

Research on Drilling Fluids and Cement Slurries

at Standard Oil Production Company

An Internship Report

by

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Research on Drilling Fluids and Cement Slurries
at Standard Oil Production Company

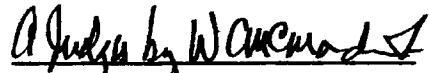
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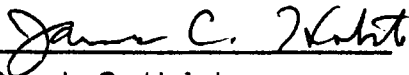
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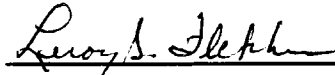
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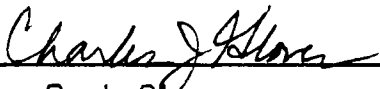
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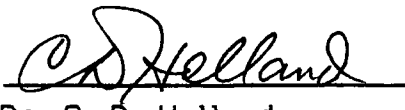
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ABSTRACT

This paper describes a one year internship with Standard Oil Production Company (SOPC). The internship covered the period from June 10, 1985 until June 15, 1986. Dr. Arnis Judzis was the internship supervisor. The chairman of the intern's committee was Dr. K. R. Hall.

Mr. Flipse was assigned to the SOPC Drilling Fluids Laboratory during his internship. Dr. W. C. McMordie, Jr. was his direct supervisor. The technical and administrative duties of this internship fell into six categories: orientation, laboratory build-out, office management, research, drilling mud technical service, and cementing technical service.

The orientation phase of the internship was made up of a short course in drillings fluids testing and terminology. The administrative services and support facilities available from SOPC were also examined. The laboratory build-out phase consisted of supervising the interior construction of the Drilling Fluids Laboratory. The necessary laboratory equipment was ordered and installed. Two major research projects were undertaken during the internship. The simulated wellbore flow loop was reassembled and tested. The intern evaluated the rheological measurement capabilities of the flow loop. The gumbo shale study required the testing and relative ranking of a number of water-based drilling fluids. The technical service aspect of the internship provided valuable field experience. Much testing of drilling muds and cements was associated with the technical service. Office management tasks included organizing a purchasing system and its necessary documentation. The necessary office

forms were designed and implemented.

ACKNOWLEDGEMENTS

I would like to use this space to thank the three groups of people who made this accomplishment possible. Without their help, I would have never finished what I started.

Standard Oil Production Company offered me an internship during a period of recession in the oil industry. I would like to thank Dr. James Rickard, Dr. Arnis Judzis, and Dr. Warren C. McMordie, Jr, for their participation in this intership. The supervision and friendship I received from Dr. McMordie and Mr. David B. Young were a valuable part of this internship. Jason Hubbard, Tim Edwards, and I shared in the work; thanks.

Dr. K. R. Hall and Dean Leroy Fletcher lent strong support to my degree program. I appreciated the help of Dr. Charles Glover and Dr. James Holste in participating on my committee. I would also like to thank Dr. Charles Holland, Head of the Department of Chemical Engineering, for his help.

Finally, I would like to thank my family for their support. My parents supported my education from the beginning. Special love and thanks to my typist, Ginny Flipse. With help like yours, I knew we would get it done.

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I. INTRODUCTION

The Doctor of Engineering Program requires a professional internship. In this paper, I describe my one year internship with the Standard Oil Production Company (SOPC), formerly Sohio Petroleum Company. The internship covered the period from June 10, 1985 until June 15, 1986. The details of some of the projects on which I worked will not be released in this report because of their possible proprietary nature. Disclosure of such confidential material is prohibited by a confidentiality agreement.

The following technical personnel were involved in this internship. Dr. Warren C. McMordie, Jr. was my direct supervisor. Dr. McMordie is the manager of the SOPC Drilling Fluids Laboratory. The internship supervisor was Dr. Annis Judzis. Dr. Judzis was the supervisor of SOPC Drilling Research. David B. Young, Staff Drilling Engineer, is a drilling fluids consultant and drilling engineer with SOPC. He was working in the Fluids Lab during the majority of this internship.

SOPC operates its Technology Center in Dallas, Texas. Because of increased drilling activity during 1985 by SOPC in its large domestic reserves, a need was felt for an in-house drilling fluids and cement slurries laboratory. The purpose of such a laboratory would be to perform basic research on drilling fluids and cement slurries in areas such as rheology and chemical reactivity. Technical support of drilling operations would also be a high priority. This technical support would include the testing of delivered drilling fluid materials and cements to ensure that they met SOPC's specifications and drilling requirements. Because of space constraints and plans for future expansion, an interim drilling fluids and cement slurries laboratory was planned near the Dallas-Fort Worth airport.

Move-in was expected in August.

The duties of this internship may be divided into three areas: technical, administrative, and management duties. Each of these areas is discussed in turn.

TECHNICAL

I was involved in a number of technical tasks which may be divided into four fields. They were setting-up the laboratory, technical support operations, basic research, and continuing education. Setting-up the laboratory involved selecting, ordering, and installing or supervising the installation of necessary laboratory equipment. I also acted as the building supervisor during the build-out of the laboratory space. The majority of the large capital expenditure items had been ordered before I started my internship. I was responsible for ordering most of the support equipment, computer equipment, hand tools, and other small laboratory equipment. After the equipment was received, I either installed, or supervised the installation of, the laboratory equipment from lab benches and cabinets to the computer terminals and communication network. Once the laboratory equipment was installed, I was responsible for its testing and calibration.

The technical service aspect of this internship covered the areas of technical support for SOPC personnel, characterizing drilling fluids and cement slurries, devising test procedures for drilling fluids and cement slurries, documenting the test procedures, and training personnel in performance of the test procedures. Technical support for SOPC personnel consisted of providing information, explanation, and direction to both technical and non-technical SOPC personnel involved in the drilling program

both in Dallas and in the field. Information was transferred through direct contact by conference, through an in-house Mud School, and through widely distributed technical notes. Direction of field personnel often occurred during trips to drilling rigs to observe conditions or to correct problems. When characterizing drilling fluids, the major area of concern was the proper maintenance of fluid properties, including rheology and filtration control. The major emphasis with cement slurries was to determine the thickening times and compressive strengths. Samples of drilling fluids and cement slurries were brought in from the field or prepared to field specifications. These samples were then tested to determine their rheological and drilling properties. I was responsible for devising a series of tests to characterize these samples. These tests had to be performed in an economical, but accurate, manner. After specifying the test procedures, the procedures were documented and technicians were trained in their performance.

The basic research aspect of this internship was to consist of both computer modeling and experimentation. A simulated wellbore flow loop was to be operated to examine solids carrying capacity and wellbore hydraulics. The results of the wellbore flow loop experimentation were then to be computer modeled. The current down-turn in the drilling industry caused the postponement of this project. The flow loop was assembled but the development of the apparatus and experimental program were delayed.

Another more technical service oriented project was undertaken. A representative gumbo shale was tested using three different methods to determine the dispersive characteristics of a variety of drilling fluids.

The necessary equipment for each test method was purchased or constructed. Standard test conditions and procedures were determined for each method. The results for each fluid using each of the three methods were compared. The methods' limitations were considered and noted.

Continuing education was an important part of this internship. There were a wide variety of forms of continuing education available at SOPC. Consultation with other SOPC personnel was the most valuable form of education. In-house courses and seminars were often presented on a variety of subjects. None of these presentation met my needs, however. Many vendors offer seminars and technical literature as a service to their professional customers. I took advantage of a number of seminars and a large amount of technical literature. The SOPC Information Service had available a wide range of literature and easily obtained inter-library loans of desired material.

ADMINISTRATIVE

The administrative tasks fell into two general categories. Initially, a majority of the administrative duties were connected with finishing the building and the start-up of the lab. These duties included frequent site inspections to monitor progress on the building. As the build-out progressed, I moved on-site to monitor the progress. Meetings with SOPC staff were necessary to discuss telephone, computer, and other utility services. The procurement of necessary supplies and furniture also required numerous meetings and proper documentation. It was necessary to set-up a records system to track the purchase of laboratory equipment. Work change-orders and completed work orders were monitored and

recorded. Once the lab was in operation, most of the administrative duties consisted of maintaining records and following SOPC procedures for purchasing, travel, expenses, inventory, etc. Proper records of equipment and time expended on various projects were necessary for SOPC accounting. Travel expenses and purchases were documented and reported to the proper departments.

MANAGEMENT

The management aspect of this internship fell into three areas. My major management responsibility was the direction of two laboratory technicians. One technician specialized in cement slurry testing. He was experienced when hired and required little direct supervision while testing. Along with his testing duties, he was also responsible for the majority of the supply ordering. I directed him extensively in ordering and record keeping. The other technician had had limited laboratory experience and received on-the-job training. I was partially responsible for his training and directed him in ordering, as well.

During the laboratory build-out, I directed the subcontractors and tradesmen. I was responsible for the efficient and correct completion of the laboratory interior. My on-site management provided an easy source for direction and explanation.

The final area of management responsibility occurred during trips to the field. Management of drilling rig or service company personnel was occasionally required to correct drilling fluid problems.

II. ORIENTATION

Much of my initial education at SOPC was necessary because of my entry into two unfamiliar fields; drillings fluids and the industrial environment. My formal engineering training was in Chemical Engineering. Some of the concepts and most of the terminology associated with drilling fluids were foreign to me. A quick course in oil field terminology and drilling fluid practices was necessary so that I could communicate and contribute in my new job.

I also needed to learn what resources were available at SOPC and how they could be be employed. Two major areas of concern to me were the computer systems and the administrative services available to our group. I expected to be working on the computer system. I was also responsible for a majority of the administrative tasks as I was initially the junior member of a two man group.

DRILLING FLUIDS

My training in drilling fluid technology and drilling practices took five forms. The most readily available source of information were books. Discussions with SOPC personnel were another valuable source of information. Seminars provided by oil field service companies provided information in the form of technical manuals and sales brochures. Field trips served to demonstrate the information derived from word of mouth or printed page. Finally, laboratory experiments served to illustrate the practical chemistry involved in drilling fluids.

I read a number of technical reference books and drilling mud service

company technical manuals during my internship. Initially titles and topics were suggested by Dr. McMordie. Subsequent titles were selected from those available from the SOPC library. Other literature that I read included SOPC reports and current periodicals in circulation for review. Dr. McMordie was constantly available to answer questions and explain concepts. He often asked leading questions to encourage further research.

Each member of the Drilling Fluids Lab provided a different information resource during informal discussions. Dr. McMordie provided initial guidance and topics. He was available to answer questions and explain terminology. He was always eager to provide a theoretical basis for practical drilling fluids operations. David Young possessed a wealth of practical field experience. He was experienced in drilling, mud, and cementing operations. He gladly shared "tricks of the trade" and explained why they worked. He also shared experiences which demonstrated proper oil field behavior. Tim Edwards' experience in laboratory cementing operations and excellent knowledge of cement test equipment were freely available for the asking. Many laboratory problems were solved by drawing out knowledge during conversations with Mr Edwards and applying it in a novel way. He also shared his good understanding of cementing theory. Discussions with SOPC field personnel provided a different point of view. These discussions were often an exercise in listening and communication. In-house seminars were a more formal presentation of SOPC personnel's work. Informal lunches and discussions normally followed these presentations and provided further valuable exchange of information.

Service company or vendor seminars provided a source of biased information. Each seminar included either a direct or indirect sales

session. The direct sales information was normally of the form that their commodity was superior to their competitor's commodity. Superior technology and personnel were touted in a less direct form of sales pitch. However, the technical information presented during these seminars was of some value. Often useful tables, graphs, or calculational methods were presented in a service company technical manual. Product specific information was also included in these technical manuals.

For example, I attended a solids separation technology seminar presented by Geolograph Pioneer. They presented the most common methods for separating drill solids from the drilling mud. These methods included hydrocyclones, centrifuges and seive screens. Methods to size the equipment were presented. The visual aids emphasized Pioneer Geolograph equipment, and the virtues of their equipment were clearly illustrated. However, after the sales program, the technical manual and product catalog remained as reasonably valuable resources.

A slightly different vendor seminar was provided by International Drilling Fluids (IDF). IDF had been invited to give a presentation on a specific drilling fluid for use on a specific well. IDF employed more indirect sales persuasion by sending one of their best technical people to give the presentation. They wished to emphasize their technical abilities as well as their superior products. Previously drilled wells were given as examples of the superior performance of their products.

Trips to the field to examine drilling equipment and to observe drilling operations were an important part of my orientation. They served to reinforce the knowledge acquired from other sources. Inspection of rig equipment served to spark my interest, resulting in further reading and

discussion.

The first well I visited was the L. W. Magoun #1. Dr. McMordie was asked to review the mud program and visit with the service company personnel at the rig. SOPC personnel were concerned about this well since it was so deep and hot. I accompanied Dr. McMordie so that I could tour the drilling rig and be present at the review of the mud program. The tour of the rig led to further discussion on our return trip. The mud program review left me curious. I actively pursued my reading and other research, especially in the area of terminology, after our review of the mud program.

The visit to the Hughes Drilling Fluids mud plant outside of Oklahoma City was also an educational trip. I went with David Young to "check" on the oil-based mud. This oil-based mud was to be used on a SOPC well. The SOPC engineer in charge of this well was concerned with the quality of mud. Mr. Young and I traveled to the mud plant where the mud was stored. We discussed the quality of the mud with Hughes personnel and received API test results for the mud. We then looked at the mud, smelled it, and rubbed it between our fingers. After we left the plant, Mr. Young explained the value of each of these tests. An experienced mud engineer can judge the quality of an oil mud by looking at the sheen on the surface of the mud. The smell can reveal decomposition of water wet emulsifiers and viscosifiers. The ability of the oil mud to wet the skin gives another indication of the mud's quality. As I said, Mr. Young was a very practical engineer. Such practical "tricks of the trade" were based upon experience and mud chemistry. This practical knowledge was valuable when establishing one's credibility.

A trip to the Mary E. Coward #1 well completed my field orientation.

This trip took place after I had completed the majority of my reading and practical education. I visited the well for three days. I observed the daily mud operations. These observations greatly helped to explain the discrepancies between field measurements and our own corresponding laboratory measurements. I spent most of my time at the rig getting to know the personnel involved, both SOPC and service company. In most cases, after a rapport was established, each person at the rig would volunteer his opinion of what was causing trouble. Listening to the personnel on-site proved to be an excellent source of information.

Another valuable part of my orientation in drilling fluids were the laboratory experiments which I performed. These experiments were practical demonstrations of the theories and field practices described in my reading. I became proficient in drilling fluids testing during these experiments. I prepared all of the basic mud types and learned the practical problems associated with their preparation.

COMPUTER SYSTEMS

It was expected that the computer system would play a large part of this internship. I was to perform data reduction for the research phase of this internship on the computer. Many of the administrative functions of the office were to be computerized. These included inventory, budgeting, and ordering. Dr. McMordie assigned me the task of determining if these plans were feasible.

Discussion with SOPC personnel was my initial source of information. Theresa Graves was the software support contact for our group. She provided information as to what was available and consulted on software

and system needs. She could also order additional software if necessary. Ms. Graves trained our group in site specific procedures, such as login and print routing and helped us set up accounts.

The primary system which we were interested in using was a VAX cluster system. This system was very similar to the Computer Graphics Facility system on which I had previously consulted.

Reference manuals and informal users guides were another valuable source of information. The VAX System Reference Manuals provided by Digital were used as necessary. The VAX User Guide Manuals were abridged versions of the VAX System Manuals. The VAX User Guide Manuals were arranged into easy to use sections and were designed to aid the user as he was using the system. The VAX System Reference Manuals provided complete information and were used as a last resort. Users manuals and procedural notes from other VAX sites were very valuable. They often were directed at common specific problems.

The final part of the computer systems orientation was to log on and practice. After log on, I personalized my account by installing user subroutines and programs. I also installed a number of site specific user routines which I received from Ms. Graves. I used the VAX system to word process progress reports and to update my resume. I also experimented with some of the other software packages such as data base managers and spreadsheets to determine if they would meet our software needs.

ADMINISTRATIVE SERVICES

As mentioned previously, I was the junior member of a two person operating group at the beginning of my internship. Hence, I was initially

responsible for a good deal of the administrative work in our group. As my internship progressed, our group increased to three professionals, two technicians and a secretary. As the junior professional, I continued to oversee the majority of the administrative matters. My training in SOPC administrative practices began soon after I reported.

The first step in learning SOPC procedures was an orientation presentation by the personnel in SOPC Administrative Services. The presentation was for new hires and transfers. The various services available, and the personnel in charge of them, were introduced. The Administrative Services Handbook was explained, and a copy was made available to our group. The most common administrative services were reviewed and the necessary forms were presented. The presentation ended with directions on where to go for help.

The Administrative Services Handbook was the immediate source for orientation and help when dealing with administrative problems. It contained listings on every normal administrative situation as well as the proper forms to use and the people to whom the forms should be routed. However, it was constantly under revision and was designed for an office environment. In our laboratory operations, many situations arose which were not covered by the Handbook.

The last method for learning the proper administrative procedures was by trial and error experimentation. My highest priority was to get the job done. I was glad to work with the various administrative offices, but refused to be stymied by their procedures. It was sometimes necessary to design new procedures or to modify existing procedures in order to serve our remote location. By cooperating in a positive manner and by being only

moderately aggressive, it was possible to operate until the proper procedure was found or created. This method of operation was only possible because of the support of Dr. McMordie. He was not interested in procedures for their own sake; he was much more result oriented.

III. LABORATORY BUILD-OUT

The completion of the laboratory interior was my first major project with SOPC. Dr. McMordie had completed planning the major features of the laboratory including its location and layout prior to my arrival at SOPC. I assisted in the detailed planning for the facility, and supervised the majority of the furniture and equipment installation. The laboratory build-out was broken down into the following phases: planning, installation, and completion.

PLANNING

I was acquainted with the overall goals and purpose of the SOPC Drilling Fluids Laboratory during meetings with Dr. McMordie and his supervisor at the time, Dr. James Rickard. The primary purpose of the laboratory was to support the drilling operations of SOPC. Support of drilling operations was to include technical service, quality control, and technology transfer. Completion of the necessary facilities and startup of operations had high priority since the cost of a drilling mud related failure could range into the millions of dollars. Some modification of the facilities was expected to correct problems after the build-out was completed. The location and general layout of the facilities had been set by Dr. McMordie based on his previous experience. I was scheduled to assist Dr. McMordie in implementing these plans and to work on much of the detailed planning.

SOPC maintained a corporate engineering group which participated in the construction of the laboratory. The corporate engineering group had been formed to construct two large chemical plants for Standard Oil

Chemical Company. The personnel in the corporate engineering group were being dispersed throughout the company as their primary function had been completed. The group was completely disbanded during the build-out.

Corporate engineering provided several valuable services. They provided specifications for laboratory furniture and utility systems; these included heating and electrical systems. They could also provide engineering supervision; however, the overhead charges for using corporate engineering were high. Each engineering supervision visit included airfare from Cleveland, Ohio, car rental, and meals. Corporate engineering's estimates for completing the laboratory were twice the cost of local estimates. Corporate engineering was phased out the project soon after I arrived.

Planning the telephone system for the laboratory was a major endeavour. Good telephone service was necessary for efficient operation. The laboratory site was approximately 15 miles from the main Dallas office. Much of our local communication within our own company had to be by telephone. Hence, a versatile, dependable telephone system was required.

The SOPC Technology Center in Dallas maintained support staff for its telephone system. The SOPC corporate office in Houston also maintained its own telephone system. During meetings with both telephone support staffs, Dr. McMordie and I were presented with a telephone system. It was much more powerful than necessary. The main component of the telephone system, the telephone switch, was surplus. It had been replaced by a larger switch in the Houston office. It was available to us at no cost. After purchasing telephones and the necessary installation costs, this system was much cheaper than any competitive system. It was decided to install

this telephone switch after three meetings between the support staff and ourselves.

Planning for the necessary computer system equipment was much simpler. Equipment planning was reduced to specifying the number of terminals and their locations. Staff support for the VAX system software and hardware was available in the Dallas office. A secretarial station, including a microcomputer word processor and a laser printer, was also specified.

Dr. McMordie had planned the purchase of the major items of mud and cement testing equipment. His previous experience guided him in the purchase of mud laboratory equipment. The purchase of cement laboratory equipment was guided by the advice of the local Chandler Engineering Company sales representative. Dr. McMordie was familiar with the equipment required for cement testing. He required the advice of the Chandler sales representative to ensure that equipment with a long lead time was ordered as necessary. Much of the cement testing equipment was custom manufactured and required three months for completion. This equipment was ordered before a cement professional was hired. It was felt that waiting for a cement professional's advice would delay the opening of the laboratory.

The majority of the office supplies necessary for the laboratory's operation were available from the Dallas office. Surplus office supplies and furniture such as a typewriter, a copier, desks, chairs, and tables were available. I met with the Facilities Coordinator to arrange for the delivery of the necessary office furniture and supplies. Dr. McMordie had reviewed my suggested list of furniture and supplies and, after some revision,

approved it. An initial stock of consumable supplies such as copier paper, pencils, etc., would be supplied by the Office Supplies group. A refrigerator was ordered from Sears; it was to be delivered as soon as the power was on in the building.

The final step in the planning stage of the laboratory build-out was to review the planned facilities with the personnel concerned. The final layout of the interior of the laboratory was discussed with the subcontractors involved. Plumbing, electrical, and heat and air conditioning drawings were discussed and finalized. I met with Charles Berger, a SOPC engineer based in Dallas, who had previously been in charge of building and operating the wellbore flow loop. We discussed its space, power, and other requirements. The installation of the telephone system was discussed with the SOPC telephone support staff. The installation was scheduled to occur shortly after power was supplied to the building. The final requirements for the computer system software and hardware were set. Arrangements were made to purchase the hardware and software which were not already available from the Dallas SOPC office.

Near the end of the planning stage, I moved on-site to act as building superintendent. I provided directions and a quick source for answers to simple questions. This move reduced the need for corporate engineering support. Moving on-site was designed to shorten the time required for build-out by providing an accessible source of information, to prevent as many problems as possible, and to solve quickly any problems which did arise.

INSTALLATION

The installation phase of the build-out began after the interior walls had been erected, painted, and finished. The carpet was in place. The majority of the electrical, heat, and air conditioning service had also been installed. Texas Power and Light (TP&L) had not yet supplied power to the building. All electrical power for the build-out was supplied by portable generators. The generators were operated by the electrical subcontractor and only provided sufficient power for the necessary lights and power tools. The installation period covered July and the first two weeks of August. Work began at 7:00 a.m. and quit by 3:30 p.m. to avoid the worst heat of the day. The installation of machinery and furnishings in the Drilling Fluids laboratory was divided into four sections: laboratory furniture, laboratory testing equipment, wellbore flow loop, and security system.

Installation of laboratory cabinets and office furnishings began at approximately the same time. The office furnishings were delivered to the laboratory site as soon as they arrived in Dallas from the closed SOPC San Francisco office. Storage space was limited in the Dallas office, and the Facilities Coordinator was glad to place the furniture quickly. A correctly sized conference table for the conference room-library-snack bar had to be ordered. The furniture was delivered by Mayflower Movers. They also arranged the furniture under my direction.

The installation of the work benches and wall cabinets was the major work in the laboratory spaces. Two walk-in fume hoods were also installed. All of the cabinets had been ordered during the layout of the laboratory space. The cabinets were delivered and received. I checked the

packing lists to ensure that all items which had been shipped were received. Delivery and receiving of the cabinets and lab bench tops required two days for the over 100 pieces. Almost as soon as the cabinets came off the truck, they were moved into the lab spaces. Each cabinet was placed in its approximate final location. The cabinets were leveled and then bolted together. The necessary electrical service was then run. Finally, the asbestos laboratory bench tops were installed. The asbestos content of the bench tops demanded special care in their handling and modification.

The following three problems were typical of those encountered during the installation of the lab furniture. The asbestos bench tops were ordered with no holes for the necessary electrical outlets. The electrical subcontractor had agreed to drill the holes in the tops. When the electricians arrived to wire the service, however, they did not have the proper drill bit to cut through the one and one-half inch thick asbestos composite top. The electricians had thought that the cabinet installer would drill the holes in the tops. The cabinet installer came to me and in no uncertain terms, told me that he did not have to drill the holes in the tops. The cabinet installer showed me the section of the plans which indicated that the electricians should perform that work. I discussed this with the electricians and discovered that they did not have the proper tools. By asking the cabinet installer if he would cut the holes for me as a personal favor, the holes were drilled that morning.

Installing the walk-in fume hoods also proved to be a problem. The major problems were a lack of cooperation among the tradespeople and a lack of experience in assembling and installing the hoods. The original specification for the fume hoods had called for all parts exposed to the

vapor space to be either inert epoxy composite, glass, or stainless steel. As shipped, the fume hoods had a number of painted steel sash parts. These were to be replaced with stainless steel sash pieces. The stainless parts were to be fabricated by a Dallas welding shop. When the stainless steel parts arrived, one part was broken and another broke during installation. These parts were returned and repaired. The same part broke again when it was being reinstalled. I directed the cabinet installers to use the painted steel parts. A telephone conference was necessary between myself, Dr. McMordie, and the president of the cabinet company to approve this decision. It was approved and work proceeded. The plumbers had to attach the water and drain services once the hoods were assembled. The plumbers refused to take directions from the cabinet installer. Hence, I had to get instructions from the cabinet installer and relay them to the plumbers. Once the plumbers were finished, the electricians had to hook-up the lights and electrical service. The fume hoods were to be prewired by the cabinet company; they were not. In this case, I had to negotiate with the electricians to get them to do the work that the cabinet company should have done.

One of the most frustrating problems was to get the electrical service connected. The power had to run approximately 110 feet from a power pole to our building. For five weeks, the service was to be connected the next week. Also, each week the reason for the delay changed. In the end, it turned out that the land owner would not pay a deposit for service. TP&L would not connect service without this deposit. The facilities coordinator called the leasing agent and demanded that someone pay the deposit. If it was not paid immediately, he said that he would pay it himself and then

withhold rent until he was repaid. The deposit was paid, and service was connected in early August.

The telephone system was installed soon after the office furniture was in place. The telephone switch was installed in an electrical service room in the back of the laboratory. Initially, the switch was not operational since there was no electrical service from TP&L . All the necessary wires and cables were run and connected. However, the only operational telephone was a single line visitor's telephone near the front door. No one could call in, and a bare wire had to be momentarily grounded to get a dial tone when calling out. The phone system remained in this condition for five weeks until power was supplied to the laboratory.

The telephone switch and multi-line telephones were commissioned after TP&L connected the electrical service. Problems immediately developed with the system. The first problem was that the temperature of the electrical service room was over 85 degrees due to heating from the electrical transformers in the room. The temperature was lowered by adding an air conditioning duct to the electrical service room directly above the switch. This modification proved sufficient until all of the transformers in the room were energized simultaneously. The temperature in the room then increased to over 80 degrees. A small oscillating fan was placed behind the switch to cool it. The fan blew onto the cooling fins of the switch and kept it cool enough to ensure consistent operation.

The wellbore flow loop was shipped to the Drilling Fluids Laboratory from the SOPC Research Center in Warrensville, Ohio. It had been constructed and operated there under the direction of Mr. Charles Berger. Mr. Berger was to help reinstall the flow loop. The electrician who had

actually performed the majority of the original installation in Warrensville, was temporarily transferred to Dallas to direct the installation. The electricians who had wired the lab were to perform the majority of the work under his supervision. My part in this job was to coordinate the installation of the flow loop with the operation of the Drilling Fluids Laboratory. I conferred on the layout of the flow loop and observed the installation to gain a better understanding of the flow loop's operation. Occasionally, I directed the electricians or other tradesmen in some portion of their work.

The flow loop arrived in about 300 pieces during the installation of the laboratory equipment. The pieces were unloaded and randomly stacked. The technician's first job was to layout the flow loop and move the major pieces into place. Mr. Berger was responsible for the majority of the layout and installation. He maintained an office in Dallas and would visit the lab as necessary. Often he passed his directives through me via a telephone call. I then relayed the directives to the technician and ensured that they were correctly performed.

I also spent an extensive period observing the work to gain a thorough understanding of the flow loop's operation. During the periods of observation, I would monitor the tradesmen and keep them on task. I also tried to establish some rapport with the tradesmen. The rapport with the tradesmen encouraged them to share their ideas on the project with me. Often the tradesmen would tell me that an idea would not work for some reason. Many problems were averted by listening to the tradesmen's ideas.

Much of the laboratory equipment was ordered and received during the installation of the laboratory furniture. Dr. McMordie had drawn up lists

for the major pieces of mud testing equipment. These lists were approved by Dr. Rickard and forwarded to the Materials Management group of SOPC in Dallas. Materials Management would place the actual order.

I was delegated the job of ordering laboratory glassware, chemical supplies, and tools. Dr. McMordie and I met and drew up a tentative list of requirements. This list included items such as "some" beakers from 25 to 3000 milliliters. Mr. Young and I spent an entire day with supply house catalogs defining "some" and the useful sizes between 25 and 3000 milliliters. I then wrote seven pages of requisitions detailing the items and their catalog numbers. These requisitions were forwarded to Dr. McMordie and Dr. Rickard for approval. After the necessary signatures, they were sent to Materials Management for ordering. The same procedure was followed for tools and chemical supplies.

I encountered an interesting practice during this ordering period. It is referred to as the business or free lunch. Sales representatives would call on our office at approximately 11:30 a.m. They generally had appointments and wished to discuss products which we might find of service. Normally these discussions would carry over into the lunch hour. These discussions were often concluded over lunch. Of course, these lunches did not influence our decisions, but they did give the sales representatives a chance to present their cases without interrupting our busy days. These discussions were a valuable source of information and a forum for informal discussion.

Receiving the ordered goods was the next step in the process. A receiving report had to be filled out and sent in for each order as it was received. The receiving report served to release payment to the supplier.

Inside delivery was specified with all goods ordered. This meant that the shipping company had to deliver equipment to a point inside our facility.

In general, inside delivery was not a problem. Most shipments were small enough to be moved by the truck driver. In the case of the cementing equipment, the specification of inside delivery was inadvertently omitted. The problem took the form of one 2,800 pound piece of test equipment and a stubborn freight company. Each time the delivery was brought to the laboratory, there was no means to unload this piece of equipment. The shipping office assured me that a pallet jack would be brought along with the equipment. Each time the shipment arrived, the driver assured me that they did not have a working pallet jack. I finally called and spoke to the manager of the freight company. When I complained, he pointed out that inside delivery was not included. Materials Management had included the specification on the purchase order; however, the company selling the equipment had not paid the freight company for inside delivery. I arranged for a crew of movers and a pallet jack. I received the shipment the next day. The company selling the equipment paid for the moving crew.

The actual installation of the laboratory equipment proceeded smoothly. Dr. McMordie and I laid out the laboratory space. We designated a location for each piece of major test equipment. The majority of the equipment required only connection to 110 volt power. Some pieces needed special 208 volt circuits. The electricians were required for these installations.

The chemical supplies and glassware arrived next. It became apparent that the layout needed to be changed when the supplies arrived. The necessary glassware for each work station required so much cabinet space

that the equipment had to be moved. Dr. McMordie also requested some other changes after viewing the initial layout.

I discovered that many small items were still missing once the layout of the laboratory equipment was completed. These items included adaptors for meter electrodes, pH buffer solutions, and other small necessary items. These were requisitioned and arrived quickly.

One major area of effort in the installation of laboratory equipment was the design and installation of the high and low pressure nitrogen supplies. Bottled nitrogen was chosen over compressed air because bottled nitrogen was cleaner and more convenient. Much of the cement and mud testing equipment used low pressure (100 psi) nitrogen. The low pressure nitrogen was also used for blow drying. High pressure (1000 psi) nitrogen was used in the high temperature, high pressure fluid loss cells. The plumbers had run tubing and installed regulators at the locations indicated on the plans. However, there were no provisions made for connecting the equipment to the nitrogen supplies or connecting the nitrogen bottles to the tubing.

I designed and installed a supply manifold and storage rack for the nitrogen system. Each bottle was connected through a regulator and flexible high pressure tubing to a cut-off valve. The valve was used to isolate the nitrogen supply system while the bottles were being changed. A safety over-pressure relief valve was connected to each nitrogen supply bottle. These valves prevented the downstream regulators from being overpressurized. The necessary cut-off and over-pressure relief valves were supplied at each nitrogen consuming apparatus.

A computerized security system was installed in the laboratory. The

security of valuable information was an industry wide concern. The lab security system was designed to prevent theft after hours. The security system was monitored by an independent security company using computers and the telephone lines. I observed and consulted in the installation of the security system. I was called upon to define the usage of each room and to confer on the placement of sensors. I received full training on the system after installation and passed this training on to the other members of the staff. I served as as back up contact in the event of an alarm. I also served as the security contact person for our site.

In one case, I received a call from the Irving Police Department at 2:55 a.m. I drove to the lab to meet two Irving Policemen . I opened the lab and helped the policemen search for signs of forced entry or theft. It was a false alarm. The next day, I discussed the incident with out security director. He suggested possible causes and took the matter up with the monitoring company.

COMPLETION

The completion of the Drilling Fluids Laboratory required two additional months after the bulk of the installation work was completed. This completion work included the final finishing, the release of the subcontractors and necessary revisions to the laboratory facilities.

The major step in releasing the subcontractors was to draw up a punch list. The punch list was a list of items which were to be completed or corrected before the building was accepted and rent begun. Before the building contractor and our facilities coordinator arrived for the final walk-through, I drew up a list of every item which needed repair or was not

up to specification. The items ranged from spots on the carpet to leaks in the roof. I presented this list to our facilities coordinator. He then presented them to the building contractors. The majority of the items were completed in the next week. In the following month, no more progress was made. Repeated telephone calls produced no results. It was necessary for me to write a letter citing the punch list before any action was taken. The next day repairs were undertaken on the final items.

Most of the revisions to the laboratory facilities were necessary to correct oversights on the original plans or to install new equipment. I called the electricians back in to install a switch on the fume hood blower motor. The wiring diagram had shown the motor, but no switch or supply wires were shown. The necessary wires and switch were connected.

Other revisions became necessary after the arrival of the cementing technician. The cement testing equipment had extreme power requirements. One machine required 60 amps at 208 volts. The electrical circuits specified in the drawings for these machines were undersized and had to be replaced. As the cement technician commissioned his equipment, other electrical, sewer, and nitrogen changes were required. Each cement testing machine required a drain for cooling water. A PVC drain line was laid along one wall.

IV. OFFICE MANAGEMENT

I was actively involved in the office management at the Drilling Fluids Laboratory. I was initially involved in a large amount of office management because I was the junior member of a two person office group. As more members were added to our group, I retained the responsibility for some of the duties. All the members of our staff were recently hired or had had no experience in office management. I was most actively involved in four areas of office management: interviewing personnel, purchasing, sample logging, and maintaining the library.

PERSONNEL INTERVIEWS

I was involved in the interview process for each of the positions filled at the Fluids lab after I arrived. Dr. McMordie asked me to join him in interviewing the candidates. He felt that another point of view would be helpful. He also felt that it was important to evaluate carefully the personalities of the candidates. The small size of our working group made this especially important. The interviews were informally structured. Normally, they were held while touring the laboratory facilities, over lunch, or in the conference room while enjoying a cup of coffee.

The first interview was more of an introduction than an interview. Dr. McMordie had worked with David Young at Hughes Drilling Fluids. The three of us went to lunch and discussed plans for the lab. We also explained our backgrounds. This meeting was mainly to see if we were compatible. Mr. Young was transferred from another division of SOPC to the Fluids lab shortly after this meeting.

The cementing professional position received the next attention. SOPC upper management had set stringent requirements for this position. There were relatively few candidates to consider who held the necessary advanced degree and experience. The services of a "headhunter" were solicited. The "headhunter" contacted appropriate candidates whom he felt might be interested in this position. A number of service company personnel were interviewed because the service companies were depressed and laying off personnel.

The high cost of housing in the Dallas area proved to be a problem in recruiting a cementing professional. Housing costs in Dallas were approximately twice the cost of areas such as Houston, Texas, or Duncan, Oklahoma. Most of the cementing professionals contacted felt that they could not afford to move.

Professional candidates were generally invited for a full day of interviewing. The candidate's resume was circulated to the concerned personnel at least one week before the candidate arrived. The candidate first met with a member of the Employee Relations department to discuss benefits. Next, Dr. McMordie's supervisor met the candidate. Dr. McMordie then picked the candidate up at the Dallas office and brought him out to the lab. They toured the facility and met the staff. These discussions normally included lunch or drinks after work.

My part of the interview process was to provide an informal evaluation of the candidate for Dr. McMordie. Dr. McMordie was especially interested in what I liked or disliked about the candidate's personality. For each candidate, one important question was did the candidate have any traits to which I could not adjust.

The cementing technician was the next position of interest. Dr. McMordie and I interviewed candidates for this position while the search for a cementing professional proceeded. The cementing equipment had already arrived at the laboratory. Dr. McMordie wished to get the cement lab operational. However, filling the cementing professional's slot was not proceeding as quickly as he wished. Hence, rather than waiting for the cementing professional to be hired and have him interview his own help, Dr. McMordie planned to hire the cementing technician. The cementing technician was hired in November, 1985; as of July 1986, no cementing professional had been hired.

Interview procedures for the cementing technician position were very similar to those described for the cementing professional. One difference was that mainly local candidates were interviewed because of the level of the position. Two cementing service companies were closing their laboratories in the Dallas area. A number of good personnel, who need not be relocated, were available. The high housing cost in the Dallas area did not affect filling this position.

A number of candidates were invited to the laboratory for an interview. The personal references of their employers played a large role in determining who was invited for an interview. Each candidate was interviewed by Dr. McMordie and the available members of the laboratory staff. Employee Relations also interviewed the candidate.

I was again called upon to provide an informal evaluation of each candidate that I interviewed. There were three areas of interest: personality, motivation, and expertise. A fair idea of the candidate's personality came across during my informal discussions with him.

Motivation and expertise were determined during a tour of the laboratory equipment and facilities. Motivated personnel tended to be interested in the laboratory equipment involved. We asked leading questions to get the candidates to display their knowledge of the equipment.

The last position interviewed was that of the mud technician. Mr. Young arrived at the Drilling Fluids Laboratory with a strong recommendation for a person to fill the position. Mr. Young had worked with this young man in the Dallas SOPC office. Dr. McMordie was willing to rely on Mr. Young's recommendation. Also, it was much easier to transfer personnel within SOPC than to hire from outside the company. Dr. McMordie, Mr. Young and I met with the candidate in the lab and over lunch. There appeared to be no problems, and the candidate was hired.

PURCHASING

The major office management task in which I was involved was purchasing. I initially became involved in purchasing items which I required. To complete projects, I would often need to purchase equipment or chemical supplies on an emergency basis. I kept track of the orders to ensure that they arrived on schedule. I also monitored our expense spending.

The Drilling Fluids Laboratory was the first laboratory operation for the Dallas office. It was necessary to work closely with the Accounting and Materials Management departments to develop a workable system for laboratory purchasing. The different method of purchasing used depended upon the product vendor and immediacy of the need for the product.

The standard method used to obtain goods and services in SOPC was the

purchase order. A list of the goods and services desired was submitted on a requisition. The requisition included a description of the goods or services, an estimate of their total cost, a suggested vendor, a proper accounting charge number, and the approval of the necessary managers. The level of manager approval required depended upon the total value of the requisition. The requisition was then sent to Materials Management. Materials Management would process the requisition and issue a purchase order for the goods or services. Materials Management was responsible for the actual ordering of the goods or services and chose the vendor. Normal processing of a requisition took from four to eight weeks. An expedited delivery could be requested. Orders were then normally filled in two to six weeks.

A verbal purchase order was used when immediate delivery was desired. The first step in using a verbal purchase order was to locate and price the materials. We then called Materials Management and gave them the vendor and the amount of the purchase. In return, Materials Management gave us a purchase order number. We ordered the materials and gave the vendor the purchase order number. The final step was to submit a properly completed requisition to Materials Management for the order. It normally required one to two hours to complete a verbal purchase order. Verbal purchase orders were reserved for emergency cases only.

To avoid the delay and paperwork involved in using purchase orders, Dr. McMordie was given a delegated commitment authority. The delegated commitment authority allowed Dr. McMordie to purchase items that cost less than \$500.00. It was designed to eliminate many small purchase orders and to improve the turn-around time when ordering. The

commitment authority was to be used for infrequent purchases from a vendor. A log of the purchases was to be kept. It included the date ordered, the vendor, and the amount of the order. Dr. McMordie was required to approve each purchase. The \$500.00 maximum per order limited the usefulness of this means of purchasing. However, the commitment authority was frequently used for odd, inexpensive items and in the case of emergencies.

Blanket purchase orders were used with vendors from whom we often purchased materials. A requisition requesting a blanket purchase order with a specific vendor was sent to Materials Management. This requisition would include the total value of the blanket purchase order, the maximum value per order, the personnel authorized to make orders, and a description of the material to be ordered. Materials Management then negotiated with the vendor to secure any possible discounts and to set billing terms. A copy of the blanket purchase order, as negotiated, was sent to the lab. At least four weeks were required to set-up a blanket purchase order. But once started, a blanket purchase order could be used by any authorized lab person to order materials, often in excess of the \$500.00 per order limit. Blanket purchase orders were the major method of purchasing used once the laboratory was in operation.

The following procedures were followed when using a blanket purchase order. An authorized member of the laboratory staff called the vendor and ordered the goods. The purchase was noted on a vendor log sheet. These sheets provided easily referenced information on the status of the order. A blanket order release was then completed. It was a five part form that documented the cost and contents of the order. It also included a blanket

order release number. This number was used by SOPC personnel to keep track of the order. One part of the form was sent to Materials Management; another part was sent to Accounting. These copies served to inform each department that the order had been placed. When the order was received, another copy of the blanket order release and the packing slip from that order were sent to Accounting. This action released payment on the order.

Each method of purchasing required careful record keeping. There were two major reasons for this record keeping. First, careful record keeping allowed us to track the orders as they were processed. We knew what had been ordered, when it had been ordered, by whom it was ordered, and when it should arrive. The other reason for careful record keeping was to keep abreast of current spending. The Accounting department ran six to eight weeks behind on account balances. Two months were required from the time we ordered goods until the invoices were received and paid. Good order record keeping allowed us to know our present expense spending.

A final important part of purchasing was receiving the materials and clearing invoices. If the materials were correctly received and the proper paperwork was submitted, the vendor was promptly paid. Often either the order was not completely received or the correct paper work did not reach the correct person. In that case, the invoices for the goods had to be cleared.

Each method of purchasing had a receiving report that had to be sent to Accounting. The invoice for the goods would be paid if the receiving report, pack list, and ordering papers all agreed as to price, quantity, etc. If the paperwork did not agree, the invoice for the goods in question would be sent to the individual who had ordered them. That individual would then

approve the invoice by signing it or take whatever steps were necessary. Routing invoices to individuals meant that someone had not done their paperwork correctly. We tried to avoid the routing of invoices if possible.

SAMPLE LOGGING

A well defined set of sample logging procedures were required to keep track of the drilling mud and cement samples which arrived at the lab. We were responsible for conducting tests on these samples. We were also required to know the status of these samples. Carefully maintained sample logs helped us to respond quickly and accurately to requests for information about a sample.

Sample log books were maintained for both mud and cement samples. Each sample, as it arrived at the laboratory, received a sample number and was logged into the correct sample log book. The sample number was attached to the sample container. The sample log book entry included the following information: sample number, date received, sample description, work requested, the sender, the logger, and the date the tests were completed. I designed the sample log books. I was initially responsible for their maintenance. Log book maintenance became the responsibility of the technicians as they were hired.

LIBRARY

I assumed the responsibility for the Drilling Fluids Laboratory library. Dr. McMordie and I conferred on the initial list of books and periodicals for our branch library. This list of materials was ordered from the SOPC Dallas Information Center. Since we were to be a branch library, there was

no problem in ordering or paying for the materials. The library materials began to arrive approximately two weeks after ordering them. Very informal check out procedures were maintained. The current periodicals circulated among the laboratory staff. Material Safety and Data Sheets for all commonly handled materials were maintained in the library. Technical manuals and product literature of interest were also maintained in the library.

OFFICE FORMS

Office forms were a valuable tool used to maintain office organization and efficiency. I designed and produced a number of forms using my Macintosh personal computer. The forms made it easier to obtain professional looking results and to keep better track of those results. As mentioned previously, I designed the forms used in the mud and cement log books. These log books helped to keep track of the large number of incoming samples. The ordering logs were used to record, by vendor, the materials ordered. The mud test sheets were of API format. They served to guide the individual performing the tests and to give a professional appearance when completed. The report cover sheets made it easy to keep track of the report's number and contents. Cement test sheets were used to record intermediate cement test results and to aid in the calculation of test parameters.

The Commitment Authority Order Release form was created to give accounting a form that they would recognize to release payment promptly. The delegated commitment authority system was installed for the first time at our laboratory. None of the associated forms had been created. By

providing a useful form, we expedited this purchasing process considerably.

V. RESEARCH

The research aspect of this internship was curtailed due to a downturn in the oil industry. There was an increased emphasis placed upon the cost, benefit ratio of a research project. More technical service oriented projects were approved. The goal of the majority of the research programs became to answer specific problems.

WELLBORE FLOW LOOP

The simulated wellbore flow loop was planned as a long term project of benefit to SOPC and the oil industry. The flow loop was originally designed to measure the cuttings carrying capacity of various drilling fluids. When the unit was transferred to the Drilling Fluids Laboratory, Dr. McMordie planned to investigate the rheological properties of water-based polymer drilling fluids. This project had very little potential for short term returns for SOPC. The assembly of the flow loop was described in Chapter III.

The wellbore flow loop consisted of four sections: the wellbore, the pumps, the mud pits, and the instrumentation. The wellbore was constructed from six sections of clear, four inch inside diameter, acrylic pipe. A one and one-half inch drill pipe ran inside the wellbore. The drill pipe could be rotated at up to 60 RPM. Differential pressure transducers and thermocouples were located every two feet along the wellbore. The differential pressure transducers were connected to a common reference pressure. The reference pressure could be used to eliminate the pressure head from the pressure measurement. The wellbore was mounted on a steel frame. One end of the steel frame could be lifted using a two ton chain

hoist. The other end of the steel frame followed along a track. The wellbore was connected to the rest of the system using two inch inside diameter flexible hose. The wellbore could not be raised to a fully vertical position because of the ceiling height.

The pump section of the flow loop was made up of two Moyno pumps and their associated plumbing. Moyno pumps were used since they did not break down the particles in the circulating system. The particles were either simulated drill solids or mud weighing agents. The larger Moyno pump delivered up to 150 gallons per minute. It was powered by a 7.5 horsepower, variable speed, electric motor. The smaller Moyno pump was driven by a single speed electric motor and delivered 30 gallons per minute. The plumbing manifold was constructed of two inch stainless steel pipe and valves. Either pump could be connected to the wellbore.

The mud pits, drilling mud storage tanks, were two 50 gallon stainless steel vessels. They were each equipped with a recirculating, shear pump. These pumps were used to help mix the mud in the pit. A large propellor mixer was also mounted on each tank. One pit was connected to the pump manifold inlet. The other pit was equipped with a transfer pump and plumbing. The fluid in the flow loop could be returned to either pit.

The flow loop instrumentation was controlled by a PDP 11/73 minicomputer. The minicomputer sampled and stored data while the flow loop was operating. The data was then transferred to the Dallas VAX cluster for reduction. A Kay-Ray densitometer and ultrasonic doppler flowmeters measured the flow rate of the fluid in the loop. The PDP 11/73 read the flowmeters, differential pressure transducers, tachometers for the electric motors, and thermocouples. As of July, 1986, the software for

the PDP 11/73 was not operational. The flow rate could be read manually; however, the pressure drop along the wellbore could not be measured.

I tested the flowloop after its assembly was complete. The differential pressure transducers and thermocouples were calibrated where they were attached to the PDP 11/73. The pumps and piping manifold were checked for leaks. The flowmeters were tested using water in the flow loop. Once the tests were completed, I evaluated the flow loop to see if it would be suitable to use in measuring polymer mud rheology.

I evaluated the flow properties and instrument sensitivities of the flow loop. I calculated the transition Reynold's number for a range of fluids from water to an 18 pound per gallon polymer mud. The transition Reynold's numbers were found to lie within the flow rate capacity of the flow loop. I next evaluated the sensitivities of the differential pressure transducers and flowmeters. The differential pressure transducers had adequate sensitivity for the required measurements if they were properly calibrated. The flowmeters would be operating at the limit of their accuracy to give adequate results. It is important to note that no operational tests could be run because of the lack of PDP11/73 software.

As a final task I presented my evaluation of the system and my suggestions for changes. I proposed modifying the piping and mixing systems. I made suggestions on the desired performance characteristics of the PDP11/73 software. I also recommended that the differential pressure transducers be recalibrated and labeled as to their calibration.

GUMBO SHALE STUDY

Gumbo shale, a soft, hydratable, clay containing mineral, was the

source of many drilling problems in Gulf Coast areas. These problems occurred when the gumbo shale hydrated. The gumbo shale expanded, causing the drill pipe to stick. The shale also fell into the wellbore as it hydrated. This also caused drill pipe sticking. Hydrated gumbo shale was a soft, sticky material which was very hard to separate from the drilling mud. All of these problems caused delays and added costs to drilling the well. Preventing the hydration of gumbo shales was a very cost effective measure.

The goal of the gumbo shale study I undertook was to find the best drilling mud to use while drilling in gumbo shales. I accomplished this by comparing the hydration of a representative gumbo shale when it was exposed to some commonly used water-based drilling fluids.

I ranked the fluids as to their lack of hydration. This information was considered, along with the cost of the mud, by the drilling engineer on the well when deciding which mud to use. Samples of a gumbo shale from a SOPC well in the Gulf of Mexico were collected for use in the study.

Initially I used two test techniques in the study. The capillary suction time (CST) method gave an indirect measure of the hydration of the shale sample. As a shale hydrated, the free water in a shale slurry decreased. The CST was a measure of the free water in a slurry and the dispersion of the shale particles.

Both the hydration and dispersion of the shale were of interest when drilling through gumbo shale. Hydration caused pipe sticking. If the shale was dispersed, into very fine particles, it was impossible to remove from the drilling mud. Dispersed shale also changed the drilling mud's rheology. The CST method gave a measure of both phenomena. However, the CST

method was rather new and controversial.

The accepted technique for testing the hydrating tendency of a drilling mud was to heat and agitate a mixture of mud and shale particles. The percentage of shale that was dispersed into the mud was measured. This technique was normally performed in a hot roll oven; hence, it was called a hot roll test. A hot roll test was useful in determining the effect of temperature on the dispersion of the shale. The agitation received by the shale was very gentle. The accuracy of this method was not high; it was a qualitative method.

A third method to measure the dispersion of gumbo shale was suggested. A better measure of the mechanical aspects of dispersion was desired. Dr. McMordie asked for a small flow loop which would hold a pressed sample of shale. The fluid of interest was flowed around the pressed sample of shale. The dispersion of the shale was measured and the flow rate was varied. I constructed such a flow loop.

Three methods were used to prepare the shale samples. The CST test required finely ground, dry shale. The shale, as received, was a plastic material. I spread this shale on a drying rack and dried it in a convection oven at 85 degrees Centigrade for 24 hours. The dry shale was then broken into small pieces. I retained some of the smaller pieces for the hot roll tests while the rest of the dried shale was ground to less than 100 Tyler mesh. The dried shale for the hot roll tests was sized between five and ten Tyler mesh. Larger particles were broken; smaller particles were ground for CST testing.

I prepared the samples for the mechanical dispersion loop (MDL) tests by pressing weighed samples of shale in dehydrating molds using a Carver

hydraulic press. Standard pressing conditions were used which gave a suitable pressed shale disc. I held the pressure and the time of pressing constant for each disc.

The drilling muds used in this study were water-based muds suitable for use offshore. SOPC field engineers suggested most of the muds tested. I added some other muds to the test list after discussions with Dr. McMordie and Mr. Young. A twelve pounds per gallon mud of each type was prepared. I prepared these muds using typical field products and formulations. I took filtrate from each mud for use in the CST tests. The whole muds were used in the hot roll tests. I made an API mud check on each mud; the rheological properties of each mud were recorded.

I conducted CST and hot roll tests on each drilling mud. The ranking of the drilling muds, from best to worst, agreed except in the case of polymer muds. The hot roll tests indicated that the polymer muds gave excellent performance. The CST tests indicated that the polymer muds gave mediocre performance. Authorities in the field of mud testing had suggested by that the CST method was not accurate in the case of polymer fluids. I found such to be indicated by my test results.

I built the Mechanical Dispersion Loop (MDL) to resolve the differences between CST and hot roll rankings. Dr. McMordie, Mr. Young, and I felt that examining the effects of mechanical dispersion on the shale as a function of the mud type would resolve the conflict found between the other methods.

The MDL consisted of a pump, a turbine flowmeter, three pieces of clear pipe, and a sample basket. The pump was a one horsepower irrigation pump which delivered a linear velocity of up to 100 feet per minute through the

sample basket. It was controlled using an output throttling valve. The three and one-half inch inside diameter, acrylic pipe was plumbed using PVC fittings and silicone glue. The right vertical leg held the sample basket. The left vertical leg held a filter unit. The upper leg served to increase the system volume to reduce surging. The lower leg contained the pump, throttling valve, and turbine flowmeter. The turbine flowmeter was a one inch turbine meter. It was preceded and followed by a settling section of one inch pipe.

Initial tests of the MDL indicated that a satisfactory dispersion of the pressed shale pellets was achieved in fifteen minutes. Fifty percent of two shale pellets were dispersed in fifteen minutes using tap water. Salt solutions were tested. The salt solutions generally required thirty minutes to achieve an accurately measurable level of dispersion. Unfortunately, my internship ended before these tests could be completed.

LITERATURE SURVEYS

I conducted three literature surveys while with SOPC. The purpose of these surveys was to review the literature for items of interest and to help establish some areas of interest for the research program at the laboratory. Items of interest included new methods for dealing with specific problems or new products being introduced into the industry. Dr. McMordie was interested in some areas of drilling research. He asked me to check the literature and to outline any recent articles in these specific areas. The Information Center at the Dallas SOPC office conducted the actual searches. They used the online service for Petroleum Abstracts.

The first literature survey was on the subject of swab and surge

calculation programs. Swab and surge programs calculated the pressure experienced in the wellbore as the drill pipe was run into the wellbore or withdrawn. Dr. McMordie wished to know if a suitable program was available for our use. I reviewed the available programs and prepared a recommendation on their use. During this period, the computer software group purchased a wellbore program which calculated swab and surge pressures.

The next literature survey was conducted on the topic of cementing problems in Gulf Coast wells. Only twenty references were located during the survey. Only six of the twenty references were of value. I reviewed each article of interest in a memo to Dr. McMordie.

The topic of the final literature survey was stuck drill pipe. Over 150 references were recovered. Most of the references were articles by equipment manufacturers demonstrating the efficiency of their equipment. I obtained abstracts of the articles which I thought would be of interest to Dr. McMordie. I passed on these abstracts for his review.

DRILLING RESEARCH REVIEW

SOPC participated in a number of joint industry and university research programs. One of these programs was the Drilling Research Program at the University of Tulsa. An annual review of the research projects underway was held at the Tulsa campus. Dr. Judzis and Dr. McMordie were unable to attend this conference in 1985. I attended in their place. The bulk of the meeting was the presentation of research projects by the graduate students working on them. I met with the Tulsa professors and other industry representatives during the lunch break and after the meeting.

VI. DRILLING MUD TECHNICAL SERVICE

The main charge to the Drilling Fluids Laboratory was to provide technical support for SOPC drilling operations. Drilling mud technical service was expected to save SOPC millions of dollars in drilling expense. A typical mud problem could easily cost the company over a million dollars. Completion of the laboratory was rushed so that technical service was provided at the earliest date. During my internship, I was trained in the science of drilling muds and participated in several areas of technical service.

TEST PROCEDURES

The major activity in the lab was the testing of drilling mud samples. These muds were tested to determine their rheological and chemical properties. The American Petroleum Institute (API) described the accepted test procedures in detail in bulletins. Initially I learned and practiced these procedures until I was proficient. I then trained the mud technician. The mud technician assumed the responsibility for all routine testing. I helped him when the lab was busy or for non-routine tests. Much of the non-routine testing included the use of our more sophisticated equipment such as the Fann 50, Granulometre, or Cameron bombs.

The use of log note books and mud check sheets kept the laboratory testing organized. The mud check sheets were a summary of the mud's rheological and chemical test results. Filling in the mud check sheet shortened report writing and helped to organize the performance of the tests.

Maintaining an inventory of the necessary test chemicals and equipment was an important part of the test procedures. The mud technician would reorder supplies as necessary to maintain a proper level of inventory.

MARY E. COWARD #1

The technical service provided to the Mary E. Coward #1 (MEC) well was an example of the type of extensive technical service which the Drilling Fluids lab provided. Technical service was provided from the beginning of the well until it was completed. This technical service included attending meetings, making site visits, solving problems, and weekly mud testing.

The Drilling Fluids lab staff was invited to the initial drilling mud meetings for the MEC. The MEC was a deep, very hot well. SOPC personnel were concerned about the type of mud which should be used. Previous wells in the area had had a great deal of difficulty during drilling. The SOPC engineer in charge of the well wanted advice on the mud program from an in-house authority.

Dr. McMordie and I were invited to attend a presentation on a proposed mud system by International Drilling Fluids (IDF). IDF presented the mud system that they suggested for use. IDF also gave some case histories on the use of the mud in similar wells. Dr. McMordie and the other SOPC personnel asked questions and discussed the mud. After the meeting Dr. McMordie gave his opinion on the mud and the possible problems with its use.

The MEC was begun while these initial mud meeting were taking place. The site was prepared. The rig was moved on site, and the drilling was begun. The SOPC personnel in charge of the well decided to use the IDF

fluid. They felt that its advantages outweighed its high cost. The IDF mud was to replace the inexpensive clay-based mud which had been used to drill the first few thousand feet of the well.

Dr. McMordie and I traveled to the MEC to observe the change-out to the IDF mud. The rig personnel were in charge during this operation. I was there to observe and learn. Dr. McMordie was there to provide advice and to make suggestions if he saw something wrong. We arrived on-site and took up residence in the SOPC provided visitors' trailer. We discussed the change-out with both SOPC rig personnel and IDF mud personnel. We watched and offered advice during the change-out. There were no problems encountered.

The next stage of technical service for this well was the processing of weekly mud samples. Each week, a sample of the mud was sent from the rig directly to our lab. We checked the mud's properties. Dr. McMordie and Mr. Young maintained a close watch on the mud's properties to ensure that no problems arose. The weekly mud checks also ensured that IDF would be vigilant and careful with their mud tests. The IDF mud engineers at the well knew that at least once a week their results were being checked.

At one point during the drilling, the mud properties began to deteriorate. Our mud tests indicated that the problem was worse than IDF claimed it was. IDF maintained that everything was under control. The drill pipe then stuck in the well. Dr. McMordie traveled to the rig to discuss the problem with IDF and SOPC personnel. The pipe was freed and the mud problems were corrected.

After approximately three weeks, the mud properties again began to deteriorate. I traveled to the well site to pick up samples of the mud and

mud components. I also went to observe the normal operation of the drilling rig. I discussed what was going on and roamed around the rig site. I observed the normal daily operations, including the IDF mud engineers performing their mud checks.

One problem that I noted was that the centrifuges, which were used to clean the mud, were off. This was in direct conflict with the approved mud program. The mud program stated that the centrifuges would be run to keep the mud clean. The deterioration of mud properties, which we had noted, was caused by dirty mud. I asked the IDF personnel about the centrifuges. The centrifuges were immediately turned back on. The next day a pair of the high level IDF engineers came down from the Houston office to explain why the centrifuges were off and to take me to lunch. The centrifuges had been turned off to cut costs. However, since the mud properties were suffering, the centrifuges would remain on. I returned to the lab with samples of the drilling mud and mud components.

We continued to monitor the MEC through its completion. Additional trips were necessary to collect samples and to correct minor problems. No major problems occurred. The mud program was a technical success. However, it was a very high cost mud system.

HELL HOLE BAYOU

The technical service performed on the Hell Hole Bayou (HHB) well demonstrated a different degree of service. In the case of the HHB well, SOPC engineers called upon the resources of the Drilling Fluids Laboratory as needed.

The first instance of technical service for the well occurred after it

had been drilled to one half its total depth. The SOPC engineer in charge of the HHB well requested that members of the staff visit the rig and review the drilling mud operations. Mr. Young and I flew to the well site. We met the personnel and toured the rig. Mr. Young suggested that the service company providing the mud should send us samples of the mud on a regular basis. We returned to the lab and prepared a favorable report on the rig operations.

The mud company personnel sent samples of the drilling mud every two weeks or as requested. Mr. Young would request a sample of the mud if any critical operations were planned or had just taken place. The routine samples received a very brief test when they arrived. The oil-based mud used on this well was very well-behaved and maintained its properties.

One major problem occurred while drilling the well. The SOPC drilling engineer felt that the oil mud was causing excessive downhole pressures in one section of the well. The SOPC engineer requested that we test the mud to determine if it was causing the problem. The Drilling Fluids Laboratory had a Fann 50, high temperature, high pressure viscometer. It could perform the required tests; however, it had never been used.

I assumed the task of making the Fann 50 operational. I had two days to get the instrument working; this problem needed to be solved very quickly. The measurement would be made as soon as the mud sample arrived. I found that a major part of the Fann 50 was missing. Also, a switch appeared to be broken. Mr. Young called the manufacturer and arranged for emergency service. The technician arrived the next day. He brought the necessary parts with him from Houston and commissioned the instrument.

I ran the tests on the drilling mud the next day using the repaired Fann 50. The tests indicated that the mud was not the source of the problem. The rig site personnel investigated and found a malfunctioning valve. The problem, which could have caused a well blow-out, was solved in under three days time. Routine mud tests were continued, and the well was completed without any further problems.

COOPERATIVE TESTING

SOPC actively supported the API and its programs. The API sponsored a number of cooperative laboratory test programs. The purpose of these programs was to define the accuracy of certain tests when these tests were conducted by different laboratories. The Drilling Fluids Laboratory participated by testing a number of drilling mud components and forwarding the test results to an API committee.

I first tested the cation exchange capacity (CEC) of three clay samples. I used the API recommended technique, the methylene blue titration (MBT), to perform the tests. Approximately ten other laboratories also tested the clay samples. I tested each clay sample six times. The major difficulty was the preparation of the methylene blue solution. I used five different methylene blue solutions. I purchased two of the methylene blue solutions and prepared the other three solutions. Each of the three prepared solutions was made from methylene blue obtained from a different source. I tested each clay with each solution and repeated the test using one purchased solution. We submitted the test results to the API. Our results compared very favorably.

The API conducted similar tests on weighing materials. We received

samples of six different weighing materials. We made muds using each weighing material. We tested the muds for their rheological properties. The mud properties were compiled and sent to the API for comparison and publication.

The petroleum companies and service companies in the Dallas area organized an informal comparison of particle size distribution measurement techniques. Three barite samples were tested by each participating company. I tested our samples using the lab's Granulometre. I sent the particle size distributions to the organizer of the test for compilation.

MUD SCHOOL

The Drilling Fluids Laboratory was also charged to transfer drilling fluids technology into the field. This transfer was accomplished by holding regular mud schools. Dr. McMordie and Mr. Young used their experience to design a curriculum and to instruct SOPC personnel. The SOPC Training Office invited eight SOPC field personnel at a time to attend mud school. The mud school was designed to be a practical, hands-on training session consisting of both lecture and laboratory segments.

I was actively involved in the mud school program. I helped Dr. McMordie and Mr. Young arrange their technical presentations. The mud service companies were glad to provide technical manuals and product samples for use in the mud school. I arranged for the delivery of the necessary materials for the laboratory and lecture sections of the school. I instructed during the laboratory sessions. The SOPC field personnel learned proper laboratory mud testing techniques; I instructed them in this

area. During the lecture sessions, I took over the routine duties of the laboratory to free Dr. McMordie or Mr. Young for their lecture duties.

GRANULOMETRE

The Granulometre was a French built instrument which used a light scattering technique to measure the particle size distribution of a finely ground solid. A slurry was made of the particles in either water or isopropyl alcohol (IPA). The scatter of a laser beam passing through the slurry was measured. The Granulometre calculated a particle size distribution from the measurement of the scattered laser beam. The Granulometre fed this particle size distribution (PSD) to a Hewlett-Packard microcomputer which was used to plot the PSD.

The Granulometre was a new instrument to all the members of the Drilling Fluids Laboratory staff. Some users of the Granulometre had recommended the instrument to Dr. McMordie. The Granulometre replaced the more tedious method for measuring the PSD. The more tedious method was recommended by the API.

Dr. McMordie and I ordered the Granulometre from its American supplier. I received the instrument and set it up. The initial test results were disappointing. I called the distributor and arranged a service call. One free service call was included with the instrument. The free service call covered the installation of the instrument. The technician, who answered the service call, realigned the laser and fine tuned the instrument. He also demonstrated all of the features of the instrument.

I then proceeded to define a standard testing technique. The standard testing technique covered the details of mixing and sample preparation.

The proper mixing of the slurry, using a dispersant compound was essential. I found it imperative to ensure that all of the sample was added to the Granulometre after mixing. I then wrote a memo outlining the standard technique. I trained both laboratory technicians in the use of the Granulometre and in the steps of the standardized technique. After repeated practice, the technicians became competent operators.

CAMERON BOMBS

The Cameron bombs were high temperature, high pressure, static aging cells. They were constructed from wellhead hardware from Cameron Iron Works. They were rated at up to 20,000 psi and 250 degrees Centigrade. Dr. McMordie had ordered parts to construct the bombs based upon drawings from Hughes Drilling Fluids. Autoclave Engineering fittings, tubing, and valves were used.

Dr. McMordie assigned me the task of assembling and testing the Cameron bombs. The first problem was that the pressure gages did not fit the high pressure tubing used. The gages used smaller tubing than did the valves and bombs themselves. I ordered the proper adaptors and assembled the valves, gages, and pressure vessels. The high temperature baths had been constructed by an outside contractor. When the first bath was connected to the 208 volt recepticle, the temperature control circuit burned out. The unit had been incorrectly wired. I wired the second heater for 110 volt current. The unit then worked satisfactorily.

I had to solve a number of other problems before the bombs could be successfully used. Each bomb had to be filled to its maximum capacity. The connecting tubing was then filled with silicone grease. The silicone

grease separated the drilling mud from the hydraulic oil used to pressurize the bombs. If the bombs were not correctly filled, the hydraulic oil would contaminate the mud sample.

I devised some handling equipment and techniques for handling the bombs. Each bomb weighed approximately 150 pounds. The bombs had to be handled carefully when they were removed from the hot, oil filled baths. I purchased an engine hoist and constructed wire rope slings to handle the bombs. A wooden stand and a four foot long wrench completed the necessary handling equipment.

VII. CEMENTING TECHNICAL SERVICE

The Drilling Fluids Laboratory was charged to provide technical service in the area of well cementing. This technical service was constrained by the lack of a cementing professional on the staff. Dr. McMordie hired a very experienced and able cement technician, Tim Edwards.

Mr. Edwards was very experienced in all aspects of cement testing. He possessed a vast practical knowledge of cement testing equipment. He also had some experience in cement slurry design and cementing operations. However, cementing technical service during this internship was limited to cement, testing field observation, and service company laboratory audits. Mr. Edwards provided all of these services. I contributed to cementing technical service in three areas: supervising testing, equipment problem solving, and report reviewing.

SUPERVISION

I supervised Mr. Edward's testing by establishing priorities and consulting on test results. He was self-directed in the performance of the actual cement tests. He sometimes needed guidance on which well should be tested first and how many times he should test each sample. Occasionally SOPC engineers would send in a cement sample after the well had been cemented. These samples were ordinarily saved for a time and then discarded. Often he would ask if he needed to test one of these samples or should he just store it. When he and I discussed his tests results, we would focus on questions such as were more tests necessary. Generally, he knew the answer if the question was posed in the correct

manner.

I often reviewed Mr. Edward' trips and reports with him. He appreciated my editorial comments on his reports. Our discussions of his trips lead to a better understanding of what had occurred for both of us.

PROBLEM SOLVING

My problem solving on the cement testing equipment was limited to trouble shooting breakdowns. Mr. Edwards established an excellent system of routine maintenance. On one occasion, a locking cam broke at the end of a test. Efforts to free the broken cam only broke the cam removal tool. He called me in to help. I designed and constructed a tool to remove the broken cam. I was given the honor of using the special tool and possibly breaking it. The tool worked, saving many hours of expensive factory service. It was also necessary to keep Mr. Edwards from spending time wastefully to save a cash cost. His previous training had stressed saving money, even if it meant spending extra time. I pointed out the value of his time to him and SOPC.

VIII. TECHNICAL ADMINISTRATION

Technical administration included administrative tasks that relied upon technical training or concerned technical tasks. These duties included technical meetings, budget preparation, and performance evaluation.

STAFF MEETINGS

Staff meetings for the Drilling Fluids Laboratory personnel fell into three categories. Local staff meetings included just the laboratory personnel. Divisional staff meetings took the form of seminars. Corporate staff meetings were called program reviews.

Dr. McMordie called local staff meetings as necessary. He held staff meetings to discuss and distribute information he received from upper SOPC management. We often had staff meetings to review field trips and to discuss current rumors. Safety meetings were held to discuss safety problems at the lab and to distribute safety information.

Drilling, Competitions, and Production Services (DCPS) group seminars were held to familiarize the members of DCPS with each others' projects. The Fluids lab was part of DCPS. The seminars were held at the Dallas office. An informal lunch and discussion followed each seminar. The seminars were biweekly, and each member of DCPS was expected to speak. Dr. McMordie presented a summary of the laboratory's operational capabilities at one seminar.

SOPC Vice Presidents and high level managers attended the Drilling Technology Program Review. During the program review, members of SOPC's divisions presented projects of interest to the visitors. The

program review lasted for two days. I gave a presentation on the build-out of the laboratory facilities. I concentrated on what had been accomplished, in a short time, for little cost.

Other corporate staff meetings occurred when members of SOPC's corporate staff felt a need to meet with operations personnel. An example of this was the Safety and Environment Review which was held at the lab. Members of SOPC's corporate safety office traveled to the Drilling Fluids Laboratory to review our operations. They toured our facilities and discussed the testing procedures and materials used in the lab. The safety experts made suggestions to improve our operations.

1986 BUDGET

Early in 1986 SOPC reorganized its operations. These changes included a change in managers for the Drilling Fluids Laboratory. With the new manager came an increased emphasis on controlling costs in SOPC. Cost justifications were required for every area in SOPC. The Drilling Fluids Laboratory was required to submit a justified budget for 1986.

I helped Dr. McMordie prepare the 1986 budget for the Drilling Fluids Laboratory. Dr. McMordie was traveling extensively at the time the budget was requested. He outlined what had to be done to myself and Mr. Young. I consulted with Mr. Young on the reasons behind a number of projects planned for the facility. I then wrote the preliminary justifications for the research and technical service projects planned for 1986. These justifications included capital spending and staffing requirements. I rewrote these justifications after they were reviewed by Dr. McMordie. These justifications formed the basis for our 1986 budget requests. I also

prepared two forms to help organize and speed scheduling. One form displayed the spending schedule for each project. The other form displayed the staffing requirements.

EVALUATION

SOPC evaluated my internship and technical performance three times. Two evaluations were directed at the internship and the intern. These reviews of the internship occurred in September and at the end of the internship. Both Dr. McMordie and myself completed a form evaluating the internship and my performance.

The other evaluation was the Performance Appraisal. Once each year, every SOPC employee received a Performance Appraisal. These evaluations were used to determine the eligibility of an individual for raises or promotion. A record of negative Performance Evaluations was required before dismissal could take place. Dr. McMordie evaluated all of the employees at the laboratory.

The form used for the evaluation asked a number of general questions to which Dr. McMordie had to provide written response. Dr. McMordie gave me a copy of the appraisal form two days before it was scheduled. He asked me to complete it evaluating myself. He did the same. We met and compared our forms. There were no major differences. He also explained his responses. I signed the Performance Appraisal to indicate that it had been reviewed with me.

IX. CONCLUSIONS

I gained a variety of practical experiences during my internship with SOPC. Each aspect of the work increased my insight into the workings of industry or my understanding of people's personalities.

ORIENTATION

My experiences during the orientation phase of the intership demonstrated the value of personal instruction. I learned a great deal about drilling and drilling fluids by reading texts and technical manuals. This knowledge was mostly superficial. Personal discussions with people knowledgeable in the field provided more depth and greater understanding. However, the best teacher was experience. Rig trips and laboratory testing drove home knowledge learned during discussions or reading.

LABORATORY BUILD-OUT

The laboratory build-out emphasized the importance of communication, planning, and assertive behavior. Clear communication between Dr. McMordie and myself was essential. During the build-out phase, much of our communication was by telephone. On a number of occasions the things that Dr. McMordie wanted done seemed impossible because I had misunderstood him. Communication between myself and the tradesmen was also essential. I found it necessary to control my preconceived notions. I had to be sure that the tradesmen really understood what I wanted done. I also had to be careful not to alienate the tradesmen when communicating with them. Establishing a rapport with some of the tradesmen made

communication easy with them and easier with other tradespeople.

The value of careful planning was apparent as the build-out progressed. The build-out was basically a rush job. At times, the blueprints did not agree with the building shell. Rooms were not the correct dimensions. Electrical outlets were missing. Much of my on-site supervision corrected problems which arose due to hurried planning.

I found assertive behavior to be required during the build-out. In many cases, nothing would get done if I did not assert myself.

I made two contributions to SOPC during the build-out. My supervision and administration significantly shortened the time required to complete the laboratory. The finished laboratory was an efficient, functional unit. Some improvements were necessary; other improvements were desirable. However, after the laboratory build-out, SOPC possessed a working, contributing Drilling Fluids Laboratory.

OFFICE MANAGEMENT

My duties in office management demonstrated the value of office forms, cooperation and assertive behavior. It was jokingly said in our office that anything could be bought if you filled out the correct forms. The use of the proper form often eliminated unnecessary problems and expedited the desired results. In the event that a form would not work, cooperation with the administrative services personnel would usually solve the problem. Assertive behavior was required if cooperation failed.

The purchasing and record keeping systems that I set up were my most valuable administrative contribution to the laboratory. Also of value were the forms and procedures for sample logging as well as the other forms for

mud checks, report covers, etc. No doubt the forms will be changed but the underlying principle will remain.

RESEARCH

My experiences with SOPC demonstrated some of the problems associated with research in industry. There was a conflict between short or long term results. Short term results appeared to be more valuable. Research funding was subjected to early scrutiny during budget cuts. On the positive side, research projects were pursued aggressively. Small scale experimentation was easily funded and encouraged.

I contributed three items of value to the Drilling Fluids Laboratory research program. I defined standard test techniques for a variety of new or sophisticated measurement methods. I designed and built a flow loop to measure the dispersive tendency of water-based muds. I found two common mud testing techniques to disagree. The relative ranking of a polymer mud differed significantly depending upon which technique was used.

TECHNICAL SERVICE

I found communication, especially active listening, to be essential in technical service work. Other people, from engineers to rig hands, had good ideas. It also paid to be aware of other peoples' motivations. The advice from someone trying to sell you something was always suspect.

My major contributions to the technical service operation at the laboratory were the design of forms and procedures and the procurement and installation of test equipment. Most of my technical service duties

were of a supportive nature. I supervised the installation of all of the laboratory equipment. The forms that I produced eased report writing and increased the efficiency of the operation. Standard ordering and testing methods simplified normal daily operations.

VITA

Eugene Charles Flipse was born October 27, 1956, in Long Island, New York. He attended primary and secondary schools in Virginia where he graduated from Gloucester High School in 1974. He received a Bachelor of Science from Virginia Polytechnic Institute and State University in Chemical Engineering in 1978. That year, he moved to College Station, Texas where he began work on a Master of Science in Chemical Engineering. While teaching undergraduate laboratories in the Chemical Engineering department, he completed the requirements for and received a Master of Science in Chemical Engineering in August 1983. He entered the Doctor of Engineering program at Texas A & M in September of that year. Having completed the course requirements, he began a one year internship with Standard Oil Production Company. He received his Doctor of Engineering with a specialization in Chemical Engineering in August 1986. He is currently employed in the chemical processing industry in south Texas.

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