National Petroleum Council

Interim Report of Committee on Use of Radio and Radar (1959)

This interim report is submitted on behalf of the Committee on Use of Radio and Radar (1959) of the National Petroleum Council which was requested by Mr. Elmer F. Bennett, Acting Secretary of the Interior, to create a committee to review its previous reports and recommendations in this specialized field, to make a current study concerning the use of radio and radar in the petroleum and natural gas industries, and to submit a report thereon, together with such recommendations as the National Petroleum Council deems appropriate.

The Committee met on July 23, 1959, and September 8, 1959. An editorial Subcommittee met September 24-25, 1959. The final rough draft has been submitted to all Committee members for study in advance of a final meeting on November 8, 1959, where this Report will be put in final form.

The main body of the report will consist of eighteen sections which provide the basis for eight recommendations.

Respectfully submitted,

Committee on Use of Radio and Radar (1959)

/s/ Morgan J. Davis

Morgan J. Davis, Chairman

October 20, 1959

SUMMARY

The National Petroleum Council Committee on Use of Radio and Radar (1959) has carefully reviewed the present uses of radio and radar in the oil and natural gas industry, examined the probable future needs and studied the problems which pose threats to the industry's continued effective use of radio and radar.

On the basis of this study, eight recommendations are offered for most serious considerations. These recommendations concern vital and, sometimes, urgent problems. They are given on pages R-1 to R-3 of this report.

To support these recommendations, this report, Section 1, quotes oil and natural gas statistics which, although they should be familiar to members of the industry, may be surprising to many members of the public and government. Likewise statistics are quoted on the growth of the use of radio by the oil and natural gas industry that may be surprising even to members of that industry.

The privilege of using radio and radar effectively is not automatically granted to an industry. This privilege is acquired only by great effort, proof of need and demonstration of real benefit to the public. The price of maintaining this privilege is eternal vigilance. The effort is demonstrated by the history given in Section 2. A description of the industry organizations which provide the necessary vigilance is given in Section 3.

The most serious challenge to the petroleum industry's continued effective use of radio is the growing intensity of competition for radio channels--for spectrum space. There is a definite, immutable upper limit

to the possible utilization. Technological improvements will increase the efficiency of radio spectrum utilization. But the demand will increase at a far more rapid rate than the efficiency.

This problem is not peculiar to petroleum radio or even industrial radio. It affects broadcasters, government users, communications common carriers alike. The problem is clearly recognized in high governmental circles and will receive intensive study. It is essential that petroleum radio needs be adequately presented in such studies. This question is considered in Section 4.

The petroleum industry has complex relationships with communications common carriers. Section 5 outlines some of the resultant problem. The oil and natural gas industry constitutes one of the major user groups of communications common carriers and relies on them to a very important extent. But other communications needs of the petroleum industry are best served by communications systems within the sole and direct control of the user. Such private systems, however, lead to competition for frequencies with the communications common carriers.

Section 6 discusses another area of vital problems. These are both problems that now arise in planning for national defense and those that would arise in the event of actual war. Detailed plans are necessary and will require the expenditure of considerable time and money.

The agency responsible for regulating all radio use, except by the Federal Government, is the Federal Communications Commission. Section 7 briefs some of the recent dockets of the FCC and discusses their impact on the oil and natural gas industry.

Two relatively new developments are certain to result in an increase in the rate of growth of petroleum radio and radar uses. These are automation and offshore operations, described in Sections 8 and 9.

The statistics on petroleum radio use, in Section 1, give an idea of the magnitude of the industry's needs, but to understand the true role of radio, it is necessary to consider in some detail the actual applications. The final nine sections, Sections 10 - 18, cover each phase of the oil and natural gas industry's operations--exploration, drilling, producing, transportation, refining and marketing--on land, sea and in the air. Each phase is keyed in an important manner to the use of radio. Safety and efficiency are greatly enhanced by this usage. Some operations would be impractical without radio.

RECOMMENDATIONS

Radio is daily becoming a more essential aid to safety, a more important economic tool, a greater convenience, a greater source of enlightenment and entertainment and a more important component of military planning and operations. This evergrowing demand coupled with the physical limitation of the radio spectrum results in more and more vigorous competition for use of the available frequencies. Technological advances will permit more efficient utilization of the spectrum, but the growing demand will surely outstrip the increases in efficiency.

The oil and natural gas industry has adopted radio as a tool to a far greater extent than most persons realize. Usage of radio is an essential element of all of the industry's operations. In light of the vigorous competition for use of the radio spectrum, the industry must maintain constant vigilance to protect its legitimate position in radio. The industry must see that its radio needs are well understood by the industry itself, by the public and by all governmental agencies concerned with radio matters.

Based on the detailed study reported herein, the Committee recommends:

1) That the Secretary of the Interior have additional studies of the petroleum industry's use of radio and radar prepared at intervals of two to three years. This recommendation is based on the fact that there has been a substantial increase in the use of radio and radar generally by industry and a great increase in usage by the petroleum industry specifically since the last National Petroleum Council report on January 1, 1955.

Furthermore, there have been outstanding technological advances which have affected the use of radio and radar since that date. Additional growth in usage and further improvement in applied technology are certain.

2) That all appropriate governmental agencies concerned either with petroleum industry problems or general utilization of radio be fully informed of the importance of the petroleum industry's use of radio and radar to the public welfare and national defense.

3) That any Congressional or Executive Committees or Commissions studying the problems of radio utilization or radio spectrum allocation be fully informed of the petroleum industry's usage of radio and radar and of its national importance.

4) That governmentally instigated plans for the cooperative use of the petroleum industry private communication systems by government agencies in times of emergency when normal communication channels are unavailable, should be based on adequate and timely planning. Such planning will require a considerable expenditure of time and money. This planning should insure both effective governmental usage and the continuity of the usage by the petroleum industry for its vital needs. Safeguards should be provided to avoid excessive or unplanned governmental usage. This might well be done by the appointment of National and Regional Petroleum Emergency Communications Directors, acting within the Office of Oil and Gas of the Department of the Interior.

5) That a vigorous effort be made to make the public aware of the need for an allocation of frequencies which gives proper weight to the importance of each radio usage and its relationship to public welfare and national defense. The assistance of the American Petroleum Institute Committee on

Public Affairs and other petroleum trade organizations with Washington contacts should be enlisted.

6) That all companies in the petroleum industry be informed as to the importance of radio regulatory matters if they are to have continued and efficient usage of radio and radar. They should be urged to cooperate fully with the American Petroleum Institute Central Committee on Radio Facilities and the National Committee on Utilities Radio.

7) That all licensees in the Petroleum Radio Service fully support the work of the National Petroleum Radio Frequency Coordinating Association and that all licensees make available qualified engineering personnel to aid in the coordinating work of the Association.

8) That contact be maintained at an appropriately high level with representatives of the communications common carriers to assure mutually helpful understanding between the two groups.

SUMMARY

PETROLEUM INDUSTRY'S USE OF THE RADIO SPECTRUM

NPC Committee on Use of

Radio and Radar (1959)

PETROLEUM INDUSTRY'S USE OF THE RADIO SPECTRUM

Section 1. Petroleum's growth and use of radio. The productivity, industrialization, and living standards of any nation are reflected in its consumption of energy in fuels and water power. Since 1927, the United States' consumption of such energy has almost doubled. In 1927, petroleum and natural gas supplied 27.5 per cent of such energy. By 1957, this had increased to 69.2 per cent. The growth of petroleum consumption in the United States has more than paralleled the growth of the economy. In turn, the industrialization of this nation is the sinew of its military strength. Petroleum has a double significance in national defense. It not only powers the industrial plants but also the military vehicles and equipment. Our military establishment runs on oil.

To provide an abundant, uninterrupted supply of oil and natural gas requires increasing activity of vast magnitude on the part of the industry. These operations, often scattered and in remote areas, require constant communications. Radio and radar are often the best, or only, possible means. Other sections describe such applications of radio and radar in detail. The scale of these uses is indicated by the fact that in the Petroleum Radio Service nearly a thousand users operate over 44,000 radio transmitters other than microwave. In addition, 176 gas distribution companies operate nearly 18,000 such transmitters. Moreover these petroleum and natural gas users have in operation or planning stage nearly 27,000 miles of microwave system incorporating 1200 stations.

Section 2. History. The history of radio in the petroleum industry is essentially the story of the growth of usable radio spectrum space, in turn governed by technological developments in the radio art. The petroleum industry's first usage of radio was on board tankers and primarily concerned the safety of life at sea. In 1925, radio was first used by geophysical crews prospecting for oil. In 1928, the industry sought the privilege of wider usage. This led to a cooperative communications company formed in 1929. Additional usage was permitted in 1932 in the Louisiana swamps in the Special Emergency Radio Service. In 1938, somewhat broader use became available in the Provisional Radio Service.

The major technical advances of the radio art during World War II, particularly the development of frequency modulation and of equipment usable in the Very High Frequency bands, led to an explosive growth of radio. The Federal Communications Commission recognized this possibility and had a series of allocation proceedings that resulted in a number of new radio services. The efforts of the petroleum industry, directed first through the Petroleum Industry Electrical Association and later the American Petroleum Institute Central Committee on Radio Facilities, resulted in the formation of the Petroleum Radio Service for users engaged in prospecting for, producing, refining and transporting by pipeline, oil or natural gas. Natural gas distributors became eligible in the Utilities Radio Service. The petroleum service companies are eligible in the Special Industrial Radio Service.

Section 3. Industry associations and committees. The Central Committee on Radio Facilities of the Division of Transportation of the American Petroleum Institute acts as a forum for the formulation of the petroleum radio

users' position concerning Federal Communications Commission proposals. It presents such positions to the Federal Communications Commission.

The National Petroleum Radio Frequency Coordinating Association is an advisory organization open to all licensees and applicants in the Petroleum Radio Service. It assists them in the selection of a specific frequency which will result in a minimum of interference.

The Petroleum Industry Electrical Association is an association of branches of the petroleum industry having communications systems or electrical departments. It provides for the study and interchange of knowledge with respect to the construction, maintenance and operation of electrical power and communications systems of interest to its members.

The National Committee for Utilities Radio combines on behalf of gas distribution, electric and water utilities, functions corresponding to both the API Central Committee on Radio Facilities and the National Petroleum Radio Frequency Coordinating Association.

The American Gas Association Committee on Communications and Telecontrol considers all problems of communications of interest to the gas industry. It arranges for discussions of technical topics. It presents statements to the Federal Communications Commission. It does not engage in frequency coordination work.

The Operational Fixed Microwave Council serves all microwave users in the safety, industrial, land transportation, marine and aviation radio services. It aids in the selection of frequencies and provides a means of exchanging information.

Section 4. Spectrum problems. Unfortunately there are physical limits to the number of radio transmitters that can be used. With a steadily and

rapidly growing demand for the advantages afforded by radio usage, this results in increasing intensity of competition for radio frequencies.

There are two international aspects. First, certain frequencies bands provide long range transmission and therefore international interference. Second, maritime and aeronautical uses require international agreements so that the ships and aircraft can communicate with one another and with ports and airports in any country. A complicating factor is the propaganda utilization of international radio broadcasts.

In the United States, the federal government has present rights to over a third of the vital bands from 25 mc to 890 mc. A serious difficulty is that no suitable agency exercises control over federal usage comparable to that exercised by the Federal Communications Commission over non-federal usage. This problem is being seriously studied by both the executive and legislative branches of the federal government.

The largest assignment of frequencies in the United States is to the broadcasters, with TV and FM having the major share. Unfortunately, these allocations were necessarily made when both technical and economic knowledge were inadequate. Major changes are needed but will meet strong opposition from those who have investments in the status quo.

The communications common carriers are vigorous contenders for additional frequencies. At the moment they are stressing a broad band general exchange type mobile service in metropolitan areas and are asking for 75 mc of spectrum to provide this service. These common carriers at present are required and permitted to serve anyone without regard to their relative contributions to the public welfare. Their spectrum requirements, therefore, should have low priority.

Section 5. Communications common carrier problem. Broadly stated, communications common carriers believe that they should have the sole right to fulfill all communication needs. From time to time, they acknowledge some exceptions to this position. The petroleum industry's position has been that there is a proper field for communications common carriers and also a proper field for private communications systems. Neither should preempt the entire field. The choice in a given instance should be made by the user, for only he has both the knowledge and incentive to make the proper choice.

Continued vigilance and continued effort to maintain good relations with the common carriers are essential.

Section 6. Petroleum radio and the national defense. Three aspects are currently being actively considered. One is CONELRAD. CONELRAD is a program to control the use of radio in time of enemy attack so that radio homing devices will be ineffective. More far reaching in its possibilities is the study of emergency utilization of a part of petroleum radio facilities by various government agencies, including the Oil and Gas Division of the Interior Department and the Defense Department. Such usage can be invaluable when normal communication channels are inoperative. However, careful, detailed planning is required to insure that the essential operations of the petroleum industry can also be carried on. This planning will require the expenditure of considerable time and money. A third aspect is the priority of restoration of leased circuits that might be requisitioned for emergency use. Present regulations provide petroleum users with little assurance of prompt restoration of service following such requisitioning.

Section 7. Recent FCC Dockets. The use of radio by the petroleum industry, in common with all use except by the federal government, is controlled by the rules and regulations of the Federal Communications Commission. Therefore the outcome of any action by the FCC is of vital importance to the industry. Two recent major actions were Docket 11866, covering the use of all frequencies above 890 mc--the microwave bands--and Docket 11997, covering the use of frequencies from 25 mc to 890 mc, the most important segment of the radio spectrum. A Report and Order in Docket 11866 was released on July 29, 1959. It constitutes the basic FCC policy concerning microwave usage. It substantially confirmed the position taken by the petroleum industry, by permitting broad private microwave usage without regard to the availability of communications common carrier service. However, since the decision was handed down, American Telephone & Telegraph Company has petitioned for a rehearing which, if granted, would postpone placing the decision into effect. The hearing in Docket 11997 was concluded in late June, 1959, and no decision is expected before next summer.

Other important recent Dockets provided for "split channel" usage, increasing the efficiency of spectrum utilization, and established new services with liberal eligibility requirements, vastly increasing the number of potential users.

Section 8. Impact of automation on communications. With the inevitable increases in the costs of many of the petroleum industry's activities, it is obvious that to remain competitive, more efficient, precise and economical methods of operation in all phases of the industry must be found. More rapid data collection and processing, more accurate forecasts, more rapid decisions and greater flexibility of utilization of equipment are essential. The results are already apparent in pipelines, refineries

and even oil and gas field operations. An integral part of an automated system is the communications facility. The growth in scope and importance of automation in the petroleum industry will demand more and better communication facilities. Many of the situations will require private systems.

Section 9. Radio in offshore operations. For more than a decade, the petroleum industry has been searching for, finding and producing oil and gas offshore, sometimes more than 30 miles from the nearest land and in water over 150 feet deep. It is obvious that the exploratory phase is totally dependent on radio for coordination of effort and for location. The location of a site for a well is likewise dependent on radio. Similarly the erection of a drilling platform could not be efficiently carried out without radio. During the drilling of a well, the need for radio is even more acute than on land. Even after the well is completed, its operation is best carried out with the aid of radio. Indeed in many cases, it can only be carried out if radio is available. Automatic remote control is a case in point. Throughout the operations, boats and helicopters must transport men and supplies. Their coordination and safety require radio.

Section 10. Radio in exploration. Some 11,000 to 12,000 wildcat wells per year are drilled to maintain the United States petroleum reserves at a satisfactory level. Geologists and geophysicists must select locations for each of these wells. Radio and radar make major contributions to this effort. Often these activities are in remote areas where there are no established communications systems. The coordination of the activities and the safety of the men are dependent on private radio. Also, radio is an integral part of some of the data gathering systems. A third use of radio and radar in exploration is for radiolocation. The exploration measurements are useless unless it is known with precision where they are

made. In many cases, such as offshore, radio and radar provide the only practical surveying method. Most of the 500 to 600 seismic crews in the United States are equipped with radio.

Section 11. Radio in drilling and production. Approximately 50,000 wells must be drilled each year in the United States. This is a hazardous and complicated operation. Good communication is essential for efficiency and safety. Often the drilling site is remote from any established communications system. The site may be occupied only a few weeks. In such cases, private radio provides the only feasible method of communication. Supervisory and engineering advice is required at unpredictable times. Such services as the delivery of "drilling mud" or "logging the hole" must be available on short notice. Such hazards as blow-outs, which may result in fire, or failure of equipment, call for immediate aid to minimize loss of life and property. All of these demand reliable communications. The operation may be 100 or more miles from the nearest commercial telephone. Or it may be offshore. Radio is the obvious answer.

After the well is completed and oil or gas is being produced, it becomes one of some 575,000 producing wells in the United States. A producing well is a facility requiring operation and maintenance. Valves must be opened and closed. Pressures and flow rates must be determined. Routine and emergency repairs must be made. Some of these varied activities are now automated, others must be done manually. In any case, each of them requires good communications. If the producing areas are near centers of population, wirelines may be used. More often the locations are such that only private radio is practical. Even where wirelines are used, mobile radio is essential to coordinate the activities of men and vehicles.

Section 12. Radio in pipeline operation. The growth of pipelines has been very rapid. By the end of 1957, there were over 145,000 miles of crude oil (trunk and gathering) and refined product pipelines delivering nearly four and a half billion barrels per year. Likewise in 1958, there were 217,000 miles of gas transmission and field gathering lines and 354,000 miles of gas distribution lines delivering over eight trillion cubic feet of natural gas per year.

Obviously these vast and widely dispersed operations require the full time use of many types of communications facilities. Often they traverse areas where public communications are difficult to obtain, even today. Moreover the need for a reliable and flexible communications network is another reason why many pipeline companies have constructed, operated and maintained a major portion of their communications systems. They do employ full period leased circuits where feasible. In the past 10 years the pipeline companies have pioneered the use of microwave radio relay systems to supplant wirelines because of their economy and greater reliability.

Communications has always been an essential part of pipeline operation, but the advent of automation and other techniques to permit economies in operation have increased the demand for communications and raised the requirements for reliability. The basic use is for the dispatching of the oil, product or gas the line is carrying. This is primarily a point to point fixed service. Equally essential however is the coordination of maintenance and repair. This involves mobile radio.

The pipeline industry is essential to our economy. Radio is essential to the pipeline industry.

Section 13. Radio in refinery operations. Unlike most other petroleum operations, refining operations take place in a well-defined area. This resulted in a somewhat slower acceptance of radio, but today all major refineries and many smaller ones have found that radio is an extremely valuable tool. The high pressures and temperatures in modern refineries present new hazards. Radio makes a contribution to safety that is beyond dispute. Moreover radio is a most attractive method of reducing costs. It increases efficiency of materials handling, dispatching of specialized heavy equipment, technical personnel, coordination of operations and plant security. In times of emergency it is irreplaceable.

Section 14. Radio in marketing operations. The most extensive use of radio in marketing is in natural gas distribution. The economic and safety contributions in this field are obvious. Over 17,700 transmitters are used in the work. The bulk marketing of petroleum products has made little use of radio largely because of Federal Communications Commission regulations. Recent changes probably will result in wider usage. An exception is the distribution of liquefied petroleum gas (LPG) and fuel oil. Mobile radio is widely used in this field and results in substantial reduction of distribution costs.

Section 15. Radio in petroleum marine transportation. The inland waterways system of some 5300 miles is an important segment of petroleum transportation. The vessels involved in this service fully utilize radar and radio for navigation, safety and communications, both intership and ship-to-shore. While VHF radio telephone has certain valuable applications, the 2 mc to 9 mc AM band is the backbone of the system. A current problem is the failure of previous international communications conferences to

provide for continued use of frequencies in the 6 mc band. The U. S. delegation to the current Geneva Conference will endeavor to remedy this lack.

The ocean going vessels of the petroleum fleet likewise fully use radio and radar for the same functions. They rely largely on the medium frequency (405-515 kc) band with some use of the 2 mc band. Moderate use is made of VHF (156 mc). A recent proposal provides for direct short range VHF bridge-to-bridge radio telephone as a navigation aid, particularly in passing situations.

Section 16. Radar and radiolocation. The petroleum industry makes extensive use of three radiolocation methods--radar, Shoran and phase comparison. Radar is widely known. It is principally used as a navigation aid, at night or in fog. With some modification of equipment, it has been used by petroleum prospectors as a surveying method. It has limited range and other difficulties which minimize its usefulness as a surveying tool. Shoran, which is similar to radar but employs "beacons" at known fixed points, instead of echoes from natural objects, is fairly widely used. It also has limited range. Its use is complicated by the fact that its operating frequencies are primarily allocated to military operations.

Phase comparison methods provide much greater range and higher precision. Two systems were developed especially for use in petroleum operations in the Gulf of Mexico. Efforts are now being made to secure permission to use these systems in Alaska and off the Pacific Coast. A third system, developed abroad for aircraft and ship navigation, is not yet available for petroleum use in the United States.

Section 17. Radio in petroleum aircraft. The petroleum industry is a large user of business aircraft, both fixed wing and helicopter. In

addition to the conventional aircraft use of radio and radar for route control, traffic control and navigation, petroleum aircraft have a number of specialized functions. These include flying inspection of pipelines to detect leaks, offshore operations and airborne geophysics.

Section 18. Petroleum relay and control stations. Normally radio communication in the petroleum industry is direct from transmitter to the desired receiver. Sometimes however the distance to the receiver is too great and the message must be relayed by one or more intermediate relay stations. Microwave systems are examples of the use of relay stations. Another example is a control station, where it is desirable for a base station to be located some distance from the operating station, frequently to take advantage of a hill or other desirable location.