

EMPLOYMENT OUTLOOK IN **PETROLEUM PRODUCTION AND REFINING**

Job Prospects
Duties
Training
Earnings
Working Conditions

UNITED STATES DEPARTMENT OF LABOR
MAURICE J. TOBIN, *Secretary*

BUREAU OF LABOR STATISTICS
EWAN CLAGUE, *Commissioner*

In cooperation with VETERANS ADMINISTRATION

OCCUPATIONAL OUTLOOK SERIES

Bulletin No. 994

Cover picture shows a rotary-drilling derrick.

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LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
WASHINGTON, D. C., *September 1, 1950.*

The SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the employment outlook in petroleum production and refining occupations. This is one of a series of occupational studies conducted in the Bureau's Occupational Outlook Branch for use in schools, colleges, offices of the Veterans Administration, local offices of the State employment services affiliated with the United States Employment Service, and other agencies engaged in vocational counseling of veterans, young people, and others interested in choosing a field of work. This study was financed largely by the Veterans Administration, and the report was originally published as Veterans Administration Pamphlet 7-4.12 for use in vocational rehabilitation and education activities.

The study was conducted under the supervision of Calman R. Winegarden; this report was prepared by Sol Swerdloff and Mr. Winegarden, with the assistance of Vincent H. Arkell. The Bureau wishes to acknowledge the generous assistance and cooperation received in connection with the study from officials of other government agencies and of trade organizations, labor unions, and individual companies in the petroleum industry.

EWAN CLAGUE, *Commissioner.*

HON. MAURICE J. TOBIN,
Secretary of Labor.

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EMPLOYMENT OUTLOOK IN PETROLEUM PRODUCTION AND REFINING

The petroleum industry is of paramount importance in our economy. Its products provide a third of the energy used in our industrial civilization. From this industry comes the gasoline used by the millions of cars and trucks and great fleets of military and civilian aircraft; the fuel oil that heats several million homes and powers thousands of ships and locomotives; the lubricants without which no modern machinery could be operated; the asphalt covering on our highways; and hundreds of other products ranging from insecticides to plastic materials.

Petroleum production and refining, the basic branches of the industry and the ones covered in this report, employed over 400,000 wage and salary workers in early 1950, in a wide range of jobs in many different parts of the country. Earnings are relatively high and many of the jobs require considerable skill. It is expected that there will be many openings for new workers during the next 5 to 10 years. For these reasons, information on the employment outlook in the industry is of interest to persons considering the choice of a vocation.

The Petroleum Industry and Its Products

Petroleum is a world-wide industry in which scores of nations participate. The United States, however, leads the world in petroleum production and consumption. At the beginning of 1948, this country had 90 percent of the world's oil wells and, in 1948, produced nearly three-fifths of the oil. The United States refined and consumed over 60 percent of all petroleum produced in 1948; its per capita consumption was 28 times the average for the rest of the world. Nearly a third of the world's proved oil reserves were in the United States. If foreign holdings of American companies are added, our reserves constituted nearly three-fifths of the total. ("Proved reserves" means the estimated amount of oil which has been discovered, still remains underground, and is recoverable by present methods of petroleum production.)

Crude oil is the raw material of the petroleum industry. The origin of oil is not fully understood. The most probable explanation, however, is that it was formed by the slow distillation of plant and animal life. The shallow waters of primeval oceans and lakes were filled with various organisms which, as they died, dropped to the bot-

tom and were buried under sand and clay deposits. Over millions of years, the sand and clay were formed into thick layers of rock. Under the resulting pressure and higher temperatures, the plant and animal material underwent chemical change, eventually becoming oil or gas. In the course of geologic change, the rock layers were tilted, folded, or broken up, creating underground collecting places, or "traps," for the oil and gas. This is what formed the "pools" of oil. The function of the petroleum industry is to find these underground pools, to bring the oil to the surface, to turn the crude petroleum into useful products, and to distribute and market these products.

To provide the huge quantities of petroleum products needed in our economy (by the end of 1949, 39 billion barrels of petroleum had been produced in the United States since the oil industry was started in 1859) a large and complex industry with many specialized branches has been developed. Most of the thousands of companies in the oil business are engaged in a single specialized aspect, such as exploring, drilling wells, producing or transporting oil, operating refineries, or operating filling stations. The bulk of the oil business,

however, is done by a limited number of large firms engaged in all branches, from production through marketing. These "integrated" firms provide a large share of the jobs in the industry.

Production, refining, transportation, and marketing constitute the main branches of the petroleum industry. This report deals exclusively with

production and refining. It does not cover transportation or marketing. Production of natural gas, often carried on in conjunction with petroleum production, is not included in the report. However, some workers, such as drilling crews, are employed in both petroleum and natural gas operations.

Petroleum Production

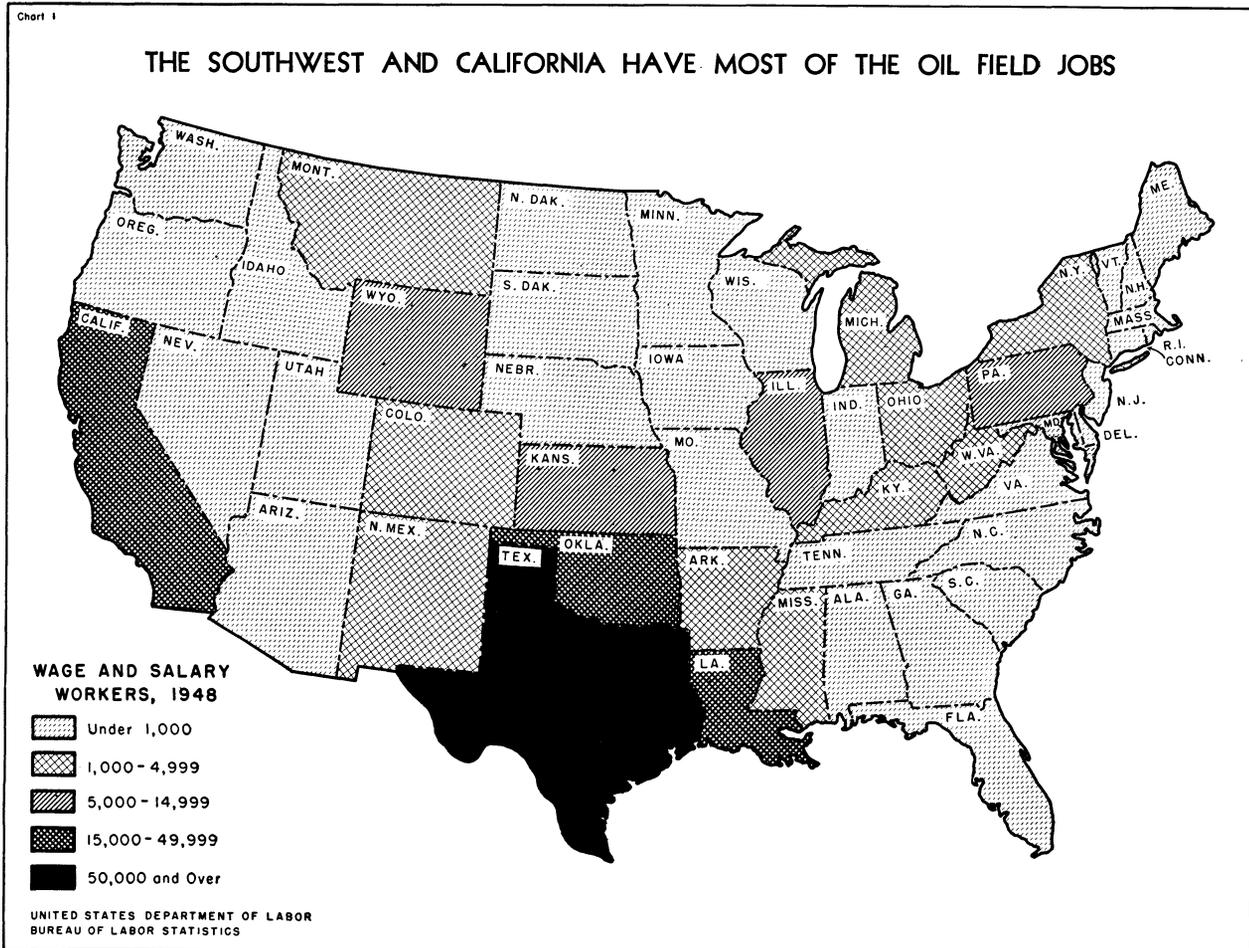
In the fall of 1949, well over 200,000 wage and salary workers were employed in petroleum production. There were about 13,000 separate companies engaged in various oil field activities. Employment is concentrated in certain States, although occurring to some extent in a number of other States. As chart 1 indicates, Texas is far and away the leading State in the number of oil field jobs, followed by Oklahoma, California, Louisiana, Kansas, Illinois, Pennsylvania, and Wyoming, in that order. An additional 10 States

each provided 1,000 or more jobs in 1948.

Petroleum production includes three broad kinds of work: exploration, drilling and other oil field servicing, and crude production (well operation and maintenance).

Exploration

Since oil is difficult to find—only rarely are there surface indications of its presence underground—a sizable business has grown up in the application of scientific methods to the search for

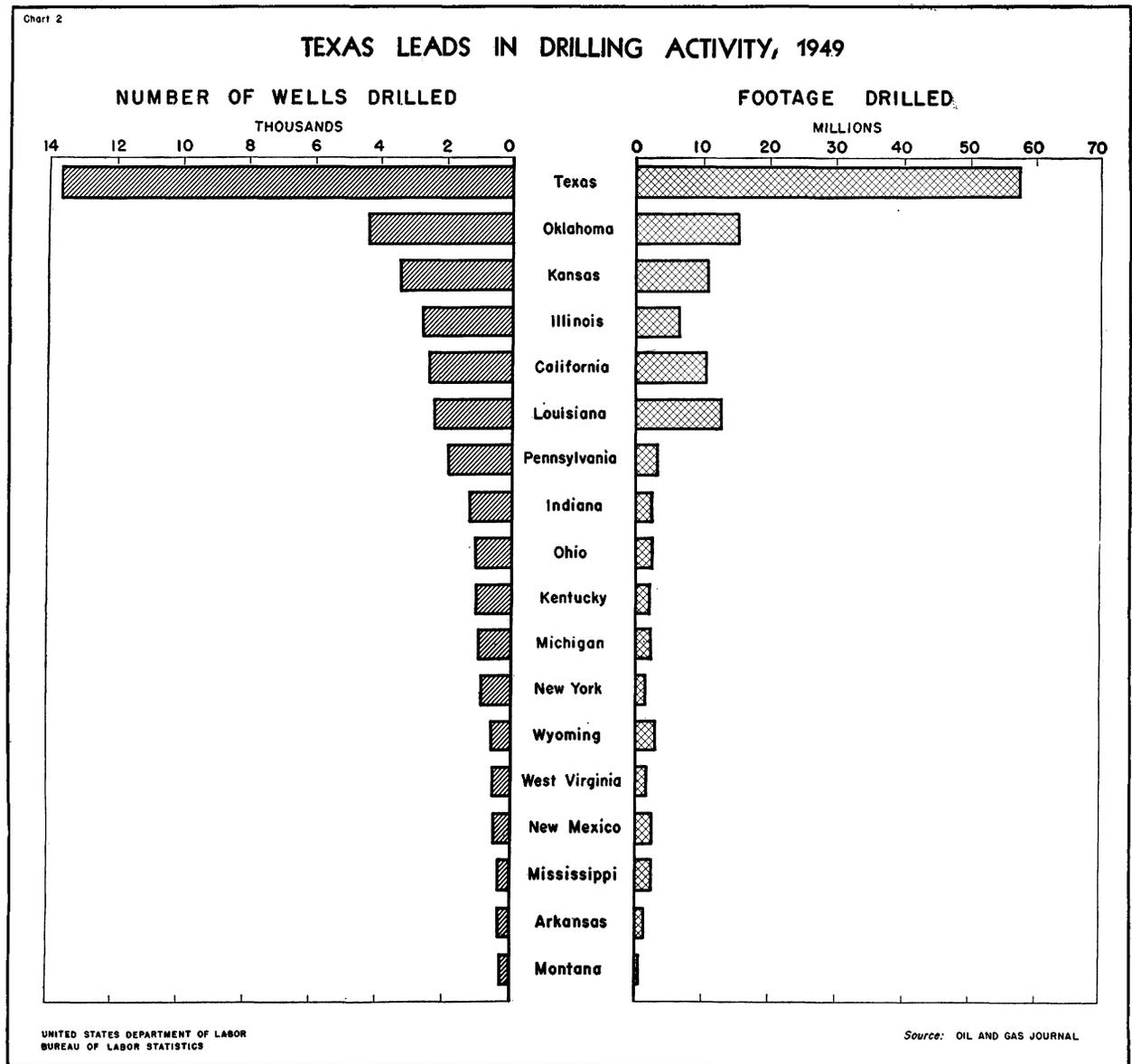


oil. This work is done mostly by the exploration departments of major oil companies; a number of independent firms are also engaged in exploration, and work under contract for companies or individuals seeking oil.

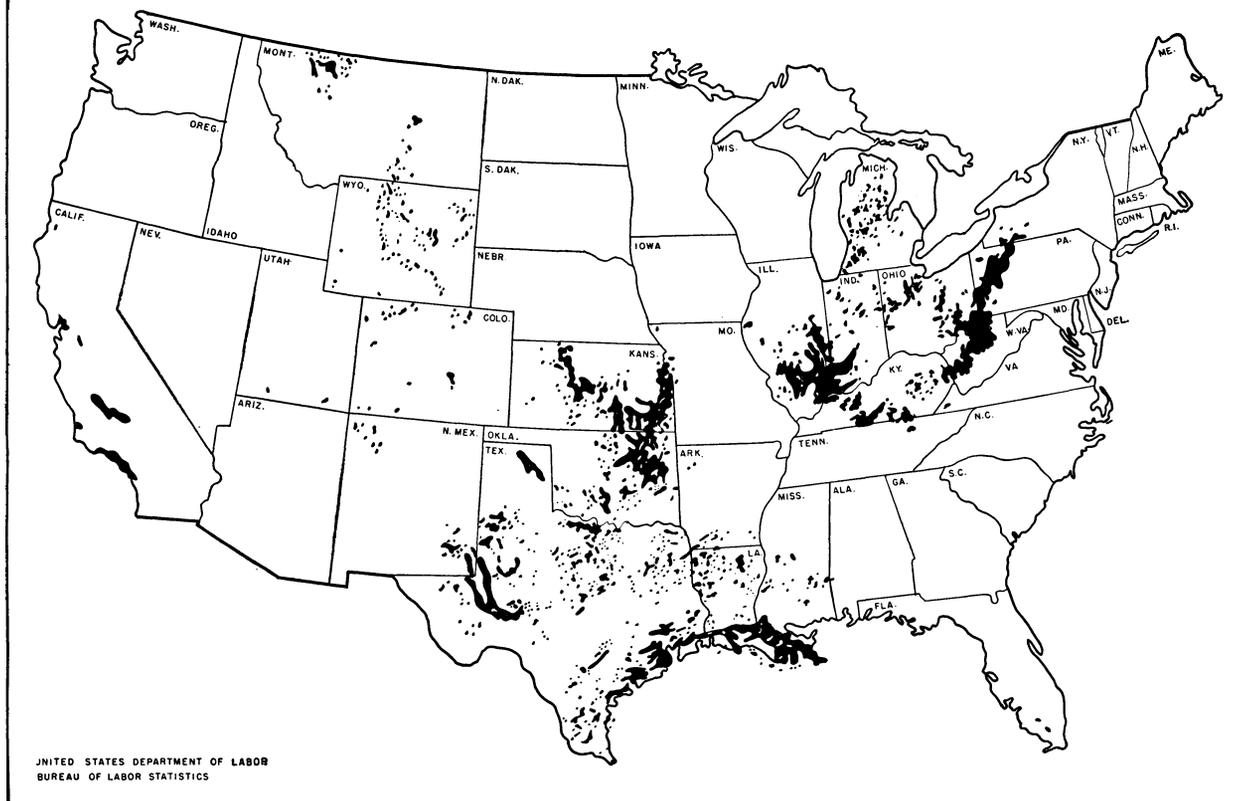
The various exploration methods can neither show the precise location of oil nor indicate with certainty whether or not petroleum is present at a particular place. They can only locate geologic formations "favorable" to oil accumulation. The old adage, "oil is where you find it," still holds, and the way to find it is to drill a hole in the ground down to the oil level.

Drilling, Rig Building, and Other Oil Field Servicing

More than 39,000 wells were drilled in the United States in 1949. Oil producing companies do some drilling, but most is done by independent firms working under contract. Of the wells drilled in 1949, 19 percent were "wildcats", that is, they were drilled in places where oil had not previously been found. The remainder were "development" wells, drilled in connection with the development and extension of existing fields. Chart 2 shows the geographical distribution of drilling activity in 1949. Texas was by far the most important



THE OIL FIELDS OF THE UNITED STATES, 1949



State, both in number of wells and total footage drilled. Wells were drilled in 25 other States, but mainly in Oklahoma, Kansas, Illinois, California, Louisiana, and Pennsylvania.

Before a well can be drilled, a derrick must be built on the spot where the drilling is to be done (unless a portable rig is used) and the drilling rig put in place. A number of independent contracting companies specialize in rig and derrick building, repairing, and dismantling.

In addition to rig building and drilling, a number of other necessary services are performed in connection with oil production. These services include hauling supplies, cementing wells, chemical treatment in cleaning of wells, and other special

operations. Much of this is handled by independent contractors.

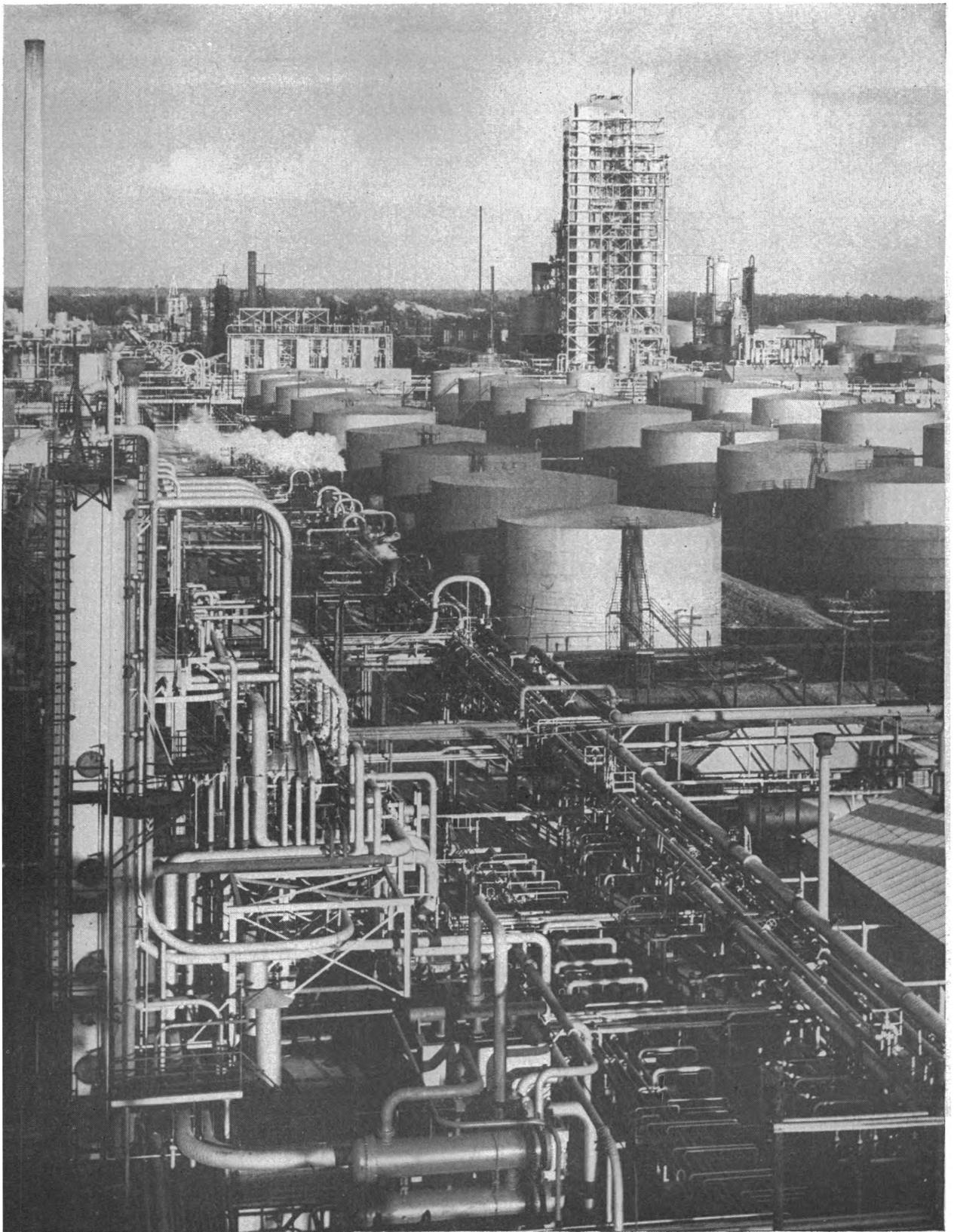
Crude Petroleum Production

Once oil is found, the next job is to bring it out of the ground. More than half of the oil field workers are engaged in operating and maintaining the Nation's 445,000 producing wells. Thousands of companies operate oil wells, and range in size from some of the largest concerns in the world to small firms with only a single well. There are over 4,000 oil fields in the United States, but 130 major fields (listed in Appendix I) accounted for half of the Nation's output in 1948. Location of oil fields is outlined in chart 3.

Petroleum Refining

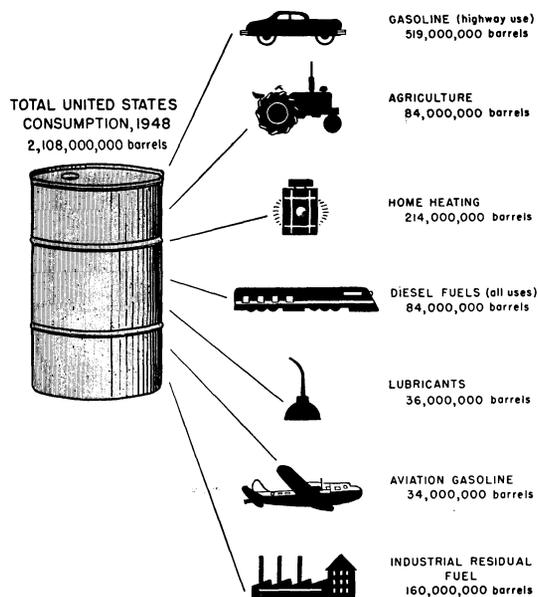
Crude oil—petroleum as it comes from the ground—has very few uses. The process of turning crude oil into hundreds of useful products is

known as refining. Chart 4 illustrates the main uses of refined products. There were about 375 refineries in the United States, employing about



General view of a refinery.

SOME PRINCIPAL USES OF PETROLEUM PRODUCTS



Source: The Oil and Gas Journal

UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

200,000 wage and salary workers at the beginning of 1950.¹ Refineries range in size from small plants, with less than 50 employees, to the relatively few large ones, each having several thousand workers on its payroll. The 16 largest refineries accounted for over a third of total capacity in 1948.

Geographic distribution of refinery employment in 1948 is shown in chart 5. The location of refineries is determined by two factors: proximity to markets or nearness to the supply of crude petroleum, i. e., near oil fields, at the terminals of oil pipelines, or on deep water ports where tankers can dock. Refineries, therefore, tend to be concentrated in the great oil-producing or oil-consuming areas. Texas led in refinery jobs (with a fourth of the United States total) followed by California and Pennsylvania. Eleven other States, of which Indiana, Louisiana, and New Jersey, were the most important, each accounted for 1 percent or more of the Nation's refinery employment.

¹ This figure includes employment in central administrative offices of integrated oil companies, even when these offices are located away from refineries.

General Employment Outlook

Many factors affect the long-range outlook for employment in the petroleum industry. Some of them are reasonably predictable, such as the generally rising trend in demand for petroleum products. Others are fundamentally uncertain. No one can say, for example, exactly how much oil remains underground, where it is, or how long it will be before it is discovered. Another imponderable, in the long run, is the rate at which alternate sources of energy may be developed. (How rapidly may atomic energy be adapted to peace-

time uses?) The future is uncertain in another respect. The petroleum industry is world-wide and its products are not only essential in the normal operation of our industrial society but also have critical military importance. Unpredictable military and diplomatic factors, therefore, may greatly affect the outlook. Nevertheless, observable trends can be used in evaluating future job opportunities, subject to the qualifications which we have noted.

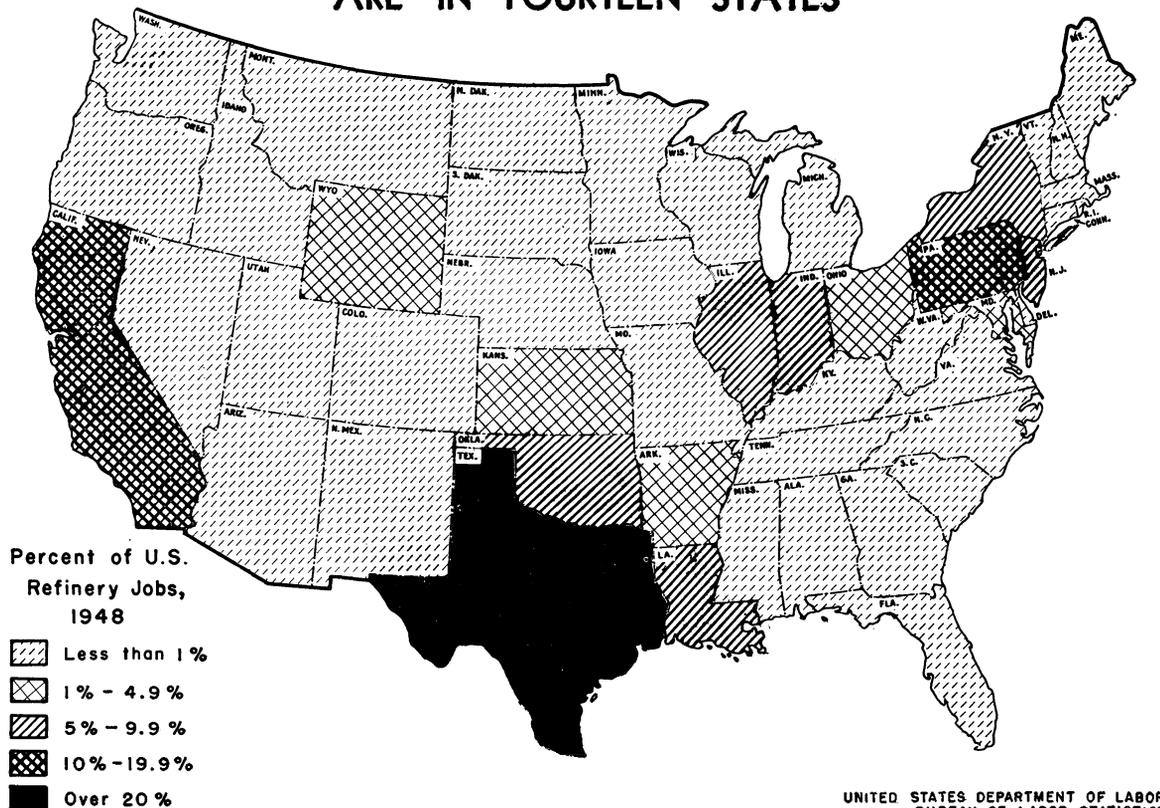
The Demand for Petroleum Products

The long-range trend in demand for petroleum products has been sharply upward. Chart 6 shows the steeply rising demand for these products in the United States. Total domestic consumption in 1949 was nearly six times the 1919 level. It is also apparent from the chart that per capita consumption has nearly kept pace with the growth in

total consumption, indicating that population growth, although a factor in the rising demand, has been less important than the intensified use of petroleum in our economy.

There has been a great rise in the relative importance of petroleum as a source of energy. This is illustrated in chart 7, which shows the

NEARLY ALL THE REFINERY WORKERS ARE IN FOURTEEN STATES

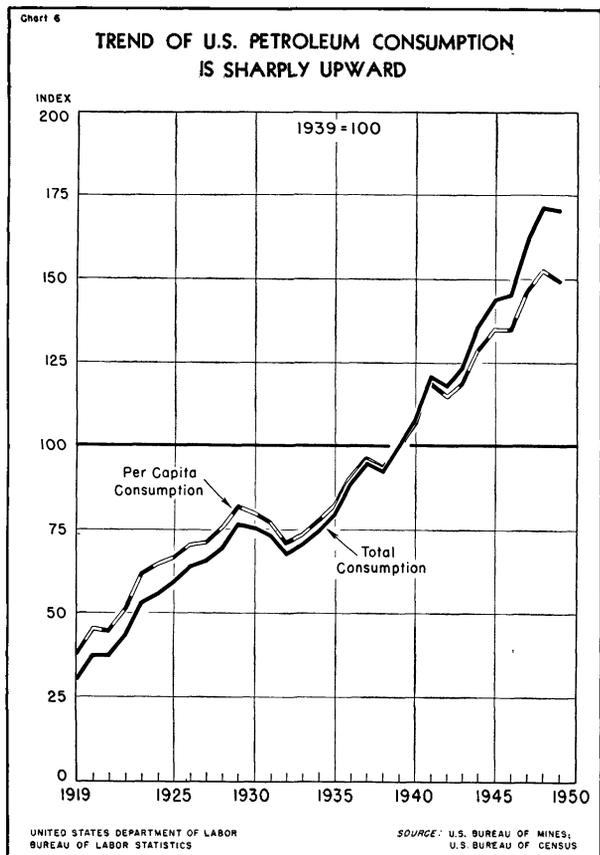


sources of fuel energy in the United States over the last five decades. At the turn of the century, crude oil accounted for only about 5 percent of energy produced; by 1948, the percentage had risen to nearly 35.

Many factors have contributed to the growth of the petroleum industry. Probably the most important single element has been the rapid increase in the number of motor vehicles. In 1900, for example, about 4,000 automobiles were registered in the United States; in 1949, the total was more than 43 million cars and trucks. Residual fuel oil has become important as a source of energy for industrial heating and power generation, as well as for fueling ships and locomotives. Several million homes and other buildings are heated by distillate oils, and thousands of Diesel units use petroleum fuels. About three million petroleum-operated tractors are in use on the Nation's farms.

Thousands of airplanes consume growing quantities of aviation gasoline. Large amounts of asphalt are used in road construction and maintenance. In recent years, there has been a rapid rise in the importance of liquefied petroleum gases as fuel for homes and industry. The development of petro-chemistry has created a multitude of new uses for petroleum. It is now an ingredient in many cosmetic, insecticides, medicines, paints, and plastics. Chart 8 shows the trend in the number of certain types of major petroleum-consuming units.

The rise in demand for petroleum products has been exceedingly sharp in recent years. Domestic consumption in 1948 was about 74 percent above the 1939 level. During the war, demand reached unprecedented heights; vast quantities of petroleum products (especially aviation gasoline) were required by the Armed Forces and by war indus-



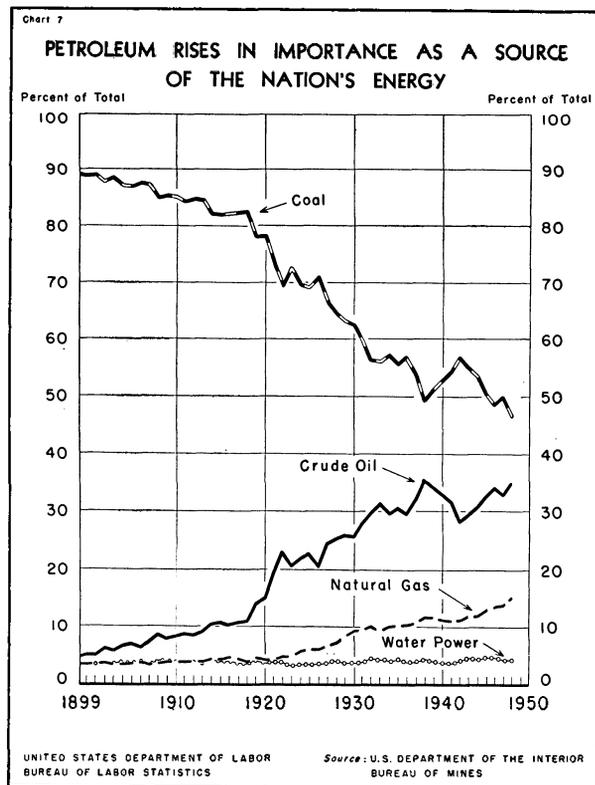
tries. Following the war, a further sharp increase in demand occurred. This unexpected development placed great strain on petroleum refining and transportation facilities, so that in 1946 and 1947 there were local temporary shortages of fuel oil and gasoline (particularly the former). In 1948 and 1949, however, petroleum supplies were ample.

What will be the future trend in demand? All indications point to a continued and fairly rapid rise during the next 5 or 10 years. Most of the factors responsible for past growth will continue to operate—rising number of motor vehicles, growth of aviation, increased use of oil in heating, wider application of the Diesel engine, greater use of petroleum byproducts and, finally, a continued growth of United States population and industry. On the other hand, exports of petroleum may continue the recent decline, partly because increased refinery capacity in Europe, which utilizes crude petroleum from the Middle East, has reduced demand for United States oil.

The expected rise in demand will affect various

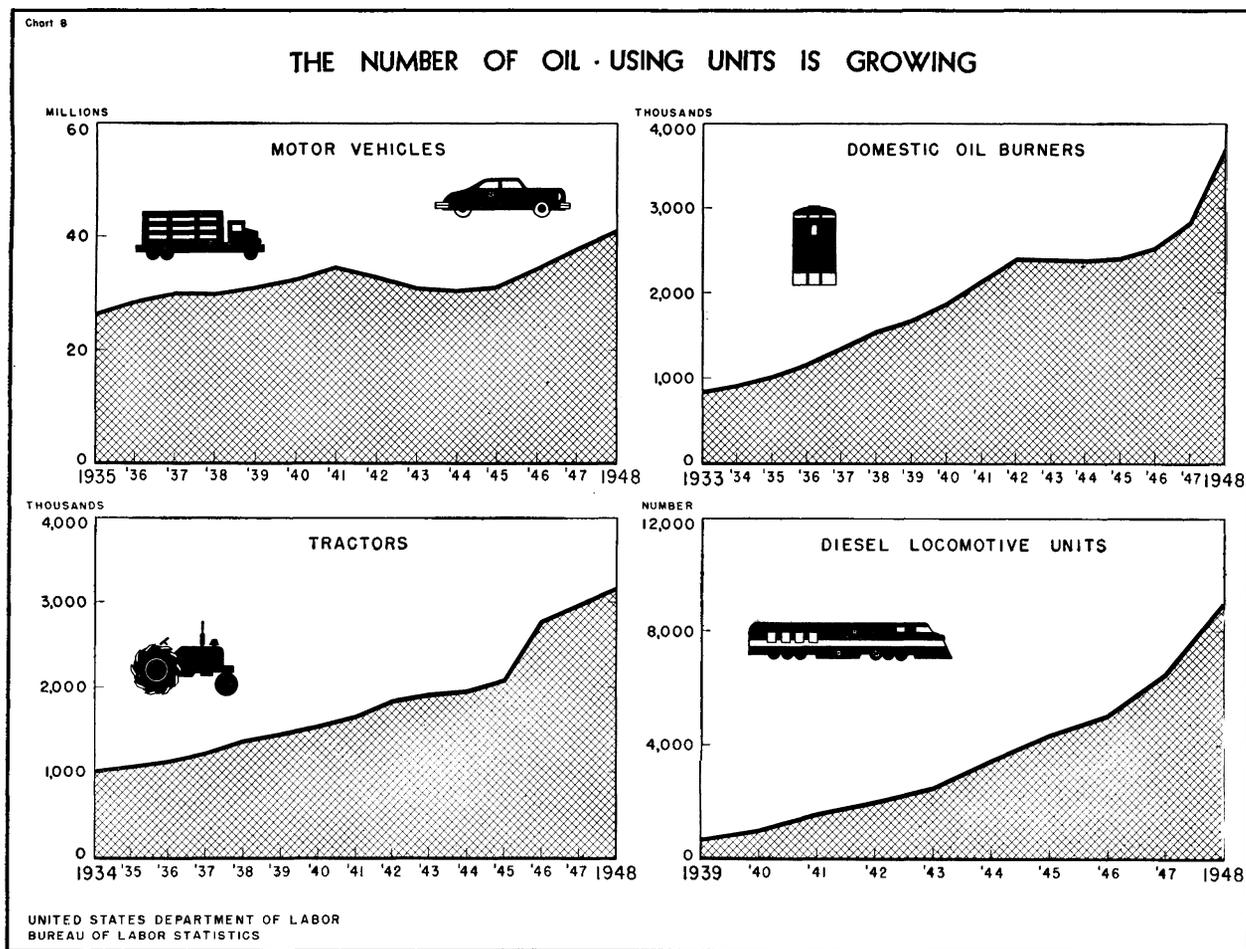
kinds of petroleum products differently. The biggest increases are likely in gasoline, distillate fuel, and liquefied petroleum gas. Demand for kerosene will increase to a lesser extent. Little rise in requirements for lubricants is likely. A slight decline in the demand for residual fuel oil is possible. Recent trends in domestic demand for petroleum products are shown in chart 9.

The effects of several of the general factors in the demand for petroleum are difficult to gage. One of these is the price of petroleum relative to that of other fuels—principally coal and natural gas. Changes in this relationship cannot be anticipated precisely. It can be safely said, however, that small changes in the relative prices are unlikely to affect demand significantly in most major uses. It is necessary also to consider possible technological developments that may make oil-consuming units more efficient, e. g., the high compression automotive engine. Improved methods of using other fuels, such as coal, may also affect demand for petroleum over the long run. In general, these developments are unlikely to have any marked effect on petroleum requirements



during the next decade. Finally account should be taken of the possible impact of the development of atomic energy. At the present time, it seems

most unlikely that atomic energy will compete seriously with oil as a fuel in any important field of consumption for a good many years.



The Supply of Petroleum

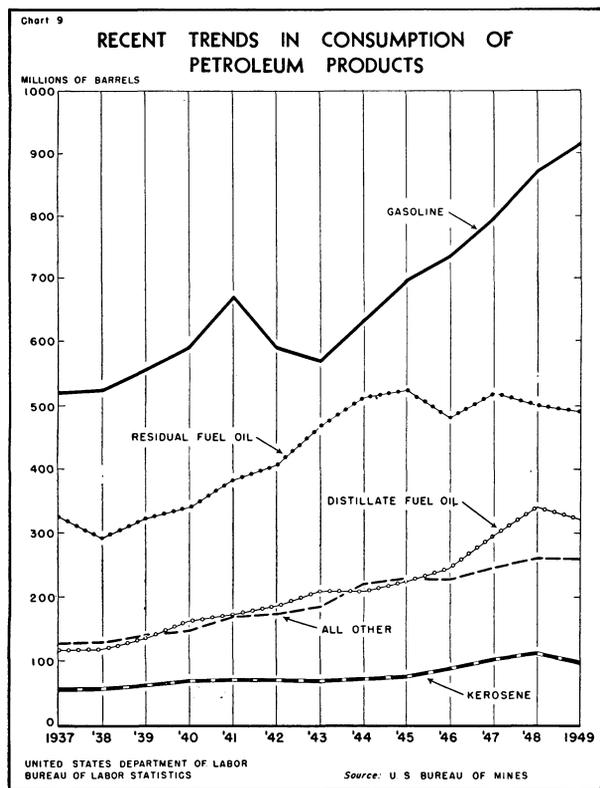
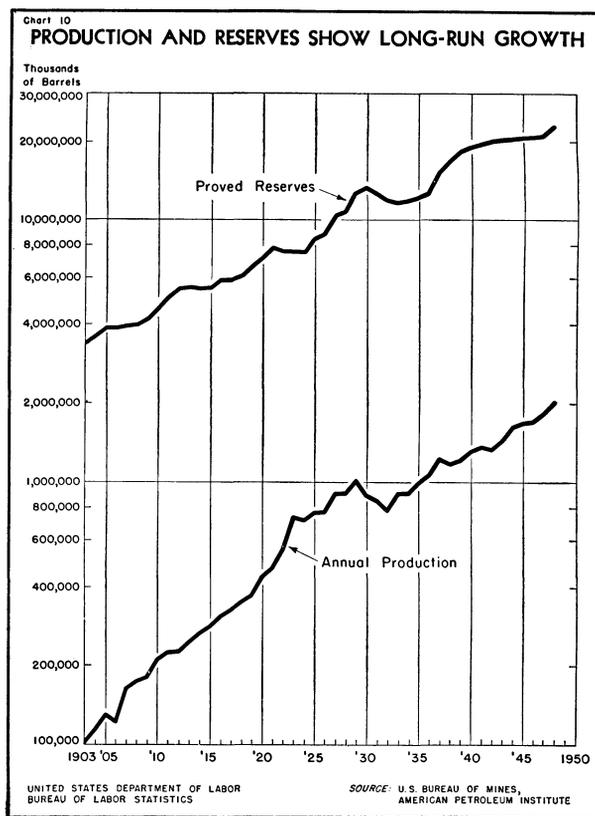
Will there be enough oil to meet the expected demand? All indications are that the supply is adequate for a number of years to come. Chart 10 shows trends in petroleum production and proved reserves since 1903. The trend in reserves is clearly upward, and there have been relatively few years in which reserves were not greater than those of the preceding year. However, in recent years reserves have been rising at a diminishing rate, and the gap between reserves and production has been narrowed somewhat. At the end of 1948, estimated proved reserves in the United States were over 23 billion barrels (crude petroleum). In addition, reserves of natural gas

liquids totaled about 3.5 billion barrels. It is estimated that another 2 to 5 billion barrels of oil are recoverable by the application of secondary recovery techniques in the older fields.² It should be noted, however, that proved reserves do not represent the total supply of oil. As indicated previously, "proved reserves" refers to the estimated amount of oil which has been discovered, which remains underground, and which is recoverable by present methods of production. If to the proved reserves were added the oil believed to

² "Secondary recovery" refers to a variety of methods for increasing the proportion of oil which can be obtained from a particular pool.

be present, but not yet discovered, upwards of 60 billion barrels of "ultimate reserves" remain, according to one estimate.

Since the petroleum industry is world-wide in its scope, it is necessary also to take into account the estimates of oil supply abroad. Crude reserves in the Western Hemisphere outside of the United States are estimated at 11 billion barrels, most of it in Venezuela. In the Eastern Hemisphere, proved reserves amount to 37 billion barrels, located mainly in the Middle East. Proved reserves of the entire world were estimated at 70 billion barrels at the beginning of 1948. Therefore, if the United States has access to the world's sources of petroleum, supply should be adequate to meet demand for many years. On the other hand, possible international developments might force the United States to depend almost entirely on domestic supplies. Although our domestic proved reserves have been rising, it has been at a declining rate and oil is getting harder to find. We formerly exported more oil than we received from abroad. In 1948 and 1949, however, this situation was changed and our imports exceeded our exports.



Our oil supplies are being stretched by more effective conservation methods. In the early days of the oil industry, there was considerable wastage through the uncontrolled "flush" production of wells. But in recent years the rate at which oil is withdrawn from the ground has been controlled by State action or by voluntary agreements of petroleum producers, thereby increasing the ultimate amount of oil recoverable from each pool. Moreover, this control of the rate of output, or "prorating", has prevented temporary overproduction of petroleum and consequent waste.

Considerable attention has been given in recent years to the possibility of producing large quantities of synthetic petroleum. The main sources of synthetic petroleum in the United States are oil-bearing shale, natural gas, and coal. Although methods have been developed to obtain oil from each of these three materials, the methods have not yet become commercially feasible. However, if an oil scarcity situation approaches or if national defense considerations require, the synthetic petroleum industry is likely to be developed on a large scale. Geologists believe that oil-bearing

shale contains billions of barrels of petroleum. The coal supplies of this country are virtually inexhaustible and an almost endless amount of oil could be forthcoming if large-scale synthesizing of coal into petroleum were to be undertaken.

In conclusion, it appears that although oil may eventually become scarce in the United States, its supply is adequate to permit a high and rising level of employment in the petroleum industry for a number of years.

Job Prospects

It is expected that there will be a substantial number of jobs for new workers in petroleum production and refining during the next 5 to 10 years.

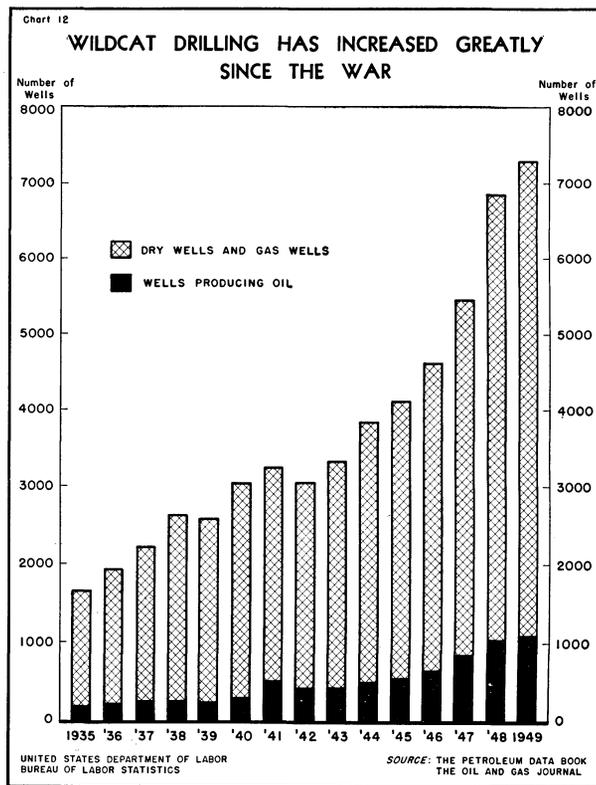
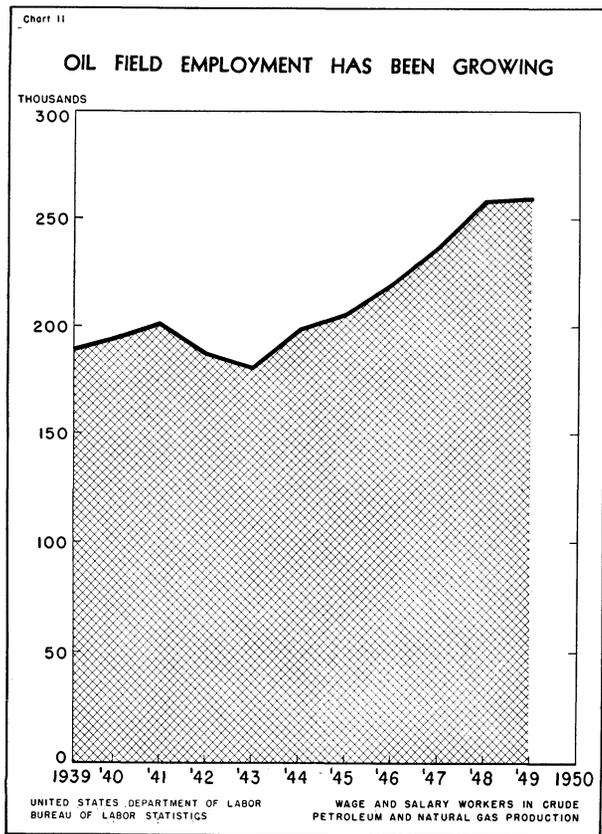
Petroleum Production

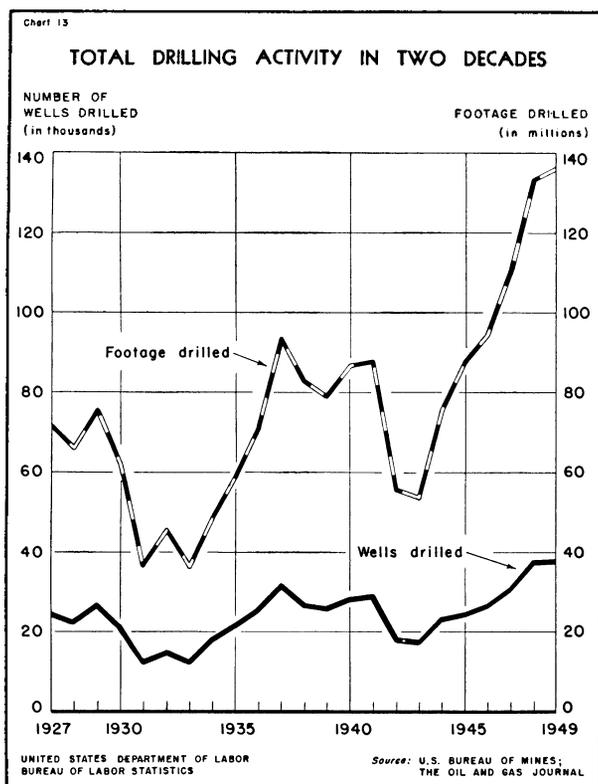
Chart 11 shows the recent trend of employment in the Nation's oil fields. In 1949, the employment level was considerably above prewar. Over the next 5 to 10 years, the number of jobs is expected to increase gradually.

Exploration activity in 1948 and 1949 was at the highest level in history. Chart 12, showing the number of wildcat wells drilled each year since 1935, provides a general index of the rate of exploration. Several factors entered into the

record rate. One was the relatively high price of crude petroleum, which doubled between 1946 and 1948. Another factor was the strong demand for petroleum in the last few years. Finally, a backlog in exploration activity resulted from the wartime restrictions on exploratory work. Expectations are that the present level of employment in exploration will be maintained during the next 5 to 10 years, both because of the rising demand for oil and the growing difficulty in finding new fields.

Employment in drilling and related activities also reached a peak in 1948 and 1949. Chart 13 shows the trend in total number of wells drilled and footage drilled in recent years. Total footage has risen much more sharply than the number of wells drilled, because it has become necessary to drill deeper to find oil. The high price of





petroleum, the strong demand for petroleum products, and the backlog of drilling built up during the war years are factors behind these high levels. Continued demand for petroleum and the trend toward deeper drilling are expected to keep such employment at or near the peak levels during the next 5 to 10 years.

More than 2 billion barrels of crude—an all-time high—were produced in U. S. oil fields in 1948. Because of rising demand, production during the next decade will reach an even higher level. The upward trend in number of producing wells and fields is expected to continue. This will mean more jobs in well operation and maintenance.

The gradual rise in employment will create opportunities for new workers in petroleum production. A much larger number of jobs, however, will result from replacement needs. In a field of employment as large as this one, annual replacement needs are very substantial. The number of workers who die or retire each year may be about 4 thousand, and additional thousands will transfer into other lines of work.

Various kinds of workers will be needed in oil production. Most of the new workers will start

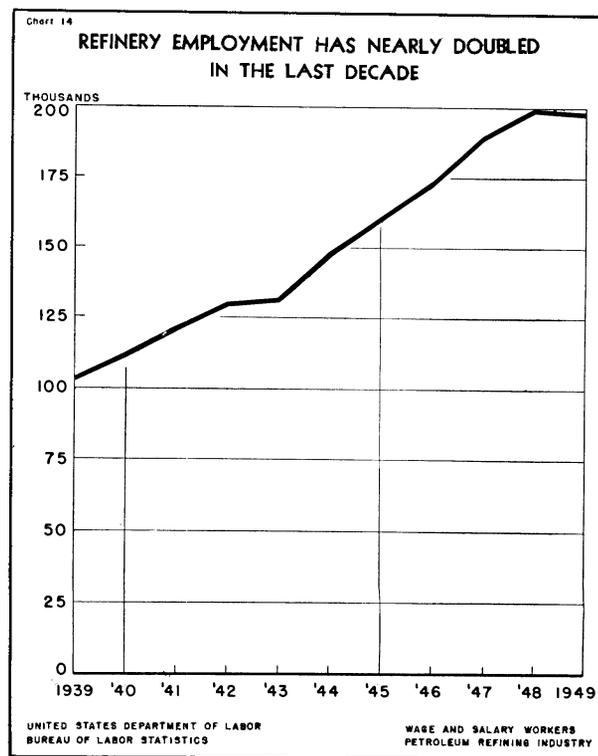
as laborers, roustabouts, or helpers. In addition, a large number of openings are anticipated for petroleum engineers, geologists, geophysicists, surveyors, draftsmen, and other technical workers. However, during the next few years, competition may be keen for openings in some of these occupations owing to the large number of persons completing training. This competition will be especially keen for those seeking professional jobs with only a minimum of preparation such as a bachelor's degree.

Although many uncertainties cloud the employment outlook beyond the next decade, it is probably safe to say that those who do obtain jobs in petroleum production during the next 5 to 10 years will probably continue to hold them over a much longer period.

Job opportunities vary widely among the different regions of the United States. Information concerning these regional differences is given in the second part of this study.

Petroleum Refining

Refinery employment in 1948-49 was the highest ever attained in the industry. Much of the increase has occurred in the last several years, as



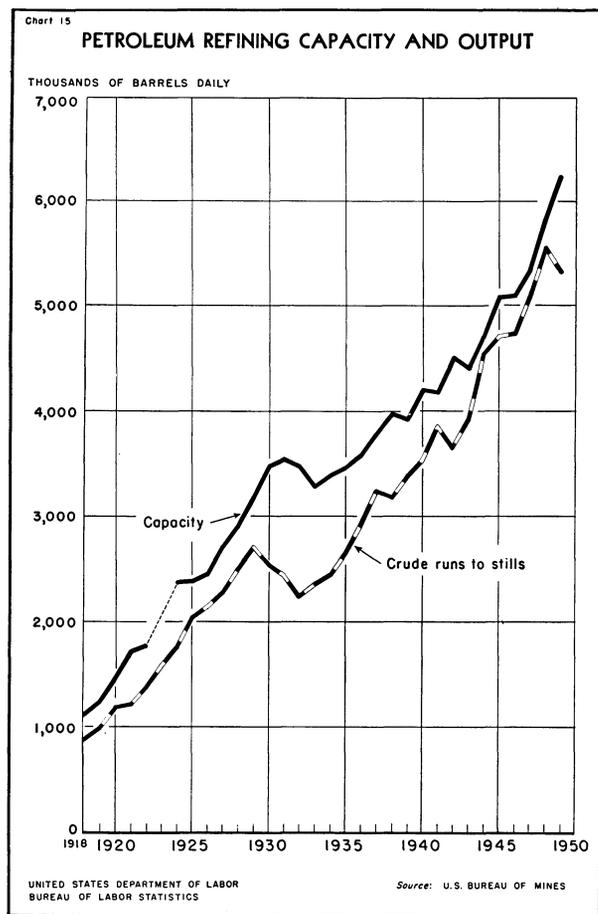


chart 14 indicates. However, the long-range trend has also been upward. Between 1909 and 1939, refinery employment rose 500 percent; this was one of the fastest rates of growth shown by any industry.

Chart 15 illustrates the growth of refining capacity and activity since 1918. In recent years, both capacity and output have risen very greatly and, at the same time, the gap between the two has been narrowed.

The outlook for the next 5 to 10 years is for continued advance in refinery output but at a slower rate than in many past periods. Reasons for this expected growth have been indicated in

the preceding discussion of the future demand for petroleum products. To achieve any substantial increases in output, considerable expansion of refining capacity will be needed. In 1948-49, work was begun on the construction of new refineries and additions to existing ones; greater capacity is planned for the near future. The rise in output and capacity will markedly increase the number of refinery jobs.

Even in a general business depression, with output of petroleum products falling far below the expected levels, refinery employment should not decline greatly. Such employment is more closely related to changes in capacity than to variations in output. A refinery may be operated at widely varying rates without greatly affecting the total number of workers needed. A large share of refinery employment is in maintenance departments, which have nearly as much work to do when the refinery is operating at 70 percent of capacity as at 90 percent. The number of administrative, technical, and clerical employees is also fairly stable, regardless of the rate of production. Finally, processing jobs involve mainly the tending of types of equipment which require a relatively fixed number of workers.

In addition to the many job opportunities resulting from the expected expansion in refining, replacement needs (resulting from death, retirement, and transfers into other industries) will be great. Most new plant workers will start as laborers, since the usual practice in refineries is to fill the more skilled jobs by promoting from within.

There will be many opportunities in technical jobs, especially for chemists, chemical engineers, mechanical engineers, and laboratory technicians. Accountants, bookkeepers, stenographers, typists, and various kinds of clerical workers will also be needed.

Refinery employment is expected to grow much more rapidly in some regions than in others. These regional trends are discussed in this study beginning on page 23.

Occupations in Petroleum Production

Petroleum production includes three broad kinds of work—exploration, drilling, and well operation and maintenance.

Duties, Training, and Qualifications

Exploration has to do with the finding of underground geologic structures likely to contain oil.

Two main methods are used—geological and geophysical. These methods are often combined in the search for oil.

The results of a special survey made by a committee of the American Association of Petroleum Geologists indicates that at the beginning of 1950 an estimated 10,000 geologists and geophysicists were working in petroleum exploration and exploitation in the United States. Of these, approximately 7,700 were professional geologists and geophysicists (graduates or with 4 or more years of college training). The remaining 2,400 were technicians or subprofessional employees with less than 4 years of college training.

There are an estimated 6,000 *petroleum geologists* in the United States. They are on the staffs of oil companies, work for independent exploration firms, or operate as independent consultants. Their main function is to recommend where to drill for oil. However, they also advise management on methods of drilling and oil field development, make appraisals of properties for leasing, and estimate oil reserves. Four or 5 years of college training in geology are needed to get a job as a beginning petroleum geologist.

Some geologists are in central or district offices of oil companies or exploration firms. Most of

them, however, spend a great deal of their time making field surveys. Geological parties, headed by petroleum geologists, study and map surface and subsurface geologic structures.

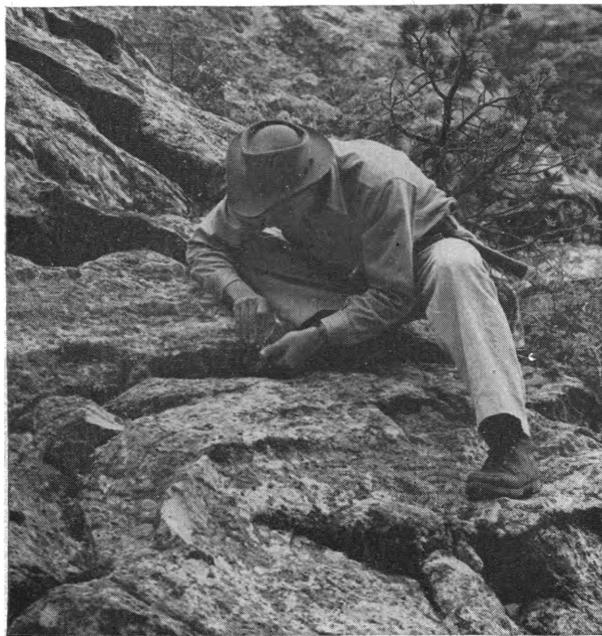
In addition, the parties may include college-trained paleontologists and chemists. *Paleontologists* study fossils—the remains of organic life in rocks—in order to determine the geologic age of the rocks. *Chemists* conduct analyses of rock samples. *Plane-table operators, draftsmen, and rodmen* assist in surveying and mapping operations.

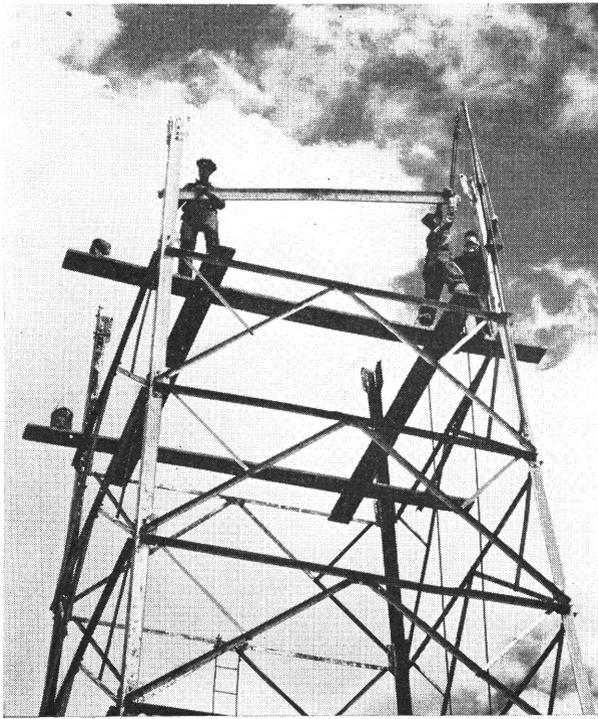
Another science used in exploration is geophysics—the application of the principles of physics to the study of the subsurface structure of the earth.

Seismic prospecting is by far the most extensively used of geophysical exploration methods. The seismograph (originally devised to record earthquakes) measures and records the rate of transmission of sound waves through the earth. In oil prospecting, a dynamite blast is set off, sending energy waves down into the earth. As these waves strike rock formations, they are reflected back to sensitive detecting instruments. The instrument readings are recorded on film and interpreted by *geophysicists*, who can thus determine the nature of underground formations. A seismograph crew is composed of from 10 to 18 persons, working under the supervision of a *party chief*, who is usually a college-trained geophysicist. *Computers*, who usually have had college training in geophysics, mathematics, or engineering, prepare maps from the seismic data. *Observers* operate and maintain the seismic equipment; they generally have a degree in electrical engineering. *Drillers* and their *helpers* operate portable drilling rigs used to make holes into which explosive charges are placed. *Shooters* are in charge of the placing and detonation of explosive charges.

Gravity prospecting, another method of finding oil traps, involves use of the gravity meter. This instrument is an extremely sensitive scale that measures the vertical pull of gravity with minute accuracy. Heavy rocks near the surface pull harder than light ones or than heavy rock at greater depth. The gravity meter, by detecting these variations, helps disclose the possible pres-

Field geologist taking reading with a compass. The main functions of the petroleum geologist is to recommend where to drill for oil.





Rig builders erect and dismantle the giant steel derricks.

ence of oil-bearing structures. Workers employed in gravity prospecting include operators of gravity measuring instruments, draftsmen, computers, party chiefs, and surveying crews.

Another method of exploring underground rock is by electricity. A special electric probe is lowered into a well. A current is passed through the rock layers and the rock's resistance to the current is measured. Different kinds of rock have varying resistance to electricity. Resistance is affected also by the oil, gas, or water content of the rock. An electrical prospecting party usually has four to eight members including the party chief, surveyor, operators of electrical measuring instruments, and cablemen.

The *land man* (or lease man) has essential functions in exploration and oil-field development. His job is to make the necessary legal and financial arrangements with the owners of prospective oil land in which his company is interested.

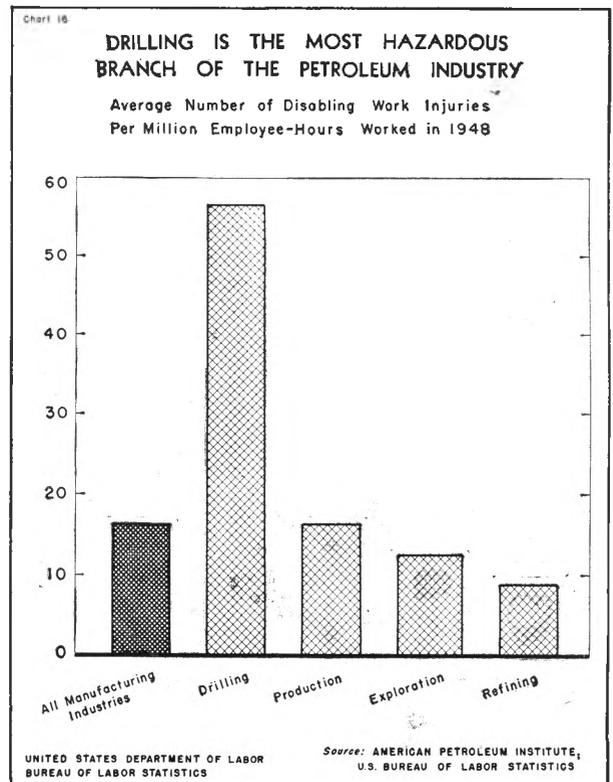
Another important job in oil exploration is that of the *scout*. He keeps his company informed on all exploration, leasing, drilling, and production activity in his area.

Drilling. In spite of all the exploration methods that have been developed, no device will actually

find petroleum. Only by drilling can the presence of oil be proved. There are two methods of drilling a well: cable tool drilling and rotary drilling.

Cable tool drilling was the original method, but it has been replaced to a great extent by rotary drilling. At present, the cable tool method is mainly employed in drilling shallow wells in hard rock formations. Most of the cable tool drilling is done in Pennsylvania, New York, Ohio, and West Virginia. In cable tool drilling, a hole is pounded through the rocks by raising and dropping (over and over again) a heavy, sharpened bit attached to the end of a cable.

The usual cable-tool drilling crew consists of the driller and the tool dresser. The *cable-tool driller* is in charge of all operations during his tour of duty and maintains a detailed record of drilling activity. One of his main functions is to control the force with which the bit strikes the bottom of the well. He also supervises and helps in the setting up of the machinery and derrick. The *cable-tool dresser* assists the driller and maintains the equipment.

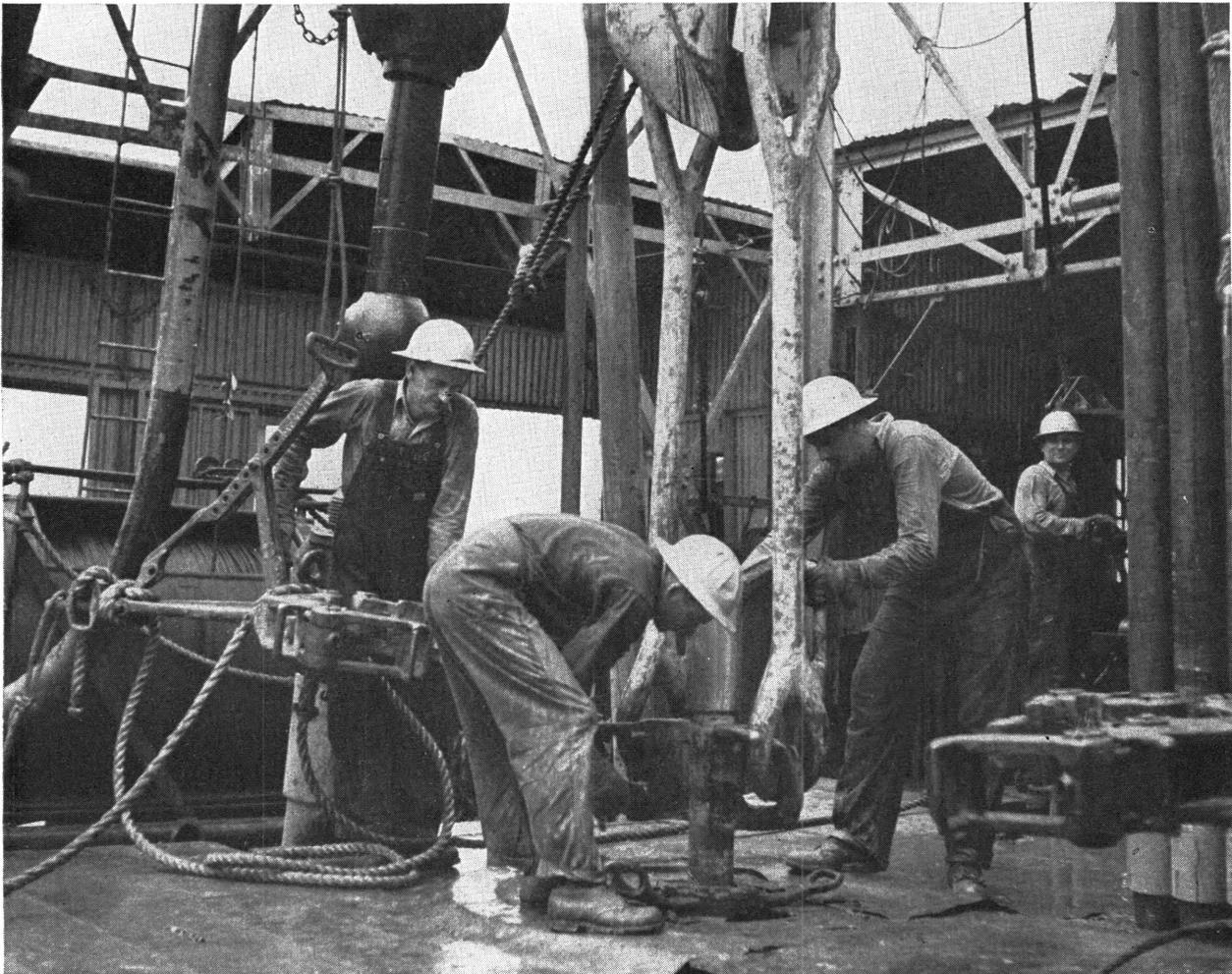


Almost all the deeper wells are drilled by the rotary method. Rotary drilling bores a hole into the ground as a carpenter bores a hole with a brace and bit into a board. The drilling bit is a steel tool having a cutting surface at its lower end. The bit is attached to a string of jointed hollow pipe held in place by a round table which is rotated by a steam, Diesel, or gasoline engine. As the bit goes down, the drill stem is lengthened by the addition of more pipe. A stream of mud is continuously pumped through the pipe in order to cool the drilling bit and to plaster the walls of the hole to prevent cave-ins.

A typical rotary drilling crew consists of a *rotary driller* and four or five helpers. To operate one rig the customary 24 hours a day, 7 days a week, about 20 workers are required. The rotary driller is in charge of the work of the crew dur-

ing his tour of duty and operates the drilling machinery. His duties include controlling drilling speed and pressure, and keeping a record of operations. He must be ready to meet a variety of emergencies, such as breakdown of equipment or encountering unusual geological formations. His helpers include a *derrickman*, a *fireman* (or *engineman*), and two or three *rotary floormen*. The derrickman is second in charge on the drilling rig. When pipe is being removed and replaced, the derrickman handles the upper end of the pipe, working on a small platform high on the rig; the rotary floormen handle the lower end, racking and unracking pipe sections and connecting and disconnecting pipe joints. The derrickman also controls the consistency and circulation of the drilling mud. The fireman or engineman operates the engine which provides power for drilling.

Rotary floormen preparing to run drill pipe into the well.





A rotary driller is in charge of the drilling crew. Part of his job is to operate the drilling machinery, controlling drilling speed and pressure.

Another important oil field worker is the *tool pusher*. He supervises the operations of a group of drilling rigs, and has the responsibility of supplying the drilling crews with needed materials and equipment. *Roustabouts* are sometimes employed in drilling operations to do odd jobs around the drilling rigs. Among other workers connected with drilling operations are the *rig builders*, who erect and dismantle the giant steel derricks.

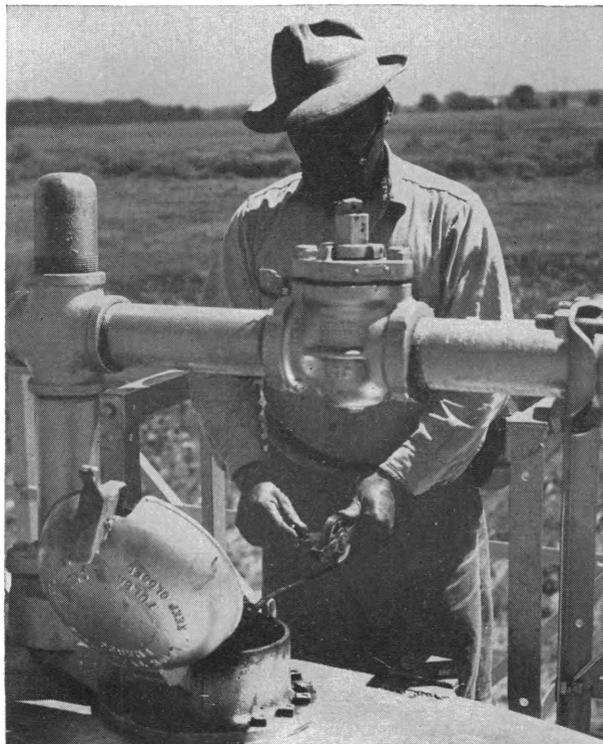
Crude oil production. Production begins once the well is drilled and oil is found. Many different kinds of workers are employed in a producing field. *Switchers* work in fields where oil flows under natural gas pressure and does not require pumping. They open and close valves to regulate the flow of oil from well to tanks, between tanks, or into pipelines. *Pumpers* operate and maintain power units, pumps, compressors, and other equipment used in producing an artificial flow of oil from the wells. This is the largest occupation in the oil fields. Generally, a pumper operates a group of wells. *Gagers* measure and record the contents of the field tanks and take samples of the oil. In many fields, the jobs of switchers, gagers, and pumpers are combined

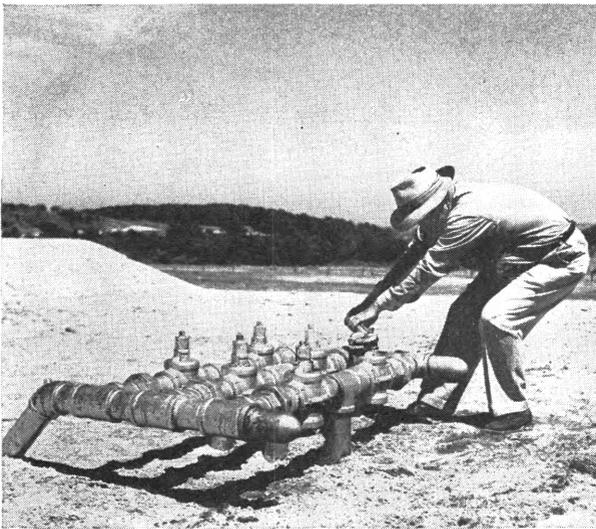
in various ways. *Treaters* test oil from wells for sediment and water content and use chemical or electrical equipment to treat oil in the storage tanks. (This occupation may also be combined with pumper or gager.) *Roustabouts* perform the various duties of field and well maintenance; these require relatively little skill but often involve heavy, hazardous work.

A number of workers are engaged in various specialized maintenance operations in the oil fields. *Welders, carpenters, electricians, machinists, and blacksmiths* are employed to repair and install equipment. *Well-pulling crews* use mechanical winches to remove the pumping rods and steel casing from wells; this is done either to clean and repair pumping equipment or to salvage the casing when wells are abandoned.

Petroleum Engineers. Over-all planning and supervision of drilling and production operations are usually the responsibility of the *petroleum engineer*. He helps to select drilling sites and directs rig builders and other workers in erection of the derrick and installation of the drilling machinery. He advises drilling personnel on technical matters and may supervise the completion of wells.

A gager measuring the contents of storage tanks out in the oil fields.





Pumper-switcher opening and closing valves to regulate the flow of oil from the wells.

One of his principal functions is to prevent waste; he may determine oil flow rates and pumping methods. The usual requirement for this job is graduation from a 4-year college course. Some petroleum engineers are trained in specialized petroleum engineering courses in colleges and universities. Others have degrees in chemical, mining, or mechanical engineering or nonengineering degrees in the physical sciences, such as geology.

Working Conditions

Most oil field work is done outdoors and the workers are thus exposed to extremes in weather. Fields may be near cities; however, they are often far from sizable communities and are sometimes in swamps or deserts. A few drilling crews actually work and live on specially constructed platforms miles off-shore in the Gulf of Mexico. Drilling employees may expect to remain in one place a few years at most; their work in a particular field may be completed in less than a year. Exploration personnel move around even more frequently. Well operation and maintenance workers, however, may stay in the same locality for years. Drilling employees who wish to settle in one place sometimes transfer to lower-paying production jobs.

Accident data indicate that exploration and crude production are not particularly dangerous; they have a lower accident frequency rate, for example, than the average for manufacturing indus-

try generally. Drilling, on the other hand, is much more hazardous. Chart 16 shows accident frequency rates in various branches of the industry.

Most oil field workers are not union members. Some of the fields have been organized, however, by the Oil Workers International Union (CIO) and by various independent unions.

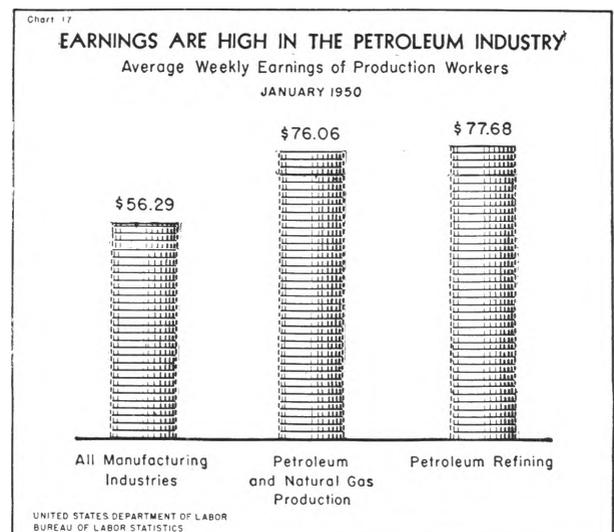
Except for scientists, engineers, and other technical employees, oil field workers generally are hired as laborers, roustabouts, or helpers, and advance to more skilled jobs as openings occur. In rotary drilling, for example, a new crew member is hired as a fireman or floorman. A floorman can advance to derrickman, and then to driller. It takes several years to attain the status of driller.

Much drilling and exploratory work requires men capable of performing heavy physical labor. Well operation and maintenance, with the exception of some of the heavy labor done by the roustabouts, does not require great physical effort. Women are employed only in the offices and laboratories of oil producing companies.

Most oil field workers are hired at the field or through the local offices of the various State employment services affiliated with the United States Employment Service. Appendix I gives the location of the major oil fields.

Earnings

Earnings of oil field workers compare favorably with those in industry generally. In January



1950, average weekly earnings of production workers in petroleum and natural gas production (excluding drilling and rig building) were over \$76 for nearly 42 hours of work. Recent earnings information for individual occupations is not available. Examination of a number of union agreements which cover only a small part of oil field employment indicates the following range of

hourly earnings in important occupations in 1948-49.

<i>Occupation</i>	<i>Typical straight-time hourly earnings</i>
Rotary driller-----	\$2.25-\$2.85
Derrickman-----	1.75- 2.00
Rotary floorman-----	1.60- 1.85
Fireman-----	1.60- 1.85
Pumper, switcher, and gager-----	1.60- 1.90
Roustabout-----	1.40- 1.80

Occupations in Petroleum Refining

Petroleum refining is the processing of crude petroleum into usable end products, such as gasoline, kerosene, fuel oil, and lubricants. This processing is done in plants called refineries. The equipment looks very much like chemical laboratory apparatus built on a gigantic scale.

Crude oil is a mixture of hydrocarbon compounds which boil at different temperatures. The

basic process of refining is distillation, which consists of breaking down or "fractionating" the crude. This is done by controlled heating, during which the compounds are first vaporized and then condensed, forming the various products, gasoline, kerosene, etc.

In many refineries large "cracking" units are employed to obtain more gasoline per barrel of

Stillmen and their helpers control the operation of the refinery units. They observe and record instrument readings showing temperature, pressure, and oil flow.



crude. As its name implies, cracking breaks down, or rearranges, the molecules of heavy oils into lighter hydrocarbons. Cracking is accomplished in these units through the application of either great heat and pressure or somewhat less heat plus the action of a catalyst.

Duties, Training, and Qualifications

About a third of the plant workers in a modern refinery are engaged in processing. The processing operations are highly mechanized and are controlled by a large number of instruments, so that relatively little manual work is required. *Stillmen* (operators) have the responsibility of running the various distillation and cracking units safely and economically. In order to control the operation of the equipment, they observe and record instrument readings showing the temperature, pressure, and oil flow. A stillman has two or more assistants (stillmen's helpers). Stillmen also supervise *firemen* who operate the burners which maintain required temperatures in the refining units. *Pumpmen* and their *helpers* main-

tain and operate power-driven pumps which circulate petroleum products, chemicals, and water through units during processing. Impurities present in gasoline, oil, and other products are removed in purification units run by *treaters*.

More than half of the plant workers in a typical refinery are employed in the repairing, rebuilding, and cleaning of operating equipment. Included among these are skilled *boilermakers*, *bricklayers*, *carpenters*, *electricians*, *instrument repairmen*, *leadburners*, *machinists*, *painters*, *pipefitters*, *pipe coverers*, *riggers*, *sheet metal workers*, and *welders*. There are also many *helpers* and *trainees* in these trades.

In addition to process and maintenance jobs, a number of workers are employed in the *packaging* and *shipping* departments.

Petroleum refining employees include a relatively large proportion of professional and technical workers. Among these are chemists, chemical engineers, mechanical engineers, laboratory technicians, and draftsmen.

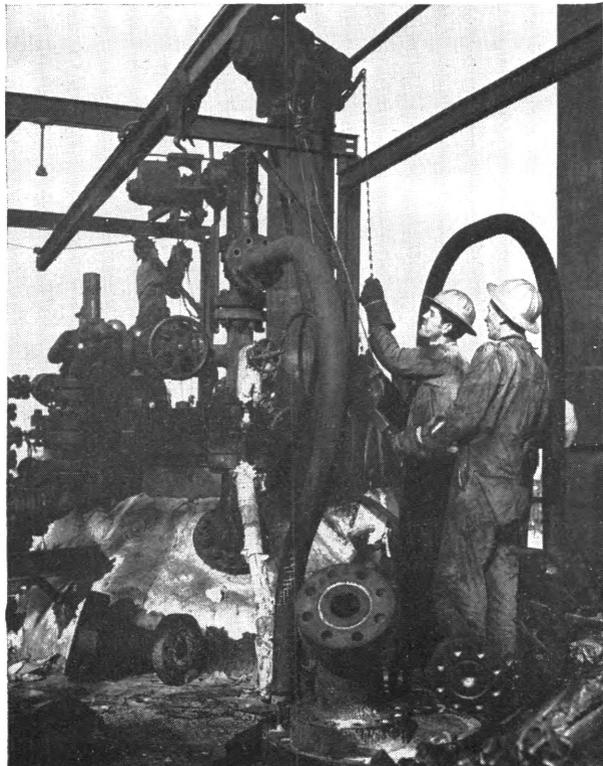
Chemists control the quality of petroleum products by conducting tests and analyses to determine their chemical and physical properties. Many chemists are engaged in the development of new products.

Engineers are employed in a variety of refinery activities, including design of chemical equipment, supervision and development of processes, plant lay-out, and quality control. Some *laboratory technicians* assist the chemists in research projects; others do routine testing. *Draftsmen* prepare working plans and detailed drawings required in refinery construction and maintenance.

Working Conditions

Working conditions in refineries compare favorably with those in manufacturing industry generally. Most refinery jobs do not require great physical effort. Some workers, however, climb stairs and ladders to considerable heights in the course of their duties. Others work in hot places or are exposed to unpleasant odors. Refineries are relatively safe places in which to work; accident frequency is barely half the average for manufacturing as a whole. Because refineries operate 24 hours a day, 7 days a week, many of the process workers are on night shifts and many

Maintenance workers checking refinery equipment. Periodically every unit in a refinery is checked cleaned, and repaired.



work on week ends. Plant jobs in refineries are filled by men; there are jobs for women in the laboratories and offices. There is little seasonal variation in refinery employment; nearly all the workers have year-round jobs.

The majority of refinery workers are union members. A large number of petroleum refineries have been organized by the Oil Workers International Union (CIO); many refinery workers are in various independent unions. Some are members of AFL craft unions.

Persons interested in getting refinery jobs should apply directly to a refinery or to the local office of their State Employment Service. The name and location of the refineries in each area appear in Appendix II.

Except for the office help and technical workers, the usual way to start in a refinery is as a laborer. When a vacancy occurs, the worker is assigned to one of the processing or maintenance departments. Here, the more skilled work is learned on the job, with advancement by strict seniority. For example, in a processing department, a worker may advance along these lines: laborer, fireman, assistant stillman, stillman. In maintenance departments, a worker advances from laborer to helper or learner. He trains, over a period of 3 or 4 years, to become skilled in such work as boilermaking, pipefitting, or welding. Some refineries have formal apprenticeship programs to train workers for skilled maintenance occupations.

Earnings

Earnings in petroleum refining are among the highest in industry. In January 1950, production workers in petroleum refining earned, on the average, \$77.68 for a workweek of 40.8 hours. (In the same month, the average for all manufacturing industries was \$56.29 for 39.7 hours of work.) The following tabulation gives straight-time average hourly earnings for selected occupations in refineries in September 1948.¹

<i>Occupation</i>	<i>Average straight-time hourly earnings</i>
Assistant stillman, cracking.....	\$1.95
Assistant stillman, straight-run.....	1.91
Assistant stillman, combination units.....	1.97
Carpenter, maintenance.....	1.98
Electrician, maintenance.....	2.01
Fireman, stills, cracking.....	1.84
Fireman, stills, straight-run.....	1.76
Fireman, stills, combination units.....	1.87
Gager.....	1.87
Helper, maintenance.....	1.67
Instrument repairman.....	2.01
Laborer.....	1.42
Loader, tank cars or trucks.....	1.70
Machinist, maintenance.....	2.01
Packer, hand.....	1.66
Pipefitter.....	1.98
Pumpman.....	1.92
Pumpman's helper.....	1.83
Routine tester, laboratory.....	1.77
Stillman, cracking.....	2.15
Stillman, straight-run.....	2.07
Stillman, combination units.....	2.18
Treater, light oils.....	1.96
Treater, heavy oils.....	1.97
Treater's helper, light oils.....	1.89
Treater's helper, heavy oils.....	1.86
Welder, hand, maintenance.....	2.02
Mechanic, maintenance.....	1.92

There have been some wage increases in petroleum refineries since September 1948; average earnings of production workers in petroleum refining rose from about \$1.87 an hour in September 1948 to about \$1.90 in January 1950.

Employees generally receive additional pay for working the second or third shifts. Most petroleum refinery workers are granted vacations with pay after 1 year's service. Many firms also make provision for paid sick leave. A large number of the companies have adopted some type of insurance or pension arrangements for their employees; some provide life insurance plans, others have health insurance programs or retirement and pension plans. Employee stock-purchase plans are in effect in many firms.

¹ Data are for refineries with 51 or more employees. Earnings exclude premium pay for overtime and night work.

STATE AND REGIONAL EMPLOYMENT OUTLOOK

West South Central

(ARKANSAS, LOUISIANA, OKLAHOMA, TEXAS)

Summary

Opportunities for large numbers of new workers in the region's oil fields and refineries are in prospect; Texas will continue to have most of the jobs.

Background

CRUDE PETROLEUM PRODUCTION.—This is “the oil country,” the principal petroleum region in the United States. Crude production in 1949 of over 1.1 billion barrels was about three-fifths of the Nation's output. All four West South Central States are among the first 10 States in crude production. These States together have nearly 70 percent of the estimated United States proved reserves. In 1948, about 140,000 oil field workers, 60 percent of the United States total, had jobs in this region (see chart 18).

Texas is the main producing area in the world. In 1948, Texas petroleum producers and oil field contractors employed about 85,000 workers. During 1949, the 117,000 wells in the State yielded about 750 million barrels of crude, over 40 percent of United States output. About three-fifths of this oil was processed by Texas refineries and the remainder was supplied to refineries in 17 other States, principally Pennsylvania, Indiana, New Jersey, Louisiana, and Illinois. Petroleum production is the State's leading industry (measured in value of product). More than a third of the State's area—about 58 million acres—was under lease to petroleum producers in 1947. There are more than 1,000 fields in the State, but 60 percent of the crude in 1948 came from 51 major fields (listed in Appendix I).

There are six main oil producing areas in this State—eastern, west Texas, Gulf Coast, north Texas, Panhandle, and southwest. The eastern district contains the fabulous East Texas field which has been considered the world's most productive oil reservoir. In its 18-year producing history, this field has yielded about a fifth of all the oil taken out of the ground in Texas and nearly 7 percent of the total United States production. West Texas, which in 1948 was the leading producing area in the State, produced more oil than

any State other than Texas, with the exception of California. The Gulf Coast area produced only slightly less than west Texas. The other three regions, the southwest, north Texas, and the Panhandle accounted for less than a quarter of the State's output.

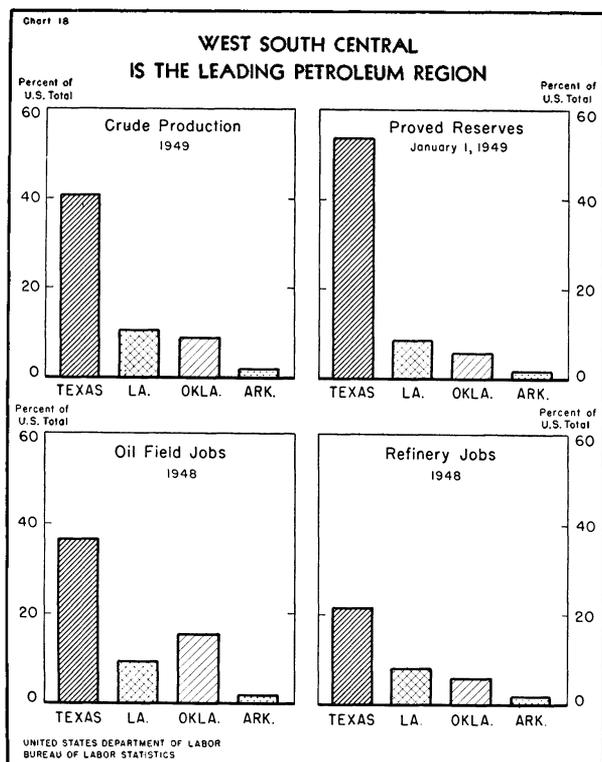
Oklahoma ranks second in crude petroleum employment. About 35,000 oil field workers, 17 percent of the Nation's total, had jobs in this State in 1948. Oklahoma's 54,000 wells produced over 150 million barrels of crude in 1949, nearly a twelfth of the Nation's output. Oklahoma has more than 900 oil fields, but nearly two-fifths of the State's output in 1948 came from 18 of them. The fields lie in a wide belt extending from the northeast corner of the State to the Texas State line. Fifty-seven of the State's 77 counties have oil or gas wells.

In 1948, over 20,000 oil field workers were employed in *Louisiana* the third ranking petroleum producing State. In 1949, Louisiana's output of over 190 million barrels amounted to 10 percent of the United States total. Average production per well in Louisiana is the highest among the leading petroleum States; in 1948, it was over 4 times the national average. This is one of the reasons why fewer workers are needed to produce a given amount of oil in Louisiana than in most other States. There are two main oil areas in the State—one in the north and the other along the Gulf Coast. The latter accounts for most of the output.

Most of the oil lands in *Arkansas* are in the southwest part of the State. In 1948, Arkansas ranked tenth in employment and provided jobs for about 2,800 workers. The State's two major fields—Magnolia and Smackover—together accounted for about a quarter of the output of nearly 30 million barrels in 1949.

REFINING.—In 1948, nearly 70,000¹ persons were employed in the 119 refineries operating in the region. These refineries had over 40 percent of the United States total refining capacity at the

¹ This figure is inflated by inclusion of central office employees of oil companies.



Outlook

CRUDE PETROLEUM PRODUCTION.—The region's oil fields will provide many jobs for new workers during the next 5 to 10 years. Rising demand for petroleum products in the United States will mean stepped-up production in this region, which in 1949 supplied about three-fifths of the Nation's crude. These four States have 70 percent of the United States proved reserves. It appears likely that they will continue to provide for the great bulk of our crude petroleum needs. During the last decade, output rose 90 percent in Texas and Louisiana, and is expected to continue to rise over the long run. In spite of greatly increased production, the proved reserves of these States have continued to grow. During the last 10 years, estimated proved reserves in Texas were increased by about 3 billion barrels and more than doubled in Louisiana. Moreover, a new oil frontier, the continental shelf on the Gulf Coast of Texas and Louisiana may very well become an important source of petroleum.

Oklahoma's oil production in 1948 was below the output in 1938. However, during the last 5 years, the downward trend of the previous decade was reversed and production is again on the up-grade. Crude production in Arkansas has been increasing slowly during the last 10 years.

Drilling activity is expected to continue at very high levels during the next several years. In 1949, an all time high in drilling activity was recorded: More than 13,000 wells were drilled in Texas, 4,300 in Oklahoma, and 2,400 in Louisiana. At year's end about 1,600 drilling rigs were operating in this region. To operate one rig the customary 24 hours a day, 7 days a week, about 20 workers are required. Exploration for oil in this region was on the greatest scale ever known. A record total of nearly 4,000 wildcat wells were drilled in the West South Central States in 1949.

Expanded employment should provide a substantial number of openings for new workers. Many more job opportunities will result from the need to replace the several thousand workers who leave the oil fields each year because of shifting to other lines of work and because of death or retirement.

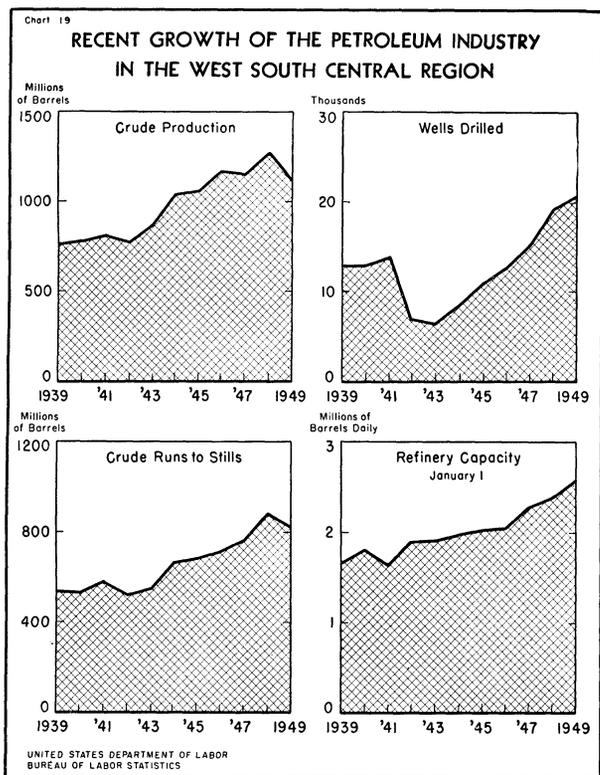
REFINING.—Refinery employment is expected to increase substantially above its present level.

beginning of 1949. Three-fifths of the region's refinery workers had jobs in Texas, which is the Nation's leading refinery State.

Petroleum refining, *Texas'* largest manufacturing industry, had about 41,000 wage and salary workers in 1948. While only 27 of the 71 operating refineries were in the Gulf Coast area, these refineries had over four-fifths of the State's total capacity. The principal refinery centers in Texas, and among the most important in the Nation, are in the Beaumont-Port Arthur, Houston-Texas City, and Corpus Christi areas.

Louisiana's 15 refineries employed about 15,000 workers in 1948. More than 95 percent of the State's facilities are located along the Gulf Coast. Two refineries, one in Baton Rouge and the other in Lake Charles, have about three-quarters of the refining capacity.

Oklahoma ranks eighth in refining capacity. About 11,000 wage and salary workers had jobs in 24 refineries in 1948. The largest refineries are in Tulsa and Ponca City. The 6 refineries in *Arkansas* provided jobs for somewhat over 2,000 workers.



Both refining capacity and employment have grown rapidly during the last decade. Crude runs to stills in 1948 were nearly 65 percent above the 1939 level (see chart 19). Refining capacity in the region is expected to increase greatly to meet the growing national demand for petroleum products. Construction of a considerable amount of new capacity was begun in 1948-49. Major expansion programs were started in Corpus Christi, Port Arthur, and Baytown, Tex.; Baton Rouge and Lake Charles, La.; and West Tulsa, Okla. In addition to the workers needed to man new

refining facilities, replacement needs will also provide a number of job opportunities.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected occupations in the West South Central States are shown in the following tabulation.

Occupation	Average straight-time hourly earnings
Assistant stillmen, cracking	\$1.99
Assistant stillmen, straight-run	1.89
Assistant stillmen, combination units	1.97
Carpenters, maintenance	2.05
Electricians, maintenance	2.08
Firemen, stills, cracking	1.87
Firemen, stills, straight-run	1.81
Firemen, stills, combination units	1.84
Gagers	1.88
Helpers, maintenance	1.67
Instrument repairmen	2.06
Laborers	1.38
Loaders, tank cars or trucks	1.65
Machinists, maintenance	2.08
Mechanics, maintenance	1.95
Packers, hand	1.69
Pipe fitters	2.06
Pumpmen	1.88
Pumpmen's helpers	1.80
Routine testers, laboratory	1.82
Stillmen, cracking	2.14
Stillmen, straight-run	2.05
Stillmen, combination units	2.12
Treaters, light oils	1.92
Treaters, heavy oils	2.08
Treaters' helpers, light oils	1.89
Treaters' helpers, heavy oils	1.85
Welders, hand, maintenance	2.05

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

Pacific Coast

(CALIFORNIA, OREGON, WASHINGTON)

Summary

Oil fields and refineries in California, the Nation's second most important petroleum State, will provide a growing number of jobs during the next 5 to 10 years.

Background

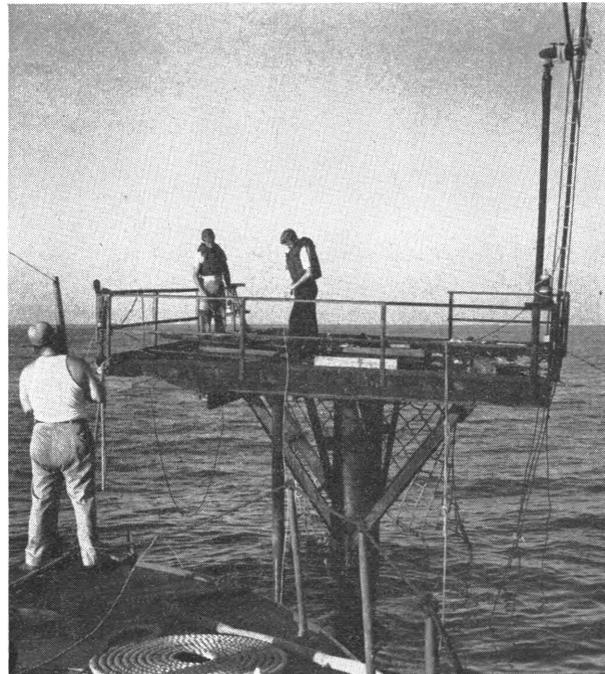
CRUDE PETROLEUM PRODUCTION.—The petroleum industry of the Pacific Coast is located almost entirely in California. Although for a number of years prospecting crews have been searching for oil in Washington and Oregon, as yet there has been no commercial production in these two States.

California's oil fields employed about 26,000 workers in 1948, a ninth of the Nation's total. Since oil was first discovered in California in 1867, this State has produced about 8 billion barrels of crude, over a fifth of all the oil taken out of the ground in the United States. Today, California is second only to Texas as a producing State and its output in 1949 of 335 million barrels was more than 18 percent of the Nation's total. At the end of 1949, there were about 25,000 producing wells in the State's approximately 170 oil fields, with 29 major fields (listed in Appendix I) accounting for the bulk of the output. Fewer workers are needed to produce a given amount of oil in California than in the country as a whole. For one thing, oil sands in California are much thicker than in most parts of the country; average output per well in this State is 3 times the national average.

Producing fields in California are located in three general areas. The largest producing area is in the San Joaquin Valley, in Kern, Fresno, and Kings Counties. The second largest section is the Los Angeles Basin in the southwest part of the State, principally in Los Angeles and Orange Counties. The third section is the so-called coastal area extending between Ventura in the south and Santa Maria in the north. The oil fields here are primarily in southern Ventura and western Santa Barbara Counties. In the latter

two sections, oil production methods are somewhat different from those in the rest of the State since some of the oil deposits are under water, just off the ocean shores. These pools are reached either by drilling diagonally out from the shoreline or by locating the drilling rigs on piers built out in the water. Neither central nor northern California has large fields.

REFINING.—In 1948, there were 51 refineries operating in the Pacific coast region, all but three of them in *California*. California is the Nation's second ranking refining State both in capacity and



Drilling a test hole away from shore. Off-shore oil fields may become an important source of petroleum.

employment. Its 48 operating refineries provided jobs for about 28,000 wage¹ and salary workers. Operating at full capacity, these refineries could process about one million barrels a day, more than a sixth of the United States total. Because of California's large crude production and because of its geographic isolation from other oil areas,

¹This figure has been inflated considerably by inclusion of central office employees of oil companies.

its refineries are supplied almost entirely by crude produced within the State.

Most refining facilities are located near the centers of population and industry around Los Angeles and San Francisco. In the Los Angeles area, large refineries are located near the coast in the vicinity of Long Beach, Wilmington, El Segundo, Torrance, and in Los Angeles itself. In the San Francisco Bay region, there are major refineries in Richmond, Avon, Martinez, and Oleum. Considerable refining is done also in the Bakersfield area in the lower San Joaquin Valley, near the producing fields.

There are three refineries in the region outside of California. The two refineries in *Oregon*, producing mainly asphalt, are located in Portland and Willbridge. The one refinery in *Washington* is in Spokane.

Outlook

Prospects for the next 5 to 10 years are for rising employment in both petroleum production and refining in California. Crude output in 1948 and 1949 in California was the highest in the State's 80-year producing history; production of around 340 million barrels in each of these years was about 50 percent above 1941. Even higher output from the California oil fields will be needed to meet the growing demand for crude by the State's refineries.

Exploration and drilling activities during 1948-49 were at the highest rate in California's history. The 2,500 wells drilled during 1949 represented total footage of over 10 million feet. Proved reserves at the end of 1948 were estimated at about three and three-quarter billion barrels, nearly a half billion higher than the year before. Exploration and drilling are expected to continue at a very high rate. Most of this activity will probably continue to be centered in the three principal producing sections (San Joaquin Valley, Los Angeles Basin, and the Coastal area). However, considerable activity is expected in the Cuyama and Salinas Valleys and beneath the Tidelands off the coast of Santa Barbara County.

The long run upward trend of demand for petroleum products on the West Coast should result in increased output in California's refineries.

Because of the State's geographical isolation and because of the high cost of transporting petroleum products overland, the market for these refineries is limited to the three Coastal States and, to a lesser extent, Arizona and Nevada, plus some overseas exports. Similarly, a very small amount of petroleum products comes into the State from other areas. The demand for petroleum in California differs somewhat from that of other regions. California crudes are, in general, heavier and of a somewhat lower gasoline content than those of other areas, producing a high yield of residual fuel oil when refined. (In November 1949, for example, the residual yield was 39.1 percent of refined products in California, compared with 21.8 percent for the Nation as a whole.) The high yield of heavy residual oil goes well with the unusually high demand for this product in the region. Since California is without commercial production of coal, it relies on fuel oil (together with water power and natural gas) to supply the heat and power necessary for industry. Western railroads operate to a large extent on residual oil. California industry depends heavily on this oil for the uses to which coal is put in other parts of the country. Fuel oil is also used to a considerable extent for electric power generation and is employed increasingly for space heating. In addition, ships docking in West Coast ports require large quantities of residual fuel oil.

Several factors contribute to the expectation of long-range expansion of demand for petroleum products on the Pacific Coast. One is the growing industrialization of the region as evidenced by the continual addition of new industrial facilities. Other factors include the rapidly growing population and the increasing number of motor vehicles in use. Offsetting these somewhat is a trend toward substituting Diesels for residual oil-burning locomotives, which tends to reduce total oil consumption of the railroads.

Stepped-up activity in the petroleum industry in California should result in rising employment in both the oil fields and refineries. Additional opportunities for new workers will result from the need to replace persons leaving the oil fields and refineries because of death or retirement or because of shifting to other lines of work.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected occupations in the Pacific Coast States are shown in the following tabulation:

Occupation	Average straight-time hourly-earnings
Assistant stillmen, cracking	\$1.89
Assistant stillmen, straight-run	1.88
Assistant stillmen, combination units	1.93
Carpenters, maintenance	1.92
Electricians, maintenance	1.93
Firemen, stills, cracking	1.80
Firemen, stills, straight-run	1.78
Gagers	1.83
Helpers, maintenance	1.65
Instrument repairmen	1.92
Laborers	1.53

Occupation—Con. Average-straight-time hourly earnings

Loaders, tank cars or trucks	\$1.73
Machinists, maintenance	1.93
Mechanics, maintenance	1.90
Packers, hand	1.59
Pipe fitters	1.92
Pumpmen	1.87
Pumpmen's helpers	1.70
Routine testers, laboratory	1.80
Stillmen, cracking	2.13
Stillmen, straight-run	2.08
Treaters, light oils	1.96
Treaters, heavy oils	1.85
Treaters' helpers, light oils	1.82
Treaters' helpers, heavy oils	1.79
Welders, hand, maintenance	1.93

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

Middle Atlantic

(NEW JERSEY, NEW YORK, PENNSYLVANIA)

Summary

Outlook is for a growing number of refinery jobs; oil field employment should remain stable for several years but may later begin to decline.

Background

CRUDE PETROLEUM PRODUCTION.—This is the oldest producing region in the United States. About a fourth of the Nation's 445,000 producing wells are here, but less than 1 percent of the crude comes from these 3 States. The region produces, however, a large proportion of the crude from which high grade lubricating oil is made. In 1948, more than 10,000 workers were employed in the region's oil fields; about four-fifths of them had jobs in Pennsylvania.

Pennsylvania has been producing oil since 1859, when Col. E. A. Drake drilled the world's first oil well near Titusville, in Vennango County. In 1948, more than 8,000 workers were employed in the oil fields. Although there are about 80,000 producing wells in the State (about a fifth of the Nation's total), crude production in 1948 accounted for only 0.6 percent of the country's output. Production per well in this State averaged about one-half barrel a day compared with about 12 barrels a day for the country as a whole. As can be seen from the map, the oil and gas produc-

ing area of Pennsylvania lies in a belt from 25 to 120 miles wide and nearly 200 miles long, extending across the western side of the State. The Bradford field, located in the northwestern part of the State, has been the most productive field in the entire Appalachian region. In 1947, it accounted for more than four-fifths of the total oil produced in Pennsylvania.

New York oil fields are located primarily in three counties in the southwestern part of the State (Allegany, Cattaraugus, and Steuben), all of which border on Pennsylvania. In 1948, about 2,000 workers were employed in the oil fields. Although there are about 22,000 operating wells in the State, 1949 output of 4,250,000 barrels was less than one-fourth of 1 percent of total crude produced in the United States. While the amount produced is comparatively small, New York's crude petroleum is important in the manufacturing of lubricating oil and commands a relatively high price. A large proportion of the wells drilled in New York oil fields in 1949 were in connection with secondary-recovery operations.

REFINING.—In 1948, about 40,000 workers,¹ over a fifth of the Nation's total, were employed in the

¹ This figure is considerably inflated by inclusion of central office employees of oil companies.

30 refineries located in these three States. These refineries depend to a large extent on shipments from other regions and from foreign countries for their crude petroleum. More than half of the crude comes from Texas; foreign imports make up most of the balance. This region receives about four-fifths of total United States imports of crude petroleum.

Pennsylvania is the Nation's third leading State in refining capacity and number of employees. Four large refineries in eastern Pennsylvania (2 in the Philadelphia area and 2 in Marcus Hook) have nearly seven-eighths of the refining capacity. The other 13 refineries are small; nearly all of them are located in the petroleum-producing area in the western part of the State. Pennsylvania gets 90 percent of the crude needed for its refinery operations from foreign or interstate sources. More than half of the crude is brought in from Texas; over a quarter comes from foreign countries, mainly Venezuela.

New Jersey is the only major refining State which has no producing wells. Most of the crude petroleum refined in this State comes from Texas; much of the remainder is brought in by tankers from abroad. Two large refineries, in the Bayonne area, have about three-fourths of the capacity of the State's 6 refineries. The other 4 refineries are located in Paulsboro, Perth Amboy, Linden, and Petty's Island.

Two of New York's 6 refineries are located in the New York City area, 2 around Buffalo, and the others in Olean and Wellsville (in the oil-producing area). Crude production in New York supplies only a small proportion of its own refining needs. The bulk of the crude comes from Texas, Oklahoma, Illinois, and from foreign sources.

Outlook

CRUDE OIL PRODUCTION.—Little change in the number of oil field jobs in the region is expected for the next several years. Looking further into the future, the outlook in this branch of petroleum is for gradually decreasing employment.

While the region's crude production has fallen somewhat in recent years, the number of producing oil wells and the number of workers have not changed materially. No new pools of any great significance have been discovered during the last 10 years. However, wells drilled in connection

with secondary recovery operations have kept drilling activity at a fairly steady level. While it is possible that new oil pools will be discovered in this area, future production will be determined by the amount of oil remaining in existing fields. Estimated proved reserves in the region have been decreasing steadily. On January 1, 1947, the estimated reserve in Pennsylvania was only about a third of the amount estimated 10 years previously. While there is a considerable area remaining to be developed by secondary-recovery methods, these methods have already been applied to many of the best oil pools. Oil field employment is expected to remain around its 1948 level, about 10,000 workers, during the next few years. Over the longer run however, prospects are for slowly declining employment.

If at any time, however, there should be any great reduction in the price of crude from its 1948-49 levels, a sharp drop in the number of jobs may occur. A substantial price reduction might cause a considerable decrease in secondary-recovery activity and might also lead to the closing down of many of the less productive wells in the region.

REFINING.—Rising employment in petroleum refining in this region is expected during the next few years and over the longer run. The region's petroleum-refining industry has expanded considerably in recent years. In order to satisfy wartime demands, new capacity was rushed into construction. Much new equipment was added to existing refineries in order to produce large quantities of aviation gasoline. Since the war, the industry has continued to expand because of the rapidly rising demand for petroleum products. More workers will be needed to man the new refining facilities placed under construction in 1948-49 in the Philadelphia and New York City areas.

Longer run refinery prospects are also favorable in this region. Refineries in New Jersey and eastern Pennsylvania have had the advantage of major markets close at hand—in the big concentrations of industry and population around New York, Philadelphia, and Boston. This marketing factor, plus the growing importance of foreign crude oil in refinery operations, is expected to result in a more rapid growth in the East than in the other

important refining areas. Another important consideration is the comparatively recent development of catalytic cracking, which is likely to be used in place of thermal cracking units in new refineries and in expansion of existing refineries. Catalytic cracking eliminates to a great extent the advantage of having refineries located in areas (such as Texas) where there is an abundance of the inexpensive natural gas used as a fuel in thermal cracking operations.

SYNTHETIC PETROLEUM.—The United States Bureau of Mines and several oil companies are working together to perfect processes for manufacturing synthetic petroleum fuels. Natural gas, oil shale, and coal are the three raw materials from which liquid fuels can be made. In this region, there are laboratories and pilot plants in Bruce-ton and Library (Pennsylvania), engaged in research and development of synthetic liquid fuels from coal. If a commercial synthetic industry using coal as a raw material is developed, it probably will be located in this region because of the great coal concentration in Pennsylvania.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected

occupations in the Middle Atlantic States are shown in the following tabulation.

Occupation	Typical straight-time hourly earnings
Assistant stillmen, cracking.....	\$1.96
Assistant stillmen, straight-run.....	1.86
Assistant stillmen, combination units.....	1.99
Carpenters, maintenance.....	2.03
Electricians, maintenance.....	1.98
Firemen, stills, cracking.....	1.81
Firemen, stills, straight-run.....	1.70
Gagers.....	1.85
Helpers, maintenance.....	1.62
Instrument repairmen.....	1.95
Laborers.....	1.43
Loaders, tank cars or trucks.....	1.57
Machinists, maintenance.....	1.99
Packers, hand.....	1.56
Pipe fitters.....	1.94
Pumpmen.....	1.87
Pumpmen's helpers.....	1.78
Routine testers, laboratory.....	1.66
Stillmen, cracking.....	2.24
Stillmen, straight-run.....	2.03
Treaters, light oils.....	1.87
Treaters, heavy oils.....	1.81
Treaters' helpers, light oils.....	1.80
Treaters' helpers, heavy oils.....	1.80
Welders, hand maintenance.....	2.05

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

East North Central

(ILLINOIS, INDIANA, MICHIGAN, OHIO, WISCONSIN)

Summary

Refinery employment is expected to rise; the number of oil field jobs is likely to remain fairly stable.

Background

CRUDE PETROLEUM PRODUCTION.—In 1948, the region's oil fields had about 17,000 workers, almost 8 percent of the Nation's total. The 60,000 oil wells in the East North Central States produced about 94 million barrels of crude during 1949, approximately 5 percent of the United States output. Three-fifths of the region's oil field workers have jobs in Illinois. Most of the others are employed in Ohio and Michigan.

As can be seen from the map (chart 3), the oil

fields in *Illinois* are in the southern part of the State. While Illinois has 280 oil fields, about a quarter of the crude produced in 1948 came from its four major fields—Louden field in Effingham and Fayette Counties, Salem field in Marion County, Bridgeport in Lawrence County, and Robinson in Crawford County. Illinois, the Nation's sixth ranking State in petroleum production, employed about 10,000 oil-field workers in 1948. The 30,000 wells in the State produced 65 million barrels of crude in 1949, slightly over 3 percent of the Nation's output.

More than 3,500 workers had jobs in *Ohio's* oil fields in 1948. Petroleum production in Ohio is concentrated in 2 separate areas; 1 in the north-west and the other in the southeast. During 1949,

the State's 22,000 wells yielded only a fraction of 1 percent of the Nation's crude. Average output per well was less than a half barrel a day, compared with about 12 barrels for the country as a whole.

In *Michigan*, about 2,000 workers had jobs in approximately 125 fields. Thirty-eight of the 83 counties have some oil or gas wells. The 3,800 wells in *Indiana's* 64 fields produced about 9½ million barrels in 1949. Most of the oil lands are in the southwestern part of the State. Although a number of wells have been drilled in *Wisconsin*, no oil has been discovered.

REFINING.—The region has nearly a sixth of the Nation's refining capacity. Fifty-three refineries provided jobs for about 30,000 workers in 1948. Much of the capacity is located near the centers of industry and population around Chicago and St. Louis. Indiana and Illinois together employ about three-fourths of the region's refinery workers.

In 1948, more than 13,000 persons worked in *Indiana's* 9 refineries. Five of these refineries (including one of the Nation's largest) located just over the State line from Chicago, have about 94 percent of the State's refining capacity. Texas and Oklahoma fields supply most of the crude used by Indiana refineries.

The 15 operating refineries in *Illinois* had total capacity of more than 340,000 barrels daily in 1948 and employed nearly 10,000 workers. The 3 largest refineries, 2 in Wood River (not far from St. Louis) and the other in Lockport (near Chicago) together have about three-fifths of the State's capacity. Other large refineries are located in Lamont, Lawrenceville, Hartford, East St. Louis, and Robinson. In 1948, Illinois oil fields supplied only about a fifth of the crude refined in the State; the rest came from Texas, Oklahoma, and Kansas.

Four of the 11 refineries in *Ohio* are in Toledo. Large plants are also located in Cleveland, Cleves, Lima, and Heath. Petroleum refining provided jobs for over 5,500 Ohio workers in 1948. The State's fields supply only a small portion of the needs of its refineries. Most of the crude is brought in from Illinois, Texas, and Oklahoma.

All but 1 of *Michigan's* 17 refineries are small; the exception is the refinery located in Trenton. *Wisconsin's* only refinery, a small one, is in Sheboygan.

Outlook

CRUDE PETROLEUM PRODUCTION.—Production in the East North Central States reached a high in 1940 of 175 million barrels (13 percent of the Nation's total) and 6 times what it had been 3 years before. Since then production has decreased each year and by 1949 had fallen to about half the 1940 total. This sharp rise and fall in production was due to the discovery in 1938–1940 of a group of new fields in Illinois. Wells in these fields were allowed to flow freely, without application of usual conservation methods and, consequently, are now producing at a lower and declining rate. While production has been falling, the number of wells in Illinois has been slowly increasing during the last several years. There has been considerable exploration and drilling activity in the East North Central States since the war, and this activity is expected to continue at its present high level during the next several years.

Not much change in employment is in prospect in the region's crude petroleum industry during the next 5 or 10 years. Replacement needs, however, will provide a small number of job opportunities each year.

REFINING.—Rising employment is expected in the refining industry. There has been a rapid growth during the last decade in refining capacity and employment. Crude runs to stills in 1948 were nearly double the 1938 level. Capacity is expected to increase, particularly near Chicago and St. Louis in order to supply the growing demand for petroleum products in these areas. A considerable amount of new refining capacity was under construction in 1948–49 which will probably increase employment. In addition, replacement needs will provide a number of job opportunities for new workers.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected

occupations in the East North Central States are shown in the following tabulation:

<i>Occupation</i>	<i>Average straight-time hourly earnings</i>
Assistant stillmen, cracking.....	\$1.98
Assistant stillmen, straight-run.....	2.00
Assistant stillmen, combination units....	1.99
Carpenters, maintenance.....	1.95
Electricians, maintenance.....	2.01
Firemen, stills, cracking.....	1.86
Firemen, stills, straight-run.....	1.76
Firemen, stills, combination units.....	1.90
Gagers.....	1.91
Helpers, maintenance.....	1.72
Instrument repairmen.....	2.02
Laborers.....	1.51
Loaders, tank cars or trucks.....	1.80
Machinists, maintenance.....	2.00

<i>Occupation—Con.</i>	<i>Average straight-time hourly earnings</i>
Mechanics, maintenance.....	\$1.93
Packers, hand.....	1.83
Pipe fitters.....	1.98
Pumpmen.....	2.08
Pumpmen's helpers.....	1.92
Routine testers, laboratory.....	1.80
Stillmen, cracking.....	2.16
Stillmen, straight-run.....	2.09
Stillmen, combination units.....	2.22
Treaters, light oils.....	1.98
Treaters, heavy oils.....	2.21
Treaters' helpers, light oils.....	1.94
Welders, hand, maintenance.....	2.05

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

West North Central

(IOWA, KANSAS, MINNESOTA, MISSOURI, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA)

Summary

Slowly rising employment in the oil fields and refineries of Kansas is in prospect. There is a long-run possibility of new oil field jobs in the Dakotas and Minnesota.

Background

CRUDE PETROLEUM PRODUCTION.—In 1948, there were about 12,000 oil field workers, slightly more than 5 percent of the Nation's total, in the West North Central States. Kansas, the Nation's fifth ranking petroleum producing State, has the great bulk of the jobs. Oil fields in Kansas are in 2 districts, 1 in the eastern and southern part of the State and the other in the west central section. However, 67 of the State's 105 counties have one or more oil or gas wells. In 1949, the 29,000 operating wells in Kansas produced about 102 million barrels of crude, amounting to 5.5 percent of the United States output, with about half the oil going to refineries within the State.

Oil production in Nebraska is limited to the four fields in Richardson County (in the extreme southeast corner of the State). In 1949, Nebraska produced only 311,000 barrels of crude. There is also some small-scale oil production in Missouri.

REFINING.—The 26 refineries operating in this region in 1948 employed nearly 7,000 workers,

under 4 percent of the United States total. Kansas, which has about four-fifths of the region's jobs, is the Nation's tenth ranking State in refining capacity. In January 1949, the 16 Kansas refineries had a total capacity of about 186,000 barrels a day. The State's three largest refineries are located in Kansas City, El Dorado, and Augusta. Missouri's only refinery is in Sugar Creek and has a capacity of about 37,000 barrels a day. There are three very small refineries in Nebraska and one in South Dakota.

Outlook

CRUDE PETROLEUM PRODUCTION.—Slowly increasing employment is in prospect in Kansas oil fields. In addition, replacement needs will provide several hundred job opportunities annually. In 1948-49, crude output in Kansas was at the highest level in the State's 60-year producing history. Although Kansas has been producing oil since 1889, output did not become large until 1917, when important discoveries were made in Butler, Marion, and Chase Counties. In 1918, Kansas provided an eighth of the Nation's output. The trend in production was gradually upward until World War II, when output began to rise sharply, reaching a peak in 1948 of 110 million barrels, nearly double the output in 1938. During 1949, exploration and drilling activity was at a very high

rate; nearly 3,400 wells were completed, of which 522 were wildcats. Exploration and drilling activity is expected to rise somewhat above its present high rate during the next several years.

Elsewhere in the region, the outlook for oil-field employment is problematical. Greatly stepped-up exploration activity is expected in the Dakotas and Nebraska. If large deposits of petroleum are found, a number of oil-field workers will be needed.

REFINING.—A small increase in refinery employment is likely during the next several years. Some new facilities were under construction in 1948-49. Replacement needs also will provide a small number of openings each year.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected occupations in the West North Central States are shown in the following tabulation:

Occupation	Average straight-time hourly earnings
Assistant stillmen, cracking.....	\$1.83
Carpenters, maintenance.....	1.88
Electricians, maintenance.....	1.93
Firemen, stills, cracking.....	1.70
Firemen, stills, straight-run.....	1.78
Gagers.....	1.74
Helpers, maintenance.....	1.69
Instrument repairmen.....	1.97
Laborers.....	1.43
Loaders, tank cars or trucks.....	1.66
Machinists, maintenance.....	1.95
Pipe fitters.....	1.90
Pumpmen.....	1.89
Pumpmen's helpers.....	1.73
Routine testers, laboratory.....	1.67
Stillmen, cracking.....	2.02
Treaters, light oils.....	1.86
Treaters' helpers, light oils.....	1.72
Welders, hand, maintenance.....	1.95

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

Mountain

(ARIZONA, COLORADO, IDAHO, MONTANA, NEVADA, NEW MEXICO, UTAH, WYOMING)

Summary

A rise in employment in both petroleum production and refining is in prospect, with the larger increase occurring in production employment.

Background

CRUDE PETROLEUM PRODUCTION.—This is one of the fastest growing producing regions. However, output in 1949 was only about 7 percent of the Nation's total. In 1948, about 13,000 workers were employed by the region's petroleum producers and oil-field contractors. Over 5,000 of the jobs were in Wyoming and nearly that many were in New Mexico. Colorado and Montana had most of the other oil field jobs.

New Mexico has two producing areas. One is in the eastern section in Lea and Eddy Counties. The other is in the northwestern corner of the State, in San Juan and McKinley Counties. In 1948, *New Mexico's* 76 fields, with their 5,600 wells, produced 48 million barrels of crude—2.6 percent of the Nation's total.

Wyoming was the eighth ranking producing

State in 1949. Its 4,900 wells yielded 47 million barrels during the year. The fields in Wyoming are scattered throughout the State, with some oil or gas wells in 19 of the 23 counties. The principal fields are in Natrona, Park, Fremont, Big Horn, Sweetwater, Niobrara, Carbon, and Hot Springs Counties.

The 750 oil wells in *Colorado* produced about 24 million barrels of crude in 1949. These wells had a daily average of 85 barrels, compared with a national average of about 12 barrels. Oil and gas is produced in 12 of the 63 counties. As can be seen from the map (chart 3), most of the producing area is in the northern part of the State, with some fields in the southwest.

Eighteen of *Montana's* 56 counties have oil or gas wells. The two principal fields are the Cut Bank field in Glacier County and Kavin-Sunburst field in Toole County. Together they accounted for more than half of Montana's output of over 9 million barrels of crude in 1948.

REFINING.—Over 5,000 workers were employed in refining in the Mountain States in 1948. Nearly

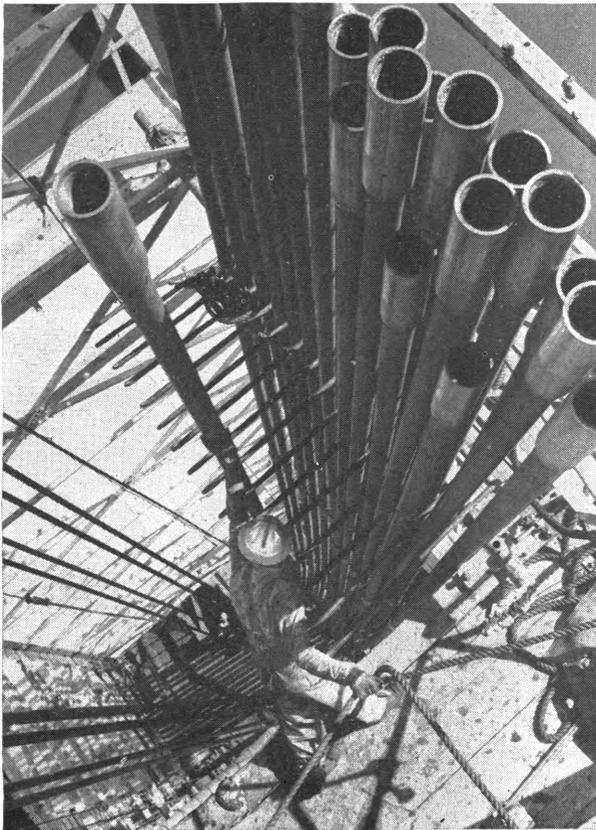
all the 42 operating refineries in this region are small; their combined capacity is less than 3 percent of the United States total.

Over half of the region's refinery workers have jobs in Wyoming's 17 operating refineries. These refineries are scattered throughout the State. The larger refineries are located in Casper, Sinclair, and Cheyenne. Two refineries in Salt Lake City have nearly all of Utah's refining capacity. There are 7 refineries operating in Montana, with total capacity of 40,000 barrels per day. The three largest refineries, which have three-fourths of the State's capacity, are located in Billings, Laurel, and Sunburst. There are 6 refineries in Colorado, 7 in New Mexico, and 1 in Idaho, all of them small.

Outlook

CRUDE PETROLEUM PRODUCTION.—Outlook is for rising employment during the next 5 or 10 years.

A derrickman working on a small platform high on a rotary drilling rig handles the upper end of the pipe when it is being removed and replaced.



Output of crude petroleum in the Mountain States has more than doubled during the last 10 years. The output of the Mountain region's 4 producing States reached record levels during 1948 and 1949. While this region, even in 1949, accounted for less than 4 percent of all the wells drilled in the United States, increasing interest in this area as a possible location of important new discoveries has led to a relatively big rise in drilling activity during the last 2 or 3 years. The amount of proved reserves is also on the upgrade in this region. At the end of 1948, the Mountain States accounted for about 7.5 percent of the United States total proved reserves.

In addition to the openings which will result from increasing employment, there will be some job opportunities created in the replacement of those who leave the oil fields.

A long-range possibility is the extensive development of the vast oil shale deposits in this region. Several pilot plants for conversion of oil shale into petroleum products are being operated in the Mountain States. If oil shale eventually becomes a major source of petroleum, much of the activity may be centered in this region.

REFINING.—Increasing employment in the refining industry is in prospect. However, this region will continue to have only a small share of the Nation's refinery workers. The rapid growth in refinery employment which has taken place during the last several years is expected to continue. New facilities were under construction in order to handle the increased production of nearby oil fields. New refineries in Salt Lake City, Utah, and Billings, Mont., were under construction in early 1949. Additions to existing facilities were being made in Thermopolis and Casper, Wyo., and in Denver, Colo. In addition to new jobs that will result from rising employment, there will be a small number of openings each year because of replacement needs.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected occupations in the Mountain States are shown in the following tabulation.

<i>Occupation</i>	<i>Average straight-time hourly earnings</i>
Assistant stillmen, straight-run.....	\$1.94
Carpenters, maintenance.....	1.77
Electricians, maintenance.....	1.94
Firemen, stills, cracking.....	1.75
Firemen, stills, combination units.....	1.90
Helpers, maintenance.....	1.69
Instrument repairmen.....	1.92
Laborers.....	1.48
Loaders, tank cars or trucks.....	1.78
Mechanics, maintenance.....	1.99
Pipe fitters.....	1.97

<i>Occupation—Con.</i>	<i>Average straight-time hourly earnings</i>
Pumpmen.....	\$1.96
Pumpmen's helpers.....	1.79
Routine testers, laboratory.....	1.75
Stillmen, cracking.....	2.10
Stillmen, straight-run.....	2.15
Stillmen, combination units.....	2.15
Treaters, light oils.....	2.00
Welders, hand, maintenance.....	1.93

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

East South Central

(ALABAMA, KENTUCKY, MISSISSIPPI, TENNESSEE)

Summary

Outlook is for rising employment in the oil fields of Mississippi. No increase in refinery employment is in prospect in the region.

Background

CRUDE PETROLEUM PRODUCTION.—Nearly 6,000 workers were employed in 1948 in the East South Central States in the search for oil, in drilling, and in the operation and maintenance of the region's 16,000 producing oil wells. The 47 million barrels of crude produced in this region in 1949 constituted 2.5 percent of total United States output. Nearly all the oil field jobs are in Kentucky and Mississippi.

Kentucky's nearly 15,000 wells produced about 8½ million barrels of crude in 1949, less than one-half of 1 percent of the United States total. Output per well in Kentucky is only about 1.6 barrels a day compared to the national average of about 12 barrels. The 51 fields in Kentucky are located in 44 of the 120 counties, in the west, the south central, and the eastern part of the State. Two-thirds of Kentucky's crude comes from the western part of the State; the combined output of Henderson and Union Counties constitutes over half of the State's production.

Almost half of the region's oil field workers have jobs in *Mississippi*, the Nation's ninth ranking State in petroleum production. While this State has only 1 out of every 300 of the Nation's

wells, its output per well is about 6 times the United States average. The 22 producing fields in Mississippi are spread over 17 counties, located principally in the southern part of the State. During the last few years, however, prospecting crews have been hunting for oil throughout the State, and wildcat wells have been drilled in 78 of the 82 counties. The Tinsley field (in Yazoo County) in its 10-year history has produced more than three-fifths of all the oil taken out of the ground in Mississippi.

The 2 small oil fields in *Alabama* are located in Choctaw County. The Gilbert field, discovered in 1944, and the East Gilbert field, discovered in 1945, together have 38 wells. *Tennessee's* oil fields are confined to 5 counties in the northern part of the State. In early 1948, there were 34 producing wells in the 6 small oil fields of this State.

REFINING.—This is not one of the important petroleum refining regions. The 12 refineries in the 4 East South Central States employed fewer than 1,500 workers in 1948, less than 1 percent of the United States total. Kentucky's 6 refineries have most of the jobs. The 2 largest refineries in Kentucky are located in Catlettsburg and Latonia; 3 refineries are in Louisville, and 1 in Somerset. About half of Kentucky's crude is delivered to refineries within the State. The rest of the crude needed for the State's refinery operations is supplied by fields in Indiana, Mississippi, Louisiana, and Illinois. There are 2 small refineries in each

of the other 3 East South Central States. These are located in Mobile and Tuscaloosa, Ala.; Sandersville and Yazoo City, Miss.; and Memphis and Nashville, Tenn.

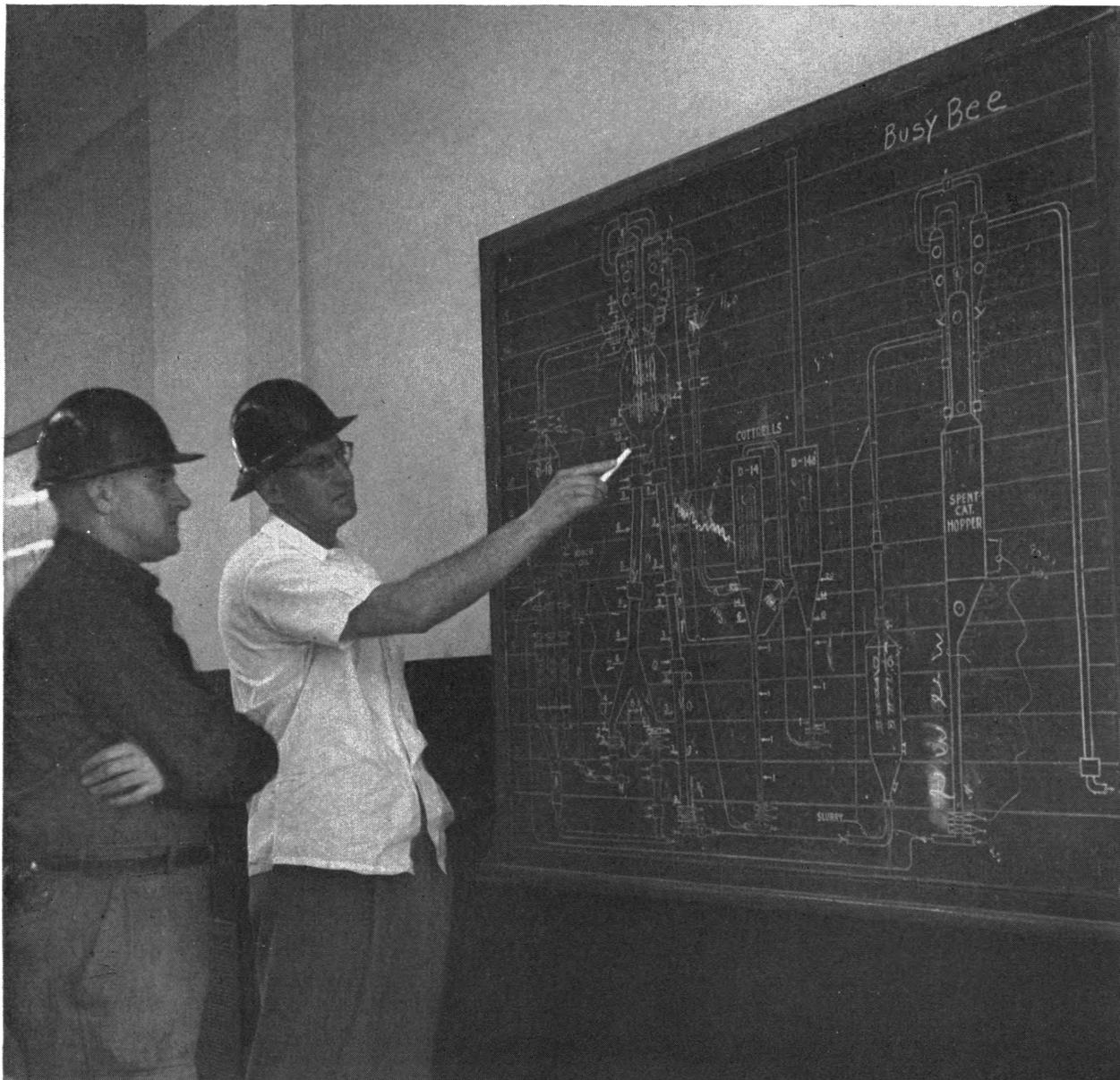
Outlook

CRUDE PETROLEUM PRODUCTION.—Employment in the region's crude petroleum industry is on the upgrade, but the East South Central States will continue to have only a small portion of the Nation's oil field workers. In Mississippi, crude

production is of recent origin; while oil was first discovered in 1933, production through 1938 was negligible. Except for some curtailment during the war, output has risen rapidly during the last 10 years. From 100,000 barrels in 1939, Mississippi's output climbed to 46 million barrels in 1948. Prospects are that this expansion will continue.

For Kentucky, on the other hand, slowly decreasing production is forecast. This State has been producing oil since 1860, reaching a peak in

Engineers checking flow chart in the control room of a catalytic cracking unit of a refinery.



1919 when its 9 million-plus barrels were about 2½ percent of the United States total. Kentucky's production showed continuous decline between the two world wars. The downward trend was reversed during the recent war years when a sharp increase in activity in Kentucky fields occurred. Production rose from 5 million barrels in 1941 to a new high of 10 million in 1945. Since the war, however, output has fallen off somewhat and is likely to continue to decline. While some

increase in activity in Alabama's oil industry is probable, neither that State nor Tennessee is likely to be a larger employer of oil field workers in the foreseeable future.

REFINING.—Job prospects in the region's petroleum refineries are not bright. No expansion in refining capacity in the East South Central States is in sight. Moreover, replacement needs will provide very few job openings annually because of the small size of the industry in this region.

South Atlantic

(DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, MARYLAND, NORTH CAROLINA, SOUTH CAROLINA, VIRGINIA, WEST VIRGINIA)

Summary

Little increase is expected in employment in petroleum production and refining. West Virginia will continue to have most of the oil field jobs and Maryland most of the refining jobs.

Background

CRUDE OIL PRODUCTION.—In 1948, about 3,600 workers, less than 2 percent of the Nation's total, were employed in crude production in the South Atlantic States. Except for a small number in Florida and Virginia, all of the jobs in this region were in West Virginia. The 17,000 oil wells in this State produced about 2,800,000 barrels in 1949, making it the nineteenth ranking State. While total output is relatively small, West Virginia crude is of high quality, yielding a good grade of lubricating oil and commanding a comparatively high price. West Virginia oil fields are in the northern and western part of the State. They lie in a belt about 40 to 70 miles wide, extending from Pennsylvania to the Kentucky State line.

Virginia and Florida are the only other South Atlantic States which have producing wells. Petroleum production in Virginia has been limited to the small Rose Hill field in Lee County in the extreme southwestern part of the State. The five producing oil wells in Florida at the beginning of 1948 were all in the recently developed Sunnyland field in Collier County.

REFINING.—About 3,000 workers were employed in 1948 in the 10 refineries located in this region; Baltimore is its only major refining center. The one large and two smaller refineries in Baltimore, Md., had a total capacity of 67,000 barrels a day, more than two-thirds of the region's total capacity. Most other refinery workers were employed in the four small refineries located in the petroleum producing area of West Virginia. There are three other refineries in this region, all of them small and engaged principally in producing asphalt for local markets. These refineries are located in Claymont, Del.; Savannah, Ga.; and Charleston, S. C.

Outlook

CRUDE PRODUCTION.—There will be few openings for new workers in crude petroleum production in this region. In West Virginia, where nearly all of the region's oil fields are located, petroleum production has been decreasing steadily for many years. In 1900, this was one of the leading producing States with an output of 16 million barrels, representing more than a fourth of the United States total. By 1920, production had fallen to half of the 1900 figure; in 1949, the State's output of less than 2,800,000 barrels was only a little more than one-tenth of 1 percent of the Nation's total. While there has been an increased amount of exploration and drilling activity since the war and some new oil pools have been discovered, no significant expansion of the petroleum production

industry is in sight. However, possible stepping-up of secondary recovery operations may create some additional jobs. Because of the limited size of the industry in this region, replacement needs will provide only a small number of job opportunities in any one year.

REFINING.—Job prospects in petroleum refineries in the South Atlantic States are not promising. Employment in the 10 plants in this region is not expected to increase much above the 1948 level in the foreseeable future. Although some openings for new workers will arise from replacement needs, the number will be limited because of the small size of the industry in this region and because the turn-over rate in refining is one of the lowest in industry.

Earnings

September 1948 average straight-time hourly earnings of petroleum refinery workers in selected occupations in the South Atlantic States are shown in the following tabulation:

<i>Occupation</i>	<i>Average straight-time hourly earnings</i>
Assistant stillmen, cracking.....	\$2. 05
Assistant stillmen, straight-run.....	2. 01
Assistant stillmen, combination units.....	2. 02
Carpenters, maintenance.....	1. 93
Electricians, maintenance.....	2. 02
Helpers, maintenance	1. 58
Instrument repairmen.....	2. 01
Laborers	1. 38
Loaders, tank cars or trucks.....	1. 65
Machinists, maintenance.....	1. 98
Mechanics, maintenance.....	1. 83
Packers, hand.....	1. 54
Pipe fitters.....	1. 96
Pumpmen	1. 96
Pumpmen's helpers.....	1. 83
Routine testers, laboratory.....	1. 67
Stillmen, cracking.....	2. 33
Stillmen, straight-run.....	2. 33
Treaters' helpers, light oils.....	1. 89
Welders, hand, maintenance.....	1. 96

Recent wage information on petroleum production for this region is not available. For earnings data for the country as a whole see page 19.

New England

(CONNECTICUT, MAINE, MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT)

Summary

There will be very limited opportunities for employment in the petroleum industry in this area.

Background

New England produces no crude petroleum and has barely 1 percent of the Nation's refining capacity. In 1948, about 1,000 wage and salary workers were employed in the 5 refineries located in this region. Two of the refineries are in Massachusetts—one in East Braintree and one in Everett. The other three, located in the Providence,

R. I., area are small and produce mainly asphalt for local use. Most of the crude needed for refining operations in this region comes from Texas and Venezuela.

Outlook

No expansion in the petroleum refining industry in this region is in sight. Because of the small size of the industry, replacement needs will provide only a very few openings for new workers. Owing to the geological characteristics of New England, there is little chance that petroleum deposits will be found.

Petroleum Jobs Abroad

In addition to the personnel working in the oil fields and refineries in this country, United States oil companies employ several thousand Americans abroad. American companies operating in foreign countries accounted, in 1947, for nearly two-fifths of all the oil produced outside the United States. These companies also operate a number of refineries abroad. Recent data are not available on the total number of workers employed in the foreign activities of these American companies. In 1944, however, 11 American companies and their subsidiaries employed about 67,000 workers outside of the United States. The great bulk of these were nationals of the respective countries, but a high percentage of the technical and skilled jobs were filled by Americans. Since 1944, employment has risen considerably.

American oil companies are operating in about 20 foreign countries. Most jobs abroad are in the Middle East, particularly Saudi Arabia, and in South America, principally in Venezuela. In the last year or two a number of United States oil companies' employees have been working in Canada. Most foreign jobs for Americans are for experienced, skilled production workers and for professional and technical personnel. These include keymen in geological and geophysical exploration parties; petroleum engineers; tool pushers, drillers, and derrickmen as the basic members of drilling crews; pumpers, switchers, pipe fitters, and welders in the producing fields; and chemical

engineers, chemists, operators (stillmen), and skilled maintenance workers in the refineries.

Prospects are that the foreign activity of United States oil companies will increase. However, the trend is to employ, insofar as possible, nationals of the countries concerned. Wages paid to Amer-

Shooter lowering charge of dynamite down shot hole. These workers are part of a seismograph prospecting crew.



ican oil workers abroad tend to be considerably higher than the rates paid for comparable jobs in this country.

APPENDIX I—MAJOR OIL FIELDS IN THE UNITED STATES ¹

130 fields produced half of the United States oil in 1948

<i>State and field</i>	<i>County</i>	<i>State and field</i>	<i>County</i>
Arkansas:		Louisiana—Continued	
Magnolia.....	Columbia.	Jennings.....	Acadia.
Smackover.....	Union, Ouachita.	Lafitte.....	Caddo, Jefferson.
California:		Rodessa (Ark.-La.-Tex.)	Mille (Ark.), Caddo (La.), Cass (Texas).
Buena Vista.....	Kern.	Vinton.....	Calcasieu.
Coalinga, East.....	Fresno.	Mississippi:	
Coalinga, Nose.....	Fresno.	Cranfield.....	Adams, Franklin.
Coalinga, West.....	Fresno.	Heidelberg.....	Jasper.
Coles Levee, North.....	Kern.	Tinsley.....	Yazoo.
Elk Hills.....	Kern.	New Mexico:	
Kern Front.....	Kern.	Eunice.....	Lea.
Kern River.....	Kern.	Hobbs.....	Lea.
Kettleman, North Dome.	Fresno, Kings.	Monument.....	Lea.
McKittrick-Cymric.....	Kern.	Vacuum.....	Lea.
Midway-Sunset.....	Kern.	Oklahoma:	
Mount Poso.....	Kern.	Avant.....	Osage.
Rio Bravo.....	Kern.	Bowlegs.....	Seminole.
Elwood.....	Santa Barbara.	Burbank.....	Osage, Kay.
Orcutt.....	Santa Barbara.	Cement.....	Caddo, Grady.
Santa Maria Valley.....	Santa Barbara.	Cushing.....	Creek, Payne.
Ventura Avenue.....	Ventura.	Earlsboro.....	Seminole, Pottawatomee.
Brea Olinda.....	Orange.	Edmond, West.....	Logan, California, Canadian, Kingfisher.
Coyote, West.....	Orange.	Fitts.....	Pontotoc.
Dominguez.....	Los Angeles.	Glenn Pool.....	Creek, Tulsa.
Huntington Beach.....	Orange.	Healdton.....	Carter, Jefferson.
Inglewood.....	Los Angeles.	Hewitt and West.....	Carter.
Long Beach.....	Los Angeles.	Little River.....	Seminole.
Montebello.....	Los Angeles.	Oklahoma City.....	Oklahoma, Cleveland.
Richfield.....	Orange.	Seminole City.....	Seminole.
Santa Fe Springs.....	Los Angeles.	Sholem Alechem.....	Carter, Stephens.
Seal Beach.....	Los Angeles.	St. Louis.....	Pottawatomee.
Torrance.....	Los Angeles.	Tonkawa.....	Noble, May.
Wilmington.....	Los Angeles.	Vehna.....	Stephens.
Colorado:		Pennsylvania:	
Rangely.....	Rio Blanco.	Allegheny.....	Allegheny.
Illinois:		Bradford.....	McKean (Pa.), Allegany (NY).
Bridgeport.....	Lawrence.	Texas:	
Louden.....	Effingham, Fayette.	Eastern Texas:	
Robinson.....	Crawford.	East Texas field...	Smith, Rusk, Gregg, Upshur, Cherokee.
Salem.....	Marion.	Hawkins.....	Wood.
Kansas:		Mexia.....	Limestone.
El Dorado.....	Butler.	Powell.....	Navarro.
Silica.....	Rice, Barton.	Talco.....	Frankline, Titus.
Trapp.....	Russell, Barton.	Van.....	Van Zandt.
Louisiana:			
Caddo.....	Caddo.		
Delhi-Big Creek.....	Richland, Franklin.		
Erath.....	Vermillion.		
Haynesville.....	Claiborne.		
Iowa.....	Calcasille, Jeff Davis.		

¹ Source: *Oil and Gas Journal*, The Petroleum Publishing Co., Tulsa, Okla.

APPENDIX I—MAJOR OIL FIELDS IN THE UNITED STATES—Continued

<i>State and field</i>	<i>County</i>
Texas—Continued	
North Texas:	
Burkburnett.....	Wichita.
K. M. A.....	Wilbarger, Wichita.
Electra.....	Wilbarger.
Panhandle Texas:	
Badger.....	Hutchinson.
Borger-Pantex.....	Hutchinson.
Finley.....	Gray.
West Pampa.....	Gray.
Southwest Texas:	
Luling-Brayon.....	Caldwell, Guadalupe.
Darst Creek.....	Guadalupe.
Texas Gulf coast:	
Agua Dulce to La Gloria.....	Nueces, Jim Wells, Brooks.
Anahuac.....	Chambers.
Barbers Hill.....	Chambers.
Conroe.....	Montgomery.
Greta.....	Refugio.
Hastings.....	Brazoria.
Hull.....	Liberty.
Humble and Light.....	Harris.
Katy.....	Waller.
Magnet-Withers and North.....	Wharton.
Old Ocean.....	Brazoria.
Refugio area.....	Refugio.
Sour Lake.....	Mardin.
Spindletop.....	Jefferson.
Thompson.....	Ft. Bend.
Tom O'Connor.....	Refugio.

<i>State and field</i>	<i>County</i>
Texas—Continued	
Texas Gulf Coast—Continued	
Webster (Friends-wood).....	Harris.
West Columbia.....	Brazoria.
West Ranch.....	Jackson.
West Texas:	
Big Lake.....	Reagen.
Cowden, North.....	Ector.
Foster.....	Ector.
Fullerton.....	Andrews.
Goldsmith.....	Ector.
Hendrick.....	Winkler.
Howard-Glasscock.....	Glasscock, Howard.
Keystone.....	Winkler.
Levelland.....	Hockley.
McCamey.....	Upton.
McElroy.....	Crane.
Seminole.....	Gaines.
Slaughter.....	Cochran, Hockley, Terry.
T-X-L.....	Ector.
Ward, North, and Estes.....	Ward.
Wasson.....	Gaines.
Yates.....	Pecos.
Wyoming:	
Elk Basin (Wyo. and Park (Wyo.), Carbon (Mont.) Mont.).....	
Lance Creek.....	Niobrara.
Oregon Basin.....	Park.
Salt Creek.....	Natrona.

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949¹

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
		<i>Barrels per day</i>	<i>Barrels per day</i>
<i>Alabama</i>			
Coastal Petroleum Corp.....	Mobile.....	8,000	-----
Hunt Oil Co.....	Tuscaloosa.....	3,000	-----
<i>Arkansas</i>			
Berry Asphalt Co.....	Stephens.....	1,500	-----
Do.....	Waterloo.....	1,000	-----
Henry H. Cross Co.....	Smackover.....	3,600	-----
Lion Oil Refining Co.....	El Dorado.....	22,000	2,500
Macmillan Petroleum Corp.....	Norphlet.....	4,000	-----
Root Petroleum Co.....	El Dorado.....	23,300	4,900
<i>California</i>			
Calstate Refining Co.....	Long Beach.....	-----	500
Caminol Co., Ltd.....	Hansford.....	4,000	-----
Century Oil Co.....	Long Beach.....	4,000	-----
Douglas Oil Co. of Calif.....	Bakersfield.....	7,400	850
Do.....	Clearwater.....	4,500	-----
Edgington Refining Co.....	Long Beach.....	3,000	-----
Envoy Petroleum Co.....	do.....	3,000	-----
Five C Refining Co.....	Santa Maria.....	3,500	-----
Fletcher Oil Co.....	Wilmington.....	3,600	1,700
General Petroleum Co. of Calif.....	Lebac.....	23,000	-----
Do.....	Torrance.....	100,000	25,800
Do.....	Vernon.....	4,000	-----
Golden Bear Oil Co.....	Bakersfield.....	2,500	-----
Hancock Oil Co. of Calif.....	Long Beach.....	12,000	1,800
MacMillan Petroleum Corp.....	do.....	7,500	-----
McCallen Refining Co.....	Huntington Beach.....	5,000	-----
Mohawk Petroleum Corp.....	Bakersfield.....	7,500	3,000
Newhall Refining Co.....	Newhall.....	3,000	-----
Norwalk Co.....	Maricopa.....	10,000	-----
Oxnard Oil & Refining Co.....	Oxnard.....	1,500	-----
Pacific States Oil Co.....	Wilmington.....	25,000	-----
Palomar Refining Co.....	Bakersfield.....	1,300	-----
Paraffine Companies, Ltd.....	Emeryville.....	2,400	-----
The Petrol Corp.....	Los Angeles.....	5,000	-----
Richfield Oil Corp.....	Watson.....	85,000	17,500
Rothschild Oil Co.....	Santa Fe Springs.....	6,300	1,125
Seaside Oil Co.....	Ventura.....	4,500	-----
Shell Oil Co.....	Martinez.....	45,000	8,000
Do.....	Wilmington.....	52,000	17,700
Socal Oil & Refining Co.....	Huntington Beach.....	1,800	500
Standard Oil Co. of Calif.....	El Segundo.....	117,000	21,200
Do.....	Richmond.....	138,000	30,600
Do.....	Segura.....	15,000	-----
Sunland Refining Co.....	Bakersfield.....	1,700	-----
Sunray Oil Corp.....	Santa Maria.....	2,500	600

¹ Source: *Information Circular*. United States Department of the Interior—Bureau of Mines—I. C. 7537—September 1949.

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
		<i>Barrels per day</i>	<i>Barrels per day</i>
<i>California—Continued</i>			
Sunset Oil Co.	Torrance	3,500	
The Texas Co.	Fillmore	5,000	1,000
Do.	Wilmington	50,000	13,000
Tide Water Associated Oil Co.	Avon	85,000	11,100
Do.	Watson	14,000	400
Triangle Oil Co.	Venice	2,500	
Union Oil Co. of Calif.	Maltha	8,100	
Do.	Oleum	62,800	4,050
Do.	Wilmington	62,000	20,200
Western Asphalt & Refining Co.	Santa Maria	1,200	
Wilshire Oil Co., Inc.	Norwalk	17,000	3,800
<i>Colorado</i>			
The Bay Petroleum Corp.	Denver	6,000	2,000
Continental Oil Co.	do	6,750	3,975
Gordon Refining Co.	Ft. Morgan	200	
Oriental Refining Co.	Alamosa	1,100	500
Do.	Denver	1,500	500
Skelly Oil Co.	do	1,500	260
<i>Delaware</i>			
The Texas Co.	Claymont	3,500	
<i>Georgia</i>			
Mexican Petroleum Corp. of Georgia	Savannah	5,500	
<i>Idaho</i>			
Wasatch Oil Co.	Pocatello	4,500	600
<i>Illinois</i>			
Advance Refining Co., Inc.	Centralia	2,500	
Arrow Petroleum Co.	do	5,000	
Calumet Refining Co.	Burnham	1,000	
Henry H. Cross Co.	Colmar	200	
The Globe Oil & Refining Co.	Lamont	31,925	8,750
Great Lakes Petroleum Co.	Blue Island	10,000	1,000
The Ohio Oil Co.	Robinson	18,500	10,800
Pana Refining Co.	Pana	4,000	700
Shell Oil Co., Inc.	Roxana	100,000	33,600
Socony-Vacuum Oil Co., Inc.	E. St. Louis	22,700	4,730
Standard Oil Co. (Ind.)	Wood River	42,600	12,000
The Texas Co.	Lawrenceville	27,000	8,000
Do.	Lockport	55,000	24,000
B. F. Wireback	Plymouth	250	
Wood River Oil & Refining Co., Inc.	Hartford	22,500	5,000
<i>Indiana</i>			
Cities Service Oil Co.	E. Chicago	33,000	11,000
Indiana Farm Bureau Cooperative Association, Inc.	Mt. Vernon	8,000	3,500
Johnson Oil Supply Corp.	Gary	2,000	
R. J. Oil & Refining Co., Inc.	Princeton	1,200	
Rock Island Refining Corp.	Rock Island	8,500	2,200

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
		<i>Barrels per day</i>	<i>Barrels per day</i>
<i>Indiana—Continued</i>			
Sinclair Refining Co.....	E. Chicago.....	85, 000	32, 000
Socony-Vacuum Oil Co., Inc.....	do.....	25, 000	8, 000
Standard Oil Co. (Ind.).....	Whiting.....	175, 800	50, 800
Troy Refining Corp.....	Maxville.....	1, 500	-----
<i>Kansas</i>			
Bareco Oil Co.....	Wichita.....	7, 500	5, 650
The Bay Petroleum Corp.....	McPherson.....	7, 000	3, 600
The Chanute Refining Co.....	Chanute.....	800	-----
Cooperative Refining Association.....	Coffeyville.....	17, 000	3, 500
Do.....	Phillipsburg.....	4, 000	1, 200
The Derby Oil Co.....	Wichita.....	9, 000	2, 200
El Dorado Refining Co.....	El Dorado.....	6, 400	2, 560
The Kanotex Refining Co.....	Arkansas City.....	8, 500	5, 800
M. F. A. Refining Co.....	Chanute.....	1, 650	400
National Coop. Refining Association.....	McPherson.....	18, 000	10, 100
Phillips Oil Co.....	Kansas City.....	38, 000	13, 000
Shallow Water Refining Co.....	Shallow Water.....	2, 500	600
Skelly Oil Co.....	El Dorado.....	25, 000	8, 000
Socony-Vacuum Oil Co.....	Augusta.....	26, 500	7, 100
Standard Oil Co. (Ind.).....	Neodesha.....	8, 500	2, 640
The Vickers Petroleum Co., Inc.....	Potwin.....	5, 500	2, 800
<i>Kentucky</i>			
Aetna Oil Co.....	Louisville.....	8, 000	1, 100
Ashland Oil & Refining Co.....	Cattlettsburg.....	38, 000	10, 500
Louisville Refining Co., Inc.....	Louisville.....	6, 000	2, 500
Standard Oil Co. (Ohio).....	Latonia.....	16, 500	6, 000
Somerset Refinery.....	Somerset.....	1, 500	-----
Stoll Oil Refining Co., Inc.....	Louisville.....	1, 800	-----
<i>Louisiana</i>			
INLAND			
Atlas Oil & Refining Corp.....	Shreveport.....	12, 000	4, 300
Bayou State Oil Corp.....	Hosston.....	800	4, 300
Calumet Refining Co.....	Princeton.....	900	-----
Coast Oil Co.....	Cotton Valley.....	2, 000	-----
Stanolind Oil & Gas Co.....	Superior.....	7, 000	2, 000
GULF			
Breaux Bridge Oil Refining Co.....	Anse La Butte.....	500	-----
Chalmette Petroleum Corp.....	Chalmette.....	14, 000	2, 650
Cities Service Oil Co.....	Lake Charles.....	110, 000	25, 000
Continental Oil Co.....	West Lake (Lake Charles).....	11, 000	4, 115
Esso Standard Oil Co.....	Baton Rouge.....	235, 000	36, 700
Evangeline Refining Co.....	Jennings.....	1, 000	-----
Gilorease Oil Co.....	Meraux.....	4, 000	-----
Pan American Petroleum Corp.....	Destrehan.....	9, 500	-----
Petco Corp.....	Marvero.....	5, 000	800
Shell Oil Co., Inc.....	Norco.....	45, 000	8, 600
Southern State Refining Co.....	Eola.....	1, 000	-----

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
<i>Maryland</i>			
American Bitumuls.....	Baltimore.....	6, 000	
Esso Standard Oil Co.....	do.....	54, 700	14, 260
Pan American Refining Corp.....	do.....	6, 500	
<i>Massachusetts</i>			
Cities Service Oil Co. (Pa.).....	E. Braintree.....	15, 000	
Esso Standard Oil Co.....	Everett.....	38, 000	8, 000
<i>Michigan</i>			
Aurora Gasoline Co.....	Detroit.....	16, 000	6, 000
Do.....	Elsie.....	4, 000	
Bay Refining Corp.....	Bay City.....	5, 921	
Crystal Refining Co., Inc.....	Carson City.....	6, 000	
Lakeside Refining Co.....	Kalamazoo.....	2, 000	
Leonard Refineries, Inc.....	Alma.....	8, 500	7, 750
Louis Rose Refining Co.....	Saginaw.....	3, 500	
Marvel Refining Co.....	Grand Rapids.....	2, 000	
Mid-West Refineries.....	Alma.....	4, 000	1, 800
Naph-Sol Refining Co.....	Muskegon.....	5, 100	1, 200
Old Dutch Refining Co.....	do.....	4, 500	1, 700
Osceola Refining Co.....	Reed City.....	750	
Petroleum Specialties, Inc.....	Flat Rock.....	3, 500	
Producers Refining, Inc.....	West Branch.....	1, 899	
The Pure Oil Co.....	Midland.....	4, 700	
Roosevelt Oil Co.....	Mt. Pleasant.....	7, 500	3, 000
Socony-Vacuum Oil Co.....	Trenton.....	25, 000	7, 299
<i>Minnesota</i>			
Northwestern Refining Co.....	St. Paul Park.....	5, 000	
<i>Mississippi</i>			
Paluxy Asphalt Co.....	Crupp.....	3, 500	1, 000
Southland Oils, Inc.....	Sandersville.....	4, 500	
<i>Missouri</i>			
Standard Oil Co. (Ind.).....	Sugar Creek.....	37, 100	15, 500
<i>Montana</i>			
Big West Oil Co.....	Kevin.....	1, 500	1, 000
Carter Oil Co.....	Billings.....	11, 000	1, 300
Do.....	Cut Bank.....	3, 800	900
Farmers Union Central Exchange.....	Laurel.....	9, 500	2, 370
The Texas Co.....	Sunburst.....	7, 500	2, 500
Union Oil Co. of Calif.....	Cut Bank.....	3, 500	1, 200
Wasatch Oil Co.—Ada Oil Co.....	Great Falls.....	2, 800	600
<i>Nebraska</i>			
Cooperative Refining Association.....	Scotts Bluff.....	1, 900	360
Petroleum Utilities Co.....	Chadron.....	600	
Searle Petroleum Co.....	Omaha.....	1, 000	

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
		<i>Barrels per day</i>	<i>Barrels per day</i>
<i>New Jersey</i>			
California Refining Co.....	Barber.....	20, 000	6, 000
Cities Service Oil Co. (Pa.).....	Linden.....	15, 000	-----
Do.....	Petty's Island.....	10, 000	-----
Esso Standard Oil Co.....	Bayonne, etc.....	175, 000	35, 000
Socony-Vacuum Oil Co., Inc.....	Paulsboro.....	47, 000	12, 600
Tide Water Associated Oil Co.....	Bayonne.....	70, 000	14, 500
<i>New Mexico</i>			
The Aerex Co., Inc.....	Bloomfield.....	200	-----
Continental Oil Co.....	Artesia.....	3, 000	750
Do.....	Farmington.....	350	-----
Malco Refineries, Inc.....	Roswell.....	1, 800	350
McNutt Oil & Refining Co.....	Brickland.....	3, 000	200
New Mexico Asphalt Refining Co.....	Artesia.....	4, 000	2, 000
Petroleum Products Refining Co.....	Prewitt.....	2, 000	-----
<i>New York</i>			
Frontier Fuel Oil.....	Tonawanda.....	10, 000	3, 500
Gulf Oil Corp.....	Gulfport.....	20, 000	-----
Sinclair Refining Co.....	Wellsville.....	9, 000	3, 000
Socony-Vacuum Oil Co., Inc.....	Brooklyn.....	26, 000	5, 800
Do.....	Buffalo.....	22, 000	6, 900
Do.....	Olean.....	7, 000	-----
<i>Ohio</i>			
Ashland Oil & Refining Co.....	Canton.....	12, 000	-----
Gulf Refining Co.....	Cleves.....	26, 600	9, 055
Do.....	Toledo.....	23, 000	7, 400
The National Refining Co.....	Findlay.....	9, 300	5, 400
The Pure Oil Co.....	Heath.....	15, 500	7, 950
Do.....	Toledo.....	29, 400	14, 800
The Standard Oil Co. (Ohio).....	Cleveland.....	42, 500	18, 500
Do.....	Lima.....	17, 500	5, 000
Do.....	Toledo.....	21, 000	7, 800
Sun Oil Co.....	do.....	37, 000	13, 700
Western Reserves.....	Miles.....	2, 500	-----
<i>Oklahoma</i>			
Allied Materials Corp.....	Stroud.....	1, 500	-----
Anderson Prichard Refining Co.....	Cyril.....	10, 000	3, 000
Bell Oil & Gas Co.....	Grandfield.....	5, 500	1, 700
Ben Franklin Refining Co.....	Ardmore.....	4, 500	1, 700
Champlin Refining Co.....	Enid.....	17, 500	7, 000
Cities Service Oil Co.....	Ponca City.....	15, 000	2, 500
Continental Oil Co.....	do.....	38, 600	12, 035
Deep Rock Oil Corp.....	Cushing.....	12, 500	4, 500
Denver Producing & Refining Co.....	Edmond.....	1, 850	-----
Johnson Oil & Refining Co.....	Cleveland.....	6, 000	2, 750
Kerr-McGee Oil Industries, Inc.....	Wynnewood.....	7, 500	-----
Mercury Oil Refining Co.....	Oklahoma City.....	2, 000	625
Mid-Continent Petroleum Corp.....	West Tulsa.....	45, 000	14, 580
Midland Cooperative Wholesale.....	Cushing.....	6, 500	1, 826

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
<i>Oklahoma—Continued</i>			
		<i>Barrels per day</i>	<i>Barrels per day</i>
Monarch Refineries, Inc.....	Oklahoma City.....	700	
Peppers Gasoline Co.....	do.....	1,500	500
Phillips Oil Co.....	Oklmulgee.....	11,000	1,600
Rock Island Refining Co.....	Beckett.....	7,100	1,700
Sunray Oil Co.....	Allen.....	12,500	6,875
Do.....	Duncan.....	20,000	10,000
The Texas Co.....	W. Tulsa.....	21,000	7,000
Tide Water Associated Oil Co.....	Drumright.....	12,000	2,700
Wilcox Oil & Gas Co.....	Bristow.....	5,000	2,000
<i>Oregon</i>			
Stancel Asphalt & Bitumuls Co.....	Portland.....	4,200	
<i>Pennsylvania</i>			
<i>EAST</i>			
The Atlantic Refining Co.....	Philadelphia.....	117,000	28,500
Gulf Oil Corp.....	Girard Point.....	76,700	22,000
Sinclair Refining Co.....	Marcus Hook.....	70,000	29,000
Sun Oil Co.....	do.....	140,000	53,000
<i>WEST</i>			
Cities Service Oil Co. (Pa.).....	Titusville.....	3,000	
Franklin Refinery.....	Franklin.....	1,650	
Freedom-Valvoline Co.....	Freedom.....	4,000	1,000
Gulf Oil Corp.....	Neville Island.....	14,500	4,800
Kendall Refining Co.....	Bradford.....	4,800	1,000
Pennsylvania Refining Co.....	Karns City.....	1,500	
The Pennzoil Co.....	Rouseville.....	8,400	2,674
Quaker State Oil Refining Corp.....	Emlenton.....	2,000	1,080
Do.....	Farmers Valley.....	4,000	1,500
Do.....	Oil City.....	2,800	1,508
United Refining Co.....	Warren.....	5,500	1,600
Waverly Oil Works.....	Pittsburgh.....	2,500	
Wolf's Head Oil Refining Co., Inc.....	Reno.....	2,000	1,027
<i>Rhode Island</i>			
American Bitumuls Co.....	Providence.....	1,200	
Socony-Vacuum Oil Co., Inc.....	E. Providence.....	8,000	700
The Texas Co.....	Providence.....	3,500	
<i>South Carolina</i>			
Esso Standard Oil Co.....	Charleston.....	6,500	
<i>South Dakota</i>			
How-Kola Refining Co.....	Sturgis.....	100	

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
<i>Tennessee</i>		<i>Barrels per day</i>	<i>Barrels per day</i>
Delta Refining Co.....	Memphis.....	4, 000	600
Southern Oil Service.....	Nashville.....	1, 000	-----
<i>Texas</i>			
INLAND			
American Liberty Oil Co.....	Mt. Pleasant.....	13, 000	3, 500
Bryson Pipeline & Refining Co.....	Bryson.....	9, 000	-----
Col-Tex Refining Co.....	Colorado City.....	10, 000	2, 000
Consumers Cooperative Refining Association.....	Levelland.....	5, 200	850
Continental Oil Co.....	Wichita Falls.....	6, 300	3, 025
Cosden Petroleum Corp.....	Big Springs.....	15, 000	6, 000
Danaho Refining Co.....	Pettus.....	2, 000	300
Gladewater Refining Co.....	Gladewater.....	2, 500	1, 500
Gulf Oil Corp.....	Ft. Worth.....	9, 500	1, 975
Do.....	Sweetwater.....	10, 000	1, 950
Humble Oil & Refining Co.....	San Antonio.....	7, 000	-----
Inland Refining Co.....	Tucker.....	1, 500	400
LaSalle Petroleum Corp.....	Burkburnett.....	2, 000	-----
Magnolia Petroleum Co.....	Ft. Worth.....	12, 000	4, 600
McBride Refining Co., Inc.....	LaBlanca.....	2, 500	-----
McMurrey Petroleum Corp.....	Tyler.....	4, 000	4, 500
Onyx Refining Corp.....	Abilene.....	3, 800	3, 000
Panhandle Producing & Refining Co.....	Lueders.....	1, 500	350
Do.....	Wichita Falls.....	4, 000	1, 000
Patton Oil Co.....	Rotan.....	1, 500	-----
Payward Refining Co.....	Shamrock.....	1, 000	-----
Phillips Petroleum Co.....	Borger.....	56, 000	23, 000
Phoenix Refining Co.....	San Antonio.....	500	-----
Pioneer Oil & Refining Co.....	Somerset.....	2, 000	-----
Premier Petroleum Co.....	Arp.....	5, 000	2, 800
Do.....	Baird.....	2, 500	750
Do.....	Fort Worth.....	8, 000	1, 500
Do.....	Longview.....	4, 500	2, 000
Prichard Refining Co., Ltd.....	San Antonio.....	1, 900	-----
Radio Refining Co., Ltd.....	McAllen.....	1, 000	-----
Reischman Refinery.....	Pecos.....	200	-----
Roger Lacy, Inc.....	Big Sandy.....	3, 000	1, 000
The Shamrock Oil & Gas Corp.....	Moore County.....	7, 000	4, 300
Skelly Oil Co.....	Longview.....	7, 000	1, 750
Standard Oil Co. of Texas.....	El Paso.....	18, 000	3, 000
The Texas Co.....	Amarillo.....	8, 000	3, 000
Do.....	El Paso.....	5, 000	1, 500
Do.....	San Antonio.....	7, 000	2, 500
Do.....	West Dallas.....	15, 000	5, 000
Three Rivers Refinery.....	Three Rivers.....	1, 000	-----
The Tydol Co.....	Gainesville.....	2, 000	-----
Ute Oil & Refining Co.....	Graham.....	800	-----
Waggoner, W. T., Estate.....	Electra.....	7, 000	2, 500
Wickett Refining Co.....	Wickett.....	1, 500	-----

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
<i>Texas—Continued</i>			
<i>GULF</i>			
Alamo Refining Co.....	Sweeney.....	45, 000	11, 000
American Mineral Spirits Co.....	Corpus Christi.....	9, 000	
Atlantic Refining Co.....	Atreco (Port Arthur).....	40, 000	6, 300
Bennett Oil & Refining Co. of Texas.....	Refugio.....	1, 500	
Coastal Refineries.....	Port Isabel.....	6, 500	600
Crown Central Petroleum Corp.....	Houston.....	24, 000	6, 850
Eastern States Petroleum Co., Inc.....	do.....	25, 000	28, 500
Eddy Refinery.....	do.....	2, 200	
Gulf Oil Corp.....	Port Arthur.....	220, 000	53, 350
Hamman Oil & Refining Co.....	Bay City.....	2, 100	
Humble Oil & Refining Co.....	Baytown.....	237, 000	45, 600
Hutex Oil & Refining Co.....	Hardin.....	1, 000	
Magnolia Petroleum Co.....	Beaumont.....	150, 000	34, 630
Maritime Oil Co.....	Galena Park.....	5, 000	
Pan American Refining Co.....	Texas City.....	114, 000	47, 000
Petrol Terminal Corp.....	do.....	15, 600	4, 500
Pontiac Refining Co.....	Corpus Christi.....	19, 000	
The Pure Oil Co.....	Nederland.....	58, 000	16, 500
Republic Oil & Refining Co.....	Texas City.....	34, 000	24, 000
Shell Oil Co., Inc.....	Houston (Deer Park).....	110, 000	25, 500
Sid Richardson Refining Co.....	Texas City.....	20, 000	4, 500
Sinclair Refining Co.....	Corpus Christi.....	16, 000	10, 400
Do.....	Houston.....	85, 000	25, 000
Southwestern Oil & Refining Co.....	Corpus Christi.....	18, 000	
Taylor Refining Co.....	do.....	31, 000	1, 500
The Texas Co.....	Port Arthur.....	190, 000	85, 000
Do.....	Port Neches.....	40, 000	
<i>Utah</i>			
Uinta Oil Co.....	Jensen.....	700	
Utah Oil Refining Co.....	Salt Lake City.....	22, 000	6, 995
Wasatch Oil Refining Co.....	Woods Cress.....	4, 200	800
<i>Washington</i>			
Wasatch Oil Co.....	Spokane.....	5, 500	1, 000
<i>West Virginia</i>			
Carbide & Carbon Chemicals Co.....	Charleston.....	2, 500	1, 200
Elk Refining Co.....	Falling Rock.....	4, 500	1, 000
The Pure Oil Co.....	Cabin Creek.....	5, 500	1, 400
Quaker State Oil Refining Co.....	St. Marys.....	2, 500	1, 050
<i>Wisconsin</i>			
Wisconsin Oil Refining Co.....	Sheboygan.....	5, 000	
<i>Wyoming</i>			
C & H Refinery.....	Lusk.....	160	
Continental Oil Co.....	Glenrock.....	3, 400	989
Cooperative Refinery Association.....	New Castle.....	2, 000	890
Elk Horn Gas Refinery.....	Osage.....	55	
Empire State Oil Co.....	Thermopolis.....	1, 500	

APPENDIX II—PETROLEUM REFINERIES IN THE UNITED STATES, JANUARY 1, 1949—Continued

Company	Location	Crude-oil capacity (in operation)	Cracked-gasoline capacity (in operation)
<i>Wyoming—Continued</i>			
		<i>Barrels per day</i>	<i>Barrels per day</i>
Frontier Refining Co.....	Cheyenne.....	11, 000	5, 750
Graco Oil & Refining Co.....	New Castle.....	2, 500	
Husky Refining Co.....	Cody.....	4, 500	
Independent Refinery.....	Lusk.....	95	
Ohio Oil Co.....	Lovell.....	6, 000	
Pilot Oil Co.....	Morton.....	200	
Resolute Oil Corp.....	Badger Basin.....	1, 200	
Sinclair Refining Co.....	Sinclair.....	20, 000	7, 000
Socony-Vacuum Oil Co., Inc.....	Casper.....	3, 300	750
Standard Oil Co. (Ind.).....	do.....	14, 000	3, 800
The Texas Co.....	Calpet.....	400	
Do.....	Casper.....	12, 000	4, 500

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Studies of employment trends and opportunities in the various occupations and professions are made by the Occupational Outlook Branch of the Bureau of Labor Statistics.

Reports are prepared for use in the vocational guidance of veterans, young people in schools, and others considering the choice of an occupation. Schools concerned with vocational training and employers and trade-unions interested in on-the-job training have also found the reports helpful in planning programs in line with prospective employment opportunities.

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