BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 15, 1958

IN THE MATTER OF: Case No. 1369

TRANSCRIPT OF PROCEEDINGS

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BEFORE THE
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IN THE MATTER OF:	
The hearing upon the motion of the Oil Conservation Commission of New Mexico at the request of The Atlantic Refining Company to amend Rule 107 of the Commission Rules and Regulations pertaining to casing, tubing, and cementing requirements.	Case 1369

BEFORE:

Mr. A. L. Porter, Jr.
Mr. Murray Morgan
Governor Edwin L. Mechem

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: We will take up next Case 1369, and I would like to ask at this time all the interested parties who wish to make an appearance in this case, do so now.

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox , representing The Atlantic Refining Company.

MR. PORTER: Anyone else?

MR. HUGHSTON: R. L. Hughston for Shell Oil Company. We are going to have to leave, Mr. Porter, and if the Commission will give us the permission to do so, we would like to make our statement before the Applicant puts on his case.

MR. KELLAHIN: We have no objection.

MR. PORTER: Any other appearances?

MR. CAMPBELL: Jack M. Campbell, Roswell, New Mexico. I would like to enter an appearance on behalf of the Independent Producers and Royalty Owners Association of New Mexico.

MR. BUELL: Guy Buell for Pan American Petroleum Corporation.

MR. BRATTON: Howard Bratton, Hervey, Dow and Hinkle, Roswell, Humble Oil and Refining Company.

MR. PORTER: Anyone else desire to make an appearance in the case? Is there any objection to Mr. Hughston's motion or request to make a statement in order to be allowed time to make his plane connection? Mr. Hughston.

MR. HUGHSTON: I wish to thank the Commission and the others interested in this case for allowing me to do this; because of transportation arrangements, we will not be able to stay throughout the entire case. We wish to go on record, however, that our engineers have gone over the rules changes proposed in Case 1369, and they are in agreement therewith.

We understood in this connection that the Applicant will in putting on its case, change the figure in the fourth line of sub-paragraph (1) of paragraph (c) from 2500 to 1500, so that the maximum pressure required on the casing, so that the sentence will read: "Minimum casing test pressure shall be approximately one-third manufacturer's rated internal yield pressure except that the test pressure shall not be less than 600 pounds per square inch and need not be greater than 1500 pounds per square inch", instead of 2500 pounds as it now reads. That change will be

agreeable to Shell, and we wish to urge the Commission, after it has heard the case, that it adopt the proposed rule.

MR. PORTER: Mr. Kellahin, will you proceed?

MR. KELLAHIN: If the Commission please, I would like to make a short preliminary statement. This application for amendment of Rule 107 proposes three basic changes in the rule. These changes would, first of all, reduce the minimum rating on cement intervals; second, establish a statewide casing test rule, a provision that does not now exist; third, allow completion with no restriction in the bottom of the tubing.

Changes one and three will make a considerable reduction in operating cost and use of approved completion equipment and procedures. Advances in technology and equipment within the last several years make these changes desirable and proper.

Change number two is proposed as a safety measure and represents an addition to the present existing Rule 107.

Just to discuss the proposed changes briefly, paragraph (a) of the present rule remains unchanged. The major change occurs in paragraph (b) where the present rule calls for a cement waiting time of 24 to 30 hours. The proposed revision would change it to either 18 hours or until a compressive strength of 500 pounds per square inch was reached, in what is defined within the rule as the "zone of interest". The zone of interest is defined as that part of the casing hole annulus where the cement should have sufficient strength to resist the stresses imposed by drilling

out or completion operations. At the present time all waiting on cement operations are based on time. Some states cover one phase of the operation; some,others; for the most part this time interval is 12 to 24 hours. In reality time is important only in that it relates to the strength of the cement, and laboratory and field work have given an insight into what strength a cement should have to perform its function in an oil well. In that connection, we will attempt to show to the Commission the strengths which can be achieved with the various types of cements and the adequacy of the proposed rule for protection of the strata involved.

We will have three witnesses. I would like to have all of them sworn at this time. Mr. Davis, Mr. Ludwig, and Mr. Smith.

(Witnesses sworn.)

MR. PORTER: At this time the hearing will recess until 1:00 o'clock.

(Recess.)

AFTERNOON SESSION
January 15, 1958

MR. PORTER: The hearing will come to order, please. Mr. Kellahin.

MR. KELLAHIN: I would like to call Mr. Davis as the first witness, please.

S. H. DAVIS

a witness, of lawful age, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. KELLAHIN:

Q Would you state your name, please?

A S. H. Davis.

Q By whom are you employed?

A By The Atlantic Refining Company, Dallas, Texas.

Q What is your position?

A At the present time, I'm staff production engineer, in the Crude Oil Production Division.

Q You have never testified before this Commission in the past, have you?

A No, I have not.

Q What are your educational qualifications, Mr. Davis?

A I have a Bachelor of Mechanical Engineering degree, Ohio State University.

Q What date did you get your degree?

A I got my degree in June of 1949 and accepted employment immediately with Atlantic Refining Company.

Q What positions have you held with Atlantic Refining Company?

A For about four years I was in the Research Department working in the completion research end of the research work. In that capacity I worked on drilling fluid research, drilling rig research, and improvements in completion practices, cementing was one of the main parts of the completion work.

Q Are you presently engaged in that same type of work?

A That's right, and there was a period of time between the research work and the present work where I was engaged with the Drilling Department for about a half a year, where actually I was engaged actively in the running of casing and cementing of wells. At the present time I am actively engaged from the production engineering standpoint in well completions and remedial work, and the improvements in cementing and cementing techniques is one of the main features of my job at the time being.

MR. KELLAHIN: Are the witness's qualifications acceptable to the Commission?

MR. PORTER: Yes, they are.

Q Have you made any study in connection with your work on the strength required in oil cementing work?

A Yes, during the past year we have made quite an intensive study, started out initially to examine our own procedures and to see what improvements could be made in our own; and with Mr. Faulk I presented a paper before the A.P.I. that summed up what our findings were.

Q You say you and Mr. Faulk presented this paper?

A That's right, co-authored the paper.

Q What was the result of this research which you did?

A We found that actual cement waiting times could be lowered considerably over what the rules called for in various states, without adversely affecting the performance of the wells.

Q Now how much strength is required in oil well cementing,

Mr. Davis?

A Well, I believe you read briefly there, many experts in the cementing field feel that, or believe that five hundred pounds per square inch is more than adequate for all cementing operations in an oil well, that this value probably is conservative and has a safety factor of from two to three within it. There is some evidence available that a compressive strength as low as two to three hundred pounds per square inch are adequate.

Q What is the required time, required to reach this strength?

A The factors that determine the time required for cement to gain strength is the composition of the cementing mixture, the temperature of the environment in which it sets or cures, and the pressure of the environment; and of these the composition and temperature are by far the most important from the standpoint of gaining strength.

Q You mentioned temperature as one of the factors involved. Have you made a study of the formation temperatures in New Mexico?

A Yes, we have, and I would like to point out some things about Exhibit 1 up here we wish to submit.

(Atlantic's Exhibit No. 1 marked for identification.)

A This Exhibit No. 1 is nothing more than a plot of sub-surface static temperatures versus depth. The temperatures in degrees Fahrenheit are along this column, and depth along this column. This line on Exhibit 1 represents a plot of data taken

primarily in southern New Mexico Counties of Eddy County, Lea County, I guess some in Chaves County, and one or two wells in Roosevelt County. The data were taken during bottom hole pressure tests where the wells would be shut in for a period of, oh, at least twenty-four hours, and sometimes as much as seventy-two hours with recording temperature bombs;and although, as specified on this particular curve as southern New Mexico because that was the area in which the data was taken, it should be fairly representative of the entire State of New Mexico. This upper line is the line that was prepared from sub-surface data in the Gulf Coast and is actually a line on which many of the A.P.I. cement test data are based. It is shown here for comparative purposes.

I want to come back to this Gulf Coast line, but right now I want to direct your attention to the New Mexico line where the temperatures ranged from about 60 degrees upward.

Q In your opinion is the temperature line for southern New Mexico representative of the sub-surface temperatures to be found in other areas in New Mexico?

A Yes, it is.

Q What relation do these formation temperatures have to this problem of cementing?

A The bottom hole formation temperature is considered to be the temperature at which the cement cures or sets. This value, this approach is somewhat conservative in that temperature surveys run after cementing actually indicate that because of the heat of

hydration liberated by the cement, the temperature may be as much as twenty to forty degrees higher, so that the average setting and curing temperature of the cement in most cases will be somewhat above the line shown, but this line is shown as the static formation temperature, as being the lowest temperature which the cement could be considered as setting, for a given depth.

Q Have you made a study of the time that is required to gain a compressive strength of five hundred pounds?

(Atlantic's Exhibit No. 2 marked for identification.)

A Yes, we have accumulated considerable data along this line. I would like to introduce Exhibit 2, which shows the time required for a number of typical cementing mixtures to reach five hundred pounds at various formation temperatures. This particular exhibit, Exhibit 2, the time is shown along this column in hours, and the formation static temperature is shown along this horizontal line. There are several typical mixtures shown here; for instance, the first one being common cement with two percent calcium chloride added for an accelerator. The next is neat common cement; the third one is common cement with two percent gel added; and over to the right side of the exhibit is the line shown for 50-50 posolan mixture, typical slow set cement and 50-50 posolan material with six percent gel.

These curves shown in Exhibit 2 indicate, well, for instance, let's look at the common cement with two percent calcium chloride.

It shows at formation temperatures as low as fifty degrees Fahrenheit that five hundred pounds would be gained in approximately fifteen hours. Of course, as the temperature increases, this time falls off rapidly. Actually you can look at this Exhibit 2, and the slow setting cement over here will gain five hundred pounds per square inch at one hundred twenty degrees here in a period of about twelve hours.

Now from this Exhibit 2 you can see that the temperatures which we are talking about, in New Mexico the lowest temperature we have shown here is about sixty degrees. With the proper use and selection of cement and the use of calcium chloride at your low temperature, which would be a shallow well, we can get five hundred pounds in fifteen hours. The slow set cement when used at the temperatures in excess of one hundred degrees, those are the temperatures for which they are designed, and five hundred pounds per square inch can be gained there in a period of twelve hours; and this indicates that actually these typical cementing mixtures when used at the temperature range for which they're designed at, five hundred pounds compressive strength can be gained in considerably less time than twenty-four to thirty hours called for by Rule 107 in the present form.

Q Actually Exhibit 1 shows that the lowest temperature you would expect would be in the vicinity of sixty degrees. As a matter of practice, you would be working at higher temperatures most of the time?

A That's right. In nearly all we will be operating at temperatures in excess of this value of sixty degrees. I would like to point out that regardless of the weather conditions that within fifty feet below the surface, the temperature will remain, for practical purposes, constant all year round. This data will be practicable for year round.

Q Would it be practical to have one time requirement for all the different types of cement?

A No, there's a difference in cementing compositions, and as I have mentioned, there is different times required for the various compositions to reach a given strength.

(Atlantic's Exhibit No. 3 marked for identification.)

A We have Exhibit 3 here, which shows some extremes in cementing mixtures. This shows the compressive strength along this column in hundreds of pounds.

Q Which column are you referring to?

A Vertical column along the left side of Exhibit 3, and along the horizontal column, or line immediately at the bottom of the exhibit is the time in hours. The first three lines of Exhibit 3 here show neat common cement with a two percent calcium chloride added, it shows for one hundred degrees, eighty degrees, and fifty degrees. In looking at this we might pick the eighty degree line. We can take a look at five hundred pounds per square inch compressive strength, a period of approximately ten hours would be required to

gain that strength. On the other hand, at the right and the lower portion of Exhibit 3, we have shown some examples of what we would refer to as filler-type cements, the top line being fifty percent posolan with six percent gel added, at one hundred degrees; the next line being the same cementing mixture at eighty degrees; and then the lower broken line is a typical filler cement that is marketed by one of the cementing companies, it is also at one hundred degrees.

From this you can see then, for instance, that five hundred pounds in compressive strength will not be gained by the fifty percent posolan and six percent gel until a period of roughly seventy hours. So here it may be necessary to wait seventy hours on this type of cement, the fifty percent posolan with six percent gel and at, say, one hundred degrees, whereas we can get five hundred pounds per square inch compressive strength at one hundred degrees and common cement, and two percent calcium chloride; this line is not actually continued down here, but it would be something less than ten hours required. So there is, because of the large difference, both the neat common cement with the two percent calcium chloride and these filler cements are excellent cementing materials, but still we would not feel that we should wait seventy hours on these mixtures of common cement, where it might be required on the filler-type cements.

Q Mr. Davis, you are familiar with the proposed rule changes which are under consideration here, are you not?

A Yes, I am.

Q Are you familiar with the proposal that a minimum waiting period of eighteen hours would be in effect?

A Yes.

Q How would you handle that, then, under the example that you have given of the mixture of fifty percent posolan with six percent gel at one hundred degrees, where you would say it would take seventy hours to set?

A We propose, we have proposed a zone of interest criterion to handle this sort of situation. In other words, we would use, if we had an application where we wanted to use a large amount of filler cement for most of the casing hole annulus, we will then finish out the operation with some common cement with two percent calcium chloride if necessary, if the temperature were down in the neighborhood of fifty or sixty degrees, to get the strength in the zone of interest.

Now as I have stated before, the zone of interest is that area in the well bore where some strength is required to resist the stresses of drilling out or perforating, fracturing. Under this proposition, if an operator instead of using the proper type cement in the zone of interest would elect to use one of these filler-type cements, then he should wait the additional time for his own protection, for the cement to gain strength.

We in our own operations, and most operators are familiar with these types of cements, would not normally use a cement of this

type in what we have defined as a zone of interest. Actually we have no, we have no provisions in the proposed rule that would actually cover this situation; however, under the rule as it exists now, there is no provision for covering the situation of that kind. There's nothing in either rule, in other words, to guarantee that good cementing practices are used. That would have to be one of judgment on the operator. I would like to point out that those filler cements would be an exception in that over here in this Exhibit 2 that I already introduced, ordinary common cement at the temperatures that we'll normally be dealing with, somewhere in the neighborhood of at least seventy to eighty degrees, we will attain the five hundred pounds compressive strength in maybe twelve hours. Certainly considerably less than the eighteen hours called for, so we don't feel that there is any need for using any other types of cement, where there are many of the other available types of cement can be obtained.

Q Those other cements would meet the requirement of the eighteen-hour rule?

A Yes, the eighteen hour criterion was picked primarily for those that did not prefer to report cement strength and maybe didn't have the information readily available. The eighteen hours was selected because one of the most critical conditions in the well, of course, is one of low temperature, and by the use of an accelerator in the common cement, at temperatures as low as fifty degrees, five hundred pounds can be obtained in less than the eighteen hours, so

the eighteen hours was selected on that basis.

Q Now, Mr. Davis, there are a great many different brands of cement. Are there variations in these brands as to the time required to reach the compressive strength that's needed?

A There is some variation in all cementing materials manufactured by different cement companies. However, in the common cements, common Portland cements which I have been discussing primarily here, the variation is not very great.

(Atlantic's Exhibit No. 4 marked for identification.)

A I have an exhibit, Exhibit 4, which shows the strength of three examples of accelerated cements. These cements were picked at random for cements that are available in New Mexico, and were sent to the Halliburton Oil Well Cementing Laboratories in Duncan to run tests on. Then I have shown in this example 4 the results of these tests. There are actually three distinct graphs on Exhibit 4. The graph A, for Portland cement A, the compressive strength in thousands of pounds is shown along the vertical column at the left of the graph, and along the bottom is the time in hours, and we have shown there the strength versus time for three different temperatures, and then the same type of data are reproduced then for Portland cement B and Portland cement C.

For example, let's look at the temperature of eighty degrees Fahrenheit on cement A, a thousand pounds per square inch compressive strength is obtained in a period of ten hours. On Portland cement

B it would appear that a thousand pounds per square inch compressive strength would be gained in somewhere between nine and ten hours; and on Portland cement C at eighty degrees, the thousand pounds would require approximately thirteen hours, so there may be a range of approximately four hours from the extreme in these examples shown.

I would like to point out that at five hundred pounds per square inch which we have proposed, all of these cements are well within the eighteen hour proposal. For instance, at sixty degrees, five hundred pounds would be right along here upon example cement A, a period of about eleven or twelve hours would be required for the cement to gain five hundred pounds per square inch. On example B, the same period of approximately eleven, about twelve hours would be required to gain five hundred pounds per square inch; and on the example Portland cement C, five hundred pounds would be obtained in, looks like fourteen or fifteen hours, all of which are below the eighteen hours proposal.

Q Now in preparing Exhibit 4 what was your source of information?

A It was the Halliburton Oil Well Cementing Company ran the tests on three separate brands of cement that were obtained in New Mexico and sent to their Duncan laboratories, and their data was then sent to me. I actually prepared the curves from the data sent.

Q Is this type of information available on other cements?

A Yes, this type of data is readily available from cement

manufacturers and from cement service companies operating in the New Mexico area. Much of it is already published in booklet form and is available on request; however, all of these companies will upon request run tests on any cement which they are asked to do so.

Q So if the Commission is in need of this type of information in administering the proposed rule, would they have any difficulty in obtaining it?

A No, they would not. In fact, I have compiled over the past year a considerable volume of this type of information, and would be more than willing to make it available. I know that the cementing companies would do the same thing.

Q On Exhibit 4 you have shown an accelerated type of cement. Will the use of these cements,when you use these cements will the mixture remain fluid long enough to be pumped into position?

A I have shown the accelerated cements in these instances primarily because the cold temperature, or the low temperature condition is the most critical and I wanted to show that cements were readily available which would handle even temperatures as low as fifty degrees. However, but for most applications down the hole, the temperature may be eighty degrees, a common cement without an accelerator would be satisfactory. However, since we have discussed the accelerated cements for use, I have prepared an Exhibit 5 to show that these cements do remain fluid enough to be pumped to the bottom of the hole.

(Atlantic Exhibit No. 5 marked for identification.)

A Exhibit 5 is a chart which shows the pumpability time, that is, the time that cement will remain fluid under various conditions of depth and temperature. Now this temperature action is across the top of the Exhibit 5, is actually taken from Exhibit 1, as is the depth, so in other words, the temperature shown up here corresponds to the depth shown at the bottom of Exhibit 5, and they were taken from the southern New Mexico temperature gradient shown in Exhibit 1. I would like at this time to direct the attention to the difference between the Gulf Coast gradient and the New Mexico gradient in Exhibit 1. The examination will reveal that a temperature difference for a given depth will vary from approximately twenty to fifty degrees Fahrenheit, the southern New Mexico temperatures being the lowest.

Now the A.P.I. has set up a standard test procedure for determining the pumpability of cements under down hole conditions. These tests are all founded and based on the temperature gradient of the Gulf Coast. For that reason, pumpability times of cements measured at Gulf Coast conditions will be too short or be conservative for use in New Mexico, because of the difference in temperatures. Actually at this time the data avilable is all based on,as I understand, there has been a lot of data accumulated, but it is based on the Gulf Coast temperature gradient. For that reason we have prepared this Exhibit 5 which shows the actual pumpability at the time of common cement with calcium chloride and ordinary common cement. This data has been shifted slightly from its original form

in order to make it adaptable to the temperatures found in New Mexico. In other words, the same data for the Gulf Coast would be slightly different. The important thing to be noticed from this is the depth to which either one of these, the common cement with calcium chloride added or the plain common cement, can be safely run in New Mexico.

This horizontal line intersecting both the pumpability lines in Exhibit 5 is the maximum time required to mix a thousand sacks of cement and pump it into position. That is based on A.P.I. specifications that have been developed during the past several years. Actually I have a safety factor of about thirty minutes to the time required, as an additional safety factor to take care of any breakdowns in cement equipment, so this maximum time then, as you see, the deeper that the well is, the greater the time required to place a thousand sacks of cement, because of the greater distance it has to be pumped.

Where this line intersects the two pumpability lines represents the maximum depth to which that slurry could be safely run so the important point from this is that actually the accelerated common cement could be run to this point of intersection or about fifty-five hundred feet in New Mexico. That would be a perfectly safe operation. Common cement without the accelerator can be run to a depth of about ninety-five hundred feet. Now at greater depths than this, the slow set cements would be required.

Q On these exhibits you have shown the time and temperature

on accelerated cement. Do you advocate their use at all depths?

A No, we advocate the accelerated cement be used only at temperatures lower than, say, eighty degrees, where by their use we can take advantage of the shorter WOC time. At eighty degrees for instance, common cement, as we can see from Exhibit 2, at eighty degrees common cement will reach five hundred pounds per square inch compressive strength in a period of twelve hours. There is no need for the use of an accelerator at temperatures of eighty degrees and above.

Q That completes your testimony on the exhibits, does it not?

A Yes, that covers the exhibits.

Q I believe you have already stated that you are familiar with the proposed changes in Rule 107 which are under consideration here. Will these changes meet the requirements which have been discussed by you in connection with the five exhibits?

A Yes, I believe they will. In looking at the proposed rule in part, paragraph (b), we have, it is proposed that a waiting time of eighteen hours or until the compressive strength of at least five hundred pounds per square inch shall be gained in the zone of interest. The eighteen hour criterion, as we pointed out, even at temperatures as low as fifty degrees, common cement with an accelerator in it will reach the five hundred pounds in fifteen hours. So we feel that the eighteen hours does represent a saving in time over the present rule, yet it is more than adequate to get the strengths that we feel necessary. As already testified, the

five hundred pounds we believe to be a conservative number, in that there is some evidence available that the compressive strengths as low as two to three hundred pounds are adequate. By defining the zone of interest, as pointed out, these filler types of cement which are excellent cost saving materials can be used in a large part of the casing hole annulus, and we can still take advantage of the low or the short waiting times afforded by common cement and accelerated common cement. Therefore we believe that the exhibits show that the proposed rule change is actually a little on the conservative side and that it represents what we would consider good practice in our own operations.

Q Do you consider a strength criterion as being superior to one in which time is the only factor?

A Yes, we believe that the strength is superior, in that time is of importance only in that it relates to the strength of the cement, and that we feel that strength is actually more direct, and since there are a number of compositions that are used, that is, of cementing compositions that are used and are excellent materials, we feel that a strength criterion fits all of these compositions, whereas a single time that we might arrive at may not fit all the cementing compositions in use today.

Q Do you consider five hundred pounds per square inch adequate for cementing operations?

A Yes, and I feel that it actually has some safety factor; I would say from two to three, that would allow us, that we will be

doubly sure, is about the only way I can put it, there is evidence available that strengths as low as two hundred pounds are satisfactory for all operations in oil well cementing.

Q Is there sufficient technical data available at this time to predict the time required for a given cementing mixture to reach the necessary compressive strength?

A Yes, this data that I have presented here, must of it has been taken from, as I said,data that was already published. The others, at low temperatures particularly, we had special tests run to provide this data, and as I pointed out by Exhibit 4, the three different brands of cement that are available in New Mexico all fall within the proposed rule; and this data, as I pointed out before, can be obtained upon request from cementing companies or the cement -- that is, the cement manufacturers or the cement service companies and other operating companies,such as Atlantic will furnish that data where requested.

Q Can these compressive strengths needed be achieved in less than the twenty-four to thirty hours called for in Rule 107, in your opinion?

A In my opinion, they can be obtained in considerably less than twenty-four hours. I will say there needs to be some judgment used in selection of the cement, but it's of primary importance for the operator to use the cement which is suitable for an operation, and there are many cements available which will meet the requirements of Rule 107. Some of the filler cements, as I stated previously,

will require a somewhat longer time, but they would require longer times, actually, than as specified under the present rule. I know of no occasion where the filler types of cement which require the longer times are used in that portion of the hole where strength is required before perforating or drilling out. Now by using the strength criterion, we would permit the use of these filler-type cements up the hole, for instance, to protect your casing against corrosion and to cover some zones that might be perforated some years later, but what we're interested in primarily is having the cement that will gain the strength within the proposed rule in the zone of interest where we are going to perforate immediately or where we are going to drill out immediately.

Q Now in the proposed rule there is a new provision calling for a statewide casing test. Will you discuss that, Mr. Davis?

A As you mentioned, this rule is an addition to the present rule, and it's proposed primarily as a safety factor or as a safety provision. An adequate casing test assures the operator that casing will hold pressure without leaking. Should casing leak, it could be responsible for the loss of hydrocarbon reserves to other underground formations, and in some instances could be responsible for serious blow-out. The proposed Rule 107 as it was initially presented called for a test pressure as high as 2500 pounds. At this time we would like to reduce that 2500 to 1500 pounds per square inch, so that the rule would then be as follows: The casing test rule when applied to rotary tools calls for a pressure test

equal to "one-third of the manufacturer's rated internal yield pressure except that the test pressure shall not be less than 600 pounds per square inch and need not be greater than 1500 pounds per square inch." The 1500 was put in at the suggestion of several operators, who felt that many of the rigs, rotary rigs available would not have mud pumps capable of reaching 2500 pounds.

Q In that connection, Mr. Davis, would you mark that change on what has been marked as Exhibit No. 6?

(Atlantic's Exhibit No. 6 marked for identification.)

A Yes, I will. Now for the cable tool operations, we have provided a bailing test, in order that the cable tool operator wouldn't be forced to have an auxilliary pump to perform the pressure test at his casing. The cable tool operator is free to use the pressure test, in addition, the operator of rotary tools is free to use a test pressure of higher than 1500 if he felt it would be desirable.

Q There is a proposal to allow completions with no restrictions in the bottom of the tubing. What is the reason for that proposal?

A Paragraph (c) of the present Rule 107 states that the bottom of the tubing shall be restricted to an opening of less than one inch or be bull plugged. During the recent years, the development of permanent type of well completion equipment and procedures makes it desirable to have the bottom of the tubing full open. As a matter of interest, one of the main developments has been the

development of the through tubing perforator, which enables us to run a perforating device through the tubing and out the casing and perforate a given zone. There are other tools that are run in conjunction with permanent type completions which also require full open tubing. There are also provisions available for putting a removable type plug in the bottom of the tubing if we want to block the bottom of the tubing to prevent the loss of instruments, the difference being, between the permanent type and this type, is that it can be retrieved by a wire line which will then permit us to run the tools out of the open end of the tubing, so we would like to propose that in order to allow the use of this equipment that we would leave off the last sentence of paragraph (c) in the current rule.

Q Mr. Davis, were Exhibits 1 through 5 inclusive prepared by you or under your direction and supervision?

A Yes, they were.

Q And Exhibit 6 is a copy of the proposed rule, as was circulated by the Commission, with the exception of the change made by you as to the pressure under the testing procedure, is that correct?

A That is correct.

MR. KELLAHIN: At this time we would like to offer in evidence Exhibits 1 through 6 inclusive.

MR. PORTER: Without objection Exhibits 1 through 6 will be admitted.

MR. KELLAHIN: That's all the questions we have.

MR. PORTER: Does anyone have a question of Mr. Davis? Mr. Buell.

CROSS EXAMINATION

By MR. BUELL:

Q Mr. Davis, my name is Guy Buell with Pan American Petroleum Corporation. I will hand you what I will ask to be marked as Pan American's Exhibit No. 1.

(Pan American's Exhibit No. 1 marked for identification.)

Q Are you generally familiar with what Exhibit 1 contains?

A Yes, I am.

Q You have seen that previous to this hearing, have you not?

A That's right.

Q That relates entirely to Section (d) of Rule 107, does it not?

A That's right.

Q I believe the changes that it makes over your proposed rule and the present Rule 107 is generally that gas wells that produce no liquids shall not require tubing, and also provides for administrative exception to where your tubing is bottomed and where your tubing has its perforation. Is that generally your understanding?

A That is generally my understanding.

Q Would you have any engineering objection to an amendment such as this being adopted?

A No, I can see cases that might come up where it may be desirable to raise the tubing to the point of getting it above a pay

zone that we hadn't completed in initially. It would be very desirable.

Q In other words, administrative exceptions should encourage more permanent type completions?

A Yes.

Q Isn't that generally considered a conservation measure?

A Yes.

MR. BUELL: Thank you.

A I have a correction to add myself. I called the wrong paragraph when I was discussing the restrictions in the bottom. I called it paragraph (c) and it is paragraph (d). I would like to make that correction.

MR. COOLEY: The restrictions as provided by the present rules are in paragraph (c).

A Is that right? I don't have my copy of the original.

MR. COOLEY: I'm sure they are. There is no paragraph (d) in the existing Rule 107.

A No (d)?

Q No paragraph (d) at all.

A I thought I had made an error when I presented that. In the proposed rule it will be in paragraph (d).

MR. COOLEY: Are you through, Mr. Buell?

MR. BUELL: Yes. I would like to formally offer Pan American's Exhibit 1.

MR. PORTER: Without objection it will be admitted. Mr.

Campbell.

MR. CAMPBELL: Jack M. Campbell, Roswell, New Mexico.

By MR. CAMPBELL:

Q I'll ask this question on behalf of Texas Pacific Coal and Oil Company. Did I understand you to say that you saw no engineering objection to the proposed amendment of Pan American with regard to not requiring tubing in gas wells?

A No, it doesn't cover not requiring tubing in gas wells.

Q That was my understanding of it.

A It was my understanding --

Q That if there was no fluid that you did not need tubing in gas wells?

A No, that doesn't cover. It covers only the movement of the lower end of the tubing without calling a hearing, is my understanding.

Q "All flowing oil wells and gas wells that produce liquids shall be tubed, and the tubing shall be set as near the bottom as practical." I would assume from that if there is no liquids the gas well doesn't need to be tubed?

A That is in the present rule.

Q That is the present rule?

A Yes.

Q Do you consider you can determine accurately whether there are liquids and the extent of those liquids without tubing?

A I have no comment to make along that regard. That was in the present rule and we proposed to change only that portion which

would, we were interested in having changed.

MR. PORTER: In order that there be no mistake here, I think possibly we should read the present rule.

MR. COOLEY: Would you like me to do so?

MR. PORTER: Yes.

MR. COOLEY: Paragraph (c) reads as follows: "All flowing wells shall be tubed, the tubing shall be set as near the bottom as practical, but tubing perforations shall not be more than 250 feet above the top of pay, unless authorized by the Commission. The bottom of the tubing shall be restricted to an opening of less than one inch or bull plugged in order to prevent loss of pressure bombs or other devices."

MR. CAMPBELL: That is a change at least in terminology. I am not familiar with whether the Commission considers a flowing well includes a gas well under their interpretation of it. This would quite definitely exclude it.

MR. COOLEY: The Commission has interpreted a gas well as being included in a flowing well.

MR. CAMPBELL: I have no further questions.

MR. PORTER: Anyone else have a question? Mr. Nutter.

By MR. NUTTER:

Q Mr. Davis, you were a co-author of a paper delivered to the A.P. I., or A.I.M.E.?

A A.P.I.

Q About a year ago?

A Yes.

Q In that paper, wasn't some mention made of the temperatures of the slurry?

A Yes.

Q And whether the setting time was affected by the slurry temperature?

A Yes.

Q What effect has the slurry temperature to do with this setting? I don't see it covered in any of the exhibits.

A Since writing that paper, we have taken a number of temperature surveys, some run in cold weather operations that would indicate that the slurry temperature,even though you may start out with cold slurry due to cold mixing water, has raised to the formation temperature in a very short period after the cement has reached bottom, particularly in the cases of shallow wells where the bottom hole temperature of the well hasn't been lowered a lot by a long period of circulation. We have investigated further this heat of hydration which I mentioned, and in examining these temperature surveys where there were temperatures taken at intervals of one to two hours after pumping, the plug indicated that the temperature of the slurry had actually come up to the formation temperature in a period of one or two hours after having reached bottom, and that it continued to rise up to as much as forty degrees above the static temperature, so thereby we now believe that the average curing temperature, so to speak, is somewhere between the peak temperature reached during

setting and the formation temperature, the static formation temperature; and that the effect of cold water mixing temperature will have very little effect on the time required to gain five hundred pounds.

Q So for that reason you don't feel that the temperature of the water is material --

A No.

Q -- in the setting time of the cement?

A No, we have other factors such as heat of hydration and loss of water into the slurry that would hasten setting that we haven't counted on, and that are factors that would more than overcome the cold water problem.

Q Do you think that all waters that would be available throughout the State of New Mexico would be of such temperature that no effect, that no detrimental effect would be had in the slurry mixtures?

A That is my opinion.

Q Have you established any temperature gradient for areas except southeast New Mexico as depicted on Exhibit 1?

A No, I have not. We operate no wells in the area other than that covered. However, that temperature gradient will actually hold also for West Texas and I see no reason why it should be appreciably different in the northern part of New Mexico.

Q So you would recommend that temperature gradient for the entire State?

A That's right.

Q Mr. Davis, are casing test rules such as you have proposed here rather common practice throughout the industry, whether they be by regulatory bodies or by individual companies? Are they recognized things?

A Yes, they are very much recognized in many pool rules and in some additional State rules. The test is made before drilling out, and as such is an actual test of whether the casing itself is leaking, and from that standpoint we feel that at the present day operations, for instance, the surface pipe is one of the important casing strings in the well and that we should be assured that the casing is not leaking before we continue operations.

Q What does the rule,as far as New Mexico is concerned, require in the line of casing tests?

A There is no statewide test rule. There are several pool rules. These pool rules in most instances call for a test to be -- a pressure test to be applied when rotary tools are used, to be applied after drilling out a portion of the casing shoe and approximately five feet into the formation. Actually we feel that this type of practice is not in the best interest of safety in the operation of drilling an oil well, since all we have done when we pressure test a condition of that kind is to determine how much is required to break the formation down, and that we have created a zone of weakness that may be there to bother us at some later date as we drill on later.

Q Is this cable tool optional test standard practice through

the industry?

A Some form of a bailing test is standard through the industry. There is some slight difference in wording in various states; however, this rule as we proposed it appears to be about what is being done in New Mexico and in parts of Texas. The specific wording is not quite the same.

Q Will this amended pressure test from 2500 to 1500 pounds provide an adequate test on the casing in a thirty-minute period?

A I believe it will provide an adequate test of whether the casing will leak if it doesn't leak under fifteen hundred pounds, it's very unlikely that it would leak at twenty-five hundred.

Q Is the ten percent pressure drop that's permitted usually construed to be an acceptable pressure drop?

A Yes, that is in a number of rules of regulatory bodies.

Q What is the meaning of "satisfactorily" drying in the bailing test with the cable tool operations?

A That is a wording that was made to approximate what was being done. Actually if you will look, there are some pool rules in the State of New Mexico, for instance in Eddy County that say "will remain approximately dry", so I guess "satisfactorily" is "approximately". Actually there can be, I might point out, in some other states the rule calls for the casing to be bailed down to a point mid-way between the top of the cement and the bottom of the cement, and that there shall be no greater, the fill shall be no greater than two percent of the bailed distance in a period of two

to six hours. To me it is very unlikely that with bailing equipment available, that when you get down to such fine numbers that might represent on a shallow well that you would actually be able to determine two percent of the bailed distance with a bailer. So the wording "satisfactory to dry" was left that way, and it would be at the discretion of the Commission to interpret it.

Q You feel that the operator of a cable tool rig that has run a test should report how dry it remained or how satisfactorily?

A Yes, I think that if there is any leakage at all he should report it.

Q Mr. Davis, you testified that you couldn't see anything engineeringly wrong with this amendment to Rule 107 (d) as proposed by Pan American on their Exhibit No. 1?

A Yes.

Q If that were rephrased to read something similar to this: That all flowing oil wells and gas wells shall be tubed, provided however that administrative exception could be granted to gas wells that did not make liquids -- would you see anything engineeringly wrong with such an amendment as that?

A Well, speaking from our own operations, if a gas well could be considered as non-corrosive, I feel there would be nothing particularly wrong in not having tubing. However, that is something that should be, you have to consider the pressure at which that gas was at. There are such things as,gas, of course, is more likely to find its way through couplings, or it's harder to hold, confine,

than is a liquid, such that if you have high pressure gas and you were to have a leak and not have tubing to immediately kill it, you might have some serious difficulties.

Q In other words, you bring up things besides just the liquids that may make it desirable or undesirable?

A That's right. In other words, we would not in our operations complete a gas well without tubing in it.

MR. NUTTER: Thank you.

MR. PORTER: Mr. Utz, did you have a question?

By MR. UTZ:

Q Mr. Davis, referring to your Exhibit No. 4, as I understand that exhibit, your Portland cement A, B, and C are different brand names?

A Different brand names.

Q Who accomplishes the test that you show on the graph there on the exhibit?

A You want to know the one specifically that made those tests?

A Yes, did the companies give you that information?

A Some operating companies are in position to make those tests themselves. We do make tests of that nature in our laboratory. Those specific tests were made by Halliburton at our request. They would make them at any operator's request or Commission's request.

Q Would there be a neutral agency that could accomplish those tests, supply us with information, other than --

A (Interrupting) There are neutral testing laboratories, yes.

It would be a matter of the expense of having the test run. Somebody would have to provide the expense of running the tests if an independent laboratory were to do them. However, I would consider any one of the cement service companies as independent, as far as that goes, of any of the operators.

Q You would consider their tests then as being accurate?

A That's right, because you see those tests are all, the pumpability tests and actual curing tests are all conducted under recommended practice bulletins published by the A.P.I.. RP-10-B and RP-10-A are two of the bulletins that specify the testing of oil well cements, and all of these laboratories that are conducting these tests are equipped with that type of identical equipment for running these tests. The tests of one laboratory have been correlated with tests of another laboratory, and in most instances where the same conditions were used, there was very little variation detected.

Q Would they test all brands of cement and make that information available to the Commission?

A I'm sure they would run tests of any brands that were available in a given state. For instance, in New Mexico they would make the test -- I would like to point out to you that the common cements that I have shown there, Portland common cement doesn't vary a whole lot from one brand to the other, and that you could accumulate some data but you would find that various brands of common cement would all fall within the specifications called for in the proposed rule. The slow set cements are something different;

various cement manufacturers use different retarding agents in their cements, and as such their pumpabilities will be different and the times to require setting will be different. However, slow set cements are used and are designed to be used at temperatures in excess of forty degrees. At those temperatures you will find that even though there is some variation between various brands of slow set cements, that they would still meet the specifications called for in Rule 107.

Q You feel that any brand of cement that the Commission would like data on would be reliable information, tested by a well service company such as Halliburton?

A I do.

MR. PORTER: Anyone else have a question of Mr. Davis? You may be excused.

(Witness excused.)

MR. KELLAHIN: I would like to call as our next witness Mr. Dwight K. Smith.

DWIGHT K. SMITH

a witness, of lawful age, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. KELLAHIN:

Q Would you state your name, please?

A Dwight K. Smith.

Q By whom are you employed, Mr. Smith?

A Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

Q What is your position?

A Section leader of the Cement Section of our Research Testing Laboratory.

Q What is your education, Mr. Smith?

A I hold a B. S. degree in Chemistry.

Q From what school?

A Oklahoma Baptist University, 1943.

Q What has been your experience since that date?

A I have been employed by Halliburton for approximately twelve years. Ten of that has been working with testing, using additives in cement in oil wells.

Q How long have you been section leader at the lab in Duncan?

A Approximately four years.

MR. KELLAHIN: Are the witness's qualifications acceptable?

MR. PORTER: Yes.

Q Have you had occasion in connection with your work to observe the cementing practices in states other than New Mexico?

A Yes, sir, I have.

Q Is that observation in states where temperature is comparable to those in New Mexico?

A Yes, sir.

Q What states would those be?

A I am actually more familiar with the practices in Oklahoma and Kansas than I would be here in New Mexico. I think the temperature

changes would be somewhat comparable in those states.

Q How do the practices in those states compare with the changes being considered in Rule 107 under consideration here?

A Actually I think the regulations in Oklahoma, there are no regulations except on surface pipe, and that is twelve hours. Kansas follows a similar trend. The regulations are fairly close. I know of some instances recently where wells have been cemented and drilled out on surface pipe within a four to twelve hour period. We have had some instances this past summer when we have been doing some work with accelerators where a shallow well has been cemented in the morning, perforated in the afternoon, and fractured the next morning.

Q Do you consider that a safe procedure?

A Yes, sir, I do.

Q In connection with your work, do you run tests on cement?

A Yes, sir, we did. We probably test cements from all areas of the United States, different manufacturers as well as foreign cements.

Q Now on the basis of work done in the laboratory, do the results of that work generally agree with the test that has been presented here by Mr. Davis?

A Yes, I think so. Most of your common cements as designated by the A.P.I. as Class A cements will have strengths at one hundred degrees in twenty-four hours of two thousand pounds or better. Some will run as high as three thousand, which is probably higher

than some of the values Mr. Davis has shown here. Actually they are designed so they are compatible with additives and still have desirable strengths.

Q Is this test data available to the operators and to the Commission from your company?

A Yes, it is.

Q In the event that the New Mexico Oil Conservation Commission needed such information, would you be willing to supply it to them?

A Yes, sir, we would. Actually here in New Mexico I doubt if you have over about three brands or four brands maybe, at the most, different brands of common cement available, and you have only one retarded type at the present time; but we would furnish such information, either existing information or new information, that might be desired.

Q On the basis of the cements which are in use here in New Mexico to which you have just referred, do those cements, both the common cement and the retarded cements, meet the requirements outlined by Mr. Davis?

A I would say yes.

Q Both as to time and as to strength?

A Yes.

Q On the basis of the information which has been given here, do you consider that the proposed Rule 107 would be a conservative approach?

A I think so, yes.

MR. KELLAHIN: That's all the questions we have.

MR. PORTER: Does anyone have a question of Mr. Smith? Mr. Nutter.

CROSS EXAMINATION

By MR. NUTTER:

Q Mr. Smith, are you acquainted with temperature gradients encountered in the wells in southeast New Mexico?

A To some extent, yes, sir.

Q Does that graph, Exhibit 1, pretty well depict the temperature gradient per thousand foot depth?

A I would say it does, yes, sir.

Q What about northwest New Mexico?

A I'm not too familiar with that area, but I would say from our experience with temperature and logs that it would. I think it would cover the area,as Mr. Davis pointed out, across the West Texas and into southeastern and northwestern New Mexico.

Q So you think that one temperature gradient chart, as this one is, would cover the entire state?

A I believe it would, yes, sir.

MR. NUTTER: Thank you.

MR. PORTER: Anyone else have a question? The witness may be excused. (Witness excused.)

MR. KELLAHIN: I would like to call Mr. Ludwig.

NORMAN C. LUDWIG

a witness, of lawful age, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. KELLAHIN:

Q Would you state your name, please?

A Norman C. Ludwig.

Q By whom are you employed?

A Universal Atlas Cement Company.

Q What is your position with that company?

A Associate director of research.

Q What is the business of the Universal Atlas Cement Company?

A Manufacturer of cement.

Q Now, in connection with your work as research associate, what educational qualifications do you have?

A I have a B. S. degree in Engineering from Illinois Tech and a Master's Degree in Physics from the University of Chicago.

Q What has been your experience, Mr. Ludwig?

A It has been more or less concentrated on oil well cements since 1939.

Q Has all of that time been with the Universal Atlas Cement Company?

A That's right.

MR. KELLAHIN: Are the witness's qualifications acceptable?

MR. PORTER: They are.

Q Mr. Ludwig, have you had any experience in oil well cementing and problems in connection with that type of work?

A That is, with the type of work that has been described here?

Q Yes.

A To preface my remarks, our company does not market cement in New Mexico because it's an out of area location. Referring to Figure 2 and Figure 3, our common cement, neat and with calcium chloride, as a rule gives a little greater strength than those curves show. On that basis I believe that the proposal as presented is conservative. The crux of the situation, of course,is the development of earlier strength.

Q Are you in agreement with Mr. Davis' testimony as to temperature being the prime factor in connection with that?

A Temperature is the prime factor in shallow depths,and at low temperatures,as has been discussed, pressure does not have a great effect.

Q To what extent, then, should time be considered in connection with achieving the strength required in oil well cementing?

A Would you state that question again?

Q Well, then, to what extent would you consider time is a factor in achieving strength?

A Well, time is the important factor.

Q But time and temperature together?

A Yes, time and temperature are the two important factors. Of course, as has been brought out by Mr. Davis, the things that

affect the initial strength is the temperature and the time and the composition; those are the three things. Pressure is an added factor which becomes important as pressure becomes greater, and especially at higher temperatures.

Q Are you in general agreement, then, with Mr. Davis' presentation as to the change in the time rule in the New Mexico rule?

A Yes, I am. I feel that, as I have said, that eighteen hours is an ample time.

MR. KELLAHIN: That's all we have.

MR. PORTER: Anyone have a question of the witness? Mr. Nutter.

CROSS EXAMINATION

By MR. NUTTER:

Q Mr. Ludwig, do you believe that the curves with the various cement mixtures that are depicted on the charts are typical of most mixtures of that type, regardless of the manufacturer of the cement?

A By "mixtures", do you mean --

Q Well, I mean the mixture of two percent gel.

A I believe that the common cement with two percent gel and with calcium chloride are typical, and as I said, our cements with those mixtures develop a little more strength than what is shown. We do not, as a cement manufacturer, have experience with the 50-50 posolan so I am not qualified to give an opinion on that. Our slow set cement in the temperature range shown on the curve would be somewhat under the curve that is shown in Figure 2, especially

when we bring in the factor of temperature which is important when you get into the well depths as you would use that cement in.

Q In other words, there is a variation, and sometimes a marked variation in the strength of one cement mixture as compared with the same cement mixture made by another manufacturer?

A Not the common cements, there is not too much; but in the slow set cements, as explained by Mr. Davis, there is a -- I wouldn't say marked difference, but there is an appreciable difference. I'm not qualified, as I mentioned a minute ago, to discuss the posolan mixtures; there are a number of different posolans, of course, as everybody knows, different types of posolans.To amplify the situation on slow set cements, you may be interested in some cooperative A.P.I. work that has been done within the past year, in which eight slow set cements were tested by eleven laboratories, to determine the strength of the cements and to determine the reproducibility of test procedures. It was rather remarkable how the application of pressure tended to bring those slow set cements down to pretty much the same common basis insofar as early strength goes. That work is available, too.

Q Do you think that by use of a chart such as these charts, when you know the brand of the cement and the mixture of the cement and the temperature of the hole, that an accurate appraisal can be made of the strength of the cement, with a given time period?

A Yes, I think it's possible.

Q You are from Indiana?

A Gary, Indiana.

Q You wouldn't know about the temperature gradient in the San Juan Basin, I don't suppose?

A No, I don't.

MR. NUTTER: Thank you.

MR. PORTER: Anyone else have a question of the witness? The witness may be excused.

(Witness excused.)

MR. PORTER: Anyone have any more testimony to present in the case? Any statements?

MR. KELLAHIN: That's all the testimony we have at this time.

MR. PORTER: Mr. Buell.

MR. BUELL: May it please the Commission, Guy Buell, Pan American Petroleum Corporation. Let me state at the outset, we certainly would have no objection to the proposal by Mr. Nutter to our proposed amendment of section (d), and we would recommend the adoption of the proposed Rule 107 as amended by our amendment and as amended by Mr. Nutter's amendment.

MR. PORTER: Mr. Campbell.

MR. CAMPBELL: With regard to the statement of Mr. Buell, I think that is a rather consequential change, and one that perhaps requires some study by operators and the Commission. I would like to inquire whether it is possible that a period of time could be given to submit comments on this proposed rule, or that the case be continued until the next monthly hearing. Most people did not

receive it until the docket was sent out. So far as the Association is concerned, we are certainly in agreement generally with all of the provisions. However, there are two or three provisions dealing with shallow cable tool pools which we would like to have an opportunity to study a little further, and perhaps make some suggestions to the Commission, either at another hearing or if, rather than slow the matter down, if there is a hurry about it, have a period of time in which to submit written comments on that.

I would like to request the Commission to allow us to do that either in that manner, or allow a continuance of the case until the next hearing.

MR. PORTER: Mr. Campbell, we will defer action on your motion for a moment. We will see if anybody else has a statement to make at this time.

MR. KELLAHIN: We would like to say there seems to be some concern expressed by the Commission staff with regard to the temperature gradient in the northwestern part of the State, and we will make every possible effort to supply the Commission with temperature gradients in that area as soon as possible. We will be able to produce it and according to the information available at the present time, it seems to be indicated that they would run higher than in southeastern New Mexico. Also in connection with the case, we have a letter from Phillips Petroleum Company expressing support of the proposed change, which I would like to submit to the Commission for their information.

I believe that we have nothing further to add to what has already been said. We urge the adoption of the rule.

MR. PORTER: Does anyone else have a statement to make at this time in the case?

MR. BRATTON: Howard Bratton, Hervey, Dow and Hinkle, Roswell, New Mexico, representing Humble Oil and Refining Company. We have a statement which we will make at this time; however, if the Commission is going to take further statements or continue the case for the possibility of further testimony, I believe we prefer to wait to introduce our statement until such time.

MR. COOLEY: Mr. Commissioner, I have some communications here.

MR. PORTER: In other words, you would like a ruling on the motion before you decide which way you would go? Is there any objection to Mr. Campbell's motion to continue this case until the next regular hearing?

MR. KELLAHIN: We have no objection, and then, as I understand it, the statements would be made at that time?

MR. PORTER: Yes.

MR. KELLAHIN: We have no objection to that.

MR. PORTER: The case will be continued until the regular February hearing, which I believe is February 13th.

* * * * * * *

C E R T I F I C A T E

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in stenotype and reduced to typewritten transcript under my personal supervision, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this 25th day of January, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My commission expires:

June 19, 1959.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 13, 1958

IN THE MATTER OF: Case No. 1369

TRANSCRIPT OF PROCEEDINGS

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 13, 1958

IN THE MATTER OF: The hearing upon the motion of the Oil Conservation Commission of New Mexico at the request of The Atlantic Refining Company to amend Rule 107 of the Commission Rules and Regulations pertaining to casing, tubing, and cementing requirements.	Case 1369

BEFORE:

Mr. A. L. Porter, Jr.
Mr. Murray Morgan
Governor Edwin L. Mechem

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: We'll take up next Case 1369.

MR. COOLEY: Case 1369: In the matter of the hearing upon the motion of the Oil Conservation Commission of New Mexico at the request of The Atlantic Refining Company to amend Rule 107 of the Commission Rules and Regulations pertaining to casing, tubing, and cementing requirements.

Is the Atlantic witness prepared to proceed?

MR. KELLAHIN: At the conclusion of the hearing in the case last month, the case was continued at the request of some of the operators and the New Mexico Producers and Royalty Owners Association. We had completed our testimony.

There was a question, however, in regard to a temperature

survey in the northwestern part of the State. We assured the Commission we would make every effort to obtain that information. We are prepared to go ahead on that phase of the hearing. I would like to ask if there are others going to put on testimony. We would like to close our witness and it would be awkward to put him on and take him off and put him back on again. If there are others, we would like for them to go ahead.

MR. PORTER: Anyone else have testimony to present in this case? It looks as though Mr. Davis may be the only witness.

MR. KELLAHIN: I would like to call Mr. Davis, then.

(Witness sworn.)

S. H. DAVIS

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. KELLAHIN:

A At the close of the hearing, we promised to provide this temperature data for the Northwestern part of New Mexico. We obtained temperature data from three or four different operators and several service companies during this interim period, and I have plotted a curve on the graph before you here which we have entered as Exhibit 7. The Exhibit 7 is identical to Exhibit 1, except that a temperature gradient line for northwestern New Mexico has been added. The line is an average line drawn through the central portion of a group of points from approximately fifty-five

wells. I would like to submit that as Exhibit 7 for the hearing.

Q Mr. Davis, was your curve on northwestern New Mexico prepared on the same basis as that for southern New Mexico and the Gulf Coast?

A Yes. It is, as you will notice, somewhat higher, as we had mentioned during the last hearing.

Q Do you have with you the temperature spotted on another exhibit showing the specific temperatures used in connection with that curve?

A I do. I have a graph, a small graph, which I will be glad to leave with the Commission, which actually shows the spread of points from which the northwestern New Mexico temperature gradient was drawn. I have no other comments to make, other than to mention that the line, the temperature being higher in northwestern New Mexico, the cement curing is actually less critical than it would be in southern New Mexico, and we have based our entire testimony on the temperature gradient in the southern part of New Mexico. There is no conflict between the two temperatures shown.

Q That curve is shown on what has been marked as Atlantic's Exhibit No. 7?

A That's right.

MR. KELLAHIN: We would like to offer in evidence Exhibit No. 7.

MR. PORTER: Is there objection to the admission of the exhibit? It will be admitted. Anyone have a question of Mr. Davis?

MR. KASTLER: Bill Kastler representing Gulf Oil Corporation.

CROSS EXAMINATION

By MR. KASTLER:

Q Mr. Davis, I hand you herewith a duplicated copy which has been prepared by Gulf Oil Corporation, and it has been deleted as to sub-paragrphs (a) and (c) of the proposed rule change, for the reason that Gulf Oil Corporation is in agreement or substantial agreement with Atlantic on those. In sub-paragraph (b) of your proposed rule change, this paper I have handed you contains certain underlining of additional language, which would accomplish two results: namely, to define the 500 pound compressor strength by A.P.I. standards, and to provide that the casing shall remain under pressure and stationary as to tension for the first eight hours, and thereafter it purports to define what is under pressure.

Mr. Davis, does this prepared statement appear to accomplish the two results that I have outlined?

A Yes. It covers those points.

MR. KASTLER: If the Commission please, I would like to submit this as Gulf's Exhibit No. 1 for the Commission's consideration of a proposed rule change containing these particular additions.

MR. PORTER: Is there objection to the admission of this exhibit? It will be admitted.

MR. KASTLER: Thank you, Mr. Davis.

MR. PORTER: Anyone else have a question of Mr. Davis?

MR. PORTER: Mr. Nutter.

By MR. NUTTER:

Q Do you feel that this temperature gradient that you have established for northwest New Mexico represents the temperatures to be encountered at various depths throughout the San Juan Basin?

A Yes.

Q You think that this provides an accurate enough measurement of temperature in order to use the minimum strength criterion--

A Yes.

Q -- to judge that the strength that a cement has attained in a certain period of time?

A Yes, I do.

Q I think last month you probably testified that you felt the same about the southern New Mexico temperature gradient?

A That is correct.

Q You feel that we have temperature gradient curves here that would reliably determine the strength of the cement?

A Yes.

MR. PORTER: Anyone else have a question of the witness? Mr. Davis may be excused.

(Witness excused.)

MR. KELLAHIN: If the Commission please, that's all we have at this time.

MR. PORTER: Anyone else have a statement to make in the case? Mr. Campbell.

MR. CAMPBELL: I would like to offer, for what consideration the Commission may desire to give it, a statement presenting the views of certain members of the Independent Producers and Royalty Owners Association, operating in the Artesia area with cable tool operations. The statement affects only a portion of paragraph (a) and paragraph (c)-2. We have no objection whatsoever to any other portions of the proposed rule change nor so far as I know to the amendments suggested in this Gulf exhibit. The statement was actually prepared by Mr. V. P. Sheldon after discussion of the matter with other operators in that area.

Independent Producers and Royalty Owners Association of New Mexico recommends that Rule 107 as proposed be amended in the following two ways:

1. In paragraph (a), the sentence, "Sufficient cement shall be used on surface casing to fill the annular space back of the casing to the top of the hole," that sentence be completely deleted.

This is the basis for that suggestion. The interest of the Oil Conservation Commission is to see that the various oil pays and water bearing strata are protected from contamination and moving of the fluids from one formation to the other. The cementing of the surface casing to ground level does not necessarily accomplish that end, nor is it always necessary to so cement to accomplish the goal and interest of the Commission. It is believed by this Association that the main objective of cementing surface

casing to ground level or to the bottom of the cellar is to provide a rigid anchor for the installation of a blowout preventer in rotary drilling. In cable tool drilling, gravel formations, either dry or water bearing, are often encountered which take cement or other fluids introduced, making it impossible to fill the annulus with cement without expensive hole conditioning. Even in cases where the cement actually reaches the surface during cementing operations, the cement often breaks down and enters the gravels after the cement is pumped and before it sets. There are a good many known cases where all of the cement pumped in enters the gravel, even leaving the casing shoe uncemented. This phenomenon is caused by an overbalanced condition, the fluid inside of the casing forcing the cement upwards away from the shoe. In cable tool drilling, a rigid anchor is not needed and it thus becomes necessary to cement to the surface or to the cellar.

We would like to further point out that the rules do not specifically define what surface casing is, and there may be several possible interpretations of that, which further complicates the picture.

We are aware of the vital importance in protecting the usable waters; we do not offer this amendment to avoid that responsibility, but we feel that by making this rule elastic in relying upon the approval by the Commission representatives in the area of the cementing program and examination of the cementing program after it is completed is sufficient to accomplish that purpose in indivi-

dual cases.

The second suggestion that we make, the waiting or test time as referred to in (c)2, to check water shut-off in cable tool drilling, be reduced from six hours to one hour.

In actual field practice, by the time the water inside the casing has been bailed,out, it is quite obvious as to whether or not a satisfactory water shut-off has been achieved. A one-hour test period after the hole has been bailed down is quite conclusive and a further wait serves no useful purpose. In fact, we would be willing to go further, in that should water break in around the shoe even after the prescribed test period indicated a satisfactory shut-off and drilling was resumed, the casing should be then re-cemented. Again, we make the point that a somewhat elastic rule better serves the goal of protecting the formations penetrated. They feel that the Commission has ample authority under the general powers in this order or this rule to set up satisfactory cementing requirements on cable tool holes in the area where these wells are drilled. The adoption of the one-hour test period will amply serve the Commission's needs and will make the operators more willing to cooperate. The Commission will still have ample powers to achieve its goals by virtue of the basic rule contained in the first paragraph of this order.

MR. PORTER: Mr. Hinkle.

MR. HINKLE: Clarence Hinkle. I have a brief statement on behalf of Humble.

Humble Oil and Refining Company would prefer a simple rule which does not involve reporting detailed information on the type of cement used, temperatures, and so forth. However, if a rule of the type proposed is to be adopted, we believe that the 500 psi compressive strength requirement is unnecessarily high. There are a number of engineering and research reports indicating that a cement tensile strength of 8 psi or compressive strength of 50 psi should be adequate. Field rules in several West Texas Fields permit drilling the plug in 12 hours and a number of wells have been cemented without failures under conditions where the theoretical cement strength before initiating tests approach 100 psi. It is our belief that if cement has reached final set, its strength is adequate to support the casing, and therefore we recommend that a rule be adopted to permit an operator to resume operations after waiting 12 hours on cement, provided the composition of the cement is such that it will have reached final set in this time.

We recommend adoption of the 1500 psi maximum casing test pressure as proposed by Atlantic.

We concur with Pan American that provision be made in Rule 107 (c) to provide for administrative exception to where tubing is bottomed. This should facilitate making permanent type completions and dual completions.

MR. PORTER: Anyone else have a statement in this case? We'll take the case under advisement.

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C E R T I F I C A T E

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in stenotype and reduced to typewritten transcript under my personal supervision, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this 6th day of March, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My commission expires:

June 19, 1959.