036,200	1,159,800	1,051,400
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Slab zinc (rounded) ¹ ..	844,800	936,100	1,002,500	1,095,200	1,228,400	1,291,500	1,134,600	1,225,300	1,256,800	1,076,800
Ores and concentrates (zinc content) ²	88,225	92,154	94,987	96,114	111,486	114,937	103,692	112,590	114,951	113,199
Secondary (zinc content) ³	162,391	181,354	185,427	201,880	240,479	244,622	218,530	245,477	274,038	235,745
Total (rounded) ¹ ..	1,095,400	1,209,600	1,283,000	1,393,200	1,580,400	1,651,100	1,456,800	1,583,400	1,645,800	1,425,700
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Slab zinc (rounded) ¹ ..	1,137,700	1,286,700	1,364,400	1,168,200	839,400	1,028,900	999,500	1,050,600	1,000,600	811,100
Ores and concentrates (zinc content) ²	108,185	107,325	117,617	115,315	75,053	91,844	86,490	89,959	79,710	58,986
Secondary (zinc content) ³	251,636	278,841	270,646	234,239	202,986	273,524	281,709	301,266	313,998	272,277
Total (rounded) ¹ ..	1,497,500	1,672,900	1,752,600	1,517,700	1,117,500	1,394,300	1,367,700	1,441,800	1,394,300	1,142,400
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Slab zinc (rounded) ¹ ..	840,900	795,000	934,000	980,000	961,000	999,000	1,052,000	1,089,000	1,060,000	991,000
Ores and concentrates (zinc content) ²	60,643	35,515	36,912	45,487	39,886	19,236	2,536	2,412	2,107	2,178
Secondary (zinc content) ³	287,851	208,105	276,370	318,018	256,455	255,752	269,319	248,461	249,122	245,692
Total (rounded) ¹ ..	1,189,400	1,038,600	1,247,300	1,344,000	1,257,000	1,274,000	1,324,000	1,340,000	1,311,000	1,239,000

^cEstimated. NA Not available.

¹Data through 1981 are reported consumption of slab zinc; 1982 forward, data are apparent consumption of slab zinc.

²Ores and concentrates used to make zinc chemicals and includes ore used directly for galvanizing.

³Excludes secondary slab and remelt zinc.

Table 7.—Yearend stocks of slab zinc in the United States
(Metric tons)

	1928	1929	1930	1931	1932	1933	1934	1935	1936
Primary producers	42,675	77,931	151,766	130,265	116,294	100,232	113,201	82,136	50,349
Secondary producers	1,262	3,220	1,732	2,265	3,057	2,249	2,436	1,044	568
Consumers	NA	NA	NA	NA	NA	NA	NA	NA	NA
Merchants	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total industry	43,937	81,151	153,498	132,530	119,351	102,481	115,637	83,180	50,917
Government stockpile	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1937	1938	1939	1940	1941	1942	1943	1944	1945
Primary producers	71,798	142,892	75,957	17,429	21,965	74,841	153,112	211,414	231,053
Secondary producers	1,786	1,737	2,318	690	807	1,762	1,659	591	1,316
Consumers	NA	NA	NA	NA	60,649	68,482	81,970	58,760	65,663
Merchants	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total industry	73,584	144,629	78,275	18,119	83,421	145,085	236,741	270,765	298,032
Government stockpile	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1946	1947	1948	1949	1950	1951	1952	1953	1954
Primary producers	159,223	60,823	17,399	82,291	7,210	19,362	73,794	160,322	110,538
Secondary producers	686	1,452	1,514	3,185	849	578	3,336	2,965	1,405
Consumers	83,694	73,345	86,985	74,209	58,247	45,889	83,710	77,741	94,081
Merchants	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total industry	243,603	135,620	105,898	159,685	66,306	65,829	160,840	241,028	206,024
Government stockpile	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1955	1956	1957	1958	1959	1960	1961	1962	1963
Primary producers	33,858	58,780	139,106	165,208	138,264	161,669	130,176	128,874	42,070
Secondary producers	1,762	1,888	2,263	1,732	3,447	6,961	3,078	2,438	1,393
Consumers	112,077	94,433	80,143	84,921	92,758	62,479	86,971	72,515	88,428
Merchants	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total industry	147,697	155,101	221,512	251,861	234,469	231,109	220,225	203,827	131,891
Government stockpile	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1964	1965	1966	1967	1968	1969	1970	1971	1972
Primary producers	27,832	25,070	57,721	73,760	58,690	58,879	111,997	43,635	26,166
Secondary producers	452	895	1,063	552	621	803	670	431	1,111
Consumers	98,349	136,770	117,565	93,018	92,368	92,539	84,072	83,028	113,358
Merchants	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total industry	126,633	162,735	176,349	167,330	151,679	152,221	196,739	127,094	140,635
Government stockpile	NA	NA	NA	NA	1,052,884	1,036,173	1,035,543	1,032,319	861,447
	1973	1974	1975	1976	1977	1978	1979	1980	1981
Primary producers	22,887	34,739	66,616	83,963	76,637	34,570	56,971	18,190	41,124
Secondary producers	651	1,295	1,129	3,989	7,123	3,358	2,095	4,362	3,540
Consumers	103,707	191,559	97,319	109,909	86,477	99,325	92,595	69,599	81,917
Merchants	NA	NA	NA	NA	NA	NA	63,637	33,650	68,773
Total industry	127,245	227,593	165,064	197,861	170,237	137,253	215,298	125,801	195,354
Government stockpile	614,172	355,254	349,914	349,440	347,828	345,872	345,684	342,380	340,581
	1982	1983	1984	1985	1986	1987	1988	1989	1990
Primary producers	30,381	20,750	42,025	29,030	16,722	13,400	6,000	7,200	6,000
Secondary producers	3,831	3,149	4,303	3,389	3,203	3,200	700	1,000	600
Consumers	77,565	89,041	72,775	60,310	54,079	57,400	64,900	60,100	60,400
Merchants	47,397	35,199	18,792	27,163	26,559	22,400	14,300	22,200	20,400
Total industry	159,174	148,139	137,895	119,892	100,563	96,400	85,900	90,500	87,400
Government stockpile	340,578	340,577	340,577	340,577	340,577	340,577	340,577	340,577	340,577

NA Not available.

Table 8.—Average U.S., LME¹, and European producer prices for equivalent zinc
(Cents per pound metallic zinc)

	1907	1908	1909	1910	1911	1912	1913	1914	1915
United States ²	5.80	4.60	5.40	5.40	5.70	6.90	5.60	5.10	14.20
LME cash	NA	NA	NA	NA	NA	NA	NA	NA	NA
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1916	1917	1918	1919	1920	1921	1922	1923	1924
United States ²	13.60	8.90	8.00	7.00	7.80	4.70	5.70	6.70	6.30
LME cash	NA	NA	NA	NA	NA	NA	NA	NA	NA
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1925	1926	1927	1928	1929	1930	1931	1932	1933
United States ²	7.66	7.37	6.25	6.03	6.49	4.56	3.64	2.88	4.03
LME cash	8	7	6	6	5	4	3	2	3
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1934	1935	1936	1937	1938	1939	1940	1941	1942
United States ²	4.16	4.33	4.90	6.52	4.61	5.12	6.34	7.48	8.25
LME cash	3	3	3	5	3	3	5	5	5
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1943	1944	1945	1946	1947	1948	1949	1950	1951
United States ²	8.25	8.25	8.25	8.73	10.50	13.58	12.15	13.88	17.99
LME cash	5	5	5	8	13	14	14	15	21
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1952	1953	1954	1955	1956	1957	1958	1959	1960
United States ²	16.21	10.86	10.69	12.30	13.49	11.40	10.31	11.46	12.95
LME cash	19	9	10	11	12	10	8	10	11
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1961	1962	1963	1964	1965	1966	1967	1968	1969
United States ²	11.55	11.63	12.01	13.57	14.50	14.50	13.85	13.50	14.65
LME cash	10	8	10	15	14	13	12	12	13
European producer ...	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1970	1971	1972	1973	1974	1975	1976	1977	1978
United States ²	15.32	16.13	17.75	20.66	35.95	38.96	37.01	34.39	30.97
LME cash	13.36	14.08	17.13	38.55	56.13	33.76	32.38	26.71	26.88
European producer ...	13.90	15.52	17.73	24.00	35.29	36.84	36.05	32.39	27.47
	1979	1980	1981	1982	1983	1984	1985	1986	1987
United States ²	37.30	37.43	44.56	38.47	41.39	48.60	40.37	38.00	41.92
LME cash	33.59	34.47	38.34	33.74	34.73	40.46	36.23	34.19	36.20
European producer ...	35.89	36.13	41.30	37.82	37.18	45.30	37.94	38.04	37.20
	1988	1989	1990						
United States ²	60.20	82.02	74.59						
LME cash	53.37	77.64	66.46						
European producer ...	51.11	75.95	67.74						

NA Not available.

¹London Metal Exchange.

²Based on Prime Western grade through 1979, starting 1980 based on High Grade zinc delivered.

Source: Metals Week and Metal Statistics.

Table 9.—U.S. imports for consumption of zinc
(Metric tons and thousand dollars)

	Ores and concentrates (zinc content)		Blocks, pigs, or slabs	
	Quantity	Value	Quantity	Value
1910	23,078	NA	897	95
1911	14,454	NA	293	38
1912	15,937	NA	9,724	1,240
1913	12,244	NA	4,686	565
1914	11,006	NA	177	21
1915	52,316	NA	57	17
1916	134,397	12,121	19	4
1917	65,747	4,374	16	2
1918	22,506	1,574	10	3
1919	15,430	530	29	2
1920	20,400	837	(¹)	(²)
1921	2,454	59	5,986	560
1922	1,750	NA	36	3
1923	2,924	NA	1	(²)
1924	4,218	NA	10	2
1925	12,280	NA	(¹)	(²)
1926	13,215	NA	(¹)	(²)
1927	8,630	NA	35	5
1928	1,512	NA	(¹)	(²)
1929	13,073	NA	205	22
1930	23,241	NA	255	25
1931	708	NA	249	15
1932	1,727	NA	281	20
1933	1,935	NA	1,715	127
1934	12,952	NA	1,565	113
1935	9,544	NA	4,032	270
1936	156	NA	10,578	770
1937	3,035	177	33,755	3,853
1938	4,409	393	6,559	480
1939	30,393	1,304	28,086	1,890
1940	40,494	1,108	9,204	801
1941	140,178	4,596	36,549	3,662
1942	256,885	10,724	32,978	2,924
1943	468,694	20,476	50,943	5,826
1944	376,485	18,679	57,721	6,133
1945	300,762	15,022	87,779	12,174
1946	151,396	8,122	94,406	16,482
1947	176,740	12,165	65,374	14,822
1948	121,394	11,738	83,910	24,911
1949	99,369	11,748	113,910	29,341
1950	215,514	24,314	140,915	38,759
1951	179,618	27,044	79,871	31,109
1952	491,979	105,429	102,560	36,220
1953	407,990	47,918	206,524	50,281
1954	436,282	52,482	145,275	33,714
1955	348,947	36,811	176,955	46,452
1956	419,463	49,231	222,012	65,034
1957	616,356	88,516	243,873	64,129
1958	487,792	51,121	168,458	35,511
1959	384,768	37,475	149,197	33,996
1960	347,396	38,704	109,701	29,639
1961	324,457	31,920	113,567	27,540
1962	351,372	31,817	123,373	28,478
1963	337,399	30,757	120,050	27,942
1964	282,529	35,831	121,670	31,898
1965	365,537	53,829	139,667	42,605
1966	359,585	51,696	254,290	75,624

See footnotes at end of table.

Table 9.—U.S. imports for consumption of zinc—Continued
(Metric tons and thousand dollars)

	Ores and concentrates (zinc content)		Blocks, pigs, or slabs	
	Quantity	Value	Quantity	Value
1967	391,286	58,075	201,397	57,531
1968	439,806	68,971	276,407	75,739
1969	512,772	79,242	294,616	84,617
1970	408,932	67,164	235,988	73,695
1971	423,989	62,678	294,159	93,628
1972	157,907	24,275	468,691	176,707
1973	139,864	24,708	535,920	273,623
1974	121,321	31,430	493,333	431,250
1975	388,769	108,822	340,124	273,636
1976	141,342	50,553	630,612	482,265
1977	109,277	37,897	503,621	359,134
1978	106,315	37,170	622,470	386,082
1979	87,499	37,104	524,130	390,599
1980	182,370	74,033	410,163	319,288
1981	245,710	110,253	612,007	549,326
1982	66,809	27,132	456,233	370,773
1983	63,156	16,548	617,679	503,888
1984	86,172	29,186	639,228	635,940
1985	90,186	33,626	610,900	508,003
1986	75,786	19,096	665,126	487,030
1987	46,464	12,322	705,985	581,221
1988	62,966	25,746	749,130	833,531
1989	40,974	23,047	711,554	1,183,523
1990	46,684	17,970	631,742	991,562

NA Not available.

¹Less than 1/2 unit.

²Less than \$500.

Source: Bureau of the Census.

Table 10.—U.S. exports of zinc
(Metric tons and thousand dollars)

	1907		1908		1909		1910		1911	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	9,234	579	11,842	878	5,650	412	8,941	649	16,584	643
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1912		1913		1914		1915		1916	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	21,182	824	16,069	632	10,079	388	755	35	71	4
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	NA	NA	NA	NA	NA	NA	NA	NA	11,351	4,119
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See footnotes at end of table.

Table 10.—U.S. exports of zinc—Continued
(Metric tons and thousand dollars)

	1917		1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	1,197	63	56	2	—	—	—	—	—	—
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	14,981	5,199	12,587	4,143	17,928	4,728	10,752	2,570	1,647	386
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1922		1923		1924		1925		1926	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	1,538	34	2,544	NA	334	NA	62,551	3,277	86,411	4,056
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	3,807	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	2,918	521	3,386	693	3,318	712	3,807	841	4,210	986
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	1,813	261	3,338	460	2,059	321	2,034	370	990	204
	1927		1928		1929		1930		1931	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	42,380	1,691	4,099	206	64	2	—	—	12	(¹)
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	3,558	788	3,924	823	4,776	975	3,509	690	2,503	418
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	1,231	235	914	181	1,139	227	1,068	176	1,270	185
	1932		1933		1934		1935		1936	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	—	—	2,734	240	23,285	2,142	2,418	21	222	6
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	2,731	393	2,893	425	3,141	516	4,366	685	4,067	656
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	1,250	171	1,423	212	1,351	203	1,463	216	1,627	249
	1937		1938		1939		1940		1941	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	285	10	122	6	275	11	406	42	—	—
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	5,273	1,002	5,204	824	6,085	1,012	6,795	1,420	4,759	1,206
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	1,946	379	2,044	323	2,571	425	2,761	537	2,632	614

See footnotes at end of table.

Table 10.—U.S. exports of zinc—Continued
(Metric tons and thousand dollars)

	1942		1943		1944		1945		1946	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	—	—	1	(¹)	—	—	—	—	81	15
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	4,325	1,170	2,873	808	3,647	966	5,656	1,586	12,561	4,053
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dust and flakes	1,608	378	5,315	1,146	268	67	299	73	332	81
	1947		1948		1949		1950		1951	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	1,274	215	3,218	422	² 2,654	² 477	² 1,034	² 265	² 2,803	² 793
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	9,887	3,841	6,662	2,985	6,764	3,172	4,364	2,106	5,968	3,956
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	NA	NA	NA	NA	1,424	203	5,635	611	4,185	790
Dust and flakes	1,493	406	808	271	626	237	459	170	656	364
	1952		1953		1954		1955		1956	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	² 3,057	² 899	² 2,679	² 759	—	—	—	—	775	162
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	3,838	2,686	4,198	2,392	3,670	1,980	3,318	1,989	4,032	2,750
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	882	257	907	154	15,140	1,835	19,606	2,041	13,536	1,397
Dust and flakes	(³)	(³)	455	164	462	137	404	147	337	123
	1957		1958		1959		1960		1961	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	6	(¹)	—	—	1	(¹)	12	3	1,515	124
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	3,680	2,676	⁴ 3,464	⁴ 2,392	⁴ 3,201	⁴ 2,457	⁴ 3,015	⁴ 2,216	⁴ 2,920	⁴ 2,060
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	4,961	746	4,848	330	10,280	955	11,040	1,360	5,352	790
Dust and flakes	540	177	471	154	473	165	705	242	650	203
	1962		1963		1964		1965		1966	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	123	46	15	6	35	12	NA	NA	NA	NA
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	⁴ 3,218	⁴ 2,169	⁴ 3,407	⁴ 2,488	⁴ 5,959	⁴ 3,609	4,645	2,768	4,464	2,901
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	7,203	867	1,627	489	5,850	1,251	5,096	1,046	4,054	637
Dust and flakes	613	218	689	237	1,658	492	NA	NA	NA	NA

See footnotes at end of table.

Table 12.—U.S. exports of zinc—Continued
(Metric tons and thousand dollars)

	1967		1968		1969		1970		1971	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blocks, pigs, anodes, etc.:										
Unwrought	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unwrought alloys	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wrought zinc and zinc alloy:										
Sheets, plates, strips	3,234	2,458	2,765	2,021	2,462	1,584	1,281	1,173	1,530	1,486
Angles, bars, pipes, etc.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Waste and scrap (zinc content) ...	1,510	481	2,080	804	1,804	650	2,823	1,049	1,814	504
Dust and flakes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1972		1973		1974		1975		1976	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blocks, pigs, anodes, etc.:										
Unwrought	3,923	714	13,214	8,259	17,293	16,511	6,257	5,870	3,187	2,306
Unwrought alloys	1,980	1,265	9,593	8,216	17,114	20,099	2,477	2,772	1,445	1,423
Wrought zinc and zinc alloy:										
Sheets, plates, strips	2,194	2,138	2,250	2,100	3,163	3,842	1,478	2,086	2,060	2,817
Angles, bars, pipes, etc.	3,510	1,811	4,085	2,349	8,701	7,244	10,402	6,607	7,010	4,653
Waste and scrap (zinc content) ...	1,002	297	5,775	2,307	9,921	5,461	4,035	1,610	7,413	2,820
Dust and flakes	309	134	604	410	1,045	819	547	838	702	715
	1977		1978		1979		1980		1981	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	NA	NA	10,973	4,356	20,095	7,317	54,457	29,473	54,232	29,280
Blocks, pigs, anodes, etc.:										
Unwrought	215	210	723	865	279	553	302	664	323	812
Unwrought alloys	899	1,069	554	698	366	832	485	1,312	378	1,258
Wrought zinc and zinc alloy:										
Sheets, plates, strips	2,432	3,144	2,262	3,414	1,824	3,385	2,103	3,810	1,500	3,226
Angles, bars, pipes, etc.	4,677	3,549	860	1,091	1,461	1,839	804	1,268	1,160	1,972
Waste and scrap (zinc content) ...	7,445	2,972	14,986	6,738	28,149	14,142	29,542	14,121	30,046	17,611
Dust and flakes	928	726	1,803	2,018	966	1,450	4,512	7,491	5,003	7,841
	1982		1983		1984		1985		1986	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Ores and concentrates	77,289	32,534	60,168	22,868	30,579	13,353	23,264	8,216	3,269	1,590
Blocks, pigs, anodes, etc.:										
Unwrought	341	547	427	801	760	975	1,011	1,525	1,938	3,533
Unwrought alloys	863	2,101	662	1,594	588	823	1,243	1,405	1,610	1,650
Wrought zinc and zinc alloy:										
Sheets, plates, strips	995	2,351	957	2,142	975	2,421	776	1,973	721	1,513
Angles, bars, pipes, etc.	1,028	1,448	1,046	1,663	840	1,526	1,434	2,098	1,531	1,706
Waste and scrap (zinc content) ...	29,424	25,309	28,255	15,389	39,146	20,360	43,947	19,600	68,660	32,803
Dust and flakes	2,066	3,207	1,914	3,000	2,933	3,511	2,037	2,480	1,551	2,108
	1987		1988		1989 ⁴		1990 ⁴			
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
Ores and concentrates	16,921	8,304	33,590	19,699	78,877	64,224	220,446	188,686		
Blocks, pigs, anodes, etc.:										
Unwrought	1,082	2,114	482	933	5,532	8,783	1,238	2,347		
Unwrought alloys	5,825	10,823	5,748	9,721	2,423	5,650	4,566	8,957		
Wrought zinc and zinc alloy:										
Sheets, plates, strips	1,732	2,337	3,814	4,416	16,515	14,816	11,881	9,893		
Angles, bars, pipes, etc.	1,271	1,711	2,016	3,071	2,653	3,632	3,731	8,648		
Waste and scrap (zinc content) ...	88,277	46,182	103,732	66,052	108,086	75,947	109,316	85,749		
Dust and flakes	1,927	3,300	2,221	3,929	8,137	13,861	8,701	17,039		

NA Not available.

¹Less than 1/2 unit.²Includes zinc dross.³Included with "Waste and scrap."⁴Owing to changes in classification by the Bureau of the Census, data not strictly comparable with earlier years.

Source: Bureau of the Census.

**Table 11.—Zinc: World mine production (content of concentrate and direct shipping ore unless noted), by country
(Thousand metric tons unless otherwise specified)**

Country	1986	1987	1988	1989	1990
Algeria	14.0	8.9	6.3	6.3	4.2
Argentina	39.5	35.6	36.8	43.2	40.0
Australia	712.0	778.4	759.0	803.0	933.0
Austria	16.3	15.7	17.1	14.8	16.7
Bolivia	33.5	39.3	57.0	74.8	103.8
Brazil	123.9	133.4	155.5	178.4	138.0
Bulgaria ^c	56.0	56.0	56.0	¹ 55.6	56.0
Burma	4.6	2.6	1.6	1.4	2.2
Canada	1,290.8	1,481.5	1,370.0	1,216.1	1,203.2
Chile	10.5	19.6	19.2	18.4	25.1
China ^a	396.0	458.0	528.0	538.0	619.0
Colombia	6.0	—	.1	.4	.4
Czechoslovakia ^a	7.3	7.0	7.0	7.1	7.5
Ecuador ^c	.1	.1	.1	.1	.1
Finland	60.4	55.1	63.9	58.4	51.7
France	39.5	31.3	31.1	26.7	23.9
Germany: Western states	103.7	98.9	75.6	63.9	58.1
Greece	22.3	20.7	21.2	25.0	26.5
Greenland	62.1	69.2	77.5	71.5	47.9
Honduras	25.4	15.4	23.5	37.2	29.6
India	46.5	54.5	61.4	65.4	71.6
Iran ^a	29.0	30.0	15.0	29.0	70.0
Ireland	181.7	177.0	173.2	168.8	166.5
Italy	26.3	33.1	37.2	43.3	42.5
Japan	222.1	165.7	147.2	131.8	127.3
Korea, North ^c	225.0	220.0	225.0	230.0	230.0
Korea, Republic of	37.3	23.5	21.8	23.2	22.8
Mexico	271.4	271.5	262.2	284.1	322.5
Morocco	17.2	10.3	10.9	18.7	18.8
Namibia	35.4	39.7	36.7	41.7	37.7
Norway	27.5	22.2	17.8	15.0	17.5
Peru	597.6	612.5	485.4	597.4	583.9
Philippines	1.6	1.1	1.4	1.2	.1
Poland	185.0	184.0	^c 184.0	179.0	178.0
Romania ^c	43.0	40.0	42.0	¹ 54.5	15.0
Saudi Arabia	—	—	.7	2.6	2.5
South Africa, Republic of	101.9	112.7	89.6	77.3	74.8
Spain	233.3	272.6	274.7	281.7	258.0
Sweden	219.3	229.4	200.4	173.5	164.1
Thailand	66.0	74.0	81.0	91.0	81.0
Tunisia	4.5	5.9	9.4	10.0	7.0
Turkey ²	40.6	42.2	37.5	39.4	40.0
U.S.S.R. ^c	600.0	600.0	600.0	550.0	550.0
United Kingdom	5.6	6.5	5.5	5.8	6.7
United States	220.8	232.9	256.4	288.3	543.2
Vietnam ^c	5.0	5.0	5.5	5.5	5.5
Yugoslavia	99.0	87.4	91.2	94.7	83.8
Zaire	81.3	74.7	75.7	72.8	61.8
Zambia ³	27.0	30.3	25.2	22.9	32.1
Total	6,674.8	6,985.4	6,780.5	6,838.9	7,201.6
U.S. market share of world mine production	3.3%	3.3%	3.8%	4.2%	7.5%

^cEstimated.

¹Reported figure.

²Content in ore hoisted.

³Data are for years beginning Apr. 1 of that stated; content of ore milled.

Table 12.—Zinc: World smelter production, by country¹
(Thousand metric tons)

Country	1986	1987	1988	1989	1990 ^e
Algeria, primary	29.0	21.0	26.5	16.8	15.0
Argentina:					
Primary	29.1	31.7	32.7	31.6	31.5
Secondary	3.0	2.6	2.7	2.7	2.7
Total	32.1	34.3	35.4	34.3	34.2
Australia:					
Primary ²	303.1	307.6	302.5	294.0	304.0
Secondary ^e	4.5	4.5	4.5	5.5	5.5
Total ^c	307.6	312.1	307.0	299.5	309.5
Austria, primary and secondary	24.0	24.3	23.9	26.1	28.3
Belgium, primary and secondary	288.8	284.5	298.1	286.9	289.7
Brazil:					
Primary	130.6	138.7	139.7	155.9	149.5
Secondary	5.9	9.4	4.3	6.4	4.6
Total	136.5	148.1	144.0	162.3	154.1
Bulgaria, primary and secondary	^e 90.0	92.0	^e 90.0	86.8	75.5
Canada, primary	571.0	609.9	703.2	669.7	591.8
China, primary and secondary ^e	³ 336.0	383.0	420.0	451.0	550.0
Czechoslovakia, secondary	1.0	1.1	1.4	1.3	1.7
Finland, primary	155.4	150.5	156.1	162.5	174.9
France, primary and secondary	257.4	249.3	274.1	265.8	264.1
Germany:					
Eastern states, primary and secondary ^e	21.0	21.1	20.0	18.5	12.5
Western states:					
Primary	344.3	350.8	313.4	308.2	300.2
Secondary	26.6	29.3	42.9	45.3	37.4
Total	370.9	401.2	376.3	372.0	350.1
Hungary, secondary ^e	.6	.6	1.6	1.4	1.3
India:					
Primary	73.8	68.9	68.9	71.6	74.0
Secondary ^e	.2	.2	.2	.2	.2
Total ^c	74.0	69.1	69.1	71.8	74.2
Italy, primary and secondary	229.4	247.0	242.1	259.5	264.0
Japan:					
Primary	626.1	591.5	601.1	591.2	605.7
Secondary	82.0	74.1	77.1	73.3	81.8
Total	708.1	665.6	678.2	664.5	687.5
Korea, North, primary ^e	180.0	210.0	210.0	210.0	200.0
Korea, Republic of, primary	127.4	186.1	223.0	240.2	248.2
Mexico, primary	173.5	184.8	192.5	193.3	199.3
Netherlands, primary and secondary	196.2	207.1	211.0	203.0	208.5
Norway, primary	90.4	116.5	121.2	120.4	125.1
Peru, primary	155.8	144.2	123.1	126.7	120.6
Poland, primary and secondary	179.0	177.0	174.0	164.0	132.0
Portugal, primary	5.7	5.8	5.5	5.0	5.5
Romania, primary and secondary ^e	53.0	39.0	42.0	42.0	11.0
South Africa, Republic of, primary	81.0	96.1	85.2	85.0	92.3
Spain, primary and secondary	202.0	249.0	256.0	257.0	252.7
Thailand, primary	58.6	66.9	68.8	68.4	63.3
Turkey, primary	15.4	22.2	22.5	24.2	20.1
U.S.S.R.: ^e					
Primary	700.0	890.0	848.0	862.0	780.0
Secondary	105.0	110.0	115.0	115.0	110.0
Total	805.0	1,000.0	963.0	977.0	890.0
United Kingdom, primary and secondary	85.9	81.4	76.0	79.8	93.3

See footnotes at end of table.

¹ Table 12.—Zinc: World smelter production, by country¹—Continued
(Thousand metric tons)

Country	1986	1987	1988	1989	1990 ²
United States:					
Primary	253.4	261.3	241.3	263.1	262.7
Secondary	62.9	82.6	88.5	95.1	95.7
Total	316.3	343.9	329.8	358.2	358.4
Vietnam, undifferentiated ³	4.2	4.2	4.2	4.2	4.2
Yugoslavia, primary and secondary	82.0	118.1	127.5	119.4	113.7
Zaire, primary	63.9	54.9	61.1	54.0	38.2
Zambia, primary	22.5	21.0	20.2	12.9	10.5
Grand total	6,530.6	7,021.8	7,163.4	7,176.9	7,052.8
Of which:					
Primary	4,370.4	4,530.4	4,566.3	4,566.7	4,412.4
Secondary	291.3	314.4	338.2	346.2	340.9
Undifferentiated	2,030.9	2,177.0	2,258.9	2,264.0	2,299.5

²Estimated.

¹Wherever possible, detailed information on raw material source of output (primary—directly from ores, and secondary—from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undifferentiated (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output. Table includes data available through July 2, 1991.

²Excludes zinc dust.

³Reported figure.

Table 13.—Zinc: 5-year averages of recoverable mine production and value, by region, 1907-91
(Metric tons¹ and thousand dollars)

Year	Pacific ²		Mountain ³		North Central ⁴		South Central ⁵		Atlantic ⁶	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1907-1911	278	35	49,100	5,967	145,000	17,408	5,840	693	61,800	1,823
1912-1916	3,270	861	167,000	36,000	169,000	34,025	27,400	6,298	87,400	W
1917-1921	1,910	394	131,000	25,739	119,000	22,541	159,000	27,930	86,200	W
1922-1926	4,120	657	126,000	19,393	126,000	19,325	246,000	37,285	80,300	W
1927-1931	2,030	232	183,000	23,269	107,000	13,830	161,000	20,553	118,000	W
1932-1936	2,310	218	116,000	11,109	58,000	5,624	114,000	10,877	109,000	12,224
1937-1941	9,450	1,271	178,000	24,630	85,700	11,608	161,000	21,797	136,000	19,795
1942-1946	16,200	3,977	261,000	63,254	96,100	23,288	123,000	29,317	124,000	26,477
1947-1951	19,100	6,073	314,000	97,657	63,200	19,716	74,400	23,318	104,000	32,837
1952-1956	29,300	8,374	245,000	71,858	62,300	18,184	72,300	20,990	89,300	25,714
1957-1961	19,100	4,879	188,000	47,577	44,600	11,413	74,700	19,166	85,500	21,835
1962-1966	W	W	209,000	89,093	43,100	12,608	106,000	31,217	128,000	37,402
1967-1971	13,900	4,022	155,000	45,379	65,600	19,360	W	W	W	W
1972-1976	W	W	W	W	W	W	W	W	142,000	85,894
1977-1981	W	W	W	W	W	W	W	W	96,000	75,851
1982-1986	—	—	W	W	W	W	W	W	49,400	45,847
1987-1991	W	W	W	W	W	W	W	W	W	W
Total United States ⁷										
	Quantity	Value								
1907-1911	262,000	25,926								
1912-1916	455,000	W								
1917-1921	498,000	W								
1922-1926	582,000	W								
1927-1931	570,000	W								
1932-1936	399,000	40,051								
1937-1941	570,000	79,103								
1942-1946	621,000	146,311								
1947-1951	574,000	179,602								
1952-1956	498,000	145,118								
1957-1961	412,000	104,870								

See footnotes at end of table.

Table 13.—Zinc: 5-year averages of recoverable mine production and value, by region, 1907-91—Continued
(Metric tons¹ and thousand dollars)

Year	Total United States ⁷	
	Quantity	Value
1962-1966	507,000	147,916
1967-1971	484,000	141,792
1972-1976	437,000	263,303
1977-1981	321,000	255,175
1982-1986	252,000	229,162
1987-1991	NA	NA

NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Metric tons rounded to three significant digits.

²Includes Alaska, California, Hawaii, Oregon, and Washington.

³Includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

⁴Includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

⁵Includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, South Carolina, Tennessee, and Texas.

⁶Includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia.

⁷Excludes quantity and value for Oregon for 1964-65.

⁸Data may not add to totals shown because of independent rounding.

Table 14.—Zinc consumption of new and old scrap in the United States, by type of scrap¹
(Metric tons)

Raw material	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Chemical residues	25,275	41,973	39,793	39,138	30,940	8,242	12,727	11,625	10,640	10,974	9,527
Diecastings	35,758	37,248	36,101	35,248	42,385	22,798	26,020	18,994	10,932	8,429	12,916
Die-cast skimmings	5,525	5,612	6,788	6,196	6,414	2,704	5,408	5,901	5,498	5,741	4,613
Engraver's plates	2,905	2,484	2,660	1,681	1,002	1,012	1,276	791	972	735	663
Flue dust	9,362	8,804	7,758	8,283	9,250	4,871	7,403	13,293	16,233	15,485	17,274
Fragmentized diecastings	—	—	—	—	—	13,486	14,140	9,368	16,500	21,932	15,179
Galvanizer's dross	56,773	61,742	68,736	57,634	48,160	36,991	51,359	43,949	42,442	57,997	57,504
New clippings	542	381	553	661	614	1,091	865	1,249	1,414	770	435
Old zinc	5,682	7,306	5,557	5,137	5,586	4,970	8,468	8,964	10,626	10,595	7,894
Remelt die-cast slab	—	—	—	—	—	6,546	10,855	13,281	9,628	9,433	10,249
Remelt zinc	—	—	—	—	—	1,201	2,966	2,477	2,645	1,977	3,961
Rod and die scrap	2,111	3,369	4,184	1,884	2,849	3,404	4,853	8,782	2,616	2,318	4,961
Sal skimmings	8,085	7,410	7,001	5,675	7,990	4,902	5,407	4,279	4,358	4,297	3,519
Skimmings and ashes	73,536	65,732	65,372	69,902	64,952	38,730	48,085	40,398	40,235	42,161	26,320
Steelmaking dust	—	—	—	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	102	134	6,093	6,439	10,863	8,024
Total	225,554	242,061	244,503	231,439	220,142	151,050	199,966	189,444	181,178	203,707	183,039
From new scrap	149,142	145,279	152,329	144,210	168,318	88,157	117,926	110,993	111,148	131,549	113,013
From old scrap	76,412	96,782	92,174	87,230	51,823	62,894	82,041	78,452	70,031	72,159	70,026
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
Chemical residues	10,100	11,531	8,312	3,154	(²)	(²)	(²)	(²)	(²)	(²)	
Diecastings	12,009	11,594	11,822	13,390	11,513	5,839	6,157	5,122	5,368	5,137	
Die-cast skimmings	6,795	3,988	6,185	6,112	7,134	(²)	(²)	(²)	(²)	(²)	
Engraver's plates	571	567	585	621	585	(²)	(²)	(²)	(²)	(²)	
Flue dust	15,966	5,884	9,642	11,637	16,418	26,754	49,320	7,483	5,514	4,491	
Fragmentized diecastings	19,236	18,221	27,017	25,514	27,711	28,285	21,878	13,640	28,217	29,230	
Galvanizer's dross	58,061	37,595	34,297	48,982	42,151	32,642	34,718	63,212	72,038	71,649	
New clippings	487	404	993	873	650	(²)	(²)	(²)	(²)	(²)	
Old zinc	8,672	3,952	1,543	1,334	1,400	4,867	2,270	3,313	2,561	1,587	
Remelt die-cast slab	17,823	7,610	8,739	12,524	8,800	11,203	13,145	14,574	16,731	W	
Remelt zinc	307	52	7,981	5,957	6,635	3,157	3,885	425	303	240	
Rod and die scrap	5,643	1,024	2,430	3,049	2,305	(²)	(²)	(²)	(²)	(²)	
Sal skimmings	4,436	5,077	5,844	5,963	5,029	(²)	(²)	(²)	(²)	(²)	
Skimmings and ashes	33,853	58,661	76,156	98,085	84,100	87,918	80,721	45,267	30,125	23,123	

See footnotes at end of table.

Table 14.—Zinc consumption of new and old scrap in the United States, by type of scrap¹—Continued
(Metric tons)

Raw material	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Steelmaking dust	—	—	—	—	—	—	—	36,111	37,380	30,882
Other	9,124	4,639	3,520	2,488	4,024	5,388	13,871	3,695	7,834	24,403
Total	203,083	170,799	205,066	239,683	218,455	206,053	225,965	192,842	206,071	190,742
From new scrap . . .	121,046	113,358	139,797	174,279	157,932	142,482	157,855	116,341	128,825	117,944
From old scrap	82,037	57,441	65,269	65,405	60,523	63,571	68,110	76,502	77,246	72,798

W Withheld to avoid disclosing company proprietary data; included in "Other."

¹From 1970 to 1974, data reported in gross weight; data from 1975 reported in zinc content.

²Included in "Other."

³Included in "Skimmings and ashes."

⁴Included in "Old zinc."

⁵Included in "Remelt zinc."

**Table 15.—Zinc recovered from scrap processed in the United States,
by kind of scrap and form of recovery**
(Metric tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Kind of scrap:										
New scrap:										
Zinc-base	119,621	127,781	132,104	124,893	110,887	98,714	134,112	128,998	129,657	150,008
Copper-base	119,893	122,652	144,092	138,064	124,095	88,429	117,537	118,350	132,165	138,565
Aluminum-base	191	201	255	278	272	—	—	—	—	—
Magnesium-base	2,853	2,570	3,310	3,660	3,402	157	94	170	211	222
Total	242,558	253,204	279,761	266,896	238,656	187,299	251,743	247,518	262,033	288,795
Old scrap:										
Zinc-base	37,426	40,711	39,007	41,750	41,478	51,351	64,516	58,928	50,545	52,691
Copper-base	25,281	28,402	29,444	34,921	23,345	17,859	21,558	23,054	25,458	27,824
Aluminum-base	2,684	3,254	3,496	4,024	3,496	218	256	261	557	524
Magnesium-base	64	247	63	96	91	189	208	217	228	196
Total	65,456	72,614	72,010	80,792	68,410	69,616	86,538	82,460	76,788	81,235
Grand total	308,014	325,818	351,771	347,688	307,066	256,916	338,281	329,979	338,821	370,030
Form of recovery:										
As metal:										
Slab zinc ¹	68,450	72,352	66,876	75,466	71,246	52,513	62,192	45,914	34,774	53,212
Zinc dust	26,482	25,893	36,399	32,842	26,376	32,186	36,715	35,992	33,346	34,141
Other ²	3,819	1,930	6,055	1,576	1,581	1,417	2,566	2,356	2,780	2,820
Total	98,751	100,174	109,329	109,884	99,203	86,116	101,472	84,261	70,900	90,173
In zinc-base alloy	17,874	22,051	14,950	14,843	14,314	8,681	10,603	11,095	9,799	10,239
In brass and bronze	147,014	155,988	174,766	163,905	134,945	131,550	181,011	178,663	198,477	209,528
In aluminum-base alloys . .	5,663	5,928	6,929	7,222	7,148	306	285	261	557	524
In magnesium-base alloys . .	395	569	394	495	404	357	308	386	438	418
In chemical products:										
Zinc oxide (lead-free) . .	18,312	20,122	23,493	26,571	29,124	17,535	23,649	29,920	29,516	31,316
Zinc sulfate	8,320	9,376	10,048	8,567	8,925	3,967	7,914	9,114	10,914	9,971
Zinc chloride	9,622	9,173	10,093	15,095	10,011	8,072	12,575	12,124	13,597	12,259
Miscellaneous	2,064	2,438	1,767	1,106	2,992	332	463	4,154	4,623	5,602
Total	209,263	225,644	242,442	237,804	207,862	170,799	236,809	245,717	267,921	279,857
Grand total	308,014	325,818	351,771	347,688	307,066	256,916	338,281	329,979	338,821	370,030
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Kind of scrap:										
New scrap:										
Zinc-base	122,654	138,515	127,651	152,653	182,976	161,268	158,885	146,394	111,133	105,203
Copper-base	115,909	116,681	94,891	119,590	134,699	116,439	111,990	123,969	133,881	124,522

See footnotes at end of table.

Table 15.—Zinc recovered from scrap processed in the United States,
by kind of scrap and form of recovery—Continued
(Metric tons)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
New scrap—Continued										
Aluminum-base	—	—	—	—	—	—	—	—	—	—
Magnesium-base	268	143	113	131	130	68	41	35	122	163
Total	238,831	255,339	222,655	272,374	317,805	277,775	270,916	270,398	245,136	229,888
Old scrap:										
Zinc-base	42,424	62,891	42,334	51,255	55,447	50,615	50,193	59,964	74,632	93,919
Copper-base	22,300	22,014	19,385	24,431	24,763	18,125	20,363	21,125	22,053	22,705
Aluminum-base	591	376	376	349	334	294	336	262	349	338
Magnesium-base	217	230	219	218	220	214	163	159	180	176
Total	65,532	85,511	62,314	76,253	80,764	69,248	71,055	81,510	97,214	117,138
Grand total	304,363	340,850	284,969	348,627	398,569	347,023	341,971	351,908	342,350	347,026
Form of recovery:										
As metal:										
Slab zinc ¹	29,396	50,192	74,288	69,390	78,113	72,567	62,914	82,589	88,492	97,904
Zinc dust	35,557	39,626	25,296	34,773	40,697	27,115	24,295	28,620	24,206	24,909
Other ²	2,690	2,807	2,576	2,867	2,438	1,112	1,300	6,741	8,016	15,564
Total	67,643	92,625	102,160	107,030	121,248	100,794	88,509	117,950	120,714	138,377
In zinc-base alloy	7,714	13,624	9,271	9,644	9,492	8,726	5,998	988	907	4,167
In brass and bronze	172,040	171,295	111,003	172,065	200,792	180,780	179,639	153,141	158,999	146,634
In aluminum-base alloys	591	376	376	454	466	332	350	³ 468	³ 317	³ 272
In magnesium-base alloys	485	373	332	349	350	282	204	—	—	—
In chemical products:										
Zinc oxide (lead-free) ..	31,306	36,236	35,969	33,196	40,072	32,337	38,422	49,901	34,527	37,028
Zinc sulfate	13,195	14,313	16,079	14,975	13,687	15,506	20,524	17,302	18,404	12,320
Zinc chloride	10,944	11,572	9,490	10,207	12,398	7,841	7,690	12,158	8,482	7,269
Miscellaneous	445	436	289	707	64	425	635	—	—	959
Total	236,720	248,225	182,809	241,597	277,321	246,229	253,462	233,958	221,636	208,649
Grand total	304,363	340,850	284,969	348,627	398,569	347,023	341,971	351,908	342,350	347,026
1990										
Kind of scrap:										
New scrap:										
Zinc-base	97,914									
Copper-base	134,360									
Aluminum-base	—									
Magnesium-base	181									
Total	232,455									
Old scrap:										
Zinc-base	86,607									
Copper-base	21,632									
Aluminum-base	512									
Magnesium-base	194									
Total	108,945									
Grand total	341,400									
Form of recovery:										
As metal:										
Slab zinc ¹	95,708									
Zinc dust	24,105									
Other ²	11,804									
Total	131,617									
In zinc-base alloy	5,144									
In brass and bronze	148,247									
In aluminum-base alloys	³ 257									
In magnesium-base alloys	—									

See footnotes at end of table.

Table 15.—Zinc recovered from scrap processed in the United States,
by kind of scrap and form of recovery—Continued
(Metric tons)

1990	
Form of recovery—Continued	
In chemical products:	
Zinc oxide (lead-free) ..	34,726
Zinc sulfate	12,769
Zinc chloride	7,436
Miscellaneous	1,204
Total	<u>209,783</u>
Grand total	<u>341,400</u>

¹Data from 1970-1986 include zinc content of redistilled slab made from remelt die-cast slab.

²Data for 1987 and 1988 include electrogalvanizing anodes and zinc content of slab made from remelt die-cast slab.

³Includes magnesium-base alloys.

Table 16.—U.S. imports for consumption of zinc, by four leading countries
(Metric tons unless otherwise specified)

Country	1970		1971		1972		1973	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Ores and concentrates (zinc content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	—	—	—	—	—	—	—	—
Canada	238,850	58	233,650	55	99,536	63	80,225	57
Chile	—	—	—	—	—	—	—	—
Germany, Federal Republic of	9,469	2	—	—	—	—	—	—
Honduras	—	—	20,399	5	—	—	14,503	10
Mexico	92,416	23	109,784	26	35,636	23	28,109	20
Nicaragua	—	—	—	—	—	—	—	—
Peru	46,510	11	40,148	9	7,257	5	11,380	8
South Africa, Republic of	—	—	—	—	8,202	5	—	—
Thailand	—	—	—	—	—	—	—	—
Other	21,687	6	20,008	5	7,276	4	5,647	5
Total	<u>408,932</u>	<u>100</u>	<u>423,989</u>	<u>100</u>	<u>157,907</u>	<u>100</u>	<u>139,864</u>	<u>100</u>
Blocks, pigs, or slabs:								
Australia	27,519	12	33,653	11	37,266	8	37,571	7
Belgium-Luxembourg ¹	—	—	—	—	35,939	8	35,954	7
Canada	109,416	46	135,806	46	247,202	53	312,815	58
Finland	—	—	29,408	10	—	—	—	—
Germany, Federal Republic of	—	—	—	—	28,448	8	—	—
Japan	29,506	13	—	—	—	—	38,708	7
Mexico	—	—	—	—	—	—	—	—
Norway	—	—	—	—	—	—	—	—
Peru	28,960	12	22,146	8	—	—	—	—
Spain	—	—	—	—	—	—	—	—
Zaire	—	—	—	—	—	—	—	—
Other	40,587	17	73,146	25	119,836	25	110,872	21
Total	<u>235,988</u>	<u>100</u>	<u>294,159</u>	<u>100</u>	<u>468,691</u>	<u>100</u>	<u>535,920</u>	<u>100</u>
	1974		1975		1976		1977	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Ores and concentrates (zinc content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	—	—	—	—	—	—	—	—
Canada	66,801	55	189,738	49	112,781	80	54,804	50
Chile	—	—	—	—	—	—	10,690	10
Germany, Federal Republic of	—	—	—	—	—	—	—	—
Honduras	16,359	13	39,212	10	11,856	8	15,757	14

See footnotes at end of table.

Table 16.—U.S. imports for consumption of zinc, by four leading countries—Continued
(Metric tons unless otherwise specified)

Country	1974		1975		1976		1977	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Ores and concentrates (zinc content)—Continued								
Mexico	24,174	20	55,933	14	8,790	6	—	—
Nicaragua	—	—	33,338	9	2,739	2	—	—
Peru	8,074	7	—	—	—	—	—	—
South Africa, Republic of	—	—	—	—	—	—	—	—
Thailand	—	—	—	—	—	—	14,232	13
Other	5,913	5	70,548	18	5,176	4	13,794	13
Total	121,321	100	388,769	100	141,342	100	109,277	100
Blocks, pigs, or slabs:								
Australia	35,298	7	20,752	6	—	—	—	—
Belgium-Luxembourg ¹	—	—	—	—	31,930	5	37,482	7
Canada	252,265	51	164,858	48	283,954	45	217,321	43
Finland	—	—	17,379	5	—	—	—	—
Germany, Federal Republic of	—	—	—	—	42,998	7	37,695	7
Japan	46,109	9	—	—	—	—	—	—
Mexico	—	—	—	—	52,618	8	—	—
Norway	—	—	—	—	—	—	—	—
Peru	28,214	6	—	—	—	—	—	—
Spain	—	—	25,863	8	—	—	—	—
Zaire	—	—	—	—	—	—	32,192	6
Other	131,447	27	111,272	33	219,112	35	178,931	37
Total	493,333	100	340,124	100	630,612	100	503,621	100
	1978		1979		1980		1981	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Ores and concentrates (zinc content):								
Australia	—	—	—	—	8,782	5	—	—
Bolivia	—	—	11,935	14	—	—	—	—
Canada	66,551	63	—	—	110,285	60	179,566	73
Chile	—	—	—	—	—	—	—	—
Germany, Federal Republic of	6,535	6	—	—	—	—	8,687	4
Honduras	13,141	12	13,383	15	—	—	—	—
Mexico	—	—	13,457	15	13,660	7	21,120	9
Nicaragua	—	—	—	—	—	—	—	—
Peru	8,615	8	29,697	34	40,176	22	29,075	12
South Africa, Republic of	—	—	—	—	—	—	—	—
Thailand	—	—	—	—	—	—	—	—
Other	11,473	11	19,027	22	9,467	6	7,262	2
Total	106,315	100	87,499	100	182,370	100	245,710	100
Blocks, pigs, or slabs:								
Australia	—	—	33,721	6	24,798	6	—	—
Belgium-Luxembourg ¹	—	—	—	—	—	—	—	—
Canada	261,841	42	259,543	50	280,075	68	308,647	50
Finland	—	—	—	—	18,128	4	29,156	5
Germany, Federal Republic of	36,955	6	—	—	—	—	—	—
Japan	—	—	—	—	—	—	—	—
Mexico	48,712	8	36,833	7	23,652	6	—	—
Norway	—	—	—	—	—	—	—	—
Peru	—	—	—	—	—	—	43,339	7
Spain	64,626	10	66,738	13	—	—	28,671	5
Zaire	—	—	—	—	—	—	—	—
Other	210,336	34	127,295	24	63,510	16	202,194	33
Total	622,470	100	524,130	100	410,163	100	612,007	100

See footnotes at end of table.

Table 16.—U.S. Imports for consumption of zinc, by four leading countries—Continued
(Metric tons unless otherwise specified)

	1982		1983		1984		1985	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Ores and concentrates (zinc content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	—	—	—	—	—	—	—	—
Canada	22,827	34	17,165	27	27,467	32	50,031	55
Chile	—	—	—	—	—	—	—	—
Germany, Federal Republic of	7,925	12	—	—	—	—	—	—
Honduras	6,303	9	11,709	19	—	—	14,302	16
Mexico	20,534	31	17,988	28	20,113	23	12,900	14
Nicaragua	—	—	—	—	—	—	—	—
Peru	—	—	8,857	14	16,605	19	10,452	12
South Africa, Republic of	—	—	—	—	10,186	12	—	—
Thailand	—	—	—	—	—	—	—	—
Other	9,220	14	7,437	12	11,801	14	2,501	3
Total	66,809	100	63,156	100	86,172	100	90,186	100
Blocks, pigs, or slabs:								
Australia	26,334	6	30,537	5	—	—	29,610	5
Belgium-Luxembourg ¹	—	—	—	—	—	—	—	—
Canada	239,839	53	307,156	50	340,490	53	383,618	63
Finland	—	—	—	—	—	—	—	—
Germany, Federal Republic of	—	—	—	—	—	—	—	—
Japan	—	—	—	—	—	—	—	—
Mexico	23,161	5	59,568	10	58,416	9	53,984	9
Norway	—	—	—	—	—	—	—	—
Peru	48,569	11	45,318	7	34,025	5	36,326	6
Spain	—	—	—	—	—	—	—	—
Zaire	—	—	—	—	32,329	5	—	—
Other	118,330	25	175,100	28	173,968	28	107,362	17
Total	456,233	100	617,679	100	639,228	100	610,900	100
	1986		1987		1988		1989	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Ores and concentrates (zinc content):								
Australia	—	—	—	—	—	—	—	—
Bolivia	—	—	—	—	—	—	—	—
Canada	28,645	38	28,960	62	25,463	40	20,161	49
Chile	—	—	—	—	—	—	—	—
Germany, Federal Republic of	—	—	—	—	—	—	—	—
Honduras	14,218	19	6,469	14	1,172	2	—	—
Mexico	6,251	8	5,422	12	5,967	10	16,408	40
Nicaragua	—	—	—	—	—	—	—	—
Peru	25,446	34	5,613	12	30,364	48	4,405	11
South Africa, Republic of	—	—	—	—	—	—	—	—
Thailand	—	—	—	—	—	—	—	—
Other	1,226	1	—	—	—	—	—	—
Total	75,786	100	46,464	100	62,966	100	40,974	100
Blocks, pigs, or slabs:								
Australia	—	—	51,435	7	—	—	42,766	6
Belgium-Luxembourg ¹	—	—	—	—	—	—	—	—
Canada	349,335	53	360,729	51	427,558	57	435,254	61
Finland	—	—	—	—	—	—	—	—
Germany, Federal Republic of	—	—	—	—	—	—	—	—
Japan	—	—	—	—	—	—	—	—
Mexico	49,619	7	53,344	8	60,947	8	70,817	10
Norway	—	—	—	—	31,695	4	—	—

See footnotes at end of table.

Table 16.—U.S. Imports for consumption of zinc, by four leading countries—Continued
(Metric tons unless otherwise specified)

	1986		1987		1988		1989	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
Blocks, pigs, or slabs—Continued								
Peru	43,590	7	—	—	—	—	—	—
Spain	48,948	7	55,427	8	65,231	9	—	—
Zaire	—	—	—	—	—	—	—	—
Other	173,634	26	185,050	26	163,702	22	162,717	23
Total	665,126	100	705,985	100	749,133	100	711,554	100
1990								
	Quantity	Percent of total						
Ores and concentrates (zinc content):								
Australia	—	—						
Bolivia	5,007	11						
Canada	17,187	37						
Chile	—	—						
Germany, Federal Republic of	—	—						
Honduras	—	—						
Mexico	24,455	52						
Nicaragua	—	—						
Peru	—	—						
South Africa, Republic of	—	—						
Thailand	—	—						
Other	35	(²)						
Total	46,684	100						
Blocks, pigs, or slabs:								
Australia	44,510	7						
Belgium-Luxembourg ¹	—	—						
Canada	372,458	59						
Finland	—	—						
Germany, Federal Republic of	—	—						
Japan	—	—						
Mexico	72,330	11						
Norway	—	—						
Peru	—	—						
Spain	23,919	4						
Zaire	—	—						
Other	118,525	19						
Total	631,742	100						

¹For 1970-87, data not available to separate; 1988-90 data for Belgium only.

²Less than 1/2%.

Table 17.—U.S. zinc metal and mine refinery production, capacity,
and capacity utilization 1967-90
(Thousand metric tons unless otherwise specified)

Year	Metal production	Total primary and secondary capacity	Percent capacity utilization	Mine production (recoverable content)	Mine capacity	Percent capacity utilization
1967	918	1,201	76.4	498	560	88.9
1968	999	1,247	80.1	480	540	88.9
1969	1,008	1,161	86.8	502	565	88.8
1970	866	1,084	79.9	485	545	89.0
1971	769	1,012	76.0	456	520	87.7
1972	641	685	93.6	434	545	79.6
1973	605	716	84.5	434	560	77.5
1974	575	707	81.3	453	560	80.9

**Table 17.—U.S. zinc metal and mine refinery production, capacity,
and capacity utilization 1967-90—Continued**
(Thousand metric tons unless otherwise specified)

Year	Metal production	Total primary and secondary capacity	Percent capac- ity utilization	Mine production (recoverable content)	Mine capacity	Percent capac- ity utilization
1975	450	684	65.8	426	526	81.0
1976	515	643	80.1	440	490	89.8
1977	454	679	66.9	408	490	83.3
1978	442	768	57.6	303	490	61.8
1979	526	771	68.2	267	474	56.3
1980	370	615	60.2	317	449	70.6
1981	397	539	73.7	312	414	75.4
1982	302	571	52.9	303	446	67.9
1983	305	582	52.4	275	428	64.3
1984	331	582	56.9	253	373	67.8
1985	334	469	71.2	227	354	64.1
1986	316	469	67.4	203	320	63.4
1987	344	469	73.3	216	330	65.5
1988	330	378	87.3	244	334	73.1
1989	358	360	99.4	276	390	70.8
1990	358	360	99.4	515	605	85.1

Page Intentionally Left Blank.

APPENDIX A.—UNIT CONVERSION FACTORS

COMMON WEIGHT CONVERSION FACTORS (Multiply by the factor below)										
From: To:	76-pound Flasks	Grams	Kilograms	Long tons	Metric tons	Pounds	Short tons	Thousand pounds	Troy ounces	Carats
76-pound Flasks	1	.000029008192	.029008192	29.473684	29.008192	.013157895	26.315789	13.157895	.000902258	.000005801638
Grams	34,473.020	1	1000	1,016,046.9	1,000,000	453.59237	907.18474	453.59237	31.103473	.2
Kilograms	34.473020	.001	1	1,016.0469	1,000	.45359237	907.18474	453.59237	.031103473	.0002
Long tons	.033928571	.0000009842065	.0009842065	1	.9842065	.00044842657	.99285714	.44842657	.000030612245	.000001988404
Metric tons	.034473020	.000001	.001	1.0160469	1	.00045359237	.90718474	.45359237	.000031103473	.0000002
Pounds	76	.002204623	2.204623	2,240	2,204.623	1	2,000	1,000	.06857143	.0004408246
Short tons	.038	.0000011023113	.0011023113	1.12	1.1023113	.0005	1	.5	.00003426572	.0000002204623
Thousand pounds	.076	.000002204623	.002204623	2.24	2.204623	.001	2	1	.00008857143	.0000004408246
Troy ounces	1,108.333	.03215075	32.15075	32,668.896	32,150.75	14.58333	29,188.68	14,583.33	1	.008430149
Carats	172,365.1	5	5,000	5,060,233	5,000,000	2,267.961	4,535,923	2,267.961	155.5174	1

PRECEDING PAGE
BLANK

VOLUME CONVERSION FACTORS
(Multiply by the factor below)

From: To:	Liters	Cubic meters	Cubic feet	Cubic yards	U. S. gallons	Imperial gallons	42-Gallon barrels
Liters	1	1,000	28.31685	764.5549	3.785412	4.404826	158.9873
Cubic meters	.001	1	.02831685	.7645549	.003785412	.004404826	.1589873
Cubic feet	.03531467	35.31467	1	27	.1336806	.1555570	5.614585
Cubic yards	.001307951	1.307951	.03703704	1	.004951133	.005761370	.2079475
U. S. gallons	.2641721	264.1721	7.480519	201.9740	1	1.163647	42
Imperial gallons	.2270237	227.0237	6.428513	173.5698	.8593672	1	36.09342
42-Gallon barrels	.006289812	6.289812	.1781076	4.808905	.02380952	.02770588	1

SELDOM USED UNITS

Unit	Equivalent
Short hundredweight	100 pounds
Long hundredweight	112 pounds
Pennyweight	.05 troy ounce
Metric quintal	.1 metric ton
Troy ounce per short ton	34.28571 gram per metric ton

APPENDIX B.—U.S. BUREAU OF MINES—THE MINERALS INFORMATION SOURCE

Established in 1910, the U.S. Bureau of Mines conducts research and collects information concerning almost every activity involved in removing minerals from the Earth and making them into useful products. The USBM is the U.S. Government's focal agency for matters relating to the technology and economics of minerals and mineral materials. The Bureau collects and analyzes worldwide information involving mineral reserves and production,

consumption, trade, and recycling of mineral commodities. This information is published and widely used for Government policymaking and industrial and financial decision-making. The Bureau also conducts basic research in the areas of mining, processing, and materials technology, with special emphasis on health and safety, mining efficiency, environmental concerns, and energy and materials conservation.

INSTANT INFORMATION

In an effort to facilitate the rapid dissemination of information and publications produced by the U.S. Bureau of Mines, two new electronic document dissemination systems are now available for use. One, MINES FaxBack, is a simple-to-operate automated fax response system. All a potential user needs is access to a fax machine. After calling the MINES FaxBack, the requester is guided by a series of voice messages to assist in ordering the desired documents. Information on approximately ninety commodities is now available on MINES FaxBack. MINES FaxBack can be accessed by calling (412) 892-4088, using

the touch-tone telephone attached to the user's fax machine.

The second system, MINES-DATA, is a computer bulletin board system that makes the Bureau's Mineral Industry Surveys reports available in electronic form, as computer files. All a potential user needs is access to a personal computer with a modem and standard communications software. Information on thirty-four commodities is now available on MINES-DATA. MINES-DATA can be accessed by calling (202) 501-0373. Further information on how to use MINES-DATA may be obtained from the system operator by calling (202) 501-0406.

MINERALS INFORMATION OFFICE

The Bureau of Mines and the U.S. Geological Survey jointly operate the Minerals Information Office at the Department of the Interior, room 2647, 1849 C Street, NW, Washington, DC. The office is staffed by mineral experts who provide and disseminate a wide variety of

mineral-related information and publications to meet and support the needs of the public, as well as government agencies and the scientific and industrial sectors. Please visit the office or call (202) 208-5520 if you need any assistance.

Page Intentionally Left Blank.

APPENDIX C.—AVAILABILITY OF U.S. BUREAU OF MINES PUBLICATIONS

FREE PUBLICATIONS

The U.S. Bureau of Mines (USBM) provides the following publications free of charge:

- Mineral Industry Surveys* (periodic reports)
- Mineral Industry Indicators* (newsletter)
- Bimonthly List of New USBM Publications*
- Technology News* (fact sheet)

Order from Publication Distribution, U.S. Bureau of Mines, Cochran's Mill Road, P.O. Box 18070, Pittsburgh, PA 15236, (412) 892-4338

Mailing List additions: U.S. Bureau of Mines, 810 7th Street, N.W., MS 9800, Washington, DC 20241, (202) 501-9559.

SALES PUBLICATIONS

The Government Printing Office (GPO) sells the following publications:

- Minerals Today*, a bimonthly magazine
- Annual commodity reports*: information on individual reports; information by State; international data
- Minerals Yearbook* (bound volumes of commodity reports)
- USBM publication lists* (annual and 5-year)
- Special publications* (e.g., *Mineral Commodity Summaries/State Summaries*, agency's annual report, etc.)

Order from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, (202) 783-3238

The National Technical Information Service (NTIS) sells the following publications:

- Reports of Investigation (RIs)*: in-progress reports on USBM research
- Bulletins* (usually final research reports)
- Information Circulars (IC's)*: economic analyses, resource surveys, information on new industrial methods, etc.
- USBM publication lists* (annual and 5-year)
- Special publications*, such as *Mineral Commodity Summaries* and *State Summaries*

Order from NTIS, Springfield, VA 22161, 1-800-553-NTIS (in VA and foreign countries: 1-703-487-4650)

LIBRARIES

The publications listed above can be reviewed in USBM libraries (headquarters and field). Some can be reviewed in Federal depository libraries throughout the Nation. Ask at your library for the location of a depository library near you.

ELECTRONIC INFORMATION

Commodities statistics and other data are available through the following USBM services:

- MINES-DATA*: Call (202) 501-0406 for more information on this computer bulletin board.
- MINES FaxBack*, accessed by calling (412) 892-4088, using the touch-tone telephone handset on a facsimile machine.

