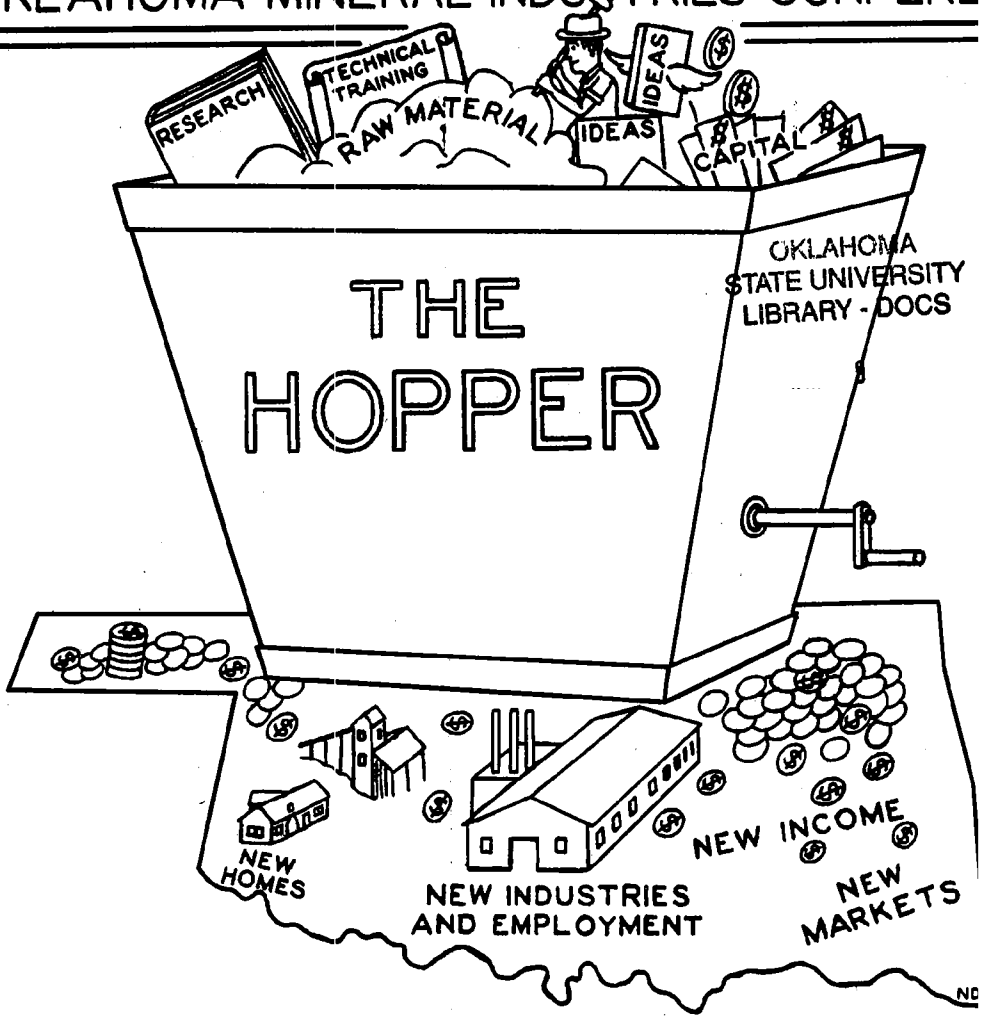
# OKLAHOMA MINERAL INDUSTRIES CONFERE



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HOPPERATOR'S PAGE

"Minerals of Oklahoma"

Director's Biennial Report

for 1947-1948

A handbook of Oklahoma's mineral resources. The 21 materials, natural, semi-processed, or by-product, listed, are now being produced or offer opportunities for development. Their location and accessibility to transportation, fuel, and water shown on the Mineral Map of Oklahoma published in 1944. Both the Mineral Map and "Minerals of Oklahoma" may be obtained from the Oklahoma Geological Survey, Norman.

# PETROLEUM REFINING

by
James J. Kelly
Manager, Kerr-McGee Oil Industries, Inc.
(Address delivered at the Oklahoma Industrial and Mineral Industries Conference, October 13, 1948)

It is indeed a privilege to be a part of this very constructive program, and I shall attempt to give you, in a brief way, some of the facts and possibilities for this area in the future as we in the petroleum industry foresee it.

It is no mere coincidence that the petroleum industry, during the past eighty years, has risen to its present day heights. This position has been attained through an intense spirit of competition and individual enterprise that prevailed among its leaders during the early phases of the industry's development.

Perhaps no other industry in the history of America can claim the distinction of having been created and pioneered by Americans, unless it be that of the automobile industry. For instance, steel was manufactured long before America was discovered, and many other industries, too numerous to mention, were created in other countries. Therefore, I think we can rightfully claim that the petroleum industry is strictly an American institution.

The first oil production of any appreciable quantity in America dates from the year 1859, when the Drake well was drilled in the Appalachian area of Pennsylvania. Development for many years after the Drake well was slow. Improvements were few and far between. It was not until World War I that progress was accelerated and improvements more rapidly made.

Little can be said regarding petroleum refining without briefly mentioning the search for and production of the raw crude oil on which the refining industry is built.

The first step in the oil business is, of course, the exploratory work, and here we have seen a remarkable increase in the development of new methods for locating possible oil pools. Geology, while important, is now aided by geophysical methods of several new and advanced types, and paleontology is also an important factor in this development work.

The drilling and development of producing properties has reached a peak in efficiency undreamed of a few years ago. Deeper horizons are being found to contain oil, and better methods of producing these formations are constantly being developed. The refining of crude oil is no longer a simple mechanical operation, but is now a highly developed form of chemical engineering and research. Research has been the means of developing the many new, as well as better, products from petroleum.

Up to 1947, Oklahoma had produced approximately 5,690,000,000 barrels of crude oil for which the producers and royalty owners received the average price of $1.31 per barrel, making a total value of $7,430,000,000.00. Since this hugh sum of money largely represented the cost of producing, transporting and storing this valuable mineral resource, the citizens of Oklahoma were themselves the direct beneficiaries of almost every dollar. This money has gone to farmers, laborers, merchants and other business men of the state. They in turn have spent this money to pay expenses of better living, to pay debts, to pay taxes, to build and buy homes, to set up other and new commercial enterprises and to build cities and communities. The evidences of this are on every hand.

Petroleum refineries of the United States had record-breaking operating capacities of 6,034,252 barrels of crude oil per day at the beginning of 1948, an increase of nearly a half-million barrels daily compared with a year previous, according to the latest annual survey of petroleum refineries and cracking plants issued by the Bureau of Mines. At the start of 1947, the daily crude oil capacities totaled 5,569,482 barrels daily.

Only part of the 464,770 barrel increases in rated capacities of petroleum refineries was due to major new construction. Spread over all of the larger refining districts, much of the added production capacity was accomplished by rearrangement and minor additions to existing facilities permitting their more efficient and complete utilization. Construction of new distillation units under way a year ago totaled only 162,200 barrels daily, compared with 367,250 barrels daily on January 1, 1948.

Oklahoma ranks third in the United States in the number of petroleum refining plants with a total of 25. These plants have combined daily capacities of 260,000 barrels. Only Texas and California have more refineries than Oklahoma.

Starting with the early day "batch" type refining process from which a large part of the products were wasted, the refining industry has progressed rapidly in the development of processes, plants, and products.

During the past few years due to war emergency and cooperation and pooling of knowledge, the results are equivalent of what normally would have been done over a fifteen or twenty year period. As an example, the first catalytic cracking plant in oil refining was installed in 1938 and at the beginning of the war we had a production of only 40,000 barrels per day of 100 Octane Aviation Gasoline. During the war period the production was

gradually stepped up until it was well in excess of 500,000 barrels per day when hostilities ceased.

Kerosene which formerly was used almost exclusively for fuel and burning purposes such as in lamps, tractors, diesel engines and other types of equipment has been found to be a suitable fuel for jet-propelled aircraft which are capable of attaining speeds of well over 600 miles per hour. Many other uses have been found for improved types of kerosene other than those which it was formerly considered suitable for. An example of such new uses is as a vechicle needed in the manufacture of DDT, the insecticide used so effectively in malaria control in the tropical areas and is now used very extensively for domestic purposes.

As we all know, the demand for petroleum products for heating purposes has increased tremendously in the past few years. This increase in demand for fuel used for heating purposes has been partially met through the use of new types of cracked fuels which are available as a result of new refining techniques.

In the 1936-1941 period, use of oil burning space heaters doubled. In 1941 there were 2,250,000 heaters of this type in use in American homes. This upward trend in the demand for burning oils for home heating is expected to continue.

Petroleum yields ethylene, normal butylene, iso-butylene, butadiane, isoprene, and styrene, all of which are basic hydrocarbons used in the manufacture of synthetic rubber. Several of the different types of synthetic rubber are better adapted for special uses, for which natural rubber is unsuitable and are now available for peacetime markets. It is quite possible that in the near future the synthetic rubber industry in America will look to the petroleum and natural gas industries for its basic raw materials.

The phenomenal growth of the plastics industry has been due largely to war-born discoveries and will depend upon refined petroleum and natural gas for base materials such as propylene, butalene, phenol, formaldehyde, styrene, methyl alcohol, and acetic acid.

Many chemicals, such as are used for medicinal preparations, components for paints and lacquers, fruit tree sprays, insecticides, garden sprays, and others are made from refined petroleum products.

Recent records disclose that some "spent catalysts" resulting from the manufacture of high octane aviation fuels now have a value. This material, which was considered a waste product, is now used as a fertilizer; in fact we are informed that it surpasses some of the commercial fertilizers in that it contains about 55 percent phosphate.

In the early days of petroleum refining many residual products as well as many heavy crude oils were wasted. Asphalt base crudes were frowned upon by the industry due to the small demand for the products which could be obtained from them. Due to product research and the development of new refining processes this situation has changed until at the present time these products are some of the most valuable derived from petroleum refining.

Asphalts are now the most extensively used cementing agents in the construction of roads, streets and airports. They are used to manufacture roofing products and battery boxes; many items in the rubber industry use them. The automobiles we buy have frames painted with asphalt base paint and the sound deadeners used in automobile construction use asphalt as a base product.

Another of the large uses of this product is coal briquettes in which they are used as a binder.

As mentioned earlier, petroleum refining started with the crudest form of "batch" type refining operation from which very few products were obtained and these of poor quality. It has improved and progressed as a result of research and plant development until virtually any industry or manufacturing process is dependent in one way or another upon refined petroleum products as a source for fuel or raw material for their manufacturing operations.

It can easily be seen that Oklahoma with its vast reserves of petroleum is a natural location for the many industries that depend upon its products.

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Excerpts from the Oklahoma Geological Survey
Director's Biennial Report for 1947-1948
by Robert H. Dott, Director

"Minerals of Oklahoma"

Utilization of mineral resources has been an important factor in the development of civilization. Throughout history, minerals and their products have enabled commercial states to gain domination over tribes and nations who were principally agricultural. People having the initiative and vigor to utilize mineral resources have the greatest chance to progress and prosper in the modern world.

As a state, Oklahoma is blessed with a combination of fuels and certain industrially important mineral materials enjoyed by few areas of similar size in the world. The importance of minerals to Oklahoma can hardly be overemphasized, and any great industrial expansion will come largely through understanding and utilizing the industrial minerals of the Region.

Mineral fuels: Petroleum, natural gas, and coal, including coking coal, give the state an enviable position for supplying industry's needs for heat and power.

Construction materials: Much of the mineral production to date has been in construction materials--crushed stone, cement, brick and tile, sand and gravel, and gypsum products.

Industrial minerals: These are the raw materials, such as chemical grade limestone, dolomite, glass sand, woolrock, volcanic ash, and salt, which form the basis of important processing industries.

Thus, it should be obvious that Oklahoma has the fuels, the construction materials, and the industrial minerals upon which to build industries of many types that will provide employment for the sons and daughters who have been going to other areas offering more abundant opportunities.

Actually, this out-migration is slowing down, as shown by recent figures on employment in Oklahoma manufacturing. The Bureau of Census gave the figure 38,000 for 1939. The U. S. Department of Labor estimated manufacturing employment subsequently, as follows: May, 1945, about the peak of war production--103,600; May, 1946--51,700; October, 1947--64,334; and October, 1948--67,823. Oklahoma is growing industrially. Minerals enter into this expansion in a very important way, as evidenced by the current expansion of the glass industry.

Work of the Geological Survey has followed the established program of investigations on basic and economic geology, experimentation on utilization of Oklahoma industrial minerals, investigation of ground water resources, publication of results of investigations, and public information and promotion of industrial development.

Geological Survey work is applied science, ferreting out scientific facts, and analyzing them with a view to their application. Obviously facts cannot be applied until they are at hand, therefore, Geological Survey work must start with a broad and sound base of accurate, comprehensive, fundamental scientific information. Oklahoma is a large state, endowed with a variety and abundance of economically important mineral materials with a variety and complexity of geological conditions. It is a young state, and made a late start in the study of its resources, with a program that always has been a modest one. Many of the older states have pretty well met their needs for basic information, and are now devoting their efforts to application; whereas, the program of the Oklahoma Geological Survey now and in the future must encompass both.

Basic geology. Studies in progress include revision of the Geologic Map of Oklahoma. This map will show the outcrops and classification of rock formations exposed at the surface. The data are being compiled by H. D. Miser, of the U. S. Geological Survey, author of a similar map published in 1926, which has been out of print for several years.

W. E. Ham is continuing detailed study and mapping of the Arbuckle limestone, in the Arbuckle Mountains. This investigation is disclosing interesting new information on the stratigraphy of the rocks and their complicated structure in the area.

G. W. Chase is engaged in mapping and microscopic study of the dark-colored igneous rocks in the central and eastern parts of the Wichita Mountains. These rocks are gabbro and anorthosite, as distinct from granites which compose most of the mountain area, and had received very little study. Associated with the gabbro and anorthosite are deposits of titanium-bearing magnetic iron ore.

Economic geology. Investigations directly concerned with application of geological data to economic possibilities include recommendations as to deposits of limestone and dolomite that have resulted in opening quarries for production of limestone aggregate, and chemical-grade dolomite. A plant near Troy, Johnston County, is now producing dolomite in Oklahoma for the first time. Discovery of this deposit, and of rock in the same vicinity that will make rock wool insulation, came as a consequence of the basic work in the earlier stages of the investigation of the Arbuckle limestone.

Anorthosite came into the list of industrial minerals because of its 30 percent content of alumina. The little-known deposits in the Wichita Mountains constitute one of the largest areas of anorthosite in the United States. In addition, the use of titanium oxide as a paint and paper pigment has expanded tremendously in recent years.

A dip-needle survey indicates a substantial volume of primary magnetite ore in at least one place. Much of the original magnetite has been eroded, transported by streams, and deposited as black sand in soils of the region. In the aggregate, this represents a very large tonnage of titanium-bearing materials, and careful study is being made to find localities that may contain black sand in sufficient concentration to be commercial.

Members of the Survey staff are constantly seeking samples of clays and shales that may have unusual ceramic qualities, such as light colors, low shrinkage, high melting point, and the like.

Utilization. The Survey's Industrial Research Laboratory has been moved from the main University campus to the South Campus, and now occupies a large, concrete block building. Considerable new equipment for research and experimentation has been added.

Work by A. L. Burwell, Industrial Chemist, has included further experimentation with bloating or expanding volcanic ash to produce a light-weight building material, which has been named "pumicell." Another interesting, light-weight product has been made by expanding or "popping" the individual grains of volcanic ash, producing small, hollow bubbles. Here is an extremely light aggregate for plaster, cement blocks, and other building purposes.

Investigations include search for a commercial method of separating iron-bearing minerals from Oklahoma feldspar for the glass industry. Feldspar now comes from Colorado, at high freight cost.

Ground water. As in all other phases of Geological Survey work, application of geology to ground water problems depends on basic investigations to obtain facts. Such studies are in progress in Grady County by L. V. Davis, and in Beaver County by S. L. Schoff. Study of representative wells in Tulsa County was made by J. H. Warren, to obtain ground water data to accompany a forthcoming report on the county by M. C. Oakes.

The program of water-level measurements involves 210 observation wells located in 25 counties, mostly in the western part of the state. Information ranges from continuous records obtained on charts by automatic water stage recorders to annual measurements of wells in the Panhandle counties.

Requests from municipal officials seeking to improve their water supplies are answered by review of information in the files and by field work. Some investigations have included pumping tests.

Under a cooperative, matched-funds arrangement between the U. S. Geological Survey and several State agencies, including the Geological Survey, a laboratory is maintained at the Oklahoma A. and M. College, Stillwater, for analysis of water samples.