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ABSTRACT

This report describes the changing nature of labor demand in the petroleum industry. Jobs have become more specialized as the value of petroleum has increased and the technology of its extraction has advanced. Numerous categories of technical jobs are available in this industry and this affects the training needs of those seeking careers in this industry as technicians. The report discusses some of the skills necessary for workers in this field and describes some characteristics of the training programs now available. Recommendations conclude the report. (RE)

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OIL and GAS

TASK FORCE REPORT

JANUARY 15 - 17, 1979

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PREFACE

This report of the Petroleum Task Force is an attempt to summarize the discussions during the 2-day meeting in Washington, D. C., November 9 and 10, 1978. It is not intended to be a comprehensive document but rather to provide a brief overview of the manpower need and the training opportunities available. The statements and conclusions presented herein are not necessarily the unanimous opinion of the individuals serving on the Task Force. The paper is an attempt to provide a brief group consensus of the topics and issue presented. It is expected that these topics will be amplified at the Education, Business and Labor Affairs conference to be held in Washington, D. C., on January 15-16-17, 1979.

The contents of this paper are predicated on the premise that although petroleum is a limited energy resource that the country, of necessity, will continue to rely on the petroleum industry to meet a large portion of its energy needs for the foreseeable future. A well trained work force is essential to the viability of the petroleum industry in its effort to help produce the products necessary to meet the needs of society.

TASK FORCE

Dr. Joseph C. Piland
President
Lincoln Trail College
Rural Route 3
Robinson, IL 62454
Phone: 618-544-8657

Mr. Dan R. Baldwin
Manager, Employee Relations-Production
Shell Oil Company
P. O. Box 60193
New Orleans, LA 20160
Phone: 504-588-4848

Mr. Ken Calvert
Area Manager, Operators Inc.
Tenneco Oil Company
P. O. Box 51345
Lafayette, LA 70501
Phone: 318-232-1090

Dr. Frank Collins
Oil Chemical & Atomic Workers Union
1126 16th Street, N.W.
Washington, D. C. 20013
Phone: 202-223-5770

Mr. Robert Custer
Manager, Training Service
American Gas Association
1515 Wilson Blvd
Arlington, Virginia 22209
Phone: 703-841-8438

Mr. Dan Durfee
Instructor, Petroleum Engineering
Technology
Muskingum Area Technical College
1555 Newark Road
Zanesville, Ohio 43701
Phone: 614-454-2501

Mr. Edward McKay
Instructor, Petroleum Technology
Lincoln Trail College
Rural Route 3
Robinson, IL 62454
Phone: 618-544-8657

Mrs. Flo Potts
College Relations Coordinator
Cities Service Corporation
P. O. Box 300
Tulsa, OK 74102
Phone: 918-586-2211

Mr. Edward Poulter
Instructor, Petroleum Technology
Midland College
3600 North Garfield
Midland, TX 79701
Phone: 915-684-7851

In April 1977, President Jimmy Carter said in a televised message to the American people...

> "The energy crisis has not yet overwhelmed us, but it will if we do not act quickly... By acting now we can control our future instead of letting the future control us... This difficult effort will be the moral equivalent of war except that we will be uniting our efforts to build and not destroy...".

We have lived through an era of cheap energy. As recent as 1973, foreign oil was a little over $3.00 a barrel. This cheap foreign oil coupled with domestic production served to give us a false sense of security. The American people are now aware of the fact that the day of cheap energy and unlimited supply is gone. We are, therefore, engaged in a major national effort to maximize the efficient use of the energy resources available as well as the development of the technology to maximize the development and production of our energy resources. It is not surprising that a part of this effort is directed toward the development of the technical competence of the manpower engaged in the energy field. The technology in the petroleum resources has changed the industry from one that utilized mules and men "off the street" as the major source of labor in drilling, producing, and transporting petroleum products. The industry now utilizes more sophisticated equipment in geographic and climatic areas that would have been deemed impossible a few years ago.

Accompanying these more difficult conditions and the increased technical sophistication has come a dramatic increase in the cost of exploration, drilling, production, refining, and distribution and marketing. The cost of drilling alone has tripled in the period from 1967 through 1977. When oil was easy to find at shallow depths if a well were ruined due to a technical error, the oil company could move over one location and drill another hole. With today's deeper wells and more difficult drilling conditions technical errors can cause serious damage to the environment, as well as the loss of so many million dollars, as a result of a well failure. As the risk of finding oil, the risk of environmental impact, the cost and the sophistication of technology increases, the need for competent, adequately trained manpower becomes increasingly important to the petroleum industry.

MANPOWER NEED

The need for trained manpower in the petroleum industry is dependent upon the stability of the industry. Within the last 10 years, manpower need has tended to fluctuate with the price paid for oil and gas. When prices have increased, the oil and gas industry has been able to expand their employment of trained manpower. Manpower need figures for the industry are imprecise and are narrow in scope. The Task Force was not able to identify any source of

national figures for the total industry. Some figures are available for particular basins and, also, for some specific aspect of the petroleum industry. Apparently, no agency has looked at the total manpower need for the petroleum industry. When manpower figures are given, they are couched in reservations regarding Department of Energy policies and regulations, and the price of oil and gas.

In the immediate future it appears that there is going to be an increased need for manpower for drilling and renovation work. The number of rotary drilling units operating in the U.S. increased from 1,700 in 1977, to 2,356 in 1978. Assuming a crew size of approximately 24, of which approximately 7 in 15 positions, would involve 2-year technician graduates, this increase in rotary drilling units alone would create approximately 1,000 jobs for 2-year graduates

TECHNICAL JOBS AVAILABLE IN THE FIELD OF PETROLEUM ENERGY

Numerous jobs and positions are available today in the field of petroleum energy. These technical jobs encompass four major categories of the petroleum industry: (1) production and exploration, (2) refining, (3) transportation and transmission, and (4) marketing and distribution.

First to be considered is the category of production and exploration. Technical support jobs in this category include three types: (1) engineering, (2) geological, and (3) geophysical.

Engineering support includes drafting, corrosion engineering, petroleum engineering, and regulatory affairs, such as keeping records, data processing, measuring, production of testing, electric log analysis, environmental technology, location surveying, and well workover.

The second type of technical support is geological. Within this category are manpower needs for drafting, map making, core analysis, sample study, record analysis, reservoir evaluation, and computer analysis.

A third type of technical support within production and exploration is that support offered by technicians to geophysicists. Such support includes drafting, data processing and computer analysis, and record maintenance.

In essence, what is said is that many jobs are available for technicians to provide support to engineers, geologists, and physicists involved in energy production and exploration.

Then, there are vast manpower needs in operations within production and exploration. Roustabouts are needed for doing general labor outside of drilling operations. Roughnecks are needed to do general labor within the drilling operations.

Other areas of service include pumper operator and maintenance operators who handle well testing, preventative maintenance, government reporting, gauging, and product control. Furthermore, personnel are required for material management, procurement, and

handling, such as those persons who handle supplies and materials in warehouses. Included in operations are field operating technicians who supervise operations at well sites, such as drilling, workover, and oil and gas well analysis.

The second major category of the petroleum industry is refining. This category comprises jobs in technical support, operations, and maintenance.

Technical support for refining calls for lab assistants, draftsmen for design and piping, and personnel in record maintenance. Operations requires process operators who are designated to operate refining units while maintenance incorporates pipefitters, instrument technicians, metal trades, pneumatics, and electricians.

A third significant category of the petroleum industry is transportation and transmission. The three sub areas involved in this category are technical support, operations, and construction.

Technical support required for effective transportation and transmission of petroleum includes quality control analysis, record keeping, measurement and metering. Operations will entail operators for pipeline pumping, compressors, maintenance repair, and corrosion control. Construction will necessitate many workers to lay new pipe lines, build new facilities, inspect construction, weld, operate heavy equipment, etc. Considerable money will be invested within the next 10 years for such construction.

The last major category of the petroleum industry which will require manpower for technical jobs is marketing and distribution. Since petroleum is an extremely marketable commodity, obviously, manpower needs within marketing and distribution will continue to exist. Jobbers, wholesalers, distributors, and salespersons will be much in demand.

Perhaps a few words should be said about the emerging areas within the industry which will increase manpower needs. These areas involve shale oil extraction, tar sands, synthetic natural gas, coal gasification, geothermal, biodegradation, LNG (liquified natural gas), and extraction of gas from hot brine.

Training needs for the future in petroleum will be affected by several factors. One such factor which will have considerable effect on training needs is the demand over supply relationship. For example, pipeline construction will see more money invested within the next 10 years than invested from the beginning to the present. In addition, it has been indicated earlier that 2-year colleges are producing less than 10% of the petroleum technicians needed.

An additional factor which will influence petroleum training needs in the future is the exportation of American training and technicians to foreign operations such as China and Mexico. Qualified personnel will be mandatory in order to make this exportation process effective and feasible. It will, nonetheless,

require additional manpower.

Advanced fossil fuel technology is another factor which will very likely affect training needs. This will move more workers into other regions leaving personnel gaps behind which will have to be filled by new personnel.

A final factor is the development of petroleum along the Eastern Seaboard. It is difficult to determine whether this development will result in new jobs and increased manpower needs, or if it will simply involve the movement of old jobs to the Eastern Seaboard. It is logical to assume that some new jobs will occur, but only time will reveal to what extent.

As manpower needs will be increasing for the industry, so will be the salaries with the changes in the economy. Salary ranges for a production technician are from $1,000 to $1,300 a month. Hourly wages for a refining technician range from $9 to $10, while the monthly salary could range from $1,000 up to as high as $1,350. The general outlook for wages is indeed encouraging to the prospective trained technician.

In the area of production, it is predicted that offshore jobs available to 2-year graduates will approximate 300 per year over the next two years. Onshore jobs related to 2-year graduates will approximate 600 over the next two years.

In the area of service and construction, a one-to-one technician relationship is assumed between service and construction

technicians and production and drilling technicians. This would mean that 2,400 jobs appropriate to 2-year graduates will exist in the service and construction aspects of the industry.

In the areas of refining and petrochemical, transportation, marketing and storage, no major increase in personnel is expected. The manpower need will be for replacement personnel only.

Throughout the industry it appears that there will be a need for increased technical support personnel in the area of complying with new regulations. No projections are available as to the number of personnel needed to fill these emerging positions. There is a demonstrated need for 2-year graduates. It is equally apparent that 2-year colleges are not producing the manpower needed by the industry. In 1976, there were 146 graduates nation-wide. In 1979, it is projected that approximately 175 to 200 graduates will be available for employment.

SKILLS REQUIRED

Due to the diversity of positions within the petroleum industry, it is impossible to come up with a common set of skills that would be required for these various positions. Each position has its own special combination of skills that are necessary for the technician to work effectively within that particular position. There does, however, seem to be some commonality of knowledge required for technicians who are preparing to work as engineering and technical support personnel. One of the most obvious skills

necessary for engineering and technical support is that of mathematics. Although some personnel working in data collection and measurement may be able to perform effectively with a background in technical mathematics, most support personnel should have mathematics through college algebra and trigonometry.

The petroleum industry relies heavily on the physical sciences. Persons expecting to find employment as engineering and technical support technicians should have a strong background in basic chemistry; physical and structural geology, specifically related to petroleum production, and an understanding of physics including electricity, mechanics, heat and hydraulics.

Being able to communicate and transmit data, as well as information, is one of the most necessary skills of a petroleum technician. Without the ability to communicate both orally and in writing, a technician is of limited value. The technician's communication skill should also include the ability to present and interpret information graphically, and he/she should have the ability to do engineering drawing. A third common skill required within the industry is that of human relations. The technician will be working with people as well as with data and information. He should understand the management and supervision process, and should have an appreciation for the important factors that affect the quality of work life. In addition, he should have a basic understanding of

management and labor relations.

A technician must also understand the industry in which he proposes to work. He must understand the nature of the industry in terms of its problems, its opportunities, its history, and the terminology used within the industry. It is therefore important that the student have exposure to the industry not only in the classroom, but also with 'hands on' experience within the industry. Internships and co-op educational experiences are especially valuable.

In addition to the general skills enumerated above, the technician should have specific skills related to his area of specialization. This may include areas such as drilling fluids, drilling technology, well logging, well completion, refining methods, reservoir engineering, basic civil engineering, or surveying.

It should be recognized that the skills of the petroleum technician are never complete. As the sophistication of the technology of the petroleum industry increases, it becomes imperative that the technician keep himself up-to-date and continually expand his technical expertise. For this reason it is also imperative that an advisory committee from industry work closely with curriculum development and changes at pre-service training institutions.

SOURCE OF WORKERS

Traditionally, manpower has been trained by the petroleum industry by employing workers at entry level occupations requiring general labor. Those that have demonstrated aptitude and effectiveness have been promoted from one level to another. This upward

mobility pattern has sometimes been organized, such as labor-sponsored apprenticeship programs, and at other times has been an unplanned upgrading development. Persons entering the petroleum industry were friends, relatives, and acquaintances of persons already in the petroleum work force. The majority of workers came from the labor supply in the geographical area where the petroleum activity was taking place. With the increasing technical demands there emerged a need for technical assistance to engineers, geologists and geophysicists. Persons employed to fill this need have come from students who dropped out prior to obtaining their 4-year degree, yet who had some of the skills required of these support personnel. In many instances graduates of 4-year engineering schools were employed to fill positions that more appropriately would be defined as an engineering assistant or a technician's position.

Within the last 10 years, 2-year post secondary schools have been initiating programs to train personnel for the engineering technician and general labor type positions. Production of graduates from these programs have not been adequate to meet the need; therefore, the traditional methods have apparently been followed in supplying manpower personnel to the petroleum industry.

The traditional employment patterns have served to fill the available positions with white males. There is an apparent need for an infusion of women and minorities into the petroleum work force. A career in the petroleum field is indeed an excellent choice for

women and minorities. However, the programs which have been established to date have had only limited success in recruiting either women or minorities into training programs designed to prepare them for the petroleum industry.

TYPE OF EDUCATIONAL PROGRAMS AVAILABLE

The employment system and the increased technology have both served to necessitate the training of new hires and upgrading and promotion of those already employed. Much of this training has been conducted by professional associations. The American Petroleum Institute, the American Gas Association, the Society of Petroleum Engineers, the American Landmen Association, and the Edison Electric Institute have all been active in providing education and training programs within their respective spheres of influence. Some of these associations publish catalogs of the programs which they offer w[illegible]ates and locations publicized well in advance of the offering.

Educational institutions reflect a diversity of approach as to the kind of training provided. Some institutions offer a broad generalized program, while others provide very narrow and specialized offerings. They also range from 12 weeks non-credit certificate courses funded by CETA to 2-year associate degrees with most, if not all, of the credit being transferable toward a 4-year degree for those who are inclined to pursue the bachelor's degree. A study published in July of 1976, conducted by Dr. John Doggett, revealed that petroleum technology programs expanded

rapidly from 1970 to 1975. Twelve colleges reported 13 existing petroleum technology programs; 9 additional colleges were reported to be planning 11 new petroleum technology programs.

It appears that industry and education are making an effort to cooperate in the development of trained manpower for the industry. One area is that of co-op training in which students may spend part of the day in the classroom and the remainder of the day with 'hands on' experience on-the-job to supplement the academic training. Also, internships of students who may attend an educational institution in a petroleum training program one year, and then spend the summer with actual on-the-job experience before returning for the second year of academic training is another example of industry-education cooperation.

Another area of operation between education and industry is reflected by the "Professor Awareness Program" in which industry offers jobs to college teachers for a short term (one year or less) to expose him to current research, procedures and development in which industry is involved. A third area of cooperation is that of advisory councils being provided to college programs. These advisory councils are typically composed of industrial and professional and labor representatives who have an interest in helping to determine the specific training needs, and establishing the guidelines for course content and curriculum direction. These councils serve to keep the college educational program in line with the needs of the industry, and serves as a link between the

educational institution and industry so that industry is aware of the competence of the graduates.

Apprenticeship programs of both industry and labor also serve as a significant training effort conducted by the petroleum industry. Apprenticeship programs are the common preparation for those who are to work in the refining and construction areas of the industry. Unit operators, control technicians, pipefitters, welders, heavy machine operators are some of the positions that are normally filled by the apprenticeship procedure.

RECOMMENDATIONS

A series of recommendations that are considered important in the development of trained manpower to meet the needs of the petroleum industry have been developed. They are as follows:

1. That more women and minorities be recruited into training programs preparing technical support personnel and general labor. This may be achieved through the use of scholarships and support for recruiting programs by both the Department of Energy and industrial companies.

2. That upgrading and in-service courses and programs offered by colleges and organizations such as the American Gas Association, the American Petroleum Institute, and Society of Petroleum Engineers be publicized, and that petroleum companies encourage their employees to take advantage of these opportunities to expand and update their technical skills.

3. That post secondary 2-year institutions produce more technical graduates.

4. That there be a few strong programs designed to train technicians that are large enough to offer speciality courses rather than numerous small programs that are limited to general offerings. Federal grants could be established to support certain identified programs to ensure that specialty courses are included in the curriculum.

5. That no programs be started on the North Atlantic coast since the exploration and development plans of the offshore operation are so indefinite. However, this potential should be monitored closely so that if a major development takes place, one or two programs could be initiated in the Northeast.

6. That colleges who are operating petroleum technology programs remain in close touch with industry and labor through personal contact and advisory committees to ensure the relevance and effectiveness of the training program.

7. That the Department of Transportation review the requirement for truck drivers to be 21 years of age. Those people who are in a training program, or who have completed a training program preparing them for an occupation in the energy field that requires that they drive a truck as a minor part of their duties should be exempted from this regulation. This recommendation specifically impacts upon service companies doing well logging, well cementing and other similar functions.

8. That safety and governmental regulations be included in training programs.

9. That students who are training for positions in the petroleum industry be counseled that they must be mobile and be willing to relocate their families as the job demands.

10. That manpower requirements in emerging technologies in fields such as; shale extraction, tar sands, synthetic natural gas, coal gasification, geothermal, biodegradation and liquified natural gas be monitored and that appropriate training for these needs be developed as they emerge.