1954

REPORT OF THE

NATIONAL PETROLEUM COUNCIL'S

COMMITTEE ON THE USE OF RADIO AND RADAR

January 1, 1955

CHAIRMAN OF THE COMMITTEE: F. W. LITTELL

HEADQUARTERS OFFICE

601 Commonwealth Building
1625 K Street, N. W.
Washington 6, D. C.

Telephone:
EXecutive 3-5167

COMMITTEE ON THE USE OF RADIO AND RADAR
OF THE
NATIONAL PETROLEUM COUNCIL

CHAIRMAN: F. W. Littell
Shell Pipe Line Corporation
Shell Building
Houston, Texas

VICE-CHAIRMAN: J. A. Polhemus, Jr.
Standard Oil Co. of California
Standard Oil Building
San Francisco, California

SECRETARY: Joseph E. Keller
Attorney
600 Munsey Building
Washington 4, D. C.

F. S. Bird
The California Co.
1111 Tulane Avenue
New Orleans 12, Louisiana

Davis D. Bovaird
Bovaird Supply Company
P. O. Box 2590
Tulsa, Oklahoma

W. T. Bulla
Natural Gas Pipeline Co.
of America
20 N. Wacker Drive
Chicago 6, Illinois

Robert Gray
Ashland Oil and Refining Co.
1409 Winchester Avenue
Ashland, Kentucky

Carl L. Lathrop
Standard Oil Development Corp.
Box 121
Linden, New Jersey

C. B. Lester
Mid-Valley Pipeline Co.
P. O. Box 2388
Longview, Texas

H. G. Pegues
United Gas Pipe Line Co.
P. O. Box 1407
Shreveport, Louisiana

H. A. Rhodes
Transcontinental Gas Pipe Line
Corp.
P. O. Box 296
Houston, Texas

W. M. Rust, Jr.
Humble Oil & Refining Co.
P. O Box 2180
Houston, Texas

Chet F. Whaley
Chet F. Whaley Well Servicing Co.
City National Bank Building
Houston, Texas

R. D. Wykoff
Gulf Research and Development
Company
P. O. Drawer 2038
Pittsburgh 30, Pennsylvania

January 1, 1955

Mr. Walter S. Hallanan, Chairman
National Petroleum Council
1625 K Street, N. W.
Washington, D. C.

Dear Mr. Hallanan:

Pursuant to the request of the Deputy Petroleum Administrator of the Petroleum Administration for Defense dated March 9, 1954, and the subsequent action of the Agenda Committee in its report of March 22, 1954, unanimously adopted by the Council on March 23, 1954, recommendations were made that the Council review the report of the Committee on Radio and Radar dated May 28, 1953 and undertake a current study to provide timely information and recommendations as appropriate.

On April 1, 1954 you appointed me as Chairman of the National Petroleum Council's Committee on the Use of Radio and Radar (1954). Other members of the Committee are listed in the report.

Interim reports of the progress of this work were submitted by the Committee's Secretary, Mr. Joseph E. Keller, at the July 15 and October 19, 1954 meetings of the Council. The Committee has now completed its task as charged and I am pleased to enclose herewith the report of the Committee.

Very sincerely yours,

/S/ F. W. Littell

Chairman, National Petroleum Council's
Committee on the Use of Radio & Radar

FWLittell:bb

INDEX

FOREWORD

This report is supplemental to the original report of the Committee on the Use of Radio and Radar, which report was submitted on May 1, 1953 and contained detailed and specific information pertaining to the history of the use of radio and radar in the petroleum and natural gas industries.

A complete new section is now included which incorporates a report of the Central Committee on Radio Facilities of the American Petroleum Institute on "Two-Way Radio in Petroleum Drilling and Producing Operations".

Another new section deals with the formation of the "Operational Fixed Microwave Council", in which petroleum industry personnel played a leading role.

Statistics showing the increase of petroleum radio stations for the past year are included, and the annual report of the A.P.I.'s Central Committee on Radio Facilities, which is also included, indicates in detail the problems and complexities facing the petroleum industry in its daily use of radio.

The present status of the proposal for 20 Kc. separation in the Petroleum Radio Service is indicated in detail.

Particular attention should be paid to the section dealing with the common carrier use of petroleum radio frequencies as this situation is fraught with danger to our continued exclusive use of the frequencies concerned.

We wish to recognize the continued fine cooperation of the Federal Communications Commission and its Bureau of Safety and Special Radio Services in their helpful consideration of our radio problems and pay special tribute to the Central Committee on Radio Facilities of the American Petroleum Institute for their excellent work representing the petroleum and natural gas industries in all phases of the use of radio and radar.

RECOMMENDATIONS

In the original report of May 1, 1953, it was stressed that the protection of the petroleum and natural gas industries' stake in radio demanded constant vigilance. The rapidly expanding use of radio, as borne out by the statistics embodied in this report, serves to emphasize the degree of dependence placed upon its use in everyday normal operations.

It is the considered opinion of this committee that the original recommendations contained in the report of May 1, 1953, be restated as this 1954 committee's recommendations namely:

1. The National Petroleum Council should continue to give careful study and consideration to the industry's radio and radar uses, and to make periodic reports on this matter as significant developments affecting the industry's operations occur.

2. The appropriate governmental agencies having an important interest in these matters should be fully informed of the industry's needs in this field and of the manner in which radio enables the industry to provide for the national defense and to serve the public welfare.

3. All radio matters of industry-wide concern should be left in the capable hands of the American Petroleum Institute's Central Committee on Radio Facilities, whose record of accomplishment is unquestioned.

4. All companies using or contemplating using radio in their operations should participate in the work of the Central Committee on Radio Facilities through representation on that Committee.

5. The National Petroleum Radio Frequency Coordinating Association is in need of competent engineering personnel to assist in frequency coordinating work and all companies should make personnel who have the qualifications for such work available for this purpose.

6. It is important that the industry itself be fully apprised of the extensive use being made of radio facilities within the industry and that all levels of the industry comprehend the essentiality of such usage.

7. We also recommend, in the view of recent developments, that, if there are points of disagreement between private users and those providing common carrier services, that these matters be openly and fairly discussed between them in order to find an area of mutual understanding of the problems of each group, in an objective and genuine effort to assure that each group may make its proper contribution to the communication needs of the petroleum and natural gas industries.

TWO-WAY RADIO
IN PETROLEUM
DRILLING AND PRODUCING
OPERATIONS

INTRODUCTION

When the Federal Communications Commission, on July 1, 1949, released its new rules and regulations governing the Industrial Radio Services and established thereunder, as Sub-Part "G", the Petroleum Radio Service, the Commission limited eligibility for licensing in this Service to those "engaged in prospecting for, producing, collecting, refining, or transporting by means of pipe lines, petroleum or petroleum products, including natural gas." Under the new rules and regulations, certain radio frequencies were allocated by the Commission for the exclusive use of licensees in the Petroleum Radio Service and additional frequencies were allocated on a shared basis with other industries.

Radio facilities for the use of the petroleum industry in prospecting for and producing petroleum and natural gas constitute one of the most important, if not almost indispensable, electronic aids to finding and developing these great natural resources. The Central Committee on Radio Facilities of the American Petroleum Institute has prepared a study entitled "Radio Facilities in Exploration Geophysics," in which the Committee presented a detailed outline of geophysical methods and the operational techniques involved, in order to provide an adequate background for an appreciation of the importance of radio facilities in petroleum exploration. The Central Committee also prepared a detailed study on pipe line microwave usage to be presented as an Exhibit in Docket 9552 in the matter of allocation of frequencies and promulgation of rules and regulations for a theatre television service.

The Central Committee feels that the use of radio in the drilling for and production of petroleum and natural gas is so vitally important that a special study and report on the use of radio facilities in petroleum production should now be prepared and made available to the Federal Communications Commission, to the petroleum and natural gas industries and to the public, generally, through the trade press and other distribution services. Dr. William M. Rust, Jr., Chairman of the American Petroleum Institute's Central Committee on Radio Facilities, at the Annual Meeting of the Committee at Chicago, Illinois, on November 10, 1953, appointed the Committee on Use of Radio in Oil Production, with Mr. L. A. M. Barnette as Chairman, to prepare such a report. Mr. Barnette called a meeting of this special committee to prepare such a report on December 5, 1953, at Houston, Texas, at which time preliminary assignments of topics to be covered were made. Another meeting was held at Houston, Texas, on May 24, 1954, to review the various reports furnished and to begin the drafting of the final report. A progress report on the study was presented by Mr. Barnette at the Semi-Annual Meeting of the Central Committee at Washington, D. C., on June 9, 1954. This final report is now being submitted herewith and it is hoped that it will serve to give a broader understanding of the vital role which radio plays in petroleum and natural gas production, not only under the emergency conditions which frequently arise in this activity, but, just as importantly, in the regularly established day-to-day operations.

As might be expected, this report must be elementary as far as drilling and producing operations are concerned. It will be evident that all the data and descriptions about techniques, machinery, and tools are incidental to the main theme--people. Few are the industries that demand so varied an array of arts, skills, and crafts. Even so, it will not be possible, in a limited report, to go into the thousands of variations of detail of all the possible combinations of circumstances met in this activity, either regularly or whenever troubles arise from unusual circumstances. In a large measure, this report covers the day-to-day petroleum drilling and producing operations and the unquestionably essential role played by two-way radio. This report will show the vital role radio plays in every phase of petroleum drilling and producing operations whether on land, in all the faraway and isolated areas where petroleum is found, or in offshore drilling operations where radio is used in all the important ways it is used on land but, in addition, in still another dimension, in radio location, radio positioning, and radio survey work generally.

Approximately two-thirds of Petroleum Radio Service two-way stations are used for drilling and producing operations. Additionally, radio for this and other branches of petroleum is required in a number of other radio services. These include maritime for mobile and fixed locations, aviation, emergency, land transportation, experimental, and possibly others. Petroleum production is now looking into the microwave region for communication relief and for telemetering and supervisory control in the places where it is possible to use such high frequencies due to the relatively short distances of direct propagation.

Total demand for petroleum passed the 8,000,000 barrels per day mark in 1953 and domestic demand alone will pass that level in 1954. Crude production gained 3.2 percent to 6,460,000 barrels daily in 1953 and will reach 6,557,000 barrels per day for 1954. Natural gas production increased 5.2 percent in 1953 to 8 trillion cubic feet. Production at natural gasoline and cycling plants averaged 662,400 barrels daily in 1953 for a gain of 9.5 percent. Refinery runs averaged 7,002,000 barrels daily in 1953, an increase of 2 percent, and runs to stills may average as much as 7,134,000 barrels daily in 1954. Proved reserves of total liquid hydrocarbons increased 901,000,000 barrels in 1953 to a total of 34,636,000,000 barrels. Natural gas reserves are estimated at 205 trillion cubic feet.

To provide these precious reserves, which are so vital to our national defense, and to supply the staggering demands for all kinds of petroleum products, which make such an important contribution to our national economy and our American way of life, the petroleum and natural gas industries must carry on a gigantic and never-ceasing exploration and drilling program. Drilling programs for 1954 call for a total of 48,410 wells, including 11,218 wildcats and 37,192 field wells. Total completions reached a new high in 1953 with 49,279 wells, an increase of 3,458 wells or 7.5 percent over the preceding year. Wildcat completions gained 4.8 percent in 1953, to set another all-time record with 11,062 wells. Radio not only makes such ambitious and gigantic exploration and drilling programs more easily accomplished, but it becomes, indeed, the indispensable tool without which it would be impossible to fulfill such a huge program of development.

HISTORY

The use of radio in petroleum drilling and production operations began in the early 1930's when a number of operators found it to be the sole means of electrical communication available between isolated marsh, water, and swamp areas, and their dry land bases 16 to 40 miles distant. Its original employment for essential communications answered an emphatic need in furthering the safety of operations in both routine and emergency situations. Accidental injury, sickness, oil field well blowouts, fires, explosions, and failure of transportation were then, and remain now, hazards to be anticipated in day-to-day operations. The imminent probability of hurricanes in coastal areas added further emphasis to the importance of a rapid and dependable means of communication, to enable operators to prepare drilling equipment and producing fields for forthcoming storms, summon boats and evacuate personnel.

The Louisiana Division of the Texas Company, Producing Department, for example, installed four radiotelephone stations in southern Louisiana in 1932, utilizing the geophysical frequencies in the 1600 KC band available at that time for operations of an exploratory nature. Somewhat later in the same year, these installations were relicensed and modified to accommodate ship radiotelephone frequencies in the 2 to 3 MC band. Fortunately, alterations were completed just prior to the first hurricane of the season, during which men from Caillou Island and Lake Barre, Louisiana, were evacuated, except for

skeleton crews; and attentive radio watches were established to advise men at these outlying installations of the progress of the hurricane.

The utilization of ship radiotelephone frequencies continued until the year 1940, when war conditions forced cessation of their use. Meanwhile, petroleum drilling and producing operations in other than water areas were also expanding and attended by most of the same daily operational problems and hazards found in isolated areas. Plans were then started to commence operation in the 25 to 40 MC band, but the wartime scarcity of materials and lack of frequency allocations prevented completion of the proposed change till the end of World War II hostilities.

Upon formation of the Radio Technical Planning Board in 1944, petroleum representatives presented proposals to include production uses of radio on a provisional basis. Radio station licenses were shortly granted by the Federal Communications Commission for specified frequencies above 25 MC and were valid for one year. By the middle of 1945, a number of petroleum people were commencing to use the newly available F-M equipment in earnest for communication in drilling in isolated locations involving swamps and marshes as well as dry land and desert areas. The use of maritime frequencies, particularly ship-to-shore, also regained momentum at that time.

Mass availability of radar, both new and surplus, greatly influenced petroleum drilling and production use of electronic equipment

after World War II. What is believed to be the first civilian owned, shore-based radar in the U. S. A. was erected in the spring of 1948 by an oil company on the coast of Louisiana as a private aid to navigation and, with the aid of radio communication, has served the purpose wonderfully well during storm weather and other periods of low visibility. This shore-based radar proved to be of definite value in saving of lives and property shortly after its installation. Hurricane detection and tracking by radar in petroleum producing operations were commenced in the fall of 1948. Of course, many crew boats and other small vessels were and are equipped with navigation radar of the surface search variety. A large, though undetermined, number of radars of this type are currently serving petroleum drilling and producing operations.

Safety of life and property continued to constitute the primary basis for licensing until 1948 when the Industrial Radio Service was established under Part 11, FCC Rules and Regulations. Section 11.151 (a)(2) officially recognized operators' rights to utilize radio for communications essential to the efficient conduct of petroleum operations.

In its wide varity of present-day applications, radio is saving money, time, and labor in true Paul Bunyon fashion, by making possible essential communications over the spaces and distances characteristically involved in exploration, drilling, producing, and transporting of petroleum products. These economies are reflected in the present cost to the public of gasoline of better quality and yet equal or lower

price than 25 years ago. Transmission by radio of orders to drilling rigs materially reduces stand-by time, where operating costs in excess of $1,000 per day per rig are commonplace. Dispatching and control of field working forces by radio result in maximum productive effectiveness with a minimum of lost motion by roustabout gangs and workover crews. The transmission by radio of production reports and orders in remote locations minimizes administrative obstacles in reducing mileage traveled and time-lags in accounting for deliveries and results in a general improvement in efficiency by making possible a comprehensive liaison between field forces and supervisors. Orders for supplies, dispatch and control of supply boats and barges, are thus greatly simplified.

No single fact is perhaps more indicative of the invaluable service rendered than the phenomenal expansion of radio facilities being utilized by the industry. That this versatile medium is a sound investment is clearly evidenced by its growth from 5,000 stations in 1948 to 24,000 in 1954. The farsighted and judicious concept upon which the Industrial Radio Service was established in 1948 can hardly be questioned in considering the immense contribution of radio communication to the efficiency of an industry occupying such a significant fole in the security and economy of the nation as does the petroleum industry.

PETROLEUM NATURAL RESERVOIRS AND THEIR BEHAVIOR

Oil and petroleum gas accumulations in the earth are from prehistoric times and unknown origins. A number of theories have been

advanced, but none of them explain the facts observed in finding petroleum reserves. Economically producible petroleum comes from porous earth formations surrounded by impervious earth structures like shale and clays and partially hemmed in by water of various degrees of salinity. Geophysical search for such structures as salt domes and the like greatly increases the probability of finding petroleum because of the traps in which petroleum may accumulate around such structures.

A petroleum reservoir of the sand type is made up of porous and permeable rock, the interstices of which contain an accumulation of oil and gas under pressure. The rock, in general, has much the same physical characteristics of concrete or other stone. The oil, under reservoir pressure, normally contains gas in solution, and any gas present in excess of that which can be held in solution in the oil under the prevailing pressure and temperature will be found occupying the higher portions of the sand body in the form of a gas cap. Salt water is usually present, underlying the oil and occupying the sand body extending away from the oil bearing zone. The original static relationship thus is one of free gas, if present, occupying the crest of the structure, oil underlying the gas, and water below the oil. This zonal arrangement is due to the gravitational segregation of the fluids over geologic time.

Aside from the possible presence of underlying water, an oil sand normally contains in its pores some initial interstitial or connate water (commonly ranging from 10 percent upward) held by capillary forces, thus reducing the possible oil content of the sandstone. The

volume of stock-tank oil is further reduced by the fact that the reservoir oil shrinks in volume due to the release of the dissolved gas upon reduction of pressure when the mixture is brought to the surface of the earth.

Gas dissolved in reservoir oil has important beneficial effects on the physical properties of the oil, the most important being the reduction in viscosity. Gas in solution renders the oil much more mobile and easy flowing than it is after the release of gas from solution, which occurs with pressure decline in the natural reservoir as petroleum withdrawal progresses.

The flow of reservoir fluids through the earth strata is a mechanism in which pressure, relative permeability to oil, gas, or water, and relative saturation of the three fluids are gradually changing and requires continuous engineering study. Permeability to each of oil, gas, and water, after flow is established, is dependent upon the relative saturations of the pore space in the rock. However, at low relative saturations there may be practically no flow of any one of the three fluids. This is illustrated in dissolved gas drive fields where produced gas-oil ratios are equivalent to solution gas until the saturation of free gas in the sand has reached 5 percent to 10 percent, when the produced gas-oil ratio begins to increase to uneconomic limits.

Increase in the water saturation of a sand as water advances has a somewhat similar effect, eventually resulting in high water-oil ratios, but the trend is less rapid than with gas, with the result that a much larger portion of the oil in place will be displaced by water advance before oil flow is retarded and its ultimate production becomes negligible.

It is impossible to recover, by normal means, all of the oil originally present in an earth reservoir, the actual limit being dependent on the stratum and the fluid characteristics. As a broad rule of thumb, maximum yield may be regarded as around 80 percent of the original oil in place, though usually somewhat less; and the remaining unrecovered oil usually being termed the minimum residual saturation.

Oil Recovery Mechanisms

The three basic mechanisms by one of which oil may be recovered from the sand are: (1) simple expansion of the gas released from solution in the oil, no free gas cap or significant water drive source being present; (2) displacement of the oil from the sand by downward expansion of a free gas cap; and (3) upward displacement of the oil by influx of water from below the oil sand. These processes have been labeled, respectively, Dissolved Gas Drive, Gas Cap Drive and Water Drive. In practice, it is seldom that any one mechanism is the sole agent in oil recovery, but the degree to which one or another is utilized will have direct bearing on the field behavior and ultimate oil yield. The degree to which gravitational segregation of the various fluids is retained or favored will also bear on the practical effectiveness of these mechanisms.

DRILLING OPERATIONS

Normal drilling of wells, in the effort to find and produce petroleum involves the work of many people and large amounts of heavy and specialized equipment along with indispensable radio communication

facilities. Physical operations concerned with the drilling of a well generally begin with preparing of a site to allow moving in of the heavy drilling equipment, actual drilling operations, various logging operations, taking earth rock samples called cores, placing of steel pipe to case the hole, cementing the casing in place, shooting holes through the casing into the earth formation (called perforating) and possible acidizing or fracturing the formations by the use of exceedingly high pressures from pumps on the surface of the earth. Two-way radio is required for regular work and coordination of the host of people in all these diverse functions. With all the precautions and tests only about 1 well in 43 wildcats produces commercial quantities of petroleum. A typical drilling risk is further illustrated by the 1953 report of one company to the effect that 67 out of 90 wildcats in a given area proved totally nonproductive. Daily safety rehearsals emphasize need for careful handling of heavy machinery and work around the high fluid pressures involved.

Drilling locations are chosen carefully, based on all available information as to geology and geophysical measurements made prior to that time. Bulldozers, drag lines, dredges and other road-building machines are brought into action to build access roads or passages to the drilling location. Areas are leveled, earthen reservoir tanks of several hundred barrels capacity are constructed or steel tanks moved in, and the drilling rig and drilling crews moved in to commence the drilling operation. Modern drilling equipment is highly complex and powerful, weighs many tons, and requires skilled personnel to operate.

Supervisory coordination by two-way radio during rigging-up periods and during drilling operations is very important. Efficiency of operation of these crews is ultimately reflected in the supply of petroleum products sold to the public.

Actual drilling for petroleum with the present-day equipment involves special tools in nearly every phase. The very heavy, hollow drill stem (or drill pipe) is forced to rotate in the earth carrying a drill bit on the lower end. Through the drill pipe and bit, special drilling fluid, called drilling mud, is pumped to flush the earth cuttings and chips up the annular space around the drill pipe to the surface of the earth. Modern drilling uses motors, either diesel, diesel-electric, or steam up to 300 horsepower to rotate the drill assembly, while other engines up to about 1,000 horsepower circulate the drilling fluid at pressures up to 2,000 psi and yet others of 1,700 to 2,000 horsepower hoist the string of drill pipe when the drill bit is dull and the drill pipe must be removed to change the bit.

Great variations in physical characteristics of earth formations being penetrated require close supervision by experienced men in applying proper techniques, especially of drilling mud control, to cope with the many problems. This drilling fluid work is supervised by an expert on such matters who is known as a mud engineer. Mud engineers are specialists, usually of chemical engineering background and special training in colloid chemistry. The drilling mud problems range from simple make-up of normal loss of drilling fluid into earth formations penetrated to the converse of "making mud" that occurs naturally while

drilling certain shale formations. Cases occur all the way from rapid or total loss of the drilling fluid into the earth formation ("lost returns") to well blowouts that occur when the hydrostatic column of drilling mud is insufficient to retain natural earth formation fluid pressures encountered. Porous limestone drilled through in Florida may receive expensive drilling fluid so fast that extra water pumped from a near-by canal is required to cool the drill bit and allow drilling to continue. On the other hand, porous oil-bearing limestone in western portions of Texas can be so contaminated and preferentially wet by water-type drilling fluid that the well may require careful treatment to keep it from being worthless as an oil producer. Drill bit penetration of a high pressure earth formation may require the addition of weighting material to the drilling mud to retain the formation pressure and allow further drilling that often encounters next a porous formation that drinks the highly expensive weighted mud. Many tons of expensive chemicals are consumed in drilling the modern oil well and these may include caustic, tannin, starch, barytes, and phosphates.

Causing the mud to form a protective sheath of filter cake on the walls of the hole recently drilled is an important function of this drilling fluid. This sheath, however, may be a hindrance to the cementing of the steel pipe casing later required in the hole to permit deeper drilling and/or petroleum production. Mud engineers must ply their skills on widely spaced wells being drilled simultaneously and in locations where wire line communication is nonexistent and their construction not feasible, indicating dire need of two-way radio.

Blowouts are those cases when high pressure water, gas, oil or combinations of these may blow the drilling mud out of the well and frequently result in fire damage when the petroleum fraction is ignited by spark from any source. Disastrous fires can, and often do, result from such uncontrolled circumstances as these, as well as the old-fashioned "gusher" that was equally out of control. Oil fields having such accidents befall them have resulted in loss of millions of dollars worth of precious petroleum reserves. Such blowouts and fires can be even more difficult to control in tideland areas, where transportation is a serious problem, and a few such cases are described later in this report.

One of the numerous methods employed in the elusive search for oil is mud analysis logging and it consists of making accurate measurements of minute amounts of petroleum constituents brought up to the top of the ground by the drilling mud from the drill bit. Ultraviolet lamps assist the operator in optically finding small specks of oil in samples of the drilling mud, while electrically heated combustion elements provide a means of measuring microscopic traces of petroleum vapor. Both gas and oil can be detected by these means in much smaller concentrations than would ever be producible economically. Discoveries of oil or gas traces in the drilling mud are reported immediately to the supervisor for geologic consideration in determining whether to continue drilling operations or to cease them and test the formation for petroleum production ability. Stand-by crew and rig time is exhorbitantly expensive, making even greater the need for two-way radio communications for transmitting work orders based on such findings and conditions.

Electric logs of the earth formations are regularly made one or several times while drilling is in progress and during the intervals of time when the drill bit and drill pipe have temporarily been removed from the well. Electric logs are made by lowering into the well an electronic probe containing a number of radio tubes and corresponding circuitry and attached to special electric cable for the purpose of measuring electrical potential and resistivity characteristics of the earth strata. Correlation of these electrical values with types of strata is an important interpretation by the field geologist, whose recommendation to the chief geologist results in a decision of what to do next regarding the drilling rig program of operation or well completion. Vital decisions like these and concerning development of petroleum reserves must be made and orders communicated immediately.

Somewhat similar well logging procedures of growing utility are used involving nuclear techniques resulting in gamma ray and neutron ray logging. Some logging also includes placing neutron markers in the walls of the well for depth reference points in future logging operations. These are additional means to try to further insure finding petroleum reserves and not overlook them.

In addition to part or all of the above operations that are part-and-parcel of petroleum well drilling operations, actual samples of the drilled-up earth rock chips, called cuttings, are gathered regularly, washed and analyzed by the paleontologist under his microscope for microfossils and sand grain size and shape information. Much slower and greatly more expensive portions of drilling involve special drill bits and techniques to cut sections of the earth rock

formations being penetrated and such operation is called coring because one of the most widely used methods obtains a core from the center of the effective cylinder being drilled out to make the well. Side-wall samples from the hole also are taken on occasions to further round out the information acquired in the expensive operation of drilling a well and to further insure not passing up any possible petroleum producing horizon of earth strata. Decisions and further work orders are determined from well logging data and radio communication moves these orders in economically developing these natural resources.

When drilling of a well is nearing completion, the calling out of cementing trucks and crews is required to cement the casing into place. This protects the well by keeping it open and yet preventing formation fluids from entering at one level and leaving at another that might allow salt water to contaminate a municipal water supply, for example. Special crews may then be required for perforating the steel casing in the appropriate potential petroleum producing zone that may be only a foot or so thick and several miles below the surface. Perforating the casing is accomplished by lowering into the cased well a special gun containing explosive charges to propel bullet slugs through the steel and cement deep into the earth strata at the carefully measured depths. An alternative casing perforating technique makes use of shaped charges, similar to those used by demolition squads, that are electrically fired successively for the desired number and location of casing perforations.

Hazards to safety plague these operations on every hand, as

illustrated by an example where a reliable and experienced perforating company had an accident to occur on an oil well derrick floor in south Texas when a perforating gun exploded prematurely injuring four men, one critically. High velocity jet shots were thus fired accidentally in many directions on the 3rd of July, 1953. The role of two-way radio at such a scene, many miles from the nearest town, needs no elaboration.

Alternative well completion techniques may be employed in different types of producing horizons. Truck-mounted high-pressure pumps may be summoned to inject acid through the casing into limestone formations in hopes of starting oil to flow or of increasing meager oil production. Alternatively, high pressure pumps may be used to fracture the potentially productive formation by forcing other fluids into, and making cracks in, the stratum involved. Still other well completion cases require that preferentially oil-wet plastic or other injections be made to consolidate crumbly sandstone formations that otherwise would plug the well from further production. The use of two-way radio for economic development of these natural resources is evident and essential in safely completing such operations.

Production testing of wells, either completed or believed to be completed, is yet another complex and specialized task again requiring special tools and skilled personnel. Coordination of all these efforts is a task of great magnitude. As such a small percentage of wells drilled prove even slightly productive of petroleum, it is neither economical nor feasible to consider placing wire line communication facilities to such isolated locations for temporary communications. Again, two-way radio is pointed to as serving this essential function where the public welfare is served.

PETROLEUM PRODUCTION

Production of petroleum from earth formations is from all conceivable depths to below 17,000 feet with some wells having been drilled to over 21,000 feet in further search. Sandstone, referred to in petroleum geological circles simply as sand, is the source of some three-fourths of U.S.A. petroleum reserves. As described above, oil well completion practices are considerably different where oil is found in sand formations from those where it is found in limestone layers. The most desirable form of oil production from the completed well is from where there is much stored energy in the form of underlying waterdrive. Desirability of a petroleum reservoir may further be enhanced where pressure is augmented by dissolved gas and/or a gas cap. In all these cases, the pressure forces the resultant petroleum mixture to flow through the oil well casing and tubing to the surface of the earth. Where fluid pressure in the earth formations has been depleted or is small when a field is discovered, the use of artificial lifting equipment is required, taking the form of mechanically or electrically powered pumping units, or else gas lift from available high pressure gas from other sources if it is available economically.

In most cases production consists of oil and gas mixtures that also contain salty water from a few percent to over 99 percent of the liquid volume. A conventional system of gas and oil separation equipment may include pressure vessels in which a major portion of the gas is allowed to separate through headers into a gas pipe line gathering system and the oil passed on to some variety of treater. Heat

and chemical treating of the liquid oil constituents are the customary requirements for the purpose of separating emulsified water to allow its disposal and make the oil of acceptable pipe line grade for transporting to a refinery.

Operating practices 30 years ago made actual recovery of only approximately one-fourth the oil in a reservoir before pressure depletion and percent of salt water production with the oil made such ventures unprofitable. Currently, through advances in technology, recovery efficiency is customarily of the order of 40-45 percent, or in special cases up to 80 percent, of the liquid petroleum in place in the earth formations. Field pressure maintenance frequently is attempted by water injection into special wells with casing perforations at levels immediately below the oil-producing horizon. Pressure maintenance may also be acquired by gas injection into the zone immediately above but within the porous zone from where the oil is produced. These procedures are excellent and are used as a means of recovering the maximum possible amount of petroleum from a reservoir. Keeping the ever-mounting lifting costs to as low a figure as possible and conserving as much of our natural resources as possible are supremely important considerations. These feats of reservoir engineering are indicative in a good measure of why petroleum energy is so widely available. Two-way radio is playing an ever-increasing part in this advance where the average citizen profits every day.

As referred to in the introductory portion of this report, the tremendous peacetime demands for petroleum in this country, as well as

military needs and potential requirements, push an ever-intensifying search for petroleum. This is augmented by a constant research program to further develop these resources to their maximum for the benefit of the American people. Demand for petroleum products has forced an increase in United States production by two-fold in the past 15 years. At the same time, one of the major problems has been the increased cost of these operations that have multiplied by three in approximately the same period. In the face of all these rising costs of petroleum production, the earnings of the average American workman for 1 hour of his work today will purchase 8-$\frac{1}{4}$ gallons of gasoline, whereas, his earnings could purchase not quite 2 gallons of gasoline in 1922. Furthermore, the development of quality of gasoline is such that 2 gallons of gasoline today will transport an automobile the distance requiring 3 of those gallons in 1925. The facts serve further to illustrate the progressive spirit of the petroleum industry in its use of modern tools, such as two-way radio, to bring these economies to the public.

Improved refining techniques have added their share to this increase in value of gasoline in the face of increased taxes and the declining American dollar. This is illustrated, in part, by the fact that 30 years ago only approximately 12 percent of the average crude oil was separated out in the form of gasoline by distillation. By contrast, modern refining, by the use of a process called cracking, breaks large molecules of crude petroleum into small molecules of gasoline to increase gasoline production to approximately 45 percent of the starting crude oil.

DESERT DRILLING AND PRODUCING

A specific case of desert petroleum drilling and producing problems and attendant communication requirements was illustrated when drilling was about to begin on Mount Pinon in Central New Mexico. Executives of Sun Oil Company were greatly in need of establishing communications from the well site to the drilling superintendent at Hobbs, New Mexico, a distance of 140 miles air line. Mount Pinon is located 75 miles due west of Artesia and 25 miles south of the highway. No power or common carrier communications extended beyond the highway along the almost impassable, tire consuming, rock road to the 4,000-foot mountain top where the wildcat was to be drilled.

Building wire line communications into a temporary location such as this would not only be slow but economically impractical. Normal radio range would not extend this far, but with the extreme height, calculations showed that a circuit was possible, if all conditions were favorable.

For testing purposes a heavy duty directional antenna was placed on top of the cable tool rig which was already in place 900 feet from the mountain peak. A butane operated, automatic load starting, generator was installed near by. Communications were found to be fairly good, but it was apparent that the large antenna would not stay on the rig very long with the incessant vibration. A light weight aluminum tower, used frequently by oil companies in temporary locations, was ordered out of Snyder, Texas, along with a remote control unit for the

radio. This would allow the radio to be moved to the peak to prevent any loss of signal due to masking of the antenna by the hill.

The mountain peak was found to be almost solid rock, and normal anchors could therefore not be used. One-inch holes were drilled eighteen inches deep in the rock in which were placed loops of one-half inch cable. Melted sulphur was then poured in the holes and, when hardened, seized the cable, forming very good anchors.

Due to heavy winds, the bunk house and office were moved down the mountain to a draw about 2,000 feet from the radio location. This complicated the problem somewhat due to the fact that not only the radio would have to be remotely controlled but also the power. With limited fuel supply, it was necessary to keep the generator shut down when the radio was not actually in use. Two pairs of field telephone wire were placed down the mountain side, one to control the radio and the other to control the generator. A switch on the lower end of the power control circuit, when operated, would complete a circuit through the generator starting batteries in series with a relay at the top of the hill, which in turn would switch on the radio. The radio comprised a load for the automatic starting generator causing it to start, thus supplying power for the radio.

Under that condition, the operating personnel had full control of both the radio and power from a point 2,000 feet away and, with the antenna on the very peak of the 4,000-foot mountain, communications were very good to Hobbs and mobile coverage was good to Artesia.

By calling the rig each day before coming out from Artesia, the drilling foreman could expedite supplies and materials, saving considerable time. This system operated for several months through both summer and winter without a single failure.

This again shows that communications in petroleum production are supremely important and must be provided quickly and positively. Obstacles to be overcome in these far-flung operations do not develop according to a specification; therefore, most of the petroleum companies own and operate their own communications systems.

TWO-WAY RADIO IN OFFSHORE PETROLEUM OPERATIONS

The first phase of offshore drilling operations is that of accurately locating the proposed drilling site. The site, which has been selected in part from results of geophysical exploration, is commonly as far as 20 or 30 miles, or more, from shore. The water at this point may be up to 45 or more feet deep and, of course, is subject to high waves, swells and storms. Accuracy of location must be within 30 to 40 feet of the exact coordinates when triangulating up to a distance of 20 miles. In nautical terms, this accuracy is considered to be within about one-half of one second latitude and longitude. Need for such accuracy is shown, in part, by the magnitude of current offshore investments totaling over $325 million.

Various methods are used to establish the exact drilling location and they include Raydist, Lorac, Loran and radar as well as

conventional triangulation with optical transit instruments. In any case, use is made of some portion of the radio spectrum. Raydist, Lorac and radar require very little voice communication and can be classified as electronic location instruments. The most common method using optical instruments requires the use of radio for voice communication. When making a single isolated location offshore, triangulation and tie-in must be made to known geodetic survey markers on shore. If the distance from shore markers is 15 miles or more, the sighting-in is done at night in clear weather using pyrotechnic flares shot into the air over sight points. The usual procedure is to leave a small crew at two or more coastal markers. They are usually transported by boat to a point on shore adjacent to a marker. From there they usually must walk or wade through marshland and water carrying their equipment to the marker. Their equipment consists mostly of radios, surveying instruments, flares, food and first-aid supplies. Each such crew communicates with the other crews and orients and ties itself in with each of the other's known location. This is done by sending up parachute flares directly over their location and observing azimuth readings from the other locations. The location boat is dispatched to the approximate location using magnetic compass. The crew on this boat then sends up flares which are observed by the two or more land crews. Land crews, after coordinated calculations, direct the movement of the location boat until, after a number of "shots," it is located at the desired point. The boat crew then lowers marker buoys.

Success or failure of such an operation depends primarily on the efficiency of the radio communication. Most of this type of communication can and is handled over two-way radio. However, the boats are also equipped with ship-to-shore marine radios which would be used to talk to land stations in cases of accident and emergency. Radio equipment carried by the surveying crews must be kept to a minimum in weight and size, yet be of sufficient power to cover the distances involved as well as operate the number of hours required with only batteries or other portable power. Mobile radio sets have been installed on unusual types of transportation, including cars, boats, marsh buggies and planes. In some cases, geodetic survey points along the coast have been destroyed or otherwise obliterated by sea wave action, erosion or hurricane. In such cases it is necessary to re-establish these points by using markers further inland.

Construction of Drilling Platforms and Structures

Most drilling locations for offshore operations vary in water depth from 20 to 45 feet and require platforms of steel or wood piling. Fabricated steel structures for locations are transported by tugs and barges out to sea under good weather conditions to location points established by the surveying crew. These structures are usually transported and erected on location by some contractor and close coordination must be maintained between company and contractor. Progress reports, information regarding transportation of men and material, weather reports and weather warnings, emergencies involving sickness and accidents are only a few of the many requirements for radio during this

construction phase. Usually the contractor will have his own radio system but the company must be capable of cooperating with him regularly and during emergencies. A man injured 60 miles from medical assistance sometimes requires immediate attention. Planes have been sent on receipt of just such a radio message to distant points and have delivered the injured man to a physician. Alternatively, doctors have been dispatched by speedboat and such meeting is arranged by two-way radio to aid injured men.

Construction of an offshore platform is very hazardous, even during ideal weather conditions, and workers must be cautious at all times. Deep water locations in the Gulf are affected by heavy seas and weather conditions. Contractors must be advised far in advance of any adverse weather change, allowing them time to proceed to calm water. Most equipment must be mobile in operation and usually capable of 24-hour operation. In order to eliminate the duplicating of radio equipment, the uses of frequencies licensed to both companies are sometimes used when interference is not excessive, particularly in the 2 to 3 mc band. Marine radio equipment is standard aboard sea-going vessels and is a very important link in the development program for offshore operations.

Drilling Operations in Offshore Areas

On completion of the offshore drilling platform, equipment is installed and barges for living quarters and auxiliary equipment moored near by. A drilling crew, plus barge and galley crews, usually numbers 40 to 45 men. They are customarily replaced by relief crews at the end

of 7 to 10 days. Each location usually has some type of emergency transportation such as a speedboat for stand-by call. Hauling drilling crews by helicopter has been recently initiated.

Drilling platforms and barges must be capable of being in continuous two-way radio communication with the operating base and with mobile units aboard other vessels supplying men and material for the operation. During rough weather, the barge must be pulled away from the drilling platform to avoid collision damage to both. Men must be transported from the drilling platform to the living quarters aboard the barge. However, in some cases the drilling crew may continue to work on the rig. Where living quarters are located directly on the drilling structure, the stand-by boat is seldom used except in cases of emergency.

Radio stations aboard drilling barges must be in constant readiness because of the possibility of fires, blowouts and other accidents described in some detail elsewhere in this report. These stations are usually classed as base stations at temporary locations because of the temporary nature of their locations. It is essential that each barge or drilling platform have a radio set capable of communicating with the operating headquarters on shore which may be over a 100-mile distance.

Where there are a number of drilling locations working under or from one land base headquarters, the base radio operators must handle all types of technical communication. It is very important that during an emergency the drilling personnel talk directly to key technical personnel on land. Instructions and directions between technical personnel while engaged in oil well fire-fighting, controlling high pressure

blowouts, and such matters, cannot be relayed very successfully through nontechnical radio relay operators. A truer concept of the message is understood by the transmitting parties and unnecessary repetition is eliminated when talking direct. Drilling wells in offshore areas requires the very best technical assistance available. Specialists are used on all such jobs as handled by directional drilling companies, well surveying and cementing companies, fire-fighting companies, geologists and many others. They must at all times consult with their home or field offices for advice, reports or instructions.

Interconnection with the Bell telephone system via Marine Stations is but one communication phase but it is an essential one for petroleum offshore development. Interconnection with the telephone companies into oil companies' VHF two-way networks is not normally available for this kind of service.

OFFSHORE PRODUCTION OF GAS AND OIL

On the completion of any gas or oil well some method of production must be decided on. In offshore cases the drilling structure itself usually becomes a support structure for separators and tank batteries, though in some cases separate platforms are built in the vicinity of the well platforms for this equipment. Some companies produce their wells directly into oil barges where they are located in sheltered or calm waters. Most operations which are located outside the 3-mile limit produce into tanks located on piling or steel structures 30 or 40 feet above the water to get the tanks above the surge and pounding of heavy seas.

As in drilling operations, production requires instantaneously available communication with the base headquarters. Flow and pressure of oil wells must be measured for delivery records and production reports and these are transmitted promptly to the operating base. As oil is accumulated, it must be barged out or delivered into pipe lines for further delivery points.

In some cases, there is a central production platform which supports living quarters, warehouses and other supply facilities, all serving a number of oil and/or gas wells in the vicinity. In this instance, a base or movable base two-way radio station is installed to communicate with the land base station as well as with all mobile units of that operator in the area. Close coordination with tankers and oil barges is necessary while loading and during transit to and from the wells. Likewise, workmen must have movable radio units while working on these isolated platforms. Where a number of wells in an area are tied together into a pipe line gathering system, it is often necessary for operating personnel to communicate from one or more wells to other wells in the vicinity to coordinate flows and pressures.

In the delivery of gas into pipe line systems, the problem of coordination is not quite as complicated as in oil deliveries, because there usually is not a start and stop cycle; however, the operator must be able to communicate with his base and/or delivery point.

Transportation for Drilling and Production

Supply needed material for offshore operations requires several different types of boats. Crew boats, which carry fifteen to twenty men and small amounts of light equipment, ply back and forth between platform and base making trips that require up to 6 hours one-way travel. Stand-by boats are used for local and emergency transportation. Supply boats carry food supplies, laundry and other small items. Providing for the needs of a drilling crew requires great amounts of fresh water, diesel fuel, drilling mud, cement, pipe and chemicals. These supplies must be transported by barge or cargo vessels in all types of weather. Sea-going tugs are used to handle large cargos and barges. Many of the larger tugs and other boats are equipped with radar to assist in navigation through the waterways and harbors, especially during periods of fog or darkness. Some of these boats use the smae channels and sea lanes as large ocean-going vessels. Radar is the only practical method developed thus far for continuous navigation during heavy fog in an economical manner.

All of these boats from smaller speedboats up to large cargo vessels must have two-way radio equipment to communicate into the company network. Most of the larger boats are equipped with ship-to-shore radio sets also to permit communication to any land station. A great majority of these boats have diesel engines for propulsion power and have direct-current generators of standard voltages. Much of the small boat radio equipment is operated from a 6-volt storage battery charged by a motor generator set driven by the boat's D. C. power.

Emergency Communications

All companies operating offshore are faced with weather problems. It is the most important single factor with which such an operation is faced and strict attention is given to the slightest change in the weather and sea conditions. Weather reports are received at the operating base from the United States Weather Bureau or private weather service via teletype or telephone routinely every 8 to 12 hours and much more frequently during anticipated stormy weather. Such weather information is relayed to the outside offshore operations via two-way radio networks. Accurate plotting and movement of these adverse weather conditions must be watched very closely as major storms and hurricanes usually completely shut down all outside operations.

A very minimum of 24 hours is needed to properly secure and abandon the drilling or producing area. The movement of barges, portable marine equipment and personnel to safe and calm waters puts the greatest strain on the transportation system and the radio communication network. Such conditions can affect the lives of some 3,000 men along the Gulf Coast, more than half of whom may be on platforms or nonself-propelled barges at any one time, and involve the more than $325 million-investment referred to previously. Kindred petroleum operations in the inland waters near the Gulf will involve an additional 10,000 people and corresponding investment in excess of $200 million. High winds and waves preceding hurricanes make abandonment very hazardous, yet all of the men must be removed from the offshore structures where production and drilling is in progress. Drilling wells must be conditioned, and flowing wells and pipe lines must be correctly shut-in and other operating material properly stored.

Safety of men and property is a prime factor in such isolated locations when major disasters such as fires, collisions, and well blowouts occur. Assistance from any company is a common understanding during such emergencies and the use of common ship frequencies in rendering aid is accepted practice.

In summarizing, offshore petroleum drilling and producing activities would almost be an impossibility without good two-way radio communication.

OFFSHORE RADAR TRIANGULATION

A specific illustration on use of two-way radio and radar, such as the one which follows, is characteristic of petroleum usage in such areas. Of all the various uses to which the electron is put in the petroleum industry, its application in connection with radio communications is probably the most popular. However, with increased activity in offshore drilling, other forms of electronics have come into use and an important application in this respect is radar.

Drilling ventures at locations on water have to be treated largely as marine operations because the big problem is that of supply and the boats necessary to carry it out. From a purely navigational standpoint many companies have operated their marine craft for years using radar as an aid to navigation.

Early in 1953 Kerr-McGee Oil Industries, Inc., of Oklahoma City, Oklahoma, put radar to work in another way. The company was faced with

the problem of drilling a number of wells for stratigraphic information, known as "strat-holes," for geological data in Breton Sound, a body of water that joins the Mississippi River Delta on the east. In the planning stages, it was estimated that 18 of these holes would furnish the data necessary to compile enough records for intelligent action in future oil drilling operations. It actually developed that, due to good progress, many more holes were drilled than originally planned. As to the actual drilling of the test holes, a submersible drilling barge was decided on due to its high degree of mobility and the lack of need for rigging up and tearing down on each hole. Kermac drilling barge No. 3 was available at the time and it was scheduled for the job.

One big handicap in this planning stage was that of actually marking the drilling site for each well. The desirable way of establishing locations is with two or more transits set up at fixed, known points. The surveying for this job could not all be done ahead of time, even though drilling sites were tentatively decided on and plotted on a chart, because of inability to permanently mark these sites at a reasonable cost and the further need of flexibility in the program as it progressed. It was anticipated that data from the first two or three wells drilled would, in all probability, force a change in location of subsequent drilling sites. Later developments proved this to be true.

Projected depth of the wells was around 3,000 feet subsea and, as the formation in the area lends to very fast drilling, a surveying crew would really have to be on its toes. Even though visual triangulation was the desired way of staking the drilling locations, it had to be

ruled out in the planning stages due to fog which exists along the Gulf Coast in the winter months when the surveying was needed. Fog is severe at times and occurs often enough to make it a thing to be reckoned with at any time that visibility is important. Certainly a surveyor's transit cannot penetrate it. Obviously, another method of surveying had to be found because it was not feasible to tie up an expensive drilling barge while waiting for fog to lift.

After checking with some radar uses and manufacturers, it was decided that radar might be the answer to the problem. Kerr-McGee acquired a standard 10-centimeter radar and installed it on Kermac drilling barge No. 3. Close calibration on the ranges to be used most reduced the manufacturer's range and bearing resolution specifications somewhat and thereby eliminated some of the expected error.

For triangulation work with this "electronic transit," a number of prominent targets in the area were selected. They were: Dead Light, North Point Light and three well platforms. All had physical structures of such dimensions that they offered at least fair radar reflection surfaces.

The drilling barge was towed to the area and submerged. A crew of three men went to work locating the first site. The crew consisted of a civil engineer, a geologist and a radar operator. Bearings were taken on the previously described targets, and the barge's position fixed. It was then a simple matter to calculate the range and bearing to the desired spot. A boat was "talked" to the location and a buoy dropped overside. The barge was then raised and moved to the well site

and submerged for drilling. While the first hole was being drilled, the second location was marked and verified and this procedure carried out for the entire program. When visibility permitted, transits were set up on the targets and locations checked for accuracy. It developed that the degree of accuracy was within tolerance for the type of work being done. In order to reduce the error that is possible in radar computations, many bearings and ranges were taken on each location and the average of all used.

Radar was very important to the company on this project. It is evident that without radar-locating the test wells could not have been drilled in the short time they were, especially in the fog season; and developmental work resulting from data gathered would not be nearly so far advanced as it now is. Thus, vividly portrayed is another way in which radio waves served the petroleum industry in a vital role. Such illustrations again and again show radio serving the nation through its use in drilling and producing in the petroleum industry.

SHELL OIL COMPANY OFFSHORE FIRE

On March 12, 1949, a well that the Shell Oil Company was drilling with its rig No. 18 at the mouth of the Mississippi River near the tip of North Pass, blew out and caught fire immediately. Within three hours after the initial blowout, the drilling derrick was totally destroyed and the drill barge nine-tenths submerged in the ocean. In a short time two converted LSM boats, that had been stationed near by, were sucked into the crater under the water and no part of these vessels could be found even after the fire subsided some three weeks later.

After every reasonable effort had been made to extinguish the flame, blazing from a now 120-foot deep, water-filled crater, the well slowly choked up and the blazing inferno slowly died out. Before the flame was extinguished, however, additional drilling equipment had been brought to the site and a new well started only a few hundred feet away. This second well was directionally drilled to provide hydraulic interconnection into the bottom of the burning well in effort to control the flame by pumping suitable materials through the subsurface formation. Complete destruction of Shell's new diesel-electric drilling barge equipment cost that company in excess of one million dollars and the ensuing loss of two oil wells in that field accounts for loss of another million dollars of investment.

Coordination of the fire-fighting activities, as well as the drilling of the directional hole, was accomplished in an excellent manner with the aid of two-way radio communication. Fortunately, during the whole series of events from the initial blowout to the extinguishing of the flame, only one man was seriously injured and that to the extent of receiving second-degree burns.

In connection with the Shell Oil Company fire, the California Company, another oil operator in the area, was brought into action giving further evidence of the value of two-way radio. Within minutes after the initial explosion, the California Company toolpusher was reporting to his Harvey, Louisiana, District Superintendent over his radio. Simultaneously, orders were given to BARGE S-24 over California's two-way system with their Gulf Coast Division Superintendent

participating by means of the radio set in his car. In less than 15 minutes after the Shell explosion, California Company boats were dispatched and assisted in the rescue of Shell men who had jumped into the water. California Company's PBY airplane was ordered out to bring the burned man, referred to above, to the hospital and an ambulance was dispatched to wait for him at the New Orleans airport. Two-way radio was used to transmit instructions of a local doctor to BARGE S-24 concerning appropriate handling of the injured man.

PURE OIL COMPANY OFFSHORE FIRE

On January 25, 1953, an accident occurred which resulted in the loss of control and ignition of a high pressure gas-condensate well of The Pure Oil Company in the Eugene Island area of the Gulf of Mexico, approximately 39 miles out in the Gulf from the port of operation at Morgan City, Louisiana. Seconds after the accident occurred, the entire drilling structure was enveloped in a flaming inferno which jeopardized the lives of many men and endangered the loss of a multimillion dollar five-well platform installation.

As is usual in emergencies of this type, time was of the utmost importance. The main drilling structure and drilling rig were rapidly being consumed by the raging fire. The drilling derrick collapsed into the Gulf in less than 30 minutes after the ignition of the well. After all personnel had been evacuated from the platform to the crew boat, it was necessary to have a means of rapid communication between this location and the port of operation 4 1/2 hours away by boat. Fortunately, the crew boat was equipped with

two-way radio communication facilities, which allowed the superintendent in charge of this operation to communicate immediately with the office of his shore base and arrange for immediate aid in combating the fire. Had there been injuries to personnel incurred by this accident, it would have been of the utmost importance to arrange for fast speedboats or planes, doctors, ambulances, and other assistance to cope with this problem. Fortunately, in this case it was not necessary as no serious personal injuries were encountered.

It was very fortunate for all of those involved in this operation that adequate radio communication had been maintained by The Pure Oil Company, for by these communication means it was possible to summon from California, by radio and telephone, a recognized expert in the field of oil and gas well fire fighting. This expert was located in less than one hour after the disaster occurred and was on location at the fire in less than twelve hours after the accident.

In combating this fire, The Pure Oil Company moved to location a ship, the LST M/V R. W. McILVAIN, from which a center of control of the operation was conducted. This ship was equipped with an excellent radio communication system. A communication network was immediately established between this ship and the various other bessels to be used in combating the fire. This radio communication system from the R.W. McILVAIN to various ships in the fire-fighting operation was the only way possible to achieve the necessary coordination between these vessels to combat effectively a fire of this magnitude at sea. Also, 24-hour communication was maintained between the ship and the shore base

at Morgan City, Louisiana. This was necessary and very important in the acquisition of the many various services and materials required out in the Gulf at the location to combat the fire.

It is believed by the members of The Pure Oil Company who were connected with this operation that adequate communication was perhaps the most important single factor which enabled the extinguishing and control of these high pressure gas wells in the amazingly short time of only fourteen days. Had not two-way radio communication been available to this oil company, it is impossible to estimate the probable loss of human life and the hundreds of thousands of dollars additional cost, as well as the great loss of natural resources which might have been incurred in combating this disastrous fire.

RADIO FREQUENCIES AND OCCUPANCY

Turning now to radio engineering factors, we find two-way mobile radio operations in the Petroleum Radio Service are practically confined to a total of 47 radio channels allocated to all phases of the petroleum business. Some of these channels are allocated to Petroleum on a shared basis with other Services. Radio operations in connection with geophysical survey work, oil well drilling, oil and gas production, the operation of oil and gas pipe lines and gathering systems, and activities connected directly with these operations are all conducted on these frequencies. The following tabulation shows the number of transmitters authorized for operation on these frequencies in each of the regions of the National Petroleum Radio Frequency Coordinating Association (N.P.R.F.C.A.) to June 1953:

Frequency Band	1953 - N.P.R.F.C.A. Regions							Total
	I	II	III	IV	V	VI	VII	
1614 - 1800 kc	98	116	64	553	400	66	221	1,518
2292,2398,4637.5 kc	9	-	-	303	-	18	-	330
25 - 30 mc	44	62	13	557	273	189	32	1,170
30 - 31 mc	77	105	100	656	103	102	2	1,145
33.18 - 33.38 mc	888	861	779	1,525	968	455	39	5,515
48 - 50 mc	1,046	731	540	4,626	1,664	1,629	501	10,737
72 - 76 mc	24	4	8	51	5	18	29	139
153 - 158 mc	330	771	28	2,233	940	474	385	5,161
Microwave	63	46	30	224	137	3	14	517
1953 Total	2,579	2,696	1,562	10,728	4,490	2,954	1,223	26,232
1954 Total	3,018	2,958	1,583	15,475	5,482	3,761	1,310	33,587

Radio congestion in Texas and Louisiana is shown by noting the great percentage of existing stations in Region IV in this chart.

It should be emphasized that these figures, showing the total number of transmitters authorized, include all of the radio operations in the Petroleum Radio Service. Radio operations in connection with oil production activities are conducted on a shared basis with activities related to drilling and pipe line operations. In the more congested areas of Region IV, it is often necessary for licensees in production activities to share time on the same channel with others in production, drilling or pipe line operations, even in critical periods of petroleum operations.

In some of the more congested areas where radio station licensees may be using equipment which is only a few years old, interference is experienced regularly from near-by stations operating on the adjacent radio channel. However, recent improvements in the selectivity characteristics of communication receivers provide some degree of protection and thus provide for operation on the adjacent channel in the same area without too much interference. Even so, there are still hundreds of units of equipment in operation which do not have adequate selectivity to eliminate adjacent channel interference. Many licensees have found it necessary to institute modernization programs to provide for replacement of the wide band receivers in spite of the fact that, as recent as four years ago, many of the units of equipment presently being replaced were considered "superselective."

Another form of interference with radio communication that is frequently experienced in the congested petroleum operation areas is the "image" interference. This type of interference is characteristic of superheterodyne receivers, especially of the type useful on the very high frequencies. Yet is is necessary to use the superheterodyne type receiver to obtain adequate sensitivity and selectivity. In this type receiver, the very minute radio signal voltage at the input of the receiver is heterodyned, or electrically mixed with another frequency from a local oscillator, to produce an intermediate frequency; thus, sufficient selectivity and amplification can more easily be obtained. In some receivers the heterodyning action can

also take place with an undesired signal to produce the same intermediate frequency with resulting signal in the loud-speaker that is obtained with the desired signal. This image interference can be particularly serious in the congested areas where the limited number of channels allocated to the Petroleum Radio Service does not provide for freedom of selection of channels to be used. With the great degree of congestion of the petroleum frequencies, even the engineering coordination of the National Petroleum Radio Frequency Coordinating Association can do but little to alleviate the interference.

Still another form of interference that causes trouble in congested areas is the intermodulation effects in the sensitive receivers used. Intermodulation is caused by an extremely strong signal, like one next door and on a frequency near the desired receiving channel, reacting on the receiver input stages to combine with a second interfering signal in such a manner that the difference between the second harmonic of one of the interfering signals and the other interfering signal is equal to the frequency to which the receiver is precisely tuned. This intermodulation interference first became a problem several years ago in the congested urban areas and only recent advances and improvements in receiver design have resulted in any significant improvement toward reducing this type of interference.

Another type of radio interference is known as "skip" interference and it is growing worse as more stations go on the air at "skip distances" and as the sun spot activity becomes greater. This form of interference could come to be one of the worst in the next

few years. The normal reliable communication range on the very high frequencies is usually considered the maximum distance over which the direct ground wave propagation is usable. This normal range is limited to a maximum of about 80 miles, depending on several variable factors such as transmitter power, antenna height, transmission line losses, ground conductivity, receiver sensitivity and electrical noise at the receiver location. Frequently, under certain conditions of the troposphere and higher layers of ionized gases in the atmosphere, electromagnetic radiations on the very high frequencies will be reflected or refracted in such a manner that they are returned to the earth's surface at locations several hundred or thousand miles from the transmitting point. The transmission media through the rarified atmosphere is such that very low loss, called attenuation, of the signal takes place and thus the interfering signal may be received at distant locations with much strength, enabling it to override the desired direct ground wave signals which may originate only a few miles from the receiving point.

These various forms of interference add seriously to the engineering problems in connection with system planning and selection of frequencies for use in the petroleum industry. Often old equipment must be replaced with more modern transmitter-receiver units of improved design to prevent the reception of transmissions of other companies operating on the adjacent channels from causing intolerable degrees of interference to communications.

Joint use of radio channels by the various phases of activities in the petroleum industry sometimes requires shifting to other frequencies in the congested areas. As an example, the recent extension of a gas pipe line operation into a large area required a change in the frequency used by the production operations of another company. The pipe line had the same frequency throughout its system in other areas that was used by the oil production department of the same integrated company. In order to provide for operation of the pipe line system on the same frequency in the new area, the radio system, operated in connection with petroleum production operations scattered over a large portion of a state, required the assignment of a second frequency in order to provide the necessary communication facilities. This type of situation occurs in many cases.

In petroleum production operations in isolated areas, the source of power for operation of radio communication facilities is frequently a serious problem. When electric power must be generated at the production location, it is sometimes necessary to operate two-way radios from stand-by storage batteries in order to provide communication when the local power plant is inoperative or shut down for repairs or adjustments. Such radio operation places a serious limitation on useable transmitter power. In other cases, it may be necessary to provide portable electric power generating equipment with its attendant service and maintenance problems.

To obtain adequate communication range from isolated locations, it is frequently necessary to erect high antenna towers. Oil well

derricks, in many cases, may be used as the antenna supporting structure; however, in other cases it is necessary to erect antenna masts under extremely unfavorable conditions, such as on the structures in bays and offshore locations and in the marshy regions. In addition to the establishment of adequate communication facilities at these locations, maintenance of the complex radio transmitting and receiving equipment under these field conditions is a major problem. Radio communication equipment used in oil production operations must be reliable under all conditions of temperature and humidity. Complexity of the electronic equipment required for communication facilities is very great as shown in the preceding paragraphs. This equipment is required to give reliable, trouble-free service from the conditions encountered in the sandy, isolated plains of central and west Texas and the varying weather conditions experienced from the Rocky Mountain region to the high humidity, marshy areas in the Louisiana-Texas Gulf coastal region.

In conclusion, modern petroleum drilling and producing operations must have prime communication, the needs of which are provided only by two-way radio. Day-to-day operations as well as the all too frequent emergencies require close supervision and coordination of work conducted by a host of specialists. The necessity of two-way radio in these operations is further illustrated by the fact that the American Petroleum Institute's Central Committee on Radio

Facilities made request to the Federal Communications Commission to split radio channels in the Petroleum Radio Service to increase their number and, indeed, split-channel communication is already in operation in the 50 MC band. This further need exists even in the face of the excellent and monumental engineering feats accomplished by the National Petroleum Radio Frequency Coordinating Association in assisting in the selection and use of the few frequencies among the some 30,000 transmitters to get the maximum utilization even on a regional basis. Competition in petroleum production has forced the use of two-way radio, along with other modern tools, in providing the essential gas and oil for civilian and military needs and for our expanding national economy. The stringent requirements that a petroleum radio communication system must meet in order to fulfill its normal functions are greatly intensified in times of emergencies. These requirements can be met only when the user company has absolute control of the radio communication system it employes.

USE OF PETROLEUM RADIO SERVICE FREQUENCIES BY COMMON CARRIERS

There is an important problem involving the relationship between the private communication facilities being operated by the petroleum and natural gas industries and the common carriers, who are offering lease and maintenance contracts that threaten the future availability of petroleum radio frequencies, which should be brought to the attention of the National Petroleum Council at this time. The petroleum industry has such a vast stake in its privately owned and operated

communication facilities that nearly every phase of the industry's operations are, to a large extent, vitally dependent upon such radio facilities. It was this important aspect, indeed, which prompted the Council's early interest in the matter and which led to the request for the original report on this subject and to the present additional report.

Communications common carriers are openly challenging the right of the petroleum industry, and all other industries which operate their own communication facilities on frequencies assigned by the Federal Communications Commission, to provide such radio facilities for their own communications needs, but rather that common carriers should do so. The efforts to supplant private communication systems have been greatly intensified by common carriers in recent months.

In an address before the Executive's Conference of the United States Independent Telephone Association at Colorado Springs on May 10, 1954, Warren B. Clay, President of the United States Independent Telephone Association, voiced his concern over what he considered this critical problem involving the telephone industry, namely the regulatory problem developing before the Federal Communications Commission with respect to allowing public agencies and private noncommunication industrial companies to operate their own intra-system services via microwave or leased radio relay facilities. He expressed a fear that the F.C.C. might "allow valuable radio frequencies and channels on our ever-shrinking radio spectrum to become burdened with commitments

for more or less uncontrolled activities of noncommunication businesses, operated for private interest." He made reference to such a course "allowing noncommunication agencies, public or private, to sneak in the backdoor of the telephone business via microwave or leased radio facilities."

Undoubtedly Mr. Clay's remarks did refer to the petroleum industry's privately owned communication systems as well as private systems of other industries which the telephone companies intend to get "out of the telephone business". But the petroleum industry is certainly not in the communications business as such. It does not derive revenue from its privately owned and operated wire line and radio systems. It does not furnish such service to others in competition with established common carriers.

Further documentation of the common carriers' intentions in this matter is to be found in the published remarks of Peter A. Nenzel, Vice-President of the U. S. Independent Telephone Association at its 57th annual convention at Chicago, Illinois, on October 11, 1954. He said that the nation's independent common carrier telephone companies cannot "afford to be complacent about such opportunities for rainy-day revenues" as offered by communications needs of industries who are now establishing their private communication systems. He further characterized private communication systems as "an embarrassing threat to our toll business" and said private systems represent "an investment of some $20,000,000, which results in the loss of considerable private line and message to our industry." He further said

"we have lost and are continuing to lose a substantial amount of business each year with the continued development of private communication systems."

The common carriers are striving to provide communication service on frequencies assigned to private industrial users, including the petroleum and natural gas industries, while at the same time failing to use the frequencies assigned to them for common carrier service. This is clearly evidenced by the statements of C. H. McLean, Chairman of the U. S. Independent Telephone Association's Radio Service Committee, made at the same meeting in Chicago. He charged that common carriers are not taking advantage of the radio frequencies made available for common carriers. Pointing out that his Association has argued "with the FCC that a logical assignment pattern would be to allot essential frequencies to common carriers, who in turn would utilize this means to provide service to the general public in the same manner as wire line service is now provided, rather than assign separate frequencies to every classified segment of industry for their own private use," Mr. McLean then stated that "it is not easy to back up this argument when it is known that the Independent telephone industry has been somewhat hesitant in the application of radio to their operations."

Communication systems owned and operated by companies in the petroleum industry, are strictly for the purpose of furnishing each companies operating communication requirements between units of their own organization, just as a marketer or manufacturer uses his own privately owned tank trucks to deliver his own products to his own

plants or to his customers. The growth of privately owned communication systems in this industry is directly attributable to the common carrier communication companies' inability to supply the service required at the time it was needed.

In the early days of the industry, oil was found in many sparsely inhabited sections of this country in which no commercial telephone or telegraph service was available, nor were the common carriers interested in furnishing such service. As a result, each oil or pipe line company was forced to build their own communication facilities. As normal expansion took place, and communication requirements increased, it became a matter of simple economics to add circuits to existing privately owned pole lines and then to add carrier equipment to the existing wire line circuits rather than lease the required circuits from common carriers. Another advantage for private ownership was the fact that by means of portable telephones, the system could be contacted at any point along the right-of-way, which allowed instant conversation with district or supervisory headquarters from any location on the system. Obviously, this could not be done under leasing arrangements because the route of the leased facilities might be miles away from the pipe line right-of-way.

To illustrate the magnitude of privately owned wire line facilities utilized by the petroleum industry, it may be interesting to know what would happen if all of these systems were combined into one system. As competitive as it is, the petroleum industry requires a terrific amount of communication between the hundreds of different companies in

the industry. Such communications are now handled over commercial facilities and contribute a considerable amount to the common carrier companies in toll charges alone.

Visualize, if you will, a system entirely independent of common carriers, which could be set up by connecting together all of the privately owned petroleum communication facilities on a non-profit cost-sharing basis, which would enable the participating companies' personnel and management to talk to one another any place on the system. The following figures are given to indicate the size of such a system based on a cumulative totals of the largest of the privately owned systems:

PRIVATELY OWNED COMMUNICATION SYSTEMS
IN THE PETROLEUM INDUSTRY

Miles of pole line	Miles of circuits operated
30,000	170,000

It must be borne in mind that such a combined system would only be for the use of the participants who owned parts of the system and thus retain its status as a privately owned and operated facility.

In addition to the privately owned communication facilities these same companies lease well over 62,300 miles of circuits from the common carriers to reach points not located on their private systems at a monthly cost of approximately $188,000.00.

One of the arguments put forth by the common carriers in soliciting leased services, is that they are exclusively in the communication

business and are equipped with the best qualified personnel to furnish such service. However, they have no monopoly on trained personnel and the petroleum industry prides itself on the high caliber and ability of its communication engineers. Most of the industry's wire line systems are comparable in construction and operating efficiency to those of the common carriers.

It is because of this industry's progressiveness and willingness to pioneer in the development of new techniques that microwave has become such a useful tool in pipeline operations. Pipeline communication engineers were quick to see the advantages offered by this relatively new communication medium in its cost differential over wire line construction due to its channel or circuit carrying capacity. This fact, coupled with the advantage of more continuous operation due to freedom from the normal uncontrollable wire line outages caused by storms, floods, etc., and the relatively low cost of each added circuit, made microwave usage all the more desirable because of the trend toward automation in pipe line operations.

Automatic operation of pump stations makes it almost imperative that complete control of the circuits or systems used in such operations be vested in the operator and not in a common carrier which may be beset by labor troubles.

At the present time, twenty-four pipe line companies have invested more than $17,000,000 in 10,969 system miles of microwave systems with 444 stations in use. These systems are privately owned and operated solely for the licensees in the daily conduct of their business.

Mobile radio systems play a very important part in the industry's daily operations. As of June 1, 1954, there were 609 licensees in the Petroleum Radio Service operating 33,587 units. Many of these systems operate in remote and inaccessible parts of the country where radio is the only dependable means of communication. The Petroleum Radio Service is a regularly established service operating under the Federal Communications Commission's Rules and Regulations, Sub-Part G. of Part 11, Industrial Radio Services and can hardly be considered as a "more or less uncontrolled activity of a noncommunication business operated for private interest."

The petroleum industry is as vitally interested in conservation of the frequency spectrum as any other group of users, including the common carriers, and is constantly seeking ways and means to make the allocated frequencies more useable. The petroleum industry, through its Central Committee on Radio Facilities of the American Petroleum Institute, initiated tests on the feasibility of 20 Kc. channel separation in the 30 to 50 Mc. range instead of the accepted 40 Kc. separation presently authorized by the Commission and has filed a petition with the F.C.C. to authorize 20 Kc. separation in the Petroleum Radio Service. It is of interest, that the telephone company is now making similar experiments on frequencies allocated to common carrier service.

Another development which has recently come to light, is the practice of common carriers to lease radio equipment to others and operate the system so leased on the frequencies assigned to the licensee -- not on common carrier frequencies.

A few oil companies have followed this practice which has not been well received by the industry as a whole. In fact, at the June Meeting of the National Petroleum Radio Frequency Coordinating Association, a motion was made and passed "that the A.P.I. Central Committee on Radio Facilities be requested to oppose vigorously the utilization of leased radio communication equipment and maintenance services provided by communications common carriers on Petroleum Radio frequencies."

This particular question was touched upon by Mr. Lester Spillane, Assistant Chief, Safety and Special Services Bureau of the F.C.C. in a talk before the Petroleum Industry Electrical Association in April of this year. The following excerpt from his paper is pertinent:

> "A competitive phenomena is revealed by the intensified and complex use of leasing and maintenance arrangements in the conduct of operations on frequencies allocated to user groups. This device has actually long been with us. For years, some users have handled their communications by leasing equipment and contracting with others for its maintenance. In these arrangements the user obtains the license on frequencies for which he is eligible. To date our main problem in this connection has been to insure and insist that any such arrangements in no wise affect or limit the licensee's control of his stations, or in any way purport to relieve him of his responsibility under the Communications Act and the Commission's rules and regulations. With increasing activity by common carriers in this leasing field, the particular problems have become especially difficult. The contracts between user and common carrier have sometimes been so drawn as to place restrictions of various kinds on the user, and to reveal in some instances that the carrier fundamentally regarded this situation as no different from that in which it rendered communication service through facilities of its own on frequencies assigned to it. We have consistently compelled the deletion of clauses which appeared to fetter, or render ambiguous, the licensee's position. Yet only recently I heard a story, which might be apocryphal, of an industrialist who, in replacing his company owned and operated system with one provided on user frequencies by common carriers, remarked that he was not in the communications business, knew nothing about it, and was glad to turn over his responsibility in that regard to experts.

Now, of course, the fact is that while such a person would be entirely free to obtain any services available from common carriers, he would never turn over to others one iota of the responsibility inherently attaching to the licenses and frequency assignments which he or his company directly hold. This is not simply a matter of documents or casual representations. If in practice full, actual, unequivocal, control is not retained by the licensee of a station, that licensee jeopardizes his right and status as a licensee."

Colonel E. L. White, Chief of the Commission's Safety and Special Services Bureau, which has cognizance of all petroleum radio matters, recently spoke out on the same topic, when, on August 12, 1954, he said in a prepared speech at Pittsburgh, Pennsylvania as follows:

"There is another phase to the lease and maintenance contract which has been disturbing to many people. That is the offer of common carriers to render a service on frequencies allocated for non-common carrier use. This uneasiness has been abetted by the attitudes of some of the common carriers involved. They are not content to be pruveyors of equipment and technical skill as are other organizations, but seem to think that they are rendering a telephone communications service such as they could offer on their own frequencies. For example, I just saw an advertisement of one of the major telephone companies regarding a system that is operated, presumably, under a lease and maintenance contract for the benefit of one of our industrial licensees. This literature spoke of the "X telephone company's private radio system," which it is now making available to selected organizations. I'm afraid the licensee of such a system will suddenly wake up to the fact that what he has is not a system for which the telephone company is responsible, but one for which he is individually responsible...."

The Petroleum and Natural Gas Industries must continue to review carefully all contracts and arrangements which involve in any way the use of frequencies assigned to the petroleum service. The Federal Communications Commission made the allocation of these frequencies for private use, based on the demonstrated need for private communication

facilities and such use should not be confused or intermingled with any hybrid common carrier usages. If common carriers are using private facilities to furnish communication service under one guise or another, then inevitably there will be a strong pressure exerted to have these frequencies assigned exclusively to common carriers on the purported theory that such assignment would make for more efficient use of such frequencies. Management and service contracts should be placed on a published tariff basis so that all would be treated alike and so that all chances of misinformation, misrepresentation, or misunderstanding could be avoided. This would provide protection on the ultimate rates to be charged for such service. The Petroleum and Natural Gas Industry management must be alerted to the true facts concerning private communication systems and to safeguard the industry's priceless freedom of choice of communications which it now possesses.

The Central Committee on Radio Facilities of the American Petroleum Institute recently unanimously passed a resolution which adequately summarized the industry's viewpoint on this subject and which will be of interest to members of the Council at this time. The text is as follows:

WHEREAS, the members of the Central Committee on Radio Facilities of the American Petroleum Institute represents the vast majority of the users in the Petroleum Radio Service; and

WHEREAS, these members are deeply concerned over recent developments tending to indicate that the communications common carriers are making a concerted effort to make inroads into

the frequencies allocated to private users, including petroleum licensees; and

WHEREAS, the petroleum and natural gas industries are presently making use of thousands of miles of leased circuits from the common carriers in circumstances where the common carriers are equipped to fulfill these industries' communications needs; and

WHEREAS, the private communication systems of the petroleum and natural gas industries are providing such facilities because common carriers were not prepared or able to fulfill these specialized needs; and

WHEREAS, the common carriers have the primary responsibility of providing a broader but less specialized service which could not serve all of the petroleum and natural gas industries needs for specialized communication services; and

WHEREAS, the petroleum industry has invested millions of dollars in the development of its radio communications systems to perform vital functions in the discovery, production, refining and transportation of petroleum products and, therefore, now has a vastly important stake in private radio communications; and

WHEREAS, most oil producers and refiners have become so dependent on their private communications systems that the systems are considered an integrated plant facility as vital to the various phases of petroleum industry operation as drilling rigs and

refining machinery; and

WHEREAS, the petroleum industry has consistently been vigorous in asserting its right to private radio facilities for the reason that the common carriers are not able to provide the service required, because:

(1) The common carriers must design systems to cover the general needs of all of its users and cannot economically use different systems for the varying situations presented by oil producers.

(2) The common carriers are obliged to serve all customers on a first come, first served basis and cannot give the special service and maintenance required in many petroleum operations which demand continual special attention.

(3) The common carriers would not adapt their systems to new uses of radio by the industry without first making certain that a new adaptation would be financially profitable regardless of whether or not it would be a contribution to the progress of the industry's operations; and

WHEREAS, the complete indispensability of private communications facilities to the petroleum industry has become well recognized, as evidenced by the fact that even the Federal Civil Defense Administration at the National Communications Conference has noted that the petroleum industry, and, in turn, the national

security and defense would be disastrously affected if the industry's use of radio channels were impaired in any way, and has recommended that present petroleum industry radio facilities should not be disturbed, but should be permitted to continue to operate under industry control even in a national emergency; and

WHEREAS, the National Petroleum Council, advisor to the Secretary of the Interior and composed of top leaders of the petroleum industry, has clearly recognized the importance of radio in petroleum industry operations through the appointment of a Radio and Radar Committee to study the contributions made by radio both to national defense and to the normal peace-time economy by implementing the industry's vital communication, transportation, production and refining operations; and

WHEREAS, it now appears that the common carriers are actively engaged in a studied plan to include the frequencies allocated to private services by the Federal Communications Commission by inducing private users to lease radio communications equipment and maintenance service from common carriers employing private frequencies, thereby promoting a plan which could be used to indicate to the Federal Communications Commission that the private services should be abolished or their frequency allocation curtailed on the theory that their function could be handled by common carriers; and

WHEREAS, the common carriers could urge this plan on the Commission by pointing to the fact that private users were employing common carrier equipment and service rather than their own on the private frequencies;

NOW THEREFORE, BE IT RESOLVED

That the Central Committee on Radio Facilities of the American Petroleum Institute vigorously oppose the leasing of radio communication equipment and maintenance services provided by communications common carriers on private frequencies assigned by the Federal Communications Commission to the Petroleum Radio Service,

AND BE IT FURTHER RESOLVED,

That the Central Committee on Radio Facilities of the American Petroleum Institute make known to the common carriers and to all other interested parties the facts in relation to this position and the reasons why it is essential to the petroleum industry's continued operations that a system of private communications, be continued and maintained.

REPORT OF JOSEPH E. KELLER, SPECIAL REPRESENTATIVE

Chicago Meeting November 9, 1954

THE CENTRAL COMMITTEE ON RADIO FACILITIES

of

THE AMERICAN PETROLEUM INSTITUTE

THE OPERATIONAL FIXED MICROWAVE COUNCIL; A VEHICLE TO MEET THE MICROWAVE PROBLEM

The history of the growth and development of the Operational Fixed Microwave Council which was established with the unanimous approval of representatives attending the September 29, 1954, Microwave Users Council meeting in Houston, Texas, attests the key role that your Central Committee has fulfilled in the formation of this vitally important cooperative endeavor. The great potential of the microwave frequencies - which have been termed the "last frontier" of unused spectrum space - was recognized many years ago by the Central Committee, as evidenced by the fact that in this field as in many others, the petroleum industry led the way in making increased use of this high frequency communication medium. At the same time this Committee was quick to recognize that a potential benefit of this sort would surely have its attendant problems of interference which would quickly get out of hand unless far reaching and comprehensive standards were promulgated by the Federal Communications Commission in this field, and unless through cooperative endeavor on the part of the entire industry, a feasible frequency coordination plan could be effectuated.

Thus, as early as June, 1952, at its annual meeting in Washington, D. C., the Chairman of NPRFCA appointed a committee to study the problem of microwave frequency coordination and to make recommendations at its next meeting. At its next meeting, the members of NPRFCA heard the committee's report, recognized the need of an industry wide coordination plan for microwave frequencies, and instructed the committee to

contact all interested organizations, with an aim toward organizing a "Microwave Frequency Coordination Association."

Also recognizing the wider usage of microwave equipment and the need for some degree of standardization in the microwave frequencies was the Federal Communications Commission which, on May 13, 1953, issued its Notice of Proposed Rule Making in Docket No. 10500, proposing the amendment of its Rules regarding operational fixed stations operating on frequencies above 890 megacycles. The Central Committee filed its Comments with the Commission in this Docket, advising that it had been working diligently in cooperation with other principal user groups in the microwave field on the drafting of proposed rules for a new Microwave Service, so as to remove these operations from the developmental status. The effectuation of an orderly and efficient utilization of the microwave band, the comments pointed out, required the adoption of a complete set of Microwave Service Rules, rather than the minumum standards which were proposed under Docket No. 10500. Accordingly, on October 29, 1953, the Commission withdrew its proposal in Docket No. 10500, indicating that it would appear desirable to defer its actions until a complete set of Microwave Rules could be adopted.

The work of the Central Committee, in cooperation principally at this time with the National Committee for Utilities Radio and the Communications Section of the Association of American Railroads, went on. As the exchange of information, correspondence, and various studies proceeded, the name of "Microwave Frequency Coordination Association" gave way to the "Microwave Users Council." On February 24,

1954, a meeting was held in Chicago to which were invited representatives of each of the industry groups having an interest in private microwave systems. This meeting achieved the official formation of the Microwave Users Council, and at this same time the Council drafted By-Laws for the consideration, study, and suggestions of the many industry groups interested in private microwave systems. You will recall, that at the June meeting of the Central Committee, both the Central Committee and the NPRFCA ratified these By-Laws thus bringing the number of group ratifieers to the number necessary to give the Council official status.

On September 29, 1954, after months of continued study, interchange of information and suggestions, and various committee and subcommittee meetings, delegates to the Council from many fields met in Houston, Texas to unanimously approve amended By-Laws which established the Microwave Users Council under the new name of the Operational Fixed Microwave Council. In attendance at the meeting were 31 representatives and other interested parties from the aviation, petroleum, pipe lines, forest products, forestry-conservation, police, railroad, trucking and power radio fields, and equipment manufacturing companies. The unanimous action that was taken represented the final phase in the development of the interservice agency so long sought by the Central Committee to guide the growth of microwave communications facilities through cooperative efforts among the Safety and Special Radio Services licensees entitled to use the higher frequency regions.

The objectives and purposes of the Operational Fixed Microwave Council are stated in the revised By-Laws: (1) to foster the mutual interests of organizations concerned with the operation or use of operational fixed radio systems in the public safety, industrial, land transportation, marine and aviation radio services; (2) to support and promote the allocation of microwave frequencies suitable and adequate for the use of such operational fixed radio systems; (3) to assist member organizations in formulating and coordinating views on uniform standards, fair and efficient regulations and technical developments beneficial to utilization of operational fixed radio systems; (4) to establish data on microwave systems within the operational fixed radio service, maintain such information on a current basis, and furnish prospective users of such facilities with information on existing or proposed installations in a specified area; and (5) to concern itself with such other matters as may be incidental or implied in any of the foregoing specified objectives.

The operations, activities and actions of the Council are specifically stipulated under the new By-Laws to be voluntary and advisory, and the Council, except for its own operations, is not to act in a representative capacity for Council members individually. All information to be collected and maintained by the Council is to be available upon reasonable request to Council representatives, to recognized organizations, and to other concerns represented by Council representatives. The Council is to collect and maintain

information relating to operational fixed microwave stations which may be useful to the purposes of the Council and of interest to the organizations which have representation on the Council.

The Council is authorized to determine each class of organization which it recognizes to be entitled to representation; terms of representatives will be for two years; a representative may be removed by the Council for "good cause"; a member organization may withdraw from the Council at any time. Whenever required, the Council by unanimous vote may appoint a general manager, and fix his compensation. Such appointed general manager is to perform the duties and services denominated by the office and determined by the Council, and is not to be a member of the Council. A manufacturers and consultants advisory committee also may be established by the Council, "provided that all manufacturers of microwave facilities used in operational fixed systems shall be accorded the opportunity of representation on such committee."

One of the highlights of the Houston meeting of the Council was the address by Colonel E. L. White, Chief of the FCC's Safety and Special Radio Services Bureau, who spoke on the future of microwave in the United States. He touched upon many of the immediate problems affecting microwave users, and in line with the spirit of cooperation which has generally marked the attitude of the Commission in regard to the proposed Microwave Frequency Coordinating Association, Colonel White noted particularly the strong advisability for the early establishment of regular Rules for microwave operations so that the developmental status of such facilities can be removed.

Another particularly noteworthy feature of the Houston Meeting was Dr. Rust's preliminary report on the results of the survey of operational microwave which, you will recall, he had been requested to make by the FCC. Response has indicated that microwave usage will be more than doubled during the next five years, Dr. Rust said, and it might be added that this serves to confirm the Central Committee's feeling on this matter many years ago.

Official approval of the By-Laws of the Council has already been given by the American Association of State Highway Officials, the Association of American Railroads Communications Section, the Committee on Manufacturers Radio Use, the Forestry Conservation Communications Association, National Bus Communications, National Committee on Utilities Radio, National Forest Industries Communications, the American Petroleum Institute's Central Committee on Radio Facilities, the National Petroleum Radio Frequency Coordinating Association, the Special Industrial Radio Service Association and the American Trucking Association. Tentative executive approval has come from the Associated Police Communications Officials, Inc. It is expected that the American Waterways Operators who have the matter under consideration, will officially approve the By-Laws and formally enter the Council in the very near future.

The work of the Operational Fixed Microwave Council, of course, goes on. The new Council will be an excellent medium for the exchange of technical information and ideas, and it should offer unlimited opportunities both from the standpoint of inter-industry cooperation,

and from the standpoint of ever increasing friendly relations with the Federal Communications Commission. It is felt that the Central Committee's pioneering enterprise in the establishment of this Council can now prove to be of enduring benefit to the entire petroleum industry.

FCC DOCKET NO. 9288;
RE: RESTRICTED RADIATION DEVICES

Under Docket No. 9288, it will be recalled, the FCC proposes to adopt rules relating to incidental and restricted radiation devices whereby certain minimum power and field intensity limitations will be established for such restriction radiation devices. The time within which to file comments in this docket had been extended by the Commission from June 16, 1954 to August 15, 1954, in response to a petition for such extension filed by the Central Committee on Radio Facilities. In later actions, the Commission further extended the deadline until October 15 and then in response to a request filed by the Radio Electronics Television Manufacturers Association, until January 3, 1955, with the request that parties who do not plan to file their comments prior to the final day of the extended period should file their interim views on this rule-making proceeding on or before November 15, 1954.

There have been more than five years of study and revision since the FCC first issued its Notice of Proposed Rule Making on Restricted Radiation Devices under Docket No. 9288. In April, 1954, the Commission issued the latest version of its proposal in this

Docket, which nevertheless, remains substantially unacceptable to the communications industry according to the great majority of Comments filed with the Commission. Among the many organizations which have submitted opinions - all unanimous in their rejection of the proposal as it stands - are communications, common carriers, government agencies, power radio service representatives, the railroad industry, and the radio manufacturing industry.

Your Central Committee, having had the proposed rule-making of Docket No. 9288 under advisement for a long period of time, proceeded some months ago to undertake, along with the Petroleum Industry Electrical Association, a more intensively detailed study of this docket, which if adopted by the FCC, would amend Part 15 of the Rules. In order to obtain independent data from a recognized and disinterested source, upon which to base their comments, the two groups engaged the services of the Southwest Research Institute of San Antonio, Texas, to measure the induction and radiation fields of six representative Petroleum Industry Wire Lines.

The report of the Southwest Research Institute contained carefully documented data reflecting measurement tests which had been conducted in the induction and radiation fields of the six companies whose equipment was tested. From these measurements, the Institute's report concluded that all its tests conducted upon wire line carrier equipment failed to identify a radiation field. Both PIEA and the Central Committee reviewed the report of the Institute carefully and then proceeded to file their comments in objection to the proposed

rule-making under Docket No. 9288, stating in substance that: (1) wire line carrier radiation is negligible and within practicable distances of the line is blanketed by atmospheric noise; (2) there has not been a single known case of interference of radio communications caused by wire line carriers, and any cases that might arise can be solved on an individual basis; (3) the regulations contemplated by the proposed rule-making under this Docket, which require registration, type approval, certification, information upon request, inspection at will and precautionary discussion and consultation to avoid penalty of violation, would greatly increase the work of the Commission and at the same time reduce flexibility of operations by the licensees; (4) no practicable useful purpose would be served by these complicated Rules, which would nevertheless greatly increase the cost of operation of existing wire line carriers.

Specifically, the comments of your Central Committee stated that: "Based upon its years of study of the Proposed Rule Making in this Docket, the Central Committee is convinced that the elaborate and extensively detailed provisions of these proposed amendments would be wholly useless from the standpoints of both the petroleum industry and the Commission. The Central Committee believes that the Proposed Rule Making in this Docket, by reducing the flexibility of operations by the licensees, by greatly increasing the cost of operations, and by adding to the general responsibilities which petroleum industry licensees must assume - all without any compensating results and benefit to the efficient control of communication media - would be

onerous and unduly burdensome." The Central Committee Comments closed with the statement that the Committee adopted the report of the Southwest Research Institute and the Comments of the PIEA, and urged the Commission to abandon the Proposed Rule Making in this Docket.

It is interesting to note that many other groups have objected to the Proposed Rule Making proceedings under Docket No. 9288, in most cases on substantially the same grounds upon which the Central Committee based its objection. The Idaho Power Company recently filed its Comments, and "seriously" objected to the proposals on the basis that they would require too much "unnecessary book work" which would result in too little gain. The proposals, these Comments said, are "unnecessary at the present time and should not be included in the Rules." The Lenkurt Electric Company stated in Comments filed on its behalf, that there is no problem regarding radiation from balanced open wire carrier current systems at 157 kilocycles or below, at powers of less than 1 watt or from those operated in shielded cables. This company went on to state that there have been no reported cases where one of its systems has interfered with radio transmission and that the certification requirements proposed in Docket No. 9288 would be an unnecessary burden not commensurate with the problem raised.

A major supplier of carrier telephone, telegraph, and remote control carrier equipment, the Stromberg-Carlson Company stated that the proposed rules "would work an intolerable hardship on a major segment of the country's communication industry, both common carrier and private wire. The proposed rules would take no cognizance of the standard practices used throughout a multi-million dollar industry,

would throttle the further development of this country's communication network and would add many thousands, if not millions, of dollars to the expense of installing, maintaining and expanding communication services to the public."

The National Committee for Utilities Radio also has objected to the proposed rule changes in this Docket, and the Joint Technical Advisory Committee, sometime ago, suggested to the Federal Communications Commission that it should consider withholding adoption of its spurious radiation suppression table, with would become effective if the Proposed Rule Making in Docket No. 9288 should be adopted.

"PARTY IN INTEREST" PROVISION OF SECTION 309 (c) GIVEN APPLICATION TO INDUSTRIAL RADIO SERVICE

The Central Committee, through its Special Representative has been following closely during the past several months the developments in, and the Commission's interpretation given to, a most important case in the Industrial Radio Service field. Recently, the FCC issued its Memorandum Opinion and Order regarding the application by R. J. Laros & Bros. of Allentown, Pennsylvania, for an authorization for a new Special Industrial Radio Station. By its action, the Commission ruled that Peter T. Kroeger was in fact a "party in interest" within the meaning of Section 309(c) of the Communications Act. Kroeger, in accordance with the ruling in the Commission's Memorandum Opinion and order, thus is entitled to a hearing upon specific issues which he had raised by way of a protest filed with the Commission, alleging economic injury within the meaning of Section 309(c) of the

Communications Act, as a result of the Commission's action of granting without hearing the application of Laros for an authorization for a new Special Industrial Radio Station.

To recapitulate the manner in which this important case arose, it will be recalled that on July 7, 1954, Laros filed application for authorization to operate one base station and ten mobile units in the Special Industrial Radio Service in Lehigh County, Pennsylvania. Inasmuch as the application appeared to establish eligibility for an authorization in this service, the application was granted by the Commission on August 11, 1954. Peter T. Kroeger, d/b/a Mobile Radio Dispatch Service, then filed protest on September 10, 1954, pursuant to Section 309(c) of the Communications Act of 1934, as amended. Kroeger stated in his protest: that he is the licensee of Station KGA-479 in the Domestic Public Land Mobile Radio Service at Allentown, Pennsylvania; that, as a common carrier protestant he has the obligation to render service to the public and has been doing so since April, 1951; that for several years protestant was rendering radio service to Laros as one of his subscribers; that Laros discontinued taking service from protestant and applied for its own station in the Special Industrial Radio Service to which it is not entitled under the eligibility rules of the Commission; and that protestant is a party in interest because he will lose revenue as the direct result of the unauthorized grant to Laros. On September 23, 1954, Laros filed its "Reply to Protest," and on September 24, 1954, Kroeger filed his "Opposition to Reply.."

The Commission, in granting Kroeger's allegation that he is a "party in interest" under Section 309(c), cited the Sanders case as

"the touchstone of a determination" of who is a "party in interest" from an economic standpoint under Section 309(c). A protest must "contain such allegations of fact as will show the protestant to be a party of interest," within the meaning of the Sanders case, the Commission pointed out. Stating that they had previously expressed the view that the term "party in interest" is a limited one, and announcing its further adherence to that view, the Commission outlined the meat of its ruling in these words:

> "We are of the opinion, however, that the allegations herein that Laros was a customer of Kroeger, that it discontinued taking service from him, that it applied for and obtained a private radio station authorization from the Commission, and that Kroeger will lose revenue as a result of this grant, are, taken together, sufficient to spell out an economic injury which gives the protestant a standing as a 'party in interest' . . . it is precisely such loss of revenue or customers, or both, that gives substance to an allegation of economic injury in a competitive situation. We therefore find that a sufficient showing to constitute protestant a 'party in interest' within the intendment of Section 309(c) has been made."

Pending the outcome of the hearing of the case, the Commission's earlier grant to Laros has been set aside. The hearing upon this application is slated to commence at 10:00 A.M. on November 15, 1954. In applying the "party in interest" provision of Section 309(c) to the Industrial Radio Service, the Commission has given concrete expression to an issue which had been much disputed for a very long period of time. It is noteworthy that in so doing, the FCC has also recognized the ever increasing importance of the Industrial Radio Service as an integral aspect of the overall control of communication media.

The Central Committee will continue to follow this matter closely since it is obvious that the grant of this protest may well lead common carriers to lodge a number of similar protests thereby causing a serious new problem in the Industrial Service field. The danger is particularly great since, once the protest is allowed, the Rules require an immediate withdrawal of the grant in question, pending the outcome of the protest proceeding.

FCC DOCKET NO. 10743
RE: MOTOR CARRIER RADIO SERVICE

Approximately one year ago the Federal Communications Commission issued its Notice of Proposed Rule Making in Docket No. 10743 which would amend Part 16 of the Commission's Rules to establish a Motor Carrier Service to cover the use of radio in connection with the operation of busses, streetcars and trucks by common or contract carriers. Early in September of this year, the Commission issued a First Report and Order finalizing in part its proposal in this Docket, and established a new service to replace the existing Intercity Bus and Urban Transit Radio Service. Four frequencies in the 44.46-44.58 megacycle band were allocated for exclusive use by urban transits, ten frequencies in the 44.06 - 44.42 megacycle band were allocated for exclusive use by intercity busses, and the frequencies 44.06, 44.10 and 44.14 megacycles remained subject to the outcome of further proposed rule-making.

That part of the proposed rule-making in Docket No. 10743 which would have included in the Motor Carrier Radio Service the carriers of property now operating under the Highway Truck Radio Service was

not adopted. The Commission instead issued a Notice of Further Proposed Rule Making looking toward the inclusion of property carriers in the new service with eligibility limited to common carriers and possible restrictions placed on the use of radio within cities.

On October 15, 1954, your Central Committee filed its Comments in connection with the rule-making proceedings in this Docket, noting that the Commission proposes, by way of completing its establishment of the Motor Carrier Radio Service, to exclude from eligibility in this service all but "common carriers of property." The Central Committee took the position that this exclusion is wholly unwarranted and that it will serve only to work a severe hardship on vital private carriers engaged in the delivery of fuel oil and butane gas. The Comments directed the Commission's attention to the fact that these carriers perform an indispensable service by way of supplying fuel oil and butane gas to the many persons in locations beyond the reach of present pipe lines, that under present rules these carriers cannot receive adequate authorizations in any of the Industrial Services, that experience has shown that carriers have a dire need for radio in their daily operations, and that particularly when emergency conditions arise in outlying areas where telephone facilities are inadequate, radio communications are highly important to minimize delay in dispatching emergency calls.

The Comments of your Central Committee pointed out further that including such carriers as eligibles in the new service would entail

no great problem for the Commission, since their radio needs are entirely consonant with those of the common carriers of property and since coordination in this service would be quite simple. In summary, the Central Committee urged the Commission that the public interest would best be served by including private carriers under the eligibility provisions in the Motor Carrier Radio Service in order that they might be able to improve their service to the very substantial part of the nation that depends upon them for daily fuel requirements. Considering all these factors, the Central Committee urged the Commission to revise its proposed rule-making in Docket No. 10743 so that private carriers engaged in the distribution of liquid petroleum gases might be eligible for authorizations in the Motor Carrier Radio Service under the same conditions as common carriers of property are made eligible.

SHORAN MATTERS

It will be recalled that the Central Committee some months ago filed its request that the use of military frequencies 230 megacycles, 250 megacycles and 310 megacycles, for Shoran Geophysical Exploration Operation be extended until December 31, 1954. This request was granted by the Joint Communications-Electronics Committee of the Joint Chiefs of Staff, along with the statement that "the expansion of the military frequencies in the 225 - 400 megacycle band will be such that harmful interference will be caused, and consequently the authorization for the use of these frequencies may be withdrawn."

In September of this year, the Commission issued a statement regarding the operation of Shoran equipment, wherein it noted that its Rules do not provide for authorizations of this type, and thereupon advised that it does not presently contemplate that new authorizations or renewals of the existing authorizations will be made after December 31, 1954. The statement was conditioned by the possibility of provisions being made by December 31, in the Commission's Rules, permitting such use of these frequencies by non-government stations. Further, licensees were advised that they might petition the Commission to amend its Rules so as to permit such authorization, or file comments regarding the matter.

The first response to this statement by the Commission regarding Shoran equipment, has been forthcoming on behalf of Offshore Navigation, Inc., and Overseas Navigation, Inc. stating that they are conducting an evaluation program to determine, in actual operations in conjunction with Shoran equipment, the accuracy, dependability, range, power and frequency requirements of some of the phase comparison configurations which are adaptable to areas other than the Gulf Coast, which program cannot be completed until after December 31. These companies requested that the action of the Commission in not making the Shoran frequencies available after the end of the year, be delayed for a period of six months until June 30, 1955. It is anticipated that a number of other groups who have been using the Shoran frequencies may in the near future file similar requests.

FCC DOCKET NO. 11140

The rule-making proceedings under Docket No. 11140, it will be remembered, propose amendment of Parts 2 and 3 of the Commission's Rules and Regulations to revise frequency allocations in the Territory of Alaska in the 72-100 megacycle band in order that non-government fixed services might share the 76-100 megacycle band with government stations. The FCC proposal under this Docket had been touched off by a letter of recommendation from the Office of Defense Mobilization on behalf of all government agencies, which had pointed out that no assignments have ever been made to FM or TV broadcast stations in Alaska in the 76-100 megacycle band during the entire period of time since the allocation of these frequencies for this purpose. The ODM letter took the view that the population density and distribution and general economic outlook make it most likely that not all of the presently allocated TV broadcast and FM broadcast channels will be required by Alaskan broadcasters within the foreseeable future and it recommended therefore, that the pertinent sections of the Rules be amended in order that non-government fixed services might share the available frequencies in this band.

The Central Committee on Radio Facilities of the American Petroleum Institute filed its Comments in this Docket on October 20, 1954, expressing approval of the FCC's Rule Making proposals which would assign part of the FM broadcast band under consideration for use by government stations and non-government radio communication services in Alaska. It was felt by the Central Committee that this Proposed

Rule Making was a move in the right direction, and the hope was expressed that the Commission might act along similar lines in relieving the frequency congestion in other radio services. The Central Committee Comments pointed out that this proceeding would made available additional frequencies to licensees who need and can well utilize them, in a band hitherto reserved for a purpose now shown to be non-existent, and that the proposed amendments would therefore be in the public interest.

CONELRAD

The FCC recently released a voluntary Temporary CONELRAD plan, you will recall, which affects licensees of all classes of radio stations, except Standard, FM and TV broadcast stations, stations in Aviation Radio Services and stations in the Amateur Radio Service. The plan was approved and released by the Commission as a wholly interim measure, and licensees affected thereunder were requested to comply with the provisions of the Temporary CONELRAD Plan until such time as regulations in final form will be approved and made mandatory.

At this state, finalized CONELRAD plans for the various radio services are still in a developmental phase that is far from complete. Reliable indications are that the final plan will follow quite closely the provisions of the present interim plan, and the FCC has suggested informally that any licensees or groups of licensees who acquire equipment and set up facilities to effectuate the voluntary plan will be able to utilize fully that equipment and those same facilities

for compliance with the final mandatory plan. Present indications are that the final CONELRAD plan will require that Industrial Radio Service licensees monitor the broadcast bands.

It should be remembered, in connection with the entire CONELRAD scheme as it relates to the petroleum industry, that the essentiality of the petroleum industry's use of radio was recognized and confirmed by the National Communications Conference held in Washington a couple of years ago by the Federal Civil Defense Administration. At that time, it was clearly established that present petroleum industry radio communications facilities were not to be disturbed in any way and that they would be permitted to continue to operate under industry control even in a national emergency. Your Special Representative has been assured by the FCC Department which is drawing up the final CONELRAD plans, that the Commission is being guided by this position taken earlier by the FCDA.

FCC ANSWERS GROUP LICENSING INQUIRY

It will be recalled that the Central Committee on July 20, 1954, transmitted a letter to the Federal Communications Commission referring to the Commission's Order in Docket No. 10776. This Order had amended Part 9 of the Commission's Rules governing aviation services so as to provide for, among other things, the issuance of a single license for the operation of all radio stations of an air carrier fleet. The purpose of the Central Committee's letter was to make formal inquiry as to the possibility of having the Commission's Rules governing the

Petroleum Radio Service amended so as to provide for pipe line system licensing.

On October 25, the Commission directed a letter to the Central Committee in response to the Committee's earlier inquiry. The letter stated:

> "Several practical considerations have discouraged, to date, any extension of the group-licensing procedure, as now permitted in the case of mobile units, to groups of base stations and/or operational fixed stations, even though closely associated in an integrated system. Since it would be necessary, under the present concept of licensing, to list each station on the authorization by call-sign and exact location even though other license provisions such as operating frequency and authorized operating power were common to all, the advantages attendant upon combining all authorizations into a single license document would appear to be outweighed by the concomitant difficulties connected with approving minor system modifications.
>
> "Accordingly, while system licensing, in this sense, is already theoretically possible, the greater simplification apparently envisaged by you is dependent on other factors such as the elimination of the present requirement that the exact station location and the authorized operating frequency be contained in the instrument of authorization of any station to be operated at a fixed location; i.e., any fixed or land station except one authorized for portable operation at unspecified locations for limited periods under conditions such as those contained in section 11.54(e) of the rules.
>
> "It may be noted that the present requirement that each application for station authorization set forth, among other things, the proposed location of the station as well as the frequencies and power desired to be used and the essential details of the proposed antenna structure, stems from the provisions of sections 303(q) and 308(b) of the Communications Act....This and other information is essential for the Commission's Master Frequency Record as well as in connection with notifications to the International Telecommunication Union. It should be noted that neither the Commissions' Master Frequency Record nor the Radio Frequency Record of the ITU contains data with respect to individual mobile stations.

"The same information is needed to meet the requirements of the various Airspace Subcommittees functioning under the Air Coordinating Committee of the United States for the avoidance of hazards to fair navigation. Additionally, it has been considered essential, in the past , that such information be included as a part of any station authorization in order to prevent changes being made without Commission approval; however, it is recognized that some other satisfactory means may be found to accomplish the same result which will permit simplification of the licensing procedure. It is suggested, accordingly, that any petition filed by you in this matter take into account these and related problems.

"It is assumed," the FCC letter went on, "that by the expression 'system licensing; you contemplate the issuance of a single document which would constitute the instrument of authorization for the construction and operation of all radio stations comprising a single radio system serving a petroleum or natural gas transmission pipe line, in somewhat the same manner as all mobile units of a single licensee may now be covered by one authorization. It is also assumed that such a system would include, in the typical case, a series of microwave or other operational fixed stations linking various points along or near the pipeline, a series of base stations associated therewith, and conducted through the facilities of the base stations and possibly also through the facilities of the operational fixed stations.

"If the interest of the Central Committee, in its advocacy of 'system licensing', is primarily in a reduction of the customary 'paper work' associated with the filing of applications to cover the stations of an integrated communications system, it may be pointed out that considerable saving over present common practice is already possible under the Commission's rules," the letter went on. "For example, section 11.56, while requiring that a separate application be submitted on FCC form 400 for each base or operational fixed station involved, does not require separate submission of supplementary statements, exhibits, etc., in connection therewith.

"Accordingly, a single submission of such supplementary statements, exhibits, etc., which is already on file or which is submitted with any one of a group of related applications is sufficient for all applications to which it applies; provided, of course, that proper cross-reference is made in the applications involved. Where additional supplemental filings are necessary in connection with individual stations,

as for example in those cases where FCC form 401-A is required to be filed, such filings should, of course, accompany the individual applications to which they refer."

FCC DOCKET NO. 10315
RE: 72-76 MEGACYCLE BAND

By Commission Report and Order issued during the past summer, the proposals pursuant to Docket 10315 governing the assignment of frequencies in the 72-76 megacycle band in the Domestic Fixed Public Service, were adopted. The new rules which became effective August 9, 1954, provide for the operation of certain fixed radio (non-broadcast) stations in the 72-76 megacycle band in such a manner as to afford protection to television operations on channels 4 and 5 which straddle that band. This Report and Order adopting the rules relating to operations in the 72-76 megacycle band, served to terminate the proceedings in Docket No. 10315.

THE 20 KILOCYCLE SEPARATION CONTROVERSY

It will be recalled that there has been on file with the Commission since March 15 a petition on behalf of the Petroleum Industry requesting 20 kilocycle spacing of channels in the Petroleum Radio Service. The fact that this petition has been before the Commission for such a long period of time without any action by that Agency, was the subject of an August letter directed to the FCC by the Central Committee, which expressed the opinion that further delay in connection with the 20 kilocycle spacing proposal will work to the increasing detriment of the Petroleum Industry, and in light of all the circumstances, is unjustified.

The Central Committee letter took note of the fact that the International Department of the Radio Electronics Television Manufacturers Association was advising the Commission not to take action at this time to make available for assignment the 20 kilocycle frequencies between presently assigned 40 kilocycle frequencies in the 30-50 megacycle band. The RETMA International Department letter took the viewpoint that the Commission should wait to determine the seriousness of the International interference problem during the approaching high of the sunspot cycle and reserve these frequencies for the solution of International interference cases. Your Central Committee has been, of course, cognizant of the slight improvement in controlling International skip interference which likely would be realized from an International plan of channel splitting. An opposing factor of overriding importance, in the opinion of the Central Committee, is that the many years required to negotiate any International agreement would cause an extended delay in the adoption of the Petroleum Industry's split-channel proposal which would more than offset the small possible advantage that might ensue if the stand of RETMA's International Department should be adopted.

Shortly after transmitting its letter to the FCC regarding the 20 kilocycle separation matter, the Central Committee through its Special Representative decided to approach RETMA directly in the hope of reaching a more harmonious position regarding this matter. Accordingly, a letter was directed to RETMA on behalf of the Central Committee, urging that the Association give further and more extensive

consideration to this problem with an eye toward a possible re-ascertainment of the RETMA position. On October 21, 1954, RETMA's President directed a letter to the Chairman of the FCC and to all land mobile equipment users, stating that the letter earlier submitted by the International Department of that Association did not represent the opinion of the Land Mobile Communications Section, as to the approach to the problem of 20 kilocycle separation. As a result of a meeting held by the Ad Hoc Committee of the RETMA Land Mobile Communications Section on October 8, the letter continued, the RETMA Engineering Department has been requested to study the problem and has accepted the task so that specific proposals may be submitted to the Commission in the near future. A few days later, at its meeting on October 25, 1954, the Land Mobile Communications Section of RETMA went on record as favoring the immediate splitting of the 40 kilocycle channels in the 25-50 megacycle band to 20 kilocycle channels for those users who desire this type of operation.

It is, of course, the plan of the Central Committee to keep in close touch with the further developments in this matter, and it is expected that the Commission may be encouraged to take action upon the petitions filed in regard to this matter, without undue additional delay.

THE PROBLEM OF LEASE-MAINTENANCE

The much disputed lease-maintenance issue is more and more with us these days, and the corresponding question of whether private mobile radio communications facilities should be owned outright by

their operators or leased from common carrier communications companies, equipment manufacturing firms or other parties, are two matters which are of considerable interest to the Central Committee and to the entire Petroleum Industry, as you well know. You will recall that the Federal Communications Commission's Common Carrier Bureau is presently conducting a selective survey of lease-maintenance agreements made by Bell System associated companies with licensees in the public safety, land transportation, and industrial radio services. An FCC letter seeking information and viewpoints on the lease-maintenance arrangements with the Bell System has been sent to 25 or 30 licensees, selected at random from those holding authorizations in the services involved. It has been alleged that Bell System associates may have induced prospective lease-maintenance customers to purchase their services by promising them that they would get other types of telephone services faster if they signed up for lease-maintenance contracts.

Under lease-maintenance agreements, licensees who subscribe to leasing arrangements use the equipment and maintenance service but receive their authorizations and maintain their status as private radio licensees within the particular service for which they are eligible. Under the Rules of the Federal Communications Commission, they are required to retain supervision and control of the radio facilities for which they are licensed. In this connection, serious questions have been forthcoming from the Commission as to the validity of licensees' control and responsibility when they operate under lease-maintenance arrangements.

The primary fact to be remembered in regard to this matter, is that the licensee himself is personally and individually responsible to the FCC for the operation and maintenance of all equipment licensed to him, in full compliance with the provisions of the Commission's Rules and Regulations pertaining thereto. This was the central point of emphasis made by Chief Edwin L. White, of the FCC's Safety and Special Radio Service Bureau, when he recently addressed the annual conference of the Associated Police Communications Officers. "If a man does not own equipment," said Colonel White, "regardless of the nature of his contract with the person who does, he loses some measure of control over that equipment. And if a man cannot hire and fire the people who are maintaining his equipment, he has lost some measure of capacity to insure the technical quality of the operation of that equipment, regardless of the terms of the contract." The Colonel warned that the licensee of such a system may "suddenly wake up to the fact" that he individually, and not the telephone company, is responsible for the system.

The first Commission-level expression regarding this problem was forthcoming from FCC Commissioner Robert E. Lee, as he addressed the 59th Annual Convention of the International Municipal Signal Association in Atlantic City in early October. He stated that the Commission is not concerned with the details or arrangements in connection with lease-maintenance equipment, "beyond the point of compliance with law and regulations." Commissioner Lee's central emphasis centered upon the same critical factor which has always

received foremost attention from the Commission whenever the lease-maintenance question has arisen. That primary and basic fact is, simply stated, that the radio responsibilities of the licensee are exactly the same, whether the equipment is owned or leased by the licensee. As Mr. Lee urged the IMSA members, the terms of any contractual agreement into which a licensee is considering entering, should be most carefully scrutinized, in order to assure that the contents of the agreements guarantee the licensee's ability to maintain absolute control of the system involved, its proper operation and maintenance. In the words of summation of Commissioner Lee: "Own if you like - lease if you wish, but recognition and complete discharge of your responsibilities as licensees are up to you."

Warren P. Clay, President of the United States Independent Telephone Association, voiced his concern over what he termed "this critical problem involving the telephone industry", in an address before the Executives' Conference of the United States Independent Telephone Association at Colorado Springs on this past May 10th. The critical problem to which Mr. Clay referred was the regulatory problem developing before the Federal Communications Commission with respect to allowing public agencies and private noncommunications industrial companies to operate their own intra-system services via microwave or leased radio relay facilities. His expressed fear was that the FCC might "allow valuable radio frequencies and channels on our ever shrinking radio

spectrum to become burdened with commitments for more or less uncontrolled activities or noncommunications businesses, operated for private interest." He also made reference to a course that has been followed of "allowing noncommunications agencies, public or private, to sneak in the back door of the telephone business via microwave or leased radio facilities."

As this problem has developed, it became evident that industry groups and other private users of private communication facilities would have to take some concrete action on this matter. One of the first definite steps to be taken has been forthcoming from the American Gas Association which passed a resolution on October 8, setting forth its vigorous opposition to the leasing of radio communication equipment maintenance services provided by communications common carriers on private frequencies assigned by the FCC to the Petroleum and Power Radio Service. The AGA resolution recites that the Association represents the vast majority of Gas Industry users, that its members are deeply concerned over recent developments indicating that the communications common carriers are concentrating their efforts toward making inroads into the frequencies allocated to private users, that the Gas Industry has invested millions of dollars in the development of its radio systems, that the majority of gas companies have become critically dependent upon their private communication systems. The resolution goes on to assert specific reasons why the common carriers are unable to provide the required service, that the national defense as well as the nation's peace-

time welfare would be seriously affected if the industry's use of radio channels were impaired in any way.

The resolution directed attention next to the fact that it now appears that the common carriers are actively engaged in a studied plan to include the frequencies allocated to private services by the FCC by inducing private users to lease radio communications equipment and maintenance from common carriers employing private frequencies in order to influence the FCC toward concluding that the private services should be abolished or their frequency allocation curtailed on the theory that their function could be handled by common carriers. The AGA resolution concluded as follows:

> NOW THEREFORE, BE IT RESOLVED, That the Communications Committee of the American Gas Association vigorously opposes the leasing of radio communication equipment, maintenance services provided by communications common carriers on private frequencies assigned by the Federal Communications Commission to the Petroleum and Power Radio Service.
>
> AND BE IT FURTHER RESOLVED, That the Gas Industry make known to the common carriers themselves and to all other interested parties the facts in relation to this position and the reasons why it is essential to the gas industry's continued operations that a system of private communications, as presently established, be continued and maintained in those vital and special areas in which common carriers cannot possibly provide the specialized services required by this industry.

It is felt that this important problem of lease-maintenance has now reached the stage where it would behoove other industry groups and users of private communications systems to pass resolutions similar to that adopted by the Communications Committee of the AGA, and to take other appropriate concrete actions.

FCC DOCKET NO. 9703

The rule-making proceedings under FCC Docket No. 9703 would revise the Commission's Rules governing the Special Industrial Radio Service, so as to eliminate the present territorial restrictions from the operation of service and trade organizations eligible for licensing in this service. Comments filed in this docket by the Central Committee had supported the removal of this restriction which limits the area of operation to areas outside Metropolitan divisions. The Central Committee comments had asked the Commission to remove the same restriction from the category of licensees which include petroleum marketing and distribution activities.

Further developments in connection with this rule-making proceeding have been forthcoming as a result of an order issued by the FCC amending the Section 11.501(d) of its Rules governing the Special Industrial Radio Service so as to provide that, notwithstanding the present requirement that each station be located outside standard Metropolitan areas of 500,000 or more population, case-by-case exceptions will be made where the applicant can demonstrate the existence of special circumstances. Such special circumstances may be peculiarity in population distribution, terrain and directional antenna characteristics. Commission indication was that the adoption of this amendment was "only in the nature of interim relief to applicants and licensees in the Special Industrial Radio Service pending the conclusion of rule-making proceedings in Docket No. 9703 and should not be construed as a prejudgment of any issue in that proceeding."

The most recent development of this matter came on November 3, 1954, when the Federal Communications Commission issued its Proposed Report and Order relative to the proceedings in both Dockets Nos. 9703 and 10742. In this Report and Order, the FCC looks toward finalizing, with certain changes, its proposed rule-making proceedings in these dockets to revise Subpart K of Part 11 of its Rules Governing the Special Industrial Radio Service to meet the needs of that growing service and to amend the table of frequency allocations of Part 2 accordingly.

The new rules as proposed would specifically delineate the various categories of industrial activities eligible for license in the service. The scope of eligibility is broadened to include certain service and trade activities which have heretofore been excluded or limited; also to persons engaged in certain professional or consulting engineering activities and to persons providing specialized functions, under contract, to single categories of persons who are themselves eligible to use radio to perform the same function. The choice has been based on the need of a given industrial class or group of radiocommunication, and not on a special need of an individual member where the group as such could get along without radio. Exceptions to this Proposed Report and Order may be filed with the Commission on or before November 19, 1954.

CONELRAD PLANS FOR PETROLEUM RADIO STATIONS

The subject of control of electromagnetic radiation for defense purposes has received mounting interest and attention since early in 1951. On October 24, of that year the President signed a bill, S. 357, which amended Section 606 of the Communications Act, concerning emergency powers of the Chief Executive, to provide for the control of electromagnetic radiations which might serve as navigational aids to an enemy, and to provide penalties for violations.

Under the authority thus given the President, an Executive order was issued on December 10, 1951 empowering the Federal Communications Commission to enforce regulations designed to minimize the use of electromagnetic radiations by radio stations in the event of an attack or the immediate threat thereof. CONELRAD (an abbreviation of the phrase "control of electromagnetic radiation") is the short name given to the present Commission project to carry out the mandate of this Executive Order. The Commission has stated that the primary object of the CONELRAD program "is to minimize the use of radio signals which might guide enemy aircraft and, at the same time, assure the maximum possible availability of radio stations and equipment for civil defense purposes and for use in connection with other essential emergency activities, such as the production and distribution of essential goods and services and the maintenance of communication services in the interest of public safety and morale".

Thus far, the Commission has adopted CONELRAD plans for Standard, FM and TV broadcast stations, the Amateur Radio Service, the Public

Safety Radio Services and the Aviation Radio Service. Just recently the Commission has adopted an interim "CONELRAD" plan for the Industrial Radio Service which does include the Petroleum Radio Service.

Fundamentally, all of the plans now adopted provide that no transmissions shall be made during a period of "RADIO ALERT" (the term applied to the military warning that an air attack is probable or imminent which automatically orders the immediate implementation of the controlled operations of all radio stations) unless they are of an extreme emergency nature affecting the national safety, or the safety of people and property; and transmissions during these periods of emergency shall be as short as possible.

"RADIO ALERTS" should be broadcast by standard broadcast, FM and TV stations and it would be the responsibility of stations in other services to monitor and receive the alert and relay it to mobile units in the air and on the ground. Thereafter all operations except those by designated "key" broadcast stations operating on 640 or 1240 kc. would cease until notification of the "RADIO ALL CLEAR" was received.

Although the Commission has, as yet, proposed no definite and final extension of the CONELRAD Plan to the Industrial Service, it is clear that such an extension is fully contemplated. For this reason, the Central Committee on Radio Facilities is following the entire CONELRAD situation with a great deal of interest and plans to file comments with the Commission on any proposed extension of the program which would affect petroleum licensees.

In this connection it should be noted that the plan adopted for the Public Safety Radio Service expressly listed as one of its purposes

"to provide a means whereby certain stations in these services may continue their radio operations under controlled conditions, when such operation is essential to the public welfare." Undoubtedly any plan extending CONELRAD to the Industrial Services would contain a similar provision. Inasmuch as the Federal Civil Defense Administration in its Manual M25-1 dated October 15, 1952, listed petroleum companies as providing essential services and recommended that the radio facilities operated by them not be impaired even in an emergency, the Central Committee would probably recommend to the Commission that the licensees in the Petroleum Radio Service be permitted to continue their operations under controlled conditions even during a "RADIO ALERT".

A REPORT ON THE OPERATIONAL FIXED MICROWAVE COUNCIL

In June 1952 at its annual meeting in Washington, D. C., the Chairman of the National Petroleum Radio Frequency Coordinating Association appointed a committee to study the problem of microwave frequency coordination and make recommendations at its next meeting. After careful consideration and study, the committee reported (June 1953) that under present conditions no plan could be proposed that could be administered effectively by the National Petroleum Radio Frequency Coordinating Association alone as microwave frequencies available to the petroleum industry are shared by all other users in the Industrial Service; therefore, any coordination plan, to be effective, must be on an industry wide basis. The committee

recommended that other interested organizations, such as the National Committee on Utilities Radio and the Association of American Railroads, be contacted relative to forming an industry wide coordinating council.

After due deliberation by members of the National Petroleum Radio Frequency Coordinating Association, the committee was instructed to contact all interested organizations and to organize a "Microwave Frequency Coordination Association".

Members of the National Committee for Utilities Radio and Association of American Railroads (Communications Section) were contacted in regard to an industry wide coordination plan which resulted in a tentative plan being drawn up by members of the three organizations to provide the type of coordination that would enable all users in the Industrial Service to participate. Representatives of the three organizations then met with members of the Commission's staff on an informal basis to discuss the feasibility of putting the plan into action. The members of the Commission's staff indicated that such a plan would be beneficial to both the users and the Commission and suggested that we go ahead and develop the plan.

Following the meeting with members of the Commission's staff, a steering committee was formed consisting of Mr. C. D. Campbell, Acting Chairman; Mr. L. E. Kearney Association of American Railroads; Mr. Dale Schreiner, National Committee on Utilities Radio; Mr. John McKinley, National Committee on Utilities Radio; and Mr. Joe Keller, Special Representative.

On February 24, 1954 an organizational meeting was held in the 12th floor Conference Room of the Association of American Railroads

Building in Chicago. There was a total attendance of 47, including representatives from 16 national service organizations, 8 representative of microwave manufacturers and one member of the Federal Communications Commission's staff. Following introductory remarks the proposed microwave frequency coordination plan was presented.

Dr. W. M. Rust, Jr. advised that the Federal Communications Commission, on the basis of comments of the American Petroleum Institute's Central Committee and Radio Electronics Television Manufacturers Association, is undertaking to organize a joint study regarding the basis for establishing private microwave service on a regular basis. The Federal Communications Commission on February 3, 1954, addressed letters to the Central Committee on Radio Facilities of the American Petroleum Institute and to Radio Electronics Television Manufacturers Association requesting their help in this study.

Dr. Rust stated that these letters made it desirable to broaden the scope of the proposed council. The previous concept had been one purely of an informational service concerning frequencies. Now it should properly cover all phases of the problems common to Safety and Special Radio Service microwave users.

The ensuing discussion concerning Dr. Rust's comments resulted in the changing of the name of the proposed council from "Microwave Frequency Coordinating Council" to "Microwave Users Council".

Mr. J. E. Keller presented a draft of proposed Bylaws for the Council. These Bylaws were discussed at length, resulting in adoption by the group for ratification by official action of appropriate

governing bodies of the organizations represented. It was stated that the Bylaws shall become effective when they are approved by a majority of the member organizations represented at this meeting.

The following officers were elected to serve one year: Mr. C. D. Campbell, Chairman; Mr. L. E. Ludekens (National Committee for Utilities Radio), Vice Chairman; Mr. L. E. Kearney, (Association of American Railroads), Secretary.

The Bylaws were submitted to all the service organizations represented for approval. As a result of the numerous comments and suggested changes of the Bylaws by the various representatives, a special committee was appointed to receive these comments and prepare a revised draft of the Bylaws for presentation to the group at a later date.

On September 29, 1954 a special meeting of the Council was called in Houston to consider the proposed revision of the Bylaws. There were 33 persons in attendance, including representatives from ten national service organizations and five manufacturing organizations.

The Special Committee on Bylaws presented its report, recommending a revised set of Bylaws. After certain discussion from the floor and certain editorial changes in the proposed Bylaws, they were adopted by unanimous vote. Included in the changes adopted was a change in the name of the Council, the new name of the Council, being "Operational Fixed Microwave Council".

It was the consensus that the function of the Council as outlined in the Bylaws, copy attached, was most important to the continued

existence of private microwave systems and that through the combined efforts of the Council members most effective utilization of the microwave spectrum could be made and that much could be done toward establishing much needed standards and specifications for microwave equipment.

The Bylaws of the Operational Fixed Microwave Council are attached and identified as Appendix "B" and a membership list of the organizations composing the council is attached as Appendix "D".

An article on "The Operational Fixed Microwave Council" submitted before the Professional Group on Vehicular Communications in Houston, Texas on September 30, 1954 is attached as Appendix "C".

MICROWAVE USAGE

In the report of May 1, 1953 under the heading "Radio in Pipe Line Operations" considerable mention was made of the use of Microwave equipment but statistical information as to the extent of microwave usage was not then available. Since that time the Central Committee on Radio Facilities of the American Petroleum Institute has completed a comprehensive study of present systems and also data on systems now under construction and those proposed for installation in the near future.

This study covers twenty-four petroleum industry systems now in operation and shows a total lineal mileage of 10,969 miles, comprizing 444 stations and 834 transmitters. A total of 60,000 miles of voice channels are indicated as being in use plus an additional 33,000 miles

of supervisory control, telemetering and teletype circuits. The potential voice channel miles available in these twenty-four systems, if used to capacity, would be 190,144 miles.

The study included six systems now under construction which will extend 1436 miles with 56 stations, 100 transmitters, 14,000 miles of voice channels with an ultimate capacity of 35,000 miles of voice channels.

Eleven systems were reported as already budgeted, or contemplated, for a total length of 3918 miles and approximately 180 stations with other details not yet determined.

These figures clearly show the utilization made by the industry of a relatively new application of the radio art and indicate a growing trend of more widespread usage.

Of particular interest is the petroleum industry's participation in the "Operational Fixed Microwave Council" which is covered in a separate section of this report.

The complete report of this Committee is attached and identified as Appendix "A".

NATIONAL PETROLEUM RADIO FREQUENCY COORDINATING ASSOCIATION

At the annual meeting held in Washington, D. C. on June 10, 1954, the steady growth of petroleum radio usage was reflected in the number of recommendations made by the Association's Coordinators for the period from June, 1953 to June, 1954.

The complete data as of June, 1954 indicates the total number of licensees as 609, who operate 33,587 transmitters. This is an increase of 83 new users (13.6%) and 5,156 transmitters (15.2%) during the twelve months period covered. The same rate of growth has been experienced since the last annual meeting.

Their study reflected an increasing number of new users are small operators indicating a broadening use through recognition of the efficacy of radio facilities even for smaller organizations.

This has resulted in creating a problem of frequency coordination within the limited number of channels available in heavily congested areas. Only through sincere and complete cooperation of the operators involved is it possible to utilize successfully the frequencies assigned.

A 1954 membership list of the National Petroleum Frequency Coordinating Association is attached as Appendix "F".

GEOPHYSICAL USE OF RADIO

The past year has brought little change in the geophysical radio picture except in the radio-location field. Geophysical activity has continued at a near record rate and the use of radio has been correspondingly high. Indeed the increase in offshore prospecting has added substantially to the radio usage.

An interesting development, still in a somewhat experimental stage, may require a modification in some existing geophysical radio licenses. At present, each license lists a number of frequencies

but restricts a given crew to the use of a single frequency in any operation. Such simplex operation has been satisfactory in seismic work. An elastic wave is initiated in the ground at one point and the resulting earth motion recorded at a remote point. It is necessary to record, at this remote point, the exact instant of the initiation of the wave. This is done by transmitting a signal by radio from the initiating point to the recording point. The operator at the initiating point normally controlled the time of initiation. A procedure was used that permitted the operator at the recording point to synchronize his recording equipment with an accuracy of a few tenths of a second. The fact that the signal transmitted by radio was received and recorded at the recording point made more accurate synchronization unnecessary.

In the new techniques, however, it is necessary not only to record the initiation instant precisely but also to synchronize the recording equipment and initiating equipment with an accuracy of a few thousandths of a second. As a practical matter, this requires that a signal be automatically transmitted from the recording equipment to the initiating equipment. Frequently this can be done only by radio; e. g., in offshore operations. For this reason it will be necessary to obtain permission to use a second frequency.

The problems of radio-location are discussed in a separate section.

RADAR AND RADIO-LOCATION

The petroleum industry's tanker and barge fleet now is practically fully equipped with radar. Improvements in equipment this past year have been gratifying.

The situation in the field of radio-location is less gratifying. First, the perennial problem of Shoran has become more acute. Permission of the Joint Chiefs of Staff for continued use of the military frequencies has been grudgingly given. But the Federal Communications Commission has announced that it no longer intends to license Shoran on these frequencies unless formal rule-making procedures are instituted to allocate them for this usage. Since the permission of the JCS is given on the basis that the usage is to be temporary, a rule-making procedure would not seem proper. Vigorous efforts are being made to arrive at a reasonable solution to this problem.

The phase-comparison systems, operated commercially by Lorac and Raydist in the 1800-kilocycle band, have experienced serious difficulties. Propagation vagaries, associated in part with the increase in sun-spot activity, have limited the usefulness of this frequency band to the hours from well after sunrise until well before sunset. Moreover, once the service has been interrupted it is necessary for the boat using it to return to a known position before continuing operations. This may result in the loss of a major portion of the day's work.

It is believed that the propagation problem can be solved by the use of a lower frequency band. Petitions are now before the FCC

asking for permission to conduct developmental operations in the 100-kilocycle band. The second problem requires the use of so-called "lane identification" methods. These too are under study.

PROGRESS ON THE PROPOSAL FOR 20 KILOCYCLE SEPARATION IN THE PETROLEUM RADIO SERVICE

Since the establishment of the Petroleum Radio Service in 1949, the growth in the use of radio by petroleum licensees has been truly phenomenal. The ever-growing number of users and units licensed to operate on the relatively few frequencies allocated to the Service by The Federal Communications Commission has resulted in severe overcrowding in some of the Regions and has made it very apparent that positive action must be taken if progress is to continue and if all those who desire to use radio in their operations are to be accommodated.

The Region which most clearly typifies the overcrowded conditions has been Region IV, comprising the States of Texas, Louisiana, Arkansas and Mississippi. As of April, 1954, 46% of the petroleum radio stations were concentrated in this area and a major portion of these were concentrated in a belt approximately 75 miles wide along the Texas and Louisiana Gulf Coasts.

As early as 1950, it had become obvious that continued expansion of the use of radio by petroleum licensees would make severe demands on the limited frequency spectrum allocated to the petroleum industry. Although industry cooperation had made possible, almost immediately, adjacent channel operation in many areas, even these measures could not alleviate the problem raised by the rapid rate of increase in

usage. For example, the major portion of users in Texas and Louisiana were accommodated in the 48-50 megacycle band until concentration in this band revealed that the saturation point was being reached, thus confronting the National Petroleum Radio Frequency Coordinating Association with the necessity of making more recommendations in the far less desirable 30 and 33 megacycle bands where sharing with other services and skip interference prevailed. Even the making of recommendations in these bands was not a sufficient solution to the problem of overcrowding and it soon became necessary to made co-channel recommendations in certain areas, contrary to the desires of many users.

At the annual meeting of the National Petroleum Radio Frequency Coordinating Association in June, 1951, the problem of congestion in the Petroleum Radio Service was the main topic of discussion and the problem was reviewed in an attempt to find some solution. As a result of these discussions, a special engineering committee under the chairmanship of Dr. W. M. Rust, Jr. was appointed to make a thorough study of the feasibility of reducing channel separation from 40 kilocycles to 20 kilocycles, thereby doubling the number of channels available.

At the time that this committee was appointed, the National Petroleum Radio Frequency Coordinating Association had already been forced to abandon its original assignment pattern designed to minimize adjacent channel and skip interference insofar as Region IV was concerned. This abandonment was necessary to accommodate the large number of requests for frequency recommendations in this Region and still other Regions were soon forced to abandon the initial assignment plans.

Indeed, in many areas of Region IV, as many as 16 users were operating co-channel, with 4 of these within the same immediate area. Nor was this situation confined to any one band of frequencies. Had not technical improvements in equipment design made practical adjacent channel installations with the same area possible, the limited number of frequencies in the Petroleum Radio Service would not have accommodated the large number of users even at that early date in the history of the Petroleum Radio Service.

In June of 1952, the special engineering committee headed by Dr. Rust submitted its report on the feasibility of 20 kilocycle spacing. This report concluded that equipment was commercially available in the 25 to 50 megacycle band which would give satisfactory operation with 20 kilocycle channel widths. This equipment would give adjacent band operation with practical separation of adjacent channel systems and would have essentially the same service range as broad band equipment. It was pointed out that in order to permit adjacent channel operation with minumum geographical separation, proper maintenance of center frequency and maximum deviation would be somewhat more important than in the case of 40 kilocycle equipment. The committee further reported that, while it was not charged with the problem of considering the economic aspects of conversion from 40 kilocycle channels to 20 kilocycle channels, it had ascertained that much of the equipment supplied during the years prior to the report could be converted to 20 kilocycle operation at a moderate cost.

In June of 1953, after two years or more of detailed study and consideration, the Central Committee on Radio Facilities of the

American Petroleum Institute at its semi-annual meeting in Washington, resolved to proceed with the preparation of a Petition to the Federal Communications Commission for rule-making looking toward split-channel operation on the 25 to 50 megacycle band. The National Petroleum Radio Frequency Coordinating Association also adopted a resolution supporting such a Petition. The Petition was prepared by the Special Representative and submitted to the Federal Communications Commission on March 15, 1954, and is presently being considered by the Commission.

Under the provisions of the plan submitted by the Central Committee, 20 kilocycle separation would be effectuated only in the region or regions where crowded channel conditions make such a policy necessary and the plan would permit users now operating with 40 kilocycle separation equipment to continue using such equipment, without modification, for at least one year after new Rules have been adopted by the Federal Communications Commission. Subsequent to the one-year period, users would be required to comply with the new deviation requirements proposed -- plus or minus 5 kilocycles -- and after three years would be required to install new transmitters meeting the new standards. Users in the uncrowded regions would be permitted to continue to operate on 40 kilocycle separation if they should so desire and the regional committees of the National Petroleum Radio Frequency Coordinating Association would issue recommendations on alternate channels, permitting continued operation on 40 kilocycle separation.

The Petition does not seek to made 20 kilocycle operation mandatory in the United States nor does it seek to establish 20 kilocycle

separation in any band other than the 25 to 50 megacycle band. Furthermore, under the plan proposed by the Central Committee, three watt equipment used in geophysical operations would be exempted from the 20 kilocycle separation requirements in accordance with recommendations with split-channeling on geophysical frequencies would not be practical due to the technical limitations which would arise in connection with portable sets used in geophysical operations.

In filing this Petition for 20 kilocycle separation, the Central Committee has taken a pioneering step towards effecting a change in the Federal Communications Commission's Rules which, if adopted, would certainly benefit users of radio facilities in all of the radio services. The fact that the adoption of the rules proposed would double the number of channels available to the petroleum industry without forcing the Federal Communications Commission to allocate new frequencies to the Petroleum Radio Service, makes the plan doubly promising and advantageous to both the Commission and the petroleum licensees. Indeed, the possibilities offered by channel-splitting, and pioneered in by the Central Committee, are now receiving wide attention from other industrial users including many of the telephone companies, the American Association of State Highway Officials' Committee on the Use of Radio, the National Committee for Utilities Radio, and the National Forest Industries Communications. Two of these groups have already filed petitions with the Federal Communications Commission asking for rule changes which would establish 20 kilocycle separation in some of the frequency bands now allocated to them.

Since the filing of its Petition, the Central Committee has been making vigorous attempts to get prompt Commission action on its proposals. Unfortunately, some delay has been experienced in this connection due to the fact that the Frequency Allocation and Treaty Division of the Commission has been considering the feasibility of an international reallocation of frequencies which would permit 20 kilocycle spacing on an international scale. The Central Committee has recently notified the Commission that it is of the opinion that any further delay in acting on its Petition, resulting from the consideration of such an international scheme, is unjustified. The Central Committee has pointed out to the Commission that 20 kilocycle spacing on an international basis would not result in any additional channels in the 25 to 50 megacycle band since, in this portion of the spectrum, there are no frequencies allocated to any other country which are not also available in the United States.

In submitting a recommendation to the Commission that further delay in connection with the granting of this Petition be avoided, the Central Committee stated that while it is aware of the slight improvement in controlling international skip-interference which might be realized from an international plan of channel splitting, this possible advantage should not justify a delay in the adoption of the proposal set forth in the Petition of March 15, since it would obviously take many years to negotiate an international agreement which would effect international 20 kilocycle separation. In the meantime, the conditions which have given rise to this Petition

would continue to become more and more unbearable. The Central Committee, through its Special Representative, is now engaged in further negotiations with the Commission and it is hopefully expected that some satisfactory action on this matter will be forthcoming in the very near future.

APPENDIX A

HUMBLE OIL & REFINING COMPANY
EXPLORATION DEPARTMENT
GEOPHYSICS EXPLORATION & RESEARCH DIVISION
HOUSTON 1, TEXAS
December 9, 1954

C
O
P
Y

Re: 7500

Federal Communications Commission
Washington 25, D. C.

Attention: Miss Mary Jane Morris, Secretary

Gentlemen:

The Federal Communications Commission in its letter to me dated February 3, 1954, requested the Central Committee on Radio Facilities of the American Petroleum Institute, in cooperation with other groups representing present users of private microwave systems, to tabulate and forward to the Commission its analysis of the various operational communications requirements of known and potential users of microwave systems which could be satisfied by the use of frequencies above 890 Mc; together with its analysis of the suitability of each of the available microwave bands above 890 Mc for those purposes.

The Commission also requested information concerning the compatibility in the same frequency bands of short-distance fixed circuits with long-distance curcuits which use several relay points. Information was also requested concerning methods of entry into urban areas. In addition, the Commission requested that it be advised of the engineering standards which the Central Committee believes should be applied in the licensing of microwave systems, bearing in mind not only the problems of design compatibility to permit the maximum utilization of the frequency band involved at any given location, but also the collateral problem of the forced obsolescence of existing equipment if that should be found necessary.

In an effort to comply with the Commission's request, the Central Committee circulated a questionnaire to all known and potential users in the petroleum industry and solicited the cooperation of the representatives of other users of private microwave systems. Excellent response was received. The attached tables summarize the information which was received on systems now in operation, under construction, or definitely budgeted or seriously being considered. It is believed that coverage of most existing systems and systems under construction was attained. It is obviously not possible to obtain nearly such coverage on systems seriously being considered. The information available presents a reasonable picture of the various types of operational require-

ments of the systems, although it represents only a partial portrayal of the magnitude of the existing potential demand.

TABLE I summarizes the replies covering twenty-four systems now operating in the Petroleum Radio Service. It sets forth the total system miles, the number of stations, the number of transmitters (excluding standby equipment), the total potential equivalent voice channel miles, the equivalent voice channel miles now in use, and the total channel miles in use. It summarizes the type of usage presently being made of these systems and also the potential usage contemplated for these existing systems. In this table, as in others, some adjustments have been made in an effort to compensate for variations in interpretations. Thus in some cases remote control and telemetry were lumped by the respondent. For the purposes of these tables, this lumped figure has been allocated on an arbitrary basis. The total influence of such adjustments has no substantial effect on the over-all picture.

TABLE II gives similar information concerning six systems now under construction or contracted in the Petroleum Radio Service. TABLE III gives similar information for eleven systems or major extensions of systems budgeted or seriously considered in the Petroleum Radio Service. This table contains only information received directly from the proposed user. It does not include information concerning several major systems that quite likely will be constructed in the fairly near future, but concerning which the user has not reached definite enough decisions to supply the requested information.

TABLE IV gives similar information for five systems now in operation in the Forest Products Radio Service. TABLE V gives information for one proposed system in the Forest Products Radio Service and one in the Forest Conservation Radio Service. TABLE VI gives similar information for two systems now in operation in the Railroad Radio Service. TABLE VII gives information for four systems under consideration in the Railroad Radio Service. TABLE VIII gives similar information for four systems operated by Aeronautical Radio, Inc.

TABLE IX shows, for the systems now existing or under construction, the radio frequency characteristics, namely the frequency band in which the system operates, the RF bandwidth, and the pair spacing.

A study of TABLES I through VIII clearly shows several important facts. First, it can be seen that the existing microwave systems are, in general, used initially only to partial capacity. Second, it will be seen that existing users contemplate using their systems to more nearly full capacity as their requirements grow. Third, while the general pattern of types of usage is expected to remain fixed, the relative

importance of the various types of usage will change. It will be noticed, in particular, that very considerable expansion of the usage of remote control and telemetry is contemplated by the users. Moreover, new uses such as facsimile are definitely contemplated. It can be safely predicted that other uses not presently under definite consideration will arise in the future. An obvious example of such new use is industrial television.

The tables referring to proposed systems indicate that the growth of private microwave systems has by no means reached a saturation point. It would seem plausible to predict that the usage will at least double within the next five-year period.

The pattern of partial initial usage with subsequent expanded usage and a changing pattern of types of usage explains answers given by the users to questions raised concerning the type of licensing that seems appropriate. The users were asked the following five questions.

1. Should licenses list the specific system channel initially to be used with subsequent amendments to cover changes?

2. Should channel changes or additions not requiring changes in the basic RF equipment be permitted without amendment of the license?

3. Should the RF bandwidth authorized be based on total intelligence bandwidth used?

4. Should short systems and long-haul systems operate in the same band? Why?

5. Should entrance to urban areas by microwave be on the same frequency band as the balance of the system? On a different frequency band? By wire line or co-axial cable? Explain the reason for your answer.

The replies to these questions can be summarized as follows.

There is universal agreement on the part of the users that the license should specify the RF bandwidth with no requirement of listing the uses to be made of portions of this bandwidth. Nor should any authorization be required for modification of such uses provided the authorized bandwidth is not exceeded. If a useful purpose were served by informing the Commission of the details of such uses, this could be included in the application.

Likewise there is universal agreement that the RF bandwidth authorized should be the full bandwidth of the installed equipment, even though initially only part of the authorized bandwidth is utilized. Insofar as compatible with the practical limitations of the art, equipment should be selected with RF bandwidth appropriate to a reasonable estimate of the ultimate requirements of the system.

There is general agreement that the selection of band should be on the basis of the bandwidth required rather than on whether the system is a short-haul or long-haul system.

Similar considerations apply to entrance into urban areas. Insofar as possible, the entrance legs should be in the same band as the rest of the system. Careful coordination with particular attention to location of the out-lying stations will make this possible in most urban areas. In those areas, where this is not possible, it is almost certain that wire lines and co-axial cables will be completely unfeasible on economic and regulatory grounds. In such cases, the use of a different band--usually higher--for the entrance leg will be necessary.

In order to reply to the Commission's request of analysis of the suitability of each of the available microwave bands of the various operational communications requirements, the users were asked for their opinions concerning the suitability of each of the bands--950, 1850, 2500, 6575, 12200, and higher--for the types of usage with which they were familiar. The replies indicate that insofar as the users are familiar with these bands they feel that the four lower bands are each suitable for any of the purposes which they have in mind. The 950 band has some limitations due to the narrow bandwidth permitted. The users are, in general, so well satisfied with the bands in which they now operate that they would not contemplate a change in band if they were to extend their systems. The absence of equipment and experience in the 12200 and higher bands makes the users reluctant to express firm opinions concerning these bands.

The Central Committee feels that the information the Commission has requested from RETMA will be adequate for the purpose of establishing appropriate engineering standards. TABLE IX shows the effect of the developmental status on the selection of bandwidth and pair spacing. It is obvious that the somewhat haphazard growth which is reflected by this table will make problems of coordination more difficult. The establishment of definite engineering standards and the removal of the developmental status should be accomplished as promptly as possible in order to facilitate orderly growth in the future and to minimize loss to users resulting from forced obsolescence or modification of existing equipment.

The Central Committee wishes to express its appreciation to the Federal Communications Commission and its staff for the interest shown in this problem and to give assurance of its willingness to cooperate in any way possible to facilitate the Commission's further study. It feels that the data summarized in this report clearly show the extraordinary importance to a wide variety of industries of microwave communication.

Very truly yours,

/S/ W. M. Rust, Jr.

W. M. Rust, Jr., Chairman
Central Committee on Radio Facilities
American Petroleum Institute

WMR:ms
Attach.

TABLE I

PETROLEUM RADIO SERVICE

(Twenty-four Systems in Operation)

A. EXTENT OF SYSTEM - EXISTING

1. Total system miles	10,969.45
2. Number of stations	444
3. Number of transmitters in service (excluding standby equipment)	834
4. Total potential equivalent voice channel miles	189,176.5
5. Total equivalent voice channel miles now in use	59,721.85
6. Total channel* miles in use	92,406.05

*Counting each telemetering, teletype, supervisory control, etc., channel as well as channels carrying voice only

B. USAGE

	Present (Total Channel Miles)	Potential (Total Channel Miles)
1. Station-to-station voice communication	48,024.75	115,874.
2. Station-to-station telegraphy	---	---
3. VHF radio relay or control	10,118.7	26,227.45
4. Teletype	4,037.5	40,619.2
5. Remote control	8,923.4	39,095.65
6. Telemetry	21,301.7	70,571.25
7. Facsimile	---	1,835.

TABLE II

PETROLEUM RADIO SERVICE

(Six Systems under Construction)

A. EXTENT OF SYSTEM - AUTHORIZED

1. Total system miles	1,436.58
2. Number of stations	56
3. Number of transmitters in service (excluding standby equipment), initial	100
4. Total potential equivalent voice channel miles	35,084.50
5. Total equivalent voice channel miles, initial use	14,303.8
6. Total channel* miles, initial	18,952.78

*Counting each telemetering, teletype, supervisory control, etc., channel as well as channels carrying voice only

B. USAGE

	Initial (Total Channel Miles)	Potential (Total Channel Miles)
1. Station-to-station voice communication	11,218.18	19,868.18
2. Station-to-station telegraphy	---	---
3. VHF radio relay or control	552.28	1,199.16
4. Teletype	1,607.2	2,540.6
5. Remote control	1,902.56	4,780.56
6. Telemetry	3,672.56	9,431.56
7. Facsimile	---	462.0

TABLE III

PETROLEUM RADIO SERVICE

(Eleven Systems Budgeted or Contemplated)

A. EXTENT OF SYSTEM

1. Total system miles	3,918 (approx.)
2. Number of stations	180 (approx.)

B. USAGE

	Potential (Total Channel Miles)
1. Station-to-station voice communication	22,450
2. Station-to-station telegraphy	730
3. VHF radio relay or control	3,570
4. Teletype	5,760
5. Remote control	1,700
6. Telemetry	7,300
7. Facsimile	---
8. Two-way dial signalling for talking	440

TABLE IV

FOREST PRODUCTS RADIO SERVICE

(Five Systems in Operation)

A. EXTENT OF SYSTEM - EXISTING

1. Total system miles	163.5
2. Number of stations	14
3. Number of transmitters in service (excluding standby equipment)	18
4. Total potential equivalent voice channel miles	2,633.
5. Total equivalent voice channel miles now is use	516.5
6. Total channel* miles in use	516.5

*Counting each telemetering, teletype, supervisory control, etc., channel as well as channels carrying voice only

B. USAGE

	Present (Total Channel Miles)	Potential (Total Channel Miles)
1. Station-to-station voice communication	300.	2,400.
2. Station-to-station telegraphy	---	---
3. VHF radio relay or control	176.	252.
4. Teletype	---	---
5. Remote control	40.5	91.
6. Telemetry	---	---
7. Facsimile	---	---

TABLE V

FOREST PRODUCTS RADIO SERVICE

FOREST CONSERVATION RADIO SERVICE

(One System Planned by Each)

A. EXTENT OF SYSTEM

1. Total system miles	430 (approx.)
2. Number of stations	20 (approx.)
3. Number of transmitters (excluding standby equipment	36 (approx.)

B. USAGE

	Potential (Total Channel Miles)
1. Station-to-station voice communication	5,332
2. Station-to-station telegraphy	---
3. VHF radio relay or control	300

TABLE VI

RAILROAD RADIO SERVICE

(Two Systems in Operation)

A. EXTENT OF SYSTEM

1. Total system miles	174.5
2. Number of stations	11
3. Number of transmitters in service (excluding standby equipment)	18
4. Total potential equivalent voice channel miles	4,187
5. Total equivalent voice channel miles now in use	760
6. Total channel* miles in use	1,420.5

*Counting each telemetering, teletype, supervisory control, etc., channel as well as channels carrying voice only

B. USAGE

	Present (Total Channel Miles)	Potential (Total Channel Miles)
1. Station-to station voice communication	585.5	1,643.
2. Station-to-station telegraphy	106	Not given
3. VHF radio relay or control	---	" "
4. Teletype	623	" "
5. Remote control	---	" "
6. Telemetry	---	" "
7. Facsimile	---	" "
8. Selective ringing	106	" "

TABLE VII

RAILROAD RADIO SERVICE

(Four Systems Planned)

A. EXTENT OF SYSTEM

1. Total system miles	775 (approx.)
2. Number of stations	35 (approx.)

B. USAGE

	Potential (Total Channel Miles)
1. Station-to-station voice communication	12,138
2. Station-to-station telegraphy	899
3. VHF radio relay or control	746
4. Teletype	6,443
5. Remote control	27
6. Telemetry	27
7. Facsimile	250

TABLE VIII

AERONAUTICAL RADIO, INC.

(Four Systems in Operation)

A. EXTENT OF SYSTEM - EXISTING

1. Total system miles	110
2. Number of stations	8
3. Number of transmitters in service (excluding standby equipment)	8
4. Total potential equivalent voice channel miles	2,276
5. Total equivalent voice channel miles now in use	766
6. Total channel* miles in use	1,025

*Counting each telemetering, teletype, supervisory control, etc., channel as well as channels carrying voice only

B. USAGE

	Present (Total Channel Miles)	Potential (Total Channel Miles)
1. Station-to-station voice communication	76	
2. Station-to-station telegraphy	---	
3. VHF radio relay or control	355	Approximate total for all usages 3400
4. Teletype	48	
5. Remote control	230	
6. Telemetry	38	
7. Facsimile	---	
8. HF radio relay	278	

TABLE IX

RADIO FREQUENCY CHARACTERISTICS

SYSTEM	BAND Mc	BANDWIDTH Mc	PAIR SPACING Mc
Petroleum Radio Service - Existing			
El Paso Natural Gas Company (San Juan system)	6000	3	90
Humble Pipe Line Company	6000	10	150
Interstate Petroleum Communications, Inc.	6000	10	120
Mid-Valley Pipeline Company	6000	10	120
Pan American Pipe Line Company	6000	11	120
Panhandle Eastern Pipe Line Company	6000	10	120
Platte Pipe Line Company	6000	--	90
Sinclair Pipe Line Company	6000	6	40
Texas Gas Transmission Corporation	6000	10	120
Texas Illinois Natural Gas Pipeline Company (three systems)	6000	12	120
Colorado Interstate Gas Company	2000	6	40
El Paso Natural Gas Company (Permian system)	2000	3	40
Keystone Pipe Line Company	2000	6	70
Plantation Pipe Line Company	2000	4	---
Texas Eastern Transmission Corporation	2000	5.6	100
Transcontinental Gas Pipe Line Corporation	2000	8	50
Trunkline Gas Company	2000	5.6	100
United Gas Pipe Line Company	2000	3	40
El Paso Natural Gas Company (leg)	950	.15	3.6
Salt Lake Pipe Line Company	950	.02	---
Sun Oil Company	950	.15	3.6
Sunray Oil Company	950	.5	2
The Texas Company	950	--	---
Salt Lake Pipe Line Company	153	--	---
Salt Lake Pipe Line Company	72-76	--	---
Petroleum Radio - Authorized			
Dow Chemical Company	6000	10	120
El Paso Natural Gas Company (No. Permian system)	2000	3	40
Standard Oil Company (Indiana)	2000	4	50
Sinclair Pipe Line Company (two systems)	2000	--	---
Buffalo Pipe Line Company	950	.3	3.6

TABLE IX (Cont'd)

RADIO FREQUENCY CHARACTERISTICS

SYSTEM	BAND Mc	BANDWIDTH Mc	PAIR SPACING Mc
Forest Products Radio Service - Existing			
Individual companies using not known			
No. 1	950	.100	3.6
No. 2	950	.500	3.6
No. 3	950	.100	6
No. 4	950	.100	3.6
No. 5	6000	--	100
Railroad Radio Service - Existing			
Chicago, Rock Island & Pacific Railroad	6000	10	60 & 240
Atchison, Topeka & Santa Fe Railroad	6000	10	150
Aeronautical Radio, Inc.			
Poplar Heights-Fork Mountain, Virginia	6000	10	120
Los Angeles, California	6000	10	100
San Francisco, California	6000	10	100
Seattle, Washington	6000	10	100

APPENDIX B

OPERATIONAL FIXED MICROWAVE COUNCIL

BY-LAWS

Article I

Name and Objective

Section 1. This organization shall be known as "Operational Fixed Microwave Council."*

Section 2. The objectives and purposes of the Operational Fixed Microwave Council shall be:

(1) To foster the mutual interests of organizations concerned with the operation or use of operational fixed radio systems in the public safety, industrial, land transportation, marine, and aviation radio services;

(2) To support and promote the allocation of microwave frequencies suitable and adequate for the use of such operational fixed radio systems;

(3) To assist member organizations in formulating and coordinating views on uniform standards, fair and effective regulations and technical developments beneficial to utilization of operational fixed radio systems;

*Operational Fixed Station - A fixed station, not open to public correspondence, operated by and for the sole use of those agencies operating their own radio communication facilities in the Public Safety, Industrial, Land Transportation, Marine or Aviation Service.

(4) To assemble data on microwave systems within the operational fixed radio service, maintain such information on a current basis, and furnish prospective users of such facilities with information on existing or proposed installations in a specified area; and

(5) To concern itself with such other matters as may be incidental or implied in any of the aforegoing specified objectives.

Section 3. The operation, activities, and actions of the Council shall be voluntary and advisory. It shall not act in a representative capacity for the members of the Council individually excepting as expressly provided under Article V hereof.

Article II

Membership

Section 1. The Council shall be comprised of organizations who are or whose members are eligible to use operational fixed radio systems and who appoint accredited representative to the Council. The Council, from time to time, shall determine, by resolution, each class of organization which it recognizes to be entitled to such representation. The Council shall determine the qualifications of its members and the procedure for certification of the Council representative of each recognized class of organization.

Section 2. Each such organization so recognized by the Council shall be entitled to one Council representative and to one designated alternate.

Section 3. The normal term of appointment of a representative of a member organization to the Council shall be two years. Designation for subsequent terms shall conform to the original procedure which shall also govern the filling of vacancies within any term.

Section 4. The Council may remove any representative or alternate for good cause and a member organization may designate a successor representative or alternate at any time.

Section 5. Any member organization of the Council may withdraw from the Council at any time by written notice to the Chairman and a copy of such notice to the Secretary of the Council.

Article III

Officers

Section 1. The officers of the Council shall be a Chairman, Vice Chairman and Secretary, each of whom shall be selected from representatives of the Council.

Section 2. The officers shall be elected by vote of the Council and shall serve for a term of two years or until their successors are elected and qualified.

Section 3. At such time as such action may be required, the Council, by unanimous vote, may designate and appoint a General Manager, and fix his compensation, who shall not be a member on the Council and who shall perform the duties and services denominated by this office and determined by the Council.

Article IV

Committees

Section 1. The Council, by resolution, may designate one or more general or special committees, determine their membership and specify their assignments. All committees shall report to the Council and their recommendations shall be subject to approval and adoption by the Council.

Section 2. The Chairman of the Council shall appoint a Nominating Committee of three (3) members selected from Council representatives of member organizations of the Council. Such Committee shall be appointed at least ninety days before any meeting at which elections are to be held.

Section 3. The Council may establish a manufacturers and consultants advisory committee, provided that all manufacturers of microwave facilities used in operational fixed systems shall be accorded the opportuntiy of representation on such committee. The functions of such committee and the activities of its members shall be as determined from time to time by the Council.

Article V

Operations

Section 1. The Council shall establish facilities and means for collecting and maintaining information on operational fixed microwave stations, of whatever character or description, useful to its purposes and of interest to the organizations represented by the Council. All such information shall be available upon reasonable request to Council

representatives, to recognized organizations, and concerns represented by Council representatives. Any release or statement for distribution, except as provided by these By-Laws, shall be subject to prior approval of the Council, adopted without dissenting vote.

Section 2. The Council shall annually determine the responsibility for collection of such data and information and shall review the effectiveness of such arrangements during the preceding year.

Section 3. At such time as such action may be required, the Council, by unanimous vote, may determine and approve an annual budget for necessary operations of the Council and shall determine the equitable apportionment among represented organizations and concerns for contributions to defray such approved budgets and expenses. In such event, membership recognition shall be given only to contributing organizations.

Article VI

Meetings

Section 1. The Council shall meet annually, the first Wednesday in March of each year at 10:00 A.M. at the place fixed by the previous annual meeting or if none be fixed, at the principal office of the Council. Thirty days notice of the annual meeting, setting forth the agenda, shall be given by the Secretary to each Council representative.

Section 2. Special meetings may be called by the Chairman of the Council or upon the written request of three Council representatives. Notice of a special meeting shall be given to each Council representative at least ten days prior to the meeting and shall specify

the time and place of the meeting and agenda of items to be considered at such meeting.

Section 3. Each Council representative shall notify the Secretary (by return air mail or telegram) of his or his alternate's intention to attend such annual or special meeting and the Secretary shall timely advise all Council representatives in the event a quorum for the transaction of Council business is not assured.

Section 4. No action shall be taken except that resulting from a duly convened meeting of the Council, except as otherwise provided in these By-Laws.

Section 5. A majority of the total membership of the Council shall constitute a quorum, and an affirmative vote of the majority of the membership of the Council present shall be necessary to carry an action, except where a larger vote is especially required by these By-Laws.

Section 6. The fiscal year of the Organization shall begin March 1st of each calendar year.

Article VII

Amendments

Section 1. These By-Laws may be amended by the adoption by a majority of the total Council representatives of a proposed amendment at an annual or special meeting of the Council unless otherwise provided by these By-Laws.

Article VIII

Section 1. These By-Laws shall become initially effective upon the date adopted by the Council. The initial terms of officers and Council representatives first elected will expire on the last day of February of the second year next following the adoption of these By-Laws.

APPENDIX C

THE OPERATIONAL FIXED MICROWAVE COUNCIL

By
Clifton D. Campbell [1/]
Chairman, Operational Fixed Microwave Council
And
Joseph E. Keller
Special Representative
Central Committee on Radio Facilities
of the
American Petroleum Institute
and the
National Petroleum Radio Frequency Coordinating Association

I. The Operational Fixed Microwave Council.[2/] A Vehicle of Coordination and Co-operation.

The Operational Fixed Microwave Council, which has been in the organizational stage for nearly two years, during which time intensive study and effort went into this important project, became a reality in Houston, Texas, on September 29, 1954, when delegates from various fields met to give their unanimous approval to new By-Laws which established the Council. The new Council, which during its developmental phases had been variously referred to as the Microwave Frequency Coordinating Association and the Microwave Users Council, is an inter-service agency established to guide the growth of microwave communications facilities through cooperative

1/ This article is based on informal remarks made at the national meeting of the Professional Group on Vehicular Communications of the Institute of Radio Engineers by Mr. Campbell and Mr. Keller and has been prepared for the official minutes of this meeting and for the use of the various user groups in assuring a wider understanding of the purposes of the Council and its current operation.

2/ Operational fixed station - A fixed station, not open to public correspondence, operated by and for the sole use of those agencies operating their own radio communication facilities in the Public Safety, Industrial, Land Transportation, Marine or Aviation Service.

efforts among the Safety and Special Radio Services Licensees entitled to use their higher frequencies. Attending the Houston meeting were 31 representatives and other interested parties from the aviation, petroleum, pipe line, forest products, forestry-conservation, police, railroad, trucking, the power utility radio fields and equipment manufacturing companies.

One of the key functions of the new Operational Fixed Microwave Council will be the critically important job of advising and assisting the Federal Communications Commission in the drafting of rules to govern development of the microwave bands. Successful accomplishment of this job will be the means of forestalling and avoiding impending chaos in this field. The new Council, with the unlimited opportunities that it makes available to representative members, was acclaimed a means of salvation from the haphazard development of the microwave frequency bands among the various radio users. Creation of the new Council provides the convenient forum which is so greatly needed by the various organizations eligible to use the microwave frequencies for operational fixed communications needs, in order that technical information, mutual ideas, and common problems may be exchanged.

The objectives and purposes of the Operational Fixed Microwave Council, as stated by its By-Laws, are:

> "(1) To foster the mutual interests of organizations concerned with the operation or use of operational fixed radio systems in the radio safety, industrial, land transportation, marine and aviation radio services;

"(2) To support and promote the allocation of microwave frequencies suitable and adequate for the use of such operational fixed radio systems;

"(3) To assist member organizations in formulating and coordinating views on uniform standards, fair and efficient regulations and technical developments beneficial to utilization of operational fixed radio systems;

"(4) To assemble data on microwave systems within the operational fixed radio service, maintain such information on a current basis, and furnish prospective users of such facilities with information on existing or proposed installations in a specified area; and

"(5) To concern itself with such other matters as may be incidental or implied in any of the foregoing specified objectives."

The Council By-Laws expressly provide that the operation, activities and actions of the Council are to be "voluntary and advisory", and that the organization is not to act in a representative capacity for the members of the Council individually. All information and data to be collected, compiled, and maintained by the Council will relate to operational fixed microwave stations, and will be available upon request to Council representatives, member organizations, and other concerns represented by Council representatives.

Comprising the Operational Fixed Microwave Council are organizations, or members of organizations, who are eligible to use

operational fixed radio systems and who appoint accredited representatives to the Council. Representing the petroleum industry, for example, is a designated member of the American Petroleum Institute - National Petroleum Radio Frequency Coordinating Association; representing the power utility industry is a member of the National Committee for Utilities Radio; and representing the railroad industry is a member of the Association of American Railroads, to name a few of the organizations - each of whom, in this case, is one which helped spearhead the drive toward the establishment of the Council - who presently are members of the Council. Each member organization is entitled to one voting member and a designated alternate.

Selected as Chairman for a period of two years was Mr. Clifton D. Campbell of Humble Pipe Line Company, who represents the American Petroleum Institute. Vice-Chairman L. E. Ludekens, of the Southern California Edison Company, and of the National Committee for Utilities Radio, and Secretary L. E. Kearney, representing the Association of American Railroads, will also serve two year periods as officers of the Operational Fixed Microwave Council.

Among those present at the Houston meeting from which emerged the Operational Fixed Microwave Council, was Colonel E. L. White, Chief of the Safety and Special Radio Services Bureau of the Federal Communications Commission, whose cooperative interest during the two year developmental period of the Council, had done so much to foster and encourage its growth. Colonel White spoke to the group

regarding the future of microwave in the United States, touched upon many of the immediate problems affecting microwave users, and noted particularly the strong advisability of the early establishment of regular rules for microwave operations so that the developmental status of such facilities may be removed. It may be said that there emerged from the concerted action of the group to which he spoke, the vehicle which offers the best assurance for the early establishment of microwave rules.

In connection with those microwave rules, a preliminary report on the results of the survey of operational microwave was given by Dr. William M. Rust, Jr., Chairman of the API's Central Committee on Radio Facilities. Speaking of the survey of operational microwave, which he had been requested to make by the FCC, Dr. Rust said that indications are that microwave usage will more than double during the next five years.

II. The Background and Development of the Operational Fixed Microwave Council: The Enlarging Response to an Insistent Need

Probably a great many of the various groups interested in the microwave frequencies had been aware of the growing problem in this field, years before the Operational Fixed Microwave Council became a reality in Houston on September 29, 1954. Certainly, various groups within the petroleum industry were acutely aware of and were becoming increasingly concerned about the chaotic future which lay ahead for licensees in the microwave frequencies. Accordingly, at the June, 1952, Annual Meeting of the National

Petroleum Radio Frequency Coordinating Association, the Chairman of that group appointed a committee to study the problem of microwave frequency coordination, and to report at the next meeting. Careful consideration and study of the problem prompted this committee to state, in June of 1953, that no successful plan of microwave frequency coordination could be administered effectively by NPRFCA alone, since microwave frequencies available to the petroleum industry are shared by all other users in the Industrial Radio Service. The committee therefore recommended, inasmuch as an effective coordination plan needed to be on an industry-wide basis, that other interested organizations such as the National Committee on Utilities Radio and the Association of American Railroads, be contacted with an eye toward forming such an industry-wide coordination council.

Members of the NPRFCA voted to contact all interested organizations relative to the eventual organization of a "Microwave Frequency Coordination Association", and in due time there emerged from the three organizations, NPRFCA, NCUR, and AAR, a tentative plan designed to provide the type of coordination which would enable all users in the Industrial Radio Service to participate. Not long thereafter, representatives of the three organizations met with members of the Commission's staff on an informal basis to discuss the feasibility of putting such a plan into action. FCC reaction to the idea was the encouraging expression that this would mutually benefit both the users and the Commission.

The Commission's blessing having been secured, a steering committee was set up consisting of Mr. C. D. Campbell of the NPRFCA, Acting Chairman; L. E. Kearney, AAR; Dale Schreiner, NCUR; John McKinely, NCUR; and Joseph E. Keller, Special Representative of the Central Committee on Radio Facilities of the API. The steering committee's function was to contact all users in the Industrial Radio Service who had not already been contacted in order that they might be advised of the plan; to solicit and maintain interest and cooperation from all industrial radio users; and to lay the ground work for an organizational meeting which would bring together interested groups to discuss the common problem of microwave co-ordination and control.

During this same period of time, the Federal Communications Commission, recognizing the need for some degree of standardization in the microwave frequencies, issued a Notice of Proposed Rule Making in Docket No. 10500 on May 13, 1953, which would have amended its Rules regarding operational fixed stations operating on frequencies above 890 megacycles. Among the comments filed in this docket, were those of API's Central Committee on Radio Facilities, which recited the diligent work, study and concerted action which it had been undertaking in the microwave field, in cooperation with other principal user groups. An immediate need existed, the comments said, for a sufficiently high degree of standardization in these bands to permit the removal of the developmental classification, and this could be accomplished only through the adoption of a complete set

of Microwave Service Rules, rather than the rule making proposed under Docket No. 10500, which contemplated Microwave Rules that set forth only minumum standards. The proposal in Docket No. 10500 was withdrawn by the Commission on October 29, 1953, on the ground that it appeared desirable to defer action until a complete set of Microwave Rules could be adopted.

While the plans for a coordinating council composed of various users in the Industrial Radio Service went forward, continuing studies were being conducted by individual groups. One such study resulted in the presentation of a paper before the AIEE Fall General Meeting in Kansas City, Missouri, on November 4, 1953, by Victor J. Nexon, Vice-President of Microwave Services, Inc. The paper, entitled "Industry Coordination of Microwave Communication Systems", reviewed the problems concerned with coordination of microwave systems in the various industrial services in order to obtain maximum utilization of the microwave spectrum. The paper cited the need for industry coordination regarding this critical problem, citing as reasons therefor the already prevalent signs of interference, the lack of any coordination program set up to administer in the interest of all users, and the huge potential realizable through the use of microwave which has been frequently referred to as the "last frontier" of unused spectrum space. The summary conclusion of the paper was that coordination solutions on a beam-wide basis together with frequency and band width should be found to provide interference-free operation for a maximum number of microwave systems in the various areas. The

single conclusion reached by the study on which this paper was based, as well as other individually conducted studies, all pointed to the need for an organization such as the Operational Fixed Microwave Council.

With the organizational meeting of industry groups interested in private microwave systems already in the offing, the FCC directed a letter on February 3, 1954, to the Central Committee on Radio Facilities of the American Petroleum Institute, and to the Radio Electronics Television Manufacturers Association, requesting that the Commission be furnished with information in connection with the drafting of proposed Microwave Rules and Standards. The job of assimilating and preparing the requested information and data is still being pursued by these two groups.

On February 24, 1954, the organizational meeting of the contemplated Microwave Council was held in Chicago. By this time, the name of the proposed organization had been changed from the Microwave Frequency Coordinating Association to the Microwave Users Council. Representatives of many of the industry groups utilizing the microwave frequencies in the Industrial Radio Service were in attendance. Chief of the Safety and Special Radio Services Bureau of the FCC, Colonel Ed White, was on hand to assure the group of the Commission's continued interest in the formation of the proposed Council, and to reiterate the need for a policy in the handling of microwave frequencies. Acting Chairman C. D. Campbell outlined the proposed plan and stipulated some of the factors that have to be

taken into consideration when selecting frequencies for a new microwave system. Some such factors, he said, are:

1. The geographical separation from existing systems on the same frequency;

2. Antenna patterns, major and minor lobes, size and shape of reflectors, etc.;

3. Microwave tower stability: How much twist due to wind could be tolerated without interference to other stations.

4. Any plan to be effective would have to be on an industry-wide basis since microwave frequencies are allocated on a shared basis to nearly all radio services under the Safety and Special Radio Services Bureau of the FCC.

A draft of proposed By-Laws for the Council was presented by the Special Representative of API. The proposed By-Laws, which set forth substantially the same purposes and provisions contained in the By-Laws which were eventually adopted at the Fall meeting of 1954 in Houston, were discussed and tentatively adopted, subject to final approval at the forthcoming meeting in September of 1954. The proposed rule making under Dockets Nos. 10500, 10797 and 10821 relative to proposed standards and rules which would affect the microwave services, were discussed: Messrs. Campbell, Ludekens, and Kearney, who had originally been chosen as acting officials for the proposed Microwave Users Council, were formally nominated and elected to fill their posts as Chairman, Vice-Chairman and Secretary, respectively.

The successfully conducted organizational meeting established and unified a purposeful nucleus of industry groups. During the months following the organizational meeting in February, the By-Laws of the tentatively established Microwave Users Council were circulated and subjected to further review and study by the various groups. A special meeting was held on June 11, 1954, in order to review and consider certain additions to the By-Laws which had been filed by one of the representative groups. At this special meeting a subcommittee was appointed which was to receive all comments or suggested changes to the By-Laws and to prepare a re-draft of the By-Laws for presentation to the entire membership and prospective membership of the Council at the forthcoming September meeting. These proposed amendments were accordingly submitted to the entire membership of the Council meeting at Houston, and unanimously approved, to finally establish the Council under its new name of Operational Fixed Microwave Council.

Official approval of the By-Laws of the Council has already been given by the American Association of State Highway Officials, the Association of American Railroads Communications Section, the Committee of Manufacturers Radio Use, the Forestry Conservation Communications Association, National Bus Communications, National Committee on Utilities Radio, National Forest Industries Communications, the American Petroleum Institute's Central Committee on Radio Facilities, National Petroleum Radio Frequency Coordinating Association, the Special Industrial Radio Service Association, and

the American Trucking Association. Tentative executive approval has come from the Associated Police Communications Officials, Inc. It is expected that the American Waterways Operators, who has the matter under consideration, will officially approve the By-Laws and formally enter the Council in the very near future.

Inasmuch as a majority of the members present at the organizational meeting have already approved the By-Laws, the Operational Fixed Microwave Council is presently duly constituted to proceed with its objectives as a full-fledged organization and plans are progressing toward the establishment of a microwave informational exchange service whereby microwave users would report all of the vital data concerning their systems so that it might be plotted on Council maps. It is the sincere feeling of all of the members of the Operational Fixed Microwave Council, and unofficially also the feeling of the Commission, that the establishment of this Council represents a most significant and constructive step toward the successful plotting and efficient utilization of that "last frontier" of unused spectrum space - the microwave frequencies.

Prospective microwave users are invited to consult with the Council on their frequency problems so that interference may be avoided and so that the most efficient use may be made of available spectrum space. The Council organization represents the first successful effort to deal with mutual frequency problems at the inter-service levels. The Council provides a badly needed forum to coordinate the use of microwave frequencies, to serve as a means of coordinated expression of viewpoint to the Commission on

microwave matters, to provide the Commission with the factual data it will need to adopt permanent rules for a microwave service and to eliminate the developmental status of the service which exists at this time.

The Council has a challenging future indeed. Microwave installations make a vastly important contribution to the efficient operation of the American industrial plant in time of peace. These microwave installations will serve in an even more important capacity in the event of another national emergency. The work of the Council is so important that it merits the cooperation and support of all indistrial radio users. The progress made to date has been most gratifying. It foreshadows the even greater accomplishments which lie ahead.

APPENDIX D

OPERATIONAL FIXED MICROWAVE COUNCIL

List of Organizations Represented

American Petroleum Institute

Aeronautical Radio, Inc.

American Association of State Highway Officials

American Transit Association

American Trucking Association

Associated Police Communication Officers

Association of American Railroads

Committee on Manufacturers Radio Use

Forestry Conservation Communications Association

International Municipal Signal Association

Motion Picture Research Council

National Bus Communications, Inc.

National Committee for Utilities Radio

National Forest Industries Communications

Radiolocation Service

Special Industrial Radio Service Association

APPENDIX E

CENTRAL COMMITTEE ON RADIO FACILITIES

Chairman: W. M. RUST, JR., Humble Oil & Refining Co. Houston, Texas

Vice Chairman: J. A. POLHEMUS, JR., Standard Oil Co. of California, Standard Oil Building, San Francisco 20, California

V. J. SITTEL, Service Pipe Line Company Service Pipe Line Building, Tulsa, Oklahoma

Secretary: B. H. LORD, JR., American Petroleum Institute, 1625 K Street, N. W., Washington 6, D. C.

CHARLES F. BERNARD.....Interstate Oil Pipe Line Co., Box 1107, Shreveport 83, Louisiana
F. S. BIRD.....The California Co., 800 The California Co. Bldg., New Orleans, La.
W. T. BORN.....Geophysical Research Corp., Box 2040, Tulsa 2, Oklahoma
S. M. BRANEN.....Continental Oil Co. Box 2197, Houston, Texas
FREDERICK BROUGHTON....Signal Oil & Gas Co., Pacific Palisades, California
C. E. BUFFUM.....Stanolind Oil & Gas Co., Tulsa, Oklahoma
W. T. BULLA.....Natural Gas Pipeline of America, 20 N. Wacker Drive, Chicago, Illinois
R. S. CAPLAN.....Gulf Refining Co., Box 2100, Houston, Texas
W. F. CARLETON.....The Texas Pipe Line Co., Houston 1, Texas
W. E. CHURCH.....Shell Oil Co., 1008 W. 6th Street, Los Angeles, California
F. T. CLARKE.....Union Sulphur and Oil Corp., Houston, Texas
D. H. CLEWELL.....Magnolia Petroleum Co., Dallas, Texas
M. S. COLLETT.....The Atlantic Refining Co., 260 S. Broad St., Philadelphia, Pennsylvania
E. E. COMSTOCK.....Phillips Petroleum Co., Bartlesville, Oklahoma
L. E. COOK.....Sinclair Pipe Line Co., Sinclair Building, Independence, Kansas
HARRY L. CORNELL.....Esso Shipping Co., Rm. 301, 115 Broadway, New York 6, New York
C. F. de MEY.....Columbia Gas System Service, 120 E. 41st St., New York, New York
LLOYD ELLIOTT.....The Texas Company, Box 425, Bellaire, Texas
J. H. FIELD.....Sohio Petroleum Co., 2300 1st Natl. Bank Bldg., Oklahoma City, Oklahoma

ROBERT L. GRAY.....Ashland Oil & Refining Co., Ashland, Ky.
KARL S. HAGIUS.....Colorado Interstate Gas Co., Colorado Springs, Colorado
W. W. HARDY.....Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, New York
CLYDE R. HEPLER.....Pan-American Pipe Line Co., Houston, Texas
VANCE JENKINS.....Union Oil Co. of Calif., 617 W. 7th St., Los Angeles 17, California
JOSEPH E. KELLER.....Attorney, 600 Munsey Bldg., Washington 4, D. C.
CARL M. LATHROP.....Standard Oil Development Co., Box 121, Linden, New Jersey
C. B. LESTER.....Mid-Valley Pipe Line Co., 430 North Center, Longview, Texas
D. H. LEVY.....Petroleum Industry Electric Assn., c/o Magnolia P. L. Co., Dallas, Texas
F. W. LITTELL .....Shell Pipe Line Corp., Shell Bldg., Houston 2, Texas
S. R. McCONOUGHEY.....Michigan-Wisconsin Pipe Line Co., 500 Griswold St., Detroit, Michigan
J. D. McCULLOUGH .....The Buckeye Pipe Line Co., 137 W. North St., Lima, Ohio
H. G. PEGUES.....United Pipe Line Co., Shreveport, La.
H. A. RHODES.....Transcontinental Gas Pipe Line Corp., 3100 Travis St., Houston, Texas
DEAN A. ROSS.....Standard Oil Co. (Ind.), 910 S. Michigan Ave., Chicago 80, Illinois
E. M. SHOOK.....Magnolia Pipe Line Co., Dallas, Texas
R. M. SLOUGH.....The Ohio Oil Company, Findlay, Ohio
C. E. SUTTON.....The Pure Oil Co., City Natl. Bank Bldg., Houston, Texas
E. H. WILDER.....Sun Oil Company, Beaumont, Texas
JOSEPH H. WOFFORD.....Radio Communications Engr. Service, 4317 Montrose Blvd., Houston, Texas
R. D. WYCKOFF.....Gulf Research & Development Co., Pittsburgh 30, Pennsylvania

APPENDIX F

EXECUTIVE COMMITTEE OF THE NATIONAL PETROLEUM RADIO FREQUENCY COORDINATING ASSOCIATION

REGION I	Mr. E. B. Dunn	Atlantic Refining Company Room 1305, 260 South Broad Street Philadelphia, Pennsylvania
REGION II	Mr. D. E. York	United Fuel & Gas Company P. O. Box 1273, Charleston, West Virginia
REGION III	Mr. D. R. Woffard	Texas Gas Transmission Corp. P. O. Box 577 Owensboro, Kentucky
REGION IV	Mr. R. L. Ransome	Interstate Petroleum Communications, Inc. P. O. Box 2648 Houston, Texas
REGION V	Mr. C. B. Scott	Carter Oil Company P. O. Box 801 Tulsa, Oklahoma
REGION VI	Mr. H. L. Thompson	Ohio Oil Company P. O. Box 120 Casper, Wyoming
REGION VII	Mr. J. V. Bowen	General Petroleum Corporation P. O. Box 2122, Terminal Annex Los Angeles 54, California

Chairman:	H. A. Rhodes Transcontinental Gas Pipe Line Corp. Houston, Texas
Vice Chairman:	C. D. Campbell Humble Pipe Line Company Houston, Texas
Secretary-Treasurer:	R. D. Wyckoff Gulf Research & Development Company Pittsburgh 30, Pennsylvania

APPENDIX G

PETROLEUM INDUSTRY ELECTRICAL ASSOCIATION

Ajax Pipe Line Corp., Springfield, Mo.....W. D. Coleman
Arkansas Fuel Oil Corp., Shreveport, La.....D. E. Tucker
Arkansas Natural Gas Corp., Shreveport, La.....G. H. Bumb
Atlantic Pipe Line Co., Dallas, Texas.....F. J. Geisel
Buckeye Pipe Line Co. (The), Lima, Ohio .....J. D. McCullough
Cities Service Gas Co., Wichita, Kansas.....J. W. Flint
Continental Pipe Line Co., Ponca City, Okla.....Frank E. McFarlin
Deep Rock Oil Corp., Tulsa, Okla.....Verle Smith
Dow Chemical Co., Freeport, Texas.....Chas. E. Neale
East Ohio Gas Co. (The), Cleveland, Ohio.....Evron L. McNeel
El Paso Natural Gas Co., El Paso, Texas.....L. G. Wainman
Freeport Sulphur Co., Port Sulphur, La.....A. J. Lehman
General Petroleum Corp., Los Angeles, Calif.....James V. Bowen
Great Lakes Pipe Line Co., Kansas City, Mo.....C. H. Scruggs
Gulf Oil Corporation, Pittsburgh, Pa..... K. P. McCord
Gulf Refining Co.,
Southern Pipe Line Division, Houston, Texas.....C. Harvey
Gulf Refining Co.,
Northern Pipe Line Division, Tulsa, Okla.....M. C. Callahan
Houston Pipe Line Co., Houston, Texas.....J. F. Collerain
Huber Corporation, J. M., Borger, Texas.....C. R. Garst
Humble Pipe Line Company, Houston, Texas.....Hezzie Clark
Industrial Gas Supply Corp., Houston, Texas.....Howard Gumm
Interstate Oil Pipe Line Co., Tulsa, Okla.....D. W. Lipe
Interstate Oil Pipe Line Co., Shreveport, La.....W. H. Massey
Lone Star Gas Company, Dallas, Texas.....C. O. Diller
Magnolia Pipe Line Co., Dallas, Texas ..... D. H. Levy
Michigan-Wisconsin Pipe Line Co., Detroit, Mich.....Alden F. Wooster
Mid-Continent Pipe Line Co., Tulsa, Okla.....L. C. Lamer
Mid-Valley Pipeline Co., Longview, Texas.....C. B. Lester
Michigan-Ohio Pipeline Corporation,
Mt. Pleasant, Michigan .....Elwood Kisby
Ohio Fuel Gas Co. (The), Columbus, Ohio .....J. C. Williams
Ohio Oil Co. (The), Findlay, Ohio.....R. M. Slough
Oklahoma-Mississippi River Products Line, Inc.,
Tulsa, Oklahoma .....J. R. Ellis
Oklahoma Natural Gas Co., Tulsa, Oklahoma.....J. W. Kaster
Pan-American Pipe Line Co., Houston, Texas.....C. R. Hepler
Pan-American Gas Company, Houston, Texas.....J. O. Phillips
Panhandle Eastern Pipe Line Co.,
Kansas City, Missouri.....J. A. Fowler
Phillips Petroleum Co., Bartlesville, Okla.....J. O. Mostrom
Phillips Petroleum Co.,
Refining Dept., Bartlesville, Okla.....T. R. Shaw

PETROLEUM INDUSTRY ELECTRICAL ASSOCIATION (cont.)

Plantation Pipe Line Co., Atlanta Ga.....Fred Armstrong
Platte Pipe Line Co., Kansas City, Mo.....A. R. Heidebrecht
Premier Oil Refining Co., Ranger, Texas.....D. D. Pickrell
Pure Transportation Co., Tulsa, Okla.....A. L. Paullin
Shell Oil Company, Los Angeles, California.....W. E. Church
Shell Pipe Line Corp., Houston, Texas.....F. W. Littell
Sinclair Pipe Line Co., Independence, Kansas.....L. E. Cook
Service Pipe Line Co., Tulsa, Oklahoma.....F. P. O'Connor
Service Pipe Line Co.,
  Engineering Dept., Tulsa, Oklahoma.....V. J. Sittel
Southern California Gas Co., Los Angeles, Calif.....Robt. V. Gray
Southern Union Gas Co., Dallas, Texas.....K. D. Wahlquist
Standard Oil Co. (Indiana), Chicago, Ill.....Dean A. Ross
Standard Oil of California,
  San Francisco, California.....J. A. Polhemus, Jr.
Sun Oil Company, Beaumont, Texas.....E. H. Wilder
Sun Physical Laboratory, Newton Square, Pa.....F. L. Johnson
Sun Pipe Line Co., Beaumont, Texas.....W. E. Dickinson
Tennessee Gas Transmission Co., Houston, Texas.....A. L. Stegner
Texas Eastern Transmission Corp., Shreveport, La.....Thos. B. Kelley
Texas Eastern Transmission Corp., Shreveport, La.....Wm. C. Brady
Texas Eastern Transmission Corp., Shreveport, La.....F. Vinton Long
Texas Gas Transmission Corp., Owensboro, Ky.....Delbert R. Wofford
Texas-Illinois Natural Gas Pipe Line Co.,
  Chicago, Illinois.....C. E. Upson
Texas Pipe Line Co., Houston, Texas.....J. S. Shull
The Texas-Empire Pipe Line Co., Tulsa, Okla.....P. F. Davis
Tide Water Associated Oil Co.,
  San Francisco, Calif.....Clifford G. Pool
Transcontinental Gas Pipe Line Corp.,
  Houston, Texas.....H. A. Rhodes
Trunkline Gas Co., Houston, Texas.....M. O. Sharpe
Union Sulphur and Oil Corp., Sulphur, La.....F. T. Clarke
United Gas Pipe Line Co., Shreveport, La.....H. G. Pegues
United Gas Corporation, Shreveport, La.....E. D. Nuttall
West Production Co., Houston, Texas.....J. M. West
Western Geophysical Co. of America,
  Los Angeles, California.....David Sheffet

PETROLEUM INDUSTRY ELECTRICAL ASSOCIATION

OFFICERS

President.....J. A. Polhemus, Jr.....San Francisco, Calif.

Vice-President.....Hezzie Clark.....Houston, Texas

Sec.-Treas.....T. A. Shaw.....Bartlesville, Oklahoma

DIRECTORS

W. E. Church, Chairman of the Board.....Los Angeles, Calif.
Shell Oil Company

J. A. Polhemus, Jr.....San Francisco, Calif.
Standard Oil Co. of Calif.

Hezzie Clark.....Houston, Texas
Humble Pipe Line Co.

T. A. Shaw.....Bartlesville, Oklahoma
Phillips Petroleum Co.

K. P. McCord.....Pittsburgh, Pa.
Gulf Oil Corporation

F. J. Geisel.....Dallas, Texas
Atlantic Pipe Line Co.

J. A. Fowler.....Kansas City, Mo.
Panhandle Eastern Pipe Line Co.

**

General Counsel: J. E. Keller.....Washington, D. C.