IC bureau of mines information circular 8244

MINERALS FOR CHEMICAL MANUFACTURING

A Survey of Supply and Demand in California and Nevada

By Wallace W. Key

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

1965

MINERALS FOR CHEMICAL MANUFACTURING

A Survey of Supply and Demand in California and Nevada

By Wallace W. Key

* * * * * * * * * * * * information circular 8244

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

This publication has been cataloged as follows:

Key, Wallace W

Minerals for chemical manufacturing; a survey of supply and demand in California and Nevada. [Washington] U. S. Dept. of the Interior, Bureau of Mines [1965]

164 p. illus., tables. (U. S. Bureau of Mines. Information circular 8244)

Includes bibliography.

1. Mines and mineral resources—Calif. 2. Mines and mineral resources—Nev. 3. Chemicals—Manufacture and industry.

TN23.U71 no. 8244 622.06173

U. S. Dept. of the Int. Library

FOREWORD

In these times of higher transportation costs, reduced profit margins, rapid depletion of favorable mineral deposits, encroachment of expanding poputions over potential mineral resource lands, more difficult zoning problems, and effects of foreign trade, the Bureau of Mines is continually called upon to become more actively engaged in economic studies of mineral marketing and utilization.

In this report, the first of its kind published by the Bureau of Mines, the author draws together new data gathered directly from California and Nevada chemical raw material producers and consumers, and augments it with pertinent information from a variety of other sources. The results are presented in a form that can be readily understood by the layman and still serve as a valuable reference for the serious researcher.

Marling J. Ankeny

Director, Bureau of Mines

PREFACE

Results of the first detailed survey of mineral raw materials consumed for chemical manufacturing in California and Nevada are presented and analyzed from the standpoint of supplier and would-be-supplier, as well as from the consumer and potential-consumer viewpoint. Data are included on over 50 inorganic mineral commodities and their uses by 800 California chemical plants which manufacture thousands of products under 31 different categories.

It is a combined supply-utilization-marketing study of inorganic minerals and mineral compounds first consumed by the California chemical industry as a "raw material" by type, sources, and specifications. The study has undergone several metamorphoses and is the combined effort of many individuals within and out of the Bureau of Mines who so generously contributed their time and knowledge.

Many details are necessarily omitted, but results of the excellent response are combined and presented in a form which readily indicates the potential markets for each mineral commodity, without revealing company confidential information. The researcher is provided the basis for figures given and can easily substitute or elaborate, based upon his own knowledge. Although there are, of course, many inherent limitations in a study of this nature, as anyone who has investigated the complexities of mineral and chemical processes and classifications fully realizes, it is hoped that the data presented will stimulate greater cooperative efforts for the mutual benefit of mineral raw material producers and consumers. Also, it is hoped that those organizations which have previously considered conducting similar studies and felt conditions were too complicated and chaotic will view this report as a beginning upon which to build.

CONTENTS

CONTENTS (Con.)

CONTENTS (Con.)

ILLUSTRATIONS

ILLUSTRATIONS (Con.)

TABLES

TABLES (Con.)

TABLES (Con.)

TABLES (Con.)

TABLES (Con.)

MINERALS FOR CHEMICAL MANUFACTURING

A Survey of Supply and Demand in California and Nevada

by

Wallace W. Key[1]

ABSTRACT

Mineral raw materials produced in California, other States, and foreign countries were purchased for consumption in quantities valued at over $60 million at 800 of the 1,200 chemical plants operating in California in 1960, according to questionnaires completed by company officials. These and other data received from mineral consumers, producers, dealers, and Government agencies formed the basis for this the first of a series of reports designed to present the intricate features and relationships controlling mineral raw material supply and demand in California industries.

The results of this study indicated certain changes in use patterns of minerals in chemical manufacturing; a shift in requirements from metals to nonmetals, from inorganics to organics, from natural to synthetic materials, and from distant to local sources of supply.

INTRODUCTION

The Bureau of Mines was encouraged by industry organizations to conduct a broad survey of the inorganic chemical raw material supply-demand situation in California and Nevada as a basis for more detailed investigations into selected chemical industry groups. It was determined that a study of this nature would fit well into the Bureau's nationwide program of economic studies, which is designed to encourage conservation and wise utilization of mineral resources.

The survey was initiated in cooperation with suppliers and consumers in California and Nevada. Data on supply were available from replies received from producers in response to established mineral production canvasses. Consumption data for 1960 were obtained by a special canvass of all chemical companies in the two States. Officials of companies were interviewed to

[1]Mining engineer, Bureau of Mines, Area VI, San Francisco, Calif.

Work on manuscript completed November 1963.

clarify replies to the canvass questionnaire, when necessary, and to determine what specifications are most desirable, the degree of flexibility and tolerance allowable in specifications, and what alternate materials would be considered in the numerous areas of use.

Only a few companies operate chemical plants in Nevada, and detailed consumption figures obtained for that State must be concealed to avoid disclosing company confidential data. Nevada chemical plants consumed an estimated $3.5 million worth of mineral raw material in 1960.

Of the 1,200 chemical manufacturers in California, over 800, including nearly all the leading companies, responded to the Bureau of Mines survey.

Many of these companies require high-quality mineral raw materials and have been reluctant in the past to consider unfamiliar and newly developed sources of supply. However, both producer and consumer organizations now indicate that due to larger tonnage requirements, reduced profit margins, and increased transportation costs in recent years, a detailed examination from both interests is needed. Also, closer liaison between the local mineral raw material producer and the consumer might be developed by emphasizing some of the problems and potentialities of each industry.

Analysis of the returned questionnaires showed that most major chemical manufacturers either produce their own mineral raw materials or purchase them directly from the producer, although the dealer-broker continues to play an important role. The 800 responding companies used over $63 million worth of minerals and mineral compounds in 1960. About 500 of these companies consumed at least $1,000 worth of one or more mineral raw materials, but 20 companies accounted for over 75 percent of the total value of consumption reported.

Some chemical manufacturers are interested in new sources of mineral raw materials, provided that price and other factors are attractive, but most are reluctant to consider changing raw material sources and product formulas. A few consumers would prefer minerals other than the types used, if alternates could be obtained at comparable costs.

The survey indicated that the rapid increase in population, new process developments, and establishment of wider and more diverse markets for California-produced chemicals--coupled with higher transportation costs and lower profit margins--can be expected to encourage more extensive search in the future for locally available raw materials.

The fact that some consumers are interested, under the proper conditions, in changing their existing mineral raw material sources, is encouraging. If this attitude becomes more widespread, many known but superficially explored mineral deposits and occurrences will be more closely examined for their suitability in chemical processing. Technologic changes, new transportation routes, and improved supplies of water and power also will offer new potentials and extended horizons for the local mineral raw material producer.

The results of this survey provide background information which can be used (1) to assist private industry in establishing adequate supplies of mineral raw materials, of suitable quality and at minimum cost, for use in chemical manufacturing; (2) to enable the mining industry to ascertain, in general, specifications for raw materials and where they may be marketed; and (3) to inform chemical manufacturing industries where supplies of raw materials may be obtained.

Because of new and changing markets, the enormous amount of information that has been published over the years on the geology and mineral occurrences in Califronia and neighboring States warrants closer examination for clues to potential sources of chemical raw materials. The waste of today may well be the valuable raw material of tomorrow.

ACKNOWLEDGMENTS

Grateful appreciation is accorded all those companies and individual who so willingly contributed time and experience to bring this project to fruition; their combined efforts were vitally required. It is impractical to list individually the many producers, dealers, consumers, technical authorities, transportation companies, Government agencies, associations, and commodity specialists drawn upon for information. Specific contributions of many of these participants, however, are acknowledged throughout the report.

The author is especially indebted to George C. Branner, former Bureau of Mines commodity-indystry analyst; John C. Bills, manager, Market Research Dept., American Potash and Chemical Co.; Donald C. Patterson, regional manager, Market-Development Dept., Stauffer Chemical Co.; William T. Sutphen, manager, Economics Division, Stanford Research Institute; and the entire memberships of the Chemical Market Research Association of southern California and the Western Chemical Market Research Group of northern California for initiating and encouraging the study.

OBJECTIVES

As a means of promoting more economical and effective use of mineral resources this publication is intended to offer sufficient data for the mineral and chemical industries to encourage better preparation and wider use of local mineral products, byproducts, and waste materials.

The immediate objectives were as follows:

1. To generate increased supply-demand data by (a) apprising suppliers of potential markets, utility, specifications, and prices at point of consumption; (b) acquainting dealers and brokers in mineral raw materials with suppliers and consumers of these materials; (c) acquainting chemical producers with present, potential, or alternate sources of supply; (d) suggesting utility, source, and market for future low-cost mineral and chemical industries by encouraging processing and utilizing of mineral raw materials that do not meet conventional tests for consumer acceptance.

2. To ascertain the quantity and value of mineral raw materials required by California and Nevada chemical manufacturing plants.

3. To list (by firm name, products handled, and location) dealers and brokers in mineral products as reported by suppliers and consumers.

4. To list chemical consumers (by firm name, geographic location, nature and quantity of mineral products consumed, and finished products).

5. To compare domestic shipments and imports of mineral raw materials into California and Nevada for use in the chemical manufacturing industry with local supply.

DATA SOURCES AND PRESENTATION METHODS

Information Sources

Primary sources of information presented in subsequent pages were as follows:

1. Questionnaires returned by officials of 800 chemical manufacturing plants in California and Nevada covering their raw material requirements for 1960.

2. Correspondence and interviews with mineral producers, dealers, brokers, and with officials of transportation companies, trade associations, private research institutions, and Federal, State, and local Government agencies.

3. Mineral production and consumption data compiled by the Bureau of Mines.

4. Data derived from published and unpublished process information.

Presentation Methods

Quantities, values, specifications, and use patterns for domestic and imported minerals, as well as pertinent data on transportation, exports, and other aspects of the economic picture, are presented. However, details pertaining to actual methods of using minerals in chemical manufacturing are minimized. Such details are scheduled to be presented in other reports. In this study of inorganic materials the "why and how" are not of as much concern as are the "where and how much."

Text, tables, and charts present combinations and summaries of the data reported by the consumers--by mineral types, forms, sources, quantities, values, uses, and products manufactured. Also, indications are given of the requirements and procedures for marketing new and different minerals to the California and Nevada chemical industry.

Occasionally, data on processed industrial materials are shown merely as examples of production methods or the types of minerals available, and are not intended to indicate the relative merits of products of any producer for any particular use.

Mineral raw materials comprised the major interest in this study, but other alternate raw materials were considered whenever they affected mineral utilization. Some intermediate chemical products, such as sulfuric acid, elemental phosphorus, and saline compounds, also were included where a direct relationship to the raw material sources exists. Final products were considered only in the overall relationship and study of the industry.

Classification of Mineral Products for Chemical Use

There are various ways in which operations within the chemical industry might have been classified and presented. The Standard Industrial Classification (SIC) 28, which shows 31 subclassifications, was used to achieve a maximum degree of uniformity and to allow comparison with related published data. This major group includes establishments producing basic chemicals and establishments manufacturing products by predominantly chemical processes. Establishments classified in this major group manufacture three general classes of products: (1) Basic chemicals, such as acids, alkalies, salts, and organic cehmicals; (2) chemical products to be used in further manufacture, such as synthetic fibers, plastic materials, dry colors, and pigments; (3) finished chemical products to be used for ultimate consumption, such as drugs, cosmetics, and soaps, or to be used as materials or supplies in other industries, such as paints, fertilizers, and explosives. Details of this classification have been published (9).[2]

Table 1 emphasizes the broad usage of minerals and mineral compounds in the chemical industry by showing:

1. The more important use categories reported by the California chemical industry.

2. Additional categories significant to the U.S. chemical industry (as reported in BuMines Bulletin 585, Mineral Facts and Problems, by the staff of the Bureau of Mines, 1960, 1016 pp.).

Classifications of crude, first-marketable-stage, and further-refined products can vary, depending on the consumer and the definition used. In some instances, a first-marketable-stage product may be in an advanced or final stage of refinement before it becomes available. Therefore, table 1 is not precise in all instances but serves to show, in general, the categories in which various minerals are used.

---

[2]Underlined numbers in parentheses refer to items in the list of references.

TABLE 1. - Minerals and mineral compounds consumed in chemical manufacturing in California and elsewhere, by chemical groups

Crude minerals and first marketable products consumed in the chemical industry:
A - in California
a - elsewhere in the United States, if not reported for California
Mineral products processed beyond first marketable stage and consumed in the chemical industry:
B - in California
b - elsewhere in the United States, if not reported for California

SIC	Chemical groups	Antimony	Arsenic	Asbestos	Barite	Bauxite (and alumina)	Bismuth	Boron	Bromine	Cadmium	Calcium chloride	Chromium	Clays	Cobalt	Copper	Diatomite	Fluorspar	Graphite	Gypsum	Iodine	Iron oxide pigments	Lead	Lime and limestone	Lithium	Magnesium and magnesium compounds	Manganese	Mercury	Mica	Molybdenum	Nickel	Nitrogen compounds	Perlite	Phosphate rock and phosphorus compounds	Potassium compounds	Pumice	Salt and sodium compounds	Silica	Strontium	Sulfur and pyrites	Talc, soapstone and pyrophyllite	Tin	Titanium	Tungsten	Zinc	Zirconium
2812	Alkalies and chlorine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	a	-	-	-	-	-	A	-	-	a	-	A	-	-	a	-	-	-	-	-	-
2813	Industrial gases	-	-	-	-	-	-	-	ab	-	-	-	-	-	-	-	-	-	-	-	-	-	A	b	-	-	-	a	-	-	-	-	-	-	-	-	-	-	B	-	-	-	-	-	-
2814	Cyclic (coal tar crudes)	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a	-	A	-	-	-	-	-	-	-	-
2815	Dyes	-	-	-	-	-	-	a	a	a	-	-	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	b	-	-	a	a	-	-	-	a	-	-	-	-	-	-
2816	Inorganic pigments	B	-	-	A	-	-	-	-	A	-	A	-	A	A	-	-	-	-	-	A	A	-	-	-	a	a	-	-	-	-	-	-	A	-	B	-	A	A	B	a	-	a	-
2818	Industrial organic chemicals, n.e.c	A	a	a	-	-	-	A	a	-	-	-	A	-	-	A	-	-	-	-	-	-	A	b	-	-	-	-	-	-	-	A	A	A	A	ab	-	A	A	-	-	-	-	-
2819	Industrial inorganic chemicals, n.e.c	AB	a	A	A	A	a	A	A	A	A	AB	AB	A	A	A	A	A	A	A	A	a	AB	a	A	AB	A	A	a	AB	A	a	AB	A	A	AB	A	a	A	a	AB	A	-	-
2821	Plastics materials	A	-	A	A	-	-	AB	-	ab	A	-	A	A	-	A	b	A	A	-	A	B	A	-	A	-	-	A	-	-	A	a	B	A	A	A	a	A	-	B	-	-	-
2822	Synthetic rubber	b	-	A	a	-	-	-	-	-	-	-	-	-	-	-	a	-	a	-	-	-	A	-	a	-	-	-	-	-	-	a	-	A	a	AB	A	-	A	-	A	-	-	-
2823	Cellulosic man-made fibers	b	-	-	-	-	-	a	a	-	-	a	-	-	-	-	-	-	-	-	-	-	-	-	a	-	-	-	-	b	-	-	-	a	-	b	-	-	-	-	b	-	-	-
2824	Synthetic fibers (excluding organic)	b	-	-	-	-	-	a	a	-	-	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	b	-	-	-	a	-	ab	-	-	-	-	b	-	-	-
2831	Biological products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	A	-	b	-	-	-	-	-	-	-	-
2833	Medical, chemical and botanical products	-	b	-	-	-	a	-	a	-	-	-	AB	-	-	A	-	-	-	a	-	-	A	b	a	-	a	-	-	-	-	-	-	-	-	ab	-	-	-	-	b	-	-	-
2834	Pharmaceutical preparations	-	b	-	-	B	A	B	ab	-	-	-	AB	B	-	A	b	-	B	A	-	-	A	-	A	B	a	-	-	-	A	B	A	A	AB	-	b	AB	B	a	A	-	-	-
2841	Soap, detergents	-	-	-	-	-	AB	-	-	-	-	-	A	-	-	A	-	-	A	-	-	-	A	b	A	-	-	-	-	-	A	-	AB	A	A	A	A	-	b	-	-	-	-	-
2842	Specialty cleaning and polish preparations	-	-	-	A	-	A	a	-	A	-	-	A	-	B	A	-	-	A	-	-	-	A	-	-	-	-	-	-	-	A	a	AB	A	A	A	A	-	B	A	a	-	-	-
2843	Surface active agents	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	a	-	-	b	-	-	-	-	-	-	-	-
2844	Perfumes, cosmetics	-	-	-	-	b	A	-	-	B	-	AB	-	-	-	-	-	-	B	-	-	-	A	b	B	-	-	A	-	-	-	-	-	A	-	B	A	-	A	-	B	-	-	-
2851	Paints, varnishes, etc	B	AB	A	A	B	-	a	-	A	A	B	A	AB	A	A	-	A	A	-	A	B	A	b	A	B	A	A	B	-	-	A	B	A	A	AB	A	-	A	B	AB	A	-	A
2852	Putty, calking compounds	-	-	A	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
2861	Gum and wood chemicals	a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ab	-	a	-	-	-	-	-	-
2871	Fertilizers	-	-	-	-	-	-	a	-	-	-	-	A	b	AB	A	-	-	A	a	-	-	A	-	A	B	-	-	-	-	a	A	A	A	A	AB	A	-	-	-	-	B	-	-
2872	Fertilizers, mixing only	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	A	-	-	-	A	-	a	B	-	-	-	-	a	-	A	A	-	ab	-	-	-	-	-	-	-	-
2873	Agricultural pesticides	A	AB	A	B	-	-	A	a	-	A	-	A	-	AB	A	-	-	b	-	-	B	A	-	-	B	a	a	b	-	B	-	B	B	A	AB	A	b	-	-	B	-	-	-
2879	Agricultural chemicals, n.e.c	-	-	-	A	-	-	a	-	-	-	-	A	-	A	A	-	-	A	-	-	-	A	-	A	-	-	-	-	-	-	-	A	A	A	AB	-	-	-	-	-	-	-	-
2891	Glue and gelatin	-	-	A	-	-	-	A	-	-	-	-	A	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-
2892	Explosives	b	-	-	B	-	-	A	-	-	-	B	A	-	-	-	-	-	-	-	-	a	A	a	-	-	a	-	-	-	a	-	B	A	-	a	-	-	-	-	-	-	-	-
2893	Printing ink	-	-	A	a	A	-	-	a	-	A	B	A	AB	-	-	-	-	-	-	AB	B	A	-	AB	B	A	-	B	-	-	-	-	A	-	a	A	-	A	-	-	-	-	b
2894	Fatty acids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	a	-	-	-	-	-	a	-	-	-	-	b	b	-	-	-	-	-	b	-	-
2895	Carbon, black	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2899	Chemical and chemical preparations, n.e.c	A	A	A	A	A	a	A	a	a	a	AB	A	a	A	A	a	a	A	a	A	AB	A	a	A	a	a	A	A	a	A	A	A	A	A	A	a	A	AB	A	A	-	A	a

The Stanford Research Institute published the following statement concerning the California chemical industry (43, p. 314):

> In addition to the vast number of industrial organic and inorganic chemicals, this group of industries includes the manufacture of soap, drugs, paints, fertilizers, fats and oils, and miscellaneous other chemicals. The number of products involved and the complexity of their supply and demand relations makes it exceedingly difficult to analyze this group in detail. For example, the Stanford Research Institute Directory of Western Chemical Producers (1955) lists 405 "prime" chemicals, excluding mixtures and formulations, made in California, ranging from acetaldehyde to zinc tallate.
>
> Previous studies at Stanford Research Institute have dealt with individual products on numerous occasions. However, the number covered in this manner represents only a small fraction of the total group. The Institute also has attempted to find common denominators that will permit some type of general analysis of the probable future development of the chemical industries in California. No satisfactory general approach has yet been found.

COMPLEXITIES OF THE STUDY

A number of involved problems were encountered in the course of this study; the more important ones are listed below:

1. Complexity of the chemical industry points up the deficiencies of Standard Industrial Classification Group 28.

2. Widespread mergers along with forward and backward company integration sometimes make it difficult to determine the status of a particular chemical plant's needs for raw materials without detailed knowledge of the processes involved.

3. It is difficult to predict the mineral raw material market from the nature of the chemical product because of alternative process methods.

4. Emphasis of competitive business considerations requires that many important details be held in confidence by the chemical company.

5. Because the canvas was being conducted for the first time, editing of complex responses was difficult.

6. The comparability of data furnished often varied because of differences in company accounting and reporting procedures.

7. The degree of thoroughness of the reply was variable.

8. Definitions of "first-marketable-stage mineral raw materials" are sometimes difficult to establish and may vary depending on production

methods and the extent to which mineral beneficiation involves chemical processing.

9. Requirements of the beneficiation process itself for mineral raw materials were sometimes unpredictable.

10. The nature and type of competitive byproducts produced in some chemical processes could not be readily determined.

11. Limitation in methods of presentation of data were imposed by requirements to preserve confidential status of competitive information.

12. The absence of comparable previous data and analyses upon which to establish trends made compilation of a publication on the subject difficult.

The chemical industry is not a single entity but a variety of complex supplier-consumer organizations. Depending upon the company, any or all of the following overlapping categories of materials were marketed in California in 1960:

1. The crude raw mineral.

2. A processed natural mineral product (retention of chemical formula).

3. A modified mineral product (change in chemical formula; i.e., smelter product).

4. An intermediate stage chemical compound (in some instances, the first marketable product, i.e., titanium dioxide).

5. A final-stage chemical.

6. A finished chemical product.

7. Manufactured items for public distribution.

No rigid rule on what constitutes a first-marketable-stage raw material could be followed throughout the study. For example, no raw ore of titanium was shipped into California, but a considerable quantity of titanium dioxide (TiO_2) was shipped into California to the paint industry as a "first-marketable product." The paint industry does not use ilmenite or rutile concentrate; therefore, titanium dioxide was included in table 2. Specific problem areas are defined in the section on mineral commodities.

Some companies, normally classified outside SIC 28 because of primary operations in other industries, were included in the canvass when it was known that they consumed substantial quantities of mineral raw materials for chemical manufacturing. The data obtained outside SIC 28 were not included in the chemical industry figures but served as a basis for discussing overall uses and markets in California under the commodity sections.

In conclusion, analysis of types and sales volumes of minerals and/or mineral products, as reported by numerous and varied chemical consumers, is difficult, particularly when questionnaire and instructions are new and subject to misinterpretation. The Standard Industrial Classification of the Chemical and Allied Products Industry is far from perfect--it is overlapping and does not cover all the "chemical process industries;" but no better standard has yet been devised. The Manufacturing Chemists' Association has been giving the matter serious consideration.

CALIFORNIA MINERAL SUPPLY-DEMAND SITUATION

California is a leading State in both production and consumption of many industrial minerals; Nevada, on the other hand, is a leading supplier or potential supplier of many raw materials to California industries but consumes comparatively little in chemical manufacturing. Other States supply California with some ores for processing to meet chemical requirements. These ores are either consumed or reshipped to other States and foreign countries.

California has led all States in diversity and quantity of minerals produced as well as in the total value of mineral raw materials consumed for many years. To maintain this position, California mineral suppliers must compete with an ever-increasing variety of substitutes and many new alternate raw material sources (some with more favorable transportation costs), keep abreast of multifarious use specifications (which usually require intimate knowledge of the consuming industries), excel in technical know-how, and carry out a variety of flexible marketing services.

California was virtually the only domestic source of boron, iodine, and rare-earth minerals in 1960, most of which were shipped out of State. Moreover, California produced and shipped more than 50 percent of the total domestic output of diatomite, sodium compounds, mercury and tungsten. It led in the production of gypsum (including gypsite), and yet, imported a large tonnage from Mexico.

California's virtual self-sufficiency in sulfur has resulted mainly from improvements in the byproduct recovery of sulfur at smelters and refineries.

Nevada has made increasingly significant contributions of mineral raw materials to the California chemical industry, particularly barite, clays, diatomite, and lime.

Despite the abundance of mineral resources in California and Nevada (table 2), chemical manufacturers were dependent on out-of-State and foreign producers to supply certain mineral requirements because supplies were unavailable locally or were either unsuitable, had not been tried, or could not meet requirements without further treatment.

Many of the minerals required by the California chemical industry which are shipped in exist locally in potentially economic quantities. The historic problems in developing these local mineral deposits have been inaccessibility, lack of utilities, and insufficient markets to sustain mining operations.

TABLE 2. - Mineral production and potential in California and Nevada counties

(O = occurrence; P = production in the past; X = production in 1960; - = none recorded)

CALIFORNIA

Mineral	Alameda	Alpine	Amador	Butte	Calaveras	Colusa	Contra Costa	Del Norte	El Dorado	Fresno	Glenn	Humboldt	Imperial	Inyo	Kern	Kings	Lake	Lassen	Los Angeles	Madera	Marin	Mariposa	Mendocino	Merced	Modoc	Mono	Monterey	Napa	Nevada	Orange	Placer	Plumas	Riverside	Sacramento	San Benito	San Bernardino	San Diego	San Francisco	San Joaquin	San Luis Obispo	San Mateo	Santa Barbara	Santa Clara	Santa Cruz	Shasta	Sierra	Siskiyou	Solano	Sonoma	Stanislaus	Sutter	Tehama	Trinity	Tulare	Tuolumne	Ventura	Yolo	Yuba
Metals and Metallic Ores																																																										
Antimony	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	O	-	-	-	-	P	-	-	O	-	O	-	-	-	P	-	P	P	O	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-
Arsenic	-	-	O	-	O	-	-	-	O	O	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	O	O	-	-	-	P	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	O	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	-	-	-	-	-	-	-	-	-	O	-	-	-	O	O	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	O	-	-	O	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	P	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	O	-	-	O	-	-	-	-	-	O	O	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromite	P	-	P	P	P	P	O	P	P	P	P	P	-	-	-	O	P	-	O	-	O	P	P	-	-	-	O	P	P	-	P	P	-	-	P	-	-	O	-	P	O	P	P	-	P	P	P	O	P	P	-	P	P	P	P	-	-	O
Cobalt	-	-	-	-	O	-	-	-	-	-	-	-	-	O	-	-	-	-	O	O	-	O	-	-	-	O	-	O	O	-	O	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-
Columbium and tantalum	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	P	P	P	P	P	O	O	X	P	P	O	X	P	X	P	-	O	P	P	X	P	P	P	P	P	P	-	P	X	-	P	X	X	P	-	X	P	-	-	P	-	-	O	-	X	P	-	-	O	P	-	O	P	P	P	-	-	X
Gold	-	X	X	X	X	P	O	P	X	X	O	X	P	X	X	O	O	P	X	X	P	X	O	X	P	X	P	P	X	P	X	X	X	X	-	X	X	-	P	P	P	P	P	P	X	X	X	-	O	X	O	P	X	P	X	P	P	X
Iron ore	-	-	O	X	O	-	-	O	O	-	-	O	O	P	O	-	-	-	O	O	-	-	-	-	-	-	-	O	-	-	P	O	X	-	O	X	O	-	-	O	-	-	-	P	P	O	X	-	-	-	-	-	O	-	-	-	-	-
Lead	-	X	-	X	-	-	-	-	X	-	-	X	P	X	P	-	-	P	P	P	-	P	-	-	-	X	-	-	X	P	-	P	P	P	-	X	O	-	-	-	-	-	-	-	X	P	P	-	-	P	-	-	P	P	P	-	-	-
Manganese	P	-	P	P	P	P	P	O	O	P	P	P	P	P	-	-	P	-	P	O	P	P	P	O	-	-	O	P	P	-	P	P	P	-	P	P	O	-	P	P	-	-	P	-	P	-	P	-	P	X	-	X	P	P	O	-	-	O
Mercury	-	O	-	-	-	P	P	P	P	X	-	P	-	P	X	X	X	-	-	-	X	O	X	P	O	P	P	X	-	P	-	-	-	-	X	P	-	O	-	X	P	X	X	-	O	-	P	X	X	X	-	-	X	-	-	-	X	-
Molybdenum	-	O	-	-	O	-	-	-	O	O	-	-	-	X	-	-	-	-	O	O	-	-	-	-	-	O	O	-	-	-	O	O	-	-	-	O	O	-	-	-	-	-	-	-	O	-	O	-	-	-	-	-	O	O	O	O	-	-
Nickel	-	-	-	-	-	-	-	-	O	-	-	-	O	-	-	-	-	-	-	O	-	O	-	-	-	-	O	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	O	-	-
Platinum group	-	-	P	P	P	-	-	P	-	-	-	P	-	-	-	-	-	-	-	-	-	P	P	P	-	-	-	-	P	-	P	P	-	X	-	-	-	-	P	O	P	P	-	-	P	-	P	-	-	P	-	P	P	-	-	-	-	X
Rare earth elements	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	O	X	X	X	X	-	-	X	X	X	-	X	P	X	X	-	-	P	X	X	P	X	P	X	P	X	P	P	X	P	X	P	X	X	-	X	X	O	P	O	P	-	O	P	X	X	X	-	-	X	-	P	X	P	X	P	P	X
Tin	-	-	-	-	-	-	-	-	O	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	P	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tungsten	-	P	-	-	O	-	-	-	P	X	-	-	-	X	P	-	-	-	O	X	P	P	-	-	-	P	-	-	P	-	O	-	P	-	-	X	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-
Uranium	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	-	-	X	O	-	O	-	-	-	-	O	O	-	-	-	-	O	O	-	-	P	-	-	-	O	-	O	-	-	-	X	-	-	-	-	-	-	-	-	O	O	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-
Zinc	-	X	-	X	-	-	-	-	X	-	-	X	O	X	P	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	O	-	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Nonmetallic (Industrial) Minerals																																																										
Asbestos	P	-	O	O	P	-	O	-	P	X	-	-	-	P	O	-	P	-	P	O	-	O	O	O	-	-	O	X	P	O	P	-	P	-	P	P	O	-	-	O	-	-	-	-	P	O	O	-	-	-	-	-	O	O	P	-	O	O
Barite	P	-	-	-	-	-	-	-	-	-	-	O	-	P	X	-	O	-	P	-	-	P	-	P	-	P	O	-	X	-	-	P	-	P	P	X	-	-	-	-	-	P	-	-	P	-	-	-	-	-	-	-	O	X	-	-	-	-
Clay	X	-	X	P	X	O	X	O	P	X	O	P	P	X	X	O	O	O	X	X	X	O	P	P	O	X	P	P	O	X	X	-	X	X	X	X	X	P	X	X	X	P	X	X	P	-	O	X	X	X	X	P	-	X	P	X	O	X
Diatomite	-	-	O	-	-	-	P	-	-	P	-	-	-	P	X	-	O	-	P	-	-	-	-	O	P	O	P	X	-	-	O	-	-	-	O	O	O	-	-	P	O	X	O	-	P	-	-	-	O	O	-	-	-	O	O	O	-	-
Dolomite	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	P	O	-	O	-	-	-	-	P	-	-	-	-	-	P	-	P	P	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-
Fluorspar	-	-	-	-	-	-	-	-	-	-	-	-	-	P	O	-	-	-	O	-	-	-	-	-	-	O	-	-	-	-	-	-	P	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Graphite	-	-	-	-	O	-	-	-	-	O	-	O	O	O	-	-	-	-	P	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	O	O	-	-	-	-	-	-	-	-	-	O	-	P	-	-	-	-	P	O	-	-	-
Gypsium	P	-	-	O	-	O	P	-	-	P	-	-	X	P	X	X	-	-	P	-	-	-	-	X	-	-	P	-	-	P	-	-	X	-	P	P	O	-	-	X	P	X	-	-	-	-	-	-	-	-	-	-	-	O	-	X	-	-
Iron oxide pigments	P	-	P	O	O	O	-	-	O	-	-	-	O	-	-	O	O	-	P	P	-	-	O	-	-	-	-	O	P	-	P	-	O	-	-	P	O	-	O	-	-	-	-	-	O	-	O	-	P	P	-	-	O	-	-	P	-	P
Limestone	P	-	P	P	X	O	P	-	X	P	-	P	P	X	X	-	P	-	P	-	P	P	P	-	-	P	X	P	P	P	P	P	X	-	X	X	P	-	P	X	X	X	X	X	P	O	P	P	P	-	O	-	P	P	X	X	-	-
Lithium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	O	-	-	X	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesite	P	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	O	-	O	O	-	O	P	-	-	-	O	P	O	-	P	-	P	-	P	P	O	-	-	O	-	O	X	-	-	-	-	-	P	P	-	O	-	P	P	-	-	-
Marble	-	-	P	O	-	O	-	-	-	O	O	-	O	P	O	-	-	-	O	O	-	O	-	-	-	-	O	-	O	-	P	O	O	-	-	P	P	-	-	P	-	P	O	-	-	O	O	O	-	-	-	-	O	P	P	-	-	O
Mica	-	-	-	-	-	-	-	-	-	P	P	-	X	P	-	-	-	-	P	-	-	P	-	-	-	-	-	-	-	-	-	-	O	-	-	O	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Perlite	-	-	-	-	-	-	-	-	-	P	-	-	-	X	P	-	-	O	P	-	P	-	-	-	P	P	-	X	-	-	-	-	O	-	-	P	-	-	-	-	-	-	-	-	-	-	O	-	P	-	-	-	-	-	-	-	-	-
Pumice (lump)	-	-	P	-	P	-	P	-	-	X	-	-	X	X	X	X	X	-	-	X	-	P	-	-	X	X	-	P	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	O	-	X	-	P	-	-	-	-	-	-	-	-	-
Pumice (volcanic ash)	-	-	P	-	-	-	-	-	O	P	-	O	-	X	P	-	X	X	P	X	-	-	-	-	X	X	-	O	-	-	-	X	-	-	O	X	O	P	-	P	-	O	-	-	X	-	X	O	-	P	-	X	X	-	-	-	-	-
Pyrites	P	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	P	-	-	-	-	-	P	P	-	-	-	-	-	-	-	-	X	-	O	-	-	-	-	-	-	-	-	-	-	-
Serpentine	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica (glass sand)	-	-	X	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	O	-	X	-	-	P	X	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica (quartz)	-	-	O	-	-	-	-	-	P	-	-	-	O	-	-	-	-	-	P	-	-	P	-	-	-	-	-	-	-	-	P	-	P	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	P	-	-	-	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	P	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	P	O	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur	-	X	-	-	-	X	P	-	-	-	-	-	O	X	P	P	X	-	P	P	-	O	-	-	-	O	-	-	-	-	-	-	-	-	-	O	-	-	-	P	-	O	-	-	O	-	O	-	O	-	-	O	-	-	-	O	-	-
Talc, soapstone and pyrophyllite	P	-	X	P	O	-	-	-	X	-	O	-	-	X	P	-	-	-	X	O	-	O	-	-	-	X	-	O	-	-	P	-	O	P	-	X	X	P	-	-	-	-	-	-	P	O	O	-	-	-	-	-	O	P	P	-	-	O
Wollastonite	-	-	-	-	-	-	-	O	-	-	-	-	-	O	P	-	-	-	-	-	-	-	-	-	-	-	-	O	O	-	-	-	X	-	-	-	O	-	-	-	-	O	-	-	-	-	O	-	-	-	-	O	O	-	-	-	-	-
Zircon	O	-	-	O	O	-	-	O	O	O	-	O	-	-	-	-	-	-	-	-	-	-	O	-	-	O	-	-	O	-	P	O	O	O	-	-	O	-	-	O	O	O	-	O	O	-	O	-	-	-	-	-	O	-	-	-	-	O
Salines																																																										
Boron	-	-	-	-	-	O	-	-	-	-	-	-	-	X	X	-	P	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	P	-	-
Bromine	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium chloride	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iodine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium compounds	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	P	X	-	-	O	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium compounds	P	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	P	O	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salt	X	-	-	P	-	O	-	-	-	-	-	-	P	P	X	-	-	-	P	-	P	-	-	-	P	P	X	P	-	X	-	-	-	-	-	X	X	-	-	-	X	-	-	-	O	-	-	P	-	-	-	P	-	-	-	-	-	-
Sodium carbonate	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	O	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium sulfate	-	-	-	-	-	-	-	-	-	-	-	-	P	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	X	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NEVADA

Mineral	Churchill	Clark	Douglas	Elko	Esmeralda	Eureka	Humboldt	Lander	Lincoln	Lyon	Mineral	Nye	Ormsby	Pershing	Storey	Washoe	White Pine
Metals and Metallic Ores																	
Antimony	P	O	P	P	P	P	P	P	-	O	P	X	-	P	-	P	P
Arsenic	-	-	O	-	-	-	-	P	-	-	-	-	O	O	-	O	O
Beryllium	-	O	-	O	-	O	O	O	-	-	-	-	-	O	-	-	O
Bismuth	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	P	P	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-
Columbium and tantalum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	P	X	P	X	X	X	P	X	X	X	X	P	P	P	P	P	X
Gold	X	X	X	X	X	X	X	X	X	X	X	X	P	X	X	X	X
Iron ore	X	O	X	O	P	X	X	P	P	P	P	X	P	X	O	O	O
Lead	X	P	X	X	X	X	P	X	X	P	X	P	P	X	P	P	X
Manganese	P	X	O	P	O	P	P	P	P	-	P	O	-	P	-	O	P
Mercury	P	O	-	X	X	P	X	X	P	P	X	X	P	X	P	P	-
Molybdenum	P	P	O	O	O	O	O	O	O	O	O	O	-	O	O	O	X
Nickel	P	P	-	O	O	-	-	-	-	-	P	O	-	-	-	-	-
Platinum group	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rare earth elements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	X	X	X	X	X	X	X	X	X	X	X	P	P	X	X	X	X
Tin	-	-	-	O	-	-	-	O	-	-	-	O	-	P	-	-	-
Titanium	O	O	O	O	-	O	O	-	O	O	-	O	-	O	-	O	-
Tungsten	X	P	P	P	P	-	P	P	P	P	X	X	P	P	O	P	X
Uranium	-	-	-	X	-	-	O	X	-	-	O	O	-	O	-	-	-
Vanadium	O	-	-	O	-	-	O	-	O	-	-	O	-	O	-	O	-
Zinc	X	X	X	X	P	X	P	X	X	P	X	P	-	X	P	P	X
Nonmetallic (Industrial) Minerals																	
Asbestos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barite	P	O	-	X	P	O	P	X	O	-	X	X	P	O	-	-	O
Clay	O	P	-	-	O	-	O	-	-	X	-	X	-	X	X	X	X
Diatomite	P	-	-	P	X	-	-	-	X	X	P	P	-	X	X	O	-
Dolomite	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorspar	P	-	O	-	-	O	O	P	X	O	P	X	-	P	-	O	O
Graphite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	-
Gypsium	P	X	P	-	-	-	-	-	-	-	P	P	-	X	-	P	-
Iron oxide pigments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Limestone	P	P	-	-	-	-	-	-	-	-	-	-	-	-	-	O	X
Lithium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesite	-	P	O	-	-	-	-	-	-	-	-	X	-	-	-	-	O
Marble	-	O	-	O	-	-	-	-	-	-	-	O	-	-	-	O	-
Mica	-	O	-	P	-	-	-	-	-	-	O	-	-	O	-	-	-
Perlite	-	P	O	-	O	-	-	-	X	-	P	-	-	X	-	-	-
Pumice (lump)	P	-	-	-	O	P	-	-	-	-	X	X	X	O	-	-	-
Pumice (volcanic ash)	P	-	-	-	-	P	-	-	-	-	P	P	-	-	-	-	-
Pyrites	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-
Serpentine	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-
Silica (glass sand)	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica (quartz)	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	X	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur	-	-	-	-	P	O	X	-	-	-	-	-	-	O	-	P	-
Talc, soapstone and pyrophyllite	-	-	-	-	X	-	-	-	-	-	O	-	-	-	-	-	-
Wollastonite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zircon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salines																	
Boron	P	P	-	-	P	-	-	-	-	-	P	-	-	-	-	-	-
Bromine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iodine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium compounds	-	O	-	-	P	-	-	-	-	-	P	-	-	-	-	-	-
Salt	X	P	-	-	O	P	-	-	-	-	P	P	-	-	-	P	-
Sodium carbonate	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-
Sodium sulfate	-	O	-	-	O	-	-	-	-	O	O	-	-	O	-	O	-

As power, water, and transport facilities become more available, new mineral processing plants undoubtedly will move closer to the deposits. Also, whenever zoning restrictions become too rigid, space becomes unavailable for plant expansion, raw material transport costs become excessive, and waste disposal becomes prohibitive; it soon becomes advantageous for some older plants to be dismantled and moved out of congested metropolitan areas.

Local mineral sources inevitably will become increasingly important in chemical manufacturing. Distant sources can be surprisingly competitive for commodities which can be transported by water (and the California chemical industry is virtually all directly available to coastal shipments). Nevertheless, there are many opportunities to encourage wider use of more locally available materials by (1) studying the nature and potential of the consumers' business, (2) analyzing their raw materials problems, (3) establishing adequate test and performance data for available mineral products, and (4) assuring the customer of a constant supply of uniform-quality products.

The population increase after World War II stimulated the growth of the California chemical industry, and attention has focused on the now sufficiently large market to justify more local mines and mineral processing plants, established, in many instances, by the consumers themselves. Yet, the rigidly increasing demands of industry should encourage even greater efforts toward discovery and development of additional local deposits, which can be beneficiated if necessary.

Decentralization of the chemical industry offers an increasing opportunity for utilization of sources of raw materials which previously were too far from markets to be considered valuable. It is to the advantage of the mineral producer to become familiar with the technology of chemical manufacturing, wherever possible, and to follow chemical industry developments and movements as reported in the various periodicals.

California suppliers have a tendency to build processing plants and warehouses closer to consumers to meet the demand for improved service, but zoning restrictions and higher land tax costs and waste disposal problems of metropolitan areas would make decentralization of mutual advantage to the supplier and consumer of minerals in some instances.

Several distant locations in California and Nevada were being rapidly transformed into chemical-plant sites during 1960-62, the period of this study, not only to avoid city congestion, rigid zoning restrictions, and high tax rates, but because they were more accessible to raw material sources. These moves should be carefully followed by the potential mineral supplier. Henderson, Nev., for example, was a small community which became a dominant chemical manufacturing area in Nevada a few years ago. At the time of this study Mojave, Calif. (another "remote" desert location but actually less than 100 miles from the heart of Los Angeles) was the site of several current and planned chemical operations.

The majority of chemical plants in California are small, and their storage space is limited; consequently, mineral raw materials are purchased in

relatively small quantities. These consumers usually rely upon the larger chemical companies and brokers in the area to supply their needs for small shipments and are willing to pay somewhat higher prices for the convenience. However, the consumers strive to reduce delivered costs by obtaining bulk and carlot shipments when feasible.

The larger chemical companies often obtain their mineral raw material requirements either from their own mines, from operating divisions of their parent companies, or from subsidiary companies. This captive tonnage makes up a significant part of the total output of mineral raw materials and cannot be considered in the potential market.

It is often easier for a potential mineral supplier to interest a consumer in the sale (royalty or outright purchase) of a well-proven deposit than to obtain him as a customer, particularly if the potential supplier has no plant and no proven sales-service record. Nevertheless there are opportunities to develop markets for mineral materials from new sources, especially in instances where present suppliers are few, unstable, or distant.

Consumers generally desire two or more sources of raw materials for several reasons, including assurance of more constant supply as a lever to reduce prices and increase competitive services, and to avoid revealing their sales pattern and volume by inference and computation.

Marketing Minerals to the California Chemical Industry

Metal and metal compound marketing is comparatively simple; however, nonmetallic (industrial) mineral usage is so diversified that only generalizations can be made regarding marketing practices, as related to the California chemical industry. Defining and analyzing the market for nonmetallic minerals are, within obvious limits, usually more important than the location of the deposits, particularly for lower unit-value materials.

Two basic considerations which the potential supplier should keep foremost in mind are:

1. Consumers hesitate to break relations with current sources unless there is more than ample justification to do so.

2. Based on the total sales prices of the consumers' products, the actual "savings" in mineral raw material costs, even at a substantial reduction in the cost per ton, may prove to be negligible.

To reduce expensive costs of introducing new types or grades of minerals in competition with presently used materials, it is advisable to seek cooperation with prospective customers. Marketing minerals to the chemical industry must usually include access to research facilities and product development which the customer may be in the best position to provide. However, even under the best cooperative relationships, nonmetallic mineral products introduced to the chemical industry may still require considerable market development time.

Factors Affecting Mineral Marketing

Factors which have both favorable and adverse effects on mineral distribution and marketing practices include the following:

1. The same type mineral commodity produced from different deposits seldom has identical physical and chemical properties, and sometimes these properties vary within the same deposit. Thus, the diversity of specifications for mineral raw materials consumed in manufacturing comparable products hinders the study of potential markets.

2. There is an understandable reluctance to switch to new sources that may not be supported by proven reserves and uniformity of quality. Also, some consumers are reluctant to change raw material sources and product formulas until forced to do so to maintain their competitive position.

3. Mineral usage is based mainly on precedent, and what is considered good quality by one chemical manufacturer might be rejected by another producing equivalent products.

4. A better product available at lower cost to the consumer is sometimes insufficient reason to warrant change (habit, opinion, reciprocity, and other factors may enter into the decision).

5. Some consumers have long-term purchase contracts with current sources.

6. It is often unwise for a producer to bear high costs of commercial laboratory testing, particularly when he has no assurance that he can break into existing markets--even after he proves that his product is of suitable quality.

7. It is difficult for a producer to obtain adequate test data from a potential consumer, and even more difficult to have him consider reformulation.

8. Although large quantities of minerals frequently are consumed in the chemical manufacturing process, in other instances the quantities needed are relatively small.

9. Some chemical manufacturers can use any one of a number of raw materials for producing certain products.

10. Relative price stability of chemical products allows the consumer to pay a fairly constant price for raw materials. However, the quality requirements and prices paid by manufacturers of similar chemical products for mineral raw materials are usually variable.

Other considerations which affect mineral consumption in chemical manufacturing include:

1. The short economic life of many chemical products and processes makes it sometimes hazardous for a mineral supplier to depend on certain specialty markets.

2. Improved development of chemical byproduct and coproduct potentials encourages additional use of mineral raw materials.

3. Comparative freedom of the major segments of the chemical industry from the effects of seasonal variations and business cycles assures a reasonably constant market for mineral raw materials.

4. Greater emphasis on research in the chemical industry, as compared with other industries, offers ever-widening potential applications of alternate mineral raw materials.

5. A multitude of competitive chemical products creates considerable difficulty in attempting to forecast utilization of specific minerals.

6. Use of certain minerals in chemical products is sometimes not apparent from the products manufactured, and the process flowsheet may be confidential.

Generally speaking, then, mineral marketing for use in chemical applications should include a systematic effort to answer these basic questions:

1. Who will buy what minerals, where, in what quantity, in what specific range in quality and form, and at what price?

2. Is the market constant, seasonal, or sporadic?

3. Does the product require packaging, or can it be shipped in bulk?

4. How and where is the product to be shipped?

5. What is the competition?

6. Is the market likely to remain static, increase, or decline?

7. What other less expensive or better alternate materials might be substituted, and what are their use potentials?

To answer the above questions, it is advantageous for marketing personnel to be familiar with the geologic occurrence; potential and current sources; and economics of mining, processing, and handling minerals as well as to have detailed knowledge of marketing methods, mineral usage, and chemical requirements.

TABLE 3. - Mineral suppliers who confirmed chemical industry reports by providing product details[1]

X--Crude minerals and first marketable products.
O--Mineral products processed beyond first marketable stage.

Company	Address (Calif. unless otherwise designated) (Street unless otherwise designated)		Miners & processors	Dealers & agents	Antimony	Arsenic	Asbestos	Barium (barite)	Bauxite (and alumina)	Bismuth	Boron	Bromine	Cadmium	Calcium compounds	Chromium	Clays	Cobalt	Copper	Diatomite	Fluorine	Gypsum	Iodine	Iron oxide pigments	Lead	Lime, limestone (& whiting)	Lithium	Magnesium & magnesium compounds	Manganese	Mercury	Mica	Mineral pigments	Molybdenum	Nickel	Nitrogen compounds	Perlite	Phosphate rock & phosphorus compounds	Potassium compounds	Pumice	Salt & sodium compounds	Silica	Strontium	Sulfur & pyrites	Talc, soapstone, & pyrophyllite	Tin	Titanium	Tungsten	Zinc	Zirconium	Refined chemical
Abbott, S. L. Co.	4255 District	Vernon		+																																											
Allied Chemical Corp.	235 Montgomery	San Francisco 4	+						O																																						O
American Mineral Resources Dev. Co.	P. O. Box 756	Williams	+																																					X							
American Potash & Chemical Corp.	3000 W. Sixth	Los Angeles 5	+								XO																								XO		XO			O						O
Aquafil Co.	349 First	Los Altos	+															X																							X						
Archer-Daniels-Midland Co.	6608 E. 26th	Los Angeles 22	+													X																															
Berkeley Yuba Milling Co.	1069 2nd	Berkeley 10	+					X																																							
Blue Diamond Corp.	1650 S. Alameda	Los Angeles 21	+																		XO																										
Braun Chemical Co.	1361 Bonnie Beach Pl.	Los Angeles 23		+	X					X				X	O	X												X			X															O
Browning, E. S., Co.	493 De Haro	San Francisco 7		+			X									X																					X		X							
Butcher, L. H., Co.[2]	3628 E. Olympic Blvd.	Los Angeles 23	+													X																															O
Cabot Corp.	125 High	Boston 10, Mass.	+																																					O							
Calif. Non-Metallics	P. O. Box 265	Trabuco Canyon	+													X																								X							
Carborundum Co.	P. O. Box 32	Akron, N.Y.	+																																										O	O	
Carrol, R. E., Inc.	231 Broad, Bank Bldg.	Trenton 1, N.J.		+												X								X						O															
Cerro Sales Corp.	310 Park Ave.	New York 22, N.Y.		+														O						O																			O			
Chemical Additives Co.	3155 Leonis	Vernon		+					O							X								X																						
Chemical Mfg. Co.	714 W. Olympic Blvd.	Los Angeles 15		+							O					X								X			X											O		X						X	
Chilean Nitrate Sales Co.	120 Broadway	New York 5, N.Y.	+																			X											O													
Clute Asbestos Bonding Corp.	1323 Main	Napa	+				X																																								
Cole & Degraf Co.	656 Townsend	San Francisco 7		+												X																															
Columbia-Southern Chemical Co.	625 Market	San Francisco 5	+																																			X									
Combined Metal Reduction Co.	Caselton	Pioche, Nev.	+																															X												
Commercial Minerals Co.	310 Irwin	San Francisco 7		+												X								X																X						
Consolidated Rock Products Co.	2730 S. Alameda	Los Angeles 58	+																																					X						
Cordero Mining Co.	131 University	Palo Alto	+																								X																			
Davis, Frank D.	3285 E. 26th	Los Angeles 23		+				X												X		X		X					X																	
Del Monte Properties Co. (Sand Div.)	P. O. Box 150	Pebble Beach	+																																					X							
Desert Minerals Inc. (Amer. Minerals Co.)	840 S. Mission Rd.	Los Angeles 23	+													X																															
Diamond Springs Lime Co.	P. O. Box 409	Diamond Springs	+																					X																						
DuPont de Nemours, E. I., & Co.	1600 Trousdale Dr.	Burlingame	+																																												O
El Dorado Limestone Co.	9 First	San Francisco 5	+																					X																						
Fennelly-Lauer Chemicals, Inc.	1485 Bayshore Blvd.	San Francisco 24		+																	X																				X						
Fibreboard Paper Products Co.	475 Brannan	San Francisco 19	+																		X																									
Flintkote Co.	2244 Beverly Blvd.	Los Angeles 57	+																					X																						
F M C Corp.	P. O. Box 337	Newark	+									X									X					X										X										O
Hall, C. P., Co.	444 Alaska	Torrance		+												X								X		O		X												X	X					
Harrisons & Crosfield, Inc.	475 Huntington Dr.	San Marino		+												X												X													X						
Harshaw Chemical Co.	32377 So. Garfield	Los Angeles 22	+		O											X		O												O		O												O			O
Hathaway Allied Products Co.	2024 Westgate Ave.	Los Angeles 25	+													X																															O
Huber, J. M., Corp.	100 Park	New York 17, N.Y.	+													X																														
Huntley Industrial Minerals, Inc.[2]	P. O. Box 305	Bishop	+													X																														
Industrial Minerals and Chemical Co.	7275 Reese Road	Florin	+					X								X																								X						
Inerto Co.	1489 Folsom	San Francisco 3	+													X																														
Johns-Manville Corp.	611 S. Catalina	Los Angeles	+				X												X																											
Kennedy Minerals Co.[2]	2550 E. Olympic Blvd.	Los Angeles 23	+													X								X																						

See footnotes at end of table.

TABLE 3. - Mineral suppliers who confirmed chemical industry reports by providing product details[1]--Continued

Company	Address (Calif. unless otherwise designated) (Street unless otherwise designated)		Miners & processors	Dealers & agents	Antimony	Arsenic	Asbestos	Barium (barite)	Bauxite (and alumina)	Bismuth	Boron	Bromine	Cadmium	Calcium compounds	Chromium	Clays	Cobalt	Copper	Diatomite	Fluorine	Graphite	Gypsum	Iodine	Iron oxide pigments	Lead	Lime, limestone (& Whiting)	Lithium	Magnesium & magnesium compounds	Manganese	Mercury	Mica	Mineral pigments	Molybdenum	Nickel	Nitrogen compounds	Perlite	Phosphate rock & phosphorus compounds	Potassium compounds	Pumice	Salt & sodium compounds	Silica	Strontium	Sulfur & pyrites	Talc, soapstones, & pyrophyllite	Tin	Titanium	Tungsten	Zinc	Zirconium	Refined chemicals
Landson Mining Co.	P. O. Box 471	Maricopa	+																																						X									
Leslie Salt Co.	505 Beach	San Francisco 11	+																																					X										
Los Angeles Chemical Co.	4545 Ardine	South Gate		+				X												X	X					X															X		X	X						
Lynch, A. J., Co.	4560 E. 50th	Vernon		+				O			O			X		X					X							O		O		O		O					O	XO	X		O	X						
McKesson & Robbins, Inc.	200 S. Los Angeles	Los Angeles 12		+	X	X	X	XO	O	O	O		O	O		X			X	X	X	X	X	X	O	X	O	O	O	X	X		O	O		X		X	X	XO	X	O	X	X	O	X			X	O
Manganese Chemical Corp.	1755 Rand Tower	Minneapolis 2, Minn.	+																										X																					
Matthews Chemical Co.	120 Montgomery	San Francisco 4		+							O																													X										O
Monolith Portland Cement Co.	643 South Olive	Los Angeles 14	+																	X		X																												
Monsanto Chemical Co.	6670 E. Flotilla	Los Angeles 22	+																																		O						O							O
Mountain Copper Co.	230 California	San Francisco 11	+																					X																										
New Jersey Zinc Co.	160 Front	New York 38, N.Y.	+																																													X		
Nuodex Products of Calif., Inc.	5915 Paramount Blvd.	Long Beach	+					O					O	O			O	O						O	O			O		O					O					O					O			O	O	O
Oglebay-Norton Co.	Hanna Bldg.	Cleveland 15, Ohio		+																X				X													X					X								O
Olin Mathieson Chemical Corp.	3848 E. Colorado	Pasadena 8	+																																					X			X							O
Pacific Salt Co.	4262 Wilshire Blvd.	Los Angeles 4	+																																					X										
Pfizer, Charles & Co., Inc.	1500 16th	San Francisco 3	+																																															O
Philadelphia Quartz Co. of Calif.	7th & Grayson	Berkeley 10		+																								O												O										
Phillipp Bros., Inc.	339 Indiana Ave.	El Segundo		+		O		X	X		X				X		X	X						X	O				O	X			X	X							X				O	O	X	O	O	
Piggott Projects	1057 Howard	San Francisco 3	+																											X																				
Pioneer Talc Co.	P. O. Box 278	Chatsworth, Ga.	+																																									X						
Quicksilver Products, Inc.	407 Sansome	San Francisco 11	+																											X																				
Royal, H. M., Inc.	11911 Woodruff Ave.	Los Angeles 22		+				X								X			X		X					X																	X	X						
San Luis Mining Co.	100 Bush	San Francisco 4	+																	X																														
Shieldalloy Corp.	West Blvd.	Newfield, N.J.		+											X					X				O																						X			X	
St. Joseph Lead Co.	250 Park Ave.	New York 17, N.Y.	+																						X																							O		
Sierra Talc Co.	1608 Huntington Drive	South Pasadena	+													X																												X						
Simplot Silica Products, Inc.	P. O. Box 308	Overton, Nev.	+																																						X									
Southern Calif. Minerals Co.	320 S. Mission Road	Los Angeles 33	+													X										X																		X						
Stauffer Chemical Co.	636 California	San Francisco 8	+		O				O		X																											X		X			X			O			O	O
Tennessee Minerals, Inc.	5433 Reseda Blvd.	Tarzana	+																																									X						
Union Carbide Nuclear Co.	3651 Del Amo Blvd.	Torrence	+															X															X														X			
U.S. Borax Chemical Co.	630 Shatto Place	Los Angeles 5	+								X																																							O
Universal Silvers Co.	400 Montgomery	San Francisco 4	+																											X																				
Vanderbilt, R. T., Co., Inc.	230 Park Ave.	New York 17, N.Y.	+														X																											X						
Victorville Lime Rock Products Co.[2]	2800 Avers	Los Angeles 64	+																							X																								
Wagner, B. F., & Co.	186 N. Vernon Ave.	Pasadena 22		+												X																																		
Walls, E. M., Co.	353 Sacramento	San Francisco 11		+												X																																		O
Wells Cargo, Inc.	D 4 C Road	Las Vegas, Nev.	+																	X		X		X		X																								
Western Chemical & Mfg. Co.	3270 E. Washington Blvd.	Los Angeles 23		+			X									X															X																			
Western Lead Products Co.	720 S. 7th Ave.	City of Industry	+		O																				O																							O		
Western Salt Co.	702 W. Washington	San Diego 3	+																																					X										
Western Talc Co.	1901 E. Slauson Ave.	Los Angeles 58	+																																									X						
Whittaker, Clark & Daniels, Inc.	100 Church	New York 7, N.Y.		+												X										X															X			X						
Williams, C. K., & Co.[2]	4650 Shellmound	Emeryville 8	+																					X								X																		
Wood, Paul W., Co.	350 Townsend	San Francisco 7		+			X																								X													X						O
Woodridge Chemical Co. (Sutcliffe Co.)	275 Brannan	San Francisco 7		+																										XO																				

[1] The generalized classifications of companies and their products available are based on interpretation of information provided by both the consumer and supplier. Data were provided by the supplier for items listed, some of which may not have been marketed, as yet, to the California chemical industry.

[2] These companies were absorbed by other companies between 1960 and 1962: L. H. Butcher Co. by Wilbur-Ellis Co.; Huntley Industrial Minerals Co. by Callahan Industrial Minerals Co.; Kennedy Minerals Co. by C. K. Williams & Co.; and C. K. William & Co. (including Victorville Lime Rock Co.) by Chas. Pfizer & Co.

Marketing Media

Many of the California chemical industries have begun in recent years to deal directly with producers (miners, grinders, and blenders), especially when a large tonnage was needed. However, dealers (jobbers, brokers, sales agents) still distribute a considerable quantity and perform a real service to both producer and consumer, particularly when they maintain research and development facilities. Most dealers specialize in handling a variety of materials for certain segments of the chemical industry, such as paints and plastics, and know the product, the customer, and his technology of use.

Dealers are particularly valuable as intermediaries between the mineral producer and numerous small consumers.

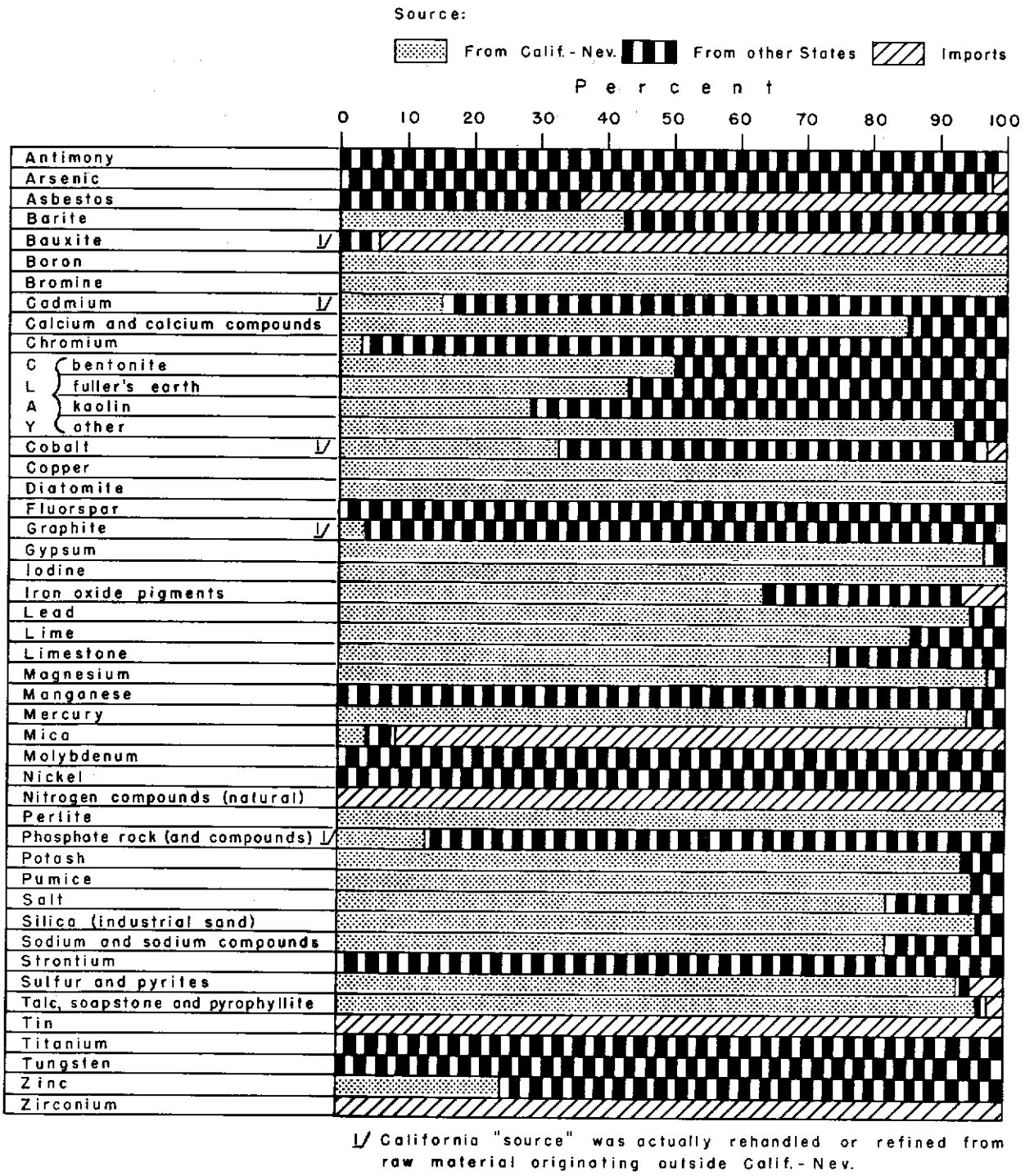
Table 3 presents a listing that is limited to companies that the California chemical industry reported as their specific raw material suppliers, and who subsequently provided details upon request concerning their products. Results do not necessarily coincide with those shown in table 1 because suppliers listed in table 3 also reported other items which are available but may not have been purchased from them by the California chemical industry.

Figure 1 shows the source, in percent, of each mineral commodity reported by the California chemical industry for (1) California and Nevada, (2) other States, and (3) foreign countries. Figure 2 shows the approximate percentage of minerals obtained directly from mineral raw material producers and through dealers.

Chemical Industry Consumption Data

Data are presented in table 4 on quantities and values of minerals consumed in California chemical plants in 1960. Table 5 indicates the relative percentages by forms. For details on how these figures were derived refer to the individual commodity sections. Figures are limited primarily to those companies whose plants consumed minerals and first-stage mineral compounds, each valued at $1,000 or more. Only companies that provided reasonably complete data were included. Data on crude minerals and compounds had to be combined in many instances.

Table A-1 (appendix) and the commodity sections list companies which supplied significant information on their mineral raw material usage under SIC 2800 (9).



1/ California "source" was actually rehandled or refined from raw material originating outside Calif.-Nev.

FIGURE 1. - Percent of Minerals From Various Sources.

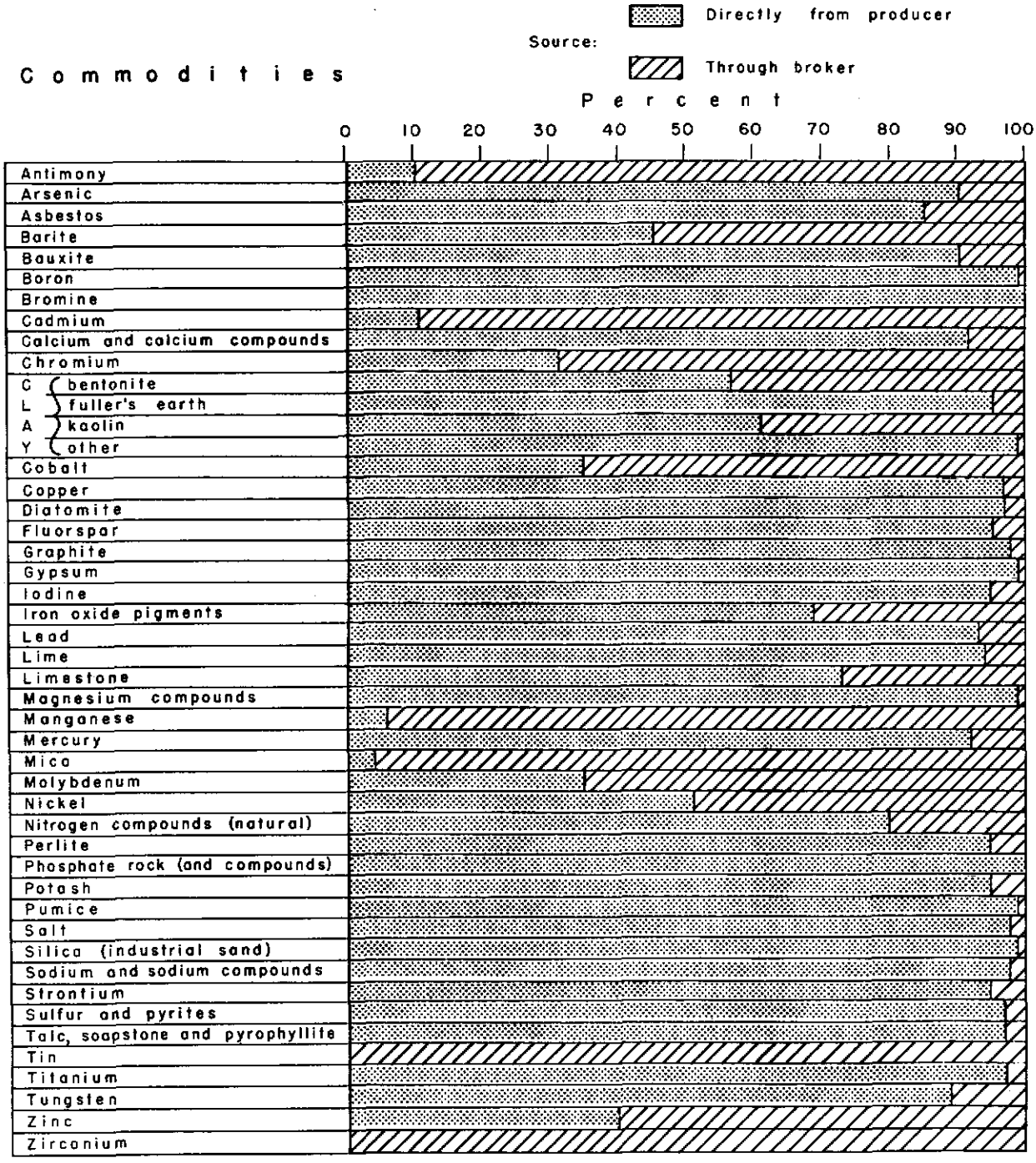


FIGURE 2. - Percent of Various Minerals Supplied Through Brokers.

TABLE 4. - Quantity and value of minerals and mineral compounds consumed in California chemical plants, 1960[1]

Commodity	Plants	Quantity	Value[2] (thousand dollars)	Average value delivered (per unit)
Antimony.....short tons	8	([3])	([3])	([3])
Arsenic.....do	6	([3])	([3])	([3])
Asbestos.....do	17	4,000	226	56.50
Barite.....do	13	([3] [4])	([3] [4])	([3] [4])
Bauxite.....long tons	4	11,800	230	19.80
Boron.....short tons	15	[4]26,000	1,011	38.90
Bromine.....do	1	([3])	([3])	([3])
Calcium and calcium compounds.....do	11	10,700	379	35.40
Clays: Bentonite.....do	39	13,000	529	40.70
Fuller's earth.....do	13	3,200	118	36.90
Kaolin.....do	22	3,900	150	38.50
Other.....do	28	8,500	311	36.60
Cobalt.....pounds	10	93,200	47	0.50
Copper.....short tons	13	1,800	862	478.90
Diatomite.....do	40	6,300	331	52.50
Gypsum.....do	12	3,200	40	12.50
Iodine.....do	2	([3])	([3])	([3])
Iron oxide pigments.....do	18	2,200	198	90.00
Lead.....do	22	7,600	1,765	232.25
Lime.....do	22	5,600	127	22.70
Limestone.....do	46	[4]11,000	271	24.65
Magnesium compounds.....do	18	([3])	([3])	([3])
Manganese.....do	11	360	46	127.80
Mercury.....flasks	6	([3])	([3])	([3])
Mica.....short tons	16	([3])	([3])	([3])
Phosphate rock (and phosphorus compounds).....long tons	25	196,000	8,903	45.40
Potash.....short tons	18	[4]10,400	915	88.00
Salt.....do	31	336,000	2,954	8.80
Silica (industrial sand).....do	34	16,000	284	17.75
Sodium and sodium compounds.....do	59	[4]189,000	6,199	32.80
Sulfur and pyrites.....long tons	29	482,000	9,821	20.40
Talc, soapstone and pyrophyllite.....short tons	54	13,400	397	29.60
Titanium.....do	43	14,200	8,094	570.00
Zinc.....do	24	6,400	1,551	242.35
Other: Items indicated by footnote 3.....	-	-	7,993	-
Value of the following undistributed commodities consumed by respondents: Bismuth, cadmium, chromium, fluorspar, gold, graphite, lithium, molybdenum, nickel, nitrogen compounds, perlite, pumice, strontium, tin, tungsten, and zirconium (and hafnium).....	-	-	2,573	-
Estimates of companies responding which consumed items valued at less than $1,000 each in 1960 but which did not furnish details.....	-	-	7,000	-
Total.....	-	-	63,325	-

[1]Consumption figures are limited, insofar as possible, to mineral commodities, which are consumed for the first time by California chemical companies listed under Standard Industrial Classification Group 28.

[2]Value figures represent reported expenditures in 1960 for the raw materials listed regardless of their physical and chemical forms. Table 5 shows the relative percentages of minerals consumed from each category, and the commodity sections outline the character of the raw materials consumed.

[3]Figures withheld to avoid disclosing company confidential data; included with undistributed.

[4]Incomplete figures; excludes captive tonnage which cannot be disclosed (e.g., items produced and consumed by the producer at the site in further chemical manufacturing; i.e., boron compounds consumed by U.S. Borax and Chemical Corp. at Boron; and potassium and sodium compounds consumed in chemical processing by American Potash and Chemical Co. and Stauffer Chemical Co. at Searles Lake).

TABLE 5. - Percentage range of mineral raw materials consumed in California chemical plants, as reported in table 4

Commodity	Mineral raw materials, percent			Commodity	Mineral raw materials, percent		
	Ores[1] (crude, ground, and concentrated)	Smelter products	Chemical products[2] (first stage)		Ores[1] (crude, ground, and concentrated)	Smelter products	Chemical products[2] (first stage)
Antimony	-	20 - 30	70 - 80	Lithium	-	-	100
Arsenic	-	40 - 60	40 - 60	Magnesium compounds	90 - 95	-	5 - 10
Asbestos	95 - 100	-	0 - 5	Manganese	0 - 20	-	80 - 100
Barite	85 - 95	-	5 - 15	Mercury	-	90 - 100	0 - 10
Bauxite	80 - 90	-	10 - 20	Mica	100	-	-
Bismuth	-	90 - 100	0 - 10	Molybdenum	-	-	100
Boron	95 - 100	-	0 - 5	Nickel	-	40 - 60	40 - 60
Bromine	80 - 90	-	10 - 20	Nitrogen compounds	100	-	-
Cadmium	-	50 - 70	30 - 50	Perlite	100	-	-
Calcium and calcium compounds	90 - 100	-	0 - 10	Phosphate rock and compounds	20 - 40	-	60 - 80
Chromium	-	0 - 10	90 - 100	Potash	75	-	25
Clays:				Pumice	100	-	-
Bentonite	90 - 95	-	5 - 10	Salt	80 - 100	-	0 - 20
Fuller's earth	95 - 100	-	0 - 5	Silica (industrial sand)	100	-	-
Kaolin	95 - 100	-	0 - 5	Sodium and sodium compounds	80 - 100	-	0 - 20
Other	90 - 95	-	5 - 10	Strontium	-	-	100
Cobalt	-	-	100	Sulfur and pyrites	80 - 90	-	10 - 20
Copper	-	20 - 40	60 - 80	Talc, soapstone, and pyrophyllite	95	-	5
Diatomite	95 - 100	-	0 - 5	Tin	-	100	-
Fluorspar	90	-	10	Titanium	-	-	100
Gold	-	100	-	Tungsten	-	-	100
Graphite	100	-	-	Zinc	-	0 - 10	90 - 100
Gypsum	85 - 95	-	5 - 15	Zirconium and hafnium	90	-	10
Iodine	-	-	100				
Iron oxide pigments	70 - 90	-	10 - 30				
Lead	-	10 - 30	70 - 90				
Lime	100	-	-				
Limestone	90 - 95	-	5 - 10				

[1]Primarily (1) natural minerals which have not been chemically altered by industrial processing and (2) smelter products (items 1-3 of Introduction); i.e., cassiterite and metallic tin would be included but not tin oxide.

[2]Primarily natural minerals which have been chemically altered to produce suitable raw materials for further chemical manufacturing (intermediate stage chemical compounds; item 4 of Introduction); e.g., titanium dioxide.

The following 20 companies accounted for over 75 percent of the value of mineral raw materials consumed by the 800 responding companies.

1. American Potash and Chemical Co.
2. Best Fertilizer Co.
3. California Chemical Co.
4. California Ink Co.
5. Desoto Chemical Coatings Co.
6. Dow Chemical Co.
7. Dunn-Edwards Co.
8. FMC Corp.
9. Fuller, W. P., & Co., Inc.
10. General Chemical Division, Allied Chemical Corp.
11. Glidden Paint Co.
12. Kaiser Aluminum & Chemical Co.
13. Mass, A. R., Chemical Co.
14. Mountain Copper Co.
15. Pittsburgh Plate Glass Co.
16. Shell Chemical Co.
17. Sherwin-Williams Paint Co.
18. Stauffer Chemical Co.
19. U.S. Borax & Chemical Corp.
20. Western Lead Co.

Companies reporting consumption of materials but which were determined to be outside SIC 2800 and nonrespondents were excluded from this listing.

Inorganic materials such as soda ash, salt cake, sulfur, ammonia, and chlorine were required in large tonnages during 1960, by many of the chemical companies tabulated in table A-1 (appendix). An effort has been made to distinguish between purchases of first-marketable-stage mineral products, which themselves may be either natural, manufactured (synthesized), or obtained as a byproduct (such as soda ash and salt cake), and their resulting chemical products such as ammonia and chlorine.

Mineral Specifications and Tests in the Chemical Industry

Specification Sources

Mineral commodity suppliers to the California chemical industry are faced constantly with the need to standardize their products. Potential consumers usually require that the materials they use meet certain minimum chemical and physical standards. The supplier who can guarantee reasonably uniform specifications of his product is in a more favorable position to find an enlarged and more receptive market in the various segments of the chemical industry.

Although regulations governing quality of chemical products have been promulgated by numerous groups, three organizations are responsible for the majority of specification standards for industrial minerals: National Bureau of Standards, American Society for Testing and Materials, and American Standards Association.

The National Bureau of Standards is the principal Government testing laboratory. It is responsible for developing new and better methods for testing materials, conducts fundamental research in virtually all the scientific and engineering fields, serves in an advisory capacity to other Federal agencies, and establishes standards for industrial use. The established standards are indexed and summarized in numerous publications available through most technical libraries. The most comprehensive source of information on specifications developed by this agency is the National Directory of Commodity Specifications, Miscellaneous Publication 178, issued in 1945, with subsequent supplementary issues.

The American Society for Testing and Materials (ASTM), which was frequently referred to by respondents to the questionnaire, is a nonprofit national technical organization dedicated to increasing knowledge of materials, standardizing specifications, and improving test methods. The ASTM is engaged in several hundred research projects, which are conducted by about 2,000 working groups and subcommittees; many of these projects have a direct bearing on industrial mineral utilization. Over 2,000 specification standards and test methods have been developed by this organization and the results published by commodity, in an 11 volume series (4). These 11 volumes normally include for a particular specification, the product definition, the range of sizes required for different uses, the chemical composition, methods of sampling and testing, packaging and marketing, inspection, and conditions for rejection. Information may be obtained on the specifications promulgated by this organization through technical libraries or by writing directly to the ASTM at 1916 Race Street, Philadelphia 3, Pa.

The American Standards Association is composed of representatives of Government agencies, national technical societies, and trade associations. The primary aim of the Association is to establish national standards for an industry or industry group, based on mutual interest. The organization has conducted numerous projects related to industrial minerals utilization and publishes a monthly publication concerned with standardization of specifications, from its headquarters at 10 East 40th Street, New York 16, N.Y.

Research directed toward standardization of specifications for specific applications in fields which directly or indirectly affect the California chemical industry and their raw material suppliers are carried out by numerous other organizations. These include virtually all branches of the Armed Forces; other Federal agencies such as General Services Administration, Food and Drug Administration, Public Health Service, and U.S. Department of Agriculture; State and local government agencies; and other technical societies and trade associations. Reference is made to specifications pertinent to the California chemical industry mineral raw materials under the appropriate commodity sections.

Specification Data Provided by Respondents

Raw material specifications reported by the California chemical industry were variable, depending on use. Although nearly half of the respondents adequately completed the questionnaire, specifications were usually much too

complex to attempt to include in this report. Some respondents simply stated that too much effort would be required to complete that section of the questionnaire. By far the majority of consumers who did complete the section of the questionnaire dealing with specifications either referred to a standard specification or reported that they accepted the analysis supplied by the producer (data sheets were provided by suppliers listed in table 4). Others listed quite detailed requirements; some ambiguous terms; and a few specified the raw material must be "as white as possible," "not too dusty," "free from grit," and similar loose designations.

Mineral specifications, as reported, included a multitude of chemical and physical requirements, as most of the 31 chemical industries have virtually their own mineral testing language, but the seemingly awesome requirements which must be met can usually be reduced to relatively simple procedures using inexpensive and standard test devices.

One paint company, for example, conducts the following test on minerals to be used in paint:

Particle shape	Weight: solid gallon
Particle size distribution	pH
Micron particle size	Color brightness
Residue on 325-mesh	Surface coating
Crystallinity	Oil absorption (ASTM D281-31)
Chemical composition	Acid resistance
Chemical analysis	Alkali resistance
Specific gravity	Water soluble salts
Bulking value	

Yet, on close examination, nearly all of the above tests can be conducted using simple laboratory equipment, and results from some can be used to compute other data.[3]

Mineral and Metal Prices

Delivered prices paid by the chemical industry may bear little or no relationship to the average f.o.b. price quoted by the mineral producer for several reasons, including (1) added transport cost, (2) higher quality requirements, (3) greater processing requirements, (4) relatively small (less than carlot or minimum) orders, (5) special blending or handling requirements, and (6) contractural arrangements.

[3] Identification tests may be conducted on mineral samples, usually without cost, by the Bureau of Mines and such State agencies as the California Division of Mines and Geology, Nevada Bureau of Mines, and the California Bureau of Chemistry. Some companies and associations will conduct tests on minerals where there is a chance the deposit might serve as a source for their own requirements.

It was interesting to note that some companies which reported the least rigid specification brought their raw materials, such as clay, from distant sources.

In addition to unit values of minerals reported by the Bureau of Mines and other Government agencies, based on industry canvasses, trade journals such as E&MJ Metal and Mineral Markets; Oil, Paint and Drug Reporter; and Chemical and Engineering News publish price figures. For nonmetals and many chemicals there are no established markets, and extreme caution must be observed not to assume that published quotations establish the actual prices. The actual price paid is subject to negotiation and will depend upon many things such as quality, quantity, sizing, color, packaging, and delivery requirements. The most desirable basis for price establishment is usually considered to be f.o.b. destination, thus relegating the responsibility of delivery, insurance claims, and loss to the supplier. However, there are many ways to purchase, each of which has a bearing on the ultimate price paid by the consumer.

Mineral Raw Materials Prices for Chemical Uses

Although average prices of mineral commodities for chemical use usually are significant, they often do not define grades and types sufficiently to show a potential supplier what price he might expect for his product. Also, published price quotations are at best mere guides, and usually are quite unrealistic in specific markets because types and grades of mineral products vary from one producer to another. Purchasing is generally carried out by negotiation. As indicated above, several periodicals report what is either quoted by the supplier or judged to be the approximate price of some minerals in various stages of preparation and degrees of purity. These prices, along with actual prices (typical and range) paid by the California chemical manufacturer are shown or referred to in the commodity sections of this report.

Suppliers often maintain fairly rigid prices for their products, but, as might be expected, concessions are made for larger orders, and market prices for some highly competitive and overstocked materials are subject to negotiation.

The smaller chemical companies usually purchase in smaller lots; hence, prices per unit of material acquired are apt to be higher.

As quoted prices of minerals and transportation costs are fairly easy to obtain, a potential supplier can calculate in general what price currently is being paid for a given commodity. In determining the net price he can expect to obtain for his product, a new producer must consider many factors, including the end use, packaging specifications, care and expense required in handling and transporting the finished product, and size and frequency of shipments.

The chemical industry is interested in reducing raw material costs but not at the risk of losing customers for its products. For example, in 1960 one official reported that his company had a raw material file of over 1,500 items available for use in paint manufacturing. Many of these materials had been tested and found to be acceptable, but only a few were actually used--compelling reasons would have to be presented before the company would make any major changes of formula or raw material sources. Officials of a number of other companies presented similar viewpoints.

Mineral Substitutes and Alternates in Chemical Manufacturing

Although one can readily name many new chemicals that have been developed in recent years, it is difficult to cite examples of chemical industries that have vanished as a result of substitution. Most find new areas of chemical use as applications in certain fields decline. On the other hand, production of some minerals and chemicals has declined greatly either because (1) of obsolete processes and products, (2) they could not be adapted readily to other uses, (3) more preferable minerals could be obtained, or (4) synthetics became available. For example, (1) there has been little use for colemanite (calcium borate), formerly the chief source of boron compounds, since the discovery of kernite and tincal (sodium borates) in the Kramer District of San Bernardino County, Calif.; (2) pyrite has become a relatively minor source of sulfur since the introduction of the Frasch process for sulfur recovery and improved methods of secondary recovery of sulfur from petroleum and natural gas; (3) the utilization of arsenic chemicals in pesticide manufacturing declined sharply after the development of organic pesticide products; and (4) the use of natural nitrates declined after plants were built to recover nitrogen from the atmosphere.

Chemicals which are produced from minerals vary in degree of purity and refinement and are required to some extent in virtually all manufactured products. Many chemicals are competitive with minerals in manufacturing; in some instances, raw materials and refined chemicals may be used interchangeably to produce the same end product.

Table A-1 (appendix) shows representative California manufacturers of selected chemicals. Consumer demands have resulted in vast changes in the types of chemical products manufactured and the raw materials required. Examples of formerly widely used paint products that now are used only in relatively small quantities are calcimine, lithopone, and white lead. New paint formulations use materials such as latex and titanium dioxide.

The substitution of one raw material for another may result from such factors as a need for products with superior properties, scarcity or uncertainty of supply, or a price advantage. Plastics, produced synthetically from petroleum, coal, and natural gas replace metals in some uses but require high percentage of minerals as fillers and to impart desirable properties, thus tending to change mineral requirements from metals to nonmetals. As alternate materials gain a foothold in an area of use, the pattern may change radically through price reduction. Ample opportunity exists to utilize lower cost products. For example, expanded perlite, which is produced in large tonnages, results in fines, which are abundant as "waste" in the West but would be quite expensive in the East, where many specifications are written. Other exclusively western minerals, such as borax and diatomite, deserve greater consideration for use in California chemical industry because of their comparatively low delivered cost.

Transporting Mineral Raw Materials

Chemical raw materials, such as mineral fillers, which have a relatively low unit value, usually cannot bear costs of long hauls, particularly when one or two mountain ranges must be crossed. Even so, transportation costs often make up more than two-thirds of the delivered price of minerals used by the California chemical industry. Consequently, mineral supply sources should be as close as possible to points of consumption so that products can be offered at attractive prices.

As a rule, water transportation is by far the least expensive method of transport over long distances. Consequently, low ocean freight might bring even abundant, low cost minerals into California from foreign countries at competitive rates.

Access to seaboard facilitates imports from abroad and results in establishment of low freight or water rates from Gulf and East Coast ports for such commodities as phosphate rock from Florida, and sulfur from Texas, Louisiana, and Mexico. Local domestic sources of gypsum cannot now compete with present shipments from Mexico into San Francisco.

Low freight rate schedules on certain products, such as clay and sulfur from Atlantic and Gulf coast ports, sometimes inhibit utilization of California and Nevada materials which have relatively high rail or motor freight costs to market.

According to statistics developed by the Federal Reserve Board, Interstate Commerce Commission, and McGraw-Hill Publishing Co., rail shipments of chemical and allied products have increased only slightly over the past decade, while the output of chemicals has doubled. Recently, however, railroads have developed several new techniques, such as "piggyback," "containerization," "integral trains," specialized hoppers, and tank cars, which may improve the relative position of rail carriers. Also, organized efforts to obtain favorable freight rates are being made; for example, the Department of Defense has set up a task force, Operation Dart, to explore rate setting in transporting materials (15).

Producers of competitive commodities must equalize their freight costs with those of the nearest supplier. Hence, many market territories are dependent on the producer's freight equalization costs.

Table 6 shows the freight rate on minerals delivered into California, based on the 1-percent sample taken by the Interstate Commerce Commission. Table 7 shows the combined freight costs, origin, and California destinations of selected commodities shipped into California by all railroads.

Shipping rates in California are regulated by three separate organizations: (1) The California Public Utilities Commission, which regulates truck rates for most commodities, (2) The Pacific Southcoast Freight Bureau, which regulates rail rates for most commodities, and (3) The Consolidated Freight Classification Committee, which regulates both truck and rail rates on those commodities not covered by the other two organizations.

TABLE 6. - Products of mines (inorganic) shipped by rail to California, 1959 and 1960, all uses[1]

Commodity	Origin		Short tons		Freight rate		Total miles	
	1959	1960	1959	1960	1959	1960	1959	1960
Iron ore.....	Calif.	Calif.	19,588	33,398	$1.21	$1.26	112	113
	Nev.	Nev.	6,800	7,524	1.07	1.18	340	317
Ores and concentrates..	Calif.	Calif.	1,654	1,422	1.99	2.00	315	199
	-	Ariz.		137	-	2.28	-	41
	Mont.	Mont.	58	119	.96	.76	1,038	1,474
	Tex.	-	135	-	1.23	-	768	-
Barites.....	Calif.	-	50	-	2.35	-	350	-
	Nev.	Nev.	862	701	1.79	1.83	505	488
Aluminum ore...	Ark.	-	61	-	1.02	-	1,777	-
Copper ore.....	Nev.	-	90	-	2.25	-	360	-
Clay and bentonite.....	Ariz.	-	339	-	1.14	-	680	-
	Calif.	Calif.	2,385	1,667	1.84	1.87	196	167
	Ga.	Ga.	143	340	.89	.80	2,489	2,716
	-	Ky.	-	58	-	.89	-	2,260
	Miss.	Miss.	141	50	.94	1.02	2,288	2,262
	Nev.	-	41	-	2.87	-	241	-
	Ohio	-	120	-	1.16	-	2,445	-
	-	Pa.	-	59	-	1.03	-	2,836
	S.C.	-	294	-	.88	-	2,520	-
	S. Dak.	S. Dak.	125	208	1.19	1.18	1,665	1,678
	Tenn.	Tenn.	100	271	1.00	1.00	2,045	2,041
	Utah	Utah	168	370	1.64	1.68	774	780
	Wyo.	Wyo.	171	40	1.29	1.19	1,536	1,660
Sand, industrial....	Ariz.	-	65	-	1.17	-	368	-
	Calif.	Calif.	4,366	4,704	1.67	1.83	105	94
	Ill.	Ill.	277	181	.63	.63	2,086	2,054
	Minn.	Minn.	66	146	.63	.63	2,082	2,075
	Mo.	-	63	-	.62	-	2,098	-
	Nev.	Nev.	1,615	1,340	1.01	.97	378	401
	Okla.	Okla.	276	525	.67	.81	1,895	1,612
	Wis.	Wis.	50	110	.61	.62	2,188	2,159
Gravel and sand, n.o.s...	Calif.	Calif.	41,164	31,705	1.90	1.91	53	51
	-	Ariz.	-	97	-	1.20	-	555
Stone, crushed.	Calif.	Calif.	12,975	9,669	2.14	2.14	82	79
	Ga.	-	50	-	.79	-	2,258	-
	Kans.	-	51	-	.89	-	1,478	-
	Mo.	Mo.	59	55	.79	.68	1,958	1,965
	-	Nev.	-	1,428	-	1.22	-	405
	-	Wash.	-	147	-	1.22	-	976
Fluxing stone..	Calif.	Calif.	1,112	1,223	2.12	1.99	64	85

[1] One percent sample.

Source: Interstate Commerce Comm., Carload Waybill Statistics SS-4, 1960.

TABLE 7. - Quantity, origin, destination, and revenue for selected commodities shipped by rail into California, 1960[1]

Commodity	Short tons	Total revenue	Freight rate per ton			Major pick-up points in order of tonnage	Destination[2]			
			Low	Average	High		Northern California		Southern California	
							San Francisco	Other	Los Angeles	Other
Iron ore.....	3,083,008	$6,144,310	$1.48	$1.99	$8.80	California, Nevada-Utah.	O	O	X	X
Aluminum ore and concentrates...	32,231	328,765	3.15	7.78	25.06	California,[3] Arkansas, Louisiana.	O	X	X	X
Copper ore and concentrates...	727	6,609	.48	9.09	9.54	Washington, Idaho, Nevada-Utah.	O	O	O	X
Zinc ore and concentrates...	162	3,706	15.00	22.87	37.70	California, Kansas, Ohio.	X	-	-	-
Barite.....	60,081	518,278	2.29	8.62	16.93	Nevada-Utah, Missouri.	O	X	O	X
Clays.....	335,792	3,511,011	3.02	10.46	23.51	California, Arizona, Georgia.	X	X	O	X
Industrial sand..	506,810	1,489,053	.74	2.94	10.37	California, Nevada, Oklahoma.	X	X	O	X
Salt.....	244,847	472,680	.81	1.93	20.16	California, Nevada-Utah, Kansas.	X	X	O	X
Phosphate rock...	158,994	920,043	3.72	5.75	8.91	Wyoming, Idaho, Utah.	X	X	O	X
Sulfur.....	111,974	1,074,968	2.74	9.60	30.75	California, Texas, Canada.	X	O	X	O

[1] Compiled from detailed data provided by purchasing agents of the following railroad companies for ultimate consumption, exporting and re-shipment to other States: Atchison, Topeka and Santa Fe, Pacific Electric Railway Co., Southern Pacific Co., Union Pacific Railroad Co., and the Western Pacific Railroad Co.

[2] X denotes major percentage and O denotes minor percentage of total.

[3] Imported.

MINERAL COMMODITY DETAILS

The individual mineral commodity presentation, which follows, was designed to serve a broad audience. For selected commodities, one table shows the relationship between U.S. and California-Nevada mineral supply (along with brief references to foreign sources); a second shows the overall consumption data reported by the California chemical industry, and a third table lists the responding companies. Data for nonrespondents and captive operations that produced and consumed raw materials at the same location have been omitted.

An attempt has been made to provide the highlights of the general supply situation along with the consumption picture in California. More detailed information on mineral supply is available in Bureau of Mines publications such as the Minerals Yearbook, Mineral Facts and Problems (Bulletin 585), Commodity Data Summaries, and numerous Information Circulars and Reports of Investigations on local mineral commodities. Also, the U.S. Geological Survey, California Division of Mines and Geology, and Nevada Bureau of Mines have issued numerous publications on locally available mineral resources.

Some details concerning mineral consumption and specifications in the California chemical industry had to be concealed to avoid disclosing company confidential data. The reader, of course, may be able to obtain additional information directly from the consumer companies listed. Most suppliers will provide detailed data sheets and samples of mineral products available to potential customers.

Antimony Supply--California and Nevada

As indicated in table 8 California had no antimony production in 1960. Potential ore occurs at many localities in California, but production has been negligible. Ores from out-of-State sources have been smelted in the past in California. A small quantity (see table A-2, appendix) of ore entered the San Diego port.

Nevada had no antimony ore production in 1960. A small quantity of bag-house product was produced from a plant in White Pine County and shipped to Los Angeles. Quartz veins containing antimony and silver-lead-antimony veins have been mined in the past in at least seven Nevada counties.

Antimony Demand--California Chemical Industry

Table 9 contains disclosable data on antimony reported by the California chemical industry in 1960. A small tonnage of antimony oxide was shipped from Nevada to Los Angeles for use as a paint pigment. Consumers listed in table 10 used antimony metals and compounds mainly in paint pigment manufacturing and in plastics. Although about one-tenth of the U.S production went into the manufacture of flame-proofing chemicals, none was specifically reported for this use in California. Rubber usage is considered outside the chemical industry, except for synthetic rubber (one California plant) for which no consumption was reported.

TABLE 8. - Antimony (ore and metal) supply, 1960

	United States[1]	California	Nevada
Mines, primary	1	-	-
Smelters	7	-	1
Production:			
Mine, quantity, short tons	600	-	-
Mine, value	(2)	-	-
Smelter, quantity, short tons	10,000	-	-
Smelter, value	(2)	-	(2)
Average value, metal, per pound, f.o.b. source	$0.31	-	-
Producer stocks, Dec. 31, short tons	7,000	-	-
Imports, ore, do.	[3] 16,000	[4] 150	(5)
Exports, ore, do.	900	-	(5)

[1] One company mined antimony as a byproduct of lead-silver ores and 7 recovered antimony as smelter byproduct.
[2] Figures withheld to avoid disclosing individual company data.
[3] United Kingdom (actually from South Africa) 27 percent; Yugoslavia 29 percent; Belgium 20 percent; and other 24 percent.
[4] Through seaports only (see table A-2, appendix, for metal and oxide import data).
[5] Not applicable.

TABLE 9. - Antimony (metals and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Antimony metal	1
Antimony oxide	7
Total consumption in above plants	(1)
Total value, delivered	(1)
Average value, per pound oxide, in bags, carlots, freight allowed[2]	$ 0.32
Typical freight rate, per short ton, oxide, Wisconsin to Los Angeles	$12.20

[1] Figures withheld to avoid disclosing individual company data.
[2] Oil, Paint and Drug Reporter quotation.

TABLE 10. - Consumers of antimony reporting chemical usage in California, 1960

Amchem Products, Inc.	Flexfirm Products Co.
Amercoat Corporation	Fuller, W. P., & Co.
American Marine Paint Co.	Narmco Resins & Coatings Co.
De Soto Chemical Coatings, Inc.	Western Lead Products Co.

As a basis for comparison, 13,000 tons of antimony and antimonial lead was consumed for all uses (about half, of which was used for oxide manufacture) in the United States, about 85 percent of which went to 100 eastern United States firms. The quantity consumed for all uses in California is not available but would probably not exceed 500 tons annually.

Chemical-grade antimony ore to be used in producing oxide, chloride, and other chemical compounds reportedly should not contain over 0.1 percent of any one other metal and not over 0.25 percent total other metals. Ore purchases are usually based on antimony content, ore size, quantity, and nature of impurities. Impurities should not exceed 0.5 percent for arsenic, bismuth, copper, lead, and selenium; calcium, iron, and silica content are not so rigidly controlled.

Liquated antimony sulfide was marketed on the basis of 70 percent antimony (needles). One California company specified that the metal should be at least 99.5 percent pure and be free from copper and arsenic. Most of the companies indicated that the suppliers' standards were acceptable.

Chemical manufacturers normally use antimony metal to produce oxides and salts. No pharmaceutical manufacturers in California specifically designated use of antimony, but they normally require a high-purity metal with no more than 0.01 percent arsenic, 0.3 percent lead, and 0.025 iron.

There is no ASTM standard for antimony use in paints, and none of the consuming companies reported any specific requirements. ASTM B-237 and General Services Administration Stockpile Specification P-2a-R requirements for ingot metal, grades A and B, require 99.80 and 99.50 percent antimony respectively, with impurities rigidly controlled (21).

One supplier to the California chemical industry guaranteed 99.8 percent antimony with a maximum of 0.05 percent arsenic and no other impurity over 0.1 percent.

In 1960, the California chemical manufacturers shown in table 10 paid from 12.2 cents to 29.15 cents a pound for antimony oxide and metals, f.o.b. source, depending on quality, quantity, and form.

Chromium, lead, mercury, tin, titanium, zinc, and zirconium may replace antimony in paints. Antimony sulfide, once used extensively in red rubber manufacture, has been largely replaced by iron oxide. Organic synthetics have displaced certain antimony alloys in fireproofing compounds. There is no satisfactory substitute for antimony in camouflage paints.

Arsenic Supply--California and Nevada

There was no arsenic production in California in 1960 (table 11). Several attempts were made to produce arsenic from California ores during the period 1920-25, but the continued low price and rising output of byproduct arsenic at smelters, forced abandonment. A number of potential deposits are known.

There was no arsenic production in Nevada in 1960. Arsenic was produced as a byproduct in gold production during World War II. Deposits of arsenic are reported in several districts in Nevada.

TABLE 11. - Arsenic trioxide (white arsenic) supply, 1960

	United States	California	Nevada
Smelters	2	-	-
Production:			
Quantity, short tons	[1] 5,000	-	-
Value	[1] $321,000	-	-
Average value, f.o.b., short tons	$45.00	-	-
Producer stocks, Dec. 31, do.	2,000	-	-
Imports, do.	[2] 13,000	[3] 30	([4])
Exports, do.	([5])	-	([4])

[1] 1959 data. Quantity produced in 1960 concealed to avoid disclosing individual company data. Production centered in Washington and Montana.
[2] Three fourths of imports came from Mexico.
[3] Through seaports only.
[4] Not applicable.
[5] No exports of white arsenic were reported, but 1.9 million pounds of lead arsenate, valued at about $35,000, was exported to 13 countries.

Arsenic Demand--California Chemical Industry

Companies listed in table 12 reported consumption of arsenic and arsenic compounds in 1960, primarily for use in insecticide preparation and marine paints. Four of the companies consumed arsenic oxide, three consumed crude arsenic, one consumed paris green, and one consumed arsenic chloride. (Although tonnage and value of U.S. output were concealed in 1960, most of the domestic output and imports of arsenic are used in manufacturing lead and calcium arsenate insecticides. Arsenic compounds were used in herbicides, wood preservatives, glass manufacture, cattle and sheep dips, dyestuffs, paint, and tanning compounds.)

The California Bureau of Chemistry listed seven companies that registered insecticides containing lead arsenate for pest control use in the State.

TABLE 12. - Consumers of arsenic reporting chemical usage in California, 1960[1]

Amchem Products, Inc.	Flexfirm Products Co.
American Marine Paint Co.	Fuller Paint Co.
De Soto Chemical Coatings Co.	Western Lead Products Co.

[1] Also others such as California Chemical Co. (Ortho Div.) and F.M.C. Corp. (Niagara Div.) reported consumption of refined arsenic compounds.

Some California companies consumed a highly manufactured form of arsenic prepared by other chemical companies. For example, leading insecticide companies such as California Spray Chemical Corp. (now Ortho Div. of California Chemical Co., a subsidiary of Standard Oil Co. of California) and FMC Corp. (Niagara Div.) merely blended prepared arsenic compounds produced by others. Chemical suppliers usually obtain arsenic compounds in quantity for wholesale

and retail marketing in small amounts, mainly for use in the preparation of insecticides.

Most of the consumption was as white arsenic (arsenic trioxide) shipped in from Tacoma, Wash., but a small quantity of arsenic metal was obtained from England. Some white arsenic was handled through local brokers.

Insecticide manufacturers normally require a free-running, fine-particle-sized white arsenic containing over 98 percent As_2O_3, with no more than a trace of antimony. Herbicide manufacturers usually prefer a coarser particle size. One California consumer of arsenic trioxide specified 96 to 99 percent As_2O_3 in powdered form.

Calcium arsenate has been replaced to a considerable extent in insecticides by chlordane, aldrin, dieldrin, demeton, DDT, benzine hexachloride, and a variety of other formulations. Many of these organic insecticides have lower human toxicities than arsenic compounds. However, as insects develop immunity to certain poisons, it is sometimes necessary to revert back to arsenic compounds.

The consumption of arsenic in insecticides in California has been affected considerably by the substitution of these organic materials, and the outlook for any increased utilization of arsenic in California pesticide manufacturing does not appear bright.

Asbestos Supply--California and Nevada

No spinning-grade asbestos fiber is produced in California, but the potential supply of shingle and shorter fibers is excellent, and by 1964, California may have the facilities for producing most of its requirements of such grades, with a substantial surplus for interstate and foreign export. Table 13 shows the U.S. asbestos supply situation.

In 1960, the Phoenix Mine--operated by Asbestos Bonding Co., Division of Clute Corp.--near Napa, was the principal producer in California.

The products were used in cement, stucco, and insulation, and were being tested as components in asphaltic paving.

Coalinga Asbestos Co., Inc. (a joint venture of Johns-Manville Corp. and Kern County Land Co.), explored a large deposit, mainly of slip-fiber chrysotile, in western Fresno County. This company planned to complete a major plant at the site in early 1962, to produce filler-grade fiber, largely for use in Johns-Manville Corp. plants. Other companies have acquired holdings in the same area and were in various stages of exploration and development.

Jefferson Lake Asbestos Co., a subsidiary of Jefferson Lake Sulphur Co., continued exploration of an extensive cross-fiber chrysotile deposit in Calaveras County in 1960 and designed a mine and mill to produce nonspinning fiber for the domestic and export trade.

TABLE 13. - Asbestos (fiber) supply, 1960

	United States	California	Nevada
Producers	13	3	-
Production:			
Quantity, short tons	45,000	(1)	-
Value	[2] $4,231,000	(1)	-
Average value, fiber, per short ton, f.o.b. source	[3] $95.00	(1)	-
Producer stocks, Dec. 31, short tons	24,000	(1)	-
Imports[4], do.	669,500	[5] 9,000	(6)
Exports, do.	5,000	300	(6)

[1] Figures withheld to avoid disclosing individual company data.
[2] Primarily centered in Vermont and Arizona.
[3] Varies widely depending on grade.
[4] Canada supplied 93 percent.
[5] Through seaports only; imports were mainly through ports of entry outside California and came in by rail (approximately 100,000 tons).
[6] Not applicable.

Subsequent to the compilation of 1960 information, there were three main producers of asbestos developing production capacity in California--Coalinga Asbestos Co., Inc., Jefferson Lake Asbestos Co., and Asbestos Bonding Co. The Coalinga Asbestos Co. plant was completed in 1962 and had annual capacity of 15,000 tons of fiber. The Jefferson Lake Asbestos Corp. plant, also completed and in operation, reported an annual capacity of 70,000 tons.

Less than 9,000 tons of asbestos entered California sea ports; an estimated 125,000 tons, virtually all short fiber, came into California by rail from Canada during 1960.

Nevada had no record of asbestos production in 1960.

Asbestos Demand--California Chemical Industry

Table 14 shows the tonnage of asbestos consumption reported by the California chemical industry. Table 15 lists the companies that reported consumption of asbestos, primarily grade 7R and floats, for use exclusively in chemical applications during 1960. In addition, large consumers, such as The Flintkote Co., Rubberoid Co., and Armstrong Cork Co., also reported consumption but were excluded because primary usage is outside the SIC chemical classification.

Where California is concerned, the estimated total consumption of 125,000 tons of asbestos for all uses, exclusive of the asbestos content of manufactured products, in 1960, was based on several studies conducted by private companies and consulting organizations in the area. Major consumption in 1960 was in asphalt tile, roofing, asbestos cement products, and refractory materials, all outside SIC 28. (As a basis for comparison, the total consumption

of asbestos fiber reported for all uses in the United States was 709,000 short tons, but a large part of this tonnage went into the Government stockpile.)

TABLE 14. - Asbestos (fiber) consumption by the California chemical industry, 1960

Plants reporting consumption	17
Total consumption in above plants, short tons	4,000
Total value, delivered	$226,000
Value range, per short ton, delivered	$35.00-$139.00
Typical freight rate, grade 7R, per short ton, Quebec, Canada, to Los Angeles area	$38.88

TABLE 15. - Consumers of asbestos reporting chemical usage in California, 1960

Bio-Rad Laboratories
Dunne, Frank W., Co.
Fuller Paint Co.
Gibson-Holmes Co.
Henry, W. W., Co.
International Wood Products
Kaull, G. W., Co.
Marvin Corp.
Poly Resins Co.
Rhodes, D. H., & Co.
Security Paint Manufacturing Co.
Shell Chemical Co.
Silver Line Products, Inc.
Sun Chemical Corp.
Synkoloid Co.
Tri-City Paint Co.
Western Chemical & Manufacturing Co.

Over half of the quantity consumed for all uses in California came from Canada (Quebec); the remainder came from California, Arizona, Oregon, and undisclosed sources. However, well over three-fourths of California consumption for chemical uses probably originated in Canada.

Chemical producers in California specified and used grades 6 and 7 chrysotile asbestos primarily for use as a filler and binder, and to offer acid resistant properties to plastics, paints, putties, and caulking compounds. Certain areas of major use, such as asphalt and cement products, roofing, and insulation, although closely related, are not included under the chemical industry classification.

Although some asbestos was obtained through brokers, most of the supply came directly from the producers.

Specifications for chrysotile, the principal type of asbestos, have been established by the Quebec Mining Association. The Vermont and Canadian chrysotile asbestos classifications are the same, but Cassiar Asbestos Corp., Ltd., uses a special classification for its British Columbia chrysotile.

The chrysotile asbestos being mined near Coalinga, Calif., is short fiber, roughly equivalent to Canadian grades 6-7 and Canadian floats, with some differences in physical properties,[4] and may be suitable as an alternate

[4]Detailed information on asbestos classifications are given in Bureau of Mines Bulletin 552 and Information Circular 7880.

source of asbestos for the chemical industry. For example, Johns-Manville Asbestos, Ltd., reported that Coalinga asbestos fibers are superior to Canadian fibers in the manufacture of floor tile (see table 16).

TABLE 16. - Asbestos fiber (floor tile grade) from Coalinga, Calif.

Typical test analyses and comparison with Canadian 7TS6

Test	Asbestos Type		
	Ultrabestos (Coalinga)		Jeffrey (Canadian)
	Red Brand	Blue Brand	7TS6
Rotap screen analysis: (100 g - 3 mins.)			
Plus 10 mesh.....percent	1.4	0.9	1.1
Plus 20 mesh.....do...	18.9	14.8	42.8
Plus 35 mesh.....do...	58.4	46.9	42.4
Plus 65 mesh.....do...	16.0	25.8	4.8
Pan.....do...	5.0	11.6	8.5
Surface area: (cm^2/g) (Dyckerhoff System).....	25,500	21,500	11,000
Color.....	66	62	56 (photoelectric reflection)
Wet screen analysis:			
Plus 14 mesh.....percent	8.7	5.5	0.5
Plus 28 mesh.....do...	16.5	14.3	4.7
Plus 100 mesh.....do...	29.6	26.5	11.7
Plus 200 mesh.....do...	4.8	5.4	10.1
Minus 200 mesh.....do...	40.4	48.3	73.0
Kerosene absorption.....cc	102	87	76
Compression kerosene.....g	5.97	5.34	4.66

Source: Johns-Manville Asbestos Ltd., July 1962.

Crude asbestos and fibers are sold by the short ton in 100-pound bags. Short-fiber asbestos (see bibliographic references (3) and (23) for full descriptions of classifications used) is sold in bags and bulk under a number of brand names.

Asbestos usually is purchased on the basis of samples and tests data sheets submitted by the seller.

Glass (rock wool, slag wool, and glass wool) and organic fibers compete with, and have replaced asbestos in some markets. However, for some grades and uses, price changes would have little effect on asbestos consumption owing to quality advantages of asbestos. When fillers with heat-resistant properties are needed, few, if any, substitutes can be used.

According to Johns-Manville Asbestos, Ltd., it will produce two grades of asbestos fiber from the Coalinga, Calif., deposit, designated "Ultrabestos, floor tile grade, Red Brand," priced at $100 a ton; and "Ultrabestos, floor tile grade, Blue Brand," priced at $75 a ton, f.o.b. Coalinga. The Red Brand reportedly differs from the Blue Brand in that it is whiter and has greater absorption, more surface area, and better indicated efficiency.

Table 16 shows comparative test results of Johns-Manville Canadian asbestos and Coalinga asbestos.

Barite Supply--California and Nevada

U.S., California, and Nevada production data are compared in table 17. Three mines, one near Yermo in San Bernardino County, and two in the 9-mile Canyon area of Tulare County, were the source of 97 percent of the crude barite sold or used by California producers in 1960. Two barite properties in Nevada County and one in Kern County supplied the remainder.

TABLE 17. - Barite supply, 1960

	United States	California	Nevada
Mines	[1] 44	6	9
Production:			
Quantity.....short tons	713,926	16,000	86,000
Value	$8,563,000	$181,000	$591,000
Average value, per short ton, f.o.b. source	$12.00	$11.30	$6.75
Imports (crude barite).....short tons	[2] 641,000	([3])	([4])
Exports.....do....	([5])	-	([4])

[1] The four leading firms produced 63 percent of the output. Arkansas and Missouri accounted for 71 percent of the total U.S. production.
[2] Crude barite--Mexico 30 percent, Canada 22 percent, Peru 17 percent, Greece 13 percent, and other 18 percent. Also ground barite and barium chemicals were imported.
[3] Barium chemicals only. See table A-2 (appendix).
[4] Not applicable.
[5] None; 200 tons of lithopone was the only recorded exports in 1960.

Crude barite mined in Nevada was processed in California by Barium Products Division of FMC Corp. at Modesto, in Stanislaus County, and the Baroid Division of National Lead Co. at Merced, in Merced County.

Nevada barite production came from eight deposits in four counties, with the major output from the Rossi mine, Elko County, and the Mountain Springs property in Lander County. National Lead Co. operated Nevada's only barite-grinding plant at Battle Mountain. Products were shipped out-of-State for use in paints and oil-well drilling muds. All crude barite shipped from Nevada was consigned to California grinding plants.

Some Nevada barite production required about a 40-mile haul to the railroad, and potentially attractive barite deposits occur 60 to 80 miles from

railroad in relatively rugged terrain. The remoteness of deposits and depletion of higher grade ores have reduced the possibility of California-Nevada deposits effectively competing with imported ores and lower-grade eastern deposits in the larger market areas.

Barite Demand--California Chemical Industry

Barite consumed in the chemical industry in California in 1960 (table 18) was used mainly in manufacturing barium chemicals. Virtually all of the barite used for this purpose came from captive operations in Nevada. Paint-grade barite came mostly from Missouri and was sold through brokers. (Nearly three-fourths of the estimated 100,000 tons of barite consumed in California, compared with 1.2 million tons consumed in the United States, was used in oil-well drilling and an additional quantity was used in glass manufacture. Both of these industries are outside of SIC 28.)

TABLE 18. - Barite consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Crude barite	3
Ground and bleached	10
Total consumption in above plants	(1)
Total value, delivered	(1)
Value range, per short ton, delivered	[2] $14.00-$16.00
Typical freight rate, ground and bleached barite, Missouri to Los Angeles	$26.00

[1] Figures withheld to avoid disclosing individual company data.
[2] Crude barite. Ground and bleached barite sold for $72.00-$96.00 delivered.

Other chemical uses for ground barite included its application as a filler in plastics and as a weighting agent in pesticides.

FMC Corp., Modesto, Calif., utilized its own Nevada crude barite and Wyoming trona (soda ash) and purchased coke to produce barium sulfide, barium carbonate, barium oxide, and barium hydroxide.

California barite consumption figures for 1960 had to be concealed because there were only two major consuming companies. Most of the companies listed in table 19 consumed only minor quantities of barite and barium compounds. However, a rough estimate of consumption by California paint manufacturers can be derived from the following published data: (1) The Bureau of the Census reported that California accounted for 10 percent of the paint output, and (2) the Bureau of Mines 1960 Minerals Yearbook showed 18,273 short tons of crushed and ground barite went into paint.

No generally accepted standard specifications for either crude or ground barite have been promulgated for chemical applications. The trade loosely classifies barite as "soft" and "hard crystalline" ores.[5]

[5] These commercial terms refer to ease of grinding. The hardness of barite ranges from 2.5 to 3.5 on Mohs' scale.

TABLE 19. - Consumers of barite reporting chemical usage in California, 1960

Amercoat Corp.	Fresno Agricultural Chemical Co.
De Soto Chemical Coatings, Inc.	Fuller, W. P., & Co.
Dowman Products, Inc.	Glidden Paint Co.
Dunn-Edwards Corp.	National Lead Co.
Dunne, Frank W., Co.	Sherwin-Williams Co.
Finch Paint & Chemical Co.	Walker Paint Co.
FMC Corp.	

Grinders prefer "soft" ore, whereas the "hard crystalline" ore is considered preferable for lithopone and barium chemical manufacture.

Crude barite for most uses should contain at least 93 percent $BaSO_4$, and the better grades contain from 95 to 98 percent $BaSO_4$ and not over 1 to 3 percent silica.

Barite was marketed in the following forms: Crude, hand-selected lump, jig, table, or flotation concentrate, fine-ground, and bleached. Crude is usually sold f.o.b. mine, and shipped in open railroad cars; processed barites is usually sold in 50- and 100-pound bags.

Ground barite for most uses must conform to rigid color and fineness requirements. It usually is ground to 99.7 percent minus 325-mesh. Companies have individual requirements for color and usually rely on comparison with known standards.

In some instances, ores containing up to 1 percent Fe_2O_3 and less than 94 percent $BaSO_4$ can be used for manufacturing barium chemicals, but a penalty might be charged. In barium chemical manufacture, fluorine is harmful and only trace amounts can be tolerated.

Barite can be used in manufacturing lithopone, a pigment which is essentially a chemical mixture of barium sulfate and zinc sulfide. Chemical & Pigment Co., Oakland, Calif., a major lithopone producer in the past (45) reported no consumption in 1960 (Sherwin-Williams Co. was reportedly the sole surviving producer of lithopone in the United States). Consumption of barite for this use gave way to titanium dioxide, which is more expensive but has greater covering power.

The cost of barite delivered to the California chemical industry averaged around $15 a short ton for crude barite in bulk and $80 a short ton for ground, bleached, and bagged barite. (Precipitated barium sulfate and carbonate sold for up to $137 a ton.)

Bauxite Supply--California and Nevada

No bauxite was produced in California or Nevada in 1960. Table 20 shows U.S. production data. Imports of 9,000 long tons of bauxite entered the San Francisco port during 1960, and an additional 32,000 tons came in by rail. Of this total, 11,800 tons was reported for chemical use.

TABLE 20. - Bauxite (ore) supply, 1960

	United States	California	Nevada
Producers	[1]12	-	-
Production:			
Quantity, crude ore, long tons	[2]1,998,000	-	-
Value	$21,107,000	-	-
Average value, per long ton, f.o.b., source	$10.50	-	-
Producer stocks, Dec. 31, long tons	5,389,000	-	-
Imports, do.	[3]8,739,000	[4]9,000	([5])
Exports, do.	29,000	-	([5])

[1]Nine companies operated mines; the leading three firms accounted for nearly 92 percent of mine production. Four additional firms processed bauxite.
[2]Arkansas, Alabama, and Georgia.
[3]Jamaica 48 percent, Surinam 37 percent, British Guiana 4 percent. Also included in import figures are 113,529 long tons of calcined bauxite valued at $2,172,269 of which 1,100 tons valued at $12,410 entered the San Francisco port from Surinam.
[4]Through seaports only. An additional 32,000 long tons entered by rail (see table 7).
[5]Not applicable.

Bauxite (and Alumina) Demand--California Chemical Industry

Bauxite was used by the California chemical industry to produce alum (aluminum sulfate). Plants were operated by Allied Chemical Corp., General Chemical Div.; Stauffer Chemical Co.; and Associated Chemical Co. (table 21). Most of the bauxite consumed came from South America and the Carribean; some was shipped from Arkansas. About one-fourth of the bauxite entering California was used by the above companies; the remainder went mainly into refractories, made by companies not included in SIC 28. Some activated bauxite was used for clarifying, decolorizing, and desulfurizing lubricating, vegetable, and animal oils. As a basis for comparison, of the 8.9 million tons of bauxite consumed in the United States in 1960, only 3 percent went into chemical manufacturing.

TABLE 21. - Bauxite (and alumina) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Bauxite	4
Alumina	25
Total consumption in above plants (bauxite only), long tons	[1]11,800
Total value, delivered (bauxite only), do.	$230,000
Value range, per long ton, delivered	$18.00-$31.00
Typical freight rate, per long ton, Arkansas to Los Angeles	$16.60

[1]Does not include 749 short tons of alumina and aluminum compounds valued at $102,000.

Bauxite for chemical uses should be low in titanium and iron, but high-silica bauxite, which cannot be used to produce alumina, is usually satisfactory for use in chemical manufacturing. In manufacturing aluminum sulfate for water purification, acid soluble iron is a critical impurity.

For aluminum salts, the Al_2O_3 content of the bauxite should be as high as possible, but ores with as much as 11 percent SiO_2, 1 to 2.5 percent Fe_2O_3, and 1 to 3 percent TiO_2 can be used. Some chemical companies do not use bauxite but utilize aluminum hydrate produced by others as a source material, for aluminum chemicals.

A high-grade bauxite, ground to about 60 mesh, was usually specified for decolorizing and desulfurizing oil. The bauxite for this purpose is activated by heat treatment.

Chemical companies shown in table 22 consumed alumina, aluminum sulfate, aluminum hydroxide, and powdered and flake aluminum in California for a variety of purposes, mainly in the manufacture of paint, as a filler in plastics, and for use in manufacturing ink. The f.o.b. value of the various alumina products ranged from $61.20 to $653.80 a ton. Individual prices are given in the Oil, Paint and Drug Reporter. Most of the metal was obtained from New York and New Jersey. Compounds came mainly from eastern States. A small quantity of various aluminum compounds, chiefly aluminum sulfate, was purchased from local distributors. Minor quantities of aluminum compounds were also obtained from England.

TABLE 22. - Consumers of aluminum compounds reporting chemical usage in California, 1960[1]

Amercoat Corp.	Kaiser Aluminum & Chemical Co.
American Marine Paint Co.	L. & H. Paint Products, Inc.
American Potash & Chemical Corp.	Leffingwell Chemical Co.
Beacon Paint & Wax Corp.	Narmco Resins & Coatings Co.
California Ink Co., Inc.	Nelson Technical Coatings Co.
Cole Manufacturing Co.	Pittsburgh Plate Glass Co.
De Soto Chemical Coatings, Inc.	Poly Resins Co.
Dunne, Frank W., Co.	Ram Chemicals, Inc.
Ellis Paint Co.	Riker Laboratories
Fuller, W. P., & Co.	Security Paint Manufacturing Co.
Interchemical Corp.	Sherwin-Williams Co.
International Paint Co.	Union Carbide Chemicals Co.
	Western Lead Products Co.

[1]Tonnage reported by these companies is not included in the bauxite consumption figure.

A variety of materials can be substituted for bauxite, such as calcium chloride as an absorbant, and fuller's earth as a decolorizer.

Alumina went into filler applications in plastics, and was used as a desiccant in drying gases and liquids, as a catalyst in many California chemical processes, to produce a glossy finish on paper, as a base for pigments and

insecticides, and in rubber manufacture. Aluminum powder was used in paints, printing ink, and for decolorizing and desulfurizing petroleum.

Boron Supply--California and Nevada

As shown in table 23, the total national output of boron minerals and compounds came from California. American Potash & Chemical Corp. produced from the brines of Searles Lake at Trona, Westend Chemical Div. of Stauffer Chemical Co. produced from Searles Lake at Westend, and Pacific Coast Borax Div. of United States Borax and Chemical Corp. produced from a deposit of borax and kernite in the Kramer District near Boron, Calif. Small quantities of colemanite were mined at Death Valley Junction, and ulexite from a deposit near Shoshone was mined by the latter company.

TABLE 23. - Boron (minerals) supply, 1960

	United States	California	Nevada
Producers	3	3	-
Production:			
Quantity, sold or used by producers, short tons	[1]640,600	[1]640,600	-
Value	$47,550,000	$47,550,000	-
Average value, per short ton, f.o.b. source	$74.22	$74.22	-
Imports, short tons	-	-	([2])
Exports, do.	300,600	300,600	([2])

[1]Gross weight--equivalent to 324,000 tons of boron oxide.
[2]Not applicable.

Boron Demand--California Chemical Industry

Table 24 shows consumption data and table 25 lists the companies that reported consumption of boron minerals and compounds in California during 1960. All material originated in California and most of it was purchased directly from the producer. A variety of boron compounds were used for various applications, including the production of chemical materials such as adhesives, cleansing compound, and chlorides.

TABLE 24. - Boron (minerals and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Processed boron minerals	15
Refined boron compounds	6
Total consumption in above plants, short tons	[1]26,000
Total value, delivered	[1]$1,011,000
Value range, per short ton, delivered	$35.00-$121.00
Typical freight rate, per short ton, Los Angeles to San Francisco	$8.70

[1]Incomplete--excludes borate compounds consumed by three principal producers at their own operations.

TABLE 25. - Consumers of boron compounds reporting chemical usage in California, 1960

Arabol Manufacturing Co.	Parker Rust Proof Co.
Chipman Chemical Co.	Poly Resins Co.
Industrial Chemical Co., Inc.	Ritchie Adhesive Co.
Jones-Hamilton, Inc.	Stauffer Chemical Co.
Kaiser Aluminum & Chemical Corp.	Tec-Chemical Co.
Klix Chemical Co., Inc.	Turco Products, Inc.
Metallic Phosphate Products Co.	Vogarell Products, Inc.
National Starch & Chemical Corp.	

Specifications of borax for chemical applications called for commercial or technical (USP) grades. Suppliers could generally meet a purity of 99.5 percent borax or better. It was used in crystalline, granular, and powder form.

The captive tonnage consumed by the three principal borate compound producers-consumers in California--U.S. Borax and Chemical Co., American Potash and Chemical Co., and the West End Div., Stauffer Chemical Co.--is not included in these totals to avoid disclosing production information. These companies also distributed finished products, including both refined chemicals and crude sodium borate minerals in various stages of beneficiation, throughout the United States (340,000 tons of boron minerals and compounds was consumed for all uses in the United States in 1960).

Most of the boron material sold at a price on the order of $50 a ton delivered, with a freight rate ranging from $5.48 a ton to $15 a ton.

Bromine Supply--California and Nevada

FMC Corp. plant at Newark, Alameda County, extracted bromine from salt works bitterns obtained from Leslie Salt Co. Bittern was received into 200-million-gallon capacity ponds where it was neutralized with sulfuric acid and processed in a manner fully described in available published (13) and company literature. Bromine production data are shown in table 26.

TABLE 26. - Bromine supply, 1960

	United States	California	Nevada
Producers	12	2	-
Production:			
Quantity, sold by producers, pounds	175,010,000	(1)	-
Value	$44,637,000	(1)	-
Average value, per pound, f.o.b. source	$0.26	(1)	-
Imports, elemental bromine and bromine compounds, pounds	[2] 122,000	-	(3)
Exports, bromine, bromide, and bromates, do.	10,200,000	[4] 23,000	(3)

[1] Figures withheld to avoid disclosing individual company data.
[2] Netherlands 92 percent, United Kingdom 4 percent, West Germany 4 percent.
[3] Not applicable.
[4] Through seaports only.

American Potash and Chemical Co.'s Trona, San Bernardino County, plant used a process similar to that of FMC Corp. to extract bromine from Searles Lake brine. Bromine was extracted as part of an integrated process for recovering potassium, sodium, boron, lithium, and phosphate minerals.

Nevada produced no bromine in 1960.

Bromine Demand--California Chemical Industry

The only domestic source of elemental bromine was American Potash and Chemical Co.; and FMC Corp. was the only source of ethylene dibromide in California. Elemental bromine, recovered from Searles Lake brines, was sold to chemical and pharmaceutical companies throughout the United States. Only three companies reported consumption in California for the year 1960, for use in compounding a wide variety of products. Recovered liquid bromine from salt works bitterns at Newark, Calif., was converted to ethylene dibromide, chiefly for use as a fumigant in treating soils and seed. Much of the ethylene dibromide used with lead as an antiknock fluid in gasoline was produced at plants outside California. Other than captive use, only one California company reported a significant quantity purchased from California producers. Although California figures must be withheld in table 27 the United States consumption figure of 165 million pounds might be used as a basis for estimation. The Oil, Paint and Drug Reporter quoted prices as shown in table 28.

The usual requirements of elemental bromine were that it must have a specific gravity at 15° to 20° C of not less than 3.1; not less than 99.7 percent bromine, with no iodine and not more than 0.1 percent chlorine present.

Potassium bromide specifications, for example, include Technical, USP (United States Pharmacopoeia), CP (chemically pure), NF (National Formulary), and Reagent grades. Potassium bromate was provided in pure (not less than 99.5 percent) CP, USP, and Powder grades. Sodium bromide specifications include CP, USP, crystalline, powder, commercial, pure, and highest purity. According to suppliers, most consumers refer to the pharmacopoeia which limit impurities to 0.3 percent chlorine, 0.05 percent iodine, 0.002 percent sulfur, and a trace of organic matter in bromine compounds.

Ethylene dibromide ($C_2H_4Br_2$) was the principal use for bromine.

Figure 3 is a generalized use pattern for bromine.

TABLE 27. - Bromine (elemental and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of elemental bromine	[1] 1
Total consumption in above plants, pounds	([2])
Total value, delivered	([2])
Average value, per pound, delivered	([2]) ([3])

[1] Excludes two companies producing captive bromine products.
[2] Figures withheld to avoid disclosing individual company data.
[3] See table 28 for price quotations.

TABLE 28. - Prices of bromine products

Form and basis of shipment	Cents per pound
Bromine, purified, cases, carlots, ton lots, delivered east of Rocky Mountains	32
Cases, less than carlots, same basis	34-39
Drums, carlots, ton lots, delivered east of Rocky Mountains	31
Drums, less than carlots, same basis	31-34
Tanks, carlots, same basis	21½
Ammonium bromide, N.F. granular, drums, carlots, freight equalized	44
Drums, less than carlots, same basis	46
Bromochloromethane, drums, carlots, freight equalized	48
Drums, less than carlots, same basis	50
Tanks, same basis	47
Ethylene dibromide, drums, carlots, freight equalized	30½
Drums, less than carlots, freight equalized	31½
Tanks, freight equalized	28½
Potassium bromide, USP, granular, barrels, kegs	39-40
Potassium bromate, drums, 1,000-pound lots, works, January through October	50
Oct. 3 through Oct. 9	53½
Oct. 10 through December, 200-pound drums, carlots, freight allowed	49
Sodium bromide, USP, granular, barrels, drums, works	40

Source: Oil, Paint and Drug Reporter.

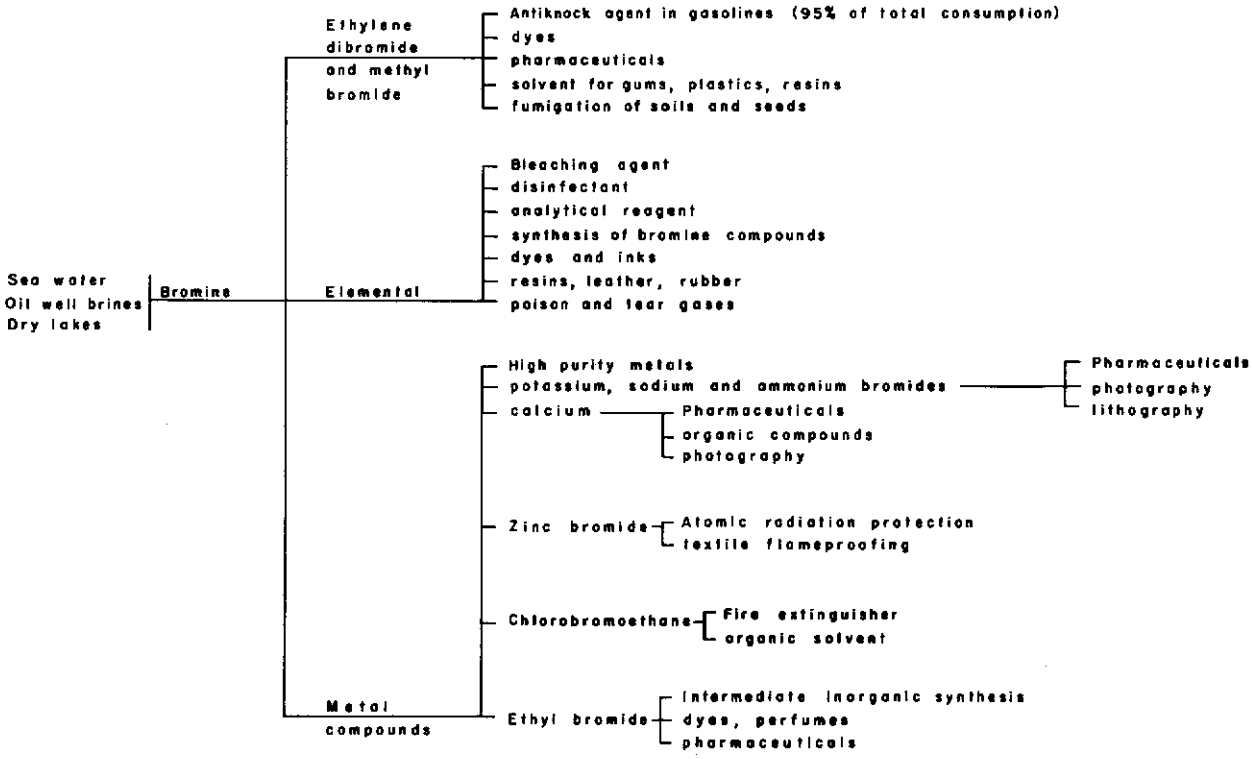


FIGURE 3. - Bromine Uses.

Calcium (Calcium Chloride) Supply--California and Nevada

The California Salt Co. and National Chloride Co. of America, both at Amboy, Calif., recovered calcium chloride from brines at Bristol Lake, San Bernardino County, in 1960. The data supplied by these companies are concealed in table 29. Hill Brothers Chemical Co. purchased crude liquid and operated a third plant in the area to produce both a flake product and a refined liquid from purchased crude liquid calcium chloride. Products of all three plants were marketed in Arizona, Nevada, and southern California, mainly as hygroscopic agents.

Nevada produced no calcium chloride during 1960.

TABLE 29. - Calcium chloride supply, 1960

	United States	California	Nevada
Producers	8	2	-
Production:			
Quantity, short tons	[1] 580,000	([2])	-
Value	$16,000,000	([2])	-
Average value, per short ton, f.o.b. source	$27.60	([2])	-
Imports, short tons	1,600	480	([3])
Exports, do.	26,800	[4] 600	([3])

[1] 1959 shipments of natural and synthetic solid and flake calcium chloride. (Excludes 259,644 tons of calcium chloride brine and brine used in production of solid and flake calcium chloride.) Source: Bureau of the Census.
[2] Figures withheld to avoid disclosing individual company data.
[3] Not applicable.
[4] By rail only. No record is available for California land imports and exports and interstate shipments.

Calcium (Calcium Chloride) Demand--California Chemical Industry

Calcium chloride consumption data shown in table 30 were provided by the companies shown in table 31.

TABLE 30. - Calcium chloride consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Calcium chloride	7
Other calcium compounds	4
Total consumption in above plants, short tons	10,700
Total value, delivered	$379,000
Value range, per short ton, delivered	[1] $14.00-$81.00

[1] Low cost per ton is due to use of major percentage as crude liquid calcium chloride. The Oil, Paint and Drug Reporter quoted prices for 40 percent calcium chloride liquor in tanks, freight equalized at $14.00 per ton; flake 77-80 percent, paper bags, carlots, f.o.b., freight equalized, at $34.00 per ton; and USP granular, 300-pound drums, freight equalized, at 32 cents per pound.

Uses reported included paints, fertilizers, insecticides, herbicides, cleansers, soaps, and variety of dessicant applications.

TABLE 31. - Consumers of calcium chloride reporting chemical usage in California, 1960

California Chemical Co.
Deepwater Chemical Co., Ltd.
Hill Brothers Chemical Co.
National Research & Chemical Co.
O'Brien Corp. of San Francisco
Union Carbide Chemicals Co.
Western Chemical & Mfg. Co.

Clay Supply--California and Nevada

Bentonite Supply

Bentonite was mined in Inyo, San Benito, and San Bernardino Counties during 1960 (table 32). In addition, hectorite, a special type of bentonite, was mined near Hector in San Bernardino County by National Lead Co. and The Inerto Co. National Lead shipped its crude product to processing facilities at Houston, Tex., for preliminary processing, and thence to New Orleans, La. for final processing. The Inerto Co. mined and processed its material near Hector.

TABLE 32. - Clay (bentonite) supply, 1960

	United States	California	Nevada
Producers	36	8	1
Production:			
Quantity, sold or used by producers, short tons	1,268,800	7,000	(1)
Value	$15,005,000	$139,000	(1)
Average value, per short ton, f.o.b. source	$12.00	$19.50	(1)
Imports, short tons	200	-	(2)
Exports, do.	58,000	-	(2)

[1] Figures withheld to avoid disclosing individual company data.
[2] Not applicable.

Bentonite was mined in Nye County, Nevada, and shipped to processors in California.

Fuller's Earth Supply

Two producers in Inyo County (Sierra Talc Co., near Keeler, and David Jones, near Olancha) mined fuller's earth in California for filler, filter, and absorbent uses.

Fuller's earth was produced in Nevada by Industrial Minerals and Chemical Co., near Weeks, Lyon County, and shipped to one of its California plants for use in preparing feed pellets and for other uses. Because of the requirement for concealing individual company data, figures for California and Nevada production cannot be shown in table 33.

TABLE 33. - Clay (fuller's earth) supply, 1960

	United States	California	Nevada
Producers	19	2	1
Production:			
Quantity, sold or used by producers, short tons	408,000	(1)	(1)
Value	$9,162,000	(1)	(1)
Average value, per short ton, f.o.b. source	$22.45	(1)	(1)
Imports, short tons	(2)	-	(3)
Exports, do.	12,000	-	(3)

[1]Figures withheld to avoid disclosing individual company data.
[2]Not shown separately from other clays.
[3]Not applicable.

Kaolin Supply

Kaolin was produced by Huntley Industrial Minerals Co. from near Casa Diablo in Little Antelope Valley of Mono County; by California Nonmetallics from the Robinson ranch east of Trabuco Canyon Road, Orange County; and by W. A. Schoeppe Clay Co. from a deposit 13 miles northwest of El Toro, also in Orange County.

Table 34 shows the kaolin output in California during 1960. As most kaolin consumed by the California chemical industry was shipped in from Eastern States, table 35 has been compiled to show the comparative supply situation based on all uses.

TABLE 34. - Clay (kaolin) supply 1960

	United States	California	Nevada
Producers	44	3	-
Production:			
Quantity, sold or used by producers, short tons	[1]2,730,000	14,000	-
Value	$45,677,000	$212,000	-
Average value, per short ton, f.o.b. source	$16.70	$15.10	-
Imports, long tons	127,000	[2]900	(3)
Exports, do.	80,000	[2]360	(3)

[1]Georgia supplied 2,121,000 tons valued at $37,822,000.
[2]Through seaports only.
[3]Not applicable.

No kaolin was produced in Nevada. Some promising deposits were being investigated by the Federal and Nevada Bureaus of Mines and others.

TABLE 35. - Comparison of domestic kaolin production and uses from major sources, 1960

Total output		
State	Short tons	Value
California	14,247	212,120
Florida and North Carolina	29,760	663,604
Georgia	2,131,237	37,822,255
South Carolina	446,620	5,502,342
Other States[1]	118,587	1,476,774

Kaolin sold or used by two major producing States, for selected uses

Georgia			South Carolina		
Use	Short tons	F.o.b. value/ton	Use	Short tons	F.o.b. value/ton
Paper	568,583	$18.51	Rubber	220,846	$12.99
Paper coating	808,916	21.19	Pesticides	49,599	13.14
Rubber	100,342	13.73	Other	124,406	13.32
Linoleum oil cloth	([2])	([2])			
Paint	66,160	20.29			
Plastics	8,899	23.59			
Chemicals	([2])	([2])			
Other	198,301	14.20			

[1] Alabama, Pennsylvania, and Utah.
[2] Included in "Other".

Source: BuMines Minerals Yearbook, volumes I and III.

Other Clays Supply

Los Angeles, San Mateo, Solano, Ventura, and Riverside Counties yielded 1.4 million tons of the 2.4 million tons of miscellaneous clay and shale produced in 25 California counties in 1960. Most of the production went into the manufacture of portland cement, brick, tile, and sewer pipe, all of which are outside SIC 28. Table 36 shows the quantity of miscellaneous clay sold or used by producers in 1960.

TABLE 36. - Clay (other) supply, 1960

	United States	California	Nevada
Producers	Numerous	Numerous	1
Production:			
Quantity, sold or used by producers, short tons	34,285,000	[1] 2,428,000	([2])
Value	$41,326,000	$3,671,000	([2])
Average value, per short ton, f.o.b. source	$1.25	$2.97	([2])
Imports, short tons	116,000	[3] 125	([4])
Exports, do.	([5])	([5])	([4])

[1] Only 220,000 tons, valued at $653,000 was sold for use other than in portland cement, brick, tile and sewer pipe manufacture.
[2] Concealed. [3] Through seaports only.
[4] Not applicable. [5] Not available.

A relatively minor amount of miscellaneous clay was produced in Nevada, but none was sold to the California chemical industry.

Clay Demand--California Chemical Industry

Bentonite Demand

Table 37 shows the tonnage of bentonite consumed by the California chemical companies listed in table 38. Bentonite went into many chemical applications, including pharmeceuticals, poly-acetate emulsions, cleaning compounds, paints, resins, fertilizers, and calking compounds. Most of the bentonite reported by the California chemical industry came from Wyoming, but some was shipped into California from South Dakota, Utah, and Missouri. The material from Missouri probably originated in Wyoming or South Dakota, as no bentonite was mined in Missouri.

TABLE 37. - Clay (bentonite) consumption by the California chemical industry, 1960

Plants reporting consumption	39
Total consumption in above plants, short tons	13,000
Total value, delivered	$529,000
Value range, per short ton, delivered	$29.00-$55.00
Typical freight rate, per short ton, Wyoming to San Francisco	$18.00

TABLE 38. - Consumers of clay (bentonite) reporting chemical usage in California, 1960

Amchem Products, Inc.
Amercoat Corp.
Ardmor Chemical Co.
Barnes, S. O., & Sons, Inc.
Borden Co., Chemical Div.
California Chemical Co.
California Ink Co., Inc.
Certified Home Products
Chipman Chemical Co.
De Soto Chemical Coatings, Inc.
E-Z-Est Products Co., Inc.
Fine Line Paint Corp.
FMC Corp.
Fresno Agricultural Chemical Co.
Hancock Chemical Co.
Indco Laboratory
Kaiser Aluminum & Chemical Corp.
Kaull, G. W., Co.
Kolmar Laboratories, Inc.
Los Angeles Soap Co.
Luseaux Laboratories, Inc.
MacMillan Ring Free Oil Co., Inc.
Marvin Corp.
Max Factor & Co.
McCloskey Varnish Co. of the West
Narmco Resins & Coatings Co.
National Lead Co.
Neville Chemical Co.
Plex Chemical Corp.
Poly Resins Co.
Rhodes, D. H., & Co.
Security Paint Manufacturing Co.
Sherwin-Williams Co.
Stauffer Chemical Co.
Union Oil Co.
U.S. Peroxygen Corp.
Vi-Cly Industries, Inc.
Western Chemical & Mfg. Co.
Wyandotte Chemical Co.

Out of 1.3 million short tons of bentonite sold or used for all purposes in the United States in 1960, uses which included chemical applications were: 27,000 tons for insecticide carriers and diluents, 74,000 tons for filtering and decolorizing vegetable and animal oils, and 4,000 tons for use in other filtering, clarifying, and filler applications.

Specifications for bleaching earths (which would also include fuller's earth) that are used in oil filtration require the clay to be at least 50 percent passing 200 mesh, and for most purposes, a clay in which 85 to 95 percent will pass 200 mesh. The limiting factors on fineness are the filtration rate and the ease with which the oil can be separated from the clay. If the particle size is too fine, the filter rate is retarded.

Freight rates were consistently reported at $18 from Wyoming, and $13 from Utah, but unit price reported ranged widely, depending on the use to which the bentonite was put and the quantity used. The usual price range for Wyoming bentonite was reported by the California chemical industry at $10 to $45 a ton f.o.b. source; but some products sold for more than $100 a ton. Oil, Paint and Drug Reporter showed that domestic bentonite, 200 mesh carlots, f.o.b. mine, sold for $14 per short ton; imported Italian bentonite sold for $97 to $98.20 per ton at warehouse.

The Wyoming, or swelling-type, bentonite has the widest range of uses in the California chemical industry. The nonswelling type is less versatile but has characteristics which make it more suitable for certain uses, mainly outside of SIC 28. Swelling bentonite was used by California chemical manufacturers as a deflocculent in detergents and as a carrier in horticultural sprays and insecticides. Small amounts were consumed as a coagulant for clarification of liquids and industrial wastes. It was also used as a constituent in polishes, water paints, asphalt emulsions, and as a filler. Nonswelling uses included a decolorizer and deodorizer of vegetable and animal oils and fats. Minor amounts were used as insecticide carriers.

There are numerous substitutes for bentonite in many of the various chemical industries but few that are as inexpensive. Other clays, talc, and pyrophyllite may substitute as pesticide carriers; bauxite may substitute as a deodorizer in vegetable and animal oil filtration.

A related chemical use outside SIC 28 for nonswelling bentonite was as a catalyst and as a decolorizing agent in petroleum refining. For those purposes, it was generally activated by acid treatment.

Fuller's Earth Demand

Most of the fuller's earth tonnage shown in table 39, as reported by the companies listed in table 40, went into wood preservatives, insecticides, aerosols, resins, and miscellaneous uses, including cosmetics. It was obtained from California, Florida, Georgia, Texas, and Utah. None of the Nevada-produced fuller's earth was used by the reporting chemical companies.

Freight rates ranged from $4 to $22.33 a ton. Unit value ranged from $23 a ton to $68 a ton, delivered. The usual delivered price from Florida-Georgia was on the order of $22 a ton.

TABLE 39. - Clay (fuller's earth) consumption by the California chemical industry, 1960

Plants reporting consumption	13
Total consumption in above plants, short tons	3,200
Total value, delivered	$118,000
Value range, per short ton	$23.00-$68.00
Typical freight rate, per short ton, from Georgia to Los Angeles	$22.00

TABLE 40. - Consumers of clay (fuller's earth) reporting chemical usage in California, 1960

American Potash & Chemical Co.	Kolmar Laboratories, Inc.
Bayside Oil Corp.	Moyer Chemical Co.
California Chemical Co.	Neville Chemical Co.
Factor, Max & Co.	Stauffer Chemical Co.[1]
Fresno Agricultural Chemical Co.	United Heckathorn Co.
Jones-Hamilton Co.	Vegetable Oil Products Co., Inc.

[1]Reported for two plants.

Kaolin Demand

A variety of chemical applications for kaolin were reported for the tonnage shown in table 41, as reported by the companies listed in table 42. Uses included linoleum paste, agricultural chemicals, aerosols, protective coatings, water-base paints, varnishes, insecticides, soaps, cosmetics, adhesives, ink, ammonia, urea, and a variety of miscellaneous chemical applications. (Kaolin was specified by the California petroleum industry for catalytic-cracking, but this use was not included here as petroleum refining lies outside the scope of SIC 28.)

Most of the kaolin consumed came from Georgia and South Carolina. Some also came from Florida. However, a substantial quantity of California kaolin was consumed by the California chemical industry.

Kaolin was used fairly extensively by California paint manufacturers as a suspending agent and as a pigment in water-base paints because of its ease of dispersion, nonabrasiveness, insolubility, and comparatively low cost. It was not used to a great extent, however, as a pigment in oil paints, because of its high oil absorption, poor covering power, and low refractive index. The sedimentary kaolins of Georgia, South Caroline, and Florida were virtually the only ones used in paints according to the California chemical industry reports.

Reference was frequently made to specification D 603 of the American Society for Testing and Materials, which requires a chemical composition for

aluminum silicate pigments to be within the following limits: SiO_2, 43 to 47 percent; Al_2O_3, 37 to 40 percent; loss on ignition, 10 to 15 percent; moisture and other volatile matter, 1 percent or less; and plus 325 mesh not to exceed 2 percent.

TABLE 41. - Clay (kaolin) consumption by the California chemical industry, 1960

Plants reporting consumption	22
Total consumption in above plants, short tons	3,900
Total value, delivered	$150,000
Value range, per short ton, delivered	$30.00-$74.00
Typical freight rate, per short ton, Georgia to Los Angeles	$22.00

TABLE 42. - Consumers of clay (kaolin) reporting chemical usage in California, 1960

Agrashell, Inc.	International Coatings Co.
Arabol Manufacturing Co.	Kolmar Laboratories, Inc.
Barnes, S. O., & Son, Inc.	National Lead Co.
Boyle & Co.	National Starch & Chemical Corp.
California Ink Co., Inc.	Pittsburgh Plate Glass Co.
Daw, A. J. Printing Ink Co.	Poly Resins Co.
De Soto Chemical Coatings, Inc.	Ritchie Adhesive Co.
Ellay Rubber Co.	Security Paint Manufacturing Co.
Factor, Max & Co.	Shell Chemical Corp.
Henry, W. W., Co.	Sherwin-Williams Co.
Interchemical Corp.	Synkoloid Co.

According to ASTM Specification D262, referred to by some consumers, kaolin used in the production of dyes must be mixed with silica, sodium salts, sulfur, and carbonaceous materials, and then calcined. It must be soft, dry, finely ground, and free of impurities, and should not have more than 1 percent remaining on 325 mesh.

Kaolin was among a variety of materials used by California pesticide manufacturers as carriers and diluents. The physical properties and low cost of certain kaolins lend themselves well to application in the insecticide industry. Most insecticide dust bases and wettable powders require grinding to at least 99 percent passing 325 mesh. Some carriers and diluents, however, are not refined to this level, but greater dispersion and better efficiency was usually achieved with the finer-grained carrier-diluent.

The following was a typical requirement for a commercial kaolin used as an insecticide carrier and diluent:

Particle size below 2 microns	87 to 92 percent
Passing 200 mesh, min	99.5 percent
Passing 325 mesh, min	99.0 percent
Moisture, max	1.0 percent
Water suspension (after 48 hours)	70 to 80 percent

Bulk density aerated, lb ft^{-3}	18 to 19 percent
Bulk density as shipped, lb ft^{-3}	35 to 36
pH	4.5 to 5.5
Al_2O_3	38 percent
SiO_2	45 percent
Particle shape	Flat, hexagonal plates
Compatibility	Excellent with most materials
Adhesiveness	Good, with or without oil
Abrasion	Very low

The general specifications for insecticide materials consider screen analysis, particle size, particle shape, adhesiveness, absorbency, suspension, compatability with the active ingredient, abrasiveness, density, and moisture. Detailed analyses, by sources, of several hundred dust diluents and carriers on the markets have been published (59).

In addition to the chemical companies shown in table 42, approximately 25 other companies consumed kaolin, valued at less than $1,000. Virtually all the material brought in from South Carolina and Georgia was handled through California brokers. Unit value, f.o.b. source, varied from $12 to $50 a ton, averaging $25 a ton. The Oil, Paint and Drug Reporter showed prices of kaolin to range from 10 to 12 cents a pound for powdered kaolin in drums and up to 17.5 cents a pound for colloidal kaolin in bags.

Other Clays Demand

Table 43 shows the tonnage of "other" clays consumed by the 23 companies, shown in table 44, that operated 28 chemical plants in California during 1960. About 0.025 percent of the U.S. miscellaneous clay went into chemical application within the scope of SIC 28.

Certain clays that could not be identified by type from consumers' reports were included with miscellaneous clays. Most of the tonnage reported in this category originated in Georgia, indicating that it was most likely either kaolin or fuller's earth (attapulgite). According to the Bureau of Mines' definition of miscellaneous clay,[6] many of these consumers might actually be listed under one of the other clay categories.

Uses included paints, insecticides, soap, cosmetics, adhesives, and various inorganic chemicals. Unit value of other clays reported by respondents was considerable higher than most clays ordinarily classified under the miscellaneous category, ranging from $22.20 to $47 a ton, delivered.

---

[6]Miscellaneous clay is a statistical designation used by the Bureau to refer to clays and shales not included under the other clay types. Miscellaneous clay may contain some kaolinite and montmorillonite, but illite usually predominates.

TABLE 43. - Clay (other) consumption by the California chemical industry, 1960

Plants reporting consumption	28
Total consumption in above plants, short tons	8,500
Total value, delivered	$311,000
Value range, per short ton, delivered	$22.00-$47.00
Typical freight rate, per short ton, Attapulgus, Georgia to San Francisco	$22.00

TABLE 44. - Consumers of clay (other) reporting chemical usage in California, 1960

Amchem Products, Inc.
Amercoat Corp.
American Adhesive Products Co.
American Potash & Chemical Co.
Borden Co., Chemical Div.
California Chemical Co.[1]
Coast Manufacturing & Supply Co.
Dowman Products, Inc.
Dunn-Edwards Corp.
Dunne, Frank W., Co.
FMC Corp.
Fresno Agricultural Chemical Co.
Glidden Paint Co.
Gold Star Adhesive Co.
Kaiser Aluminum & Chemical Corp.[2]
Lever Brothers Co.[1]
O'Brien Corp. of San Francisco
Old Colony Paint
Ritchie Adhesive Co.
Spebra Products Manufacturing Co., Inc.
Stauffer Chemical Co.
Stone, E. B., & Son
Union Oil Co. of California

[1]Reported for three plants.
[2]Reported for two plants.

Cobalt Supply--California and Nevada

As shown in table 45, no cobalt was produced in California in 1960. There has been no production since a few tons of ore was mined at the Mar John property, Calaveras County, in 1924. Occurrences of cobalt minerals have been reported at Long Lake, Inyo County, and at the Friday Mine, Julian-Cuyamaca area, San Diego County.

Nevada has never reported production of cobalt.

Cobalt Demand--California Chemical Industry

Consumption of cobalt compounds, mainly cobalt napthenate, by the California chemical industry, as shown in table 46, was reported by the companies listed in table 47.

Cobalt unit value was quite variable, depending on form, quality, and concentration. The quoted prices in Oil, Paint and Drug Reporter conformed rather closely to prices paid by the California chemical industry. Some cobalt compounds came from foreign sources, some from New York, and some from Pennsylvania.

Cobalt napthenate was used mainly as a raw material for the manufacture of salts and driers and for use in paints, inks, and pigments.

TABLE 45. - Cobalt (ore and metal) supply, 1960

	United States	California	Nevada
Producers	[1] 2	-	-
Production:			
Quantity, pounds	([2])	-	-
Value	([2])	-	-
Average value, per pound[3]	$1.50	-	-
Consumers stock, Dec. 31, pounds	1,856,000	-	-
Imports, metal, ores, and concentrates, do.	[4] 18,952,000	[5] 91,000	([6])
Exports, metal, ores, and concentrates, do.	1,829,000	[5] 197,000	([6])

[1] Producers of cobalt concentrate. Also, about 25 refiners or processors were active in the production of cobalt products.

[2] Concealed.

[3] Price published by major supplier for cobalt metal granules and fines, f.o.b. carrier, port of New York, in 500-pound drums. Ceramic grade was quoted at $1.15 per pound.

[4] Based on gross weight of metal, oxides, and salts: Belgian Congo 63 percent, Belgium 18 percent, Canada 7 percent, other 12 percent. Total estimated cobalt content was 12,170,000 pounds.

[5] Seaports only. The difference between exports and imports apparently can be attributed to interstate shipments.

[6] Not applicable.

TABLE 46. - Cobalt (compounds) consumption by the California chemical industry, 1960

Plants reporting consumption	10
Total consumption in above plants, pounds	93,200
Total value, delivered	$47,000
Value range, per pound, delivered	$0.40-$0.60

TABLE 47. - Consumers of cobalt (compounds) reporting chemical usage in California, 1960

Allied Chemical Corp.	Ellis Paint Co.
American Marine Paint Co.	O'Brien Corp. of San Francisco
California Chemical Co.	Security Paint Manufacturing Co.
California Ink Co.	Sherwin-Williams Co.
De Soto Chemical Coatings Co.	Vita-Fluor Corp.

Copper Supply--California and Nevada

Union Carbide and Nuclear Co. in Inyo County, Celtor Chemical Corp. in Humboldt County, and Mountain Copper Co. in Shasta County produced 94 percent of the total California output, as shown in table 48. The remainder came from 11 other operations within the State.

Virtually all of the copper recovered from Nevada ores in 1960 came from properties of Kennecott Corp. in White Pine County; The Anaconda Company in

Lyon County; Bristol Silver Mines Co., Lincoln County; and the Copper Canyon Group of claims in Lander County. Although 26 active mines contributed to the total output, only 10 were classified as copper mines.

TABLE 48. - Copper (ore and metal) supply, 1960

	United States	California	Nevada
Mines	130	[1] 14	10
Smelters	15	-	1
Production, mine:			
Quantity, short tons metal	1,080,000	1,100	77,500
Value, short tons metal	$693,468,000	$698,000	$49,745,000
Production, smelter:			
Quantity, short tons metal	1,811,000	-	([2])
Average value, per pound, metal	$0.321	-	-
Producer refined stocks, Dec. 31, short tons	98,000	-	-
Imports, do.	([3])	([3]) ([4])	([5])
Exports, do.	([6])	([4]) ([6])	([5])

[1] Three mines yielded 94 percent of total output.
[2] Figures withheld to avoid disclosing individual company data.
[3] Imports (unmanufactured):

	United States	California
Ore, short tons	10,000	-
Concentrates, do.	66,000	100
Matte, do.	5,000	-
Blister, do.	298,000	-
Refined, do.	143,000	1,300
Scrap, do.	3,000	-

[4] Through seaports only.
[5] Not applicable.
[6] Exports:

	United States	California
Ores, concentrates and matte (copper content), short tons	434,000	400
Scrap, do.	59,000	-
Pipes and tables, do.	700	-
Plates and sheets, do.	500	-
Wire and cable, do.	13,000	-
Other, do.	5,000	-

Copper Demand--California Chemical Industry

The tonnage of copper and copper compounds used in chemical manufacturing as shown in table 49 was reported at 16 plants operated by the 13 companies shown in table 50. As a basis for comparison, of the 1,350,000 short tons of refined copper consumed in the United States in 1960, 1,036 tons was consumed by chemical plants. Prices paid for copper compounds were highly variable depending on type, form, purity, concentration, and container. The Oil, Paint and Drug Reporter lists a wide variety of copper compounds and their price ranges. Virtually all the copper compounds consumed by the California

chemical industry were produced in California. Uses included specialty cleaning preparations, polishes, paints, fertilizers, insecticides, and a variety of other inorganic chemicals.

Several common standard specifications were cited (4), including ASTM D964 for copper powder used in anti-fouling paints, and D912 used for the same purpose.

TABLE 49. - Copper (metal and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Scrap copper	4
Copper oxide	5
Copper sulfate	3
Total consumption in above plants, short tons	1,800
Total value, delivered	$862,000
Average value, per short ton, delivered	(1)

[1] Highly variable price depending on form. Scrap copper sold on the order of $565.00 per short ton and copper sulfate crystals sold for $220 to $660 per ton depending on purity and quantity purchased. Some copper sulfate was marketed as solution to the California chemical industry.

TABLE 50. - Consumers of copper and copper compounds reporting chemical usage in California, 1960

American Marine Paint Co.
California Chemical Co.
Coastal Chemical Co.
Fuller, W. P., & Co.
Hawley, H. F., Chemical Co.
International Paint Co.
Leffingwell Chemical Co.
Mountain Copper Co.
Narmco Resins & Coatings Co.
Security Paint Manufacturing Co.
Shell Chemical Co.
Tec-Chemical Co.
United Heckathorn Co.

Diatomite Supply--California and Nevada

Most of the diatomite produced in California (table 51) came from two producers, and the figures were concealed to avoid disclosing company confidential data. California led all States in production in 1960. Most of the output came from open pit operations at Lompoc in Santa Barbara County, but tonnages also were mined in Kern and Napa Counties. The material was processed mainly in mills near the pit sites. Crude material was prepared for a wide variety of markets in nearby processing plants of Great Lakes Carbon Corp. and Johns-Manville Corp. Most of the finished diatomite was consumed as a filter aid, filler-carrier, and in thermal and acoustical products.

Nevada was second in diatomite production in 1960. There were five open pit operations; one each in Churchill, Esmeralda, Lincoln, Pershing, and Storey Counties. Increased output was attributed to the development of two new pits of filter-grade diatomite in Pershing County by The Eagle-Picher Co. which supplemented the output from the company's mine in Pershing County, where production began in 1958.

Preparation plants were operated in conjunction with the open pit mines in Esmeralda, Pershing, and Storey Counties. Crude material from the Churchill County deposit was processed in the producer's Lyon County plant.

TABLE 51. - Diatomite supply, 1960

	United States	California	Nevada
Producers	[1] 10	6	[2] 3
Production:			
Quantity.....short tons	[3] 482,000	([4])	([4])
Value	[5] $2,414,000	([4])	([4])
Average value, per short ton, f.o.b. source	$50.00	([4])	([4])
Imports.....long tons	-	-	([6])
Exports.....do....	92,000	[7] 30,000	([6])

[1] Operated 13 plants.
[2] Operated 5 mines.
[3] Based on prior three years. Domestic industry consists of 10 firms with 13 plants. Leading three firms supply most of the production.
[4] Figures withheld to avoid disclosing individual company data.
[5] Average value 1960-62 production.
[6] Not applicable.
[7] Through seaports only.

Diatomite Demand--California Chemical Industry

Table 52 shows the tonnage of diatomite consumed by the chemical companies listed in table 53. In addition to these plants reporting specific quantities valued at more than $1,000, about 25 chemical plants utilized quantities of diatomaceous earth valued at less than $1,000.

All the diatomite consumed originated in California and Nevada; it was usually obtained directly from the producer.

Numerous uses of diatomite were reported. The major ones included paints, cleaning compounds, soaps, cosmetics, resins, and filter aids (for pharmaceuticals, water in swimming pools, oils, organic and inorganic chemicals).

The nature and types of diatoms present and the content and nature of impurities are all-important factors in meeting requirements of most chemical applications. The three basic types of bulk diatomite marketed are natural, calcined, and flux-calcined. From each of these, a variety of products is supplied by manufacturers to suit specific applications. Products vary in particle size distribution, bulk density, color, chemical inertness, and other properties. Consumer specifications are sometimes quite rigid; they are difficult to meet and vary appreciably from one consumer to another for equivalent uses.

According to some leading consumers in the California chemical industry, producers of diatomite usually provide standards and conduct tests for the

various chemical uses; consequently each supplier of diatomite is expected to maintain quality within the limits of data sheets provided. In addition to recommendations made for their diatomite products, the usual practice is for producers to provide standard samples. The few specifications stipulated by individual consumers of diatomite are based on the properties of the new materials which have proven to be most satisfactory for their purposes. Consumers for specialty applications such as filtration have their own requirements in some instances, based on definite chemical and particle-size specifications. Polish and abrasive users also specify particle size and freedom from impurities. Few standard test methods are used, although some references were made to ASTM specifications D-604-42 and D719-51 concerning diatomaceous silica pigments.

TABLE 52. - Diatomite consumption by the California chemical industry, 1960

Plants reporting consumption	40
Total consumption in above plants, short tons	6,300
Total value, delivered	$331,000
Value range, per short ton, delivered	$28.00-$220.00
Typical freight rate, per short ton, Lompoc, Calif., to San Francisco	$7.20

TABLE 53. - Consumers of diatomite reporting chemical usage in California, 1960

American Agar & Chemical Co.
Barnett Laboratories, Inc.
Benton, C. H., Co.
California Chemical Co.
Coast Manufacturing & Supply Co.
De Soto Chemical Coatings, Inc.
Dow Chemical Co.
Dowman Products, Inc.
Du Bois Chemicals, Inc.
Dunne, Frank W., Co.
E-Z-Est Products Co., Inc.
FMC Corp.
Hawley, H. F. Chemical Co.
International Minerals & Chemicals Corp.
Kaiser Chemical Corp.
Klix Chemical Co., Inc.
Lever Brothers Co.
Maas, A. R., Chemical Co.
McCloskey Varnish Co. of the West
Mountain Copper Co., Ltd.
National Lead Co.
O'Brien Corp. of San Francisco
Pacific Soap Co.
Patek & Co.
Pittsburgh Plate Glass Co.
Rhodes, D. H. & Co.
Riker Laboratories, Inc.
Scofield, L. M., Co.
Shannon Luminous Materials Co.
Shell Chemical Corp.[1]
Shell Oil Co., Inc.
Sherwin-Williams Co.
Stauffer Chemical Co.[1]
Synkoloid Co.
United Heckathorn Co.
Vegetable Oil Products Co.
Vi-Cly Industries, Inc.
Vi-Jon Laboratories, Inc.

[1]Reported for two plants.

Performance tests for specific applications are not standardized. Depending upon the use, samples are sometimes tested to determine moisture content (free and combined), dry screen analyses, apparent density (wet, dry, and vibrated), absorption capacity, impurities, color, pH, particle size,

microscopic appearance, and chemical composition. For application as a filter aid, tests are conducted to determine the flow rate and clarity of the filtrate.

Gypsum Supply--California and Nevada

As shown in table 54, crude gypsum and gypsite output in California and Nevada totaled 1,616,000 tons in 1960, of which 892,000 tons was agricultural gypsite. Producers sold 878,000 tons of gypsite from State production. According to figures of the California Department of Agriculture, a total of 1,086,000 tons including out-of-State sources was consumed in California in 1960. Kern County alone produced 730,000 tons during the year. Gypsum also was produced in Kings, Merced, San Luis Obispo, and Santa Barbara Counties, solely for agricultural use.

TABLE 54. - Gypsum supply, 1960

	United States	California	Nevada
Producers	[1] 30	13	3
Production:			
Quantity.....short tons	9,268,000	1,616,000	802,000
Value	$35,690,000	$3,687,000	$2,721,000
Average value, per short ton, f.o.b. source	$3.85	$2.28	$3.39
Producer stocks, Dec. 31.....short tons	3,400,000	159,000	21,000
Imports (crude).....do....	[2] 5,301,000	[3] 469,000	([4])
Exports (crude).....do....	17,000	[5] 5,500	([4])

[1] Operated 69 plants. Four firms accounted for over 80 percent of the output.
[2] Canada 83 percent, Mexico 10 percent, Jamaica 6 percent, and other 1 percent.
[3] Through seaports only; 245,627 short tons valued at $224,914 entered San Francisco port and 223,917 short tons values at $203,000 entered Los Angeles port from Mexico.
[4] Not applicable.
[5] Seaport shipments only.

Rock gypsum was mined in Imperial and Riverside Counties for use in manufacturing building products, and in Ventura County for use as a retardant for cement. A plant in Alameda County recovered gypsum from salt water bitterns as a byproduct of magnesium production. The gypsum was sold for use in agriculture and as a cement retardant. Calcining plants were operated at plaster and board mills in Alameda, Contra Costa, Imperial, Los Angeles, and Riverside Counties.

Crude gypsum production in Nevada totaled 806,000 tons in 1960. Crude gypsum was shipped from Clark County, Nev., to gypsum board plants in Los Angeles and Newark, Calif., and for use as a cement retardant and in soil conditioning. The remaining output was processed at calcining plants in Clark and Washoe Counties, Nev., and at California plants, for construction purposes.

Gypsum Demand--California Chemical Industry

Table 55 shows the tonnage of gypsum consumed by the companies listed in table 56.

Virtually all the gypsum used in paints, varnishes, wood preservatives, and insecticides in California was locally produced. Agricultural gypsite used in direct soil application was outside SIC 28.

Ground gypsum is used in the paint industry under the commercial names of "terra alba" and "mineral white." Although gypsum has a low refractive index and usually is not suitable for use as a pigment in oil paints, it is used in the manufacture of low-cost lake pigments and as a base for cold water paints.

Gypsum for use in insecticides is seldom used alone, because it is comparatively dense after grinding; it may be mixed with kaolin to increase its flowability. The use of gypsum alone, however, would probably minimize the dispersion of the insecticide product in high winds.

TABLE 55. - Gypsum consumption by the California chemical industry, 1960

Plants reporting consumption	12
Total consumption in above plants, short tons	3,200
Total value, delivered	$40,000
Value range, per short ton, delivered	[1] $6.00-$25.00
Freight cost range, per short ton	$2.00-$10.00

[1] Calcined; crude gypsum averages about $6.00 per short ton delivered.

TABLE 56. - Consumers of gypsum reporting chemical usage in California, 1960

Boyle & Co.
Du Bois Chemicals, Inc.
Dunne, Frank W., Co.
Factor, Max & Co.
Finch Paint & Chemical Co.
Jones-Hamilton, Inc.
National Lead Co.
Plant Food Corp.
Rhodes, D. H., & Co.
Stone, E. B., & Son Co.
Synkoloid Co.
United Heckathorn Co.

Iodine Supply--California and Nevada

Iodine production declined sharply in California in 1960. Waste oil well brines were pumped from the Los Angeles basin to the Dow Chemical Co. Orange County extraction plant for production of iodine compounds. Deepwater Chemical Co. Ltd. recovered a small quantity of iodine at its plant at Compton, Los Angeles County, in early 1960 but subsequently suspended recovery operations and began purchasing crude iodine for use in manufacturing iodine salts. Iodine production figures are not revealed in table 57 to avoid disclosing company confidential data.

TABLE 57. - Iodine supply, 1960

	United States	California	Nevada
Producers	[1] 1	[1] 1	-
Production:			
Quantity.....pounds	([2])	([2])	-
Value	([2])	([2])	-
Average value, per pound, f.o.b. source	([2])	([2])	-
Imports (crude).....pounds	[3] 1,894,000	[4] 72,000	([5])
Exports.....do.	251,000	[4] 46,000	([5])

[1] Production came from 3 operations of the Dow Chemical Co. in southern California; refined iodine and iodine compounds were produced in about 50 plants, mainly in Eastern States.
[2] Figures withheld to avoid disclosing individual company data.
[3] Chile 76 percent, Japan 24 percent.
[4] Through seaports only.
[5] Not applicable.

Iodine Demand--California Chemical Industry

Dow Chemical Co. utilized its captive output of iodine in producing refined iodine products for use in the manufacture of a wide variety of items, including dyestuffs, heat-sensitive paints, light-polarizing materials, and special gas masks. Consumption data on purchases of elemental iodine were provided by Regent Scientific Co. and Deepwater Chemical Co. The consumption figure for California cannot be disclosed (table 58), but 1,944,000 pounds was consumed in the United States in 1960. The Oil, Paint and Drug Reporter quoted prices of $1.10 per pound for crude iodine in kegs and $2.20 a pound for resublimed, USP grade in drums, f.o.b., works.

Chlorine and bromine were substituted for iodine and iodine compounds wherever possible, as they are less expensive materials. Some substitutes for iodine compounds and antiseptics, such as mercurochrome and antibiotics, were used.

TABLE 58. - Iodine (elemental) consumption by the California chemical industry, 1960

Plants reporting consumption	2
Total consumption in above plants.....pounds	([1])
Total value, delivered	([1])
Average value, per pound, delivered	([2])

[1] Figures withheld to avoid disclosing individual company data.
[2] The following per pound prices were quoted by Oil, Paint and Drug Reporter: Crude iodine in kegs, $0.95-$1.10; resublimed iodine, USP, $2.00-$2.22; ammonium iodide, NF, drums, bottles, $4.26; calcium iodide, jars, $4.27-$4.52; potassium iodide, USP crystals, granular, powdered, drums, $1.40-$1.55; sodium iodide, USP, 300-pound drums, $1.98-$2.13.

Iron Oxide Pigments Supply--California and Nevada

As C. K. Williams Co. of Emeryville, Alameda County, a subsidiary of Charles Pfizer Co., was the only producer of iron oxide pigments in California in 1960, data could not be shown in table 59. Most of the output was brown, red, and yellow iron oxides made from scrap iron, using acids and caustics. Small tonnages of hematite from Arizona and limonite from Oregon were used to make natural brown iron oxide, ventian red, and ocher pigments. In addition, some finished iron oxide pigments were shipped into California from Pennsylvania.

Nevada reported no production of iron oxide pigments in 1960.

TABLE 59. - Iron oxide pigments supply, 1960

	United States	California	Nevada
Pigment mines	7	([1])	-
Iron mines	3	-	-
Production, pigment mines:			
Quantity, short tons	30,400	-	-
Value	$262,000	-	-
Average value, per ton, f.o.b.	$8.60	-	-
Production, iron mines:			
Quantity, short tons	40,700	-	-
Value	$373,000	-	-
Average value, per ton, f.o.b.	$9.20	-	-
Imports, short tons	14,460	([2])	([3])
Exports, do.	4,000	[4]130	([3])

[1] C. K. Williams manufactured iron oxide pigments from iron scrap, imported a small tonnage of ores from Arizona and Oregon, and operated a pigment mine in Colorado. California iron ore producers reported no sales of raw material to the pigment manufacturing industry.
[2] See table A-2 (appendix).
[3] No applicable.
[4] Through seaports only.

Iron Oxide Pigments Demand--California Chemical Industry

Table 60 shows the tonnage of iron oxide pigments consumed by the chemical companies listed in table 61. These 28 California plants consumed iron oxide pigments as raw materials, mainly for use in the manufacture of paints and inks.

In addition to uses of iron oxide pigments in paints, they are also used to color roofing materials, concrete and stucco, rubber, and floor tile. Sienna, formerly used in printing ink, has been replaced to a large extent by other pigments of brighter shades. (Only 81,000 tons was consumed for all uses in the United States in 1960.) According to the Oil, Paint and Drug Reporter, the market price of iron oxide pigments ranged from 6 to 16 cents a pound, depending on type and quality.

The consumers in the paint industry generally require conformance of the supplier to ASTM Tentative Specification D767-52T for the pigment Venetian red, where provision is made for three types. Red and brown iron oxide pigments come under ASTM Specification D84-51; raw and burnt sienna come under D765-48 and D763-48; and yellow iron oxide pigments are covered by Specification D768-47.

TABLE 60. - Iron oxide pigments consumption by the California chemical industry, 1960

Plants reporting consumption	18
Total consumption in above plants, short tons	2,200
Total value, delivered	$198,000
Value range, per short ton, delivered	[1] $12.00-$34.00
Typical freight rate, per short ton, Arizona to San Francisco	$9.00

[1] Crude oxide pigments; finished oxide pigments sold for $180.00 to $325.00 per short ton. (Average of all types was $90.00 per ton.)

TABLE 61. - Consumers of iron oxide pigments reporting chemical usage in California, 1960

Amercoat Corp.	Kaiser Aluminum & Chemical Co.
American Marine Co.	Klix Chemical Co., Inc.
California Ink Co., Inc.	O'Brien Corp. of San Francisco
De Soto Chemical Coatings, Inc.	Old Colony Paint & Chemical Co.
Finch Paint & Chemicals Co.	Pittsburgh Plate Glass Co.
Fuller, W. P., & Co.	Poly Resins Co.
Great Western Paint Co.	Sherwin-Williams Co.
Hercules Powder Co.	United Heckathorn Co.
International Paint Co., Inc.	Williams, C. K., & Co.

Lead Supply--California and Nevada

Table 62 shows the tonnage of lead produced in the United States, California, and Nevada in 1960. Lead and lead-zinc ores were mined in Alpine, Butte, Inyo, Mono, Nevada, San Bernardino, and Shasta Counties in California, but the Defense and Santa Rosa mines in the Modoc and Lee districts, respectively, of Inyo County were the primary sources in 1960.

Of the total lead produced in Nevada, 85 percent was recovered from lead ores, 8 percent from copper ores, 5 percent as a residue resulting from treating manganese ores, and 2 percent from all other primary sources. Three lead mines in Elko County, one each in Eureka and White Pine Counties, and a copper mine in Lincoln County were the source of more than three-fourths of the lead produced. In all, 36 mines contributed to the output.

TABLE 62. - Lead (ore and metal) supply, 1960

	United States	California	Nevada
Mines	[1]135	10	36
Smelters	11	1	-
Production, ore:			
Quantity (lead content)....short tons	246,669	400	987
Value	$57,722,000	$103,000	$231,000
Production, metal:			
Domestic....short tons	228,899	50	-
Foreign....do....	153,557	-	-
Average sales price per pound	$0.117	([2])	([2])
Producer stocks, Dec. 31, refined....short tons	248,000	-	-
Imports, ores, concentrates bullion....do....	146,000	-	-
Imports, pigs and bars....do....	206,000	8,450	([3])
Exports, all forms....do....	6,000	1,500	([3])

[1]265,000 short tons of primary lead was shipped to manufacturers of lead pigments which in turn shipped 11,770 tons of white lead (dry) valued at $4,806,000; 6,170 tons of white lead (in oil) valued at $2,810,000 (weight of white lead only but value of paste); 22,600 tons of red lead valued at $6,843,000; and 98,600 tons of litharge valued at $26,951,000.

Over 80 percent of the white lead produced went into paint and other chemical applications; red lead used in paints accounted for nearly half of the production, and many of the uses included (see p. 686, 1960 Minerals Yearbook, vol. I) under other undoubtedly could be classified in the chemical group.

[2]Not available.

[3]Not applicable.

Lead and Lead Compounds Demand--California Chemical Industry

Table 63 shows the tonnage of lead and lead compounds consumed by the chemical companies listed in table 64. These materials came mainly from California sources, but some compounds were obtained from Missouri, New Jersey, and New York. Lead and lead compounds were required by the California chemical industry for manufacturing white lead, red lead, lead napthenate, lead octoate, lead stearate, lead tallate, litharge, and other lead chemicals. Although galena can be used, metallic lead was mainly used in paints, inks, plastics, and rubber.

The major compounds consumed were lead oxide and red lead, white lead (a mixture of lead carbonate and lead oxide), basic lead sulfate, metallic lead, litharge, and leaded zinc pigments.

About 100,000 tons of lead was consumed in California (74,000 tons as refined soft lead, 24,000 tons as antimonial lead, and 2,000 tons in other forms) for all uses, but less than 8 percent was used in pigment manufacturing.

TABLE 63. - Lead (metal and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Lead oxide	12
Lead sulfate	2
Metallic lead	3
Other lead compounds	5
Total consumption in above plants, short tons	[1] 7,600
Total value, delivered, do.	$1,765,000
Value range, lead oxide, per short ton	$280.00-$380.00
Value range, primary lead, per short ton	$216.00-$246.00

[1] Consists of about 80 percent primary lead; the remainder is mainly lead oxide.

TABLE 64. - Consumers of lead and lead compounds reporting chemical usage in California, 1960

Amercoat Corp.	Fine Line Paint Corp.
American Marine Paint Co.	Fuller, W. P., & Co.
Armite Laboratories	International Paint Co., Inc.
Caldow Paint Co.	Long Manufacturing Co.
California Chemical Co.	National Lead Co.
California Ink Co., Inc., The	Poly Resins Co.
Daw, A. J. Printing Ink Co.	Security Paint Manufacturing Co.
De Soto Chemical Coatings, Inc.	Sherwin-Williams Co. of Calif., The
Dunne, Frank W., & Co.	Tibbetts-Westerfield Paint Co., Inc.
Ellis Paint Co.	Vi-Cly Industries, Inc.
Finch Paint & Chemical Corp.	Western Lead Products Co.

ASTM Specification D82-44, Basic Sulfate White Lead for Use in Paints, subscribed to by most California paint manufacturers, specifies that basic sulfate white lead should contain 15 to 29 percent lead oxide, the remainder being lead sulfate. Zinc oxide is limited to 5 percent, and the total of other impurities, including moisture and volatile matter, must not exceed 1 percent; size requirement is 99 percent passing 325-mesh.

Red lead was marketed in three grades under ASTM Specification D83-41, Red Lead Pigment. It was used primarily in the paint industry. Other uses were in colors, lubricants, rubber, and miscellaneous unspecified uses. ASTM recognizes three types of red lead for use in paint (4). These contain 97, 95, and 85 percent Pb_2O_3, the remainder being PbO. The total amount of impurities must not exceed 1 percent.

ASTM Specification D81-43 for white lead basic carbonate referred to by some consumers, requires it to be between 62 and 75 percent lead carbonate; it should be free from contaminants; moisture and volatile matter should not be greater than 0.7 percent; and the total of all other impurities is limited to 1 percent. Size requirement of basic lead carbonate is that at least 99 percent should pass 325-mesh.

Other pigments, chiefly titanium and zinc pigments, replaced lead pigments extensively in paint formulation.

Calcium plumbate was reported as a relatively new commercial compound and is a substitute for red lead as a rust inhibitor when mixed with linseed oil. Orange lead, produced by calcining white lead, was used in printing inks and enamels.

Primary metal had a delivered value range of $216 to $246 per short ton. The delivered value of lead compounds (mostly oxide) to the California chemical industry ranged from $280 to $380 per short ton.

Lime Supply--California and Nevada

The total lime produced in California, from 1894 through 1960, was 6,446,000 short tons, valued at $85 million. As shown in table 65, active plants in California produced 345,000 short tons of lime, valued at $5,628,000 in 1960. Seven plants in California had nine rotary kilns and three shaft-type kilns in operation, with a reported annual lime-burning capacity of 440,000 tons.

TABLE 65. - Lime supply, 1960[1]

	United States	California	Nevada
Plants	[2]156	7	4
Production:			
Quantity.....short tons	12,960,000	345,000	([3])
Value	$173,000,000	$5,628,000	([3])
Average value, per short ton, f.o.b. source.	$13.30	$16.30	([3])
Imports.....short tons	32,000	([4])	([5])
Exports.....do....	61,000	-	([5])

[1]Not included in limestone production figures.
[2]36 leading plants account for 72 percent of the production, and 56 plants account for 24 percent of the production.
[3]Figures withheld to avoid disclosing individual company data.
[4]None, except 4.5 short tons of dead-burned dolomite valued at $2,000 from United Kingdom (through seaports only).
[5]Not applicable.

The Natividad operation of Kaiser Aluminum & Chemical Corp. in Monterey County, producing dolomitic lime, was the largest lime-producing plant in the State. Plants operated also in Alameda, El Dorado, San Bernardino, San Diego, and Tuolumne Counties. Lime also was recovered in water-treatment plants.

Lime was produced in Nevada at plants in Clark and White Counties. Some other grades of lime were produced for use in construction as well as for water-purification, sugar refining, glass, agriculture, and for use in insecticides. Only a minor quantity of the hydrated lime produced in Nevada was consumed in the State; most of it was shipped to California. Some Arizona lime reportedly was shipped into California.

Lime Demand--California Chemical Industry

Table 66 shows the tonnage of lime consumed by the companies listed in table 67. Of all the many applications, insecticides and paints accounted for the major tonnage. (Alkali manufacture by the solvay process accounts for the major U.S. lime consumption; this is not true in California as sodium carbonate, potassium carbonate, and other saline materials are extracted from natural deposits in California.) Also, calcium carbide, which requires a significant amount of lime in the United States, is not manufactured in California. (As a basis for comparison, about three-quarters of the lime consumed in the United States for all uses was for chemical use, compared with less than 10 percent in California.)

TABLE 66. - Lime consumption by the California chemical industry, 1960

Plants reporting consumption	22
Total consumption in above plants, short tons	5,600
Total value, delivered	$127,000
Value range, per short ton, delivered	$15.00-$35.00
Freight cost, range per short ton	$3.00-$14.00

TABLE 67. - Consumers of lime reporting chemical usage in California, 1960

American Better Chemicals
American Potash & Chemical Co.
Borden Chemical Co., The
Caldow Paint Co.
California Chemical Co.
Chemical Process Co., Inc.
Coastal Chemical Co.
Colgate-Palmolive Co.
Dunne, Frank W., Co.
Emery Industries, Inc.
Hill Brothers Chemical Co.
Merck Marine Chemical Co.
Michel & Pelton Co.
Oil Base, Inc.
Shell Chemical Corp.[1]
Silver Line Products, Inc.
Stone, E. B., & Son
Synkoloid Co.
Union Carbide Chemicals Co.
Union Oil Co. of California
Universal Detergents, Inc.

[1]Reported for two plants.

Commercial-grade limestone, used in lime manufacture, was usually high-grade, having low silica and low iron contents. High-calcium lime contains at least 90 percent CaO and 0-5 percent MgO. Low-magnesium lime contains 5-25 percent magnesia. Dolomitic, or high-magnesium lime, contains 25-45 percent MgO (3).

Lime is widely variable in its physical characteristics, and, as a result, there were a multitude of specifications reported. The California chemical industry can account for many of the uses shown in figure 4.

Consumers of large tonnages of lime usually had individual specifications. Limits are designated on the settling rate, surface area, abrasiveness, particle size, gradation, whiteness, and other properties for certain uses.

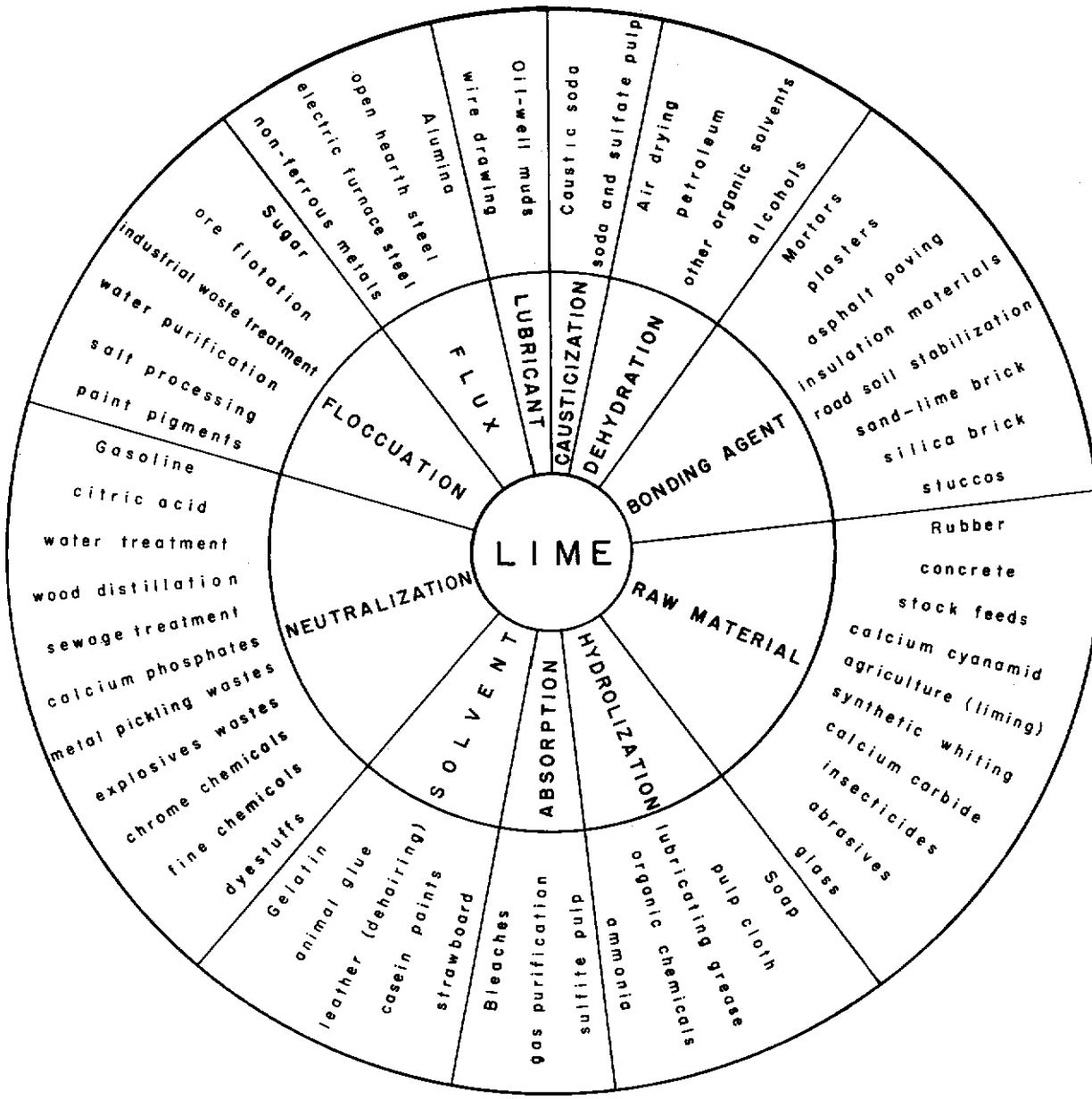


FIGURE 4. - Lime Uses.

ASTM C-46, C-53, C-258, C-259, C-25, C-110, and C-51 are pertinent specification standards which should be consulted by potential suppliers.

Lime was used extensively as a neutralizing agent, in insecticides, soap, resins (phenols), and (the) extraction of salt from brine.

Captive lime consumption for use in processing sodium carbonate, potassium sulfate, and other chemicals, such as are produced at the Stauffer (West End Chemical Div.) plant at Searles Lake, was not included in the total shown in table 66.

Limestone Supply--California and Nevada

Table 68 shows the tonnage of limestone and whiting produced in the United States, California, and Nevada. Of the limestone and oyster-shell produced in California in 1960, 80 percent was used in cement and lime manufacturing (compared with about 40 percent for the United States). The remainder went into agricultural, chemical and miscellaneous applications.

TABLE 68. - Limestone (crushed and ground) supply, 1960

	United States	California	Nevada
Producers	[1] 1,000+	48	6
Production:			
Quantity.....short tons	450,000,000	[2] 12,457,000	536,000
Value	$606,000,000	[2] $20,693,000	$1,147,000
Average value, per short ton, f.o.b. source	$1.35	$1.66	$2.15
Imports.....short tons	([3])	([1])	([4])
Exports.....do....	926,000	446	([4])

[1] Combined with other stone types.
[2] Excludes over 1 million tons of oyster shell used in cement manufacture.
[3] Crushed and ground limestone imports are not reported separately from other stone types; 222,000 short tons of chalk and whiting (natural) was imported.
[4] Not applicable.

Limestone was quarried in Clark and White Pine Counties, Nev., and was used for lime, flux, and other applications. Limestone, which constituted a major part of the total Nevada stone output in 1960, was shipped in substantial quantities into California for a variety of chemical uses.

Limestone Demand--California Chemical Industry

Table 69 shows the tonnage of limestone and whiting consumed by the chemical companies listed in table 70 at their California plants. Captive tonnage reported by consumers was excluded.

As a basis for comparison of consumption patterns in the United States and California, the United States consumed 2,637,000 tons of limestone for alkali manufacturing (none reported in California); 424,000 tons went into fertilizer filler, and 657,000 tons was prepared as whiting. Limestone was consumed in its various forms in California chemical manufacturing but primarily as ground limestone (or limestone whiting). Whiting is a rather loose term. The material may be either finely ground natural calcium carbonate (limestone, chalk, marble, oystershell, etc.) or the product obtained from chemical precipitation. It may be water-ground, air-ground, surface-treated, or not. The extent of preparation is all-important in establishing the value, and the product in which it is used seldom offers a clue as to the quality required.

TABLE 69. - Limestone (crushed and ground) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Crushed limestone	3
Ground limestone (whiting)	43
Total consumption in above plants, short tons	[1] 11,000
Total value, delivered	$271,000
Value range, per short ton, delivered	[2] $13.00-$80.00
Freight cost range, per short ton	$3.00-$8.00

[1] About 25 percent crushed limestone and 75 percent limestone whiting. About 145,000 short tons of crushed and ground limestone were reported for uses related to the chemical industry by limestone producers.

[2] Ground limestone and limestone whiting. Crushed limestone sold on the order of $8.00 per short ton, delivered.

NOTE: Because of the loose use of the word "limestone" some of the tonnage here might actually be lime.

TABLE 70. - Consumers of limestone (and whiting) reporting chemical usage in California, 1960

All-Phase Color Corp.
American Better Chemicals
American Marine Paint Co.
Beacon Paint & Wax Corp.
Beverly Manufacturing Co.
Caldow Paint Co.
California Chemical Co.
California Ink Co., Inc.
De Boom Paint Co.
De Soto Chemical Coatings
Du Bois Chemicals, Inc.
Dunn-Edwards Corp.
Dunne, Frank W., Co.
Ellis Paint Co.
Fine Line Paint Corp.
Fuller, W. P., & Co.
Gibson-Holmes Co.
Glidden Paint Co.
Grant & Co.
Great Western Paint Co.
Henry, W. W., Co.
Hill Brothers Chemical Co.
International Coatings Co.
International Wood Products Co.
Kaull, G. W., Co.
L. & H. Paint Products, Inc.
Master Putty Manufacturing Co., Inc.
Michael-Lawrence Co., Inc.
National Lead Co.[1]
O'Brien Corp. of San Francisco
Oil Base, Inc.
Old Colony Paint & Chemical Co.
Pittsburgh Plate Glass Co.
Poly Resins Co.
Rhodes, D. H., & Co.
Security Paint Manufacturing Co.
Shell Chemical Corp.
Sherwin-Williams Co.
Silver Line Products, Inc.
Synkoloid Co.
Tri-City Paint Co.
Vi-Cly Industries, Inc.
Vinyl-Line Paint Co.
Vita-Fluor Corp.
Walker Paint Co.

[1] Reported for two plants.

Limestone and marble were the major sources of whiting for the putty industry, replacing the traditional European cliffstone chalk. ASTM Specification D317-33 requires the whiting used in oil for glazing to be free from grit, virtually free from acid, and to contain 95 percent calcium carbonate.

Specifications for putty do not establish limits for the finer particles below 50 microns, which may be important in many applications.

Alternate materials for limestone whiting as a filler include a variety of materials such as ground talc and diatomite. No new materials threaten to displace limestone for most chemical uses in California.

The Oil, Paint and Drug Reporter quotes prices for calcium carbonate, as follows:

Natural, dry-ground, air floated, 325-mesh in bags, carlots, f.o.b. source, short ton	$10.50
Natural, water-ground to 0.5 to 10 microns, in bags, f.o.b. source	$30.00
As above but 10 to 30 micron size	$17.00-$18.00
Chalk, whiting, 325-mesh in bags, carlots, f.o.b. source	$32.00-$34.00
Precipitated, dense, in bags, carlots, f.o.b. source	$30.00-$38.50
Surface-treated	$42.00-$44.00
Ultrafine	$117.50-$167.50

Depending on the use, physical properties and chemical composition of limestone are of primary importance. Limestone, either natural or calcined to lime, had by far the widest and most diversified use of all varieties of stone, and it is a necessity in the chemical industry. (Although limestone was used in large quantities for the manufacture of soda ash by the ammonia-soda process, it was not used for that purpose in California because there are sources of natural sodium carbonate, or trona, available--one in California at Searles Lake, and the other in Wyoming. Consequently, limestone is not a significant factor in soda ash production in California; West End Chemical Co. does use some limestone, however.)

Limestone can have no more than trace amounts of manganese, clay, iron, and magnesia when used in producing bleaching powder, according to one consumer.

Most of the finely ground limestone, or limestone whiting, produced was used in paint, rubber, and putty, in the order named. The rest was used for many diversified chemical purposes, including calcimine, dyes, fabrics, plastics, phonograph records, dentrifices, explosives, medicine, white ink, glue, and insecticides.

Precipitated calcium carbonate was used in the California paint and rubber industries, but separate data are not available.

Whiting reportedly cannot effectively compete in paint as an opacifier with zinc oxide, white lead, and the titanates because of its lower refractive index, but it was used by the California chemical industry as an inexpensive filler and extender, particularly in low-cost oil paints. Whiting is the standard extender for flat wall paints and enamel undercoats. Water thinnable paints, which have grown rapidly in use, consist essentially of a pigment, a filler, and an organic colloid. Both precipitated and ground whitings are

used, but special types of surface-treated whitings are preferred under certain conditions. The factors controlling the use of extenders in paints are: Particle size and particle size distribution, freedom from impurities, textural properties, particle shape, chemical reactivity, oil absorption, color, bulk density, and specific gravity. Chalk whiting was reported to have somewhat better opacity than limestone or marble whiting. This may be due to the characteristic shapes, which cause a greater dispersion of light.

Specifications for calcium carbonate products include: U.S. Navy Specification 52C28 (for precipitated calcium carbonate) provides for comparison of color, absorption, consistency, and abrasion with a standard sample, with specific requirements on particle size and composition; ASTM Specification D1199-52T (for calcium carbonate used in pigments or as filler in putty) provides detailed requirements for the grades P.C. (precipitated calcium carbonate), G.C. (ground mineral), and G.M. (a ground dolomite).

(Considerable limestone whiting was used in the rubber industry, but only synthetic rubber is included in SIC 28.) Usually, a product is specified as containing not less than 98 percent $CaCO_3$, with the following maxima: Free CaO, 2 percent; copper oxide, 0.005 percent; manganese, 0.02 percent, with traces of iron oxide, alumina, and silica. A major rubber producer specifies the following properties:

Chemical

1. Heating loss with a maximum of 0.2 percent.
2. Ignition loss with a range between 42 to 44 percent.
3. Alkalinity, with a maximum requirement of 0.03 percent maximum.

Physical

1. Color, usually to match a type sample which will vary, depending on the particular type and grade, from white to gray.
2. Density, within a reasonable tolerance of that of a type sample.
3. Sieve test, the amount remaining on a 325 mesh screen is determined and a maximum limit specified, varying from about 0.1 to 1 percent, depending on grade.
4. A compounding test in rubber, made in accordance with a standard recipe and procedure.

Whiting made specifically for rubber is surface treated with fatty acids to increase its dispersion in rubber. Whiting is used because of its processing characteristics rather than the properties conferred on the final product.

Whitings are not used in all rubber compounds; for example, tire stocks of either tread or carcasses do not contain whiting.

Magnesium Compounds Supply--California and Nevada

The Western Quarry near Livermore, Calif., was operated by Mother Lode Rock Industries, Inc., the only active magnesite mine in California in 1960.

FMC Corp. operated salt water bittern extraction plants in Alameda and San Diego Counties for removal of magnesium hydroxide and magnesium chloride, respectively. Kaiser Aluminum and Chemical Corp. in Monterey County and Merck & Co. in San Mateo County used calcined dolomite and limestone to extract magnesium compounds from sea water. Such details as can be revealed are shown in table 71.

TABLE 71. - Magnesium compounds supply, 1960

	United States	California	Nevada
Brucite and magnesite.....crude	6	1	2
Plants.....compounds	23	3	-
Total short tons produced.....crude	[1] 499,000	([2])	([2])
Do.....compounds	[3] 571,966	[4] 86,500	-
Total value of production.....crude	[1] $2,051,000	([2])	([2])
Do.....compounds	[3] $35,155,000	[4] $6,233,000	-
Average value per short ton, f.o.b. source.....crude	$4.10	([2])	([2])
Do.....compounds	$61.50	$72.00	-
Imports (crude magnesite).....short tons	[5] 118,000	1,800	([6])
Exports (magnesite and magnesia, dead-burned).....do....	92,000	[7] 34,000	([6])

[1] Also 66,000 short tons of caustic-calcined magnesia, 506,000 short tons of refractory magnesia, and 1,949,000 short tons of dead-burned dolomite was produced (see BuMines 1960 Minerals Yearbook for details).
[2] Figures withheld to avoid disclosing individual company data.
[3] Also five plants produced 17,500 short tons of $MgCO_3$ (ppt.); five plants produced 320,000 short tons of $Mg(OH)_2$; and seven plants produced 160,000 short tons of $MgCl_2$
[4] Sea water and bitterns only.
[5] A variety of magnesium compounds was imported.
[6] Not applicable.
[7] Also magnesite and magnesia (except dead-burned) and manufacturers n.e.c. were exported in 1960. (See table A-3, appendix.) Through seaports only.

Standard Slag Co. and Basic, Inc., mined magnesite near Gabbs, Nye County, Nev., and produced caustic-calcined and refractory magnesia in nearby plants. Basic, Inc., upgraded magnesite by flotation and shipped brucite from stockpiles. Expansion of facilities, which began in 1958 at this operation, was completed and allowed a wider range of products (31).

Magnesium Compounds Demand--California Chemical Industry

Because two companies consumed most of the magnesium compounds produced, the data in table 72 must be concealed. Table 73 lists the companies that consumed magnesium compounds and dolomite for use in a variety of chemical applications.

California chemical manufacturers consumed magnesium compounds of technical and USP grades for use in fertilizers, plastics, and a wide variety of miscellaneous uses, including filler for paint and ink.

Virtually all the magnesium minerals and compounds came from California sources, except some magnesium sulfate which was obtained from Germany. Magnesium oxide sold on the order of 28 cents per pound; magnesium carbonate (technical grade) at 12 cents per pound; and magnesium sulfate (technical grade) sold at from $2.15 to $3.00 for 100-pound bags.

TABLE 72. - Magnesium (minerals and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Crude minerals	5
Magnesium oxide	7
Metal (powder)	2
Sulfate	3
Silicate	1
Total consumption in above plants, short tons	([1]) ([2])
Total value, delivered	([2])
Average value, per short ton, delivered	([2])
Freight cost range, per short ton	$4.00-$6.00

[1] Two companies consumed most of the tonnage reported.
[2] Figures withheld to avoid disclosing individual company data.

TABLE 73. - Consumers of magnesium minerals and compounds reporting chemical usage in California, 1960

Amercoat Corp.	Kolmar Laboratories, Inc.
American Potash & Chemical Corp.	Merck & Co., Inc.
Caldow Paint Co.	Narmco Resins & Coatings Co.
California Chemical Co.	Philadelphia Quartz Co. of California
California Ink Co., Inc.	Poly Resins Co.
Ellis Paint Co.	Security Paint Manufacturing Co.
FMC Corp.	Stone, E. B., & Son
Hill Brothers Chemical Co.	Swift & Co.
Kaiser Aluminum & Chemical Co.	Vita-Fluor Corp.

Manganese Supply--California and Nevada

Table 74 shows the United States, California, and Nevada production data which can be revealed. There was no production of chemical-grade manganese in California and Nevada in 1960. Low grade manganiferous ore was shipped to an Arizona mill from the Buckeye mine in the Mt. Oso area of Stanislaus County and from a small mine in Tehama County for upgrading and eventual consumption by California steel producers.

Manganese, Inc., in Clark County was the only source of manganese ore concentrate in Nevada during 1960. The ore was nodulized in a nearby plant before shipment. The total shipment (49,076 long tons gross weight, valued at $3.3 million) went to General Services Administration.

Deposits of manganese-bearing rocks are widely distributed in California and Nevada. More than 700 localities in 44 counties have been prospected. About one-fourth of the deposits have yielded ore. The Federal Bureau of Mines, Federal Geological Survey, California Division of Mines, and Nevada Bureau of Mines have published numerous reports on manganese deposits. In addition, slags from open-hearth and blast furnaces have been studied as potential sources of manganese.

TABLE 74. - Manganese (ore) supply, 1960

	United States	California	Nevada
Producers	[1]4	1	([2])
Production:			
Mn over 35 pct...short tons (Mn content)	[3]39,100	-	49,000
Mn 5-35 pct.....do.....	[4]49,800	100	([5])
Mn over 35 pct.....value (Mn content)	$5,352,090	-	$3,301,000
Under 35 pct.....do.....	$4,466,000	([5])	([5])
Average value, f.o.b. source:			
Mn over 35 pct.....	$66.90	-	-
Mn 5-35 pct.....	$6.80	([5])	([5])
Producer stocks, Dec. 31.....short tons	2,588,000	([5])	([5])
Imports, Mn over 35 pct.....do....	[6]1,082,000	[7]300	([8])
Exports.....do....	[9]5,000	-	([8])

[1]With the close of the domestic purchase program in August 1959, the pattern of the domestic manganese ore-producing industry changed from approximately 100 to 4 producers.
[2]No production in 1961; plant sold and dismantled.
[3]Represents 80,000 tons of ore (gross weight) over 35 percent Mn.
[4]Represents 658,500 tons of ore (gross weight) under 35 percent Mn.
[5]Figures withheld to avoid disclosing individual company data.
[6]From Brazil 35 percent, Africa 34 percent, and India 20 percent.
[7]Through seaports only.
[8]Not applicable.
[9]Represents re-exports of imported ore which has been ground and blended.

Manganese Ore and Compounds Demand--California Chemical Industry

None of the canvassed California industries reported consumption of crude manganese ore. Table 75 shows data on consumption of manganese compounds. The 11 companies listed in table 76 reported consumption of a variety of manganese compounds, mainly sulfate, primarily from eastern Tennessee. Some items were also obtained from Minnesota.

No specific chemical requirements were designated for the manganese compounds purchased by the respondents. Based on company products manufactured, the compounds of manganese mainly went into the manufacture of paint and ink. American Potash and Chemical Corp., at Henderson, Nev., purchased manganese ores from mines in Arizona and Mexico in 1960 for use in the production of electrolytic manganese dioxide. Some additional companies consumed refined

manganese chemicals, such as acetate, chloride, borate, napthenate, oleate, resinate, and tallate, in quantities valued at less than $1,000 at each plant during the year. As these items were considered to be beyond the first marketable stage, they were excluded from the study.

A variety of materials can be substituted for manganese in some chemical applications, depending on cost and other factors. Manganese carbonate is manufactured and competes with manganese ore. In some instances other manganese chemicals were produced from manganese carbonate.

TABLE 75. - Manganese (compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Manganese sulfate	8
Manganese carbonate	1
Manganese (other compounds)	2
Total consumption in above plants, short tons	360
Total value, delivered	$46,000
Value range, per short ton, delivered	$118.00-$150.00

TABLE 76. - Consumers of manganese compounds reporting chemical usage in California, 1960

American Marine Paint Co.
California Chemical Co.
California Ink Co., Inc.
Coastal Chemical Co.
Dunne, Frank W., Co.
Ellis Paint Co.
Leffingwell Chemical Co.
Parker Rust Proof Co.
Stone, E. B., & Son
Swift & Co.
Vita-Fluor Corp.

Mercury Supply--California and Nevada

Well over two-thirds of all mercury produced in the United States through 1960 came from California deposits. As shown in table 77, 42 mines produced mercury in California in 1960, with 5 mines producing more than 90 percent of the total. (The New Idria mine, San Benito County; the Mount Jackson mine, Sonoma County; the Abbot mine, Lake County; the Buena Vista mine, San Luis Obispo County; and the New Almaden mine, Santa Clara County.)

Mercury was produced in 20 mines in 7 counties of Nevada, but 3 mines in Humboldt County produced 90 percent of the output. The Cordero mine, the major mercury producer in the State, was the second largest in the Nation.

TABLE 77. - Mercury supply, 1960

	United States	California	Nevada
Mines	[1]75	42	20
Production:			
Quantity.....flasks[2]	[3]33,000	18,000	8,000
Value	$7,002,000	[4]$3,955,000	[4]$1,648,000
Average value, per flask, f.o.b. source.	$210.76	$210.00	$208.00
Producer stocks, Dec. 31 .....flasks	[2]$20,000	400	2,000
Imports.....do..	19,500	-	([5])
Exports.....do..	360	1	([5])

[1]Leading six producers supplied 85 percent of production, each producing over 1,000 flasks.
[2]Flask--76 lbs.
[3]California accounted for 56 percent, Nevada 24 percent, Alaska 13 percent, Idaho 6 percent, and Oregon 1 percent.
[4]Calculated value based on New York price.
[5]Not applicable.

Mercury Demand--California Chemical Industry

Two companies consumed most of the mercury in the California chemical industry, so details on consumption cannot be shown in table 78. The companies listed in table 79 reported that nearly all the mercury consumed came from California and Nevada but that some was shipped in from Arizona.

Mercury metal must contain less than one part per million of any base metal, for nearly all chemical uses. Mercury reclaimed from gold and silver amalgamation usually contains excessive quantities of objectionable impurities unless it is purified by distillation.

Mercury was used as a catalyst by California chemical manufacturers, and in paints (marine) and pesticides. According to Oil, Paint and Drug Reporter, mercuric oxide, red, 50-pound drums, f.o.b. works, sold for $4.72 per 100 pounds. Other materials can replace mercury as a cathode. Copper might be substituted for mercury compounds in agricultural use.

TABLE 78. - Mercury consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Metallic mercury	2
Mercuric oxide	3
Mercury acetate	1
Total consumption in above plants.....flasks	([1])
Total value, delivered	([1])
Average value, per flask, delivered	[2]$210.76

[1]Figures withheld to avoid disclosing individual company data.
[2]Average U.S. figure.

TABLE 79. - Consumers of mercury reporting chemical usage in California, 1960[1]

American Marine Paint Co.	Ellis Paint Co.
California Ink Co., Inc.	Fuller, W. P., Co.
Dow Chemical Co.	Precision Chemical Corp.

[1]Only Dow Chemical Co. and Precision Chemical Corp. of the above companies consumed liquid mercury; others consumed mercury compounds. Companies such as Regent Scientific Co. which reported consumption of mercury were excluded because of being technically classified outside the chemical industry group.

Mica Supply--California and Nevada

Only one producer of crude mica (sericite schist) operated in California during 1960, so production data for that state must be concealed in table 80. The deposit is near Ogilby, Imperial County. Mica from the property was dry-ground by the producer and sold for roofing material. Crude, scrap mica shipped in from South Dakota and imported from India and Mexico was dry-ground at a Los Angeles County processing plant and sold to paint and roofing manufacturers. A fine-grained mixture of sericite and quartz, with a trade name of "Marter-white," quarried between Victorville and Barstown in San Bernardino County and marketed by Desert Minerals, Inc., in Los Angeles, might be broadly classified as mica, but it is more closely allied with clay or pyrophyllite and is considered in the clay (other) classification in this study. Del Monte Properties Co. intermittently markets a few tons of biotite mica as a lubricating agent and for use in roofing, but none was reported in 1960.

Mica schist, pyrophyllite, and mica-bearing pegmatites have been mined intermittently at several other California localities. The deposits are described in the literature (13).

Nevada reported no production of mica during 1960.

TABLE 80. - Mica (ground) supply, 1960

	United States	California	Nevada
Producers	[1]30	1	-
Production:			
Quantity, sold or used, by producers, short tons	[2]98,000	([3])	-
Value	$5,193,000	([3])	-
Average value, per short ton, f.o.b. source	$52.99	([3])	-
Imports, short tons	([4])	([5])	([6])
Exports, ground mica, do.	[7]3,500	7	([6])

[1]Leading four firms supplied nearly half of production.
[2]Dry-ground 90 percent; wet-ground 10 percent.
[3]Figures withheld to avoid disclosing individual company data.
[4]Only 23 tons of ground and pulverized mica was imported, but a considerable tonnage of other types was imported. (See BuMines 1960 Minerals Yearbook, vol. I.)
[5]No ground and pulverized mica came through California seaports in 1960, but 55 tons of unmanufactured mica entered San Francisco and Los Angeles ports.
[6]Not applicable.
[7]Valued at $370,000.

Mica (Ground) Demand--California Chemical Industry

As one company consumed most of the mica, details on consumption cannot be shown in table 81. (The mica used by U.S. chemical manufacturers came from scrap, schists, and byproduct sources, and was either dry-ground under pressure, micronized by jet impact, or wet-ground. Specifications for high-grade, wet-ground mica called for 99.5 percent through 80-mesh and 88 percent passing 325-mesh. Specifications for dry-ground mica varied with different consumers and uses.)

The companies listed in table 82 consumed ground mica for use mainly in paints. Unit value ranged up to $264 a ton, with most materials selling in the order of $100 to $150 a ton, delivered. A detailed listing of mica size ranges and prices appears in the Oil, Paint and Drug Reporter. Mica was shipped in from Oregon, West Virginia, New York, North Carolina, Maryland, Arizona, India, and Italy. Freight rates ranged from $3.50 (from port) to $36.00 a ton.

TABLE 81. - Mica (ground) consumption by the California chemical industry, 1960

Plants reporting consumption	16
Total consumption in above plants	(1)
Total value, delivered	(1)
Average value, per pound, delivered	[2] $0.04
Freight cost range per short ton	$20.00-$36.00

[1] Figures withheld to avoid disclosing individual company data.
[2] Quotation of Oil, Paint and Drug Reporter for dry-ground mica, for use in paint, in bags, f.o.b. source in carlots. Wet-ground mica for use in paint and lacquer varied from 8½ to 9 cents per pound, same basis.

TABLE 82. - Consumers of mica reporting chemical usage in California, 1960

American Better Chemicals
Amercoat Corp.
Caldow Paint Co.
Central Valley Chemical Corp.
De Soto Chemical Coatings, Inc.
Du Bois Chemical, Inc.
Dunne, Frank W., Co.
Factor, Max & Co.
L. & H. Paint Products, Inc.
National Lead Co.[1]
O'Brien Corp. of San Francisco
Rhodes, D. H., & Co.
Security Paint Manufacturing Co.
Synkoloid Co., The
Vi-Cly Industries, Inc.

[1] Reported for two plants.

ASTM Specification D607 for mica pigment, cited by some consumers, requires a wet-ground muscovite with a maximum apparent density of 10 pounds per cubic foot. Coarse particles must not exceed 0.1 percent on 140-mesh and 7 percent on 325-mesh. Moisture and other volatile matter must not exceed 0.5 percent.

Ground mica acts as a mold lubricant in the rubber and plastics industry, as well as a filler. It acts as a lubricant, filler, extender, bond, and as a wear-resistant surface film in paints. Sericite mica is produced mainly for use in roofing and in rubber manufacturing (not included in SIC 28. Some use is made of mica in California in asphalt and plastic floor tile and in wallpaper (not SIC 28). Biotite has been used from time to time in lubricating greases.

Phosphate Rock and Phosphorus Supply--California and Nevada

There has been no recorded production of phosphate rock in California or Nevada. Phosphate rock, phosphoric acid, and elemental phosphorus, in addition to fertilizers and phosphate compounds, were brought into California from out-of-State sources. Also, California fertilizer producers made phosphoric acid, super phosphates, and ammonium phosphates from materials shipped into the State.

Although no phosphatic materials have been mined in California (table 83), apatite occurs in the Titanomagnetite rocks of the San Gabriel Mountains and minor occurrences of phosphatic shales and nodules occur in several localities.

An area of about 100,000 square miles in parts of Idaho, Montana, Nevada, Utah, and Wyoming contains an estimated 8 billion tons (56) of mineable phosphate rock.

Collophane nodules are found off the coast of California in potentially commercial quantities. The Federal Bureau of Mines and others have studied the feasibility of commercial production from offshore deposits.

TABLE 83. - Phosphate rock supply, 1960

	United States	California	Nevada
Producers	[1]26	-	-
Production:			
Quantity.....long tons	17,516,000	-	-
Value	$117,041,000	-	-
Average value, per long ton, f.o.b. source	$6.68	-	-
Producer stocks, Dec. 31.....long tons	4,181,000	-	-
Imports, crude.....do....	129,290	([2])	([3])
Exports, crude.....do....	4,251,000	-	([3])

[1]Leading five firms supplied 67 percent; next five supplied 23 percent.
[2]None, but 684 tons of dicalcium phosphate entered through seaports. A considerable tonnage of phosphate rock, elemental phosphorus, and phosphoric acid entered California by rail, mainly from the Montana-Utah area (see table 6).
[3]Not applicable.

Phosphate Rock and Phosphorous Compounds Demand--California Chemical Industry

Table 84 shows the tonnage and value of phosphate rock and phosphorous compounds consumed by the California chemical companies listed in table 85. All the phosphate rock and most of the elemental phosphorus, phosphoric acid, and phosphorous compounds came into California from Idaho, Montana, and Utah. To avoid revealing company confidential figures, data on different types of phosphatic raw materials consumed were combined. Most of the phosphate rock and phosphorous compounds went into the manufacture of super-phosphate and triple-superphosphate. The elemental phosphorus and phosphoric acid were used to make inorganic and organic chemicals which, in turn, were employed as water softeners, in soaps and detergents, plasticizers, insecticides, and for many other purposes.

TABLE 84. - Phosphorus (ore, elemental, and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Crude phosphate rock	9
Elemental phosphorus	3
Phosphoric acid	8
Other compounds	5
Total consumption in above plants, long tons	[1] 196,000
Total value, delivered	$8,903,000
Value range, per short ton, delivered	[2] $100.00-$325.00
Typical freight rate, per short ton, Idaho to San Francisco, for phosphate rock	$7.50

[1] Combined figures as reported; no attempt has been made to establish a common denominator.

[2] Phosphorous compounds; phosphate rock $14.00 to $17.00 per long ton. (Average of all types was $45.40.)

TABLE 85. - Consumers of phosphate rock, elemental phosphorus, and phosphorous compounds reporting chemical usage in California, 1960

Amercoat Corp.
Amchem Products, Inc.
American Better Chemicals Co.
Best Fertilizer Co.
California Chemical Co.
Certified Home Products
Chemurgic Corp.
Cleaning Chemicals Corp.
Colgate-Palmolive Co.
De Soto Chemical Coatings, Inc.
Economy Chemical Co.
FMC Corp.
Hercules Powder Co.
Klix Chemical Co., Inc.
Maas, A. R., Chemical Co.
Monsanto Chemical Co.
Plant Food Corp.
Poly Resins Co.
Stauffer Chemical Co.[1]
Stone, E. B., & Son
Swift & Co.
Turco Products, Inc.
United Heckathorn Co.
Western States Chemical Corp.

[1] Reported for two plants.

Potassium Compounds Supply--California and Nevada

Except for a relatively small quantity of potassium sulfate obtained from flue dust at a cement plant near Davenport, Santa Cruz County, for use as a soil aid, the entire 1960 California potash production was extracted from Searles Lake brines by American Potash and Chemical Corp., at Trona, San Bernardino County. Consequently, production details could not be shown for California in table 86. Muriate of potash (potassium chloride, some of which was converted to potassium sulfate) was extracted from the brines. The company recently completed building a $7 million evaporation plant to replace obsolete potash, borax, soda ash, and salt-cake producing units. The expansion reportedly would increase production considerably.

Numerous salt lakes have been worked for potash in various parts of the United States, but the Searles Lake deposit, where the potash (K_2O) content ranges from 4 to 20 percent, is the only one that has been operated on a large scale. Large quantities of sodium carbonates, sodium sulfates, borax, disodium lithium phosphate, and bromine are also produced from Searles Lake brines.

No potassium compounds were produced in Nevada. Several companies were actively investigating extensive saline deposits as a potential source of potash and other minerals.

TABLE 86. - Potash supply, 1960

	United States[1]	California	Nevada
Producers	[2]11	2	-
Production:			
Quantity, short tons	[3]2,638,000	([4])	-
Value	$89,676,000	([4])	-
Average value, per short ton, f.o.b. source	$20.04	([4])	-
Producer stocks, Dec. 31, short tons	[3]311,000	-	-
Imports, do.	[5]400,000	([6])	-
Exports, do.	[7]832,893	[8]539,000	-

[1] Six leading firms supplied 92 percent (includes two cement manufacturers--one in California--producing potash as a byproduct).
[2] Production is centered primarily in New Mexico, 93 percent; California, Maryland, Michigan, and Utah, 7 percent.
[3] K_2O equivalent. Marketable production of potassium salts totaled 4,472,000 short tons.
[4] Figures withheld to avoid revealing individual company data.
[5] Revised in 1961. West Germany 41 percent, East Germany 20 percent, France 19 percent, Spain 10 percent, and other 10 percent.
[6] A variety of potassium compounds imported (see table A-2, appendix).
[7] 815,521 short tons valued at $23,518,000 (fertilizer) and 17,372 short tons valued at $2,417,995 (chemical).
[8] Through seaports only.

Potassium Compounds Demand--California Chemical Industry

Table 87 shows tonnage and value of potassium compounds consumed for chemical uses by the companies listed in table 88. The main use of potassium compounds was in the manufacture of fertilizer. Crude potassium compounds were processed to yield a variety of other end-product potassium chemical compounds, such as carbonate, chlorate, cyanide, bromide, chromate bichromate, nitrate, and perchlorate. Consumption by primary producers who utilized their production at the site (captive) in producing further refined products were excluded to avoid duplication of consumption data. Potassium compounds were important ingredients in the manufacture of soaps and detergents in California.

Manufacture of potassium compounds sometimes requires a number of raw materials, for example a ton of potassium chlorate reportedly requires 400 pounds of lime, 4,320 pounds of chlorine, and 1,400 pounds of potassium chloride (18). Potassium chloride, in turn, is extracted from about 41,000 pounds of saturated lake brine.

TABLE 87. - Potash consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Potassium minerals	8
Potassium chloride	5
Other compounds	5
Total consumption in above plants, short tons	[1] 10,400
Total value, delivered	$915,000
Value range, per short ton, delivered	[2] $33.00-$230.00
Typical freight rate, per short ton, Searles Lake to Los Angeles	$5.60

[1] Combined figures as reported. No attempt has been made to establish a common denominator.
[2] Depending on type, form, and purity.

TABLE 88. - Consumers of potash (potassium mineral and compounds) reporting chemical usage in California, 1960

American Better Chemicals Co.	Klix Chemical Co.
Boyle & Co.	Jones-Hamilton, Inc.
California Chemical Co.[1]	Long Manufacturing Co.
Colgate-Palmolive Co.	Maas, A. R., Chemical Co.
Deepwater Chemical Co., Ltd.	National Research & Chemical Co.
Dow Chemical Co.	Rand Chemical Co.
FMC Corp.	Swift & Co.
Fuller, W. P., & Co.	United States Borax & Chemical Corp.
Houghton, E. F., & Co.	

[1] Reported for two plants.

The following bulk prices per K_2O unit were quoted by American Potash and Chemical Corp., carlots, f.o.b. source, for California potash in 1961:

	January-June
New improved muriate of potash, 60 percent K_2O minimum.....	45.5 cents
Granular muriate of potash, 60 percent K_2O minimum.....	46.5 cents

There are no substitutes for potassium compounds in agriculture, and changes in price would have little effect on sales. However, as in many bulk commodities, the cost of transportation from place of production is a major part of the delivered cost of potash. The higher transportation cost from producing areas to consuming centers, the development of the Canadian potash industry in Canada, and the threat of lower priced imports from Europe are problems of concern to the domestic potash industry.

Salt Supply--California and Nevada

As shown in table 89, salt was produced at 11 plants in 7 California counties in 1960. Most of the output was solar salt harvested and processed in the San Francisco Bay area. Leslie Salt Co., the leading producer, operated 4 plants in the area and planned to open an additional operation.

TABLE 89. - Salt supply, 1960

	United States[1]	California	Nevada
Plants.....	[2]93	11	1
Production:			
Quantity.....short tons	25,481,000	1,443,000	([3])
Value.....	$161,214,000	([3])	([3])
Average value, per short ton, f.o.b. source.	$6.33	([3])	([3])
Imports.....short tons	[4]1,057,000	[5]25	([6])
Exports.....do....	420,000	[5]310,000	([6])

[1]Louisiana produced 19 percent, Texas 16 percent, Michigan 18 percent, New York 16 percent, Ohio 12 percent, and California 5 percent of the total production.

[2]Leading 4 companies operated 14 plants and supplied 47 percent.
Next 6 " " 24 " " " 36 "
remaining " " 55 " " " 17 "
93 plants supplied 100 percent.

[3]Figures withheld to avoid revealing individual company data.

[4]Canada 61 percent; Bahamas 17 percent; Mexico 13 percent; others 9 percent.

[5]Through seaports only.

[6]Not applicable.

Although solar evaporation was the major method of production in California, a salt deposit (mined by California Salt Co.) in San Bernardino County contributed significantly to the total output. More than 50 percent of the California salt production was consumed within the State. The remainder was shipped to Nevada, Washington, Arizona, Oregon, Hawaii, several other States, various Pacific islands, Canada, and Mexico. Salt was sold chiefly for use as a food preservative, in the manufacture of chlorine and caustic soda (of the five chlorine-caustic plants supplied with California-produced salt, only one was in California), and as a water softener. Relatively small

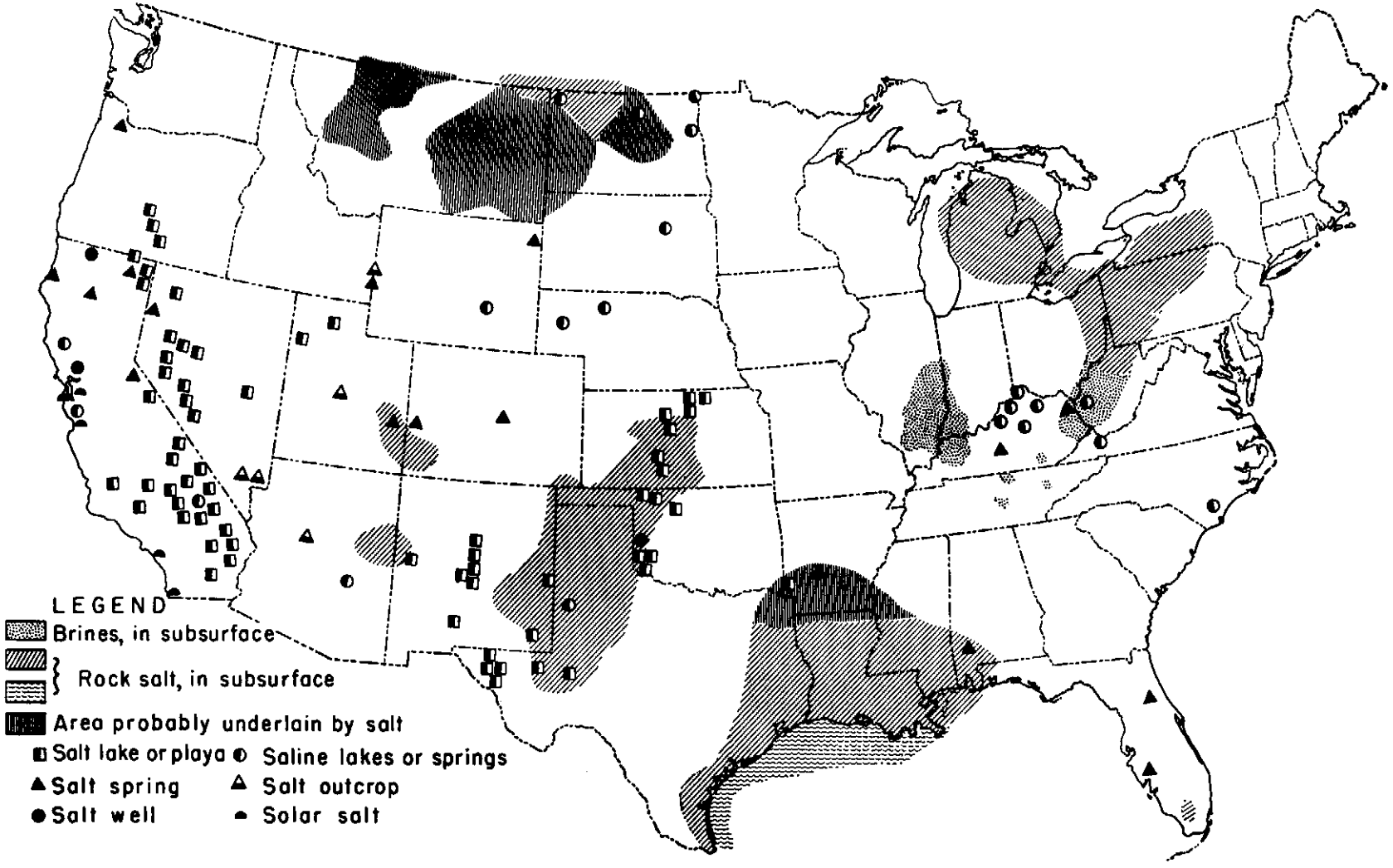


FIGURE 5. - Location of Salt Occurrences in the United States (adapted from U.S. Geol. Survey Bull. 1019-J).

quantities of salt were required in the manufacture of paper, ceramics, rubber, processing oils, and metals, and the deicing of roads and streets.

In 1960, according to producers, California received 675,000 short tons of evaporated salt and 67,000 tons of rock salt from other States. Details concerning salt production methods in California have been published (55).

The only salt produced in Nevada during 1960 came from a dry lake about 27 miles east of Fallon. The salt was consumed locally.

Figure 5 indicates the relative availability of salt in California and Nevada compared with other States.

Salt Demand--California Chemical Industry

About half of the salt consumed in California as reported in table 90 was in crude, bulk form for use in manufacturing chlorine and caustic soda; FMC Corp. (Newark) utilized salt brines in extracting magnesium hydroxide and bromine.

Consumption details cannot be shown because of confidential requirements between the producers and consumers, but a typical use pattern is shown in figure 6. Approximately 675,000 short tons was consumed in California for all uses in 1960 compared with 26 million tons consumed in the United States. Table 91 lists the California chemical producers that reported consumption of salt, including salt contained in brines, in 1960. The products manufactured by these companies are shown in table A-1, appendix.

TABLE 90. - Salt consumption by the California chemical industry, 1960

Plants reporting consumption	31
Total consumption in above plants, short tons	336,000
Total value, delivered	$2,954,000
Value range, per short ton, delivered	$7.00-$20.00
Freight cost range, per short ton	$1.60-$9.00

TABLE 91. - Consumers of salt reporting chemical usage in California, 1960

American Agar & Chemical Co.	Lever Brothers Co.
American Better Chemicals Co.	Los Angeles Soap Co.
American Potash & Chemical Corp.	Luseaux Laboratories, Inc.
Ardmor Chemical Co.	MacMillan Ring Free Oil Co., Inc.
Borden Co.	National Research & Chemical Co.
Boyle & Co.	Pacific Soap Co.
California Chemical Co.	Plex Chemical Corp.
California Ink Co., Inc.	Procter & Gamble Manufacturing Co.
Denalan Co., Inc.	Shell Chemical Corp.[1]
Dow Chemical Co.	Stauffer Chemical Co.
E-Z-Est Products Co.	United States Peroxygen Corp.
Emery Industries, Inc.	Vogarell Products, Inc.
Houghton, E. F., & Co.	Wyandotte Chemicals Corp.
Jones-Hamilton, Inc.	Yosemite Chemical Co.

[1]Reported from four plants.

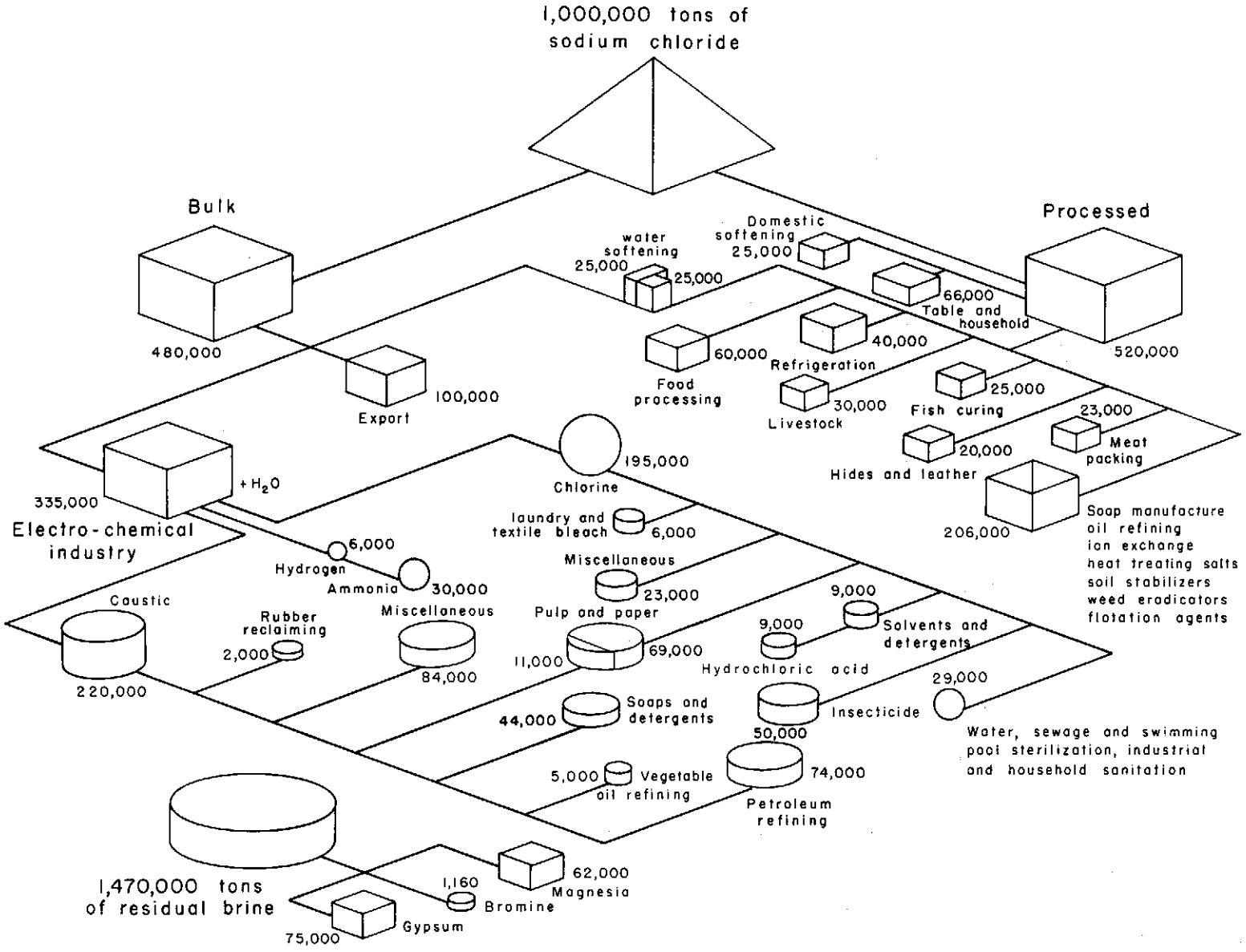


FIGURE 6. - Distribution Pattern per Million Tons of Salt Produced in the San Francisco Bay Area.
(Courtesy, Leslie Salt Co.)

Specifications and packaging have been somewhat simplified and standardized through the efforts of the Salt Producers Association. Undried or crude salt is crushed minus ½ inch to plus ¼ inch (coarse), minus ¼ plus 1/8 inch (medium), and minus 1/8 inch (fine).

Kiln dried salt is prepared in five particle size ranges. A variety of salt products is marketed, including trace mineral salt, granular, brick, and block form. Salt was specified as vacuum, kiln dried, undried, packaged, and bulk.

Salt was frequently marketed by the producers to large-scale consumers under closely-guarded, long-term contracts. Southern California received some crude salt from Mexico and Utah (13). Only a small quantity of the salt produced in southern California was marketed to chemical plants north of the Los Angeles metropolitan area.

Silica (Industrial Sand) Supply--California and Nevada

Silica sand production in California in 1960, to the extent that it can be revealed, is shown in table 92. Industrial sand was produced mainly from Recent beach, dune, and alluvial deposits near the coast, in San Francisco, Santa Cruz, and Los Angeles Counties, and from Tertiary sandstone deposits in Amador, Contra Costa, Orange, and San Diego Counties. The beach and dune sands constituted the principal source of sands for specialty applications.

TABLE 92. - Silica (industrial sand) supply, 1960

	United States	California	Nevada
Plants	[1]	[2] 26	1
Production:			
Quantity, short tons	[3] 18,314,000	[4]	[4]
Value	$58,961,000	[4]	[4]
Average value, per short ton, f.o.b. source	$3.20	[4]	[4]
Imports, glass sand, short tons	11,000	-	[5]
Exports, silica sand-unspecified, do.	1,115,000	[6] 500	[5]

[1] Not separated from construction sand and gravel producers.

[2] The industrial sand producers in California reported the following major industrial none specifically chemical uses by counties: Amador (glass); Calaveras (glass); Contra Costa (blast); Los Angeles (molding, grinding and polishing blast, engine); Monterey (glass, blast, engine, and filtration); Nevada (blast); Orange (blast, fire, and furnace); Placer (blast); Plumas (filtration); Riverside (glass); San Diego (glass, molding, and filter); San Luis Obispo (molding and engine).

[3] Industrial sand only (about 5 percent of the total output)

17,333,000	tons of unground sand valued @	$50,957,000
981,000	" " ground " " "	8,004,000
18,314,000	tons " "	$58,961,000

excludes diatomite which is a form of industrial "silica" shown in table 50.

[4] Figures are concealed to avoid revealing company confidential data.

[5] Not applicable.

[6] Through seaports only.

Dune sands must be processed before qualifying as high purity silica sand as they contain high proportions of feldspar, dark mineral grains, and rock fragments.

Captive production for glass manufacturing purposes was the largest part of the 1960 California output, although large quantities were sold as naturally bonded foundry sands. Some abrasive sand, engine sand, and filter sand was also produced. All these uses are outside SIC 28.

Del Monte Properties Co. and Lowry Paving Co. were the only grinders of silica in California during 1960. Principal sand treatment plants were located near Corona, Pacific Grove, Ione, Camanche, and Oceanside. (The Camanche plant was closed in 1961 as dam construction caused backwater to flood the area.) Two other sand treatment plants operated near El Toro.

The Simplot Silica Co. produced silica sand in the Overton, Nev. area for use in the manufacture of glass, as well as for molding, blasting, and refractory uses. Reno Silica Co. shipped high-quality quartz to Oregon exclusively for ferrosilicon manufacture from a deposit near Reno.

Silica (Industrial Sand) Demand--California Chemical Industry

Table 93 shows the tonnage and table 94 lists the chemical companies in California that consumed silica sand, mainly as a filler in paints, plastics, and rubber. Other uses for silica included the manufacture of silica jel, activated silica, calcium silicate, and silicones; and as a packing (as quartz and quartzite) in acid towers. (As a basis for comparison, of the 981,000 short tons of ground sand sold or used in the United States, 123,000 went into filler applications and 13,000 into chemical applications during 1960.) A considerable part of the total silica reported was obtained from out-of-State, mainly from Nevada, Oklahoma, and Illinois. Sand of flint-glass quality was used to manufacture sodium silicate (water glass).

The competitive nature of the silica sand consuming industry is of principal importance in evaluating raw-material sources. For example, a low-grade deposit close to market might be beneficiated to produce a satisfactory product which could then be sold at lower cost than higher-grade products from a more remote deposit. Specifications for silica used in the California chemical industry vary according to use. Ordinarily the sand should be of a purity at least as high as that used for plate glass. It should contain no more than 0.2 percent Fe_2O_3, with a low calcium and magnesium content. (Preferably the Fe_2O_3 content should not exceed 0.1 percent.)

Sand for sodium silicate must be 98 to 99 percent SiO_2, with less than 0.7 percent Al_2O_3 and less than 0.05 percent Fe_2O_3. Grain size should be less than 20-mesh but greater than 80-mesh. Sodium silicate (manufactured from silica sand) was used in soap manufacturing under ASTM tentative Specification D537-57.

Consumers of ground silica for use as a filler usually require that all particle sizes be less than 200-mesh and about 90 percent passing 325-mesh.

A variety of other materials may be used as an alternate for silica sand for certain applications, such as diatomite, perlite, pumice, crushed and ground rock, and many other items. The primary considerations for most applications are cost, durability, purity, particle size, and inertness.

TABLE 93. - Silica (industrial sand) consumption by the California chemical industry, 1960

Plants reporting consumption	34
Total consumption in above plants, short tons	16,000
Total value, delivered	$284,000
Value range, per short ton, delivered	$15.00-$62.00
Typical freight rate, per short ton, Ottawa, Ill. to Los Angeles	[1]$6.21

[1]Depending on purity and particle size.

TABLE 94. - Consumers of silica reporting chemical usage in California, 1960

Amercoat Corp.	Grant & Co.
American Better Chemicals Co.	Hasa Products Co.
Borden Co.	Kaiser Aluminum & Chemical Corp.
Caldow Paint Co.	Klix Chemical Co., Inc.
California Ink Co., Inc.	Los Angeles Soap Co.
Cedar Sweep Co.	National Lead Co.
De Boom Paint Co.	Philadelphia Quartz Co. of California[1]
De Soto Chemical Coatings, Inc.	Pittsburgh Plate Glass Co.
Diamond Alkali Co.	Poly Resins Co.
Du Bois Chemicals, Inc.	Procter & Gamble Manufacturing Co.
Dunn-Edwards Corp.	Purex Corp.
Dunne, Frank W., Co.	Rhodes, D. H., & Co.
E-Z-Est Products Co.	Scofield, L. M., Co.
FMC Corp.	Security Paint Manufacturing Co.
Fine Line Paint Corp.	Vi-Cly Industries, Inc.
Fuller, W. P., & Co.	Western Chemical & Manufacturing Co.
Glidden Paint Co.	

[1]Reported for two plants.

Sodium Compounds Supply--California and Nevada

Sodium Carbonate

The Pittsburgh Plate Glass Co., Chemical Div. (formerly Columbia Southern Chemical Corp.), produced anhydrous sodium carbonate, and sodium sesquicarbonate from Owens Lake brines in Inyo County, Calif. American Potash and Chemical Corp. and West End Chemical Co. (Div. of Stauffer Chemical Co.) recovered sodium carbonate (soda ash) through processing Searles Lake brines in plants at Trona and West End. Production details could not be shown in table 95.

Nevada reported no sodium carbonate production during 1960.

TABLE 95. - Sodium compounds (carbonate and sulfate) supply, 1960

	United States		California		Nevada
	Carbonate	Sulfate	Carbonate	Sulfate	
Producers	4	[1]6	3	3	-
Production:					
Quantity.....short tons	809,000	450,000	([2])	([2])	-
Value	$20,865,000	$8,706,000	([2])	([2])	-
Average value, per short ton, f.o.b. source	$25.79	$19.35	([2])	([2])	-
Imports.....short tons	([3])	167,000	([3])	([3])	([4])
Exports.....do....	155,000	31,000	([3])	[5]16,000	([4])

[1] Leading three firms supplied 99 percent of total sulfate produced; production centered mainly in California and Texas. Natural sodium carbonate came from California and Wyoming.
[2] Figures withheld to avoid revealing individual company data.
[3] Not available.
[4] Not applicable.
[5] Through seaports only.

Sodium Sulfate

United States Borax & Chemical Corp. produced anhydrous sodium sulfate in its Wilmington refinery in Los Angeles from borates mined and partly refined in Kern County. Stauffer Chemical Co. purchased borates from United States Borax & Chemical Corp. and recovered byproduct sodium sulfate in its San Francisco plant. American Potash and Chemical Corp. and West End Chemical Co., a Div. of Stauffer Chemical Co., recovered sodium sulfate (salt cake) through processing Searles Lake brines in plants at Trona and West End during 1960. Production details could not be shown in table 95.

Nevada reported no production of sodium sulfate during 1960.

United States Borax & Chemical Corp. produced anhydrous sodium sulfate in its Wilmington refinery in Los Angeles from borates mined and partly refined in Kern County. The Stauffer Chemical Co. purchased borates from United States Borax & Chemical Corp. and recovered byproduct sodium sulfate in its San Francisco plant. American Potash and Chemical Corp. and West End Chemical Co., a Div. of Stauffer Chemical Co., recovered sodium sulfate (salt cake) through processing Searles Lake brines in plants at Trona and West End during 1960.

Nevada reported no production of sodium sulfate during 1960.

Sodium Compounds Demand--California Chemical Industry

Table 96 shows the tonnage and table 97 lists the companies in the California chemical industry that reported consumption of sodium compounds, primarily carbonates and sulfates. About 40,000 tons of the consumption was sodium sulfate; the remainder was nearly all sodium carbonate. Small quantities of metallic sodium and sodium hydroxide were consumed.

TABLE 96. - Sodium compounds (except salt) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Sodium carbonate	35
Sodium sulfate	20
Other	4
Total consumption in above plants, short tons	189,000
Total value, delivered	$6,199,000
Value range, per short ton, delivered	$24.00-$36.00
Typical freight rate, per short ton, Green River, Wyo., to San Francisco	$7.00

TABLE 97. - Consumers of sodium compounds reporting chemical usage in California, 1960

American Agar & Chemical Co.
American Better Chemicals Co.
American Potash & Chemical Corp.
Ardmor Chemical Co.
Babbitt, B. T., Inc.
Bayside Oil Corp.
Betz Laboratories, Inc.
Borden Co.
California Chemical Co.
California Soda Co.
Chipman Chemical Co., Inc.
Cleaning Chemicals Corp.
Columbia-Southern Chemical Corp.
Cornell Soap Co.
Daw, A. J., Printing Ink Co.
Dow Chemical Co.
Economy Chemical Co.
Emery Industries, Inc.
Erlen Products Co.
FMC Corp.[1]
Hasa Products Co.[1]
Hawley, H. F., Chemical Co.
Industrial Chemicals Co.[1]
International Minerals & Chemicals Corp.
Jones-Hamilton, Inc.
Kelite Corp.
Klix Chemical Co., Inc.
Leffingwell Chemical Co.
Lever Brothers Co.
Los Angeles Soap Co.
Luseaux Laboratories, Inc.
Maas, A. R., Chemical Co.
Merit Manufacturing Co.
Metallic Phosphate Products Co.
Mountain Copper Co., Ltd.
Narmco Resins & Coatings Co.
National Lead Co.
National Research & Chemical Co.
Oil & Solvent Process Co.
Pacific Soap Co.
Patek & Co.
Philadelphia Quartz Co. of California
Plex Chemical Corp.
Purex Corp.
Riley, Stephen Co., Inc.
Shell Oil Co., Inc.[1]
Skasol, Inc. of Southern California
Smith, Robert Manufacturing Co., Inc.
United Heckathorn Co.
United States Borax & Chemical Corp.[1]
Universal Detergents, Inc.
Western Chemical & Manufacturing Co.
Wyandotte Chemicals Corp.
Yosemite Chemical Corp.

[1]Reported for two plants

According to sodium compound producers, about 40 percent of the sodium carbonate produced in California went into the manufacture of glass (not in SIC 28). The next largest use was in soaps and cleansers. Smaller quantities were consumed in the manufacture of chemicals such as sodium phosphate, sodium nitrate, sodium bicarbonate, and sodium silicate. Significant quantities went outside California for use in the preparation of wood pulp.

The chemical and physical requirements of ASTM Standard Specification D958-51, referred to by some respondents, cover soda ash used for various cleansing, washing, and scouring processes. Other ASTM specifications referred to were for sodium bicarbonate (D928-52) and modified soda-sesquicarbonate (457-29). These specifications are described in detail in item (4) of the list of references.

A number of chemical companies manufactured secondary sodium compounds such as arsenite (California Chemical Co.), cyanamide (American Cyanamid Co.), fluosilicate (Stauffer Chemical Co.), hexametaphosphate (FMC Corp.), hydroxide (Dow Chemical Co.), hypochlorite (Chlorox Chemical Co.), metasilicate (Diamond Alkali Co.), tetraborate (United States Borax Co.), orthosilicate (Philadelphia Quartz Co.), sulfite (A. R. Maas, Co.), and thiosulfate (Allied Chemical and Dye Corp.), but figures for these items are not included in table 96 as they are considered to be beyond the first marketable stage of manufacture.

Sulfur and Pyrite Supply--California and Nevada

Sulfur production data could not be shown in table 98. Most of the sulfur ore production came from the Leviathan deposit operated by The Anaconda Company in Alpine County, Calif. Four other mines produced sulfur for use as soil conditioner. The total output from the Leviathan mine went to the company's plant in Nevada, where it was converted to sulfuric acid for use in leaching copper ores.

TABLE 98. - Sulfur and pyrite supply, 1960

	United States	California	Nevada
Producers	[1]94	5	1
Production:			
Quantity, long tons	[2]5,003,000	([3])	([3])
Value, shipments (Frasch only)	$115,494,000	([3])	([3])
Average value, per long ton, f.o.b. source	$23.10	([3])	([3])
Producer stocks, Dec. 31, long tons	3,778,000	([3])	([3])
Imports, sulfur, do.	[4]741,000	-	([5])
Exports (crude, elemental sulfur[6], do.	1,776,000	([7])	([5])

[1] Four firms in Texas and Louisiana accounted for over three-fourths of output.
[2] Also 991,000 long tons of pyrites was sold or consumed by producing companies in 1960. Of this quantity, 118,000 tons having a sulfur content of 56,870 tons was sold at a value of $815,537; the remainder was consumed by the producer.
[3] Figures withheld to avoid revealing individual company data.
[4] Mexico 90 percent; Canada 10 percent.
[5] Not applicable.
[6] Also 12,000 tons of crushed, ground, refined, sublimed, and flowers was exported.
[7] 125 tons of "other" sulfur valued at $118,928.

Mountain Copper Co. of California (Iron Mountain, Hornet Mine, Shasta County, Calif.) was the only pyrite producer. The entire output was shipped

to two chemical plants (Stauffer Chemical Co. and Allied Chemical Corp.) in Contra Costa County, Calif., for the manufacture of sulfuric acid.

The sulfur produced from Anaconda's Leviathan mine in Alpine County was shipped to the company's sulfuric acid plant in Yerington, Nev. Shipments of all sulfur into California, by rail, are shown in table 7. Detailed information on the sulfur balance in California and Nevada was published by the Bureau of Mines (8).

Petroleum refineries yielded 88,936 short tons of elemental sulfur, mostly in the Los Angeles area. Also, recovery of sulfur from stack gases was reported from smelter operations at Selby, Contra Costa County.

The only active sulfur deposit in Nevada, in Humboldt County, produced a small quantity of sulfur for soil treatment.

Sulfur, Pyrite, and Sulfuric Acid Demand--California Chemical Industry

Table 99 shows the tonnage and value of sulfur, pyrites, and sulfuric acid consumed by the companies listed in table 100. These consumers, some with several plants, manufactured a wide variety of chemicals. Fertilizer was the major chemical produced by California chemical manufacturers in 1960.

The quantity of sulfur consumed by the California fertilizer industry in 1960 is shown in table 120. There were 10 sulfuric acid plants operating in California; 2 in southern California, 1 in central California (Fresno), and 7 in the San Francisco-Bay area.

According to a paper presented at the Chemical Market Research Association meeting in 1961 (16), northern California (above Kern County Line) and Hawaii required 460,000 tons of sulfuric acid (for all uses) or 2.6 percent of U.S. requirements in 1960. Table 101 shows the California sulfuric acid producers by city, annual estimated capacity, and source of sulfur. All plants shown are of the contact type.

According to producers, sulfur for all uses in California totaled about 850,000 tons, of which about 150,000 went into chemicals. According to SIC 28, an additional 50,000 tons used in producing inorganic pigments and some of the 480,000 tons going into fertilizer should be included. Agricultural, or soil sulfur, should not be included.

Suppliers of sulfur usually guarantee a purity of 99 percent; it often contains 99.5 percent or more. The chief impurities found are ash and bitumen.

Pyrites is normally purchased on the basis of an elemental sulfur content of 48 percent, with penalties being assessed for each percent lower than this figure. Arsenic is an undesirable impurity, although most pyrites contain some arsenic. Phosphorous in pyrite is undesirable when the residual roasted product (cinder) is used as an iron ore.

TABLE 99. - Sulfur, pyrite, and sulfuric acid consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Elemental sulfur	20
Pyrite	5
Sulfuric acid	4
Total consumption in above plants, long tons	[1]482,000
Total value, delivered	$9,821,000
Value range, per short ton, delivered	$12.00-$50.00
Typical freight rate, per long ton, Texas to Los Angeles	[2]$15.00

[1]Consists of about 80 percent sulfur and 20 percent pyrites and sulfuric acid.
[2]Local haulage of byproduct sulfur ranged from $2.00 to $5.00 per ton.

TABLE 100. - Consumers of sulfur, pyrite, and sulfuric acid reporting chemical usage in California, 1960

American Better Chemicals Co.
American Potash & Chemical Corp.[1]
Best Fertilizer Co.
California Chemical Co.
Coastal Chemical Co.
Deepwater Chemical Co., Ltd.
Factor, Max & Co.
Fresno Agricultural Chemical Co.[1]
General Chemical (Div. Allied Chemical Co.)[2]
Long Manufacturing Co.
Maas, A. R., Chemical Co.
Monsanto Chemical Co.
Narmco Resins & Coatings Co.
National Research & Chemical Co.
Plant Food Corp.
Shell Chemical Co.[1]
Silver Line Products, Inc.
Stauffer Chemical Co.[2]
Stone, E. B., & Son
United Heckathorn Co.
United States Borax & Chemical Corp.
Western States Chemical Corp.

[1]Reported for two plants.
[2]Reported for three plants.

TABLE 101. - California sulfuric acid plant capacities and raw materials consumed, 1960

Company	Location	Plant capacity[1]	Raw material
Allied Chemical Corp.	Bay Point	120,000	Sludge, and pyrite.
Do.	El Segundo	150,000	Sulfur, sludge, and hydrogen sulfide.
Do.	Richmond	65,000	Do.
American Smelting & Refining Co.	Selby	15,000	Smelter gases.
Best Fertilizer Co.	Lathrop	72,000	Sulfur.
Monsanto Chemical Co.	Avon	150,000	Sulfur, sludge, and hydrogen sulfide.
Stauffer Chemical Co.	Dominguez	325,000	Do.
Do.	Stege	175,000	Sulfur, and pyrite.
Do.	Vernon	120,000	Sulfur.
Valley Nitrogen Co.[2]	Fresno	60,000	Do.
Total	-	1,252,000	-

[1]Reed, Arthur H., and Bruce P. Lord. Sulphuric Acid--The Present and Potential Market in Oregon and the Northwest. Research Report 43, 1961, p. 21.
[2]1959.

The requirements for sulfur and sulfuric acid for industrial and agricultural applications undoubtedly will continue to increase at a rapid rate in California as a direct result of increasing population.

The prices of Frasch sulfur were standard at $25 per long ton, f.o.b. Gulf ports for bright sulfur, with a discount of $1 a ton for off-colored material. Freight to the Los Angeles and San Francisco areas was $12 per long ton. Posted prices of Mexican sulfur was $23.50 for bright and $22.50 for off-colored sulfur, f.o.b. Coatzacolcos, Mexico; but the prices were increased $2 a ton on Dec. 19, 1960. Deliveries from Tampa, Fla., also were increased $2 a ton.

Pyrite must compete in price directly with Frasch sulfur, based on sulfur content. The consumer of pyrite must pay for transporting approximately twice the tonnage, as well as providing equipment for roasting the pyrite and disposing of the resulting cinder. Reportedly, approximately 30 to 60 percent more investment is required to construct a sulfuric acid plant that uses pyrite than one that uses elemental sulfur (18).

A breakdown of sulfur uses is shown in figure 7.

Talc, Soapstone, and Pyrophyllite Supply--California and Nevada

Approximately 87 percent of the combined California output of talc, soapstone, and pyrophyllite, reported in table 102, was mined from deposits in Inyo and San Bernardino Counties in 1960. These two counties were the source of all the talc produced. Soapstone came mainly from one deposit each in Amador, El Dorado, and Los Angeles Counties. Pyrophyllite was shipped from one property each in Mono and San Bernardino Counties and three properties in San Diego County.

The entire production of Nevada talc came from deposits in Esmeralda County. The quantity and value of output in 1960 was the lowest since before World War II. No soapstone or phyrophyllite was produced during the year.

TABLE 102. - Talc, soapstone, and pyrophyllite supply, 1960

	United States[1]	California	Nevada
Producers	62	7	2
Production:			
Quantity.....short tons	734,000	131,000	5,000
Value	$5,378,000	$1,396,000	$30,000
Average value, per short ton, f.o.b. source	$7.30	$10.65	$6.00
Imports.....short tons	[2]24,000	[3]1,000	([4])
Exports, crude and ground.....do....	59,500	[3]2,500	([4])

[1]Leading 12 firms supplied 75 percent of mine production; next 15 firms supplied 19 percent of mine production; remaining 35 firms supplied 6 percent.
[2]Ground talc from Italy, 71 percent; Canada, 10 percent; and France, 15 percent.
[3]Through seaports only.
[4]Not applicable.

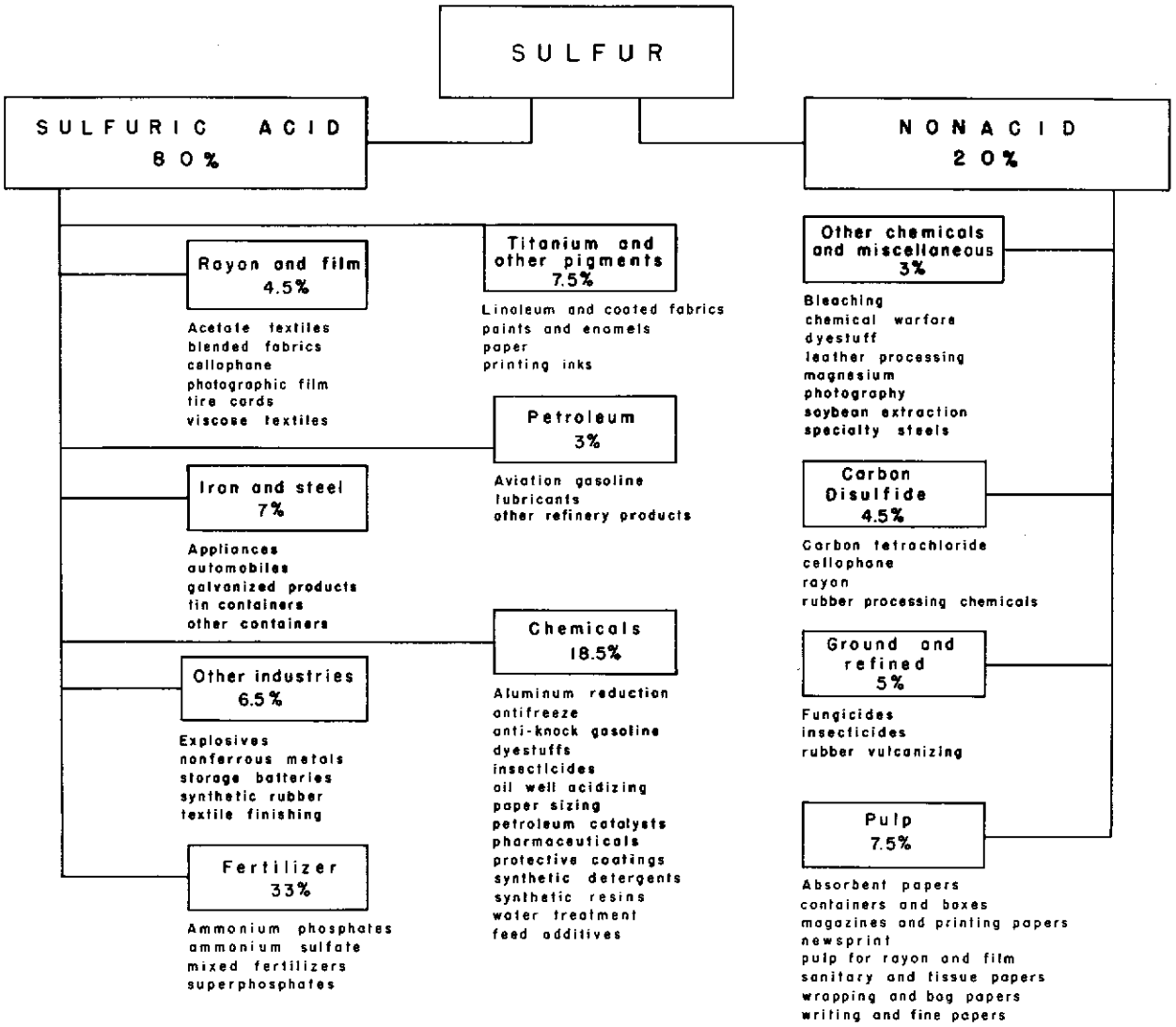


FIGURE 7. - Sulfur Uses.

Talc, Soapstone, and Pyrophyllite Demand--California Chemical Industry

Table 103 shows the tonnage and value, and table 104 lists the chemical companies which reported consumption of talc, soapstone, and pyrophyllite in 1960. These minerals were used in the chemical industry mainly as a filler in various applications such as paints, plastic, rubber (synthetic only), and as a carrier for insecticides. Talc from open-pit operations in Montana was being shipped to California in competition with California-produced material.

For comparison, producers' reports indicated that about 150,000 tons of talc, soapstone, and pyrophyllite was consumed in California during 1960, for all uses, mainly ceramics. Paint accounted for 7 percent, pesticide manufacture 8 percent, rubber manufacture 2 percent, and toilet preparation 1 percent. The remainder was outside SIC 28.

TABLE 103. - Talc, soapstone, and pyrophyllite consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Talc	50
Pyrophyllite	3
Soapstone	1
Total consumption in above plants, short tons	13,400
Total value, delivered	$397,000
Value range, per short ton, delivered	[1] $20.00-$90.00
Typical freight rate, per short ton, Los Angeles to San Francisco	$9.50

[1] Depending on quality and particle size.

TABLE 104. - Consumers of talc, soapstone, and pyrophyllite reporting chemical usage in California, 1960

All-Phase Color Corp.
Amercoat Corp.
American Better Chemicals Co.
American Marine Paint Co.
Barnes, S. O., & Son, Inc.
Boyle & Co.
Caldow Paint Co.
California Chemical Co.
California Ink Co., Inc.
Central Valley Chemical Corp.
Certified Home Products Co.
Coastal Chemical Co.
Colgate-Palmolive Co.
Colonial Dames Co., Ltd.
Dau-Hansen Paint Co., Inc.
Daw, A. J., Printing Ink Co.
De Boom Paint Co.
De Soto Chemical Coatings, Inc.
Dunn-Edwards Corp.
Dunne, Frank W., Co.
Factor, Max & Co.
Finch Paint & Chemical Co.
Fine Line Paint Corp.
Glidden Paint Co.
Great Western Paint Co.
Hill Brothers Chemical Co.
Indeo Laboratory
International Paint Co., Inc.
International Wood Products Co.
Jones-Hamilton, Inc.
Kaull, G. W.
Kelite Corp.
Koppers Co., Inc.
L. & H. Paint Products, Inc.
Marvin Corp.
Moyer Chemical Co.
McCloskey Varnish Co. of the West
Narmco Resins & Coatings Co.
National Lead Co.
O'Brien Corp. of San Francisco
Old Colony Paint & Chemical Co.
Plant Food Corp.
Pittsburgh Plate Glass Co.
Poly Resins Co.
Ram Chemicals, Inc.
Shannon Luminous Materials Co.
Shell Chemical Co.
Southern Lacquer & Paint Corp.
Stauffer Chemical Co.
Tibbetts Corp.
Vi-Cly Industries, Inc.
Vi Jon Laboratories, Inc.
Vinyl-Line Paint Co.
Western Chemical & Manufacturing Co.

Talc grades are often identified with end use, such as pharmaceutical grade, cosmetic grade, and ceramic grade; they are sometimes characterized by crystal shape and structure such as fibrous, massive, and accicular, or by color or degree of softness.

The paint industry was the largest user of ground talc for those reporting under SIC 28. It was used mainly as an inert extender or filler, where it competed with other materials, such as limestone whiting, gypsum, magnesite, and clay.

Paint manufacturers require that talc suppliers meet specified physical and chemical properties for each talc shipment, including color or brightness test, specific gravity, particle size limitation, bulk density, particle shape, absorption, and pH. Talc acts as an extender in paints by reducing the settling rate, which allows the paint to flow smoothly and disperse easily.

The rubber industry uses either off-color talc or ground limestone which were usually specified to pass 100 percent through a 100-mesh sieve with no more than 0.1 percent remaining on 200-mesh. The rubber industry preferred talc because of its lubricating quality.

Talc for cosmetics must meet rigid requirements as to impurities which affect color and are abrasive and harmful to the skin. Domestic preparations usually require near-steatite grade with approximately 99 percent passing a 325-mesh screen. Products usually are ground in fluid-energy mills, popularly called micronizers.

Talc, soapstone, or pyrophyllite for use as a filler or carrier for DDT and other pesticides usually is ground to pass 200-mesh.

ASTM Specification D605-53T contains detailed chemical requirements for uses of magnesium silicate.

Titanium Supply--California and Nevada

As shown in table 105, no ilmenite or rutile was mined in either California or Nevada during 1960. Titanium sponge was produced in Nevada, and titanium was melted in California. No titanium dioxide was produced in either State during 1960. E. I. duPont de Nemours & Co., Inc. disclosed that a plant having a capacity of about 25,000 tons annually of titanium dioxide would be constructed at Antioch, Calif. Rutile from Australia reportedly will be used by duPont to produce titanium tetrachloride as a basis for producing the titanium dioxide. Use of rutile to produce titanium dioxide is a process new to the United States; only ilmenite and titanium slag have been used as raw materials.

The titanium dioxide capacity of North American plants is shown in table 106. As a basis for comparison, 454,986 tons of TiO_2 was produced, and 982,572 tons of ilmenite and 24,229 tons of rutile were consumed in 1960. Pigments were manufactured from 864,794 tons of ilmenite and 119,308 tons of titanium slag.

TABLE 105. - Titanium (ilmenite and rutile) supply, 1960

	United States	California	Nevada
Producers:			
Ilmenite concentrates	7	-	-
Rutile concentrates	3	-	-
Production:			
Quantity, ilmenite concentrates, short tons	789,000	-	-
Value, ilmenite concentrates, do.	$14,655,000	-	-
Quantity, rutile concentrates, do.	9,000	-	-
Value, rutile concentrates, do.	$879,000	-	-
Average value, ilmenite concentrates, per short ton	[2] $18.50	-	-
Average value, rutile concentrates per short ton	$97.70	-	-
Imports, ilmenite concentrates, short tons	266,000	-	-
Imports, rutile concentrates, do.	29,000	[1] 2,000	([3])
Exports, do.	([4])	-	([3])

[1] Through seaports only.
[2] E and MJ Metal and Mineral Markets reported a range of $23.00-$26.00 per long ton (59.5 percent TiO_2, f.o.b. Atlantic seaboard) for ilmenite and $85.00 per short ton for rutile (94 percent TiO_2, f.o.b. Atlantic seaboard).
[3] Not applicable.
[4] Exports, ores and concentrates (1,300 short tons); metal and alloy in crude form and scrap (900); primary forms (400); ferro alloys (200); dioxide and pigments (34,000).

TABLE 106. - North American titanium dioxide capacity

Company	Location	Tons/year
United States		
American Cyanamid Co.	Piney River, Va.	18,000
	Savannah, Ga.	72,000
du Pont, E.I., de Nemours	Baltimore, Md.	40,000
	Edgemoor, Del.	90,000
	New Johnsonville, Tenn.	70,000
	Antioch, Calif.	[1] 27,000
Glidden Co.	Baltimore, Md.	56,000
	Hawkins Point, Md.	
National Lead Co.	St. Louis, Mo.	136,000
	Sayreville, N.J.	157,000
New Jersey Zinc Co.	Gloucester City, N.J.	48,000
Cabot Triania, Inc.	Ashtabula, Ohio	[1] 40,000
Canada		
British Titan Products	Sorel, Que.	20,000
Canadian Titanium Pigments	Varennes, Que.	25,000
Continental Titanium	Baie St. Paul, Que.	[1] 6,000

[1] Planned.

Source: BuMines Minerals Yearbook.

Titanium Dioxide Demand--California Chemical Industry

Table 107 shows the tonnage and table 108 lists the chemical companies that reported consumption of titanium dioxide in California during 1960, mainly for use in paint manufacturing; most of it came from New Jersey.

TABLE 107. - Titanium dioxide consumption by the California chemical industry, 1960[1]

Plants reporting consumption	43
Total consumption in above plants	14,200
Total value, delivered	$8,094,000
Average value, per short ton, delivered	$570.00

[1]Titanium metal is produced at Henderson, Nev., by Titanium Metals Corp. from titanium sponge shipped into the State.

TABLE 108. - Consumers of titanium minerals and compounds reporting chemical usage in California, 1960

Amercoat Corp.
American Marine Paint Co.
Armstrong Cork Co.
Beacon Paint & Wax Corp.
Borden Co.
Caldow Paint Co.
California Ink Co., Inc.
De Soto Chemical Coatings, Inc.
Dewey & Almy Chemical Co.
Dowman Products, Inc.
Dunn-Edwards Corp.
Dunne, Frank W., Co.
Ellis Paint Co.
Factor, Max & Co.
Fine Line Paint Corp.
Fuller, W. P., & Co.
Glidden Paint Co.
Great Western Paint Co.
Henry, W. W., Co.
Interchemical Corp.[1]
International Paint Co., Inc.
Kolmar Laboratories, Inc.
L. & H., Paint Products, Inc.
Marvin Corporation
Metallic Phosphate Products Co.
Michael-Lawrence Co., Inc.
McCarty Paint Co.
Narmco Resins & Coatings Co.
Nelson Technical Coatings Co.
Nutrilite Products, Inc.
O'Brien Corp. of San Francisco
Old Colony Paint & Chemicals Co.
Pittsburgh Plate Glass Co.
Rhodes, D. H., & Co.
Security Paint Manufacturing Co.
Sherwin-Williams Co.
Sterling Paint Co.
Tech-Chemical Co.
Tibbetts Corp.
Tibbetts-Westerfield Paint Co.
Vi-Cly Industries, Inc.
Vinyl-Line Paint Co.

[1]Reported for two plants.

It is estimated that only about a third of the total consumption of titanium dioxide was reported because (1) numerous small paint companies used relatively small quantities which in aggregate amounted to a sizable tonnage and (2) some larger consumers did not consider manufactured TiO_2 as one of their raw materials. Some of the companies listed purchased titanium pigments for their own paint manufacturing, and in addition, sold some to other paint manufacturers.

Assuming that California consumed its proportionate share of TiO_2 in paint manufacturing and that approximately 10 percent of the total U.S. paint output is made in California, some 45,000 tons of TiO_2 would have been consumed in 1960 by the California paint industry alone. Other uses for pigments, such as rubber and ink manufacturing, consumed at least 5,000 tons, bringing the total consumption to more than 50,000 tons annually in the California chemical industry.

Titanium dioxide was valued as a white pigment because of its high degree of opacity, owing to its high refractive index. Also, it was valued because of its low specific gravity, nontoxic character, and inertness. The covering power of titanium dioxide was rated about four times that of zinc lithopone and zinc oxide, and nearly twice that of zinc sulfide. The Bureau of Mines Minerals Yearbook showed the following distribution by gross weight of titanium pigment shipments in 1960:

	Percent
Pigments, paints, varnishes, and lacquers[1]	65.1
Paper	11.3
Floor-covering	4.8
Rubber[1]	4.0
Coated fabrics, textiles[1]	2.8
Printing ink[1]	1.3
Others	10.7

[1]Chemical uses designated by author.

ASTM Specification D476-48 gives the detailed requirements for three types of titanium pigments, and Federal Specification TT-T-425A provides for three types of titanium pigments. Titanium pigments are also valued in manufacturing light-colored rubber goods. They have largely replaced zinc oxide in cosmetic manufacturing and are used in dyes and textiles; titanium tetrachloride is used in producing smoke screens. Although the tonnage of titanium pigments used in paints continues to increase, the percentage of the total market supplied by titanium pigments has declined. This trend will probably continue.

Zinc Supply--California and Nevada

Copper and lead-zinc ores were the source of 99 percent of the total California zinc output shown in table 109 for 1960. Lead, tungsten, gold, and silver ores combined, furnished the remaining 1 percent.

More than 90 percent of the Nevada zinc production in 1960 was recovered from ores of six mines in Elko, Eureka, Lincoln, and White Pine Counties.

TABLE 109. - Zinc (ore and metal) supply, 1960

	United States	California	Nevada
Mines	(1)	(2)	3 6
Smelters	26	1	-
Production:			
Mine.....short tons, metal	435,000	500	500
Value	$112,365,000	$120,000	$108,000
Smelter	872,000	(4)	-
Average sales price, per pound	$0.1295	(5)	(5)
Producer stocks, Dec. 31	255,000	(2)	(2)
Imports[6].....short tons	(7)	(7) (8)	(9)
Exports[10].....do....			(9)

[1] Leading 25 mines produced 82 percent of domestic zinc output. Tennessee supplied 21 percent, Idaho 13 percent, New York 10 percent, Arizona 9 percent, Utah and Colorado each 8 percent; of the lead ore remaining, 39 percent was distributed among 18 States. Shipments of zinc pigments as oxide totaled 145,000 short tons valued at $226 per ton; smaller quantities of chloride and sulfate shipments were also reported in the BuMines 1960 Minerals Yearbook.

[2] Byproduct--not separated from primary production.

[3] Accounted for over 90 percent of output; remainder came from copper and lead ores.

[4] Figures withheld to avoid revealing individual company data.

[5] Not available.

[6] Canada 37 percent, Mexico 28 percent, Peru 16 percent, others 19 percent.

[7] Through seaports only.

[8] Imports:

	United States	California
Ore (zinc content)	383,000	3,000
Blocks, pigs, slabs	121,000	150
Sheets	900	3
Dross and skimmings	1,000	-
Dust	20	-
Other	100	-

[9] Not applicable.

[10] Exports:

	United States	California
Ore, concentrates	13	-
Slabs, pigs, blocks	75,000	30
Sheets, plates, strips, or other forms, n.e.s	3,000	4
Zinc, scrap, dross	12,000	2,000
Semi-fabricated forms, n.e.s	3,000	-
Zinc dust	800	300

Zinc Compounds Demand--California Chemical Industry

Table 110 shows the tonnage and table 111 lists the industries reporting the consumption of zinc, mainly as zinc oxide (including leaded zinc oxide), for use in paint. Other applications included plastics, inks, and miscellaneous uses.

Other zinc pigments such as lithopone (mixture of zinc sulfide and barium sulfate) and titanated lithopone were used in paint manufacturing as well as for filler applications in rubber and plastics, but, in general, these are considered as being beyond the "first marketable stage" and are excluded.

Federal Specification TT-P-641B, January 23, 1953, covers three types of zinc paints, and U.S. Specification MIL-P-15145A, June 20, 1955, covers the use of zinc oxide paints.

TABLE 110. - Zinc (metal and compounds) consumption by the California chemical industry, 1960

Plants reporting consumption of:	
Zinc oxide	18
Zinc chromate	3
Zinc metal	1
Zinc compounds (other)	2
Total consumption in above plants, short tons	6,400
Total value, delivered	$1,551,000
Value range, per short ton, delivered	$240.00-$280.00

TABLE 111. - Consumers of zinc and zinc compounds reporting chemical usage in California, 1960

Amchem Products, Inc.	International Paint Co., Inc.
Amercoat Corp.	L. & H. Paint Products, Inc.
American Marine Paint Co.	Leffingwell Chemical Co.
Associated Chemical Co.	Long Manufacturing Co.
California Chemical Co.	Narmoc Resins & Coatings Co.
Coastal Chemical Co.	Nelson Technical Coatings Co.
De Soto Chemical Coatings, Inc.	O'Brien Corp. of San Francisco
Dewey & Almy Chemical Co.	Parker Rust Proof Co.
Dunne, Frank W., Co.	Pittsburgh Plate Glass Co.
Eden Paint Products Corp.	Security Paint Manufacturing Co.
Ellis Paint Co.	Vi-Cly Industries, Inc.
Fuller, W. P., & Co.	Western Lead Products Co.

The competition from alternate materials is keenly felt in chemical and pigment uses for zinc and its compounds. Aluminum and magnesium could replace zinc to some extent as reducing agents in chemical reactions. In the California paint industry, lead and titanium pigments are used instead of zinc pigments in many instances. Titanium pigments have almost totally replaced lithopone but supplement rather than compete with zinc oxide in most paint formulations. Zinc oxide consumption per unit of rubber consumption has

declined in recent years not because of substitution of an alternate product but rather because synthetic rubber requires little or no zinc oxide in the vulcanizing process.

In most applications there is little necessity to seek substitutes for zinc, as ample quantities of zinc in the various grades are available at relatively low prices.

ASTM Specification D475-45 includes requirements for zinc sulfide pigments, such as lithopone (ZnS-$BaSO_4$), titanated lithopone, and zinc sulfide. Specification D79-44 designates the requirements for dry zinc oxide manufactured by the American and French processes; D80-41 specifies the impurities which can be tolerated in leaded zinc oxide; D520-51 covers zinc dust for use as a pigment; D479-49 deals with zinc chromate; D432-50 and D1271-56 cover zinc chloride for use in preserving and treating wood.

Miscellaneous Minerals Supply and Demand--California and Nevada

Bismuth

There has been no production of bismuth in California since 1909, when 20 tons of ore was produced from the Lost Horse Copper mine in the Piñon District, Riverside County. Native bismuth has been reported to occur at a number of localities in California and Nevada, but none has been produced commercially. (Total United States production is exclusively as a lead byproduct and comes from smelters at Omaha, Neb., Port Amboy, N.J., and East Chicago, Ind.) The Garnet Dike Tungsten mine, which operated in Fresno County, produced tungsten concentrates containing 14 percent bismuth as bismuthinite, but no attempt was made to recover the bismuth and the ore remaining is reported to be quite limited.

Bismuth was reported by the California chemical industry for use in cosmetics by Boyle and Co. in Los Angeles. Although pharmaceutical manufacturers of California did not include bismuth in their reports, about 711,000 pounds was sold for use in pharmaceutical manufacture and in laboratories in the United States.

The pharmaceutical, medical, and cosmetic trades require a 99.99 percent purity with no trace of arsenic, in conformance with the U.S. Pharmacopoeia. General Services Administration Stockpile Specification P-7 covers requirements for bismuth for use in alloys and salts.

Cadmium

There is no direct production of cadmium and its compounds in California and Nevada. However, smelter flue dusts from copper-zinc ores, as well as zinc concentrates from California and Nevada, are significant sources of cadmium that is recovered by various processes in plants outside these States.

The following reported consumption of 96,000 pounds of cadmium and cadmium compounds, valued at $50,000 in 1960: American Potash and Chemical Co.,

California Ink Co., De Soto Chemical Coatings, Inc., Ellay Rubber Co., Pittsburg Plate Glass Co., Tibbetts-Westfield Paint Co., and Western Lead Co.

Only one consumer obtained cadmium compounds from a California dealer; the other sources were New York and Maryland. The unit value (delivered) ranged from $0.28 to $2.42 a pound, depending on the form and purity.

Chromium

There was no production of chromite in California in 1960. Chromite production was first reported in 1869; and from then through 1955, over 500,000 tons, valued at over $20 million, was produced in the State. There are a number of relatively small, scattered chromite deposits in California that could not be mined profitably at the open-market prices prevailing in 1960.

No deposits of chromite are known to exist in Nevada.

In addition to large tonnates of chromite ores reported by Kaiser Aluminum and Chemical Co. for refractory use and smaller but significant consumption reported by Owens-Illinois Glass Company for use in the process of manufacturing glass (both of which are outside SIC 28), consumption of 800 tons of chromium compounds (mostly acid, oxide, and flake) valued at $515,000 was reported by Amercoat Corp., American Better Chemicals Co., California Ink Co., Frank W. Dunne Co., Ellis Paint Co., Kaiser Aluminum & Chemical Co., Nelson Technical Coatings Co., Parker Rust Proof Co., Sherwin-Williams Co., and Turco Products, Inc.

Chemical-grade chromite should contain over 44 percent Cr_2O_3. A higher iron to chrome ratio can usually be tolerated in chemical-grade chromite than in metallurgical or refractory grades. The silica content should not be more than 8 percent. Most of the chemical-grade chromite used in the United States comes from the Union of South Africa.

Chromium compounds were used in paints, inks, dyes, production of chrome pigments, mordants, and as a corrosion inhibitor.

Fluorspar

Only one California mine, the Pacific Fluorite operation in the Clark Mountain area of San Bernardino County produced in 1960. The small tonnage of crude ore produced was concentrated to ceramic grade at the site and shipped to glass manufacturers in Los Angeles and Ohio. Most of the fluorspar produced in Nevada came from two operations--in Nye and Lincoln Counties. The output was metallurgical-grade fluorspar, which was shipped to California steel and cement plants in 1960.

Virtually all of the 14,086 short tons of fluorspar consumed in California for all uses during 1960 came from Colorado and went into steelmaking and glass manufacturing. Hydrofluoric acid was produced in California by the General Chemical Div. of Allied Chemical and Dye Corp. at Nichols, Calif.

Gold

Gold was obtained in California and Nevada from lode and placer ores, and as a byproduct of copper, lead, and zinc smelting.

Security Paint Co. was the only California chemical plant that reported gold consumption in 1960.

Graphite

No natural graphite was produced in either California or Nevada. The entire domestic output came from one company in Texas and one in Pennsylvania. One California plant produced manufactured graphite; other plants were in Michigan, North Carolina, New York, Pennsylvania, Tennessee, and West Virginia. Imports of natural graphite came from Mexico, Malagasy Republic, and Ceylon.

The following companies in California consumed small quantities of graphite for use in paint, plastics, and unspecified uses: Amercoat Corp., Caldow Paint Co., California Chemical Co., Frank W. Dunne Co., Great Western Paint Co., Narmco Resins & Coatings Co., Poly Resins Co., Security Paint Manufacturing Co., and Southern Lacquer & Paint Corp.

Lithium

Dilithium sodium phosphate was one of several products produced in California from brine at Searles Lake, San Bernardino County, by American Potash and Chemical Corp. The dilithium sodium phosphate was converted to lithium carbonate before marketing.

Commercial lithium has been produced since 1938. The brine contains 0.015 percent Li_2O.

Nevada has produced no lithium to date, although extensive saline deposits reportedly contain significant quantities of lithium.

The California chemical industry did not report any consumption of lithium for 1960.

Molybdenum

Molybdenum minerals (molybdenite and powellite, combined) were recovered as byproducts of tungsten ores at the Pine Creek mine, Inyo County, Calif., during 1960. Part of the molybdenum concentrates were exported; the remainder were shipped out-of-State. Molybdenite was recovered as a byproduct from copper ores mined in White Pine County by Kennecott Copper Corp. at its McGill, Nev., smelter and shipped out-of-State.

The following California chemical companies reported consumption of molybdenum (mainly as lead molybdate) in 1960, for chemical applications: Amercoat Corp., Bio-Rad Laboratories, California Ink Co., De Soto Chemical Coatings, Inc., Security Paint Manufacturing Co., Skasol Inc. of Southern California.

Nickel

Although nickel mineralization covers large areas in California, there is no recorded production; also, none has been reported in Nevada.

Consumption of nickel and nickel compounds was reported in 1960 by Allied Chemical and Dye Corp., Parker Rust-Proof Co., and Shell Chemical Co., within SIC 28. Vegetable Oil Products Co., outside SIC 28, but closely related, used nickel as a catalyst for the hydrogenation of fats and oils for use in making soaps and food products. (The use of nickel catalyst, reportedly, is the only means by which the fish odor can be removed from fish oils to render them suitable for consumption.) Nickel was also used as a catalyst in various other industries indirectly related to the chemical industry, for uses such as petroleum cracking, the manufacture of hydrogen from natural gas, the manufacture of acetic acid from acetylene, and the manufacture of methane from carbon monoxide and hydrogen.

Nickel compounds, particularly nickel sulfate and nickel oxide, are used extensively in chemical manufacturing. Nickel chloride, nickel formate, nickel carbonate, nickel hydroxide, and nickel nitrate are used to lesser extent, but none was reported to be used by the California chemical industry.

Nitrates

A number of companies in California produced ammonia and other nitrogen compounds synthetically, but no natural nitrates were produced in either California or Nevada.

The following companies reported consumption of 30 tons of nitrates (natural) valued at $8,000 and obtained from Chile, mostly for use in fertilizers: American Better Chemicals Co., Columbia-Southern Chemical Corp., Long Manufacturing Co., Inc., Ohio Chemicals Pacific Co., Procter and Gamble Co., Purex Corp. Ltd., Skasol Inc. of Southern California, and E. B. Stone & Son. An indication of the quantity of ammonia and other nitrogen-bearing materials (natural and synthetic) consumed in California may be derived from table 120, which shows agricultural materials consumed in California.

Perlite

Nevada ranked second after New Mexico in output of crude perlite; California ranked fourth. California was the leading U.S. producer of expanded perlite, both in tonnage and number of plants, with an output of 24,000 tons (from 12 plants) at an average value of $59.13 a ton.

Four California chemical plants reported consumption of expanded perlite as filter aid, as a filler in paints and plastics, and as an insecticide carrier.

Diatomaceous earth competed with expanded perlite in the filter aid market. Almost all of the industrial minerals used as fillers and extenders will compete with perlite for those uses. On the other hand, perlite fines are available as a byproduct from screening plants at low cost and might be

more widely used as fillers, extenders, and carriers in place of other minerals such as ground limestone, lime, talc, and clays.

Platinum

Two dredging operations, on the American and Yuba Rivers in Sacramento and Yuba Counties, respectively, obtain platinum as a byproduct in gold recovery.

No consumption of the platinum-group metals was reported by the California chemical industry as raw materials for use in chemical manufacturing. Undoubtedly, some was used as a catalyst in nitric acid manufacture. Petrochemical catalyst use is outside SIC 28. Companies did use platinum items such as crucibles, which are not considered in this study.

Pumice

Pumice (including pumicite) produced in 11 counties in California totaled 427,000 short tons valued at $1,895,000. It was sold for a variety of construction and industrial uses. Chemical industry uses for which producers reported sales included carriers for pesticides.

Crude and prepared pumice (including volcanic cinder) was produced in Mineral, Ormsby, and Nye Counties, Nevada. Virtually the entire tonnage went into construction materials, which are outside SIC 28.

Only three companies--Fresno Agricultural Chemical Co., National Lead Co., and Vita-Fluor Corp.--reported consumption of ground pumice in the California chemical industry during 1960, for use mainly as insecticide filler. Other uses were in cleaning compounds, as oil absorbents, and as a paint filler. Only a small amount of pumice was obtained through brokers; most was obtained directly from the producer. Most of it originated in California, but some came from New Mexico and Utah.

Rare-Earth Minerals

The Molybdenum Corp. of America, Mountain Pass barite-bastnasite mine in the Ivanpah Mountains, San Bernardino County, Calif., was active during 1960. The concentrate was processed at company plants in York and Washington.

No thorium or rare-earth mineral consumption was reported by the California chemical industry in 1960.

Silver

Silver produced in California in 1960 was derived from copper, and from gold placers. Nevada silver output in 1960 was obtained mainly from lode deposits of silver ores, from treatment of copper ores, and from lead ores.

No silver consumption was reported by the California chemical industry for 1960, but undoubtedly some was used as a catalyst in pharmaceutical

preparations, as silver compounds. (Silver has been used industrially as an oxidation and dehydration catalyst, especially in the manufacture of aldehydes for primary alcohols, and in interaction between acetylene and formaldehyde in the manufacture of butadiene. Silver nitrate is used in marking inks and certain hair dyes. Silver zeolite is used by the U.S. Armed Forces to produce fresh water from salt water.)

Strontium

No strontium was produced in California or Nevada. The small-size domestic market and the low cost of imported strontium minerals have made domestic production economically unattractive.

A relatively large deposit of celestite occurs in San Bernardino County, Calif., in the Cady Mountains near Argus Station. Other deposits of celestite, associated with gypsum, occur in the Avawatz Mountains in the same area and in the Fish Creek Mountains on the eastern boundary of San Diego County. The latter deposit has been worked on a small scale in recent years. Also, strontianite occurs near Barstow.

No strontium consumption was reported by the California chemical industry in 1960. The major use of strontium is in pyrotechnics, but it also is known to have been used in greases, medicines, plastics, and paints.

Tin

Although tin occurring as cassiterite has been recovered in small quantities from California and Nevada deposits, there has been no production since World War II, and reserves are insignificant.

Only one company in the California chemical industry reported consumption of tin during 1960.

Tungsten

Four tungsten mines were active in California during 1960; the Pine Creek mine and mill of Union Carbide Nuclear Co., Inyo County, was the major tungsten operation in the State.

Four Nevada mines produced tungsten in 1960, but only one produced as much as 50 tons of crude ore. Some purchases of concentrate produced out-of-State were made.

Only two California chemical companies reported tungsten consumption in 1960. (Of the 9 million tons of tungsten products consumed by all U.S. industries in 1960, only 112,000 tons was used by the chemical industry. The chief tungsten compounds marketed in the United States were sodium tungstate, tungstic oxide, tungstic acid, and paratungstates. Sodium tungstate was used as a mordant in printing and for dyeing silk, and in fireproofing compounds. It was also used in the preparation of phosphotungstic acid.)

Uranium

California uranium output came from two properties; one each in Lassen and Sierra Counties. The Lassen County ore was processed in Utah, and the Sierra County ore was consigned to a plant at Lakeview, Ore.

Nevada uranium output came from four producers, two each in Elko and Lander Counties. Ore shipments were made to Oregon and Utah.

No uranium consumption was reported by the California chemical industry in 1960.

Wollastonite

Two firms in Riverside County, near Blythe (Lawrence Johnson and Mineral Exploit Co.), produced wollastonite in 1960.

The California deposits were mined exclusively for ornamental and building stone, although in the past some of the material was used to make rock wool.

Several chemical companies in California reported consumption of small quantities of New York wollastonite for use in paint. The Oil, Paint and Drug Reporter quoted prices for wollastonite at $29 to $51 a ton, f.o.b. source, depending on grade.

Zirconium

Although zircon is abundant in the heavy sands and gold placers of California, none was produced in 1960.

Only an insignificant quantity of zircon (obtained from Australia) and zirconium chloride was reported to be consumed by the California chemical industry in 1960.

HIGHLIGHTS OF THE CONDITIONS IN THE U.S. AND CALIFORNIA CHEMICAL INDUSTRIES

Origin and Growth

In 1790, the first U.S. patent, signed by George Washington, was for a chemical process (an improved potash kettle) (29). In 1960, the chemical industry had become the fourth largest in terms of assets ($24 billion) and ranked fifth in sales ($28 billion) among manufacturing industries. Expenditures for chemical plant construction totaled $1.6 billion in 1960 (53). Since 1950, per capita sales have risen sharply, and in 1960 exceeded $140 (fig. 8).[7]

[7] The California chemical industry is an integral part of the U.S. chemical industry, and many California products are bought and sold on the national market. Therefore, as fewer comparative data are available which can be revealed for California chemicals alone, the U.S. chemical industry must serve in many instances as background for consideration of the California chemical industry.

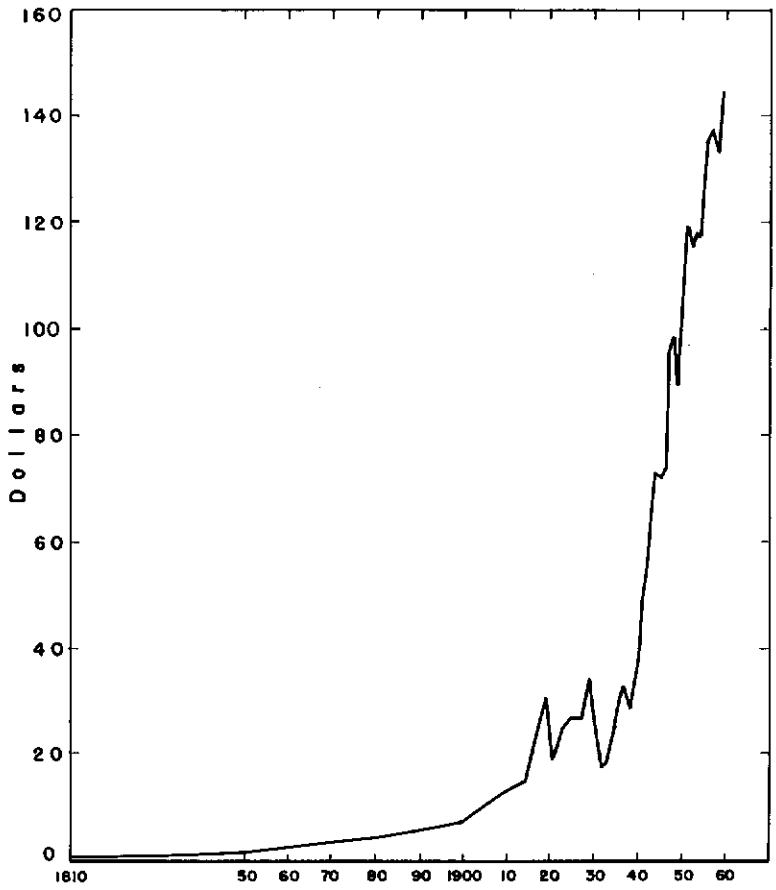


FIGURE 8. - Per Capita Sales of Chemicals and Allied Products.

The history of the California chemical industry parallels the history of the West. The chemical industry moved westward with the gold rush, and the first acid plant was built shortly thereafter, to meet the refining needs of the U.S. Mint. By 1960, 34,000 people were occupied by the California chemical industry, earning $208 million while producing products with value added by manufacture of $690 million.

Historically, the chemical industry has not been affected by business cycles and seasonal changes to the same extent as most other industries, principally because chemical production resists recession through new product development and sales to more stable industries, such as the food processing industry which provide a steady market for raw materials (29, 34, 44).

The growth of the chemical industry has paralleled the gross national product for over two decades. However, some chemical products, such as antibiotics, detergents, and cosmetics have shown much higher growth rates (29). On the other hand, some rapid-growth chemical items occasionally encounter serious and unexpected marketing problems. One current problem concerns use of petroleum-base frothers in detergents and the effects of waters containing them on sewage treatment and stream quality. There have been instances in which detergent foam has appeared in drinking water. Another problem currently encountered is the controversy over the effects of pesticides on humans and the normal wildlife balance.

Relative Importance of the California Chemical Industry

California accounted for two-thirds of all manufacturing in 1960 (50, 52) in the 11 Western States. A number of mineral raw materials and chemical manufacturing plants in the Western States were managed from headquarters in California (21, 57, 58). Also, California division offices of many national and international organizations had been given extensive management responsibilities.

The chemical industry was growing much faster in California than nationally; as shown in figure 9, production was concentrated in the Los Angeles-Long Beach and San Francisco-Oakland areas.

Comparative population growth of the ten leading U.S. metropolitan areas is shown in figure 10. Tables 112, 113, and 114 show how California ranks in terms of chemical production, employment, and manufacturing facilities. Table 115 shows how the San Francisco-Oakland and Los Angeles-Long Beach areas rank in terms of chemical output in comparison with other metropolitan areas. Table 116 shows how California compares with other States in terms of the value added in chemical production.

TABLE 112. - Rank of California chemical industry compared with other industries

Industry group	1958[1]	1954[1]	Increase	1958 rank	1954 rank
Transportation equipment	2,979.5	2,163.9	815.6	1	1
Food	1,831.8	1,400.9	430.9	2	2
Fabricated metals	867.8	579.0	288.8	3	4
Machinery, except electrical	801.0	580.3	220.7	4	3
Electrical machinery[2]	755.3	409.6	345.7	5	8
CHEMICALS AND ALLIED PRODUCTS	603.8	424.1	179.7	6	5
Printing and publishing	585.5	416.4	169.1	7	7
Stone, clay, and glass[2]	475.8	297.9	177.9	8	10
Primary metals	465.0	357.7	107.3	9	9
Lumber and wood products	399.9	422.0	-22.1	10	6
Petroleum and coal products	373.2	273.1	100.1	11	12
Apparel	349.2	279.4	69.8	12	11
Pulp, paper, and products	256.4	182.7	73.7	13	13
Furniture and fixtures	213.6	153.7	59.9	14	14
Instruments	185.5	111.2	74.3	15	16
Rubber	169.3	135.3	34.0	16	15
Textiles	52.4	39.3	13.1	17	17
Miscellaneous and ordnance	547.9	371.0	176.9	-	-
Total	11,912.9	8,597.5	3,315.4	-	-

[1]Value added by manufacture (unadjusted) in millions of dollars.
[2]Not comparable for two years.

Source: U.S. Department of Commerce, Bureau of the Census. 1958 Census of Manufactures, Area Reports.

TABLE 113. - Employment in chemical manufacturing in the 20 leading States, 1958

	State	Employment		State	Employment
1.	New Jersey	81,267	11.	West Virginia	23,613
2.	New York	66,272	12.	Indiana	23,423
3.	Illinois	49,955	13.	Missouri	18,104
4.	Ohio	47,384	14.	Louisiana	17,133
5.	Pennsylvania	44,785	15.	Massachusetts	16,110
6.	Texas	42,166	16.	Florida	14,741
7.	Tennessee	39,831	17.	South Carolina	14,299
8.	Michigan	35,979	18.	Maryland	12,953
9.	CALIFORNIA	35,806	19.	North Carolina	12,196
10.	Virginia	31,111	20.	Washington	11,641

Source: Bureau of the Census.

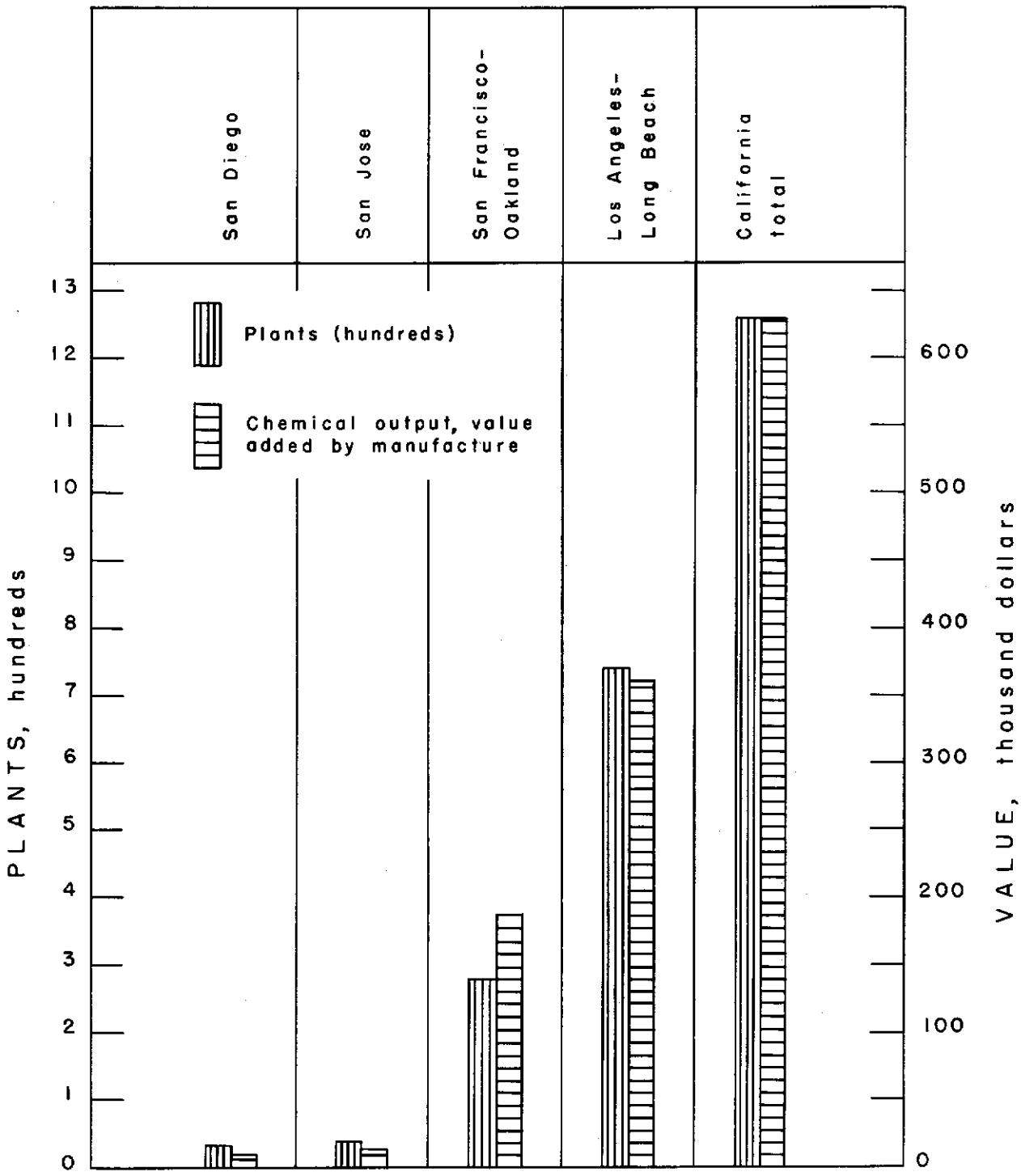


FIGURE 9. - Chemical and Allied Product Plants in California and Four Leading Areas–1958.

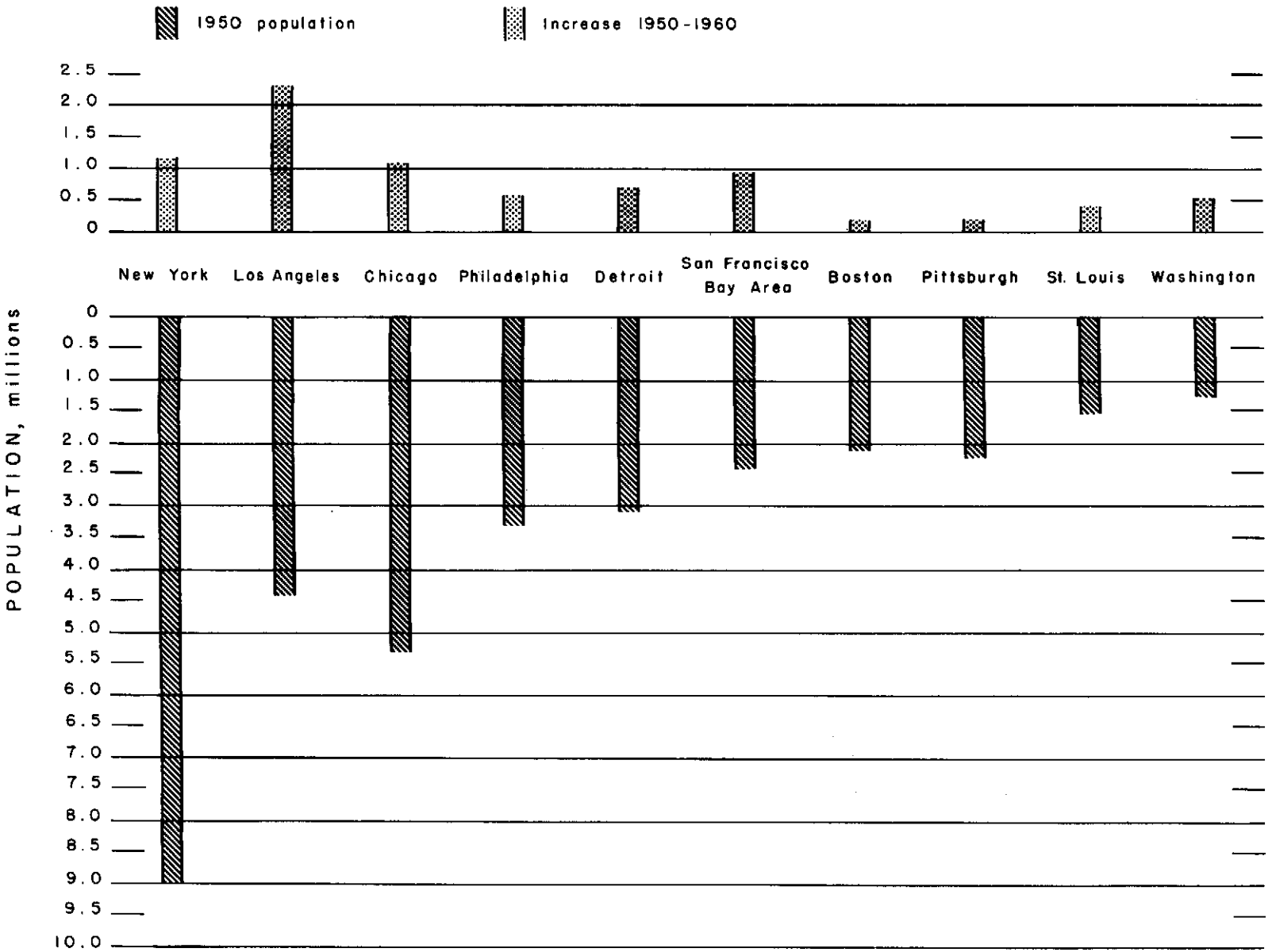


FIGURE 10. - Comparison of Population Growth of 10 Largest Metropolitan Areas.

TABLE 114. - Manufacturing plants in California and 11 Western States[1] [2]

SIC No.	Industrial group	California		Total manufacture employment		California employment as percent of	
		Total plants	Plants with over 20 employees	California	11 Western States	11 Western States	U.S.
2000	Food and kindred products.....	3,077	1,220	156,301	252,300	62.0	9.3
2200	Textile mill products.....	222	85	5,713	8,980	63.6	0.6
2300	Apparel and related products.....	2,280	799	57,899	70,100	82.6	4.9
2400	Lumber and wood products.....	2,331	546	51,943	187,760	27.7	8.9
2500	Furniture and fixtures.....	1,494	361	27,904	36,100	77.3	7.7
2600	Pulp, paper, and products.....	395	205	24,539	49,800	49.3	4.4
2700	Printing and publishing.....	3,114	521	63,573	94,580	67.2	7.4
2800	CHEMICALS AND ALLIED PRODUCTS.....	1,260	345	35,806	63,770	56.1	4.8
2900	Petroleum and coal products.....	178	66	20,645	29,600	69.7	11.4
3000	Rubber products.....	170	78	15,247	20,700	73.6	6.6
3200	Stone, clay, and glass products.....	1,433	388	41,611	62,770	66.3	7.4
3300	Primary metal products.....	651	276	43,432	87,500	49.6	4.0
3400	Fabricated metal products.....	2,963	856	87,964	106,200	82.8	8.4
3500	Machinery (except electrical).....	3,996	728	84,581	107,700	78.5	5.4
3600	Electrical machinery.....	1,106	418	81,121	90,400	89.7	8.0
3700	Transportation equipment.....	1,326	468	308,836	365,900	84.4	19.0
3800	Instruments and related products....	469	129	18,366	21,300	86.2	6.3
3900	Misc. mfg. (including ordnance).....	1,925	399	54,730	109,710	49.9	5.3
	Total.....	28,390	7,888	1,180,211	1,765,170	66.9	7.6

[1] Based on 1958 Census of Manufacturers.

[2] The 11 Western States are Washington, Oregon, California, Nevada, Arizona, Utah, Idaho, Montana, Wyoming, New Mexico, and Colorado.

TABLE 115. - Output of chemicals from 20 leading cities

City	Value added by manufacture (million dollars)		
	1958	1956	Change (percent)
1. New York-Northeast New Jersey	1,835	1,657	10.7
2. Chicago	608	591	2.9
3. Philadelphia	542	487	11.3
4. Newark	518	-	-
5. LOS ANGELES-LONG BEACH[1]	348	301	15.6
6. Cincinnati	259	239	8.4
7. St. Louis	257	273	-5.9
8. Houston	255	291	-8.1
9. Detroit	240	229	4.8
10. Buffalo	227	218	4.1
11. Paterson-Clifton-Passaic	185	-	-
12. Louisville	180	187	-3.7
13. SAN FRANCISCO-OAKLAND[1]	175	160	9.4
14. Indianapolis	157	-	-
15. Jersey City	155	-	-
16. Baltimore	152	134	13.5
17. Cleveland	150	184	-18.5
18. Boston	125	103	21.3
19. Minneapolis-St. Paul	120	83	44.5
20. Kansas City, Kans. Kansas City, Mo.	110	99	11.1

[1] Subsequently available figures show value added by manufacture to be $199 million for San Francisco-Oakland and $412 million for Los Angeles-Long Beach in 1960.

Source: Bureau of the Census. Chemical Week.

TABLE 116. - Output of chemicals from 10 leading States

State	Value added by manufacture (million dollars)		
	1958	1956	1954
1. New Jersey	1,446,573	1,354,930	1,121,765
2. New York	1,222,149	979,101	872,140
3. Texas	1,063,313	1,020,881	722,056
4. Illinois	868,058	785,368	663,669
5. Pennsylvania	706,359	714,086	510,561
6. Ohio	698,213	698,546	566,366
7. CALIFORNIA	603,849	522,811	424,136
8. Michigan	602,728	560,799	497,024
9. Tennessee	542,104	491,636	454,064
10. Indiana	498,778	430,295	343,491

Sources: Bureau of the Census. Chemical Week.

Table 117 shows the number of chemical plants operating in California during 1960, by county; plant size, based on employment; and chemical industry group. Table 118 lists employers in the California chemical industry in 1960 and shows a significant increase over 1958 employment as shown in table 114. Figure 11 shows graphically, the employment situation in the San Francisco Bay area.

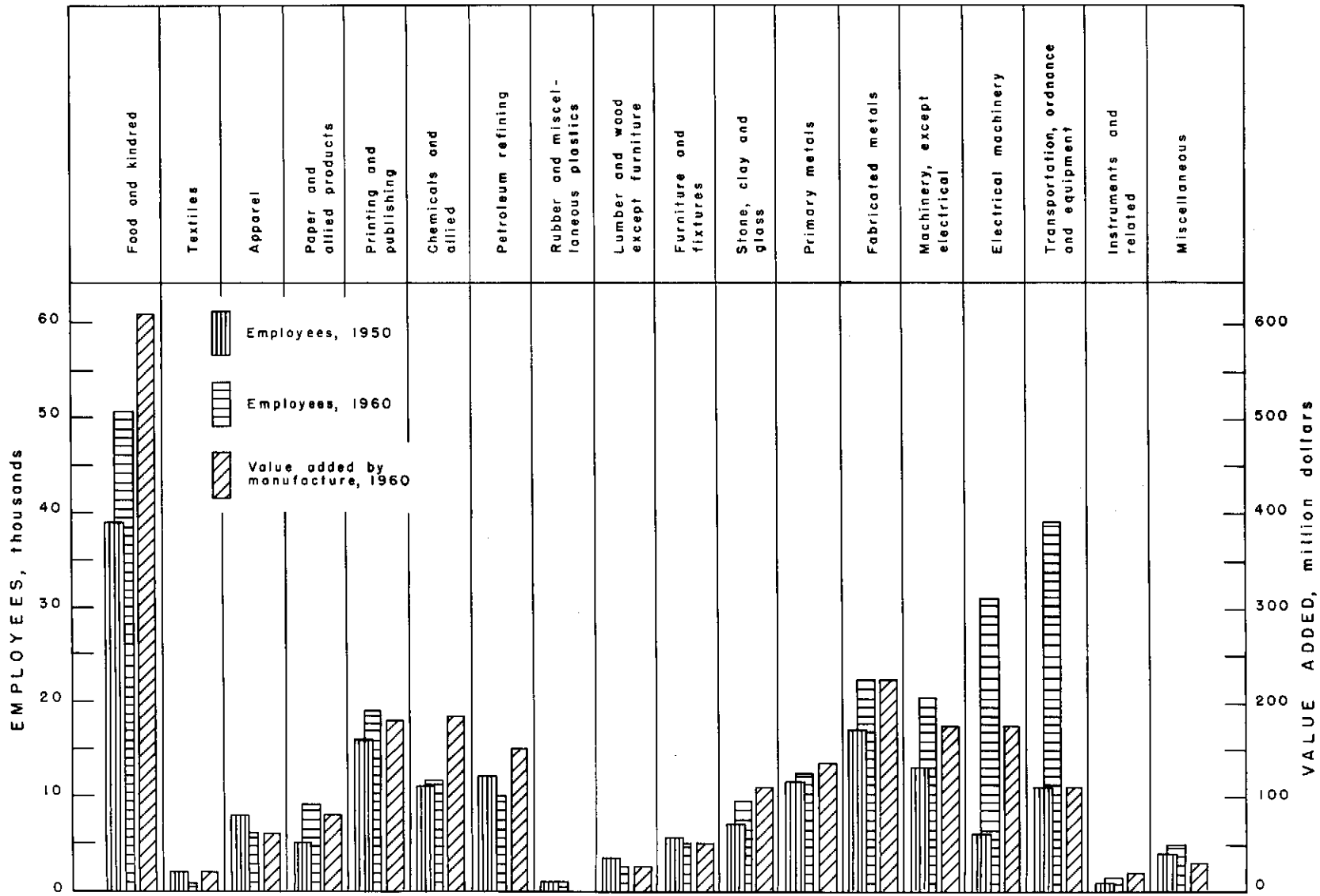


FIGURE 11. - Employment in the San Francisco Bay Area in 1950 and 1960, by Product.

TABLE 117. - Number and size of plants by chemical groups and California counties, 1958, compiled from the Bureau of the Census data MC (58) S - 2.5[1]

Employees

A = 1-10; B = 20-49; C = 50-99; D = 100 or more

SIC	Chemical groups	Alameda	Butte	Contra Costa	Fresno	Humboldt	Imperial	Kern	Kings	Los Angeles	Marin	Mariposa	Monterey	Orange	Riverside	Sacramento	San Bernardino	San Diego	San Francisco	San Joaquin	San Luis Obispo	San Mateo	Santa Barbara	Santa Clara	Santa Cruz	Shasta	Solano	Sonoma	Stanislaus	Tehama	Tulare	Ventura	Yolo	California totals
2812	Alkalies and chlorine.....	1D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1D
2813	Industrial gases.....	5A 3B 3C	-	-	1A	1A	-	-	1A	2A 2B 4C 1D	-	-	-	1A 1C	-	1A 1C	1C	1A	1A	-	-	2A	-	-	-	-	-	-	-	-	-	1A 1D	-	17A 5B 10C 2D
2814	Cyclic (coal tar crudes)..	-	-	-	-	-	-	-	-	-	-	-	-	1A	-	-	1B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1A 1B
2815	Dyes.....	-	-	1B	-	-	-	-	-	1B 1C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2B 1C
2816	Inorganic pigments.....	1B 1C	-	1A	-	-	-	-	-	8A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9A 1B 1C
2818	Industrial organic chemicals, n.e.c.....	-	-	2A 1B 1C 2D	1A	-	-	-	-	8A 2D	-	-	-	1C	-	-	-	1D	-	-	-	1A		2A 1C 1D	-	-	-	-	1A	-	-	-	15A 2B 3C 6D
2819	Industrial inorganic chemicals, n.e.c.....	2A 5C 1D	-	2A 1C 4D	1A	-	-	1A	-	12A 2B 10C 4D	1A	-	-	1B 1D	-	-	3A	1A	1A 1B	-	-	1B	-	-	-	-	-	-	1D	-	-	1D	-	24A 5B 16C 12D
2821	Plastics materials.....	1A	-	-	-	-	-	-	-	18A 3B 8C 1D	-	-	-	1A 1C	-	-	1A	1A	1A 1B	-	1D	-	-	1B	-	-	-	-	-	-	-	-	-	23A 5B 9C 2D
2822	Synthetic rubber.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2823	Cellulosic man-made fibers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2824	Synthetic fibers (excluding organic).....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2831	Biological products.....	1A	-	-	-	-	-	-	-	4A 1B 1C 1D	-	-	-	-	-	-	-	1A	2A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8A 1B 1C 1D
2833	Medical, chemical, and botanical products.....	-	-	-	-	-	-	1D	-	5A 2C	-	-	-	-	1A	-	1A	-	-	-	-	1A	-	-	1A	-	-	-	1A	-	-	-	-	10A 2C 1D
2834	Pharmaceutical preparations.....	4A 1C 1D	-	2A	3A	-	-	-	-	49A 3B 18C 4D	1A	-	2A	1A 1D	1A	-	2A	3A	7A 1C	-	-	1A	-	1A	1A	-	-	-	-	-	-	1A	-	79A 3B 20C 6D

2841	Soap, detergents..........	7A 2D	-	-	-	-	-	-	-	34A 2B 4C 7D	-	-	-	-	-	1D	-	5A 1C	4A 2C	1A	-	1C	1A	2A 1D	-	-	-	-	2A	-	-	-	-	56A 2B 8C 11D
2842	Specialty cleaning and polish preparations......	11A 1C	1A	-	2A	-	-	1A	-	75A 1B 8C 1D	1A	-	-	2A	-	1C	-	1A	8A 1C	2A	-	1A	-	3A 1C	-	-	1A	-	-	-	-	1A	1A	111A 1B 12C 1D
2843	Surface active agents.....	-	-	1B	-	-	-	-	-	1A 2C	-	-	-	-	-	-	-	-	-	-	-	1A	-	1A	-	-	-	-	-	-	-	-	-	3A 1B 2C
2844	Perfumes, cosmetics.......	4A	-	-	1A	-	-	-	-	59A 3B 10C 3D	-	-	-	1A	-	-	1A	2A	8A 1B	-	-	1A 1C	1A	2A	-	-	-	-	-	-	-	-	-	80A 4B 11C 3D
2851	Paints, varnishes, etc....	19A 2B 1C 3D	-	2A	1A	1A	-	-	-	87A 7B 21C 10D	-	-	-	5A 1B	1B	3A 1B	2A	5A	13A 1B 3C 2D	-	-	5A 2C 2D	1A	8A	1A	1A	-	1A	-	-	2A	1A	-	158A 13B 27C 17D
2852	Putty, calking compounds..	3A	-	1A	-	-	-	-	-	8A 2C	-	-	-	-	-	1A	-	-	1A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14A 2C
2861	Gum and wood chemicals....	1A	-	-	-	-	-	-	-	1A	-	1A	-	-	-	-	1A	1A	-	-	2A	-	-	-	-	-	-	-	-	-	-	-	-	7A
2871	Fertilizers...............	3A 2C	1A	2A 1B 1C	2A 1D	-	1A	-	-	16A 2B 2C	-	-	1B 2C	3A	2A	2A 1C	1A	2A	2A	2A 1D	-	-	-	4A	3A	-	-	-	1A 2C	-	2A	1A	1A	50A 4B 10C 2D
2872	Fertilizers, mixing only..	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	([2])
2873	Agricultural pesticides...	1A 1C	-	1B 1C 2D	2A 1C	-	2A 2C	1A 1C	-	12A 2B 2C 1D	-	-	2A	-	2A	2A	-	-	-	2A	-	3A	1A	2A 2C	-	-	-	-	-	-	-	2A	-	34A 3B 10C 3D
2879	Agricultural chemicals, n.e.c....................	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2891	Glue and gelatin..........	2A	-	-	-	-	-	-	-	10A 3C	1A	-	-	1A	-	-	-	-	4A 1C	1A	-	1A 1C 1D	-	-	-	-	-	-	-	-	-	-	-	20A 5C 1D
2892	Explosives................	1B	-	1D	-	-	-	-	-	1C	-	-	-	1A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1A 1B 1C 1D
2893	Printing ink..............	2A 3C 1D	-	-	-	-	-	-	-	11A 1B 4C	-	-	-	1A	-	-	-	1A	1A	-	-	1C	-	-	-	-	-	-	-	-	-	-	-	16A 1B 8C 1D
2894	Fatty acids...............	1B	-	-	-	-	-	-	-	2B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2B
2895	Carbon black..............	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2899	Chemical and chemical preparations, n.e.c......	5A 2D	-	1A	3A	-	-	1A	-	79A 3B 9C 1D	-	-	1C	3A	2A	2A	5A	3A 1C	13A	2A	-	3A 1B 1C	-	2A 1C	-	-	1A	1A	-	-	1A	-	1A	128A 4B 13C 3D

[1] Compilation based on location of manufacturing plants, census of manufacturers, part 5, 1958, U.S. Department of Commerce, Bureau of the Census.
[2] Included in SIC 2871.

TABLE 118. - Number of covered reporting units (employers) in chemicals and allied products, by County(s), State of California, 1960

County	Reporting units (quarterly average)
Alameda	104
Butte	2
Colusa	1
Contra Costa	30
El Dorado	1
Fresno	14
Humboldt	2
Imperial	7
Inyo	1
Kern	8
Kings	1
Los Angeles	663
Marin	1
Merced	1
Monterey	6
Orange	28
Riverside	5
Sacramento	11
San Bernardino	18
San Diego	19
San Francisco	78
San Joaquin	10
San Luis Obispo	5
San Mateo	31
Santa Barbara	2
Santa Clara	33
Santa Cruz	3
Shasta	2
Siskiyou	1
Solano	2
Sonoma	5
Stanislaus	5
Tulare	4
Ventura	6
Yolo	3
Total, all counties	[1] 1,107

[1] Average monthly insured employment of these units totaled 41,110. Counties omitted had no reporting units.

Source: State of California Dept. of Employment.

Table 119 shows the comparison of chemical values added by manufacture in the United States, Western States, and California, in 1958, and costs of raw materials for those products in the United States.

Fertilizer markets in California for minerals are indicated in figure 12 and table 120. An undeterminable percentage of these products was shipped in from other States.

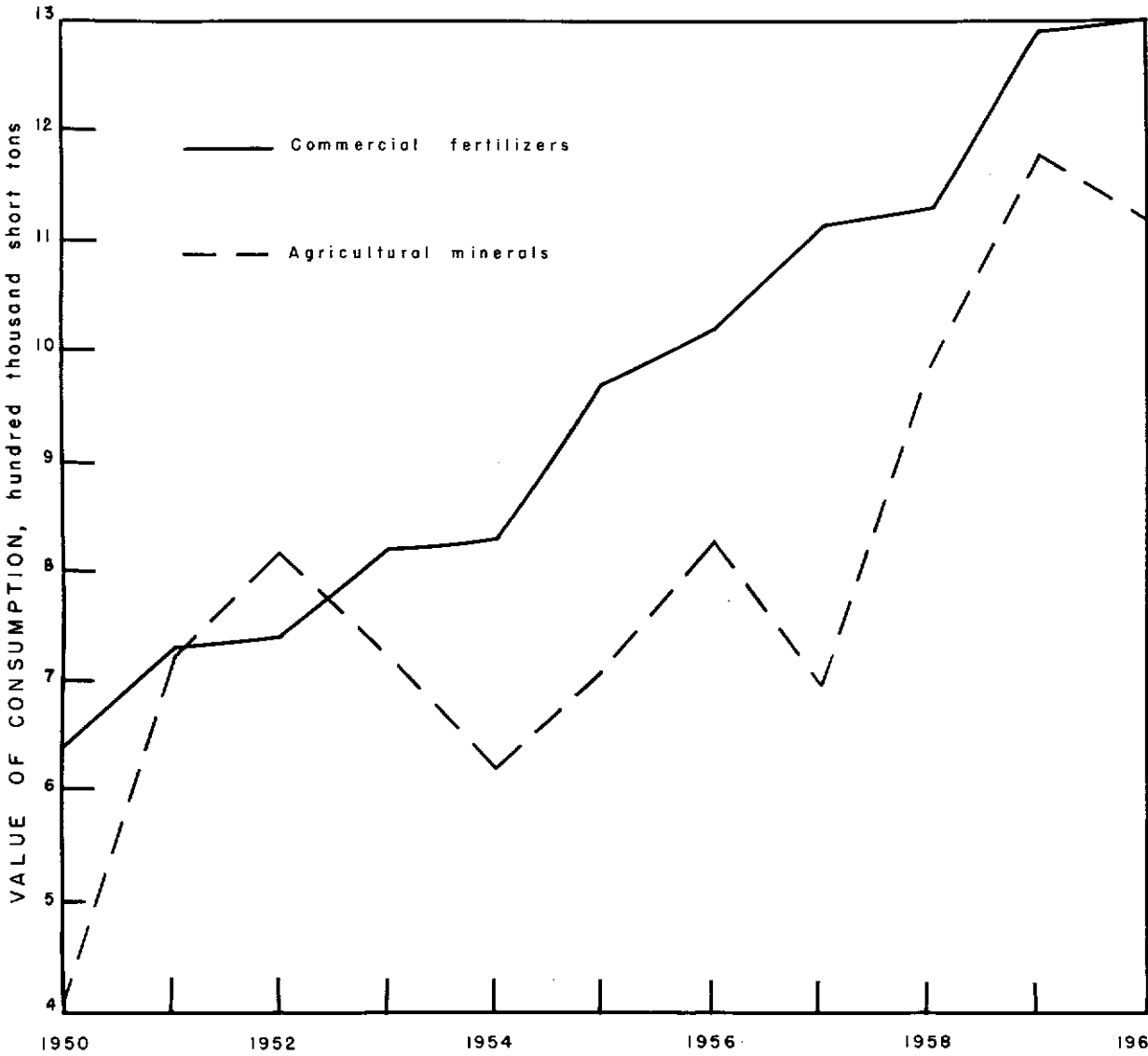


FIGURE 12. - Commercial Fertilizers and Agricultural Minerals Consumed in California, 1950-60.

TABLE 119. - Comparative production of the U.S., Western, and California chemical industries, 1958

Chemical product groups	Value added by manufacture (million dollars)			Value added, as percent of U.S. total	Value added, as percent of total in 11 Western States	Value of shipments (million dollars)
	In United States	In 11 Western States[1]	In California	In 11 Western States	In California	Calif.[2]
Industrial inorganic chemicals	1,748.0	317.3	(3)	18.1	(3)	(3)
Sulfuric acid	72.6	(29.0)	(3)	40.0	(3)	(3)
Alkalies and chlorine	306.2	41.1	(3)	13.4	(3)	(3)
Industrial inorganic chemicals n.e.c.	1,369.2	247.2	80.0	18.0	32.4	152.5
Industrial organic chemicals	4,106.2	148.6	46.8	3.6	31.5	99.4
Cyclic (coal tar) crudes	30.0	(2.5)	(3)	8.3	(3)	(3)
Intermediate coal tar products	373.1	7.8	(3)	2.1	(3)	(3)
Plastics, synthetic resin, etc	872.0	(50.0)	45.8	5.7	91.6	83.8
Synthetic rubber	197.9	(20.0)	(3)	10.0	(3)	(3)
Synthetic fibers	829.9	-	-	-	(3)	(3)
Explosives	131.6	14.0	3.5	10.7	25.0	6.6
Organic chemicals n.e.c.[4]	1,671.7	54.3	(3)	3.2	(3)	(3)
Drugs and medicinals	2,096.2	49.4	46.0	2.4	93.1	(3)
Biological products	38.9	4.3	3.5	11.0	81.4	6.8
Medicinals and botanicals	175.8	5.5	4.9	3.1	89.1	10.0
Pharmaceutical preparations	1,881.5	39.6	37.2	2.1	93.9	52.7
Soaps, detergents, and cleaning preparations, etc	1,903.1	150.8	(3)	7.9	(3)	(3)
Soaps and detergents	857.6	92.1	90.8	10.7	98.6	195.4
Polishes and sanitation goods	295.6	17.1	15.6	5.8	91.2	31.9
Surface active agents	52.4	4.2	4.2	8.0	100.0	9.4
Toilet preparations	697.5	37.4	36.4	5.4	97.3	56.9
Paints, varnishes, and lacquers	1,044.6	106.9	(3)	10.2	(3)	(3)
Paints and varnishes	783.3	96.0	83.6	12.2	87.1	206.1
Inorganic color pigments	235.7	(8.5)	(3)	3.6	(3)	(3)
Putty and calking compounds	23.6	2.4	1.9	10.0	79.2	(3)
Gum and wood chemicals	85.3	.2	-	.2	(3)	(3)
Agricultural chemicals	414.0	40.8	30.0	9.9	73.5	(3)
Fertilizers	303.0	21.6	13.1	7.9	60.6	24.1
Agriculture, pesticides, etc	111.0	19.2	16.7	17.3	87.0	57.9
Vegetables and animal oils	362.2	36.9	(3)	10.2	(3)	(3)
Miscellaneous chemical products	826.4	91.1	(3)	11.0	(3)	(3)
Glue and gelatin	106.4	12.5	6.1	11.7	48.8	14.5
Printing ink	108.8	12.1	11.3	11.1	93.4	22.3
Compressed and liquified gases	174.2	29.5	20.4	16.9	69.2	30.1
Carbon black	72.6	(3.6)	(3)	5.0	(3)	(3)
Salt	59.3	(9.3)	(3)	15.7	(3)	(3)
Chemical preparations n.e.c.[4]	305.1	24.1	(3)	7.9	(3)	(3)
All groups	12,585.8	942.0	597.0	7.5	63.4	(3)

[1] The 11 Western States are Washington, Oregon, California, Nevada, Arizona, Utah, Idaho, Montana, Wyoming, New Mexico, and Colorado. Figures shown in parentheses are estimates made by David Gaber, Bank of California, in December 1961 issue of California Magazine (p. 9) published by California Chamber of Commerce.

[2] By subtracting the value added by manufacture from value of shipments, the cost of raw materials, supplies, container fuel, purchased electrical energy, and contract work can be derived.

[3] Not available or not disclosable.

[4] N.e.c. means all other combined or "not elsewhere classified."

Source: Bureau of Census MC 58 (2) A-G and California Chamber of Commerce estimates.

TABLE 120. - Fertilizers sold in California, 1960[1]

Commercial fertilizers	Short tons
Ammonia, anhydrous	96,653
Ammonia-ammonium nitrate solution	10,579
Ammonia solution	226,402
Ammoniated superphosphate	1,304
Ammonium nitrate	42,909
Ammonium nitrate solution	34,904
Ammonium phosphate 11-48-0	14,369
Ammonium phosphate 13-39-0	2,246
Ammonium phosphate 21-53-0	2,233
Ammonium phosphate nitrate 27-14-0	2,135
Ammonium phosphate sulfate 16-20-0	66,544
Ammonium sulfate	187,678
Blood meal	2,228
Bone meal	1,184
Calcium cyanamide	4,305
Calcium ammonium nitrate solution	9,525
Calcium nitrate	28,132
Fish emulsion	847
Fish meal	590
Hoof and horn meal	240
Liquid phosphoric acid	11,339
Mixed fertilizers, dry	265,195
Mixed fertilizers, liquid	92,857
Potassium chloride	2,007
Potassium sulfate	6,772
Seed meal, castor	2,831
Seed meals, other than castor	358
Sewage sludge, activated	13,286
Sodium nitrate	201
Superphosphate, normal	94,095
Superphosphate, treble	14,176
Tankage	880
Urea	28,787
Miscellaneous	6,372
Unsegregated	1,300
Delinquent reports and corrections by audit	-7,672
Total	1,267,791

Agricultural minerals	Short tons
Aluminum sulfate	129
Borax	379
Calcium carbonate	8,420
Calcium hydroxide	2,115
Copper sulfate	135
Gypsum	1,009,832
Iron oxide	3,094
Iron sulfate	2,210
Lime-sulfur solution	8,523
Magnesium carbonate	4,038
Magnesium sulfate	55
Manganese sulfate	26
Mixed materials	3,092
Phosphate rock	381
Sewage sludge	30,071
Soil sulfur	23,123
Sulfuric acid	676
Zinc oxide	241
Zinc sulfate	2,018
Miscellaneous	2,695
Unsegregated	790
Total	1,102,043

Grade of dry-mixed fertilizers[2]	Short tons
4-10-16	3,212
4-12-4	1,468
6-9-6	1,621
6-10-4	5,012
8-8-4	4,990
8-10-12	2,164
10-10-5	16,306
10-10-10	29,326
11-8-4	6,610
14-14-7	4,805
15-18-4	7,072
15-8-8	1,564
16-10-0	1,030
16-20-0	10,753
17-7-0	9,835
Miscellaneous	155,275
Unsegregated	4,142
Total	265,195

[1]California State Bureau of Chemistry.

[2]The three figures below mean the ratio of nitrogen, phosphoric acid, and potash--in that order.

Research and Development

There was considerable emphasis on research in the U.S. chemical industry in 1960. As much as 3 to 4 percent of gross sales may have gone into research and new product development, which includes evaluation of new raw materials (2). Standardization of quality is of paramount importance. Slight differences in quality may drastically affect sales, and each market has its own unique quality standards. For example, one kitchen scrubbing compound manufacturer reported that sales dropped markedly when a colored compound, designed to be attractive, was introduced. If the introduced color had been successful, it would have masked iron-oxide-stained silica and allowed a lower-priced abrasive to be used.

Chemical product research and development are widely emphasized throughout the industry. Expenditures for these purposes alone totaled about $1.4 billion in 1960. The relative amounts of research and development expenditures in the chemical and other manufacturing industries are shown in table 121. The percentage of research which goes with developing new raw materials is difficult to establish.

TABLE 121. - Research and development expenditures by U.S. industry, 1956-60

(Million dollars)

Industry	1960	1959	1958	1957	1956	Percent federally financed, 1960
Food and kindred products....	106	89	79	67	58	8
Paper and allied products....	66	59	50	45	44	1
CHEMICALS AND ALLIED PRODUCTS	1,047	949	781	701	620	29
Industrial chemicals.....	737	676	542	494	437	40
Drugs and medicines.....	168	147	128	104	94	3
Other chemicals.....	143	126	111	104	89	1
Petroleum refining and extraction.....	289	272	241	224	194	9
Rubber products.....	115	111	89	107	([1])	30
Stone, clay, and glass products.....	82	72	64	59	51	5
Primary metals.....	164	138	125	111	93	11
Fabricated metal products....	126	124	121	107	92	43
Machinery.....	993	946	778	687	562	39
Electrical equipment and communication.....	2,405	2,240	1,947	1,775	1,486	68
Motor vehicles and other transportation equipment....	849	866	849	702	666	25
Aircraft and parts.....	3,482	3,028	2,498	2,540	2,125	87
Professional and scientific instruments.....	416	353	288	249	200	51
Other industries.....	358	303	309	291	242	57
All industries.....	10,497	9,553	8,218	7,664	6,538	58

[1]Not separately available but included in total. NOTE: Excludes expenditures for R & D conducted by outside organizations.

Sources: National Science Foundation; Department of Commerce.

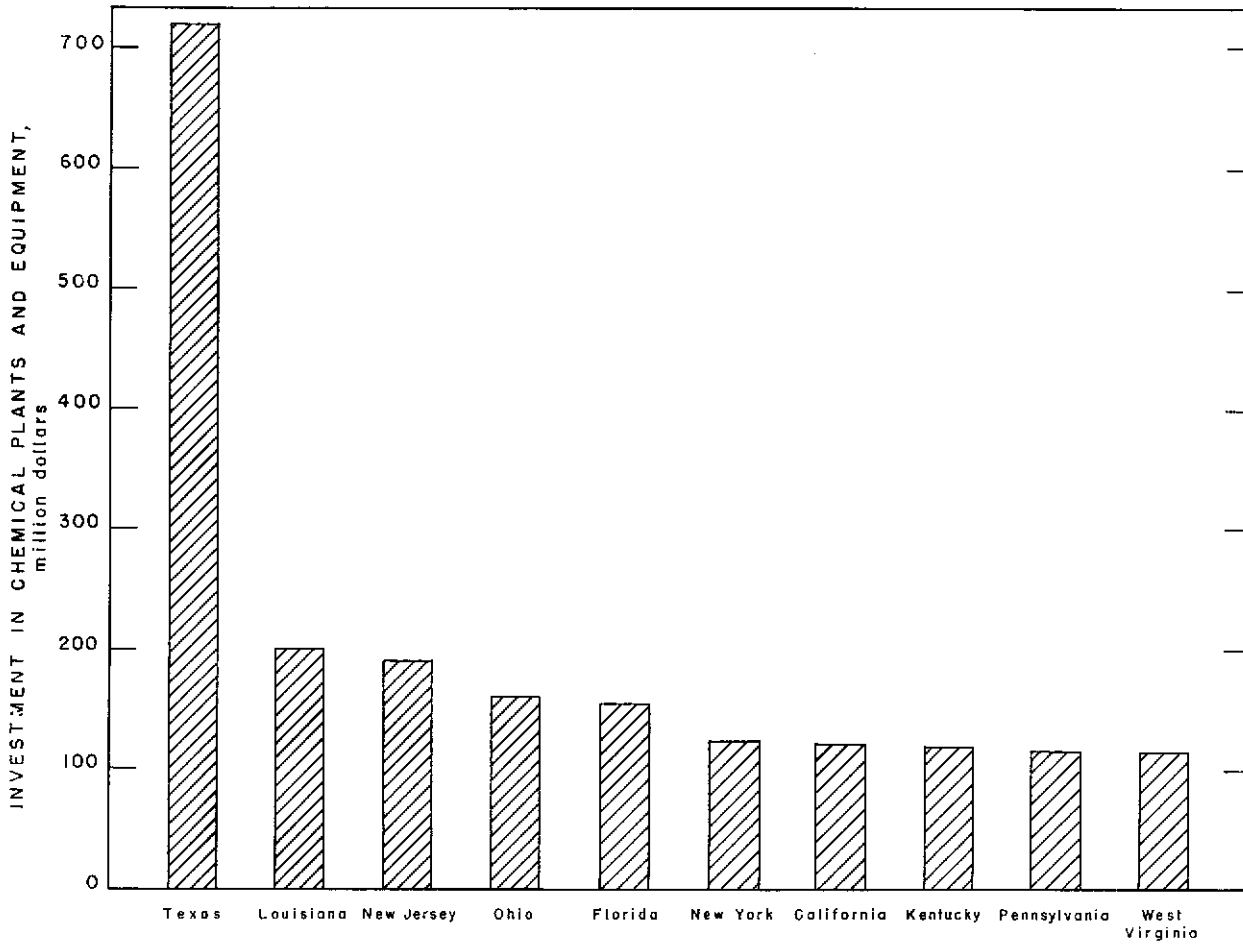


FIGURE 13. - Investment in New Chemical Plant and Equipment in the 10 Leading States, 1961 (in million dollars).

Figure 13 and 14 indicate the States and chemicals leading in terms of investment in new plant construction.

OUTLOOK

The outlook appears excellent for increased chemical production. A greater part of the raw material requirements probably will be met from local mineral deposits in California and Nevada.

California accounted for 62 percent of the income and 58 percent of the population of the 11 Western States in 1960. This lead is expected to continue, at least through 1980. The 11 Western States had a population of 28 million in 1960, compared with 19 million in 1950, and much of the resulting increase in chemical needs was filled by California producers. According to projections of Stanford Research Institute, these States will increase in population to at least 35 million by 1970 and 40 million by 1975--over 100 percent growth in 25 years, compared with about 42 percent expected for the entire Nation. Based on statistical projections, the high rate of growth in

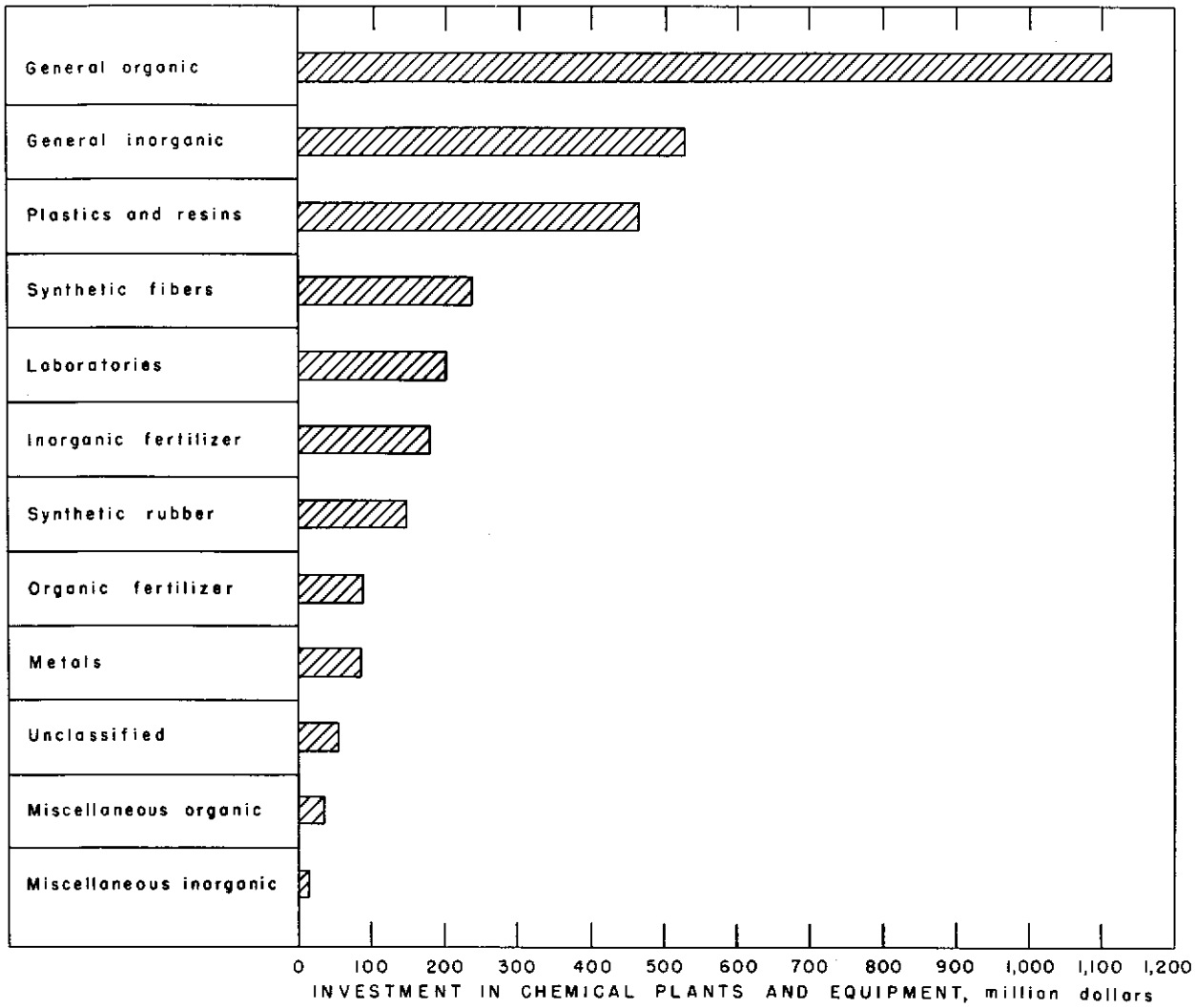


FIGURE 14. - Investment by Chemical Category. 1961 construction survey (in million dollars).

the chemical industry in California should result in a doubling of output by 1985 (43). Consequently, the quantity of mineral raw materials required should also double during this period.

Figure 15 shows projected California consumption of minerals based on several estimates of gross national product and total U.S. population, all of which are considered to show conservative growth rates for California. California population and general economic growth are expected to increase at a higher rate than the national average. The percentage of chemical raw materials that will be supplied by the California-Nevada mining industry will depend to a large extent upon its initiative in the areas outlined in this study.

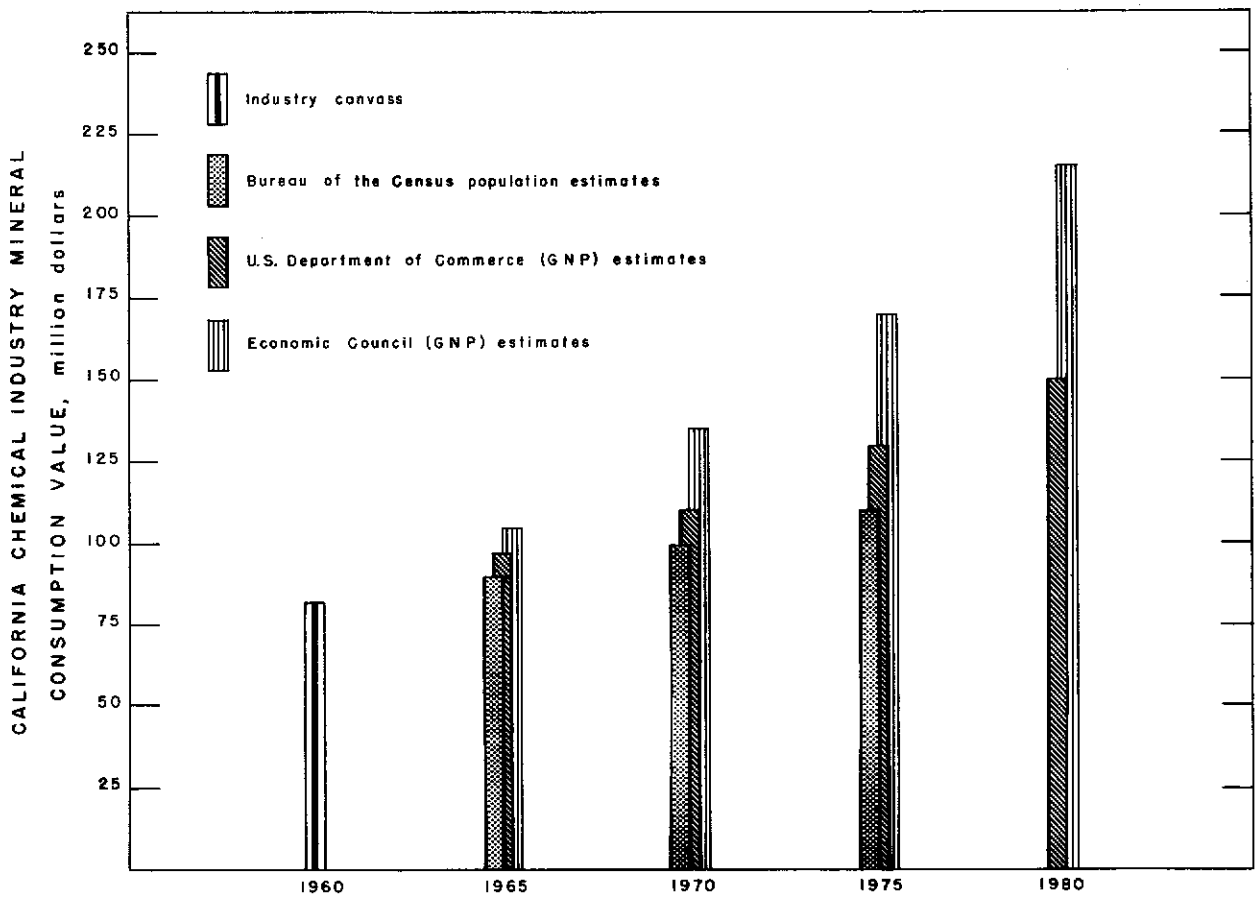


FIGURE 15. - Projected Use of Minerals in the California Chemical Industry to 1980 (based on 1960 canvass and selected indicators).

The chemical industries of southern California (primarily the Los Angeles-Long Beach area) and northern California (essentially the San Francisco-Oakland area) differed in the sources of raw materials used and the products manufactured in 1960. It was expected, however, that these differences would become less as new plants became more diversified.

As markets continue to develop and transportation costs increase, it seems logical that there will be a greater dependence on local sources of raw materials. Many locally occurring raw materials not considered in the past and many others from little explored areas undoubtedly will become of considerable importance in the future California chemical industry.

Improved local mineral supply to the California chemical industry will depend to a considerable degree upon successful application of improved technology to insure a constant flow of diversified, high-quality, and low-cost raw materials. Also, intimate knowledge of the potential applications and aggressive sales campaigns to encourage the chemical industry to convert to their use will be essential measures.

Many mineral substitute raw materials in the future will be manufactured synthetically, as cryolite and nitrogen compounds are now. For example, within the next decade or so, clay and anorthosite probably will be used as sources of aluminum, based on results of Bureau of Mines research. In the more distant future, minerals such as asbestos, talc, kaolin, and mica may be manufactured from abundant source materials.

The sea is a commercial source of minerals such as bromine and magnesium and a potential supplier of many other elements such as manganese, cobalt, nickel, copper, and phosphate, presumably at higher prices than from present sources. Nevertheless, one company in California leased several thousand acres of sea bottom to study the feasibility of recovering ocean floor phosphorite pebbles. Other companies are investigating the use of brines from salt water desalting plants as a source of minerals. Several desalting plants have been installed in the United States; one at Coalinga, Calif., and one at San Diego, Calif.; they are presently in operation.

The interdependence of population centers and mineral raw materials will be emphasized. It will be recognized that with few exceptions low-cost, large-volume materials can be obtained locally, and evaluation of resources will be made on a local basis. Higher-valued raw materials, however, will continue to be shipped over greater distances.

The foreign chemical industry, because of lower labor costs and relatively inexpensive water transport, will offer domestic mineral and chemical producers serious competition in some fields, particularly in coastal marketing areas.

CONCLUSIONS

Based on analysis of data provided by California mineral raw material consumers and their suppliers, the following conclusions are drawn:

1. Some companies will consider new sources and possibly different and lower quality materials, but a major and complete changeover to a new raw material source overnight is very unlikely. The company must always be assured that the changeover is a definite advantage, either because of price, quality, service, or other features.

2. Some companies are bound to their present sources of supply in various ways that would make it difficult, if not impossible, change sources promptly.

3. Specifications for mineral raw materials are usually set much higher than necessary for many uses and are, in some instances, so rigid that there is little chance of introducing similar and alternate materials. There is a need for uniform standardization of requirements for mineral raw materials. Too many companies have widely variable mineral specifications for equivalent use.

4. Many physical and chemical tests do not establish what the consumer needs as raw material for a product but merely what he knows that he can use. Therefore, in some instances, the consumer perpetuates the standards provided by a supplier. If the material is sold for lower use requirements, and if the consumer uses these data sheets as guides to subsequent possible suppliers, chances are unlikely that significant reduction in raw material costs will be achieved. Unless the difference in cost is significant, the consumer is not interested in changing sources.

5. Marketing by a new producer or of a new product can prove to be a dilemma in some instances (i.e., the customer demands proven sales records of a processed and uniform product, while the potential supplier needs market assurance before investing the necessary time and equipment to meet the demands).

6. Process "secrecy" of manufacturers and insufficient cooperation between the mineral and chemical industries handicap both the potential supplier and the manufacturer in developing raw materials and usually reduce the consumer's margin of profit. There are indications, however, that these conditions are improving.

7. As profit margins are reduced, more chemical companies will seek lower cost raw materials, but the tendency has been for them to establish their own sources rather than change suppliers.

8. The majority of chemicals manufactured require large quantities of relatively few minerals and small quantities of a large number of minerals. Many minerals are used in processing and do not enter into the finished chemical product.

9. Synthetic and byproduct materials are substituting more and more for natural minerals in chemical manufacturing.

10. The California chemical industry will undoubtedly continue to expand at a rapid rate and move plants farther from metropolitan areas, which tends to allow development of mineral deposits formerly too distant from markets.

11. There will be increasing opportunities for western mineral producers to market their minerals to California and Nevada chemical manufacturers. To take advantage of that opportunity, the salesman-miner will need an understanding of the purchaser's problems and must be able to assure a reliable supply of a uniform product.

12. Many minerals exist in abundance in the Western States that might well be suitable for use as raw materials by the West's chemical manufacturers and would result frequently in appreciable savings to them for raw materials. Admittedly, however, suitable process research would often be required to fit nearby minerals into established flowsheets. Where nearby deposits are sizable, appropriate process research could be quite worthwhile.

Specific Factors Affecting the Mineral Producer

The trend towards obtaining more materials from locally available sources in the future as lower grade deposits are developed and beneficiated to meet industrial requirements will be counteracted somewhat by zoning restrictions on land use, which undoubtedly will become more strict, with resultant tendency to increase costs of mineral raw materials by forcing consumers to bring materials in from more distant sources.

Producers of minerals for other industries will seek to expand their business through investigations of requirements, uses, and markets for minerals in the chemical industry.

Mergers, acquisitions, and joint ventures will continue to be of significance in the mineral supply industries. Companies outside the mineral industry will enter the field at an increased pace, and more chemical companies will operate their own mineral deposits.

California has become one of the leading States in the manufacture of paints, lacquer and related products, but the paint industry is not expected to increase in output as rapidly as the plastics, organic chemicals, and pharmaceuticals industries.

California's chemical industry growth will be more broadly based. Stanford Research Institute has stated that future growth is expected to "result from (1) import substitution, by which is meant the production in California of goods formerly brought into the State from other areas, and (2) changes in consumer demand that will favor California industries" (38).

Trona from the Wyoming bedded deposits may eventually reduce the consumer cost of soda ash in California. A high-quality kaolin clay will continue to be sought in the West by users in the chemical and paper industries.

Rapid technological changes will affect radically mineral and chemical products and processes. Through technological changes and new laboratory developments, certain raw materials may become obsolete in the production of chemicals. Shortages hasten development of substitutes. Some basic chemical raw materials such as limestone and salt probably will always be necessary, but technological changes undoubtedly will affect even their areas of utilization. In some instances, byproducts may force out prime products or seriously reduce their normal market sales.

Future marketing problems of mineral raw materials in the chemical industry are difficult to analyze because of many complexities and unique operating conditions, such as continued variations in manufacturing techniques and ease in substituting alternate raw materials.

REFERENCES

1. Aljean, G. W. Purchasing Handbook. McGraw-Hill Publishing Co., Inc., New York, N.Y., 1958, pp. 14-73.

2. American Chemical Society. Advances in Chemistry. Washington, D.C., 1959, No. 24, 147 pp.

3. American Institute of Mining, Metallurgical, and Petroleum Engineers. Industrial Minerals and Rocks. New York, N.Y., 1960, 3d ed., 934 pp.

4. American Society for Testing Materials. Index to ASTM Standards. Philadelphia, Pa., 1960, 11 v. (Annually).

5. Arnold, Robert K., Houston, Neil T., Poland, Orville F., Spielgelman, Robert G., Trexel, Carl A. Jr. The California Economy, 1947-1980, Stanford Res. Inst., Menlo Park, Calif., 1961, 456 pp.

6. Bennett, H. Concise Chemical and Technical Dictionary. Chem. Pub. Co., Inc., 1962, 2d ed., 1039 pp.

7. _____. Substitutes. Chem. Pub. Co., Inc., New York, N.Y., 1943, 225 pp.

8. Branner, George C. Sulfur in California and Nevada. BuMines Inf. Circ. 7898, 1959, 50 pp.

9. Bureau of the Budget, Standard Industrial Classification Manual, Chemical and Allied Products, 1957, (SIC 2800 group) pp. 76-82.

10. Business and Defense Services Administration. Chemical and Rubber. (Monthly)

11. California Bureau of Chemistry. Fertilizing Materials. Dept. Agri., Sacramento, Calif., 1959, Special Pub. 279, 229 pp.

12. _____. Pesticides, Economic Poisons. Dept. Agri., Sacramento, Calif., 1957-58, Special Pub. 272, 210 pp.

13. California Department of Natural Resources. Mineral Commodities of California. Div. Mines Bull. 176, 1957, 736 pp.

14. Chaddock, R. E. Chemical Market Research in Practice. Reinhold Pub. Corp., New York, N.Y., 1956, 196 pp.

15. Chemical Week. Railroad Traffic Picking Up Steam. V. 90, No. 23, June 9, 1962, pp. 23-25.

16. Doan, Leland. Dow Chemical Co. Chemical Requirements of the San Francisco-Bay Area. Paper presented at Chemical Market Research Association of Northern California meeting, November 1961.

17. Engineering Index, Inc. Engineering Index. 1295 Modern Ave., New York 28, N.Y. (Monthly, bound annually).

18. Faith, W. L., D. B. Keyes, and R. L. Clark. Industrial Chemicals. John Wiley and Sons, Inc., New York, N.Y., 1950, 844 pp.

19. Financial Index Company, Inc. Financial Index. New York, N.Y. (Weekly).

20. Foose, R. M. Industrial Mineral Resources of the Western States. Stanford Res. Inst., Menlo Park, Calif., March 1958, 8 pp.

21. Johnston, Sydney J. and Margery G. Johnston. Minerals for the Chemical and Allied Industries. John Wiley & Sons, New York, N.Y., 1961, 3d ed., 788 pp.

22. Kirk, Raymond E., and Donald F. Othmer. Encyclopedia of Chemical Technology. Interscience Encyclopedia, Inc., New York, N.Y., 1947, 15 v. and supp.

23. Ladoo, R. B., and M. W. Myers. Nonmetallic Minerals. McGraw-Hill Pub. Co., New York, N.Y., 1951, 2d ed., 605 pp.

24. Linley Publishing Company, Inc. Western Paint. 1872 West 54th St., Los Angeles 62, Calif. (Monthly).

25. McGraw-Hill Publishing Company, Inc. Chemical Week, Buyers' Guide. New York, N.Y. (Annually).

26. _____. McGraw-Hill Encyclopedia of Science and Technology. New York, N.Y , 1960, 16 v. and supp.

27. _____. E&MJ Metal and Mineral Markets. (Weekly).

28. MacRae's Blue Book Co. MacRae's Blue Book, Chicago, Ill., 1961 (Annually).

29. Manufacturing Chemists' Association, Inc. Chemical Industry Facts Book, 1960-1961. Washington, D. C., 1959, 4th ed., 163 pp.

30. Marquis, A. N., Company. Who's Who in Commerce and Industry. Chicago, Ill., 1955, 9th ed., 1255 pp.

31. Mining World. Basic Inc. Increases Magnesite Production at Gabbs, Nevada. V. 22, No. 12, November 1960, pp. 30-32.

32. Moody's Investors Service. Moody's Industrial Manual. New York, N.Y., 1961 ed., 2975 pp. (Annually).

33. National Academy of Sciences. Industrial Research Laboratories of the United States. Nat'l. Res. Council Pub. 844, 1960, 698 pp.

34. National Industrial Conference Board, Inc. Chemical and Allied Products. New York, N.Y., 1960, v. 1-4.

35. Oil, Paint and Drug Reporter. Buyers Directory. 1962 1784 pp. (Annually).

36. Perry, John H. Chemical Engineers Handbook. McGraw-Hill Pub. Co., Inc., New York, N.Y., 1950, 3d ed., 1942 pp.

37. Reinhold Publishing Corporation. Chemical Materials Catalog. New York, N.Y. (Annually).

38. Robison, H. E. Economy of the Western States. Paper presented at Chemical Market Research Association meeting, San Francisco, November 1961.

39. Shreve, R. N. Selected Process Industries. McGraw-Hill Pub. Co., Inc., New York, N.Y., 2d ed., 1004 pp.

40. Snell, Foster D., Inc. Chemical Market Abstracts. New York, N.Y. (Annually).

41. Snell, Foster D., and Cornelia T. Snell. Chemicals of Commerce. D. Van Nostrand and Co., Inc., New York, N.Y., 1952, 2d ed., 587 pp.

42. Standard and Poor's Corporation. Standard and Poor's Industrial Surveys. New York, N.Y. (currently loose-leaf; also corporation records) (Annually).

43. Stanford Research Institute. California Economy to 1980. Menlo Park, Calif., 1961.

44. _____. Chemical Economics Handbook. Menlo Park, Calif., 1950, 7 v.

45. _____. Directory of Western Chemical Producers. Menlo Park, Calif., January 1955, p. 17.

46. _____. Western Resources Handbook. Menlo Park, Calif., 1955, 4 v.

47. Stenger, V. A. Encyclopedia of Chemical Technology. Interscience Pub., Inc., New York, N.Y., 1948, 15 v.

48. Thomas Publishing Company. Thomas Register of American Manufacturers, New York 1, N.Y., 1962, 9020 pp. (Annually).

49. Times-Mirror Press. California Manufacturers Annual Register. Los Angeles, Calif., 1961, 1040 pp. (Annually).

50. U.S. Department of Commerce. Census of Manufacturers--California, 1958. Bureau of the Census Area Report MC 58 (3).

51. U.S. Department of Commerce. National Directories for Use in Marketing. Business Service Bull. 123, revised January 1957, 15 pp.

52. _____. Survey of Current Business. (Monthly).

53. U.S. Government Printing Office. Economic Indicators. (Monthly).

54. _____. Statistical Abstract of the United States. (Annually).

55. Ver Planck, William E. Salt in California. Calif. Div. Mines Geol. Bull. 175, March 1958, 168 pp.

56. Waggaman, Wm. H. Phosphoric Acid, Phosphates, and Phosphatic Fertilizers. Reinhold Publishing Corp., New York, N.Y., 1952, 683 pp.

57. Walker's Manual, Inc. Walker's Directory of Northern California Directors and Corporations. San Francisco, Calif., 1955, v. 1, 255 pp. and v. 2, 416 pp.

58. _____. Walker's Directory of Southern California Directors and Corporations. San Francisco, Calif., 1958, v. 1, 264 pp. and v. 2, 424 pp.

59. Watkins, T. C., and L. B. Norton. Handbook of Insecticide Dust Diluents and Carriers. Dorland Books, Caldwell, N.J., 1955, 233 pp.

60. Wilson, H. H., Company, The. Applied Science and Technology Index (formerly Industrial Arts Index). New York 17, N.Y. (Monthly, bound annually).

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]

Company name	Address (Primarily main office not necessarily plant address).	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
A A Chemical Co.[3]	921 E. Redondo Blvd. Inglewood	2840	4	Soaps and detergents
Accent International[3]	P.O. Box 647 S. Monterey Rd. San Jose	2818	275	Monosodium glutamate, glutamic acid, glutamic acid hydrochloride, betaine
Acme Fertilizer Co.[3]	7223 E. Alondra Blvd. Paramount	2870	(4)	Fertilizers
Acme Soap Products[3]	821 57th Street Oakland 8	2841	2	Industrial hand soaps
Acorn Advertisers[3]	1123 W. Century Blvd. Los Angeles 44	2821	15	Plastic window coatings
Adhesive Engineering[3]	1411 Industrial Road San Carlos	2800	43	High temperature structural aircraft adhesives and concrete adhesives
Advance Finishes, Inc.[3]	1410 E. Grand Ave. El Segundo	2851	3	Paint
Agriform Co. of Imperial Valley, Inc.[3]	Sandia Siding Holtville	2870	20	Agricultural chemicals, fertilizers, insecticides
Air Reduction Pacific Co.[3]	100 California St. San Francisco 4	2813	400	Oxygen, acetylene and nitrogen
All-Phase Color Corp.	2619 E. 8th Street Los Angeles 23	2851	8	Tinting colors and all purpose color grinding liquids
Alumatone Corp.[3]	1523 Grande Vista Ave. Los Angeles 23	2850	30	Aluminum and gold paints, industrial finishes, asphaltum aluminum paint
Amchem Products, Inc.	P.O. Box 2698 37899 Niles Blvd. Niles	2810	(4)	Metal working chemicals and agricultural chemicals
Amercoat Corp.	4809 Firestone Blvd. South Gate	2851	125	Protective coatings and linings; reinforced plastic pipe
American Adhesive Products Co.	1855 E. 63rd Street Los Angeles 1	2899	8	Paste for linoleum, waterproof cement, asphalt tile adhesive
American Agar & Chemical Co.	P.O. Box 431 San Diego	2810	20	Agar, bacteriological, industrial medicinals
American Better Chemicals	425 S. Isis Ave. Inglewood 1	2810	12	Industrial chemicals
American Bio-Chemical Corp.[3]	1133 Venice Blvd. Los Angeles 15	2800	15	Pharmaceuticals
American Cyanamid Co.	2300 S. Eastern Ave. Los Angeles 22	2800	15	Chemicals
American Marine Paint Co.	311 California St. San Francisco 4	2851	35	Paints, anti-corrosive and anti-fouling marine paints, enamels, varnishes
American Potash & Chemical Corp.	3000 W. 6th St. Los Angeles 5	2819	2,200	Potash, soda ash, salt cake, borax, boric acid, bromine, lithium compounds
Ampruf Paint Co., Inc.[3]	10930 Elliott Ave. El Monte	2851	38	Rubber and oil base (all types of paint)
Anabolic Food Products, Inc.[3]	514 Riverdale Drive Glendale 4	2834	35	Pharmaceuticals and custom formulations
Anderson Paint Factory[3]	202 Fulton Street Fresno	2850	16	Paints
Anfo Manufacturing Co.[3]	3129 Elmwood Ave. Oakland 1	2842	16	Insecticides, garden and household detergents

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Applied Plastics Division of Hexcel Products, Inc.[3]	130 Penn Street El Segundo	2821	4	Special resins and hardeners for laminations
Arabol Manufacturing Co.[3]	1950 16th Street San Francisco 3	2891	(4)	Industrial adhesives
Ardmor Chemical Co.	750 Stone Street Oakland 3	2840	13	Chemicals, detergents and soap
Arm Industries[3]	129 E. Linden Ave. Burbank	2842	25	Deodorants
Armite Laboratories	6609 Broad Street Los Angeles 1	2899	80	Sealing compounds
Armor Laboratories, Inc.	538 Commercial Street Glendale 3	2851	17	Paints, vinyl, plastic
Art Plastics Mfg. Co.[3]	799 Towne Ave. Los Angeles 21	2818	25	Vinyl and transparent acetate products, electronic sealing and fabricating
Associated Chemical Co.	1210 W. Holt Ave. Pomona	2873	27	Liquid fertilizers, insecticides, allied chemicals
Artco Products Co.[3]	1350 Watson Ave. Wilmington	2842	(4)	Insecticides
B & W Chemical Co.[3]	25920 Belle Porte Ave. Harbor City	2841	20	Detergents, waxes, soaps, disinfectants
Babbitt, B. T., Inc.	2601 Wood Street Oakland 7	2840	(4)	Cleansers
Baker Castor Oil Co.[3]	5585 E. 61st Street Los Angeles 22	2834	35	Castor oil and castor oil derivatives
Bandini Fertilizer Co.	4139 Bandini Blvd. Los Angeles 23	2872	(4)	Fertilizers
Barnes-Hind Laboratories, Inc.	895 Kifer Road Sunnyvale	2834	50	Pharmaceuticals
Barnes, S. O., & Son, Inc.	17250 S. Main Street Gardena	2834	55	Pharmaceuticals
Barnett Laboratories, Inc.	6256 Cherry Ave. Long Beach 5	2833	20	Vitamins
Bateman, T. O., Co.	3596 California Street San Diego	2810	7	Industrial chemicals and compounds
Bauer, J. E., Co.[3]	1021 N. Mission Road Los Angeles 33	2851	16	Traffic marking paint, enamels, house paints
Baxter, Don, Inc.[3]	1015 Grandview Ave. Glendale 1	2831	(4)	Intravenous solutions
Bayside Oil Corp.	977 Bransten Road San Carlos	2814	6	Lubricating oils
Beacon Paint & Wax Corp.	2833 Army Street San Francisco 10	2851	3	Paints, automotive finishes
Beagle Products Co.[3]	White Rock Road W. Sacramento	2841	(4)	Rice hull ash, pink ash for soap manufacturers
Beauty Shine Products	13400 Saticoy Street North Hollywood	2840	(4)	Automobile waxes and cleaners
Beaver Chemical Co.[3]	522 S. Pilgrim Street Stockton	2800	6	Industrial chemicals, liquid and paste soaps, machinery degreasers, rust removers
Bennett, E. W., & Co.	2000 16th Street San Francisco 3	2842	(4)	Metal polish for copper, chrome, brass, aluminum, duco
Benton, C. H., Co.	2136 Kettner Blvd. San Diego 12	2850	25	Paints, varnishes, enamels
Best Fertilizers Co.	P.O. Box 198 Lathrop	2873	166	Commercial fertilizers, phosphoric and sulfuric acids

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Best Maintenance Supply Co.	1922 E. 7th Place Los Angeles 21	2840	150	Floor cleaners, waxes and seals, disinfectants, insecticides
Betz Laboratories, Inc.	12922 S. Weber Way Hawthorne	2899	(4)	Chemical compounds for water treatment
Beverly Manufacturing Co.	9116-18 S. Main St. Los Angeles 3	2852	8	Wood filler
Bio-Rad Laboratories	1250 S. 32nd Street Richmond	2810	9	Exchange resins, chromatographic alumina, and water deionization
Black, J. Chemical Products[3]	1643 12th Street Santa Monica	2873	7	Insecticides and fumigants
Boehme, F. J., Paint Factory	10038 E. Garvey Blvd. El Monte	2850	(4)	Paints and varnishes
Boncquet Protein-Hydrolysates[3] Products	1781 N. Fair Oaks Ave. Pasadena 3	2834	(4)	Pharmaceutical food products
Borden Chemical Co.	P.O. Box 430 Compton	2820	125	Adhesives, caseins, synthetic, latex, formaldehyde, chemicals and epoxies
Borden Laboratories, Inc.[3]	2445 6th Street Berkeley 10	2834	12	Pharmaceuticals
Boyer Fertilizer Service Mfg.	1st St. and Van Ness Ave. Watsonville	2870	12	Commercial fertilizers
Boyle & Company	6855 E. Gage Ave. Bell Gardens	2834	140	Drugs, pharmaceuticals, vitamin products
Boyle-Midway Div. American Home Products Corp.[3]	6000 Sheila Street Los Angeles 22	2842	100	Waxes, soaps
Boysen, Walter N., Co.	42nd & Linden Sts. Oakland 8	2851	70	Paints, varnishes and enamels
Bradley Paint Co.[3]	4070 E. Washington Blvd. Los Angeles 23	2851	60	Finishes, chemicals, and coatings
Bray Oil Co.[3]	3344 Medford Street Los Angeles 63	2899	35	Rust preventives, lubricating oils, industrial and special oils, heavy duty lubricants
Bronchi-Lyptus Laboratory[3]	732 Ceres Ave. Los Angeles 21	2834	5	Cough syrup and eucalyptus products
Buff Products Manufacturing Co.	790 Leland Place El Cajon	2843	3	Waterless handcleaner, pipe lubricant
Burbank Chemical Co.[3]	20 W. Burbank Blvd. Burbank	2821	11	Chemicals, nitrocellulose solutions, paints and lacquers
Burdett Oxygen Co. of Calif.	2014 Belgrave Huntington Park	2813	(4)	Oxygen, acetylene
Butcher, L. H., Co.	3628 E. Olympic Blvd. Los Angeles 23	2899	(4)	Insecticides, cleaners, buffing and polishing compounds, ceramic colors
Caldow Paint Co.	1401 E. 14th Street Oakland 6	2851	(4)	Paints and allied products, wallpaper
California Ammonia Co.[3]	P.O. Box 198 Lathrop	2842	(4)	Chemicals and ammonia
California Cotton Oil Corp.	2301 E. 52nd Street Los Angeles 58	2899	50	Oilseed crushing, producing vegetable oils and protein meals, cotton linters and hulls
California Ink Co., Inc.	545 Sansome Street San Francisco 11	2893	625	Printing inks, lithographic inks, dry colors, varnish, printer's rollers, and paint raw materials
California Salt Co.[3]	2436 Hunter St. Los Angeles 21	2819	60	Rock salt, solar evaporated salt, and calcium chloride

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
California Soap Co., Inc.	1923 Santa Fe Ave. Los Angeles 21	2841	14	Soap powders and granulated soap, synthetic soaps
California Soda Co.	355 Cypress Street Oakland 20	2812	(4)	Chemical compounds, custom alkaline compounding, specializing in alkaline compounds.
California Termite Control Co., Inc.[3]	433 No. Hoover Street Los Angeles 4	2842	10	Insect powder, moth spray, roach powder, ant powder, ant syrup
Calusa Chemical Co., Inc.[3]	801 E. Macy Street Los Angeles 12	2843	55	Soaps and laundry powder
Carbo-Fung Laboratories, Inc.[3]	5800 York Blvd. Los Angeles 42	2834	(4)	Antiseptic fungicide solutions
Cardinal Laboratories, Inc.[3]	1405 S. Highland Ave. Los Angeles 19	2840	15	Chemical Laboratory for Development and Research Beauty Products, products for animal care and grooming, industrial specialties
Cavalier of California	1681 8th Street Oakland 20	2842	12	Shoe polishes, shoe dressings and dyes
Cedar Sweep Co.	436 Clementina St. San Francisco	2842	2	Cedar sweep and sweeping compounds, liquid floor polishes, oil water and grease absorbents
Cee-Bee Chemical Co.	9520 E. Ceebee Drive Downey	2842	75	Industrial cleaning compounds
Cello Printers, Inc.	Box 2-343 Los Nietos	2820	(4)	Wholesale printing of transparent film for the industry
Cenci, H. R.	152 N. Broadway Fresno	2834	(4)	Pharmaceuticals
Central Valley Chemical Corp.	6317 Elvas Ave. Sacramento	2850	4	Varnishes, wood filling compounds
Certified Home Products	2902 Nebraska Ave. Santa Monica	2842	(4)	Deodorizers
Chase Chemical Co.[3]	12270 Montague St. Pacoima	2810	9	Industrial chemicals
Chemical & Pigment Co.[3]	766 50th Ave. Oakland 1	2810	40	Zinc, sulphate crystals, zinc chloride, zinc ammonium chloride
Chemical Plastics Research[3] International Corp.	555 N. Alaska Ave. Torrance	2810	(4)	Urethane chemicals, fabricated products, and formulations for aircraft, missile, marine, heating
Chemical Process Co., Inc.	1901 Spring St. Redwood City	2821	125	Ion exchange resins, polyester resins, adhesives
Chemical Research Products, Inc.[3]	110 Ash Avenue Burbank	2810	(4)	Biochemicals
Chemirama Co.[3]	291 4th Street Oakland 7	2842	25	Floor waxes, floor seals, floor finishes
Chipman Chemical Co., Inc.	1990 Bay Road East Palo Alto	2873	20	Agricultural insecticides, fungicides, defoliants
Chromatone Corp.	1527 Grande Vista Ave. Los Angeles 23	2851	18	Aluminum and gold paints, pressurized spray cans
Circle Paint Corp.	7234 Atoll Ave. N. Hollywood	2851	(4)	Industrial and house paints
Cleaning Chemicals Corp.	1924 E. 7th Pl., Los Angeles	2800	(4)	Paints
Coalinga Soap Co.[3]	249 S. 4th St. Coalinga	2840	(4)	Hand cleaner (waterless), soaps and glass cleaners
Coast Manufacturing and Supply Co.	Box 71 Livermore	2892	125	Safety fuse, primacord, blasting supplies
Coastal Chemical Co.	1015 E. Woodley Rd. Oxnard	2800	(4)	Agricultural insecticides

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Colgate-Palmolive Co.	2700 7th St. Berkeley 10	2840	700	Soap, glycerine, and synthetic detergents
Colonial Dames Co., Ltd.	P.O. Box 22022 Los Angeles 22	2844	50	Cosmetics
Color-Tite Manufacturing Co.	1626 High St. Oakland 6	2851	(4)	Waterproof cement paint for porous masonry surfaces, basement waterproofing for porous masonry surfaces
Columbia-Southern Chemical Corp.	625 Market St. San Francisco 5	2812	50	Soda ash, sodium sesquicarbonate
Columbia Wax Co.	530 Riverdale Drive Glendale 4	2842	45	Floor care products; institutional, commercial, and industrial
Commercial Chemical Co.[3]	5501 E. Valley Blvd. Los Angeles 32	2851	(4)	Sand-finish masonry paint, smooth masonry paint
Commercial Solvents Corp.[3]	P.O. Box 151 San Jose 3	2800	2,126	Industrial and agricultural chemicals
Conroy & Knowlton, Inc.[3]	2315 Ripple St. Los Angeles 39	2820	30	Plastics fabrication, electrical mfg.
Cornell Soap Co.	1139 Pepper Drive El Cajon	2841	6	Soap
Coyne Chemical Co.[3]	4476 E. Washington Blvd. Los Angeles 23	2842	7	Insecticides, moth-proofers, fumigants and rodenticides
Crosby Laboratories[3]	3010 W. Burbank Blvd. Burbank	2834	25	Pharmaceuticals, vitamins and mineral tablets
Cutter Laboratories	4th & Parker Sts. Berkeley 10	2830	450	Drugs and biologicals
Cycleweld Chemical Products[3] Div. of Chrysler Corp.	5800 S. Eastern Ave. Los Angeles 22	2891	(4)	Industrial adhesives
Dartell Laboratories, Inc.	1226 S. Flower St. Los Angeles 15	2834	90	Bio-chemicals, pharmaceuticals, medical and drug specialties
Dau-Hansen Paint Co., Inc.	2307 Sepulveda Blvd. Los Angeles 64	2851	12	Paint, varnishes, enamels, stains, synthetics, lacquers
Davi-Miracle Foam[3]	1111 W. Grand Ave. Oakland 10	2840	2	Soaps (upholstering and rug cleaning)
Davis, Frank D., Co.	3285 E. 26th St. Los Angeles 23	2810	16	Dry colors and pigments
Daw, A. J., Printing Ink Co.	3559 S. Greenwood Ave. Los Angeles 22	2893	15	Printing, lithographic, and inks
De Boom Paint Co.	1300 22nd St. San Francisco 7	2851	20	Paints and oils
Deepwater Chemical Co., Ltd.	P.O. Box 588 Compton	2819	(4)	Iodine products
De Heriot, Inc.	407 N. Maple Drive Beverly Hills	2844	(4)	Perfumes, dusting powder
Denalan Co., Inc.	335 S. Van Ness Ave. San Francisco 3	2844	7	No brushing denture cleanser
De Soto Chemical Coatings, Inc.	4th & Cedar Sts. Berkeley 10	2851	200	Paints, varnishes, industrial finishes synthetic resins
Destruxol Corp., Ltd.	495 S. Arroyo Parkway Pasadena	2873	14	Insecticides, fungicides, garden supplies
Detrex Chemical Industries, Inc.	3027 Fruitland Ave. Los Angeles 58	2818	15	Degreasers, trichlorethylene, degreasing solvent

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Dew Foam Co.	14547 Arminta Ave. Van Nuys	2821	10	Polyurethane foam products
Dewey & Almy Chemical Div. of W. R. Grace & Co.	2140 Davis St. San Leandro	2899	50	Sealing compounds, fluxes, battery separators, construction chemicals
Dex Chemical Corp.	1526 Park Ave. Emeryville	2899	4	Chemical compounds for de-rusting rust proofing and metal pre-treatment
Diamond Alkali Co.	1269 66th St. Emeryville	2819	25	Silicates of soda, sodium meta-silicate, cleaning compounds
Diamond Patent Co.	290 8th St. San Francisco 3	2891	3	Glass cement, show cases
Dickinson Ink Corp.[3]	625-1/2 S. Date Ave. Alhambra	2899	(4)	Ink and adhesives
Diketan Laboratories, Inc.[3]	5837 W. Adams Blvd. Culver City	2834	40	Drug and vitamin products, pharmaceuticals
Doidge-Koren Paint Co., Inc.	210 Bayshore Blvd. San Francisco 24	2851	18	Paints and lacquers, putty and varnish
Dow Chemical Co.	350 Sansome St. San Francisco 4	2800	1,000	Chemicals
Dowman Products, Inc.	1856 Cherry Ave. Long Beach 6	2899	25	Water paints, wall board tape, and building patching materials
Downey Fertilizer Co.[3]	9447 E. Imperial Highway Downey	2871	125	Commercial fertilizers and cattle feed
Drackett Company[3]	792 West Ave. 135 San Leandro	2842	25	Drain cleaner, window cleaner
Drew, E. F., & Co., Inc.[3] Malaga Division	P.O. Box 557 Lindsay	2840	107	Vegetable oil refining, soap and detergent manufacturer, nutrients for animal feeds
Du Bois Chemicals, Inc.	300 S. Mission Rd. Los Angeles 33	2841	100	Industrial and institutional cleaning compounds
Dunn-Edwards Corp.	1838 S. Flower St. Los Angeles 15	2851	250	House paints, industrial and commercial paints
Dunne, Frank W., Co.	1007 41st St. Oakland 8	2851	45	Paints, enamels, varnishes, protective coatings, color suited toners
DuPont, De Nemours, E. I., & Co.	1600 Trousdale Drive Burlingame	2851	(4)	Paints, varnishes and enamels
Durham Chemical Co.	4124 E. Pacific Way Los Angeles 23	2873	20	Pesticides and plant foods
Dyna-Therm Chemical Corp.[3]	3813 Hoke Ave. Culver City	2851	20	High temperature coatings, paints and industrial protective coatings
E-Z-Est Products Co., Inc.	2528 Adeline St. Oakland 7	2840	17	Household polishes and cleaners, tile and formica cleaner
Easterday Supply Co.[3]	901 E. 61st St. Los Angeles 1	2842	150	Insecticides, disinfectants, bowl cleaners, scale solvents, soap
Economics Laboratory, Inc.[3]	640 Lenfest Road San Jose	2840	25	Dishwashing detergents, household cleaners
Economy Chemical Co.	2926 Denby Ave. Los Angeles 39	2841	3	Silver and china cleaner
Eden Paint Products Corp.	940 Estabrook St. San Leandro	2850	3	Architectural, marine, cannery and industrial protective coatings
Edwards, H., Mfg. Co.[3]	37 Clementina St. San Francisco 3	2899	(4)	Writing ink, adhesives, mucilage, paste
Electro Bleach Products Co.[3]	1628 W. 134th St. Gardena	2840	8	Industrial bleaches, dishwashing liquid detergents

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Elixir Paint & Lacquer Co.	18037 S. Broadway Gardena	2851	12	Paints and lacquers
Ellis Paint Co.	718 W. Anaheim Road Long Beach 13	2851	10	Paints, enamels, flats
Emery Industries, Inc. Vopocolene Div.	5568 E. 61st St. Los Angeles 22	2818	80	Acids, glycerine, chemicals
Empire Chemical Co.[3]	715 Lamar Street Los Angeles 31	2842	15	Janitorial supplies and maintenance materials
Endres Paint Co.	6240 E. Florence Ave. Bell Gardens	2851	(4)	Paints, varnishes, enamels
Enjay Chemical Co.[3]	615 S. Flower St. Los Angeles 17	2899	(4)	Chemicals
Erlen Products Co.	700-710 S. Flower St. Burbank	2840	35	Floor waxes and cleaners
Ethyl Corp.	P.O. Box 987 Pittsburgh	2818	10	Anti-Knock Compound
Ever-Kleen Products, Inc.	320 Judah St. San Francisco 22	2840	(4)	Lotions and cleaning compounds
Exeter Oil, Ltd.	714 W. Olympic Bldg. Los Angeles 15	2821	25	Petroleum resins, specialty asphalt products, aluminum-asphalt paints
Factor, Max & Co.	1655 N. McCadden Place Los Angeles 28	2844	2,000	Cosmetics and toiletries
Fauquier & Howson Co.	8629 S. Norwalk Blvd. Los Nietos	2851	(4)	Paint
Feder Products, Inc.[3]	1940 E. Gage Ave. Los Angeles 1	2852	30	Painter's and plumber's putty, mastics, calking compounds, thread cutting oils
Felton Chemical Co., Inc.	2242 Purdue Ave. W. Los Angeles 64	2800	(4)	Chemicals, essential oils, perfume and flavor bases
Finch Paint & Chemical Co.	1536 W. 228th St. Torrance	2851	20	Paints, lacquers, thinners, synthetics
Fine Line Paint Corp.	12200 Los Nietos Rd. Santa Fe Springs	2851	(4)	Paints
Fla-Pana Research Laboratory[3]	2477 Pulgas Ave. Palo Alto	2830	3	Vitamins for human and animal nutrition
Flamort Chemical Co.[3]	746 Natoma St. San Francisco 3	2851	4	Fire retardant materials
Flexfirm Products	2300 N. Chico Ave. El Monte	2821	13	Coatings and impregnations on vinyl, neoprene, nylons and cotton fabrics
Flint Ink Corp.[3]	6100 Avalon Blvd. Los Angeles 3	2893	15	Printing & lithographic inks
Food Machinery & Chemical Corp. (Subsequently changed to FMC Corp.)	1105 Coleman Ave. San Jose	2800	16,125	Agricultural chemicals, agricultural equipment, automotive service equip.
Fowler Sterling Products	7349 Coldwater Canyon Ave. N. Hollywood	2841	6	Paste and liquid cleaners
Fresno Agricultural Chemical Co.	P.O. Box 1286 Fresno 15	2870	40	Agricultural chemicals, fertilizers and insecticides, custom milling
Fuller, H. B., Co. of California	57 S. Linden Ave. S. San Francisco	2891	(4)	Adhesives, glues, resins, protective coatings, paste
Fuller, W. P., & Co.	301 Mission St. San Francisco 19	2851	3,000	Paints, varnishes
Furane Plastics, Inc.	4516 Brazil Street Los Angeles 39	2820	(4)	Formulations of epoxy resins used in casting, laminating, potting, coatings

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Gamlen Chemical Co.	321 Victory Ave. S. San Francisco	2840	([4])	Tank cleaning, fuel oil treatment, boiler compounds
Garan Chemical Corp.	210 E. Alondra Blvd. Gardena	2800	25	Peroxide, accelerators, parting and mold release agents, specialty resins
General Carbon Co.[3]	7542 Maie Ave. Los Angeles 1	2816	15	Lampblack
General Chemical Div. Allied Chemical & Dye Corp.	235 Montgomery St. San Francisco 4	2810	([4])	Industrial chemicals, (acids, alums, sodium and fluorine compounds)
General Foam Products[3]	4400 District Blvd. Los Angeles 58	2821	16	Insulation (expandable polystyrene foam)
General Plastics Corp.	2260 Centinela Ave. Los Angeles 64	2820	40	Industrial Plastics, fabrication of thermo plastic sheeting (plexiglas)
Gibson-Holmes Co.	1035 Wright Ave. Richmond	2899	12	Asphalt waterproofing products
Gibson Paint Co.	1199 E. 12th St. Oakland 6	2850	9	Protective coatings, architectural and marine paints, aluminum roof coatings
Gilmore & Nolan, Inc.[3]	1451 S. Lorena St. Los Angeles 23	2851	20	Industrial surface coatings
Glidden Paint Co.	1000 16th St. San Francisco 7	2851	250	Paints, enamels, lacquers, varnishes
Gold Star Adhesive Co.	763 46th Ave. Oakland 1	2890	3	Linoleum paste and asphalt tile cement
Golden State Plant Food Co.[3]	7034 N. Valencia Ave. Glendora	2871	12	Commercial chemical fertilizers
Goodrich, B. F. Co.	5400 E. Olympic Blvd. Los Angeles 22	3011	1,200	Rubber, tires, tubes, repair and retread materials
Goodwin Chemical Corp.[3]	9245 Glenoaks Blvd. Sun Valley	2818	5	Chemical solvents and reconditioning of industrial solvents
Goodwin Company[3]	1806-12 Marengo St. Los Angeles 33	2842	5	Household ammonia
Goss & Goss[3]	1415 Van Dyke Ave. San Francisco 23	2852	20	Putty, glazing compounds, calking compounds, tile mastic
Grant & Co.	2144 E. 7th St. Los Angeles 21	2899	15	Plastic sand, foundry supplies and equipment, core oil, foundry partings
Grant, R. J., Protective Coatings Co.[3]	4707 E. Compton Blvd. Compton	2851	6	Protective coatings
Great Western Paint Co.	3432 E. 15th St. Los Angeles 23	2851	25	Industrial and architectural enamels, varnishes
Grossman & Son Brush & Chemical Co., Inc.[3]	816 E. Montecito St. Santa Barbara	2840	([4])	Cleaners, chemicals
Guardian Paper Co.[3]	6590 Central Ave. Newark	2822	46	Polyethylene coated packaging material
H. M. Chemical Co., Ltd.[3]	1754 22nd St. Santa Monica	2800	8	Amino acids, pharmaceuticals and research chemicals
Hancock Chemical Co.	23208 S. Alameda St. Long Beach 10	2819	29	Elemental sulfur
Hasa Products Co.	1853 Belcroft Ave. El Monte	2899	10	Chemical compounds
Hathaway Allied Products[3]	2024 Westgate Ave. Los Angeles 25	2830	6	Gums, resins, crude botanical drugs, dyes
Hawkins Chemical Co.	2035 E. 7th Place Los Angeles 21	2899	15	Chemicals, industrial water treatment
Hawley, H. F., Chemical Co.	800 S. Ophir St. Stockton	2842	4	Industrial cleaners and floor wax

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Henry, W. W., Co.	5731 Bickett St. Huntington Park	2851	50	Roof coatings, driveway coatings, floor covering adhesives, paints and coatings
Hercules Powder Co.	120 Montgomery St. San Francisco 4	2892	(4)	Acids, anhydrous ammonia, fertilizers, high explosives, nitrate of ammonia, urea
Hexol, Inc.[3]	1500 17th St. San Francisco 7	2842	18	Germicides
Hi-Lustre Products, Inc.	3208 E. Fowler St. Los Angeles 63	2842	10	Auto polishes, glazes, cleaners and waxes
Hill Brothers Chemical Co.	15017 E. Clark Ave. La Puente	2819	70	Magnesite products, calcium chloride, asbestos
Hockwald Co.[3]	P.O. Box 24000 San Francisco 24	2840	75	Waxes, disinfectants, cleaners, liquid soap, insecticides
Hollister-Stier Labs[3]	2030 Wilshire Blvd. Los Angeles 57	2830	10	Drugs and medicines
Hornkohl Laboratories, Inc.[3]	714 Truxton Ave. Bakersfield	2899	25	Boiler compounds, chemicals, chemical research
Horton & Converse[3]	621 W. Pico Blvd Los Angeles 15	2834	475	Pharmaceuticals, hospital supplies and medicinal chemicals
Houghton, E. F., & Co.	54 Tanforan S. San Francisco	2899	25	Hydraulic fluids and packings, industrial lubricants, metalworking chemical
Houston Waterproofing Mfg. Co.[3]	712 S. Marengo Ave. Alhambra	2899	(4)	Waterproofing for masonry materials, penetrating preservatives for wood products
Hughes Paint Co., Inc.	5924 S. Western Ave. Los Angeles 47	2851	40	Paints, enamels and varnishes
Hygin Sanitary Supply Co.	1872 W. Washington Blvd. Los Angeles 71	2840	11	Soaps, waxes, cleaners, polishes
Hyland Laboratories	4501 Colorado Blvd. Los Angeles 39	2830	175	Biologicals and pharmaceuticals
Imperial Chemical Co.	2412 Eads, Los Angeles 31	2842	6	Dry cleaning soaps and specialty soaps
Indco Laboratory	1669 Euclid St. Santa Monica	2840	6	Creams, lotions
Industrial Chemical Co., Inc.	12134 S. Main St. Los Angeles 61	2810	15	Fuel conditioners to reduce monoxide fumes, fluid for diesel fuel to reduce soot and fumes
Industrial Plastic Service	4425 Linden St. Oakland 8	2820	20	Resins for glass fiber molding and laminating
Industrial Polychemical Service	17116 S. Broadway Gardena	2821	8	Adhesives for acrylics, ceramics, cork, porous felt, foams, glass, leather, metal
Ingram Pharmaceutical Co.	340 Front St. San Francisco 11	2834	13	Pharmaceuticals
Ink Ribbon Mfg. Corp.[3]	679 Chenery St. San Francisco 31	2899	(4)	Ink
Inland Fertilizer Co.	4134 Bandini Blvd. Los Angeles 23	2871	6	Fertilizers
Insto Co.[3]	1328 Willow St. Los Angeles 13	2842	6	Powdered hand soap, mechanics' soap
Insulating Aggregates	275 S. Main St., P.O. Box 572 Bishop	2800	(4)	Acoustical granules, pumice for polishing, paints, chemicals, soaps and cleansers
Interchemical Corp., (Finishes Div.)	P.O. Box 2182, Terminal Annex Los Angeles 54	2851	115	Paints, varnishes, lacquers, industrial finishes, enamels, synthetic and polyester resins
Interchemical Corp., (Printing Ink Div.)	1701 16th St. Oakland 7	2893	100	Printing, lithographic, rotogravure inks, inks of all kinds, industrial coatings and finishes

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
International Minerals & Chemicals Corp. (Accent Div.	2200 Monterey Rd. San Jose	2818	275	Chemicals
International Paint Co.	So. Linden Ave. S. San Francisco	2800	(4)	Paint
International Wood Products	1370 Freeman Ave. Long Beach 4	2899	(4)	Wood substitutes
Irwin Paint Co.[3]	4th & Addison Sts. Berkeley 2	2851	20	Paints, enamels, varnishes, industrial finishes, marine paints
Jasco Chemical Corp.[3]	808 Terra Bella Mountain View	2850	(4)	Paint specialty items
Jergens, Andrew Co.	99 W. Verdugo Ave. Burbank	2844	120	Cosmetics and toilet soap
Johnson Ant Control, Inc.[3]	P.O. Box 397 Walnut Creek	2842	(4)	Pesticides
Johnson & Johnson[3]	4100 Bayshore Highway Menlo Park	2834	50	Surgical dressings, baby products
Johnson, W. D., Chemical Lab., Inc.	3605 Elm Ave. Long Beach 7	2899	11	Boiler water treatment, corrosion control tower treatment, complete water analysis
Jones-Dabney Co.[3]	P.O. Box 188 Riverside	2851	(4)	Automotive paints, coatings, enamels, resins
Jones-Hamilton Co.	Cor. Wells & Willow Newark	2840	35	Industrial cleaning compounds, sodium bisulfate, custom mfg.
K & W Products, Inc.[3]	8319 Allport Ave. Whittier	2842	36	Seals, automotive cleaners, chemicals and protectives
Kaiser Aluminum and Chemical Corp.	(Moss Landing & Salinas) 1924 Broadway Oakland 12	2800	1,700	Basic refractory brick, ramming mixes, dead-burned magnesite, gunny grains, dolomite, special periclose, insulating, cements, coatings, plastic firebrick, refractories, costables, chrome
Kaull, G. W.	5520 Avalon Blvd. Los Angeles 11	2852	7	Calking compounds and equipment
Kelite Corp.	1250 North Main St. Los Angeles 12	2899	300	Cleaning and processing compounds, steam cleaners, cleaning equipment
Kelly-Moore Paint Co., Inc.	1015 Commercial St. San Carlos	2851	46	Paint
Kerkling & Co.	8319 S. Allport Ave. Santa Fe Springs	2899	(4)	Automotive and radiator chemicals
Keystone Chemical Corp.	415 E. 12th St. Oakland	2840	20	Industrial, household, maintenance & automotive chemicals, liquid soaps
Kelly, John F. Co.[3]	956 Bransten Road San Carlos	2851	17	Oils, varnishes and resins
Kip, Inc.[3]	778 E. Pico Blvd. Los Angeles 21	2834	10-50	Antiseptics
Klasco Products Co., Inc.[3]	8700 Firestone Blvd. Downey	2840	30	Household deodorants, moth preventatives
Kleenmaster Products Co.[3]	7837 Sepulveda Blvd. Van Nuys	2840	(4)	Automotive and industrial cleaning compounds
Klix Chemical Co., Inc.	551 Railroad Ave. S. San Francisco	2840	23	Soaps, dishwashing compounds, sweeping compounds
Kolmar Laboratories, Inc.	1266 No. Western Ave. Los Angeles 29	2844	15	Private label cosmetics
Koppers Co., Inc.[3]	3450 Wilshire Blvd. Los Angeles 5	2814	76	Hard and soft carbon pitch, creosote, creosote coal tar solution
Krieger Color & Chemical Co., Inc.	6531 Santa Monica Blvd. Hollywood	2815	11	Aniline dyes and pigments, color specialties

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
L & H Paint Products, Inc.	150 Mississippi St. San Francisco 7	2851	25	Paints, varnishes, enamels, lacquers
Lambert-Kay, Inc.[3]	2619 Exposition Blvd. Los Angeles 18	2834	27	Pet pharmaceutical products
Lan-Lay Co.	65 11th Street San Francisco 3	2844	([4])	Cosmetics
Landon Products, Inc.[3]	1432 N. Chico St. South El Monte	2852	12	Paint remover, waterless hand cleaner, aluminum screen cleaner
Lebec Chemical Corp.	14066 S. Garfield Ave. Paramount	2820	16	Synthetic phenolic and urea resins, adhesives specialized chemicals and protective coatings
Leeder Chemicals	5738 Bankfield Ave. Culver City	2840	6	Chemicals for cleaning, processing
Leffingwell Chemical Co.	P.O. Box 1187 Perry Annex, Whittier	2873	90	Agricultural insecticides, fungicides, fertilizer mixing plant
Lefohn Scientific Beauty Aids	1604 N. High Ave. Los Angeles 28	2844	([4])	Cosmetics
Lever Brothers Co.	6300 E. Sheila St. Los Angeles 22	2840	800	Soaps, detergents, edible oils, margarine glycerine, toothpastes and food products
Lincoln, John Co.[3]	380 7th Street San Francisco 3	2842	([4])	Shoe polish, cleaners, leather dyes
Linseed Oil Products Corp.[3]	1603 Talbert Ave. Santa Ana	2851	20	Specialists in resin-free finishes, color preservatives
Liquid Plant Food Co., Inc.	1726 S. Magnolia Ave. Monrovia	2870	20	Liquid chemical fertilizers, organic soil conditioners
Liquid Plastic Co. of Calif.[3]	8611 Crenshaw Blvd. Inglewood	2821	25	Plastic coating for prevention of corrosion, calking, and waterproofing.
Liquinox Co.[3]	1409 W. Chapman St. Orange	2870	14	Liquid fertilizer
Long Beach Salt Co.[3]	2476 Hunter St. Los Angeles 21	2899	15	Salt
Long Manufacturing Co.	991 Williams St. San Leandro	2842	6	Rodent bombs and bait
Los Angeles Chemical Co.	4545 Ardine St. South Gate	2810	175	Industrial chemicals, agricultural insecticides, ceramic colors
Los Angeles Soap Co.	617 E. 1st St. Los Angeles 12	2840	400	Soap and glycerine, industrial household paint, detergents
Lund & Sons Co.	1120 Lincoln Ave. Anaheim	2851	([4])	Commercial, industrial household paint
Luseaux Lab., Inc.	1532 W. Redondo Beach Blvd. Gardena	2840	15	Detergents and sanitary chemicals
M & H Chemical Co.[3]	2386 Davis St. San Leandro	2840	5	Aircraft, boat and auto lubricants, automotive chemicals
Maas, A. R., Chemical Div.	4750 Ardine St. South Gate	2819	160	Phosphoric acid, acetic acids, sodium phosphates
Maclean, Neil A., Co., Inc.	1536 Industrial Way Belmont	2810	29	Agricultural and industrial chemicals, fumigants and supplies
Maqlin Co.[3]	6700 Stanford Ave. Los Angeles 1	2820	15	Plastic compounds, custom compounded to specifications
Macmillan Petroleum Corp.	530 W. 6th St. Los Angeles 14	2852	253	Asphalts, road oils, distillates, lube oil, jet fuels
Magna Coatings & Chem. Corp.	1785 N. Eastern Ave. Los Angeles 32	2851	19	Industrial paint finishes, special custom aircraft, marine and architectural finishes
Marin Products[3]	4041 Sebastopol Rd. Santa Rosa	2842	([4])	Pesticides
Martin's Aqua Supply[3]	15015 Raymer St. Van Nuys	2899	10-15	Swimming pool chemicals

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Marvin Corp.	1641 Bluff Road Montebello	2899	12	Roof coatings, aluminum coatings, driveway coatings
Marzilli Shellac Corp.	16915 S. Broadway Gardena	2851	15	Shellac and shellac thinner
Master Putty Mfg. Co., Inc.	5526 Avalon Blvd. Los Angeles 11	2852	(4)	Putty
Maywood Industries[3]	550 S. Palm St. La Habra	2899	20	Lint remover, plastic and ceramic items
McCarty Paint Co.	1600 Lyn Way Santa Cruz	2851	6	Paints, enamels, and protective coatings
McCloskey Varnish Co. of the West	5501 E. Slauson Ave. Los Angeles 22	2851	40	Varnish, alkyds, and polyvinyl-acetate emulsions, paint raw materials
McGuire Chemical Co.[3]	735 Terminal St. P.O. Box 98	2810	50	Industrial solvents, chemicals, oils
McKesson & Robbins, Inc.	200 S. Los Angeles St. Los Angeles 12	2830	100	Drugs
Merck & Co., Inc. Marine Magnesium Div.	E. Grand Ave. South San Francisco	2834	70	Magnesium carbonates, hydroxides, oxides
Merit Mfg. Co.	4222 Van Buren Place Culver City	2840	5	Powdered detergents and cleaning compounds
Metallic Phosphate Products Co.	1609 Azalea Drive Alhambra	2819	(4)	Polyphosphoric acid
Michael-Lawrence Co., Inc.	535 N. Eucalyptus Ave. Inglewood	2851	4	Exterior paint
Michel & Pelton Co.	5743 Landregan St. Oakland 8	2841	8	Chemical compounds, grafting wax, soft soaps
Mido Products	1801 Border Ave. Torrance	2840	10	Chemicals, chem. cleaning compounds, barrel finishing supplies and equipment
Mill-Hall, Inc.	829 Wright Ave. Richmond	2800	5	Formulating and compounding chemicals, custom processing
Minnesota Mining & Mfg. Co.	6411 Randolph St. Los Angeles 22	2891	300	Adhesives, coatings, and sealers
Mirror Bright Polish Co.	365 N. Altadena Drive Pasadena	2840	15	Polish glaze for autos, furniture, airplanes, chrome, and glass
Monsanto Chemical Co.	6670 E. Flotilla St. Los Angeles 22	2870	100	Chemicals, plastics, adhesives
Mountain Copper Co., Ltd.	230 California St. San Francisco 11	2870	70	Copper chemicals and fertilizers
Moyer Chemical Co.	P.O. Box 945, 1310 Bayshore Blvd., San Jose	2870	40	Agricultural chemicals, insecticides, fungicides
Narmco Resins & Coatings Co.	600 W. Victoria St. Costa Mesa	2820	190	Metal adhesives, synthetic resins, coatings and impregnation of cotton
National Chemical & Mfg. Co.	7006 Stanford Ave. Los Angeles 1	2851	30	Emulsion, paints
National Cylinder Gas Div. of Chemetron Corp.[3]	11705 S. Alameda St. Los Angeles 59	2813	(4)	Industrial and medical gases, welding equipment and supplies
National Lacquer Co.[3]	1600 Armstrong Ave. San Francisco 24	2851	6	Lacquers, liquid plastic, sealers
National Lead Co.	2240 24th St. San Francisco 10	2851	700	Paints, varnishes, specialized finishes
National Research & Chemical Co.	12520 S. Cerise Ave. Hawthorne	2840	45	Photographic specialties, industrial cleaning compounds, institutional chemical compounds
National Sanitary Supply Co.[3]	230 W. 116th St. Los Angeles 61	2842	50	Mechanics paste soap, waterless hand cleaner, skin protector
Nelson Technical Coatings Co.	2147 N. Tyler Ave. El Monte	2851	6	Chlorinated rubber stucco, concrete and pool coatings, industrial and household paints

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Neville Chemical Co.	2201 Cerritos Ave. Anaheim	2821	(4)	Resins
Nevin Engineering Assoc.	208 Toyopa Drive Pacific Palisades	2819	(4)	Barium bronze
Nion Corp.[3]	1001 N. McCadden Place Los Angeles 38	2834	75	Pharmaceuticals
Nopco Chemical Co.	1141 S. 14th St. Richmond	2800	75	Chemicals, plasticizers, emulsions, petroleum sulfonates
Noxal Products Co.[3]	P.O. Box 156 Monterey Park	2834	7	Pharmaceuticals, antiseptics
Nu-Line Processing Co.[3]	3457 E. 15th St. Los Angeles 23	2851	10	Specification painting
Nutrilite Products, Inc.	5600 Beach Blvd. Buena Park	2834	194	Vitamin-mineral food supplement, agricultural products
Nutritional Aids Co., Inc.[3]	1775 W. Jefferson Blvd. Los Angeles 18	2834	5	Vitamins, bio-chemical, pharmaceuticals
O'Brien Corp. of San Francisco	1019 Mission St. San Francisco 3	2851	29	Paint, enamels, lacquers
Ohio Chemical Pacific Co.	1231 2nd St. Berkeley 10	2810	60	Medical gases, therapy oxygen, lab. gases
Oil & Solvent Process Co.	1734 W. First St. Azusa	2851	(4)	Solvents and thinners
Old Colony Paint & Chemical Co.	P.O. Box 2176 Terminal Annex Los Angeles 54	2851	(4)	Paints, varnishes, and industrial surface coatings
Olin Mathieson Chemical Corp.	P.O. Box 245 Morgan Hill	2899	(4)	Railway fuses, highway fuses, forest fire torches
Omega Shoe Polish Co.[3]	1525 S. Los Angeles St. Los Angeles 15	2842	(4)	Shoe polishes of all kinds
Orange County Chemical Co.[3]	3622 W. Hazard Ave. Santa Ana	2842	(4)	Sweeping compounds
Overton Laboratories	4648 Hollywood Blvd. Los Angeles 27	2844	(4)	Cosmetics, toilet preparations
Pacific Coast Lacquer Co., Inc.[3]	1500 Spence St. Los Angeles 23	2851	(4)	Lacquer thinners and synthetic allied products
Pacific Coatings Corp.[3]	13400 S. Paramount Blvd. Hollydale	2851	9	Vinyl plastic masonry coatings, paints, enamels
Pacific Glue Mfg. Co.	921 E. Church St. Stockton	2891	8	Liquid glues
Pacific Guano Co.	1832 2nd St. Berkeley 10	2870	200	Fertilizers, insecticides, seeds
Pacific Oxygen Co.	2205 Magnolia St. Oakland 7	2813	32	Oxygen, nitrogen, argon and acetylene gases, liquid oxygen
Pacific Paint & Varnish Co.	4th and Cedar Sts. Berkeley 10	2851	200	Paints and varnishes
Pacific Press, Inc.	5201 S. Soto St. Vernon 58	2851	1,100	Printers, lithographers, photoengravers
Pacific Soap Co., Ltd.[3]	6830 McKinley Ave. Los Angeles 1	2841	35	Granulated soap, laundry chip and powdered soap, bar soap
Pamasa Products[3]	P.O. Box 2031 Fullerton	2840	(4)	Floor finish
Parasan Co.[3]	8918 Golf Drive Spring Valley	2843	8	Sanitary supplies
Parco, Inc.[3]	3818 Bandini Blvd. Los Angeles 23	2871	15	Fertilizers
Parker Brothers, Inc.	7044 Bandini Blvd. Los Angeles 22	2820	(4)	Tank coatings and linings, thermosetting phenolic epons, vinyls
Parker Rust Proof Co.	3710 Fruitland Ave. Maywood	2819	11	Phosphate coating chemicals, metal cleaners, cold forming lubricants
Parko-Pacific Co.	15722 Broadway Gardena	2840	35	Auto and aircraft chemicals, polishing products and abrasives

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Parks-Barnes, Inc.[3]	530 Sixth St. Hermosa Beach	2870	35	Horticultural products
Patek & Co.	201 Bayshore Blvd. San Francisco 1	2840	85	Laundry and dry cleaning supplies
Patten Concentrates, Inc.[3]	4635 Alger St. Los Angeles 39	2834	6	Pharmaceuticals, food concentrates, vitamins
Pemaco, Inc.[3]	5989 District Blvd. Los Angeles 22	2899	17	Metal working products, metal forming compounds, chemical products
Perf Products	235 Bayshore Blvd. San Francisco 24	2841	6	Soaps and detergents
Petrochemicals Co.	1825 E. Spring St. Long Beach 6	2841	21	Detergents, anti-caking agents, wetting agents and aromatic solvents
Philadelphia Quartz Co. of Calif.	7th & Grayson Sts. Berkeley 10	2819	124	Sodium silicate, potassium silicate, sodium metasilicate
Pioneer Chemical Co., Inc.[3]	418 E. 3rd St. Los Angeles 13	2841	15	Sanitary maintenance supplies, disinfectants, cleaning compound
Pioneer Soap Co., Inc.[3]	470 Carolina St. San Francisco 7	2841	22	Laundry soaps, cleansers, detergents
Pittsburgh Plate Glass Co.	742 Grayson St. Berkeley 10	2851	350	Industrial and household paints, varnishes, enamels, lacquers
Plant Food Corp.	3711 Medford St. Los Angeles 63	2870	30	Fertilizers and agricultural chemicals, insecticides
Plex Chemical Corp.	235 Bayshore Blvd. San Francisco 24	2800	14	Chemicals
Plus Products[3]	2302 E. 38th St. Los Angeles 58	2834	50	Vitamin and mineral supplements
Ply-On Coatings, Inc.[3]	55 Sheridan St. San Francisco 3	2851	10	Plastic coatings, vinyl lacquers
Poly Resins	11655 Wicks St. Sun Valley	2821	10	Synthetic resins and compounds, protective coatings
Polytron Corp.[3]	1175 S. Kent St. Richmond	2821	10	Plastic raw materials
Procter and Gamble Co.	1601 W. 7th St. Long Beach	2841	650	Soaps, oils, shampoos and dentrifices
Productol Co.[3]	417 S. Hill St. Los Angeles 13	2814	90	Naphthalene, cresols, cresylic acids
Protex Wax Co.[3]	1235 48th Ave. Oakland 1	2840	6	Floor wax and cleaners
Pure Carbonic Co.	3rd and Virginia Sts. Berkeley 10	2813	65	Carbon dioxide gas (CO_2) Dry-ice
Purex Corp., Ltd.	9300 Rayo Ave. South Gate	2899	1,200	Liquid bleach, dry bleach, synthetic detergents, cleansers, toilet soap
Reaction Products Co.[3]	829 Wright Ave. Richmond	2810	5	Chemicals, copper salts, and organic compounds
Redel, Inc.	2300 E. Katella Ave. Anaheim	2813	20	Liquid oxygen, thread sealant, resin backed copper stripping
Reichhold Chemicals, Inc.[3]	120 S. Linden Ave. South San Francisco	2821	100	Chemicals, chemical colors, synthetic resins, industrial chemicals
Reliance Varnish Co. of Calif.	5025 E. Slauson Ave. Los Angeles 22	2851	30	Industrial finishes
Rexco-Chemical Co.[3]	1325 Warehouse Rd. Costa Mesa	2800	4	Chemical specialties
Rhodes, D. H., & Co.	434 9th St. San Francisco 3	2851	10	Paints, oils, and waxes

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Riders Limited[3]	7234 Varna Ave. North Hollywood	2830	22	Pharmaceuticals
Riker Laboratories, Inc.	19901 Nordhoff St. Northridge	2834	400	Pharmaceuticals
Riley, Stephen Co., Inc.	3821 W. Jefferson Blvd. Los Angeles 16	2844	30	Bubble baths, bath oils, perfume
Ring-In Chemical, Inc.[3]	5300 Los Gatos Hwy. Santa Cruz	2899	(4)	Auto chemicals
Ritchie Adhesive Co.	7822 Salt Lake Ave. Huntington Park	2891	7	Cellulose pastes, vegetable and vinyl adhesives
Roberts Chemical Co.[3]	600 N. Baldwin Blvd. City of Industry	2891	(4)	Adhesives and solvents
Roberts Co.[3]	1049 Broadway Burlingame	2873	5	Insecticides
Rocket Chemical Co., Inc.[3]	4674 Alvarado Canyon Rd. San Diego 20	2899	7	Rust and corrosion preventatives
Rolley Co. (Div. of Botany[3] Industries)	1355 El Camino Real Millbrae	2840	(4)	Cosmetics
Rust-Oleum	9038 E. Las Tunas Drive Temple City	2899	(4)	Rust preventatives
Sanico of California[3]	7331 Varna Ave. North Hollywood	2800	6	Chemical concentrates
Santa Barbara Paint Factory[3]	314 Palm Ave. Santa Barbara	2851	7	Paints, enamels, marine paints
Scofield, L. M., Co.	2071 Laura Ave. Huntington Park	2842	15	Cement color hardener and wax
Seal-Ins Laboratories, Inc.[3]	4021 E. Florence Ave. Bell	2834	(4)	Pharmaceuticals
Seaside Paint and Lacquer Co.[3]	1439 Cota Long Beach 13	2851	2	Paints, lacquers, enamels
Security Paint Mfg. Co.	1621 N. Indiana St. Los Angeles 63	2851	24	Paint, enamels, varnishes
Sentinel Chemical Co.[3]	1790 11th St. Oakland 20	2840	11	Cleaning compounds, detergents, insecticides, disinfectants
Servex[3]	6122 N. Figueroa St. Los Angeles 42	2830	(4)	Feminine Hygiene drugs
Shaaco Products	921 E. Redondo Blvd. Inglewood 3	2899	2	Chemical cleaning compounds
Shannon Luminous Materials Co.	7356 Santa Monica Blvd. Hollywood 46	2851	7	Paints, lacquers, dyes, inks
Shell Chemical Co., Agricultural Chemicals Div.	110 W. 51st St. New York 20, N.Y.	2873	(4)	Specialty chemicals
Shell Chemical Co., Ammonia Div.	100 Bush St. San Francisco 6	2819	(4)	Nitrogen chemicals
Shell Chemical Co., Industrial Chemicals Div.	110 W. 51st St. New York 20, N.Y.	2821	(4)	Alcohols, solvents, other organic chemicals
Shell Chemical Co., Plastics and Resins Div.	110 W. 51st St. New York 20, N.Y.	2821	(4)	Epon resins, other organic chemicals
Shell Chemical Corp., Ammonia Div.	100 Bush St. San Francisco 6	2819	(4)	Ammonia products
Shell Chemical Corp., Agricultural Chemical Sales Div.	460 Park Ave. New York 22, N.Y.	2873	(4)	Insecticides, agricultural and non-agricultural and soil fumigants
Shell Chemical Corp. Chemical Sales Div.	380 Madison Ave. New York 17, N.Y.	2821	(4)	Organic solvents, industrial chemicals
Shelley Urethane Industries, Inc.[3]	4528 Brazil St. Los Angeles 39	2821	35	Design and engineering services

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Sherwin-Williams Co. of California, The	490 Grand Ave. Oakland 10	2851	700	Paints, varnishes, lacquers, chemicals, insecticides
Shontex Co., The[3]	1556 20th St. Santa Monica	2844	7	Cosmetics
Silver Line Products, Inc.	5618 E. Washington Blvd. Los Angeles 22	2891	55	Friction and bonding materials
Sinclair-Valentine Co., Div. of American Marietta[3]	1104 57th Ave. Oakland 21	2893	100	Printing inks
Skasol Inc. of Southern Calif.	967 N. Vignes Los Angeles 12	2899	8	Water treatment, chemical de-scaling
Smith-Davis Co., Div. of Maas & Waldstein Co. Newark, N.J.[3]	10751 Venice Blvd. Los Angeles 34	2851	(4)	Industrial finishes, lacquers,
Smith, E. W., Chemical Co.[3]	10520 E. Proctor Ave. La Puente	2899	15	Cleaning compounds, water softeners, fly sprays
Smith, Robert Mfg. Co., Inc.	6507 Salt Lake Ave. Bell	2840	25	Soaps and detergents
Sno-Boy Paints, Inc.[3]	1612 Market St. San Francisco 2	2851	3	Paints
Snowden Enterprises[3]	P.O. Box 1213 Modesto	2800	8	Chemicals
Socony Paint Products Co., Div. of Socony Mobil Oil Co., Inc.	2647 E. 37th St. Los Angeles 58	2851	40	Paints, varnishes, and enamels
Southern California Disinfecting Co.[3]	2424 San Fernando Rd. Los Angeles 65	2840	28	Cleaners, disinfectants, janitor supplies
Southern Lacquer & Paint Corp.	9845 Miller Way South Gate	2851	30	Lacquers, paints, and synthetic enamels
Sovig Conrad Co.[3]	875 Bryant St. San Francisco 3	2815	(4)	Sealers, waxes, hardeners, waterproofing
Sparks Chemical Co. of California, Inc.	1925 Temple, Long Beach 4	2840	5	Cleaning compounds
Spartan Lacquer Co.	9255 E. Imperial Highway Downey	2851	(4)	Lacquers, lacquer thinners, synthetic enamels
Spebra Products Manufacturing Co.	2017 Granville Ave. Los Angeles 25	2820	8	Chemicals for the food and beverage industries
Spicer-Gerhart Co.[3]	8350 Foothill Blvd. Sunland	2834	9	Pharmaceuticals
Staley, A. E. Mfg. Co.	5832 Garfield Ave. Los Angeles 22	2818	(4)	Water softener
Standard Homeopathic Co.[3]	436 W. 8th St. Los Angeles 14	2830	50	Drugs
Standard Paint Co.	3209 Adeline St. Berkeley 3	2851	20	Paints
Stauffer Chemical Co.	636 California St. San Francisco 8	2840-99	1,450	Insecticides, fertilizers, borax and boric acid, cleaning fluids
Stayner Corp.[3]	2531 9th St. Berkeley 10	2834	45	Pharmaceutical and vitamin products
Stephenson Air Brush Paint Co.[3]	60 Hegenberger Loop Oakland 21	2850	(4)	Paints
Sterling Paint Co.	6460 Hollis St. Emeryville 8	2851	(4)	Paints
Sterol Derivatives, Inc.	3626 Medford St. Los Angeles 63	2834	24	Fine chemicals, food chemicals, brominated oils
Stone, E. B., & Son	P.O. Box 57 Salinas	2800	(4)	Chemicals and allied products

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Stoner-Mudge Co., Div. American-Marietta[3]	1004 W. 10th St. P.O. Box 576 Azusa	2851	30	Industrial finishes, lacquers, enamels, thinners
Studio Cosmetic Co.	12232 W. Olympic Blvd. Los Angeles 64	2840	([4])	Cosmetics
Studio Girl Hollywood, Inc.	3618 San Fernando Road Glendale 4	2844	40	Cosmetics
Sun Chemical Corp.	20 S. Linden South San Francisco	2893	([4])	Inks, paints, hardeners, calking and glazing compounds
Sun Products Co.	402 15th St. San Diego	2842	5	Industrial cleaning compounds
Sunland Chemical Co.[3]	11630 Wicks St. Sun Valley	2899	4	Metal cleaners and custom compounds
Super Concrete Emulsions, Ltd.	1372 E. 15th St. Los Angeles 21	2899	25	Waterproofing compounds
Super Soap Co.[3]	1421 Egbert Ave. San Francisco 24	2841	5	Soap and waterless cleanser
Superior Paint & Lacquer Works	6231 Maywood Ave. Huntington Park	2851	([4])	Enamels, industrial finishes, specification paints
Sweep Rite Products Co.[3]	2986 E. Century Blvd. Lynwood	2841	8	Wax and oil base compounds
Swift & Company (Agricultural Chemical Div.)	4060 E. 26th St. Los Angeles 23	2870	100	Plant foods and agricultural chemicals
Synkoloid Co., The	3345 Medford St. Los Angeles 63	2851	195	Paints, construction finishing products
Takara Laboratories[3]	1161 N. Las Palmas Ave. Los Angeles 38	2830	12	Pharmaceuticals
Tap and Drill E-Z Div. of Darco Industries, Inc.[3]	2151 E. Rosecrans El Segundo	2899	6	Cutting and tapping compounds
Tec-Chemical Co.	524 Monterey Pass Road Monterey Park	2899	([4])	Chemical compounds and coatings
Textilana Corp.	12607 Cerise Ave. Hawthorne	2841	([4])	Synthetic detergents, cleaners
Thompson Chemicals Corp.	3600 Monon St. Los Angeles 27	2873	([4])	Insecticides, organic chemicals for agriculture
Thompson, W. T., Co.	2727 Hyperion Ave. Los Angeles 27	2834	([4])	Vitamins and pharmaceuticals
Thurston, Emory W. Laboratories, Inc.[3]	3355 Glendale Blvd. Los Angeles 39	2834	12	Pharmaceuticals, food supplements, vitamin products
Tibbetts-Westerfield Paint Co., Inc.	6901 S. Stanford Ave. Los Angeles 1	2851	16	Paints, varnishes, lacquers
Tomso Products Co.[3]	3020 Clement St. San Francisco 21	2899	4	Silicone eyeglass and shoe shine cloths
Tops Chemical Co.	1727 Buena Vista Ave. Duarte	2899	22	Chlorine, bleach, and miscellaneous chemicals
Trail Chemical Corp.	1614 W. Gidley St. El Monte	2851	45	Industrial finishes, enamels, lacquers, paints, thinners
Trailite, Inc.[3]	4707 E. Compton Blvd. Compton	2851	3	Protective coatings
Tretolite Co. of California	200 S. Puente St. Brea	2899	([4])	Oil field emulsion breaking compounds
Trewax, Inc.	5631 S. Centinela Ave. Culver City	2842	15	Floor waxes

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No. of employees	Major chemical products manufactured
Tri-City Paint Co.	1220 Fourth St. Berkeley 2	2850	8	Paint
Trimal Laboratories	7029 Willoughby Ave. Hollywood 38	2842	7	Cosmetics
Trojan Powder Co.	620 Market St. San Francisco 4	2892	100	Explosives
Troy Industrial Products Co. of Los Angeles	2249 E. 39th St. Los Angeles 58	2842	25	Chemical compounds and janitorial supplies
Turco Products, Inc.	24600 S. Main St. Wilmington	2840	495	Industrial chemical cleaning and maintenance compounds
Ultra Chemical Works, Inc.	12607 Cerise Ave. Hawthorne	2842	(4)	Floor waxes, detergents
Unit Chemical Corp.[3]	4161 Redwood Ave. Los Angeles 66	2840	25	Sanitizers, disinfectants
United Heckathorn Co. (subsequently changed to United Chemetrics Corp.)	600 S. 4th St. Richmond	2870	200	Insecticides, fertilizers and their application, industrial chemicals
United Laboratories, Ltd.[3]	333 S. Fair Oaks Ave. Pasadena	2834	13	Pharmaceutical products
United States Borax & Chemical Corp.	630 Shatto Pl. Los Angeles 5	2819	(4)	Borates, borax, weed killing compounds, industrial hand soaps
U. S. Peroxygen Corp.	850 Morton Ave. Richmond	2810	5	Organic chemicals
United States Rodent Destroyer Co.	P.O. Box 305 Los Gatos	2873	4	Rodent and gopher destroyers
Universal Chlorinator Co.[3]	14831 Bessemer St. Van Nuys	2800	8	Chemicals, liquid powder, tablets
Universal Detergents, Inc.	1825 E. Spring St. Long Beach 6	2842	(4)	Detergents, solvents
Urell, Inc.	2630 Humboldt St. Los Angeles 31	2899	13	X-ray and photographic chemicals
V-O Manufacturing Co.	13165 Sherman Way North Hollywood	2810	2	Automotive and industrial chemicals
Valley Queen Products Co.	6027 Wilmington Ave. Los Angeles 1	2842	6	Cleaning compounds, soap
Van-S Laboratories	1681 8th St. Oakland 20	2830	6	Drugs, cosmetics, and chemicals
Vi-Cly Industries, Inc.	18414 Santa Fe Ave. Compton	2851	60	Paint, enamels, varnish
Vi-Jon Laboratories, Inc.	1833 Peralta Oakland 7	2840	15	Cosmetics, drugs
Vinyl-Line Paint Co.	6127 Sepulveda Blvd. Van Nuys	2851	5	Paints
Visco Products Co., Inc.	400 E. Vermont St. Anaheim	2899	13	Oil treating chemicals
Vita-Fluor Corp.	409 N. 5th St. Redlands	2834	22	Vitamins, pharmaceuticals
Vitaminerals, Inc.[3]	1815 Flower St. Glendale 1	2834	100	Dietary food supplements and pharmaceuticals
Vitamins for Industry, Inc.[3]	3456 W. Olympic Blvd. Los Angeles 19	2834	(4)	Vitamin products

See footnotes at end of table.

TABLE A-1. - California chemical companies reporting purchases of individual minerals and mineral compounds in 1960 for their own use in chemical manufacturing[1]--Continued

Company name	Address	SIC No.	Approx. No.[2] of employees	Major chemical products manufactured
Vitex Laboratories	1141 S. 14th St. Richmond	2834	([4])	Vitamin concentrates and pharmaceuticals
Vitmora Co.	100 S. Adams St. Glendale 5	2834	30	Pharmaceuticals, food supplements
Vogarell Products, Inc.	1212 W. Washington Blvd. Los Angeles 77	2834	([4])	Proprietory drugs
Vogue Cosmetic Products	2130 Canyon Dr. Costa Mesa	2842	8	Cosmetics
Vonett Sales Co.[3]	645 N. Martel Ave. Los Angeles 36	2840	7	Cosmetics
Walker Paint Co.	149 Hendy Ave. Sunnyvale	2851	([4])	Paints
Weatherwise Products, Inc.	15119 Oxnard St. Van Nuys	2899	8	Protective coatings
West Chemical Products, Inc.[3]	2110 E. 37th St. Los Angeles 58	2840	([4])	Disinfectants, germicidals, maintenance
Western Chemical & Mfg. Co.	3270 E. Washington Blvd. Los Angeles 23	2810	80	Industrial chemicals
Western Lead Products Co.	720 S. 7th Ave. City of Industry	2816	50	Lead oxides, powdered lead, soft lead, antimonial lead, zinc alloys
Western States Chemical Corp.	Port Chicago Hwy. Nichols	2871	5	Chemical fertilizers
Western Stencil Co.[3]	527 Howard St. San Francisco 5	2893	6	Duplicating stencil sheets, ink, stencil correction fluid
Westling Roger Ink Corp.	5001-B Firestone Bldg. South Gate	2893	6	Printing inks
Whiteline Paint Co., Inc.	1520 Spence St. Los Angeles 23	2851	25	Paint, enamels, varnishes
Wilco Co.	4425 Bandini Blvd. Los Angeles 23	2899	200	Chemical specialties
Williams, C. K., & Co.	4650 Shellmound St. Emeryville 8	2816	([4])	Iron oxide pigments and colors, nonmetallic fillers
World Spray Co., Inc.	2211-1/2 Chico Ave. El Monte	2870	8	Domestic and agricultural insecticides
Wulff Process Co.[3]	3040 E. Slauson Ave. Huntington Park	2813	10	Acetylene
Wyandotte Chemicals Corp. J. B. Ford Div.	8921 Dice Rd. Los Nietos	2899	75	Metal treatments, cleaning compounds
Yates & Smart Paint Co.	630 E. 10th St. Oakland 6	2850	12	Paints, varnishes
Yosemite Chemical Co.	1040 Mariposa St. San Francisco 7	2840	40	Industrial cleaning compounds
Zolatone Process, Inc.[3]	3411 E. 15th St. Los Angeles 23	2851	125	Paints, lacquers, synthetics, technical coatings

[1]Also, 332 companies in the SIC 28 category in California responded with reports of either no consumption of any of the items listed; consumption of mineral raw materials valued at less than $1,000 (and no specific commodities designated); or the products reported were materials which had lost their identity as a mineral raw material.
[2]California Manufacturing Association Register.
[3]Consumed exclusively organic materials, minerals and chemicals beyond first processed stage, or items included elsewhere.
[4]Not reported.

TABLE A-2. - Imports of selected minerals by California ports of entry, 1960[1]

Commodity	Ports of entry						Major sources of origin
	San Francisco		Los Angeles		San Diego		
	Quantity	Value[2]	Quantity	Value[2]	Quantity	Value[2]	
Antimony:							
Metal.....short tons	53	$23,234	44	$19,326	-	-	United Kingdom, Belgium.
Ore.....	-	-	-	-	153	2,222	Mexico.
Oxide.....	50	19,048	255	103,780	-	-	United Kingdom, France, Belgium, Netherlands.
Arsenic:							
Metal.....pounds	-	-	2,240	858	-	-	Sweden.
Sulfide.....do..	-	-	38	1,037	-	-	United Kingdom.
Trioxide (white).....do..	-	-	69,511	4,213	-	-	Mexico.
Asbestos:							
Amosite (crude).....short tons	264	32,035	308	42,443	-	-	Republic of South Africa, Rhodesia.
Chrysotile (blue).....do..	4,095	886,374	1,893	420,716	-	-	Australia, Republic of South Africa, Rhodesia.
Chrysotile (other).....do..	1,687	388,185	-	-	-	-	Do.
Shingle fiber.....do..	301	38,700	-	-	-	-	Do.
Short fiber (15 percent impurities).....do..	5	930	357	68,131	-	-	Do.
Barium chemicals:							
Barium carbonate.....do..	4	3,239	115	9,761	-	-	Germany, West.
Barium chloride.....do..	12	1,502	50	7,677	17	1,403	Germany, West, France, Italy.
Blanc fixe.....do..	80	4,800	-	-	-	-	Germany, West.
Lithopone.....do..	11	1,078	-	-	-	-	Netherlands.
Bauxite:							
Crude.....long tons	9,226	71,779	-	-	-	-	British Guiana, Surinam.
Calcined.....do..	1,100	12,410	-	-	-	-	Do.
Calcium chloride.....short tons	480	16,544	-	-	-	-	Belgium.
Chromite (refractory grade).....do..	8,372	493,500	-	-	-	-	Philippines.
Clays:							
Kaolin.....do..	-	-	900	17,300	-	-	United Kingdom.
Other.....do..	-	-	123	2,220	-	-	United Kingdom, Japan.
Cobalt metal.....pounds	2,500	43,750	88,499	126,040	-	-	Germany, West, Belgium.
Copper (copper content)							
Ore.....short tons	1,256	336,699	-	-	-	-	Peru, Australia, Bolivia, Canada, Morocco.
Concentrates.....do..	83	18,343	-	-	-	-	Philippines, British Honduras.
Fluorspar (97 percent or less).....do..	-	-	102	2,041	-	-	Mexico.
Graphite (amorphous, natural).....do..	929	26,664	-	-	-	-	Hong Kong, Ceylon, Germany, West.
Gypsum (crude).....do..	245,627	224,914	223,917	203,119	-	-	Mexico.
Iodine (crude).....pounds	-	-	72,000	68,382	-	-	Japan.
Iron oxide pigments:							
Siennas.....short tons	12	1,365	10	1,453	-	-	United Kingdom, Italy.
Umber.....do..	-	-	36	2,776	-	-	Malta, United Kingdom.
Vandyke brown.....do..	-	-	6	419	-	-	Germany, West.
Other.....do..	270	28,861	2,817	377,453	-	-	Germany, West, Italy.
Lead:							
Pigs and bars.....do..	5,639	1,186,434	2,808	518,467	-	-	Australia, Peru.
Reclaimed.....do..	-	-	5	1,756	-	-	Japan.
Lime (dead-burned dolomite).....do..	-	-	5	2,009	-	-	United Kingdom.
Magnesium compounds (lump or ground).....do..	20	1,544	805	40,133	-	-	Netherlands.
Manganese ore (over 35 percent Mn).....do..	-	-	262	15,963	-	-	Philippines.
Mica (unmanufactured).....pounds	107,680	944	5,561,920	37,322	-	-	India, Republic of S. Africa.
Nitrogen compounds:							
Calcium nitrate.....short tons	12,721	354,898	24,469	701,763	3,934	176,665	Norway, Germany, West, Netherlands, Chile, Belgium.
Potassium nitrate (crude).....do..	20	2,145	-	-	-	-	
Potassium--sodium nitrate.....do..	20	2,091	60	6,354	-	-	Germany, West.
Sodium nitrate.....do..	4,310	113,130	3,498	99,312	-	-	Chile.
Synthetic.....do..	500	12,245	9,105	476,784	1,500	76,411	Norway, Germany, West.
Urea.....do..	2,937	214,004	2,218	181,987	301	28,474	Germany, West, Norway, Japan, Belgium, United Kingdom.
Phosphates (dicalcium).....long tons	270	13,233	375	18,286	39	1,786	Belgium.
Potassium salts:							
Carbonate.....short tons	-	-	11	1,478	-	-	Germany, West.
Caustic.....do..	-	-	16	2,893	-	-	France, Germany, West, Sweden.
Cream of tartar.....do..	23	12,482	8	4,072	-	-	Italy, Germany, West, Spain, United Kingdom.
Cyanide.....do..	5	2,792	76	42,318	1	288	United Kingdom, Germany, West, France.
Ferricyanide.....do..	22	14,493	-	-	-	-	Belgium, Germany, West.
Ferrocyanide.....do..	-	-	22	9,795	-	-	Netherlands, Germany, West.
Nitrate.....do..	-	-	55	7,969	-	-	Germany, West.
Permanganates.....do..	-	-	6	2,426	-	-	United Kingdom.
Salt.....short tons	-	-	-	-	25	299	Mexico.
Stone (limestone):							
Chalk and whiting:							
Processed.....do..	640	8,766	962	16,735	-	-	France, Belgium.
Precipitated.....do..	15	1,291	30	2,831	-	-	Japan, United Kingdom.
Talc (ground).....do..	351	13,656	-	-	401	8,669	Mexico, Italy.
Titanium (rutile concentrate).....do..	1,270	212,659	6,759	1,026,066	-	-	Australia, Japan.
Tungsten (ore and concentrate).....do..	155,215	163,044	-	-	-	-	Argentina, Australia.
Zinc:							
Ore.....do..	2,493	302,484	-	-	50	5,957	Australia, Peru, Canada.
Blocks, pigs and slabs.....do..	-	-	150	33,145	-	-	Peru.
Sheets.....do..	-	-	3	978	-	-	Belgium.
Zirconium.....do..	427	9,465	2,693	107,340	-	-	Australia.

[1]Compiled from U.S. Department of Commerce data.
[2]Values are, in general, based on dollar market value in the foreign country and exclude U.S. import duties, ocean freight, and marine insurance.

TABLE A-3. - Exports of selected minerals and compounds from California seaports, 1960[1]

Commodity	San Francisco		Los Angeles		San Diego		Major destination
	Quantity	Value	Quantity	Value	Quantity	Value	
Asbestos:							
Chrysotile No. 1.....short tons	23	12,800	222	88,295	-	-	Italy, Japan, Germany, West, Guatemala.
Chrysotile No. 2.....do..	-	-	11	2,499	-	-	United Kingdom, Switzerland.
Chrysotile (other).....do..	5.6	900	21	74,025	-	-	Europe, Philippines.
Bismuth (metal).....pounds	-	-	13,168	11,916	-	-	Netherlands.
Bromine.....do..	18,602	11,298	4,391	4,126	-	-	Saudi Arabia, Iran, Peru, Brazil, Nicaragua, Canada.
Cadmium:							
Metal.....do..	355,260	468,393	-	-	-	-	
Calcium chloride.....short tons	585	2,644	21	316	8	544	Mexico, Canada, France, Pacific Islands.
Clay:							
Kaolin.....do..	47	1,498	311	12,404	-	-	Mexico, Philippines, Argentina.
Other.....do..	912	42,875	334	26,585	566	21,118	Mexico, 11 other countries including Italy, Argentina, Japan, Venezuela.
Cobalt (alloy ores and concentrates)[2]..pounds	65,704	33,147	131,345	57,709	-	-	Netherlands, Germany, West, United Kingdom, Japan.
Copper (unmanufactured ore).....short tons	151	67,377	288	142,128	-	-	Japan, Germany, West.
Diatomite.....short tons	1,064	95,783	28,426	2,037,323	464	27,150	Mexico, Japan, 30 other countries including Sweden, Italy, United Kingdom, Germany, West, Switzerland, Netherlands.
Graphite (flake).....do..	15	2,346	-	-	-	-	Venezuela.
Graphite (amorphous, natural).....do..	11	1,708	-	-	-	-	Philippines.
Graphite (amorphous, artificial).....do..	-	-	-	-	35	2,792	Mexico.
Gypsum (crude).....do..	2	506	98	5,203	5,254	113,851	Mexico, Australia, Barbados, Indonesia, Republic of South Africa, Philippines.
Iodine, iodide, and iodate.....pounds	3,908	8,699	42,564	40,628	-	-	India, Peru, Philippines.
Iron oxide pigments.....short tons	85	49,958	24	5,941	20	7,309	Mexico, Guatemala, Hong Kong, Philippines, Korea.
Lead:							
Pigs and bars.....do..	1,174	478,701	6	2,001	29	8,703	Peru, Panama, Philippines, Korea, Mexico, Columbia.
Reclaimed.....do..	236	32,561	208	30,848	-	-	United Kingdom, Viet Nam, Germany, West, Netherlands, Colombia.
Lithium.....pounds	3,020	1,733	-	-	-	-	Korea.
Magnesium compounds (dead burned)..short tons	34,104	1,815,318	3	2,089	-	-	Italy, United Kingdom, Germany, West, Colombia, Chile, France, Japan.
Mercury.....flasks	-	-	1	176	-	-	Indonesia.
Mica (ground and pulverized).....pounds	14,000	1,680	-	-	-	-	Philippines.
Molybdenum (ore).....do..	72,077	113,154	1,446,694	2,091,943	-	-	United Kingdom, Australia, Netherlands, France, Japan.
Nickel (ore and metal).....short tons	6,586	595,682	4,637	1,137,406	353	69,402	Japan, Sweden, United Kingdom, Germany, West, Italy, Norway.
Nitrogen compounds:							
Ammonium phosphate.....do..	26,185	333,598	3,743	11,725	1,719	114,925	Mexico, El Salvador, Peru, Korea, Republic of South Africa, Malaya.
Ammonium sulfate.....do..	445	265,543	1,502	114,340	6,573	373,600	Mexico, Korea.
Nitrogeous materials:							
Ammonium (anhydrous).....do..	44	13,291	-	-	29,879	1,884,238	Singapore, New Zealand.
Potassium-sodium-nitrate.....short tons	0.5	500	-	-	20	1,337	Mexico, Australia.
Urea.....do..	2	514	4,239	272,813	1,964	139,703	Mexico, Korea, Singapore.
Other.....do..	82	8,551	14	1,119	395	20,983	Mexico, Costa Rica, El Salvador.
Potassium chloride.....do..	-	-	506,349	14,448,421	32,358	867,694	Japan, Philippines, Sweden, Mexico.
Salt.....do..	308,260	1,613,558	36	2,594	1,497	91,596	Canada, Japan, Philippines, Mexico. Panama, Costa Rica, Brazil, Equador, Peru.
Sand (silica).....do..	115	7,552	80	7,539	302	4,374	Mexico, China, Turkey, Venezuela, Malaya, Philippines.
Sodium sulfate (crude).....do..	70	2,968	16,241	383,253	2	460	Mexico, Canada, Australia, Cuba, New Zealand.
Stone (ground limestone).....do..	-	-	-	-	446	7,166	Mexico.
Sulfur.....long tons	111	17,034	-	-	14	894	Mexico, Canada, Nicaragua, Panama, New Zealand.
Talc and soapstone.....short tons	191	38,987	1,977	107,208	664	13,590	Mexico, 14 other countries including Norway, Canada, Greece.
Tin.....do..	3	7,287	-	-	-	-	
Tungsten (ore and concentrates).....pounds	-	-	21,530	10,876	-	-	Germany, West, New Zealand.
Zinc:							
Blocks, pigs, etc.....short tons	4	1,344	26	7,327	-	-	Viet Nam.
Sheets.....do..	0.5	2,123	3	4,758	0.4	826	Mexico, United Kingdom, Taiwan, Philippines.
Old.....do..	1,299	178,468	686	114,191	-	-	Netherlands, Japan, Chile, Belgium.
Dust.....do..	237	84,747	68	21,675	-	-	Pacific Island, Venezuela, Belgium, Canada.

[1]Compiled from U.S. Department of Commerce records.
[2]Figures given are not for this commodity alone.

5-1287-X
(May 1961)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
DIVISION OF MINERAL RESOURCES
420 CUSTOM HOUSE, 555 BATTERY STREET
SAN FRANCISCO 11, CALIFORNIA

Budget Bureau No. 42R103
Approval expires: 10-31-61

INDIVIDUAL COMPANY DATA—CONFIDENTIAL

If permission to disclose is withheld by checking the box marked "No" in question immediately preceding the signature, the data furnished in this report will be treated in confidence by the Department of the Interior, except that they may be disclosed to defense agencies.

We realize that you are constantly searching for sources of mineral raw materials, at a lower delivered cost, that will meet your specifications.

To help you in this search, we are making a study to determine whether or not nearby California and Nevada mineral resources are being used to the maximum extent possible by the chemical manufacturing industries in these states. We believe this study will be of material value to you; but naturally, it can be successful only if we receive your full cooperation.

Such organizations as the Chemical Market Research Association of Southern California, Western Chemical Market Research Group, chambers of commerce, Government agencies, and others in the area have recognized the importance of this survey to the Western economy. Will you give us your support by returning this form soon so we can make the results available to you at the earliest possible moment?

Please return a separate questionnaire (more will be sent on request) for each of your chemical producing plants in California and Nevada. Use separate sheets if necessary. Information provided will be held in confidence and publication will be in such a way as to conceal your individual company data.

If further clarification is needed, please contact W. W. Key at the above address, or telephone YU-6-3111, extension 2324.

Very truly yours,

W F Dietrich

W. F. Dietrich, Chief
Division of Mineral Resources
Region II

(Over)

FIGURE 16. - Canvass Questionnaire Sent to the California Chemical Industry (plate 1).

CONSUMPTION OF MINERALS, METALS, ALLOYS, AND COMPOUNDS

by the

CHEMICAL INDUSTRIES OF CALIFORNIA AND NEVADA DURING 1960

NAME AND LOCATION OF CHEMICAL PLANT COVERED BY THIS REPORT

Name _____ Nearest City or Town _____

County _____ State (check which) Calif. ☐ Nevada ☐

Period covered by this report, if other than calendar year:

From _____ to _____ 19____

Please reply to the following questions and return the form as promptly as possible in the enclosed envelope, which requires no postage. A separate report should be prepared for each chemical processing plant in California and Nevada operated during the year. Additional blanks will be furnished upon request. STUDY ENCLOSED INSTRUCTION SHEET CAREFULLY.

I. KIND AND FORM OF MATERIAL CONSUMED AT THIS PLANT

In Sections A and B, provide information on the mineral materials, regardless of source, which were *consumed* at this plant in manufacturing (including up-grading) during the calendar year 1960 or the most recent 12-month operating period. Report on only those materials consumed whose value exceeded $1000. Items 1-42 of Section A cover mainly natural raw materials, and items 43-86 of Section B cover metals, alloys, and compounds purchased or produced by you.

A. *Natural Mineral Raw Materials*

Check kind *consumed* and specify type and/or form, such as crude, concentrate, ground lump, etc., and trade name, if any.

Check here.	Kind	Type or Form	Trade Name, if any		Kind	Type or Form	Trade Name, if any
Example:		Processed					
4. ✓	Boron minerals	*Kernite*	*Rasorite*	22. ___	Nitrates		
1. ___	Asbestos			23. ___	Perlite		
2. ___	Barite			24. ___	Phosphate rock		
3. ___	Bauxite			25. ___	Potash minerals		
4. ___	Boron minerals			26. ___	Pumice		
5. ___	Calcium chloride			27. ___	Pyrites		
6. ___	Chromite			28. ___	Rare earths		
7. ___	Clays:—(a) Kaolin			29. ___	Salt		
___	(b) Fullers earth			30. ___	Silica (incl. sand)		
___	(c) Bentonite			31. ___	Sodium carbonate (soda ash)		
___	(d) Miscellaneous			32. ___	Sodium sulfate (salt cake)		
8. ___	Copper minerals			33. ___	Stone (except items 16 and 30)		
9. ___	Diatomite			34. ___	Strontium minerals		
10. ___	Feldspar			35. ___	Sulfur		
11. ___	Fluorine minerals			36. ___	Talc		
12. ___	Gypsum			37. ___	Zirconium		
13. ___	Iron minerals						
14. ___	Titanium minerals				Others: (specify)		
15. ___	Kyanite						
16. ___	(a) Limestone						
___	(b) Lime						
___	(c) Whiting						
17. ___	Lithium minerals			38. ___			
18. ___	Magnesium minerals			39. ___			
19. ___	Manganese minerals			40. ___			
20. ___	Mica			41. ___			
21. ___	Mineral pigments			42. ___			

FIGURE 16. - Canvass Questionnaire Sent to the California Chemical Industry (plate 2).

B. *Metals, Alloys and Compounds* (Materials derived by mineral processing)
Check kind *consumed* and specify form in which product was obtained, and trade name, if any.

Kind	Type or Form	Trade Name, if any	Kind	Type or Form	Trade Name if any
Example:					
43. ✓ Aluminum	*Oxide*	—	66. ___ Nickel		
43. ___ Aluminum			67. ___ Phosphorus		
44. ___ Antimony			68. ___ Platinum		
45. ___ Arsenic			69. ___ Potassium		
46. ___ Beryllium			70. ___ Silver		
47. ___ Bismuth			71. ___ Strontium		
48. ___ Boron			72. ___ Sulfur		
49. ___ Bromine			73. ___ Tantalum		
50. ___ Cadmium			74. ___ Tin		
51. ___ Calcium			75. ___ Thorium		
52. ___ Chromium			76. ___ Titanium (incl. Slags)		
53. ___ Cobalt			77. ___ Tungsten		
54. ___ Columbium (niobium)			78. ___ Uranium		
55. ___ Copper			79. ___ Vanadium		
56. ___ Gold			80. ___ Zinc		
57. ___ Graphite			81. ___ Zirconium		
58. ___ Iodine					
59. ___ Iron			Others: (specify)		
60. ___ Lead					
61. ___ Lithium			82. ___		
62. ___ Magnesium			83. ___		
63. ___ Manganese			84. ___		
64. ___ Mercury			85. ___		
65. ___ Molybdenum			86. ___		

II. SOURCE, QUANTITY, AND VALUE OF MINERAL RAW MATERIALS, METALS, ALLOYS, AND COMPOUNDS CONSUMED.

	Item No. (a)	Type of Supplier (b)	Origin of Material (c)	Quantity Consumed: Amount (d)	Quantity Consumed: Unit (e)	Delivered Cost (f) Whichever is convenient: (1) Per Unit	or (2) Total	Average freight charge per unit (g)	If source is other than original producer, give name & address of supplier. (h)
EXAMPLES	4	Producer	*Calif.*	68	sh. tons	$72.00		$4.50	—
	43	Producer	*Ariz.*	20	sh. tons	~~$63.00~~		$8.00	—
	43	Sup. Ho.	*Nev.*	86	sh. tons			$6.50	Acme Supply, Reno

FIGURE 16. - Canvass Questionnaire Sent to the California Chemical Industry (plate 3).

III. SPECIFICATIONS. Please list specifications you require for the materials you consumed. (Limits of chemical content, fineness, color, density, or ASTM or other established standard designations, if any.) Supply specifications sheet when possible.

Item No. from Sec. IA and/or IB	

IV. MISCELLANEOUS (Use additional sheets if necessary.)

A. Would you consider using *lower grade* mineral raw materials if costs were lower and other conditions equal? No ☐ Yes ☐

B. Would you consider using *alternate minerals* if available at lower prices? No ☐ Yes ☐
If yes, list minerals now used (1)_____ (2)_____ (3)_____
State possible alternatives (1)_____ (2)_____ (3)_____

C. Would you *prefer* other minerals if costs were comparable? No ☐ Yes ☐
If yes, list minerals now used (1)_____ (2)_____ (3)_____
State preferred minerals (1)_____ (2)_____ (3)_____

D. List your principal products (include available brochures, company reports, etc.)
(a)_____ (c)_____
(b)_____ (d)_____

Comments:

May the Bureau of Mines disclose your individual data? . . . . . Yes ☐ No ☐

The signature on this report constitutes a consent to the publication of the individual company data in this report unless the blank designated "No" in the preceding sentence has been checked.

(NAME OF PERSON SIGNING REPORT) (OFFICIAL POSITION)

(SIGNATURE) (DATE)

FIGURE 16. - Canvass Questionnaire Sent to the California Chemical Industry (plate 4).

Note: If you did not consume any of the items shown during 1960, please return forms in the enclosed self-addressed envelope which requires no postage.

INSTRUCTION SHEET (Bureau of Mines Questionnaire No. 6-1287-X on Minerals for the Chemical Industries)

Include all natural mineral raw materials and first-marketable-stage chemical products, regardless of source, where the total value of each item consumed at the plant covered by this report during 1960, or most recent 12-month period, was over $1,000.

Section I. A. (minerals as they occur in nature) covers both crude minerals and concentrates which are either purchased or produced by you for use at this plant in the same chemical form as the exist in nature, except possibly extracts from brines (salines). Columns may be used to designate the mineral species as well as form, such as crude, concentrates, ground, lump, etc. If more space is needed, use separate sheet and tie in by item number.

Section I. B. (mineral products resulting from smelting or chemical process alterations) covers those mineral products derived from natural minerals as first-marketable-stage products, for example, lead arsenate produced at a smelter as the first commercially available form of arsenic. Another example of items included in this group is aluminum (or aluminum oxide) - the word "alumina" or "oxide" would be written in the first column after item 43. Do not include those products obtained for consumption which are beyond the first marketable stage; that is, items produced from materials which are already manufactured products. If in doubt, please list and we will make the final determination. Chapter 28 of the Standard Industrial Classification Manual will be used as a guide.

Section II covers sources, quantities, values, and transport costs of mineral raw materials that you consumed at this plant during the year. Col. (a) Indicate kind of material consumed by entering appropriate item number from Section I. A. or B. Col. (b) Indicate type of supplier, such as producer, broker, another plant of your company, etc. Col. (c) Report name of State where material originated. If origin is now known, enter "unknown." Cols. (d & e) Report amount consumed and appropriate unit. Col. (f) Report average delivered cost of each commodity consumed. If the same material is obtained from more than one source, average unit costs or total costs may be combined, as shown in the examples, wherever possible. Col. (g) Show average freight rate for each item. Col. (h) If mineral raw materials are obtained through brokers or supply houses and origin is unknown, please give name and address of sources of supply in order to avoid duplications.

Section III covers the specification requirements that the supplier must meet. If available, include detailed specification sheets, that show the range in requirements the supplier must meet, or indicate ASTM or other standard specifications used. Please give details on any upgrading that you are required to do to the mineral raw materials before they are suitable for your use.

Section IV may indicate problem areas in mineral raw materials supply where the Bureau might provide additional assistance. If you have further thoughts along these lines, please include them.

Please give as many details as possible so that we can avoid duplication of figures in economic studies of the over-all supply situation.

FIGURE 16. - Canvass Questionnaire Sent to the California Chemical Industry (plate 5).

INT.-BU.OF MINES,PGH.,PA. 7413