BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO. 1441

TRANSCRIPT OF HEARING

May 14, 1958

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I N D E X

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
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IN THE MATTER OF: Application of Pubco Petroleum Corporation for an order promulgating temporary special rules and regulations for the Verde-Gallup Oil Pool in San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an order promulgating temporary special rules and regulations for the Verde-Gallup Oil Pool in San Juan County, New Mexico, to provide for 80-acre proration units, well spacing, and such other rules and regulations as the Commission may deem necessary and proper.	CASE NO. 1441

BEFORE:

A. L. Porter
Murray Morgan

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: The meeting will come to order, please, and we will take up next Case 1441.

MR. PAYNE: Application of Pubco Petroleum Corporation for an order promulgating temporary special rules and regulations for the Verde-Gallup Oil Pool in San Juan County, New Mexico.

MR. WEBB: May it please the Commission, William G. Webb, representing Pubco Petroleum Corporation. We have two witnesses to be sworn, who intend to present testimony in this case.

(Witnesses sworn)

MR. WEBB: Mr. Gorham, will you take the stand.

FRANK E. GORHAM, JR.

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

DIRECT EXAMINATION

BY MR. WEBB:

Q Will you state your name, please?

A Frank E. Gorham, Jr.

Q By whom are you employed?

A Pubco Petroleum Corporation.

Q In what capacity?

A Vice-president and chief geologist.

Q Have you heretofore qualified as an expert witness as a geologist before this Commission?

A Yes, I have.

Q Are the witness' qualifications acceptable?

MR. PORTER: Yes, they are.

Q Directing your attention to Exhibit C, will you go to that Exhibit and briefly describe the area outlined in green and what that represents?

A The area outlined in green represents the present outlines of the Verde-Gallup Field. The Field, at present, consists of the following acreage in Township 31 North, Range 14 West, the southeast quarter of Section 7, the northwest quarter of Section 17;

all of Section 18, all of 19; the northwest quarter of Section 29, and the northeast quarter of Section 30. In Township 31 North, Range 15 West, it consists of the east half of Section 10; all of Section 11; all of Section 12 except the northeast quarter; all of Sections 13, 14, 15, and the east half of Section 16; the southeast quarter of Section 20; all but the northwest quarter of Section 21; all of Sections 22, 23, 24; the northeast quarter of Section 25; the southeast quarter of Section 27; all of Sections 28 and 29; all but the northwest quarter of Section 31; all of Section 32, and the northwest quarter of Section 33.

In Township 30 North, Range 15 West, the Verde-Gallup Field includes the north half of Section 5, and the northeast quarter of Section 6. The Verde-Gallup Field produces 40-degree API gravity oil from the Gallup formation within the mancos shale. There are approximately 80 wells within the field at present.

Q What type of structure is the structure from which production is being obtained in the Verde-Gallup Pool?

A The Verde-Gallup Pool is located on the topographic hog back of the northwest portion of the San Juan Basin which is really a monocline dipping to the southeast with a dip gradient ranging from approximately 500 feet per mile in Section 18 of Township 31 North, Range 14 West, to over a thousand feet per mile south dip in Section 19, of Township 31, Range 14 West, and it would appear that, on the current well control, that the deep wells are actually increasing to the south. At the present time there is

no known closure of any sort on this particular pool, and the production itself apparently is limited to a fracture type reservoir associated with the steep monoclinal dip.

Q What is the actual depth of production within the pool?

A The average depth of production within the pool at the present time approximates 2800 feet.

Q And from what zone or formation is that being obtained?

A It is producing from the upper Gallup, which in this particular area is actually a shale rather than a sandstone. It is slightly silty in part, and the upper Gallup is located within the Mancos Shale in the upper retaceous in age.

Q Mr. Gorham, have you prepared Exhibits, in addition to Exhibit C, under your supervision or control, which show in detail the type, characteristics and extent of the reservoir? In this connection I would direct your attention to Exhibits D, E and F. First Exhibit D behind the Commission?

A Yes, I have. Exhibit D as shown on the first Exhibit C, is a cross section which is an attempted strike section extending from the northeast quarter of Section 6 of Township 30 North, Range 15 West, extending northeastward to the southwest of the southeast quarter of Section 18, Township 31 North, Range 14 West. The wells depicted on this particular section are labeled in red on Exhibit C and will be mentioned by name while discussing the Exhibit D. Well Number one is the Pan American No. 1 Thurland Well located in Section 6, Township 30 North, Range 5 West and was completed for 96

barrels of oil per day out of Claud Carroll or upper Gallup -- Verde-Gallup producing zone. The next well on this particular section is the Pan American Ute No. 2 Well, Section 33, Township 31 North, 15 West, completed for 96 barrels of oil per day out of the same zone. Third well on the section is the Pan American Ute No. 1-C Well in Section 27 of Township 31 North, Range 15 West completed for 91 barrels of oil per day, out of the same zone as the same previous well described. The fourth well, Southern Union's Ute 2-23 in Section 23, 31 North, 15 West completed for 95 barrels of oil per day also completed from the same zone. No. 5 Well is the Southern Union Ute 1-24 Well completed in Section 24, Township 31 North, Range 15 West, again out of the upper Gallup producing zone. The last well on this particular cross section is the Pubco Ute 18-15, located in Section 18, Township 31 North, Range 14 West, also completed from the same zone. On this particular section, which is an attempted strike section, that is, at right angles to the dip which is to the southeast, we are attempting to portray here the characteristics of the reservoir primarily. This section is also hung structurally on sea level, and so, therefore, we are showing some undulation which is due to structure. However, we have on here three correlating zones which Pubco Petroleum utilizes for correlating purposes. The upper A zone is within the Mancos Shale as is the B zone within the Mancos Shale, and the C zone is right at the top of the producing pay section, sometimes referred to as the Claud Carroll producing zone. Unfortunately, on all of the

electric logs which you see on the cross section, until we get to the producing zone, because of the practice of setting production strings on top of the producing horizon, it was necessary to use a gamma ray neutron log below the C point. An exception to that, however, are our Wells Nos. 4 and 5 previously referred to which have Schlumberger logs throughout showing the lack of resistivity and self potential which one would associate with a sand stone or lime stone reservoir, and clearly portrays the reservoir characteristics electrically in the producing zone, and are very comparable to the overlying Mancos Shale. The gamma ray neutron logs are consistent in that same respect. However, their character is much more definitive and will show slight amounts of silt stone, which are present in this particular zone.

Q In your opinion, Mr. Gorham, are all of these six wells depicted there, are they producing from the same zone notwithstanding the undulation you have there in the middle of the Exhibit?

A We have shown here on Exhibit D the correlation points that were selected, A, B and C, with the C being at the top of a particular correlative marker in the Mancos Shale, or upper Gallup, and as being shown by the casing symbols in each particular well. The well is either being produced from open hole below the casing or is perforated in a comparable zone in each well.

Q Before you leave that Exhibit, Mr. Gorham, would you explain to the Commission the meaning of the topographical illustration at the top of the Exhibit and what effect that might have on

drilling practices in the area.

A In answering that, I would like to also point out that in the horizontal scale of this cross section, that 12 inches equals one mile, and in the vertical scale, two inches equal 100 feet. It was believed to be impossible to have both the vertical and horizontal scales the same because of the high dip rate which would call for a very very large cross section in line with the horizontal and vertical shale. As mentioned, we have superimposed at the top of the cross section, to scale, the vertical relief of the topography in the area showing the presence of cliffs and very difficult terrain as far as location and roads are concerned.

Q Now, Mr. Gorham, I would like for you to come down and direct your attention to Exhibit E. Ask you to explain to the Commission the meaning of that cross section and how it relates to Exhibit C.

A Exhibit E portrays cross section BB prime, as shown by the red line, BB prime superimposed on Exhibit C. This particular cross section is a dip section extending from the approximate -- well, the southwest quarter of the northeast quarter of Section 10, Township 31 North, Range 15 West and terminating at the southeast in the northwest quarter of Section 30, Township 31 North, Range 14 West. This dip section again has a scale comparable to the previous section where the horizontal scale is 12 inches equals one mile and the vertical scale is 2 inches equals 100 feet. Again, the reason for the variance in scale is because of the necessity of keeping

the section relatively small and at the same time portraying the dip information which we wish to show. The Well No. 7, which is the Aztec Oil and Gas Well, Ute No. 2, is located in Section 20, Township 31 North, 15 West, was completed for 15 barrels of oil per day. Well No. 8 on the cross section is the Claud M. Carroll Unit No. 14, 31 North, 15 West, completed for 48 barrels of oil per day. Well No. 9 is the Southern Union Unit 5-23 Well located in Section 23, Township 31 North, Range 15 West and was completed for 100 barrels of oil per day. The last well on the dip section, Well No. 10, is the three-stage Ute No. 1 located in Section 30, 31 North, Range 14 West, which was completed for 136 barrels of oil per day. The purpose of this dip section is to show the relationship between these four wells structurally in the Verde-Gallup Pool. These wells are at sea level. That is,hung from sea level. The data will show a relatively low dip rate in the northwestern portion of the area with a much greater dip rate increasing to the southeast. This dip rate has caused all sorts of difficulty in drilling in the area. Hole deviations have gone from 2, 3 degrees on up to 15 to 20 degrees requiring the redrilling of locations because of the high dip rate in the southeastern and southern portion of the field.

Q Do the characteristics of these logs -- do the logs shown on Exhibit E have the same characteristics as the logs shown on Exhibit D?

A Yes, they do. They demonstrate again the correlative points A, B and C, the C point, again, being the same point at the

top of the producing zone. In this particular case, on Well No. 9, we have a gamma ray induction log through a large portion of Mancos shale, as well as the producing zone, showing very little, if any, difference between the known shale and the Mancos formation as compared to the producing zone in the Claud Carroll zone.

Q Now, directing your attention to Exhibit F, does this Exhibit show somewhat the same thing as Exhibit E?

A Exhibit No. F, which is a cross section of CC prime is, again, a dip section located in the southwestern portion of the field showing generally that the same characteristics which exist in cross sections BB prime exist in this particular area.

Q And all of these wells, in your opinion, are producing from the same zone?

A They are all producing from the same zone.

Q Now, Mr. Gorham, in conducting operations on the wells that Pubco has drilled in the area, was any coring done, and in this regard I would refer you to Exhibit A.

A Yes, we cored Well No. 19-15, which is shown on Exhibit D and is located in Section 18, Township 31 North, Range 14 West.

Q Is that the Pubco Ute No. 8-15?

A Yes, that is correct.

Q Would you give a general description of that core?

A The core was representative of the formation itself and showed that the producing horizon or zone is a shale slightly silty in part, with a certain amount of oil saturation within the shale

itself. The shale is very highly fractured both horizontally and vertically, and, in our opinion, it represents, the fractures represent the entire reservoir.

Q What was the result of the core analysis? Was there any porosity or permeability, either, shown by that analysis?

A Core analysis was taken of the shale itself, the matrix, which showed an average horizontal permeability of .17 milladarceys; an average porosity of 9.2 percent, residual oil saturation of 38.3 percent, and total water percentage of porous space, 58.6 percent. These ranges included the following: Permeability ranges went from .01 milladarceys to 1.9 milladarceys, porosity from .6 percent to 13.9 percent, residual oil ranged from 8.4 to 53.0 percent and waters ranged from 42.7 to 84.0 percent. Now, this core analysis was taken of the interval 2557 to 2608 in the previously mentioned well.

Q In your opinion, would this analysis hold true on other wells drilled in the pool if sand had been obtained?

A I am certain that a comparable analysis would be obtained on any well currently completed in the Verde-Gallup Pool. It is my understanding that all wells which have been cored have resulted in somewhat the same characteristics.

Q I believe you mentioned that the -- earlier in your testimony, that the formation was highly fractured. Do you have a sample of that fracture with you?

A Yes, I do.

Q Will you explain that to the Commission?

A We have here a sample or a piece of the core taken in the Pubco Mountain Ute 18-15 Well at a depth of 2605 feet. The interesting part of this specimen is the fact that the operation conducted on the well was comparable to all of the other completion practices that we have employed in the Verde-Gallup Pool to the extent that we set five and a half inch production casing right about at the C point above the fractured shale producing zone, cemented with a normal amount of cement, and after waiting for cement, drilled approximately 15 feet with oil and went in with a core barrel 57 feet below the casing set point. We encountered this particular situation where cement had fallen from our normal cementing operation below our guide-shoe through the completion fracture system and had actually filled a void between existing fractures as demonstrated by this particular sample and the photograph which is before the Commission. The white material in the -- in the middle of this particular core is cement with loose circulation material and is flanked on both sides by the typical shale of the producing zone. The base is nothing but plaster of Paris to support the Exhibit.

Q In your opinion, Mr. Gorham, would shale itself produce anything, or if the production, if any, to be obtained from fractures such as this? All of them probably are not that large?

A In my opinion, I am quite certain that the production itself must come from the fractures alone, in view of the extremely low permeability as detected by the core analysis. The core analysis

shows permeability of less than one milladarcy. As a matter of fact, the average was .17 milladarceys, which in my opinion, would not support the type of production we are getting in the Verde-Gallup Pool and necessarily, therefore, must be coming from the intricate fracture system existent in the pool.

Q Does the analysis show that the formation itself as a reservoir is capable of producing? That is, the shale itself?

A The shale itself, I do not believe, will support production.

Q Is this the only reservoir of this type with which you are familiar in the State of New Mexico?

A This is the only reservoir of its type in New Mexico that I am familiar with, and is unique in that extent; that it is the only one, I am certain, that is present in the State of New Mexico.

Q Now, Mr. Gorham, with the information that you have available from your study of wells Pubco drilled in the area and the wells drilled by other operators, can you estimate from that information the reserves that may be obtained from the reservoir on a volumetric basis?

A No, I cannot. In the absence of a nonsand body, a nonlimestone body, it is impossible to compute volumetrically the reserves in the Verde-Gallup Pool.

Q At the present time, at any rate, you have insufficient information available with which to properly evaluate the reserves?

A That is correct. I feel that with time, through produc-

tion curves, that we will perhaps be able to estimate the reserves on the pool.

Q Now, Mr. Gorham, to what density has this field been developed at the present time?

A At the present time, the field is developed on 80-acres per well.

Q Are there any exceptions to that?

A There are no exceptions to that, to the best of my knowledge. There are some wells located on a 40-acre spacing pattern, but in no way is there less than 80 acres allocated to that particular well.

Q Do you feel from the information you have available and from the experience you have had in the area, that the reservoir or field conditions warrant the drilling of wells to a density of less than 80 acres to be economically practical at this time?

A I do not.

Q If not economically practical, then why isn't it practical to go out to a greater density?

A At the present time we have no concept as to the per acre recovery per well, and until such time as the information is received, it would be ill-advised, in my opinion, to increase the well density in the Verde-Gallup Pool.

Q Are the wells which other operators have drilled in the field, are they more or less expensive than wells drilled to this

depth in other areas?

A For the average depth of approximately 2700 feet, these wells are quite expensive as shown by --

Q That will be Pubco Exhibit B.

A By our Exhibit No. B.

Q What does Exhibit B show, Mr. Gorham?

A This particular Exhibit B shows cost analyses of six wells drilled and completed by Pubco Petroleum Corporation in Section 18 of Township 31 North, Range 14 West, which I would like to point out is a relatively northern section and is at a considerably shallower depth than the wells which we have drilled in Section 19 directly to the south. In this particular Exhibit, the six wells involved have an average depth of 2500 feet, and have been completed for an average cost of $44,100 per well.

Q And if these wells were drilled to the north in a relatively flat or level area, then the wells drilled further down dip would have, they would be more expensive, would they not?

A That is correct. As you go further south from these wells, the dip rate requires deeper drilling, and with the high dip rate, the problems of drilling itself become much more difficult.

Q Then from both an economic and from a reservoir valuation point of view, you deem that 80-acre spacing in this pool is proper for the present time?

A Yes, I do.

Q And, in your opinion, based upon your study of reservoirs and field conditions, will 80-acre spacing in the Gallup Pool prevent waste and protect correlative rights?

A In my opinion, 80-acre spacing in it will prevent waste and protect correlative rights.

Q Mr. Gorham, do you have any special rules for the development and operation of the Verde-Gallup Pool which you would care to introduce before the Commission at this time?

A Yes, I do. RECOMMENDATIONS OF PUBCO PETROLEUM CORPORATION FOR SPECIAL RULES AND REGULATIONS FOR THE VERDE-GALLUP OIL POOL

RULE 1. Any well projected to or completed in the Gallup Formation within said pool or within one mile of the boundaries thereof shall be spaced, drilled, operated and prorated in accordance with the Special Rules and Regulations hereinafter set forth.

RULE 2. All wells projected to or completed in the Gallup Formation within the Verde-Gallup Oil Pool shall be located on 80-acre proration units comprising two adjacent governmental quarter-quarter sections within a single governmental quarter section, which unit shall run either North and South or East and West, and that wells projected to or completed in said formation in such proration units shall be located on diagonal quarter-quarter sections within a governmental quarter section.

RULE 3. All wells projected to or completed in the Verde-Gallup Oil Pool shall be located within one hundred feet of the center of either quarter-quarter section in the 80-acre unit; pro-

vided, however, that nothing contained herein shall be construed as prohibiting the drilling of a well on each of the quarter-quarter sections in an 80-acre unit.

RULE 4. The Secretary-Director of the Commission may grant exceptions to the requirements of Rule 2 and, for topographical reasons only, to the requirements of Rule 3 above without notice and hearing where the application is filed in due form, provided the applicants furnish all operators within a 2640-foot radius of the subject well a copy of the application to the Commission, and provided further that the Secretary-Director of the Commission shall wait at least twenty days before approving any such application and that no such application shall be approved over the objection of an offset operator. In the event an offset operator objects to the application, the Commission shall consider the matter only after proper notice and hearing. The applicant shall include with his application a list of names and addresses of all the operators within the radius set forth above together with a stipulation that proper notice of the application has been given said operators.

RULE 5. An 80-acre proration unit in the Verde-Gallup Oil Pool shall be assigned an 80-acre proportional factor of two (2) for allowable purposes, and in the event there is more than one well on an 80-acre proration unit, the operator may produce the allowable assigned to the unit from said wells in any proportion.

In summary, I might say that our suggested rules could perhaps be reset as follows:

RULE NO. 1 merely outlines the area and the formation affected.

RULE NO. 2. We are suggesting that an operator make his first location within a quarter section and the second well as a diagonal to the location of the first well which will provide maximum flexibility consistent with ordinary 80-acre development. RULE NO.3, the location within the governmental quarter-quarter section an option to drill to a 40-acre density. RULE NO. 4 states the method by which exceptions can be granted to Rules 2 and 3. We wish to state, however, that in the case of exceptions to Rules 2 and 3 for topographical reasons we have no objection to a provision whereunder the twenty-day waiting period would be waived if all offset operators approved the exception. RULE NO. 5 pertains to the allowable to be assigned to the unit.

Q Mr. Gorham, were Exhibits C, D, E and F prepared by you and under your supervision?

A Yes, they were.

MR. WEBB: That's all the questions I have. I would like to turn into evidence Exhibits A through G.

MR. PORTER: Without objection, the Exhibits will be admitted.

Does anyone have any questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Gorham, on your Exhibit No. D up here, you mentioned potential for several of those wells, but I don't think you gave

any potential for the last three. What were the potentials on those wells?

A The potential for Well No. 4 was 95 barrels of oil per day, No. 5, 88 barrels of oil per day, and No. 6, 119 barrels of oil per day.

Q Thank you. These wells were productive, then, dispite the fact that they showed very little production in SP or resistivity curves?

A Yes, and I have testified the reason they were productive was because of the presence of the fracture system in that particular zone.

Q Mr. Gorham, now, on Exhibit No. C there, what are the contour intervals of that contour map?

A The contour intervals shown on Exhibit C are one hundred foot contours above sea level. The southeasternmost contour is 1500, indicating 1500 feet above sea level. The furthermost northwestern contour actually is plus 4100 feet above sea level.

Q So the uppermost line extending clear across the Exhibit would be 4,000 feet?

A That is correct.

Q Now, where would 2700 feet from the surface appear, approximately, there?

A Well, actually, --

Q I think you stated the average well was 2700 feet deep. I was wondering where the average well on that map would be.

A I would have to point to it. I can't specifically point to a particular well, but the average depth, I believe to be somewhat near the center of the field. Now, topographic difference will change that. In other words, if a well starts off in a low area, the actual footage would be less, but the general topography of the area is a large series of hogbacks which affords very difficult terrain in the northwestern portion, and further to the southeast there is the Louis Valley, and that is not too difficult.

Q What is the actual variation in the depth of the producing wells from the surface?

A I believe the variation extends from a shallow approximately 2500 feet to, I believe, to a depth of over 3700 feet.

Q Some of the wells are producing from 3700 feet?

A That is my understanding.

Q Mr. Gorham, on your tabulation of well costs for six wells in Section 18, I notice $5100 expended for formation stipulation. What is that stipulation that is required?

A That formation stipulation is sand-oil fracture, which includes approximately one thousand barrels of crude oil, a pound of sand per gallon of oil, and which includes, of course, the cost of Halliburton pumping units, etc.

Q Is the fracturing in this formation sufficient, the natural fracturing, that is, to cause the wells to produce without this artificial stipulation?

A In certain areas and in certain cases, wells have been drilled to the fracturing producing zones and have obtained from it flow of fluids which did not require fracturing. However, at least 50 percent of the wells in the Verde-Gallup Pool do so, but apparently the six inch well bore in this well was drilled slightly off of a particular fracture system and has been and is necessary to artifically fracture the well into the existing major fracture system.

Q This well that you cored had not been fractured at the time it was cemented, had it?

A No, it had not.

Q And the cement penetrated the fracture and was encountered 27 feet below the casing shoe?

A That is correct.

Q Do you have any idea how far the fracturing effect of your $5100 fracturing job extends from the well bore?

A No, we don't. However, all of the wells behave slightly different from each other. In a large number of cases, on our particular property, we have attempted to drill in with oil and have not been able to get circulation and have lost oil within the formation. So, therefore, a frac treatment,as such,would be of relatively negligible value in certain other cases. However, we have had no fluid entry whatsoever and it was necessary to break the formation down before the formation took the fracture fluid.

Q Now, Mr. Gorham, your total well cost here is $44,100.

That includes a certain amount of tangible equipment that could be salvaged after the depletion of the well, doesn't it?

A That is correct.

Q What could be salvaged there in that tangible equipment?

A Well, I believe that a certain portion of the casing could perhaps be salvaged, probably the tubing, the well head and, for the most part, the actual surface equipment.

Q What does that surface equipment include, pump unit and motor?

A Pump unit and a location to tank batteries.

Q So you have some eleven thousand dollars of that forty-four thousand dollars that could be salvaged?

A I believe that to be correct, yes, sir.

Q Mr. Gorham, did you say that you had not made any study of this pool to determine what the reserves in the pool were?

A No, I did not say that. Actually, I have done quite a bit to try and determine the reserves in the pool as far as the reserves materially pertain to this type of a reservoir, but apparently, it is impossible to estimate reserves on a volumetric basis on a fractured reservoir, which this particular field is.

Q Do you have any opinion as to what the reserves in this pool are per acre?

A No, I do not, sir.

Q Is there a pipeline in this area?

A Yes, there is. There is a gathering line which El Paso Products Company has within the field, which takes the oil from the Verde-Gallup Pool southwest to the Four Corners pipeline.

Q Was a study made of the reserves in the area prior to the time that pipeline was constructed in the area?

A Yes. As I understand it, there were some estimates made as to the possible reserves. However, in order to protect their equality, the El Paso Products Company found it necessary to charge each operator for its tie-in cost on a premature basis in the event that their reserves estimate was inaccurate.

Q Do you know what the reserve estimate was in that study prior to construction of the pipeline?

A No, I do not, sir.

Q Mr. Gorham, why have you chosen in your proposed Rule No. 5, that an 80-acre proration unit receive the proportional factor of two?

A Well, it was my understanding that on the basis of the Bisti hearing, that this particular method of prorationing units, of two for 80-acre spacing, was adopted by the Commission, and it is our attempt to follow in every way possible therules governing the Bisti Field.

Q Do you think the well drilling costs and equipment costs in this pool are comparable with the well costs in the Bisti Pool?

A I think the costs are slightly less than what are en-

countered in the Bisti Pool. However, on cost per foot basis, I think they are equally as high, if not higher. In our particular case, we have absolutely no concept, in my opinion, of the ultimate results, and until such time we can get reservoir information from production, I think it would be inadvisable to go to 80-acre spacing.

Q I realize that the wells have been producing at a rather sizeable rate for only a short time, but has there been any indication so far that they will not be able to sustain that rate for a considerable period of time?

A Well, that has been the primary problem. I can't give you a direct answer on that, I don't believe, for some period of time. We've been selling as little as 5,710 barrels of oil per day, depending upon the local market. It has only been recent that we have been able to sell, last month and this month, at a rate which would provide us with the information which you are seeking. We will, however, show some tests based on even this short a period, indications of the reserves at a later time.

MR. NUTTER: That is all.

MR. PORTER: Anyone else have a question? Does anyone wish to question the witness? Mr. Cooley has indicated he has a question, but he is not quite ready.

MR. UTZ: I have one or two questions.

QUESTIONS BY MR. UTZ:

Q Mr. Gorham, in your opinion, is the horizontal communication through this fracture system continuous throughout the produc-

ing area?

A To the best of my information, that is apparently so.

Q To your knowledge, have you ever drilled wells in this area, through the producing horizon, that have not been fractured?

A Would you repeat the question, please?

Q Do you know, of your own knowledge, any wells that have been drilled in this pool that have not encountered the fractured section?

A I find that rather difficult to answer on the basis that only very few wells have actually been cored which would actually show the presence or absence of fracturing. However, what wells that have been cored, have shown this intensive fracture system. As a matter of fact, most wells in drilling through have lost circulation. However, there are some that have not, and in my opinion, it would be in a very local situation adjacent to the actual main fracture system.

Q The fact that about 50 percent of these wells have to be fractured, would that indicate to you that that section would not be fractured?

A No, I don't believe so, on the basis that the actual sand fracturing itself is really not comparable to most sand fracture jobs in other areas in that at no time have we encountered in our sand fracturing, any high breakdown pressures. In fact, they have been unnoticed in most parts, and we feel that in our sand fracturing, that what we are actually doing is perhaps propping up or

opening up the existing standing fractures with the sand contained in our fracture system.

Q Do you know at what pressure this formation breaks down on fracturing?

A About eight hundred pounds.

Q That is pretty low, isn't it?

A Yes, it is.

Q Is it possible to measure permeability in the fractured reservoir?

A I don't believe it is. It perhaps is. I would say it had unlimited permeability.

Q Even one small fracture has an extremely high permeability?

A I would say so, yes, sir.

Q On your Exhibit B, under surface equipment, how many wells, on your $44,000 allotted for tankage, how many wells do you plan to commingle into one tank battery?

A I am not quite certain as to the answer to that question. However, I feel or believe that one of the wells had an individual tank battery, our 18-1 well, and I believe that the remaining wells that come under the average cost either had two common tank batteries. I am sure they had two additional common tank batteries. Now, the actual batteries themselves, as far as costs are concerned, still have required the amount of tankage as if they were actually located on the individual well, but because of centralization, we have seen fit to make a common tank battery in Section 18.

Q The more wells you mix into a tank battery, the lower the cost of the individual well?

A That would be true providing sufficient storage were available.

MR. UTZ: That's all I have.

QUESTIONS BY MR. COOLEY:

Q Mr. Gorham, to continue this a little bit, with the line of questioning that Mr. Utz was pursuing here concerning the natural fracturing in this reservoir, I didn't quite understand your answer as to why it was necessary to artifically fracture if these fractures continue throughout the pool and would permit drainage over wide areas.

A Well, the fracturing system itself, although it continues throughout the Verde-Gallup Pool, within the system there are zones of less dense fractures per foot, and in my opinion, in certain areas at least, it is conceivable that you could drill a six-inch hole and encounter no fractures, although actually located within the heart of the overall fracture system, and in certain cases, where that has happened to a degree, it has been necessary to break down the nonfractured shale apparently for a very short distance because of the low breakdown pressure and support the fractures with sand to keep them open and produce the oil therein.

Q Isn't it possible by virtue of the same logic, to assume that there could be a considerable amount of oil that could be isolated, contained within the fracture system, but due to the fact

it is not continuous throughout, it could be completely isolated?

A That is possible. However, I see no evidence at this particular time. In this stage of development, it would appear that, based upon the pressures which we have measured on our two sections and pressure information we've observed from others, that the fracture system, as being currently drained by the existing wells, is of a common reservoir.

Q Apparently, your information wouldn't reveal the presence of isolated oil, would it?

A I don't know whether it specifically would or would not. However, I think it certainly would be a great indication that there is a different system, if we had a different pressure gradient within that particular isolated fracture system which you point out could exist.

Q Well, being deposited the same depth and in the same reservoir, you'd expect to find the same pressure substantially, wouldn't you?

A Well, the depths actually are quite different throughout the entire field.

Q I believe you testified that, in your opinion, one well would efficiently and economically drain 80 acres, did you not?

A Yes, I did.

Q Can you give me what information you have available to substantiate this opinion?

A Well, the data that I have, I believe, has been testified

to earlier to the extent that the reservoir is a common reservoir. It is a reservoir which consists of the fractures which are apparently in full communication and that, therefore, in actuality, it is quite conceivable that the vertical pool could be drained on much larger spacing. I do believe, however, that in view of the possibility that you indicated, that a density of one well per 80 acres would very adequately drain the reservoir.

Q You haven't conducted anything in the nature of pressure interference tests?

A Yes, we have. That will be brought out by another witness.

Q I believe you answered this question, but does the inability to take pressure production decline curves in this well indicate a short producing life?

A That is correct. We need more production history in order to determine the characteristics of reservoirs.

Q That will be practically the only reliable means of determining the oil in place in this pool?

A In my opinion, that is correct.

Q Do you have an opinion as to where this oil came from, whether it was laid down or migrated in?

A Well, in my opinion, the source for the oil in the Verde-Gallup Field is the Mancos Shale, or upper Gallup shale siltstone sequence itself, and the reservoir as such, the fracture system located on a monocline. Now, as far as migration, I have no con-

cept at the present time as to whether or not the migration occurred from the southeast to the northwest or as to whether or not the oil may actually be in toto.

Q If it were the latter, it would indicate that there would be some oil in the Mancos Shale itself?

A I am certain. As a matter of fact, there is no well which -- I believe that it can be safely said that most wells, at least the ones that have cored the Mancos Shale, have shown high residual oils, relatively high porosity, and no permeability throughout the entire basin.

Q And is it your opinion -- I believe I assumed this from your testimony -- is it your opinion that even though there is a high residual oil in this shale itself rather than the fracture, the major portion of production will come from the fractures themselves due to the extremely low permeability of the shale?

A That is correct.

Q Do you get any significant contribution from the shale itself to recharge, so to speak, the fractures?

A I think it is possible, but based on what we have seen in the way of core analyses, it is highly improbable. I personally feel that we will need to see permeability within the silt zones or shale itself in excess of three milladarceys, and I haven't seen that as yet.

Q You don't feel you can get any significance out of shale unless the permeability is three milladarceys?

A Well, that specific figure is not necessarily the rule, but I feel it should approach that range.

Q Have you formulated an opinion as to what the reservoir drive is in this pool?

A No, I have not as yet, on the basis that we have again had insufficient producing history in order to determine that. I would suspect, however, at this time, that the reservoir drive would be in part dissolved gas, and perhaps gravity drainage has a large part to play in this particular pool.

Q You haven't found the presence of water in that zone?

A We have not encountered water in the producing horizon. We have had some water difficulties, however, which were found to be problems in regard to isolating the water bearing point, like out from the producing zone.

MR. COOLEY: That is all.

MR. MORGAN: I will ask you a question. You say there is gravity participation there. Would that mean that the wells in the lower part of the dip would eventually produce the oil, that the oil would eventually drain away from the higher portion of horizon?

A I don't believe that you could necessarily say that the lower wells would drain away from the upper wells, but I believe that the upper wells would produce their oil and perhaps become dry wells before the lower wells would exhaust their particular reservoir. If that happened, there is no gravity drainage away

from those upper wells.

Q Why would that happen?

A Well, the gravity drainage itself would merely represent the increased pressure which we would find in the lower dip wells, and for that matter, we have really not ascertained the northwestern limits of the field; the northeastern limit or the southwestern. I interject gravity drainage merely as a possibility, based upon the very steep dip which occurs across the field itself, and as I understand it, when we have high dip rates comparable to this field. We have had it in other areas, gravity drainage has played a particular part in well performance.

Q With a certain amount of oil in place, and say a uniformity in thickness, these wells completed in shallower formation would probably be depleted before the ones in the upper formation? Would you say in that event, then, that the wells in the lower area would get more oil than the ones in the upper area because they would produce for a longer period of time?

A Well, that is a distinct possibility. However, I am not familiar enough with the mechanics of gravity drainage to give you a real answer on that.

MR. MORGAN: That is all.

MR. COOLEY: Mr. Gorham, have you found any indication at all in your examination of this field as to whether there is existence of a gas cap in that area?

A To the best of my information there is no known free gas

in the field at all at the present time.

MR. COOLEY: That's all the questions I have.

QUESTIONS BY MR. NUTTER:

Q Mr. Gorham, is there any current development going on in this pool?

A Yes, there is. On Exhibit C we have shown current development by circles indicating well locations which have not been filled in. I can give you the specific locations. There is considerable development located -- wells, drilling, or locations made in Section 17, Section 20, Section 30 of Township 31 North, Range 14 West. There is development drilling taking place at the present time in Township 31 North, Range 15 West in Section 24, and there is also considerable development drilling occurring in the southwestern portion of the field in Township 30 North, Range 15 West.

Q In other words, except for infill drilling right in the center of the pool, most of the current development is either in the east end to extend the pool to the east, or on the southwestern to extend the pool in that direction, is that correct?

A There are some inside well locations. Here is an example, in the southeast of the southeast of the Section 29 of Township 31 North, Range 15 West, and there are several other locations. I would consider all of these locations, which I pointed out earlier in Section 24, as primarily being inside locations, and, of course, Pubco Petroleum has completely developed its inside location on an 80-acre space.

Q Is there any indication that the pool has reached its productive limits to the east and west?

A There is no indication, in my opinion, that the field has been delineated at the present time.

Q What happens when you go northeast up the structure, Mr. Gorham?

A It is my understanding, and from what studying I have done in this particular field, that in the northwestern area the wells are slightly smaller and the bottom hole pressure is less than what is found in the southeastern area. I would say that you might consider this a relatively light producing area as compared to some other areas in the field.

Q The actual productive limits have not been defined for the northwest?

A That is correct.

Q How about to the southeast, Mr. Gorham?

A Again, there are no limits to the southeast of the pool as yet.

Q Has any water-oil contact been encountered by drilling wells down deep?

A None, to the best of my knowledge.

Q Mr. Gorham, is not a characteristic of the wells in reservoirs of this type, which produce from a highly fractured formation, to produce at relatively high rates throughout their life and then suddenly drop off to almost nothing?

A I don't believe so. I'm sure there are cases of that type. However, within the Rocky Mountain area, one example would be the Florence Canon City Pool which, as I understand it, was the first field discovered in the Rocky Mountains, and its flush period of production occurred in about a twenty-year period and some of those wells are producing today. However, a large portion of them have since been abandoned.

Q Have they declined at a gradual rate as would be encountered in a normal sand or other field?

A They have had a decline, but the records for the fractured reservoirs are totally inadequate, the field being discovered in the very early 1900's or, as a matter of fact, I think it was 1895. I can't quote the exact date, but the records are very inadequate as to what those wells produced, and in a lot of instances, it is difficult to ascertain their exact locations, but the fact does remain that a certain number of wells are still producing today from that field in very small quantities.

MR. NUTTER: Thank you.

QUESTIONS BY MR. UTZ:

Q Do you have pressure information on the pool available to you or will you take that up with another witness?

A That will be the next witness.

MR. PORTER: Anyone else have a question?

MR. WEBB: Just one question.

REDIRECT EXAMINATION

BY MR. WEBB:

Q Mr. Gorham, isn't the impact of this testimony at the present time the fact that the pool has been developed such a short period of time and insufficient production history has been obtained, that you don't have all the information necessary to form a lot of opinions that you might like to have, and that you are asking for this temporary order so that the pool can be developed on an ordinary basis until that information is available?

A Yes, that is correct. I believe, until such time that we can obtain sufficient producing history which will aid us in establishing the probabilities as to reserves, that the field should be developed on an 80-acre basis.

RECROSS EXAMINATION

BY MR. GRENIER:

Q How long would you anticipate, assuming present rates of production, it would take you to have that data available, Mr. Gorham?

A In my opinion, we should have probably at least sufficient information for that purpose within one year's time.

Q So that you would be suggesting a temporary order of one year's duration?

A That is correct.

MR. PORTER: Anyone else have a question?

MR. MORGAN: Would a suspended order for 40-acre spacing rather than a temporary order for 80-acres, would that serve the

same purpose?

A I don't believe it would, sir. I don't quite understand what the implication would be one way or the other. We would like to be in the position that, until such time that the reservoir is better understood, that we would prefer not to have people drill on 40 acres except within the 80-acre proration unit.

MR. WEBB: Mr. Gorham, the primary reason you don't want a suspended 40-acre order is that wells can't be undrilled after they are drilled?

A That is correct.

MR. MORGAN: I have one more question I would like to ask. Is capillary force as strong as the gravity force might be in oil migration in a structure of this type?

A I don't believe it is.

MR. PORTER: Any further questions? The witness may be excused.

(Witness excused)

MR. WEBB: I would like to call Mr. Norman Maxwell.

NORMAN E. MAXWELL, JR.,

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

DIRECT EXAMINATION

BY MR. WEBB:

Q Will you state your name, please, sir?

A Norman E. Maxwell, Jr.

Q By whom are you employed?

A Pubco Petroleum Corporation.

Q And in what capacity?

A Petroleum engineer.

Q Would you state briefly your educational background and experience in the oil business?

A I graduated from the Colorado School of Mines in 1941 with a degree in petroleum engineering. Served for Uncle Sam from '41 to '45 in the Seabee I Theater, principally on construction work. I was employed by the California Company in 1945 upon my discharge from the Army in Rangely, Colorado. I was moved from Rangely in 1945 to Edgerton, Wyoming, still with the California Company, and then moved to Lake St. John, Louisiana, served a year there and then to Brookhaven, Mississippi and served a year there before joining Pubco in 1952. Since 1952 I have been employed by Pubco in their Aztec district office, and I am supervising the drilling and completion of a large percent of Pubco's operations both in the San Juan Basin and other areas that Pubco operates.

Q In what capacity were you employed by the California Company?

A Petroleum engineer.

MR. WEBB: Are the witness' qualifications acceptable?

MR. PORTER: Yes, sir.

Q Mr. Maxwell, directing your attention to Exhibit C and specifically to Section 19 in Township 31 North, Range 14 West,

would you go to that Exhibit and point out to the Commission the wells which are circled in green and red, identifying them by name and location?

A In Section 19 of 31 North, 14 West, we ran an interference test with six wells being involved: Our Mountain Ute 19-1 in the northeast of the northeast quarter of the section; Mountain Ute 19-7 in the southwest of the northeast quarter; Mountain Ute 19-3 in the northeast of the northwest quarter; Mountain Ute 19-5 in the southwest of the northwest quarter;; Mountain Ute 19-11 in the northeast of the southwest quarter; Mountain Ute 19-9 in the northeast of the southeast quarter.

Q I believe you stated that you have recently conducted interference tests involving these wells, is that correct?

A That is correct.

Q On what dates were the wells initially shut in, in conducting these tests?

A These six wells were shut in during the first week of March of 1958. The production for March had been made, and they were all shut in during the first seven days of March.

Q How long did the wells remain shut?

A They remained shut in until April 24th of 1958.

Q Were all the wells turned on at that time?

A All the wells with the exception of 19-7 in the center of the five spot were put on production on April 24.

Q And that well remained shut in, is that correct?

A That is correct.

Q How long did you keep the 19-7 well shut in after the others had been producing?

A Well, the 19-7 was kept shut in for a forty-eight hour period while the other wells were produced.

Q How much oil was produced from those other five wells while the one well remained --

A 1646 barrels.

Q And what observation did you make of the 19-7 well during that forty-eight hour period?

A At the beginning of the test, before the wells were turned on, a fluid level pressure was taken showing 636 pounds at the top of the sea datum, which is shown on Exhibit E at the bottom line. 636 pounds was the shut-in pressure on 19-7. After twenty-four hours, the pressure -- after twenty-four hours of production by the surrounding wells, the pressure dropped to 632 pounds, and after forty-eight hours with 1446 barrels of oil produced, the pressure dropped to 626 pounds, a pressure drop of 10 pounds; 1446 barrels of oil produced.

Q We realize that, as interference tests go, forty-eight hours is not too long a period. What was the reason you couldn't prolong the test, in other words, keep that 19-7 well shut in?

A It was necessary to shut the well in to make its production for the month of April and also we were limited by storage in our tank battery for other wells.

Q In your opinion, does the ten-pound pressure drop shown during this forty-eight hour period, which was the ultimate result of this interference test, even though the same was conducted over such a short period of time, does that show a communication between wells drilled on 80-acre spacing in the Verde-Gallup reservoir, at least between those six wells?

A In my opinion, ten-pound pressure drop over such a short period of time and small volume of fluid removed definitely shows communication in 80-acre spacing, and it would be unwise at this time, I believe, to -- I certainly wouldn't advocate to my company to drill on 40-acre spacing with the little knowledge we have of the reservoir at this time.

Q In your opinion, will one well efficiently and economically drain 80 acres in the Verde-Gallup reservoir?

A In my opinion, one well will efficiently and economically drain 80 acres in the Verde-Gallup reservoir.

Q Now, Mr. Maxwell, directing your attention to the reserves which may or may not be in this reservoir, you are familiar specifically with all the Pubco Wells and generally with all the other wells located in the area, are you not?

A That is right.

Q As a petroleum engineer, do you have information available based upon your knowledge of these wells to adequately evaluate the Verde-Gallup reservoir from a reserve standpoint on either a decline curve basis or as a result of material balance calcula-

tions?

A I do not, sir.

Q Mr. Maxwell, has there recently been formed an engineering committee, subcommittee of the operators of the Verde-Gallup Pool to study and make recommendations to the New Mexico Oil & Gas Engineering Committee concerning this pool?

A That is right, sir.

Q Are you not chairman of that subcommittee?

A Unfortunately, yes.

Q Has the subcommittee commenced work, that is, have they started a study of --

A A meeting was held of the subcommittee last Friday, during which time we elected officers. We are working under the New Mexico Oil & Gas Engineering Committee -- under their auspices, and we set forth a tentative program to compile fluid level and pressure data, DOR data. We will study data, outline interference projects, study completion practices, study paraffin and remedial pressures, and exchange information on straight hole drilling techniques, as well as to investigate the reservoir conditions with a view to secondary recovery methods to increase recoverable reserves.

Q Do you feel that after the subcommittee has had an opportunity to function for another -- at least one year, more adequate comprehensive and reliable information will be available on the reservoir characteristics and producing capabilities of the Verde-Gallup Pool to more properly and soundly evaluate that reser-

voir?

A That is the purpose of the committee, sir.

Q Do you recommend the adoption of the Special Rules as promulgated by Mr. Gorham and submitted as Exhibit G?

A I do.

MR. WEBB: That is all.

MR. PORTER: Any questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q I didn't get your name, sir.

A Norman Maxwell.

Q Mr. Maxwell, why, in your opinion, is it necessary to fracture the wells in this pool to artifically stimulate them?

A We have drilled most of our wells in with cable tools that we have set on top, as Mr. Gorham testified, and we have drilled in with cable tools, which method we felt would give us a relative DST of the zone, and when we started in our drilling operation, it was semi-wild cat. We certainly didn't have any preference production, and we wanted to evaluate the zones as best we could, so we used cable tools. From the cable tool operation, out of sixteen wells we have completed, only four showed any natural oil in the well bore at all at TD.

Q This would indicate the lack of fracturing, then, wouldn't it, the lack of natural fracturing?

A I don't know what the cable tools do to a well bore, but

I do know that from actual observation of frac operations in the field, that you do not have a breakdown like you do in the Picture-Cliffs or the Mesa Verde or in other formations in the field. The pressure will start off at 800 pounds, and the frac will go in at 800 pounds. There is no breakdown, so I can't see that the fractures are closed. They may be sealed off by cable tool drilling methods, but --

Q Have any wells been completed in this pool with rotary tools?

A Yes, there have.

Q Have they encountered the same problem when they complete the wells with rotary tools?

A The rotary tools have lost circulation, and those that have tried to drill with water base mud have circulation problems too.

Q And with cable tools, they don't?

A No, I wouldn't say that. The wells that have been drilled in by oil have lost circulation, and in many instances drilling has had to cease because they just couldn't keep enough oil on location.

Q Well, is it conceivable that a well may miss these fractures by a matter of a few inches but then the fractures pick up and extend several hundred feet, as necessary, between 80-acre locations?

A I think this Exhibit is fairly conclusive. If that cement went down under the well bore, we would have had a slab like

this all the way throughout the center of our core. However, we did not encounter any cement until we were 57 feet below the casing shoe. I believe we fraced adequately by drilling and coring with oil. It was not necessary to refrac it upon completion.

Q Now, Mr. Maxwell, if you had an open fracture extending from one well to the other, there would be a noticeable pressure decline in the well that is shut in when the first well is produced, would there not? Is it possible that --

A Yes, sir.

Q -- on your 19-7 well interference test that there was a fracture between one of the producing wells and the shut-in well and that the pressure decline resulted from that one well rather than the production from all six?

A That is possible, sir, but we have other data which are not on the Exhibits, which show a remarkable similar bottom hole pressure when related to sea level. You relate your pressure throughout the two sections -- of which I have knowledge -- sections 18 and 19, of 31, 14, and the pressure related to the common level datum is very close on all wells.

Q Do you agree with Mr. Gorham's testimony that the permeability of the shale itself is practically nill?

A That is so indicated by the core analysis. However, you may have some capillary activity there.

MR. NUTTER: I believe that's all. Thank you.

QUESTIONS BY MR. ARNOLD:

Q Mr. Maxwell, in view of the fact that you found cement 57 feet below the shoe, I am wondering if you had any behind the pipe.

A Well, Mr. Arnold, we had a Bradenhead squeeze on this well.

Q I believe you have had a little difficulty -- I thought you were having difficulty with getting the water shut off?

A That is right, sir.

Q I wondered if you had any recommendations to make as to special cementing programs?

A I thought the U.S.G.S. had taken care of that.

Q I believe it is also probably the responsibility of the Commission?

A Well, this well was completed prior to the time that all that came up.

Q You wouldn't recommend any particular requirements so far as cementing to be written into the pool Rules?

A I believe the recommendation that was given to the U. S. G. S. of covering off what we call the A zone, which is the top line of the correlative formations that is below the point lookout, we feel the water is coming from the point lookout, and I believe by covering that A zone you should be above all fractures and should keep that point lookout water from getting down into the pay zone.

Q How would you accomplish that, by running a temperature survey?

A Our own method is to use the D V tools set at that specific place so that we can put cement where we want to, but we wouldn't force all operators to use a D V tool. In some areas they don't have the bad loss circulation that is in our area. If they can get cement in their preliminary job above the A zone and have proof on that with a temperature survey, that would be fine with us.

Q You recommend that procedure be required?

A I believe so, yes, sir.

MR. ARNOLD: That's all.

QUESTIONS BY MR. STAMETS:

Q Mr. Maxwell, would you liken the fracture system in this reservoir to, say a major stream and its tributaries with, oh, say, many major fractures connected by minor fractures connected to more minor fractures and so on?

A I believe you could use that similarity.

Q In other words, you can drill a well into the main stream or you can drill it into a tributary?

A That is right, sir.

MR. STAMETS: That's all.

MR. PORTER: Does anyone else have a question?

QUESTIONS BY MR. UTZ:

Q Mr. Maxwell, do you have any pressure buildup information on this pool?

A Pressure buildup?

Q Do you have a well that has been produced for a certain length of time and the pressure checked regularly?

A Yes. I have information on two where we took a twenty-four hour, thirty-six hour and seven-day -- beg your pardon, twenty-four hour, seventy-two hour and seven-day buildup.

Q Do you have those pressures available?

A Yes, sir.

Q What wells are they on?

A We have one set on Mountain Ute 18-5 located in the southwest of the northwest of Section 18, 31, 14.

Q What was your pressure on the shutin?

A The twenty-four hour shutin pressure was 192 pounds.

Q Did you have a pressure when you shut it in?

A Prior pump pressure. I do not have a pumping pressure on that well for that specific period, but after twenty-four hours, it was 192 pounds.

Q Okay. What was it at seventy-two hours?

A Seventy-two hours was 406 pounds, and on this particular well, seven-day pressure was 461 pounds.

Q Do you consider that a relatively rapid buildup?

A I believe it will take at least three days to get anywheres near a true reservoir shut-in pressure, and then if other wells are producing with interference such as has been exhibited, it looks like all wells will have to be shutin to get a true shut-in pressure.

Q Do you think the buildup on this well was slowed down by offset producing wells?

A No, I don't believe it was. This is a mediocre well, it is not one of our best wells.

Q What was the IP on the well?

A I believe the pump IP was in the neighborhood of 181 barrels.

Q Did you ever get a stabilized pressure on this well?

A I believe some of the data we have is stabilized. We have shut-in pressures of up to 93 days.

Q Would you continue to build up to 93 days?

A No, they didn't.

Q How long does it take them to stabilize?

A We didn't take intermediate pressures all along that period.

Q That is what I was interested in, knowing if you had any information that would indicate how fast these wells build up.

A This curve that I have described to you, and several others that aren't of as long duration, is all the information I have at this time. We are currently conducting similar tests, one-day, three-day and seven-day shut-in on all of the wells that we are able to shut-in and still make our production.

Q Based on what information you have available, how long do you say it would take to stabilize the well?

A I believe after seven days that you'll be within 95 per-

cent of stabilized pressure. That will be dependent upon the production rates of offset wells. After seven days you may have a decline, or even after two days you will have a decline caused by production from offset wells.

Q On your interference tests -- let's see, which well was it you shut in?

A 19-7.

Q 19-7?

A Yes, sir.

Q You had the offset wells producing at the end of the interference test, you did not shut-in the offset wells, you just turned on the 19-7?

A That's right, sir.

Q Do you think it would have been good information to have shut-in the offset wells to determine the 19-7?

A Yes, I do. I regret that we were not able to do that, but as I stated, we were attempting to get our April allowable out in the last five days of the month and we were unable to do it, but we will incorporate it in our future studies.

Q Do you think that a seven-day shut-in stabilization in seven days in a reservoir of this type is indicative of high permeability?

A Well, it wouldn't appear to be that, sir.

Q Were these pressures bottom hole pressures?

A No, they were fluid pressure levels.

Q Were they bombed?

A Done with acoustic well sounder.

Q Do you know of your own knowledge what the variation within this pool is of your fluid level pressures?

A Not over the entire pool. We do have knowledge of our two sections.

Q You don't know whether the pressures vary considerably or not?

A On our sections, they vary from 452 at the north end of Section 18, down to 825 on the south end of Section 19.

Q What do you attribute that differential in pressure to?

A That is due to the slope of the formation, the C zone, due to depth, difference in depth.

Q Entirely due to depth?

A That is right.

MR. UTZ: I think that's all.

QUESTIONS BY MR. NUTTER:

Q Mr. Maxwell, why have you continued to develop your property until it has been completely developed on 80-acre density when this is such a unique reservoir, and you don't have any information at hand? Do you think the wells will pay out?

A I don't know, sir.

Q You have nearly developed the Pubco area, have you not?

A Our neck is stuck out.

Q How much oil has been produced from some of the older and better wells in this pool to date?

A Well, the total production from the 16 Pubco Well has

amounted to about 71,000 barrels over a thirteen months' period.

Q Are these among the older wells in the pool?

A Well, our first completion was in March of 1957.

Q Which well in the pool has produced the maximum amount of oil of any well, do you know?

A No, I don't, not of my own knowledge. On our wells, our maximum producer is possibly 15,000 barrels.

Q That well has pretty nearly paid out to date, hasn't it?

A Close.

MR. NUTTER: That's all.

QUESTIONS BY MR. UTZ:

Q Mr. Maxwell, can you tell me about what the weight of the column of frac oil is in wells that you have fraced?

A Well, it would be .34 times the depth of the fluid. If it was 2,000 feet, why it would be around 650 pounds.

Q In other words, it is very little more pressure than the weight of the column of oil that you need to frac this well, isn't it?

A That is correct.

Q Fracing itself indicates high permeability, does it not?

A No restriction of permeability, certainly nothing that you have to break into.

Q Yet these wells will not stabilize in less than seven days. How do you account for that?

A Well now, as I explained, this well is sort of an average

well, it does pump off. It will pump off at about a hundred barrels a day, and the fluid level builds back up, and in Section 19 we have not been able to pump any of those wells off. We can't get any gas on the casing to run our pump unit motors with, and those wells probably don't pull the fluid level down over a hundred feet, so I would say within twenty-four hours they are stabilized. They just don't pull the fluid level down.

MR. UTZ: That's all.

MR. PORTER: Any further questions of this witness? You may be excused.

(Witness excused)

MR. WEBB: That concludes our case.

MR. PORTER: Who would like to be next with testimony?

WARREN L. MANKIN,

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

DIRECT EXAMINATION

BY MR. DAVIS:

Q Please state your name.

A Warren Mankin.

Q By whom are you employed, Mr. Mankin?

A Aztec Oil & Gas Company.

Q What position?

A Chief engineer.

Q You have testified before this Commission in previous

cases as a petroleum engineer and geologist?

A I have.

MR. DAVIS: Are the qualifications of this witness acceptable?

MR. PORTER: Yes.

Q Mr. Mankin, I would like to call your attention to Aztec Oil & Gas Company's Exhibit No. 1, and ask you to identify by color the holdings of Aztec in and in the vicinity of the present limits of Verde-Gallup Pool.

A I might say at the outset here, that this is a map primarily of ownership similar to the Exhibit C put on by Pubco. The only difference in the outline of the pool is that there are -- two more quarter sections have been added to this pool. That is on this nomenclature hearing that will be heard on this particular docket, and that is the only difference. The primary reason for putting this Exhibit up is to show that the ownership of Southern Union and Aztec in 80-acre units has been divided, and which wells have been drilled or are being drilled and the tops that are used. The yellow is Aztec's 100 percent rights on the acreage involved. The yellow with the crosshatch is Aztec's holding with 50 percent rights, and the green is Southern Union holdings in which Aztec has a portion, and the attempt there is to show that the wells have been drilled within the pool, or are being drilled. You might say at the present that Aztec is drilling two wells, drilling the Ute 1-D Well in the southeast quarter of Section 24, 31, 15, and drilling its 1-E

Well in the southwest quarter of the northwest quarter of Section 20, in 31 North, 14 West.

Q How many wells has Aztec drilled or participated in drilling?

A Aztec has participated in the drilling of 13 wells in this pool. Aztec drilled the first 8 wells and Southern Union drilled the last 5 wells, each being 50 percent interest.

Q Mr. Mankin, is there development in the various boundaries of the pool going on at this time other than our own drilling where you pointed out?

A Yes.

Q Will you just briefly state the area that development is occurring?

A Development is occurring on the southwestern portion of the pool in El Paso's and Pan American's acreage. That's the northwestern portion of Township 30 North, Range 15 West, and then all along to the northeast in that particular direction, and then there is development going on, in fill drilling, inside the pool and, of course, the drilling which I have mentioned going on in the east end of the pool.

Q Mr. Mankin, do you have any average cost figures of the wells that Aztec has drilled either on its own or in part ownership with Southern Union?

A Yes, I have made a study of that. I might, at the outset, say that Aztec completed wells early in the life of this pool

in Sections 10 and 15, along this vicinity here, of 31 North, 15 West. Those wells vary in depth from 1800 feet to, oh, in the neighborhood of 2400, 2500 feet. Those are some of the shallower wells in the pool as contrasted to the others. I believe Pubco indicated it was in the neighborhood of 2000. We have some in the neighborhood of 1800 feet in depth.

Q Do you agree with the deeper depth that Mr. Gorham testified to of some 3500 or 3700 feet?

A Yes, I agree with that. The wells down in the southeastern portion of the pool are at a much greater depth. The cost about which you asked me on the first 8 wells which Aztec drilled, the average cost was $40,850, which is at an average depth of 2000 feet.

Q Excuse me, Mr. Mankin. You say Aztec drilled?

A On behalf of Southern Union.

Q As operator?

A As operator. That particular well was drilled at a cost of approximately $20.00 per foot into the tank, including pumping equipment and tankage. One reason the cost is so heavy is that this is very rough terrain and as a result of that, individual tanks per well has to be installed. Southern Union drilled, in which Aztec participated, in Sections 23 and 24 of 31 North, 15 West and in Section 17 of 31, 14, 5 wells at an average cost of $53,500. Those depths averaged 2600 feet. Of course, they were some greater. Some of the wells, of course, were at 3000 but the

average was 2600 feet. Again, that is extremely rough terrain, possibly the most rough terrain in the entire field. There are some impossible locations, and as a result, locations costs average as much as $15,000 per well. So this was, again, at a cost of approximately $20.00 per foot into the tanks, including pumping equipment and tankage.

Q Mr. Mankin, before we leave Exhibit 1 there, you've indicated there in yellow the Aztec acreage, is that correct?

A Yes, sir.

Q Would you state how those quarter sections were divided? In other words, are they east west, east half and west half?

A Each quarter section was divided into east half and west half with Southern Union and Aztec taking alternate acre units.

Q Except for those 80-acre tracts that had been developed?

A Those had been developed on an 80-acre basis as shown by the crosshatch there.

Q When did this occur?

A I don't recall the particular date, it was sometime in the latter part of '57. You may say that these 13 wells, incidently, had an average cost of $47,500.

Q This division occurred prior to the filing of the application?

A Yes, sir.

Q How do the wells, the average cost of the wells that we have drilled in Verde-Gallup Pool, Mr. Mankin, compare with drilling

and development in the Bisti Pool?

A The drilling and development in this pool is about the same cost as those wells drilled in the Bisti Pool, which is almost twice as deep. Therefore, the cost in the Bisti Pool is approximately $10.00 per foot whereas in this pool it is $20.00 per foot.

Q What information has come to your attention concerning the reservoir conditions of the Verde-Gallup Pool to date?

A Well, I would agree to some extent with what Pubco has already related. Of course, we really don't know what reservoir conditions are as yet. It is still in a nebulous stage. There may be some solution gas drive. That seems to be improbable, and water drives seem to be the greatest possibility. There is gravity drainage.

Q Is Aztec a member of the subcommittee that Mr. Gorham mentioned in his testimony --

A Yes, sir.

Q -- that will be compiling data for this pool?

A Yes, sir. Aztec is participating in that study.

Q Mr. Mankin, do you have any opinion as to the fracture system that we have heard some testimony on today as to this pool?

A I believe that there is a considerable fracture system. I don't conceive of it being like a super highway that is opened from well to well. I conceive it similar to what Mr. Stamets made some comment about, a river system or highway system feeding into this thing, lateral type things of which there is no direct channel,

but which there is definitely good communication.

Q In other words, a network of fractures?

A In other words, a network of fractures.

Q Mr. Mankin, you heard Mr. Gorham read into the record as their Exhibit C the proposed Special Rules and Regulations that Pubco has for the Verde-Gallup Pool. Do you have any comments concerning those, or any suggestive changes in Aztec's opinion as to what the proper Special Rules for this pool should be?

A Well, again, I think, as I have mentioned before, that we need more time to determine just what the reservoir condition is, and certainly a year's time should give us a pretty good opinion as to what is happening here. Therefore, I would first agree with them that it should be of a temporary nature and should be on 80-acre spacing to let us determine exactly what this reservoir consists of.

Q For at least a year?

A Yes, sir. As to the particular rules which he suggested, Aztec finds itslef in a position that it has very rough terrain. Of course, not only Aztec, but I think Southern Union is participating similarly in this development. Some of these locations are almost impossible on 40-acre locations; some of them we have to move from one 40 to another 40. This is almost impossible terrain. It is solid rock. It is probably one of the most difficult terrains I have ever observed. Locations, as I say, are almost impossible, in which case you have to move to another 40 in some cases. I have

spent some time in the field observing this, and the cost may vary from, anywhere from a few thousand dollars to as much as $15,000 for a location, including some roads. There are cliffs, and it is very difficult terrain, so I think we should have considerable flexibility in these Rules.

Q Would you point out just generally, on our Exhibit 1, some of the rough areas that you have certain familiarity with that have not been drilled?

A I might point out on this Exhibit 1 that we have staked locations and that we are drilling presently two wells, as I mentioned before, one in Section 24 and one in Section 20. We have stake locations for approximately five other wells too, one in Section 17 and one in Section 20 and three other locations in Sections 23 and 24.

Q Are all of those diagonal?

A Yes, sir, they are diagonal alternate locations from wells already drilled or drilling. In some cases, in certain locations, particularly in the west half of the northwest quarter of Section 23, it is almost impossible to get wells in there. We are unable at this time to determine just where we can get a location in that entire 80 acres. We have offset obligations we have to meet, so it makes it rather difficult. Similarly, in the east half of the northwest quarter of Section 23, Southern Union finds itself in a similar position. That is possibly one of the roughest terrain, in Section 23, and somewhat in Section 24, although we have

been able to work it out fairly well in Section 24. There is also some very rough terrain along the northwestern portion of the pool, not quite as rough, but still extremely difficult in Sections 15 and 16 and 10 of 31, 15. So we do find ourselves in a very bad position. Of course, other operators have similar positions, but we have some of the roughest terrain of any operator.

Q With that in mind, with the need for a lot of flexibility in any Special Rules that are adopted as a temporary spacing proration here, would you just go down Rules 1, 2, 3 and 4 and make any recommendations that you see fit to achieve this flexibility?

A I find it a little difficult to change some of these things without changing their meaning. I have referred to the Special Rules that were put in for the Bisti Lower Gallup Oil Pool, which supposedly these pools were formed, which was Order R-1069-B, and in that particular thing, I find that in Rule 2 it should be amended somewhat similar to the Bisti Lower Gallup Oil Pool rules which could be 80-acre spacing, but would consist of either the east half or west half of a single governmental section, rather than either the north half or east half, or east half or north half of that quarter section.

Q Do you feel that that would impose any hardship on anyone if you actually had an east half and west half of the quarter section as your unit?

A To my knowledge, there is no ownership which would be affected by this particular assignment of acreage.

Q And if it did, you would be agreeable to exceptions?

A The reason I make this request here is because we don't feel that the Commission ought to be burdened with a lot of exceptions from the other operators to these rules, as we find ourselves in a very difficult topography condition.

Q Which we know are coming up?

A Which we know are there, yes, sir.

Q In other words, then, you would recommend that Rule 2 of the Pubco's proposed Special Rules be modified to be identical to Rule 2 of the Bisti Pool, except changing it to east half and west half instead of north half and south half?

A Yes, sir. And in Rule 3, as I say, we have very difficult terrain here to meet in some cases, so I would suggest that Rule 3, which was in the Bisti, that that be changed from 100 feet to 330 feet, which is the state-wide rule. And, of course, Rule 4, I don't see any reason for any change, or Rule 5. The only possibility is that possibly there should be some provision made in these rules for administrative approval of these things, in the administrative approval, for the Commission to have authority to grant these exceptions immediately if everything is met and all waivers are given, rather than waiting the twenty days as mentioned, put some extra provision in there for immediate approval if all waivers were granted. And the last thing, possibly, would be that the Commission might feel it is necessary to have something in the Rules to the effect that all wells now drilled or

drilling be granted exception.

Q All wells?

A All wells now drilled or drilling, that did not meet these rules, would be granted exception.

Q Without a hearing?

A Without a hearing as part of this order.

Q Do you have any further comments concerning this case?

A I have none.

MR. DAVIS: That concludes our testimony. I would like to offer Aztec's Exhibit No. 1 in the hearing.

MR. PORTER: Without objection, Exhibit No. 1 will be admitted.

Mr. Mankin, a temporary order wouldn't improve the terrain?

A No, sir.

MR. PORTER: Anyone have any questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Mankin, as I understand it, Aztec has an interest in 13 wells in the Verde-Gallup Pool, is that correct?

A A 50 percent undivided interest.

Q And you have an interest in 8 wells up in the northermost part of the pool which were drilled at an average cost of $40,850?

A That was in the tanks.

Q The figure of $40,850 represents some tangible equipment

which has salvage value, does it not?

A Yes.

Q What was the average location and road cost in that area?

A I don't have those figures immediately available. They were, I would say, just in an average of, somewhere in the neighborhood of $5,000 or less.

Q How much less?

A Well, again, portions of those 8 wells were in very rough terrain. I would hesitate to say. Possibly would average close to $5,000.

Q And you have an interest in 5 wells which were drilled at an average cost of $53,500?

A Yes, sir. Southern Union drilled those as operator, and we participated 50 percent. Those were in Sections 23 and 17.

Q Does that amount include tangible equipment with salvage value?

A Yes.

Q What would you estimate, in these two instances, that the tangible equipment would amount to?

A Well, of course, Exhibit B which Pubco had put in, wouldn't be entirely out of line. Of course, we have greater depth on some of our wells and we have shallower depths. Therefore, there would be some difference in those drilling costs, but the tangible items would be casing, tubing, well head, surface equipment. There wouldn't be too much difference, I presume, from

what Pubco has put in Exhibit B, which I believe in that vicinity was some $16,000.

Q What is the average well location and road cost in that area where those 5 wells were drilled?

A Again, I would have to segregate those in Section 23. They were in the neighborhood of, oh, $12,000. $12,000 to $15,000.

Q How about the other wells?

A In Section 24 they would possibly be in the neighborhood of $10,000 or slightly less.

Q Is there a marked difference in the terrain in which you have drilled wells and the terrain in which Pubco has drilled wells?

A Oh, yes, very distinctly so.

Q The terrain where Pubco wells were drilled is fairly flat?

A As is in a low section. Of course, the one well which we drilled in Section 17 just east of Pubco was in a similar terrain, so the location costs there were not high. The only thing is that in that particular well we had to whip stock the well at a total cost of $93,000 for that well. Southern Union drilled the well, however, we participated.

Q Is that $93,000 figured in the average cost of the well?

A Yes, sir.

Q Is this an average thing that you have to whip stock?

A No, sir. Skelley found the same thing. This is the

offset well to it. I believe their costs were a little bit less than this.

Q Abnormalty is figured in these average costs?

A Yes, sir. I have the individual well costs, but that $93,000, of course, increased the sum of those other 5 wells.

MR. PORTER: How much would you say it raised the average, Mr. Mankin?

A Well, if you would knock that particular well out of the $93,000, the costs were in the neighborhood of $56,000, $39,000, $39,000, $66,000. So you can see it would have been considerably less than this $53,000.

Q $66,000 is higher than the average too, is it not?

A Yes. There again we had considerable loss circulation. There is a lot of loss circulation zones in this point lookout, and there was considerable trouble in that particular well; loss circulation, squeezing, cementing, and difficulties in completing the well.

Q Has Aztec attempted to drill any wells?

A Yes, sir. At the present time we are drilling two wells with cable tools.

Q That would have been a large part of the loss circulation problem?

A Yes, sir, if it is completed; it is taking a long time to do so.

Q Do you have any locations, Mr. Mankin, that could be

built with roads to the location in accordance with the estimate that Pubco gives of $15,000, that Pubco gives for roads?

A I think we will find a considerable number of those wells over here in Section 17, and 20, over here east of Pubco. Yes, sir, but not west of the Pubco.

Q So when you start drilling over there, your average per well cost will come down more, will it not?

A Yes, sir, but again, as was mentioned before, that is shown by this map, Exhibit C. There is considerable cranked hole problems encountered.

Q Do you have to fracture your wells, Mr. Mankin?

A Yes.

Q Would you explain why the wells have to be fraced in the presence of a widespread fracing system such as you testified to a while ago?

A Well again, I think some of these are, of course, somewhat natural, but in most cases you have to frac them anywhere from, oh, I would say from six thousand gallons to fifty thousand gallons or say more or less than a thousand barrels a pound per gallon to get them to break down. The pressure that we found, break down pressures, varied anywhere from 500 to 1600 hundred pounds, depending on the area you were in.

Q How far up from the well bore do you think the artificial fracing is affected?

A I have no idea.

Q Mr. Mankin, how much oil has an Aztec well produced, which has produced more than any of the others?

A That is a rather remote question because there has been no sustained production until the month of April due to the pipeline, and it has been extremely erratic. We had some of the first wells in the pool.

Q I mean the cumulative production.

A Well, the oldest wells that we have produced something less than 22,000 barrels through the month of April. I understand Mr. Carroll has a well that has produced in the neighborhood of 60,000 barrels, which is one of the older wells in the pool. Ours vary from place to place and how long a well has been on.

Q This well of Mr. Carroll's has produced what, 60,000?

A Sixty some thousand.

Q Is that the most oil that any well in that pool has produced?

A It is my understanding that it is.

MR. NUTTER: I think that's all.

QUESTIONS BY MR. COOLEY:

Q Mr. Mankin, returning for the moment to your proposed revisions of the Special Rules and Regulations submitted by Pubco, referring particularly to Rule 2, I am not sure I understand you on the terminology. It is a little bit different in this Rule too, I believe, than it is in the Bisti Order. In the Bisti Order it is north half of the south half of the quarter section, and the way it

is presented in this Rule, it says, it shall run north and south, which reverses the two directions you use completely.

A I don't like the word "shall run." I think it is rather confusing. The one in the Bisti, you can actually pinpoint what you are actually talking about.

Q Comprises which half?

A Comprises the east half or the west half of a single governmental quarter section. Then there is no question what you mean by running. That is strictly my own opinion as to how I would write it. I think it could be somewhat simplified similar to the Bisti Order. Of course, again, we would put -- we would knock out the word "diagonal quarter-quarter section" and put it in "either quarter-quarter section" for flexibility.

Q I didn't get that. In other words, you would have -- you could have two wells in the same end of the quarter section?

A No, sir, two -- yes, sir, you could have.

MR. PORTER: In the same end of the quarter section?

A I might point out, from looking again at Exhibit 1, that Aztec and Southern Union have split their acreage almost completely in alternate 80-acre units and, therefore, in no case would there be more than one well in either one of these 80-acre tracts, but in very few rare cases, not many, there would be two wells in the same quarter section, on the same end of the quarter section, very, very few cases, which would be occasioned primarily because of the topography, and secondly, because of previously drilled wells, which

you would have to fill in your obligations.

Q (By Mr. Cooley) You said there would be very few occasions. You mean because you would voluntarily stagger them?

A Yes, sir. We have so shown on this Exhibit 1 our proposed locations that we have already staked on the ground.

Q I see.

A We haven't made them all. There are very few cases there where there is still a location not shown. In Sections 23, 20 and 17.

Q You have no opposition to the inclusion of the requirement of drilling on diagonal quarters, except for the possibility of terrain difficulties?

A Well, that, and if you will note there, there has already been some wells drilled, which is almost impossible to keep the alternate pattern, in a very few cases, there in Sections 23 and 24.

Q I don't observe those. Would you point them out, please?

A Yes, sir. At the present time Southern Union is drilling Well 5-24 in the southeast, northwest of Section 24. There is presently a well located in the northeast, northeast Section of 24. With that situation, I don't see how it is possible to stagger those wells, unless you put it in the center on the 80 acres.

Q Well, sir, it won't. That's the only requirement I see in this order, the way I interpret it.

A If that is the way it is, again we can find ourselves in this position. There is another situation like that also, as I

mentioned before, this 3-23, which is a location and had previously been indicated in the southeast, northwest of Section 23. They thought, Southern Union thought they would drill a well there, but it is so difficult to drill a well there that they are going to change the well back to the northeast of the northwest and, therefore, there will be two wells along that line, but again, to get to your point, in each quarter section there would be alternations.

MR. WEBB: I believe your interpretation is correct.

A Again, as I mentioned, we find ourselves in one or two of those positions, of not being able to get a well in that quarter-quarter section, and, therefore, there are a few situations where we would have to put two wells, as an example, along the north half of the northwest quarter of Section 23. It would be an extreme exception.

Q When you say that this would be the extreme exception, you would be unable to locate any in the quarter-quarter section at all?

A There are a few situations like that.

Q That would be pretty extreme?

A Where we have extreme rough terrain, where wells are to be drilled.

Q Are you of the opinion that this diagonal pattern, as suggested by the Pubco Order, would result in a more orderly development of the pool, assuming that it would remain on permanent 80-acre spacing?

A That would be the object, and which we would attempt to do so as well as --

Q Then, I take it you have no substantial objection to the inclusion of the diagonal requirement?

A Well, I don't know. Of course, we are going to attempt to do so, attempt to keep it in a diagonal pattern similar to that, but we have the feeling that we are going to find ourselves in one or two situations where that wouldn't be possible.

MR. DAVIS: May I testify a little bit right here?

MR. COOLEY: Please do.

MR. DAVIS: Actually, Aztec is interested in orderly development of this pool as well as any other, but we are not in favor of the absolute requirement, in the situation that we have here, for these diagonal locations, where we have a bad terrain situation, and the reason that we are suggesting that we go as Rule 2 of the Bisti Rules provide is that you can locate it in either place there on that, on the 80 or 40, and that it would save the time and effort of going to operators or before the Commission and obtaining an administrative order; just saves an awful lot of time, when we know what the situation is in advance. I think our company, as well as the other operators out there will make every effort to follow the recommendations of Pubco. We feel we need the flexibility in this area on the basis that we have suggested, and that's the reason we have suggested that Rule 2 of the Bisti Rules be incorporated in the proposed rules on an east

half, west half governmental quarter section.

Q (Mr. Cooley) Very good. Now, Mr. Mankin, you do not feel that you can state, based on the engineering data presently available, that one well will drain 80 acres in this pool, do you?

A I have no definite proof, but it is my firm conviction, from what I observed here, that apparently it will drain, one well will drain 80 acres, but the only way we can tell is by getting more information, but apparently from what we have seen up to now, including the interference test, one well should drain 80 acres.

Q The data that is available at the present time is quite inconclusive; the approach is, "Give us another year and then we will know."

A Well, that is true to some extent, but again, to me, this interference test shows that we certainly have good communication, and that there is every reason to believe that it will drain at least 80 acres. Of course, there is only one such interference test, and it is our feeling that that might be done in other parts of the pool and, therefore, properly evaluate other parts of the pool as well.

Q From a pool-wide standpoint, the data as to the ability of one well to drain 80 acres is rather scant at the present time?

A Well, we are still working on such data.

Q Now, in view of that, I will ask what purpose will the temporary acre spacing order serve for a year, why can't it continue on its present status for another year?

A Well, you've got to state somewhere on one of these pools to determine what the spacing should be. If you keep going by something you can't put your finger on, somebody will revert to another pattern, and the first thing you know, you can't go back. You've got to start at a point and go forward and try to orderly develop a pool. That's the reason for the request for temporary 80-acre spacing.

Q By that, do you mean that someone might start developing on 40's?

A There is always a possibility. Apparently, the operators are in accord.

Q These Special Rules, as suggested by Pubco, would permit this very thing, permit the drilling on 40's?

A I didn't understand it that way.

Q In Rule 3 it says, "Provided, however, that nothing contained herein shall be construed as prohibiting the drilling of a well on each of the quarter-quarter sections in an 80-acre unit."

A I think that wording -- instead of "each," I think it should be on "either."

Q Well, this provision exists in the Bisti Rules.

A Of course, the reason that was put in there, there were already wells on the 40 acres. You had to have it on the Bisti.

Q Again I refer to Mr. Webb for interpretation of his proposed Rule.

MR. WEBB: I believe that you can drill on 40 acres, I

don't believe you can prevent that in New Mexico, but the detriment to drilling on 40 acres will be the allowable which would be allowed under these Rules for drilling wells on 80 acres.

MR. COOLEY: You used the term "detriment," and it seems to me that your only purpose for a temporary 80-acre spacing at the present time, in view of the fact that there is evidence as to what one well will drain in the pool, is still quite inconclusive. It can't prohibit drilling on 40's. Now, the only purpose would seem to be the assignment of an 80-acre, or double allowable to the wells in the Verde-Gallup Pool, would it not, Mr. Mankin?

A Of course, that's one of the desires of this order, yes, sir, but that isn't the entire reason, of course. We want to be able to develop proper reservoir conditions, and you can't do it if you are going to bunch your wells together, and to properly evaluate the draining areas of these wells.

Q Again, I realize, as the Rules are proposed, that nothing would be contained therein to prevent the drilling of wells. Of course, if an operator so chooses --

A I believe that is why it was put in there, because of the statutory provision of those --

Q You don't feel anyone will drill on 40's anyway?

A I don't know.

Q I think you understand very well the proration formula for oil proration in the State of New Mexico, and as you know, a given amount of allowable will be assigned to northwestern New

Mexico based on the nomination for the purchase of oil from that area. Now, from this total amount of nominated oil, the Verde-Gallup would receive exactly twice as much as it would on 40-acre spacing, is that correct?

A Yes, sir.

Q Do you feel that the assignment of twice the allowables to Verde-Gallup Pool is warranted until such time as it can be shown with some assurance that one well can --

A I think there is reasonable assurance that it is able to drain 80 acres and, of course, not all wells will be able to, at the present time, get the double allowable, but there will be a substantial amount that will.

Q What do you mean all wells wouldn't be able?

A Not all wells will be able to produce twice as much.

MR. DAVIS: May I ask you a question along those lines of questioning there? It was my understanding that one provision in the Bisti Rules was required to permit another well on the 80-acre tract, if the operator so desired, and as was pointed out, it is a statutory provision that you cannot prevent someone from drilling on 40 acres in New Mexico. Secondly, as to the provision for the double allowable, so to speak, for an 80-acre unit, your New Mexico state-wide Rules do not provide for an 80-acre allowable on a well depth to 5,000 feet. I may be mistaken.

MR. COOLEY: The state-wide Rules do so provide that. However, in the event that Special Pool Rules are promulgated for

any given pool, as set forth in Rule 1 of our Rules, I believe those Special Rules take precedence over all state-wide Rules and Regulations which might be in contract therewith.

MR. DAVIS: That is my understanding. Therefore, in doing so, in setting up 80-acre spacing, it seems also desireable to go ahead and determine some allowable factor, which we are asking for in the case of an 80-acre spacing.

MR. WEBB: Mr. Cooley, as you remember, you had some correspondence with Mr. Selinger on that very point, of which I have some copies, so that was the reason we incorporated that as it is here in these Rules. Now, what we are trying to do here is promote an orderly development within the pools on alternate sections; that is, the northwest, or southeast, or northeast, but as you stated, there is a provision in the New Mexico Statute which does not prevent anybody from drilling on a 40-acre tract. There may not be any 40-acre tracts in this pool at the present time, but under these Rules, they can drill on that 40 and be able to get what, in fact, is half a unit allowable.

MR. COOLEY: For the sake of the record, as Commission attorney I do not take the position -- I do not concur that the statutory provision to which you refer, I believe being 65-3-13 provide that no operator shall be denied the opportunity to drill a well in his property, and would not preclude an order which would require development on 80-acre spacing, and I think you could strike this paragraph in Rule 3 and still be within statutory --

MR. WEBB: If you, as Commission attorney, recommend, we will be glad to strike it because that's the only reason it was incorporated.

MR. COOLEY: That's my feeling. Nobody can tell us but the Supreme Court. That's all.

QUESTIONS BY MR. NUTTER:

Q Mr. Mankin, is there any possibility that the development of the Verde-Gallup Oil Pool to the southwest will carry into the Horse Shoe Canyon Pool which is several miles to the southwest?

A I think there is a remote possibility. I think there has been a well or so drilled on the northeast end of the Horse Shoe-Gallup which has indicated that there might be some possible separation there. At the present time I don't foresee that the two will join up particularly. In fact, they are producing from essentially different zones of the Gallup.

Q It is in the Gallup, isn't it?

A Different portions of the Gallup.

Q Where in the Gallup would it be with relation to Exhibit D, there on the wall, the producing horizon of the Horse Shoe Pool?

A I am not sure just how that would correlate. I believe other people here, such as El Paso, would be more in a position to say that, but I believe there is a portion of the upper Gallup in the Horse Shoe-Gallup.

Q The development of the Verde-Gallup is continuing?

A At the present time there has been no drilling.

MR. COOLEY: Thank you.

MR. PORTER: I will have to interrupt the questioning at this point. We only have one Reporter, and we would like to use him tomorrow, so the hearing will recess until nine o'clock tomorrow morning and we will reconvene out at the Highway Building, which is out on Cerrillos Road. I don't know the exact address, but just follow the crowd.

MORNING SESSION, FRIDAY, MAY 16, 1958

MR. PORTER: The meeting will come to order, please. We will continue with Case 1441. Mr. Davis, I believe you were through with your direct examination and Mr. Mankin was under cross examination at the time we recessed yesterday. Does anyone else have any questions of Mr. Mankin?

MR. DAVIS: I have one or two questions.

REDIRECT EXAMINATION

BY MR. DAVIS:

Q Mr. Mankin, yesterday in answer to Mr. Nutter's question concerning well cost, there was some idea given that as you moved into the flatter areas, this $56,000 average might be reduced. Is it your opinion that, notwithstanding when you move off the flatter areas we are talking about, going into deeper drilling, that the average cost of,per well should still stay somewhere in the neighborhood of $45,000 to $47,000?

A Yes, sir, I believe that is true because you've got the deeper zones, and in addition, you've got loss circulation zones and you have extreme crooked hole problems.

Q Mr. Cooley asked a question concerning more or less why Pubco and Aztec and some of the other operators were asking for 80-acre spacing for this pool. Would you just elaborate on that point, the reason we are asking for it at this time?

A Well, of course, I personally feel that one well will drain 80 acres, but I would like to have more time to obtain more

information, and in doing so, we'll be able to determine just what the spacing should be in this year's time, and certainly nothing will be -- no problems will be encountered if this is granted.

Q In other words, we are not threatened at the moment with any 40-acre drill applications to drill on the 40 acres?

A None, to my knowledge.

Q But that possibility is always with us?

A Yes.

Q And today the operators have voluntarily developed on 80-acre spacing? A Yes.

Q So in order to give us an opportunity to develop the information we need, we are asking for an 80-acre spacing and proration at this time, is that correct?

A Yes, and also so that the Engineering Committee can have an opportunity to properly obtain this information so that we can evaluate it.

Q We are not out here just to get a one-year development program, so to speak, on 80-acres, because we think and believe that by the end of the year we'll have sufficient and adequate data to support a permanent 80-acre order, is that correct?

A Yes, sir.

Q And is it true also, that in the event a well is drilled on 40, you can't undrill it, is that correct?

A That is my opinion of it.

Q Mr. Mankin, to clear the record, Rule 2 was discussed

briefly yesterday, and our suggested change. Would you read Rule 2 and Rule 3 into the record as we recommend it?

A Rule 2, I would recommend should read: All wells projected to or completed in the Verde-Gallup Oil Pool shall be located on a unit containing 80-acres, more or less, which consists of either the east half or the west half of a single governmental quarter section.

Rule 3, I would recommend to be, "all wells projected to or completed in the Verde-Gallup Oil Pool shall be located within 330 feet from the center of either quarter-quarter section in the unit provided, however, that nothing contained herein shall be construed as prohibiting the drilling in a quarter-quarter section in 80-acre tracts."

MR. PORTER: Just one minute. I was making notes here. Rule 3, Mr. Mankin, what tolerance did you recommend?

A 330.

Q As to Rule 3, Mr. Mankin, you wouldn't have any objection to eliminating the highest proviso?

A No, sir. That was strictly a suggestion which might be put in here and easily left out, as far as I am concerned.

Q What about allowables? What is your feeling on that, if that is eliminated, do you still think that if there is one well on an 80, that it ought to receive an 80-acre allowable?

A Yes, sir.

Q What is your reason for that?

A Because each person should have an opportunity to develop his acreage on a 40-acre basis if they so desire, and in doing so, if you assign the allowable of two 40-acre tracts to a single well, you should be able to produce a certain amount of oil.

Q Do you have any other comments?

A No, sir.

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

RECROSS EXAMINATION

BY MR. GRENIER:

Q Mr. Mankin, you've indicated that although this engineering committee hopes to develop information about this field, that there is already a certain amount of data available to it, is that correct?

A Yes, primarily the formations stages, to my knowledge.

Q Now, is there any of this data, which has come to your attention, which you feel is inconsistent with the idea that one well will efficiently and economically drain 80-acres?

A No, sir, I don't know of any inconsistencies that have been set up as yet.

Q All of the data that has been obtained to date, to what extent it has been obtained, is consistent and supports that conclusion which you have reached, is that correct?

A Yes, sir.

MR. PORTER: Anyone else have a question?

MR. COOLEY: I still don't understand their position with

regard to whether they can or cannot drill on 40-acre tracts? Would you try to clarify that one more time, please, Mr. Mankin?

MR. PORTER: Your question, Mr. Cooley, is as to whether they should be allowed to drill on a 40-acre tract if 80-acre units are established?

A Well, I have no knowledge of that, as to whether -- the only thing, I think, the statute provides that a person will be allowed an opportunity to drill on his acreage, whatever it might be, whether it is 40-acre or not. I don't particularly care whether it should go in there or not. To me, it is more of a legal aspect.

Q Aside from the legal aspect, as an engineer, do you feel that the pool will be more efficiently and more economically and more uniformly developed if you eliminate this proviso which permits the operator to drill on 40's if he wants to? Divorse your mind entirely from any possible legal objection, and as an engineer testify whether you feel it would be in the interest of conservation and possibly prevention of waste, and certainly the drilling of unnecessary wells, whether you feel this provision should be omitted?

A I don't quite understand your question. Are you indicating that, do I feel that the alternate or diagonal quarter-quarter section should be utilized?

Q The provision in Rule 3 which states, "that nothing contained herein shall be construed as prohibiting the drilling

of a well on each of the quarter-quarter sections in an 80-acre unit?"

A Well, again, from an engineering standpoint, of course, there should be only one well in the 80.

Q In the interest of uniform development?

A Yes, sir, one well on the 80.

Q And do you think that drilling a pool -- assuming for the moment that 80-acre spacing will completely and adequately drain the Verde-Gallup Oil Pool, do you feel that the drilling of additional wells to a density, the unnecessary density of 40-acres would cause any waste?

A At the present time it would cause economic waste.

Q Mr. Mankin, waste as defined by our statutes -- and I am sure you are very familiar with it -- is underground waste, surface waste, production in excess of market demand, or violation of rate of take.

A My feeling is that that certainly would be waste.

Q Do I understand your answer, Mr. Mankin, to be that if you drill two wells on an 80-acre unit that it would be waste --

A Yes, sir.

Q -- assuming that one will drain?

A Of course, I have made that assumption already, yes, sir.

MR. PORTER: Anyone else have a question?

QUESTIONS BY MR. KENDRICKS:

Q Mr. Mankin, you recommended that the east half of the

quarter section or the west half of the quarter section be set up as a unit. Is there any specific reason why the east half or the west half should be designated?

A My first thought there was that that would give it a much more orderly development. However, I am not particularly bound by either one. I think it could be either way, either the east half or west half, or north half and south half. You could find yourself in grouping of wells in either one or both, but I believe it could be either one.

Q Well, you have recommended that an operator drill at his election in either of the 40-acre tracts of the 80, have you not?

A Yes, sir.

Q So the particular half of the quarter section would not make any difference as to where the well would be located?

A Very little difference.

Q You referred yesterday to an average cost of your first eight wells as being something over forty thousand dollars. Is that the total cost from the time the locations were made until the well was first run to tanks?

A Yes, sir, that includes tankage, puming, location well, cost complete.

Q That is the total cost applied to those first eight wells?

A Yes, sir.

Q Does that include the plugging and drilling out costs for the first two wells that were plugged and abandoned and then reopened?

A As I recall, there was only one well -- there was one well that was abandoned, the hole was lost, but the original well that was plugged and reopened some two years later, that did not include that cost.

MR. KENDRICKS: That is all.

QUESTIONS BY MR. MORGAN:

Q Mr. Mankin, are you telling this Commission that you don't think it is necessary to have a fixed pattern in this 80-acre spacing that you propose?

A No. As I think I indicated yesterday, I think we would desire a fixed pattern. We are certainly going to try to develop on a fixed pattern, but we didn't think it would be advisable, in view of some of the extreme topography, to cause the burden on other operators and the Commission to grant these exceptions right at the offset or almost at the offset. If the Commission desired to do that, and the other operators desired to allow those exceptions, why that would be all right. We certainly would desire a fairly rigid pattern as far as the actual development is concerned, if we didn't have this topography.

Q That's what I understood you to say. Your answers to Mr. Kendricks indicated you abandoned that thought.

A He said either to assign the east half or the west half, or the north half or south half, and as I said, I didn't think it made too much difference what the assignement of the acreage was as long as it was an 80-acre tract.

Q I understood that answer, but then I understood you to say that it didn't matter which end of the 80- anybody wanted to drill on.

A I didn't mean to leave that impression.

MR. MORGAN: That is all.

QUESTIONS BY MR. KENDRICKS:

Q You mean, in answer to my question, you do not recommend that the operator have the option to drill the north half or the south half of that 80-acre tract, whether it be the east half or the west half?

A I don't believe we've indicated to drill in either quarter section, not in alternate quarter sections or diagonal quarter sections.

Q You mean quarter-quarter sections?

A I mean quarter-quarter sections.

Q In other words, two wells may be drilled in the south half of a quarter section or in the north half of a quarter section?

A Could be. We don't anticipate that there will be many of those sort of thing, but there is that possibility.

MR. DAVIS: May I ask one question?

MR. PORTER: Surely.

MR. DAVIS: Mr. Mankin, in answer to Mr. Morgan's question, I think you were a little bit confused. Actually, we are trying to get flexibility on this -- on the 160-acre tracts as such, divided into 80's, because of the topographical conditions that we know

about now, we are making the recommendation that we drill anywhere on the 80, depending on the better location, to save money and drilling costs. As was indicated, we intend to develop a diagonal thing insofar as possible, is that correct, Mr. Mankin?

A Yes, sir.

QUESTIONS BY MR. GRENIER: Mr. Mankin, are you sufficiently informed as to the terrain on these various tracts on which locations have not already been staked to be able to advise the Commission as to any anticapatory exceptions which you think ought to be granted and perhaps in that way get definite with them as to just where you think deviations might be necessary from a diagonal spacing pattern?

A Well, as I tried to indicate yesterday, we only have, as we know it now, possibly two places where that might happen, but there might be more of them over on the west side of the pool, which as yet we haven't staked the location to determine that.

Q You haven't made a sufficient examination to determine what might be needed?

A I personally inspected that, and I know that two are going to be very difficult and I have also examined aerial photographs as well.

QUESTIONS BY MR. NUTTER:

Q Mr. Mankin, if a pool is developed on the state-wide spacing pattern of one well to 40 acres, is there anything in the state-wide rules that prohibits the drilling of as many as four wells on that 40-acre unit?

A Not to my knowledge.

Q Other than the unnecessary cost of the well, which may not be needed on a 40-acre unit, if there is one already there, would any waste result if an additional well were drilled other than the cost of the well?

A Other than the economic waste of the well?

Q No. Underground waste is what I mean.

A Again, there might be some pressure signs. Having too many wells in an area, that certainly could be a reservoir condition that might not be adviseable.

Q You think there is a reservoir condition in this pool that would cause underground waste if two wells were drilled on 80-acre spacing, if a pool were developed on 80-acre spacing pattern?

A At the present time I think there would be, until we know more about it.

Q You mean there would be waste until you know more about it?

A Well, at the present time, it would appear that that many wells would certainly cause pressure signs around the already producing wells, and cause these wells to drop their pressures more than they should to properly produce the amount of oil that is there. Right now we don't think that those other wells are necessary. Just one well on an 80.

Q Well, if an operator chose to drill two wells on an 80 and

was willing to foot the bill for the extra well, is there any underground waste or damage to the reservoir going to occur?

A Unless it becomes an offset obligation where you would start a chain reaction. That would be the only way. If it is within his lease, there might not be any problem.

Q And the chain reaction would result in economic waste and not underground reservoir waste?

A Primarily underground waste.

MR. NUTTER: That is all.

QUESTIONS BY MR. MORGAN:

Q Mr. Mankin, in answer to Mr. Nutter's question, you spoke of anticipated reservoir energy in building to many wells on one tract?

A Yes, sir.

Q What is the reservoir energy in this case?

A We don't know. There is very small amount of gas, not even enough to pump the wells in the area, and we assume that what reservoir energy is there, it's primarily of a gravity type drainage.

Q What would drilling more wells have with changing the laws of gravity?

A Won't change the laws of gravity. You do have reservoir pressure.

MR. PORTER: What is the source of reservoir pressure?

A I don't know.

Q (By Mr. Morgan) But there is some?

A Yes, sir. Pubco's engineering witness so testified as to these reservoir pressures and the interference tests.

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

QUESTIONS BY MR. UTZ:

Q Mr. Mankin, did I understand you to say that as far as you know now, you only have about two locations that you would have to drill off of a fixed pattern?

A That seems to be certain. There apparently will be others in the west half of the lease after we get development on that.

Q Do you think that having to move off a fixed pattern will be the exception rather than the rule?

A It seems to be, at the present time.

Q Then would you have any objection to the Rules giving you opportunity, for top preferable reasons, for applying for administrative approval to move off of a fixed pattern?

A If there were sufficient flexibility to allow all of those, I see no great concern. We just wanted to arrest that sort of a condition.

Q You are not advocating that they move off a fixed pattern indiscriminately?

A No, sir. Definitely not. We are going to attempt to keep on a fixed alternate pattern whenever possible.

MR. UTZ: That's all I have.

MR. PORTER: Anyone else have a question? The witness may

be excused.

(Witness excused)

MR. PORTER: Mr. Buell.

DANIEL R. CURRENS,

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

DIRECT EXAMINATION

BY MR. BUELL:

Q Mr. Currens, state your full name, by whom you are employed and in what capacity and in what location, please.

A Daniel R. Currens. Employed by Pan American Petroleum Corporation. Reservoir engineer, Roswell, New Mexico.

Q Have you testified at a Commission hearing prior to today?

A Yes, I have.

Q Are your qualifications a matter of public record?

A Yes, sir.

MR. BUELL: Are his qualifications acceptable?

MR. PORTER: They are acceptable.

MR. PAYNE: Mr. Currens, you were sworn yesterday, weren't you?

A Yes, sir, I was.

Q Mr. Currens, would you briefly go over to Aztec's Exhibit No. 1 and locate generally for the record the area of Pan American properties?

A Pan American has six sections in one general area in the

Verde-Gallup Pool adjacent thereto, being the Sections 35, 34, 33, 29, 28, and 27 in Range 15 West, Township 31 North. In addition to this, we have another quarter section, which is a quarter section consisting of the east half of the east half of section -- let me refer to my own maps over here for the exact locations.

MR. PORTER: I think we will have a display board here in a few minutes.

A It is the east half of the east half of Section 6, Township 30, Range 5.

Q How many completed wells do we have at this time?

A We have four completed wells.

Q In order to save time, Mr. Currens, and avoid what, in my opinion would be needless repetition, let me just ask if you are in general agreement with the Exhibits and the testimony that have been presented with respect to this reservoir?

A With respect to the reservoir, with the reservoir information available and the analysis that has been made, yes, sir, I am in general agreement with that information.

Q Let me ask you this, whether or not in your reservoir studies of this pool, you, like the other witnesses who testified, have had trouble in ascertaining the reserves at this time?

A Yes, sir, I have.

Q In your opinion, is an 80-acre order a proper order for this pool at this time?

A Yes, sir, I think so. All the indications are that we

would have 80-acre drainage, but now, of course, we are only asking here for a temporary one-year order. A committee has been formed, and we are studying the reservoir -- we are diligently pursuing the study of the reservoir and at the end of the year, I feel that we'll possibly know a great deal more about it, and we can at that time conclusively prove 80-acre drainage.

Q All right, sir. Heretofore, two sets of Rules have been proposed, one by Pubco and one by Aztec. Of those two Rules, which do you think would be the more effective Rules for this pool?

A Well, sir, I believe with the terrain as it is, that we are going to need a lot of flexibility in locating our wells. Certainly I am in agreement with the 80-acres, the allowable, but I believe that the Rules proposed by Pubco might be a little too restrictive here, making it necessary for us to come before the Commission in one form or another pretty often for topographical reasons, and with a little more leniency, a little more flexibility in the Rules, we could very well get away from this problem.

Q In other words, you prefer the Rules proposed by Aztec?

A In general, yes, sir.

Q Let me ask you this, Mr. Currens. Now, in Pubco's proposed Rules, they provide for administrative exceptions. Do you think that will give you the flexibility that you will need?

A Well, I don't think it will be necessary if we just made a couple of changes in those Rules, or would not very often be necessary, let me put it that way.

Q But you do feel that the flexibility of drilling in either a 40-acre or an 80-acre unit is necessary?

A Yes, sir. I think that if we can utilize either 40-acre or the 80-acre tract, that we will be able to operate more efficiently, economically, and with a minimum of trouble to the Commission.

Q You mentioned terrain difficulties. Do you have anything at this time to offer the Commission in the way of an example of some of the problems you are encountering?

A Yes, sir, I do. However, let me add one other point to what I previously said. If we were to go a three-thirty tolerance rather than a hundred foot tolerance from the center of the 40-acre tract in which we are drilling, I think that would give us a lot of flexibility and would make necessary a lot of appearances before the Commission in one form or another.

Q Would you identify that map as Pan American's Exhibit 1, please? What is Exhibit No. 1, Mr. Currens?

A Exhibit No. 1 is a sketch map of the six-section block that I previously referred to where Pan American is operator.

Q Did you prepare this sketch map, Mr. Currens?

A No, sir. This was prepared by our engineers in our Farmington office. It was, I might add, not prepared for purposes of this hearing, it was prepared for use in their day to day operations in the location of wells, estimation of road costs, and things like that.

MR. BUELL: May it please the Commission, while we are discussing terrain, I have an area photograph here. I must apologize to the Commission, we wanted to submit one as an Exhibit, but it takes about six months to obtain one, they are copyrighted and we can't reproduce them, but I would -- since this is the only one we have, I would like for the Commission to have the advantage of looking at it. It certainly helps to show the terrain problem that we are encountering in this area. The six-section block of Pan American there is outlined in red and for orientation purposes, it is this same thing that we show on the sketch map.

MR. PORTER: What is the most of the surfact there, Mr. Currens, rock?

A Yes, sir.

Q (By Mr. Buell) What comments do you have to make on Exhibit 1, Mr. Currens?

A Well, sir, in looking at Exhibit 1, you can see the wells we presently have completed. I mentioned that we had four wells completed. We also have three in the process of drilling or completing at this time. One completed well and one incomplete well are not on this map. They are on the Thurland lease in the 160-acre block referred to previously. You can look at these locations, which are numbered 1, 2, 3. One is an A lease and one is a C lease, and see that we have endeavored to follow a uniform pattern. You'll also see here certain locations that are listed by letter, A through G. Now, these are the locations that we have made road costs esti-

mates on, and if you look at them, you will see that they also follow a pattern. However, you can see by looking at them, and a trace of terrain here, that a lot of them aren't going to be within a hundred feet off center. We want to develop on as orderly a pattern as possible. However, we are going to have trouble in here and we are going to need some flexibility, and I believe that the two proposals, the utilizing of either quarter section of 80 and increasing the tolerance from a hundred feet from the center to 330, would probably give it to us, would put us in good shape. Actually, those are about all the comments I have. I might mention some road costs here, for instance, A to D there, something in excess of $12,000, as I recall. You can see the big switchback in there, it is very steep slope, and it is going to cost us a lot of money to get roads in there.

Q What distance would you say that is, Mr. Currens?

A Approximately 2,000 or 2,100 feet.

MR. PORTER: Less than half a mile?

A Yes, sir.

Q And how much do you estimate that will cost, Mr. Currens?

A Something over $12,000 for that particular one.

Q Exhibit 1, then, is a vivid reflection of terrain difficulties and the problems that we are encountering in this area?

A Yes, sir, especially so when you can look at the area photographs in the area.

Q What has been Pan American's experience from the stand-

point of average well cost, Mr. Currens?

A On our running to the well head, some $45,100. Counting pumpbing units, tank batteries and so on, put it in the neighborhood of $55,000.

Q And the well head?

A Well head cost for the four wells, we have completed at $45,100, not including pump units, road.

MR. PORTER: Surface equipment will run you in the neighborhood of $5,000?

A Yes, sir, oil into the battery.

Q (By Mr. Buell) Do you have anything else to add, Mr. Currens?

A No, sir, I don't. I just certainly wanted the Commission to be aware of the terrain problem we have in there and point out the difficulties we are going to have.

MR. BUELL: That's all we have at this time.

MR. PORTER: Any questions of Mr. Currens?

CROSS EXAMINATION

BY MR. COOLEY:

Q Mr. Currens, how many 40-acre tracts belong to Pan American that you have personal knowledge of, or in your opinion, that you do not believe you can locate within the 40 at all?

A Within the 40 at all, I believe that I would rather not make an estimate there, Mr. Cooley. I would say it would be in the order of five or six.

Q You have knowledge of some?

A We are going to have trouble. There are very steep slopes. I would say in the order of five or six.

Q What about 80-acre spacing, would there be an awful lot of trouble there?

MR. PORTER: Might have to do some directional drilling?

A I believe we would have to. We have problems there too just like anyone else.

MR. COOLEY: That's all the questions I have.

QUESTIONS BY MR. UTZ:

Q Mr. Currens, you spoke of a 330 foot tolerance instead of a hundred foot tolerance in regard to Rule 3 of the Pubco Rules. Now, what do you mean by 330 foot tolerance, you mean a radius of 330 feet from the center?

A I was thinking under the terms of state-wide Rule for an oil well location with a square, a box more or less, is it not, of 330 feet to the side from the center of the tract?

Q When you speak of 330 foot tolerance from the center point, -- wouldn't it be better to say 330 feet from a 40-acre tract, quarter-quarter section line?

A Yes, sir. Certainly would.

MR. UTZ: That's all.

MR. PORTER: Any other questions?

MR. BUELL: May I offer at this time Pan American's Exhibit No. 1?

MR. PORTER: Pan American's Exhibit No. 1 without objection will be admitted to the record, and the witness may be excused.

(Witness excused)

MR. HINKLE: If the Commission please, we have one witness, Mr. Taylor, and one Exhibit.

MR. PORTER: Was he sworn yesterday?

MR. HINKLE: I believe he was.

A Yes, sir.

MR. HINKLE: This has been marked Humble's Exhibit 1.

J. C. TAYLOR,

recalled as a witness, having been previously duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. HINKLE:

Q State your name, please.

A J. C. Taylor.

Q Where do you live, Mr. Taylor?

A Midland, Texas.

Q By whom are you employed?

A Humble Oil & Refining Company.

Q In what capacity?

A Petroleum engineer.

Q Are you a graduate petroleum engineer?

A I graduated from Mississippi State College in January, 1949, was employed by Humble shortly thereafter, worked in Houston

as petroleum engineer approximately three and a half years. The remainder of the time I have been working in the West Texas and New Mexico area.

Q Have you made a study of the Verde-Gallup Field?

A Yes, sir, I have.

Q The whole entire Field or just some special study?

A I have not.

Q Some portion of it?

A I have not studied the entire Field. I have studied the properties which relate to Humble's properties.

Q Have you prepared a cross section map that is a result of your study in this area?

A In cooperation with our Humble geologist, I have prepared a cross section.

Q Will you refer to Humble's Exhibit 1 and explain to the Commission what it is and what it shows?

A Humble's Exhibit No. 1 is a cross section from Humble's Ute Indian Wells No. 1, Section 7, 31 North, 14 West, extending across the east end of the field to Humble's Ute Indian "B" Well No. 1, Section 25, 31 North, 15 West. A small insert is shown at the bottom of the cross section to show the actual wells which are incorporated in the cross section.

Q Is that on the east side of the field?

A Yes, sir, it is on the east side of the field, a north-south cross section across the east side. This Exhibit shows first

that the logs in this area are correlatable. We have connected some of the correlatable points, the most interesting of which to this Commission at this time would be the top of the Gallup pay, which is labeled as the bottom line connecting the logs. Second, it shows that no faulting of the field is indicated, which would confine well spacing to any small degree.

Q It does show a very steep dip?

A It does show unusually high formation dip. The cross section starts at the north part of the section, the south is on the left, and the dip is easily seen to increase as you go to the south. And fourth, it shows that our interpretation of the relative position of the subsurface formations are in substantial agreement with similar exhibits previously submitted by Pubco.

Q Does the depth of the well vary, does this show that the depths of the wells vary greatly?

A The depths of the wells vary considerably. Humble's shallowest well is 2485 feet, and deepest is 3810 feet.

Q Does that necessarily mean that the cost of these wells will vary greatly?

A Yes, it certainly does. Humble's varied from $42,500 to $76,000. The drilling time of these wells has varied from 11.3 days to 56.9 days. The 56.9 days was on Humble Ute Indian "B" No. 1, which is an example of the high drilling cost encountered in steep formation dip, causing crooked hole drilling problems.

Q Are Humble's well costs in line with other drilling costs

in the area?

A Humble has used the standard contract rate. I believe we reimbursed the contractor in good faith to a portion of his loss on our Ute Indian's "B" 1. He took the well in good faith and, actually, at reduced footage rate, so he ended up with considerable loss maintaining the hole under 5 degree diviation to leave it in shape that Humble could complete the hole with a cable took rig.

Q I believe you stated that your cross section shows that there is no faulting in the area and that --

A No faulting.

Q -- it is a continuous reservoir as far as you know?

A The formations are correlatable and no faulting is indicated. We do have a serious lack of data and have a minimum of production history upon which to base any estimate of recoverable reserves. Because of this, we have made no attempt to estimate the reserves on Humble's property, but we have made an economic analysis which shows the minimum production from Humble's wells. Humble has two producers, one on each lease, that would pay out our current investment of the wells. Humble Ute Indian Well No. 2 and Ute Indian "B" No. 1 would have to produce 39,700 and 50,300 barrels of oil respectively to pay present lease wells and surface facilities investments, if they omit the dry holes. However, they are a part of your drilling costs and liable to be encountered by anybody, and if you include the dry holes, it would have to produce

88,600 barrels and 50,300 barrels respectively, or a total of 138,900 barrels for the two wells. We do not know where these wells will produce this quantity of oil.

Q And there is no way really of getting a reservoir estimate at this stage of development of the field that is worth while or accurate?

A We know of no reasonable way of estimating reserves at this time.

Q Do you have any recommendations to make to the Commission at this time?

A Yes. Because of the absence of technical data and a minimum of production history, because of the high well costs variation, because of varying depths and crooked hole drilling programs, Humble recommends a one-year temporary order for 80-acre well density to allow us to obtain data to determine the optional well spacing.

Q Was Exhibit No. 1 prepared by you or under your supervision?

A It was prepared in collaboration by our Humble geologist.

Q Under your supervision?

A Under my supervision.

MR. HINKLE: We would like to have this Exhibit No. 1 received in evidence.

MR. PORTER: Without objection, it will be received.

CROSS EXAMINATION

QUESTIONS BY MR. PORTER:

Q Mr. Taylor, did you give the potential of Humble's wells?

A I didn't,but I can, sir.

Q Just say from your low to your high.

A Give the potentials?

Q Yes, sir.

A We only have two wells, sir, that are producing; two were dry holes. Our No. 2 Ute Indian had a potential of 153 barrels, that's the well on the north, and our "B" 1 had a potential of 336 barrels.

Q What about the terrain in the area of your acreage?

A I have not personally been there, I could only testify to hearsay. I understand that we have very rough terrain on the north. On the south, it is not too bad.

Q But you haven't made a physical inspection?

A No, sir, I have not.

Q Do you agree with the other witnesses here in general with the type of formation we have here?

A Yes, sir, I certainly do.

MR. PORTER: Anyone else have any question?

QUESTIONS BY MR. NUTTER:

Q Mr. Taylor, you stated that you would have to recover so many barrels from each of these two wells. How will you know, or when will you know when you are going to get that much oil out of those wells?

A We are hoping that at the end of the one-year period we

will be in a position, by decline curves, to predict our recovery from the wells.

Q You think decline curves are going to be the only method of determining ultimate production from this pool?

A I would say that they are the best method at the present. Most of the wells in the area that I have any knowledge of are pumping wells. Therefore, pressures will be difficult to obtain readily.

Q Will there be any means of making reserve estimates by material balance or any other type of calculation?

A I do not think it would be as accurate as a decline curve on this type of reservoir.

Q Now, what will your decline curve indicate to you?

A It should indicate the possible anticipated reserves to be produced from that particular well. By using a number of these throughout the field, you should be able to get an anticipated production from the field.

MR. NUTTER: Thank you.

QUESTIONS BY MR. COOLEY:

Q To clarify that point further, just one more point. If you do not know how much oil is in the reservoir, the decline curve will not tell you how much acreage you are draining, will it, just tell you whether you are going to pay out or not?

A That particular method would not tell you how much acreage you are draining. However, there are other ways of determining

drainage other than that one.

Q What would you suggest to prove 80-acre drainage in this pool?

A I think it has been previously suggested that additional communication tests be run of a longer nature than the one that has been run previously testified to. I think that would certainly help establish the fact that you are draining a certain amount of acreage.

Q Especially a pool like this which would have -- tend to finger, and the effect of a well bore, the pressure created by a well bore would tend to finger out through these fractures even more than it would in a sand reservoir, wouldn't it?

A If you are asking if a reservoir of high permeability would notice a decline on offset wells by production, yes that is true.

Q No, that isn't the question. The questions is, wouldn't your drainage pattern be more radial and tend to be more uniform in a regular good or average sandstone reservoir than it would in fractured shale reservoir like this, where the effect of your well would tend to follow the natural fractures in the system?

A I have nothing to think that the fractures are not a network throughout the reservoir, and I would not say that the sand would drain then in a more radial fashion.

Q Have you found it necessary to artifically fracture any of your wells?

A Yes, we have attempted to stipulate the frac holes. A frac job has been performed on all four of our wells.

MR. NUTTER: Where are your drill holes, Mr. Taylor?

A On our Ute lease in Section 7, 31 North, 14 West, Humble Ute Indian No. 1 and No. 3 are dry holes.

Q Did you have to drill your "B" 1 twice?

A Yes, sir. We abandoned the first hole at 394 feet because of excessive deviation. There was eight days in drilling the first hole, which was included in the 56.9 days I previously gave.

MR. COOLEY: Back to my question. Then you feel that an interference test performed on a reservoir such as this would, with unusual characteristics, would be just as probative towards proving drainage of a given acreage as would a pressure interference test in an average sand reservoir?

A I say that if several interference tests are run through the reservoir, not only one, it is possible, in a fractured reservoir, for one fracture from one well to do to the other.

Q Do you think that a water flood would at all be possible in this type of reservoir?

A I see no reason why it shouldn't be possible.

Q Wouldn't there be a great tendency to channel through these fractures from one well to the other?

A If it was properly designed, and assuming your water would come up at an even rate, I see no reason why it should chan-

nel. You have a reasonable constant permeability through the reservoir.

Q You say you have a reasonable constant permeability in this reservoir. Do you really have any permeability in that reservoir as that term is ordinarily used?

A It is my opinion that the matrix rock, in terms of common thinking, is nonproductive. The permeability of the matric rock itself is so hollow that I doubt that oil will even be recovered from it.

Q In the ordinary sense, this reservoir has no permeability at all, the reservoir rock?

A The matrix rock has very low permeability. I think that the oil reservoir is actually found in the fractures themselves.

Q And the size of the fractures will be the sole determination of how well that oil will flow out?

A That is true, sir.

Q There is now, or two years from now, there still will be no way of making accurate determination of how much oil is in place under a given amount of acreage in that pool?

A Well, it depends on your definition of accurate. We have no means, in reservoir engineering, of getting the accuracy that some of the other industries might obtain.

Q I mean accurate by comparison to the accuracy you would obtain from a volumetrical calculation in a reservoir.

A I see no reason to assume that a decline curve would not

give an accurate --

Q How can they tell you how many acres it is going to drain, or how many acres it is draining if you don't know how much is under one acre? How can you tell from the volume you have produced how much is under two acres?

A Well, sir, I don't know of anyone that has found a means of calculating the volume under a fracture. I don't know any way of obtaining such information.

Q Back to my question again, that from calculating the amount of volume you produce, as compared with the pressure drop you've experienced in producing this volume, you still wouldn't know how many acres of reserve you produced, you will just know whether you are going to pay out or aren't going to pay. That is about all that this information will give us, isn't it?

A Well, sir, if you have additional data to substantiate the communication through the reservoir, I think you can safely assume that you are draining the total reservoir.

MR. PORTER: Such as the interference tests?

A Yes, sir. I think interference tests.

MR. COOLEY: That's all. Thank you.

QUESTIONS BY MR. GRENIER:

Q Mr. Taylor, if you take pressure decline curves on a number of wells which have been drilled on an 80-acre spacing pattern and which are fairly well surrounded by additional wells so that they plainly cannot be draining past that area, wouldn't it then be

fairly apparent that each of that center group of wells would be draining on the average of some 80-acres as a maximum and couldn't be draining out past that, could they, with other wells all around them?

A Are you saying that if a well is drilled -- the field is drilled up on 80-acre spacing in a reasonable ordinary pattern, that each well should get its pro rata share of the oil?

Q No, I was trying to explore a little further what Mr. Cooley was getting into, in an attempt to determine whether a pressure decline curve would achieve any element of accuracy here, and I was suggesting the possibility of taking pressure decline curves on a rather substantial number of wells in an area which had been fully developed on an 80-acre pattern and which was surrounded by an external barrier of additional wells, so that no gas could be coming into this area from outside. Wouldn't such a series of decline curves, when averaged, tend to give a fairly, in fact a substantially accurate indication of the reserves that are within that area?

A I believe I previously stated that a series of decline curves would be the only basis, and not a single decline curve, upon which you can get a reasonable estimate of the oil anticipated to be productive from the reservoir, yes, sir.

Q And would that series of decline curves, taken in this fashion, tend to substantially meet the concern expressed by Mr. Cooley in his line of questioning?

A I certainly would think so.

Q Now, you said that you hoped that by the end of a year there would be sufficient data available to be able to express more accurate opinions on the subject than you are able to express at the present time. Is that a rather remote thing, or do you feel it is a thing with a high degree of probability?

A Well, sir, I am more familiar with our leases than anyone else's, and one week ago we only had one lease tied to a pipeline and we are selling an awful small volume of oil, and the other lease was going to be tied in shortly. We have had no production history to speak of from our wells and, therefore, we believe that it's a substantial reality to think in terms of one year that we should be able to give some reasonable estimate of reserves.

Q And that would be in cooperation with the other operators and not limited to your own?

A It would have to be in cooperation with other operators.

Q Is Humble participating in this sub committee which was brought into testimony yesterday?

A I did not attend the meeting myself, but I understand that our representative, our district engineer in Farmington did attend and is participating.

Q And it is your company's intention to keep participating in that area?

A Yes, sir.

MR. GRENIER: That is all.

QUESTIONS BY MR. PORTER:

Q Mr. Taylor, do you think the tests cited by the Pubco witness yesterday, the interference test or the shut-in on these seven wells, six wells and one well, were indicative that one well will drain at least 80 acres?

A I think so. The interference test was very short. In my experience with interference tests, as was indicated, if you can see a pressure drop in so short a time under sustained operation, it does increase considerably.

Q I believe they showed a ten-pound pressure drop there in forty-eight hours?

A That was my understanding, sir.

Q Would you consider that high?

A I would think that would indicate excellent communication, yes, sir.

QUESTIONS BY MR. NUTTER:

Q Mr. Taylor, do you believe that the reserves in this pool will turn out to be rather uniformly distributed around the pool, or certain areas that have large reserves, or other areas that have negligible amount of oil?

A I have no knowledge of the degree of the fracture system throughout the pool, and I don't think that there is sufficient engineering -- I would only be giving just a guess which would not be a valid opinion -- I don't think that such an opinion has enough engineering data behind it at this time to be put forth, sir. I

can say that the one well we cored was a fractured well.

Q You subscribe to the theory that most of the reserves in this pool are in open fractures?

A Yes, sir.

Q Do you think that there is considerable amount of oil in the shale itself which will be produced?

A I think that little, if any, production will be obtained from the matrix rock itself.

Q Haven't some wells had a considerable producing history in this pool to date, Mr. Taylor?

A I am not familiar, if they have. The only thing I know as to the production length is the testimony I've heard at this hearing, sir.

Q Do you think a well, such as the well which you mentioned yesterday, which produced 70,000 barrels, has enough production history behind it to be able to determine the reserves under that well?

A It possibly has, sir. I am not familiar with the production test or anything about it, but I would certainly think it certainly should have.

Q Do you have knowledge of any decline curves that have been drawn for any of the wells?

A I do not, sir.

MR. PORTER: Any further questions?

MR. HINKLE: One other question.

REDIRECT EXAMINATION

BY MR. HINKLE:

Q Mr. Taylor, in your study of this particular area of the field, was there anything found that would lead you to believe that the fracture system was not uniform throughout the field?

A No, sir, we have encountered fractures. We have cored only one well and it had an extensive fracture system. However, the larger samples which were obtained from the drilling in with cable tools indicated that the reservoir was probably fractured in our Ute Indian "B" 1, and we think that the fracture system, as we know it, is continuous through the reservoir.

MR. HINKLE: That's all.

MR. PORTER: Mr. Utz.

RECROSS EXAMINATION

BY MR. UTZ:

Q In answer to Mr. Porter's last question, you answered that the interference test, in your opinion, proved excellent communication. Now, if an interference test proves excellent communication, how do you associate that with efficient drainage?

A I think it would certainly substantiate the fact that a well could drain a minimum of 80-acres in this space.

Q Efficiently?

A Efficiently, sir.

Q Now, could you determine from that interference test what the shape of the drainage pattern would be?

A I know of no other way than to assume that the pressure goes from the center out to the producing wells, which would be a radial pattern.

Q Just assume it was a radial pattern, then.

A I see no reason for believing otherwise, sir.

Q You wouldn't assume that one or two wells or possibly one well would --

A From the interference test that was taken, I believe we had a number of, some 1400 barrels which were produced in a ten-pound drop, and I think we had seven wells or six wells surrounding.

Q Six wells?

A I think that one-sixth of the 1400 barrels would not produce a ten-pound drop in the well normally, unless some unusual circumstance would occur, so I believe all the wells were contributing to the ten-pound drop.

MR. UTZ: I believe that's all I have.

QUESTIONS BY MR. GRENIER:

Q Mr. Taylor, in answer to Mr. Nutter's question about the Carroll No. 1 Well, that was the discovery well in this field, was it not?

A I understand it was.

Q Do you know whether in a substantial portion of its producing life it was producing without being substantially surrounded by offsetting wells?

A I do not know, sir. I understand it wasn't surrounded. However, I do not know.

Q In a reservoir where there are indications of excellent communication, such as we have here through the fracture system, would you think that the fact that this well, during a substantial portion of its producing life had been drilling -- I mean, producing without complete offsetting, might lead to distorted results if it were considered that the well were draining merely an 80-acre tract?

A Well, if you ran a decline curve, your decline curve would be based upon the offsets at that time. Actually, if he only had one offset, then your decline curve would be valid, if he had only one offset; if he had offsets on the other three sides since then, of course, your decline curve should show a sharper drop. As I indicated before, I think that we are draining a minimum of 80 acres.

Q But if you were to assume, in the Claud Carroll Well, it was draining only 80-acres, and interpreted your decline curve in that fashion, would it perhaps tend to give you a distorted picture of these reserves, if you attempted to rely on that well's pressure decline?

A I think it would be very distorted and show a picture of far too much oil in place.

MR. GRENIER: Thank you.

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

The witness may be excused.

(Witness excused)

MR. SANDERS: I am W. H. Sanders, representing Tennessee Gas Transmission Company. We have one witness who was sworn in yesterday. And I would like to make a general statement, first, that we concur basically in most of the testimony and the situation as has already been presented here. However, at the risk of being accused of excessive indulgence, we believe that our 18 producing wells, which are on a pattern of a 160 acre, are sufficient to drain the leases that we have drilled on, so that our testimony will attempt to show that at least 80-acres, and we feel 160-acres, is adequate.

CLOVIS RODLANDER

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

DIRECT EXAMINATION

BY MR. SANDERS:

Q Would you state your name and qualifications, please?

A Clovis Rodlander. I am employed by Tennessee Gas Transmission Company as district engineer in Casper, Wyoming.

Q Would you qualify yourself, your educational background and engineering experience?

A I graduated from Oklahoma State University in 1949, and I was employed by Stanolind Oil & Gas Company during 1949, and from 1949 until 1954 I have been in the employ of Tennessee Gas Trans-

mission Company as petroleum engineer for two years and ten months, now.

Q And you are familiar with this particular field, Mr. Rodlander?

A Yes, sir. This is one of the fields that is under our supervision from the Casper district offices.

Q How many wells does Tennessee have in the field at this time?

A Tennessee has drilled 20 wells in the field in the Verde-Gallup Field to this date, 18 of which are producing and are included on the proration schedule. We have two wells which should probably be classified as noncommercial.

Q Could you explain the pattern that Tennessee has developed in the field at this time?

A In general, Tennessee has drilled on locations in the southeast offset quarter-quarter section and is generally on 160-acre spacing at the present time.

MR. COOLEY: Let me interrupt. You say southeast offset quarter-quarter section. Do you mean that or --

A Southeast of the quarter section.

Q It might be helpful if we had that Pubco exhibit.

MR. PORTER: Mr. Nutter, do you have that Exhibit?

A Mr. Rodlander, would you point out the area in which Tennessee wells are situated?

A Tennessee holds leases -- I am going to have to refer to

my own map here -- in Sections 22, 21, 29, 30, 31 and 32, all located in Township 31 North, Range 15 West.

Q Has Tennessee ran an interference test relating to any of the wells located in the field?

A Yes, we have.

Q Would you explain the nature of the results of that test to the Commission, please?

A In June of 1957, Tennessee Gas Transmission Company ran an interference test in which the roads and pumps were pulled from our Ute Mountain Tribe "B" No. 9, located southeast, northwest of Section 32, Township 31 North, Range 15 West, and a bottom hole pressure bomb was run in said Ute Mountain Tribe "B" No. 9, and the well shut in for 79 hours thereafter, during which time a rapid increase in bottom hole pressure was noted with the bomb. We then started swabbing our Ute Mountain Tribe "B" No. 3, located southeast, southwest of Section 32, 15 North, 31 West; from the information obtained from the bomb, pressure in "B" No. 9 continued to build up for an additional 21 hours, for a total of a hundred hours shut-in, during which, in 21 hours, 240 barrels of oil were swabbed from the Ute Mountain Tribe "B" No. 3. Also at this time, our Ute Mountain Tribe "B" No. 4 was pumping; our Ute Mountain Tribe "B" No. 6 was pumping, and our Ute Mountain Tribe "B" No. 10 was pumping.

Q Would you point those wells out, locate them there?

A This is our Ute Mountain "B" No. 9.

MR. COOLEY: Is that the shut-in well?

A That is the shut-in well. This is the well that was swabbed. The Ute Mountain Tribe "B" No. 6 is located here; Ute Mountain Tribe "B" No. 10 is located here, and our "B" No. 4 is located here, which is a west 160-acre location to well No. 9, the shut-in well. During the next 44 hours, 536 barrels of oil were swabbed from Ute Mountain Tribe "B" No. 3. During this time, 30 barrels of oil were pumped from the Ute Mountain Tribe "B" No. 4; 436 barrels were pumped from our Ute Mountain Tribe "B" No. 6, and 38 barrels of oil were pumped from our Ute Mountain Tribe "B" No. 10, for a combined total of 1380 barrels removed from the immediate vicinity of the reservoir. A bottom hole pressure decline of six PSI was recorded in "B" 9, the shut-in well. I am sorry that we don't have additional copies of the curves which were prepared from this data, but we would like to submit this as Tennessee Gas Transmission Company's Exhibit No. 1. The importance of the data obtained from this test was that the bottom hole pressure buildup in the shut-in well was arrested, and a six PSI pressure decline noted. Over the last 24 hours of the shut-in time, bottom hole pressure had been increasing at the rate of -- increase in bottom hole pressure was .833 PSI per hour. We have extrapolated the bottom hole pressure data obtained by the Horner method, which is a commonly used and accepted engineering method for projecting bottom hole pressure build-up data to a condition of complete build-up. At the rate of build-up bottom hole pressure recorded by bomb on the

Ute Mountain Tribe "B" No. 9, the bottom hole pressure would have been expected to have obtained a pressure of 301 PSI by extrapolation by the Horner method to the time at which a pressure of 288 PSI was actually recorded by the bomb in Ute Mountain Tribe "B" No. 9. This represents a 30 PSI drawdown in bottom hole pressure, and indicated to us that reservoir conditions were such as to allow fluid migration and interference between tests on a 160-acre spacing. The approximate distance between Ute Mountain Tribe "B" No. 9, the shut-in well, and "B" 3, the well from which the majority of the fluid was removed, is approximately 3500 feet.

Q Actually, that is greater than 160-acre spacing, then, isn't it, in that particular instance?

A Yes, because that would be on the diagonal.

Q That's on the diagonal?

A Yes.

Q Mr. Rolander, would you state to the Commission whether or not you believe the Tennessee at this time would believe it to be practical to further develop the field, as we are located in it, in a closer spacing than the 160 that we are situated in?

A With the information available to us at the present time, we feel that we have at least an indication of interference on 160-acre spacing, and it wouldn't be our program at the present time to develop wells on any closer spacing, except as needed for offset obligations. I would again like to state to the Commission that we have no objection to 80-acre spacing in this field. It is

just that the information that we've been able to ascertain indicates to us that it could be developed on a wider spacing and that 80-acres certainly is the smallest that we believe at this time, with the information we have, would make for an orderly development of the field.

Q Mr. Rolander, will you state the position of Tennessee as far as the pattern is concerned, if they went to 80-acre spacing?

A It would be our belief that wells should be located diagonally on 40-acre locations on 80-acre drilling units. At the present time, we have no specific recommendation as to whether these units should be east, west, north or south.

MR. SANDERS: The Commission may question.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Rolander, in your Indian Pool, do you encounter any difficult terrain that would prevent your drilling in the center of a 40?

A We have some rough terrain there, sir, but I know of no specific location in which we would, but that doesn't preclude the possibility. I just don't know, I haven't been on the ground to look at it. Actually, we have built some rather difficult locations on our location. Costs have been $8,000 approximately as a maximum.

Q You recommended that these wells be on diagonal locations which, of course, would preclude the drilling of two wells

on the same end of a quarter section. Would you have any objection to Mr. Mankin's recommendation that the Commission allow wells to be drilled to within 330 feet of a quarter-quarter section unit line?

A I believe that would conform with the state spacing rules and we would have no objection.

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

QUESTIONS BY MR. COOLEY:

Q On this terrain question, Mr. Rolander, how does your terrain compare with the operators that have presented testimony, better, worse, average, or what?

A We have some that are probably as bad for building well locations. We have some in which the terrain has not been any problem, and I am sure there is terrain there which is worse than what we have.

MR. SANDERS: I believe that Mr. Rolander can state that our well costs are approximately the same, on an average, as the other parties.

MR. PORTER: Do you have those average well cost figures?

A Yes, I do. Of the 20 wells which Tennessee Gas had drilled, our average well -- excuse me -- we have cost figures on only 18 of those wells. The average well cost has been approximately $40,000, with the maximum well cost being approximately $65,500.

MR. PORTER: Does that average include your surface

equipment?

A That average figure includes the completed well into the tanks.

MR. PORTER: All right. Thank you. And you may have testified to this, but about what is the average depth of your well?

A Our average depth of these 18 wells is approximately 2160 feet total depth.

MR. PORTER: Which would place it in the shallow part of the pool?

A Yes, sir.

MR. PORTER: Were you through?

MR. COOLEY: I have one more question.

Q (By Mr. Cooley) Can you tell me, sir, again, the nature of the shut-in well?

A That well was our Ute Mountain Tribe "B" No. 9.

Q Would you go to the Pubco Exhibit on the board and point it out, please?

A It is this location right here, Mr. Cooley.

Q Was the 40-acre direct offset to the east completed at the time this test was run? Whose well is that?

A That's Pan American's.

Q Was it completed at the time this test was taken?

A I do not have knowledge of that, Mr. Cooley.

Q Do you know whether it was producing at the time the test was taken?

A No, I do not. The only knowledge that I have, as far as producing, or shut-in status, are the wells I indicated, Ute Mountain Wells No. 4, 10 and 6.

Q As a matter of fact, you would expect the greatest amount of effect, and possibly the greatest effect from the offset well had it been producing, isn't that reasonable? Your well is 660 from the section line?

A It would be approximately that.

Q It looks like it might be closer. Wouldn't be more than a thousand feet between the two wells?

A That would be true.

MR. NUTTER: Perhaps a representative of Pan American is here and can tell us.

MR. SANDERS: I believe we have a witness of our own who can.

A Our No. 2 Well is located in Section 33.

MR. CURRENS: The well was completed August the 11th, 1957.

MR. COOLEY: When was it put on production?

MR. CURRENS: I don't have that information available with me, Mr. Cooley.

MR. COOLEY: And you don't know how much production had been taken from that well, Mr. Currens?

MR. CURRENS: Production from our well test has been very small. I can't quote you the exact figure.

MR. NUTTER: What was the date of your test?

A The date of this test, the bomb was run in the hole June, 6, 1956. The interference test was prior to completion of the Pan American.

Q (By Mr. Cooley) It wouldn't affect it?

A It wouldn't have at that time.

MR. COOLEY: That is all.

QUESTIONS BY MR. NUTTER:

Q Mr. Rolander, do you have any idea as to the reserves per 40-acre tract, per 80-acre tract, or per 160-acre tract in this pool?

A I know of no method at the present time by which we can calculate reserves in this type reservoir.

Q Has your company made any attempts to calculate the reserves to date?

A We have in the Casper district office made no attempt, other than keeping track of current production rate and setting up decline curves.

Q What will be the means of determining the reserves in this pool when such a means is available?

A Well, probably the best -- the most accurate method will be whatever the figure is at the time the field is completed. I know of no method at the present time by which we can predict recoverable reserves other than by decline curves.

Q Have you any decline curves on any of your wells today?

A We keep decline curves in our office. I don't have any

with me, no, sir.

Q What would the decline curves that you keep in the office indicate the reserves to be?

A We don't have enough producing history at this time to even be able to project those decline curves to a point of completion.

Q How much oil has been produced from the Tennessee gas well which has produced the most?

A Well, as of April the 1st, 1958, our Ute Mountain Tribe "B" No. 3 produced 23,694 barrels of oil.

Q This is the most oil that any of your wells has produced?

A Our Ute Mountain Tribe "A" No. 1 at that time had produced 23,885, which is approximately 200 barrels greater than the figure I just quoted.

Q That would be the latest cumulative well production?

A Yes, sir.

Q Mr. Rolander, I note that you drilled two wells on the 160-acres lying in the southwest quarter of Section 21. What was the reason for drilling two wells in that quarter?

A Would you please repeat your question?

Q Yes, sir. I note that you drilled two wells in the southwest quarter of Section 21, what was the reason for drilling two wells there when you could have developed the rest of your acreage on 160-acre spacing?

A The question had reference to wells drilled in the south-

west quarter --

Q Yes, sir.

A -- of Section 21?

Q Yes, sir.

A Well, those wells are on the 160-acre well spacing that we have followed on our other leases.

Q On your other leases, though, you have drilled one well per 160-acre, have you not?

A That's right. Those wells were drilled and completed before I came to the Casper district, and I have no knowledge of what that reason might have been.

Q Do you think that any oil, any appreciable amount of oil will be left in the ground if these Tennessee gas leases are produced at the rate of one well per 160-acre throughout their life?

A At the present time, the information that we have indicates that there will be interference in fluid migration over areas as large as 160 acres and, therefore, I see no reason to believe at the present time that there would be any appreciable amount of oil left in the reservoir on those leases. It might take a longer period of time to recover it.

Q Mr. Rolander, the interference test does now communication between wells, does it not?

A They do show that the reservoir conditions are such that regular fluid will travel through the reservoir, the well bores and be produced.

Q They indicate that the acreage is being efficiently drained?

A At the present time, I don't think that we have sufficient information to be able to answer that question fully.

MR. NUTTER: I believe that's all.

MR. MORGAN: I would like to ask one question.

QUESTIONS BY MR. MORGAN:

Q The applicant in this case is asking for a temporary order on 80-acre spacing. Now, in case the Commission a year from now decides that the way the -- supposing we did have an 80-acre order at this time, and in a year from now we find it would not be advisable to continue it. All right, what would be your well costs to go back in and drill in wells as compared to what they are now? Would be less or more than they are now?

A I think in our portion of the field they would be substantially the same.

Q You wouldn't find any disadvantage in drilling a well on a 40-acre tract a year from now over what you find right now, is that it, sofar as cost --

A So far as cost.

Q -- and physical ability to drill a well?

A Well, of course, well drilling completion costs are influenced greatly by footage rates, costs of materials, and negligenting changes in those factors, I would suspect that well costs be substantially the same.

Q Time element might change?

A Yes, sir.

Q Might save a little on the roads and such as that, tank batteries?

A Well, these costs that I gave you, of course, reflect some savings that are achieved through batteries which can handle --

MR. PORTER: More than one?

A Yes.

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

QUESTIONS BY MR. PAYNE:

Q Mr. Rolander, is your company participating in this committee that has been formed to get additional data from this field?

A Yes, sir, we are. At the time the first meeting was held, we were unable to have a representative present, but we did notify the subcommittee that we would praticipate, and I believe I was appointed as our representative to that committee, and we intend, of course, to participate in it.

QUESTIONS BY MR. UTZ:

Q Mr. Rolander, were the offset wells producing on your interference test at the time you ran a bomb in No. 9?

A Were those wells producing?

Q Yes, sir.

A Well, as I stated previously, I have no knowledge of the condition of any of the other wells there, except those that I pointed out.

Q Those are the ones that I have reference to. They are the offset wells, are they not, to No. 9?

A Yes. No. 4, 6 and 10. Condition of those wells at the time that the shut-in well was shut in and the bomb ran in it?

Q That's right.

A The Ute Mountain Tribe "B" No. 4 was producing at the time the well was shut in. The Ute Mountain Tribe "B" No. 6 was producing as was the Ute Mountain Tribe "B" No. 10.

Q Then they were all producing. What was your first shut-in pressure on the No. 9?

A Shut-in pressure that is recorded here at a depth of plus 3400 datum, which we have used as our pressure datum, was, by this Chart, 5 pounds, as close as I can read it.

Q How much?

A 5 PSI.

Q 5 pounds.

MR. NUTTER: That's the initial shut-in pressure?

A Yes, sir, at the time the first recording that was made with the bomb.

Q (By Mr. Utz) And how long did you leave the well shut in?

A The well was shut in for a total of approximately 148 hours.

Q What was your pressure at the end of 148 hours?

A Pressure at the end of the 148 hours was the 283 PSI at the datum of plus 3400.

Q In the interim between the 5 pound reading and 288, the well had built up and declined?

A Yes, sir.

Q What was the maximum pressure?

A The maximum recorded pressure was 294 pounds.

Q How long was that after the well was shut in?

A That was timed at a hundred hours shut-in.

Q So the decline you received on that well was the difference between 288 and 294, is that correct?

A That was the pressure decline that was actually measured in the well at that depth, yes, sir.

MR. UTZ: That's all I have.

MR. PORTER: Any further questions?

MR. SANDERS: We would like to formally introduce the photograph as an Exhibit A into evidence.

MR. PORTER: Tennessee's Exhibit A, without objection will be admitted. It is designated as Tennessee Gas Company's Exhibit No. 1. There being no further questions, the witness may be excused.

(Witness excused)

MR. PORTER: Any further testimony to be presented in the case?

MR. COOPER: If the Commission please, my name is J. Cooper, with Three State Natural Gas Company. I have previously qualified before this Commission as a petroleum engineer and would

like to introduce one exhibit.

MR. PORTER: You may proceed, Mr. Cooper. I believe you were qualified at the time you were with Skelley, is that right?

MR. COOPER: Yes.

MR. PORTER: Let's have a ten-minute recess.

(Short recess)

MR. PORTER: The meeting will come to order, please. Mr. Cooper, will you proceed, please, sir?

MR. COOPER: Yes, sir. Three States has two leases in this Verde-Gallup area in Sections 30 and 31, in 31 North, 14 West. Our leases in the area consist of Sections 30 and 31, 31 North, 14 West. We have completed our Tribal Well No. 1 in the northwest, northwest of Section 30 for 136 barrels per day, completed on March 30, '58. This Exhibit 1 of Three States Natural Gas Company is a breakdown of the cost of this well. Total cost, $84,364. The well was drilled with rotary to 3702, and cable tools to 3837, and was fraced on completion. It has a total tangible equipment value of $29,433. The estimated salvage value of that tangible equipment, after 15 years producing life, is $8,000, less the cost of salvage of 2000 or 6000 feet. Subsequently to drilling this well, we had started our No. 2 Well in the northeast, northeast of Section 30. The contractor on No. 1 refused to take a second well at the same bid price. We, therefore, switched to cable tools. That contractor has been on the hole over 60 days and he is 2000 feet deep, and we don't know whether he is going to do any better

or not. We think this well cost is about as low as we are going to be able to drill at that depth, and that's all I have to say.

MR. PORTER: Mr. Cooper, what about the terrain in your area?

A We are fortunate on those leases. The terrain is not such that we couldn't drill in the center of 40 with a hundred foot tolerance. Now, we had to move the second well to get out of the bottom of the wash. We moved it a hundred feet, but otherwise the terrain is all right.

Q Then, your well location costs are not too excessive?

A Well, the location cost on No. 1 was $17,000, including the pits, filling them up, so the $04,000 here does have road and location costs in it.

MR. PORTER: Any questions of Mr. Cooper?

QUESTIONS BY MR. NUTTER:

Q There is something here that is awfully high. I can't figure out what it is. How long did it take to drill this well, Mr. Cooper?

A Slightly over thirty days.

Q This was drilled with rotary?

A This was drilled with rotary.

Q This must have taken a lot of day work, didn't it?

A The day work there primarily is drilling in with cable tools; the rotary day work there wasn't a great deal, I believe 48 hours.

Q Why did it take so long to drill the well?

Q Why did it take so long to drill the well?

A The maximum weight carried by it was 11,000 pounds on one bit, and the rest of it not over 4,000 pounds. Our deviation got to six and a quarter degrees at one time and brought back just to under six at the completion of the well.

Q What was the contract price per foot?

A Five seventy-five. The contractor would take the second well at seven and a quarter, he hoped. We also had lost circulation at the total depth, and in fact, set the pipe higher than we intended because of the lost circulation.

Q I notice your water bill is over $4,000.

A Yes, sir.

Q What was the reason that the water bill was so high?

A Lost circulation. When you start hauling water for lost circulation you run up a pretty good sized bill. It is also the reason for the mud bill being around $4,000.

Q So in large part, this additional expense of drilling a well was a lost circulation problem, wasn't it?

A To some extent. There is probably $6,000 or $7,000 reflected there in mud and water costs due to lost circulation.

Q Did you have any problem with the hole deviating from the vertical?

A Vertical, away from the surface.

Q That's the reason you kept such light weight on the bit?

A That's the reason we kept such light weight on the bit.

Incidently, the second hole we are drilling with cable tools, and we lost the first hole with cable tools because of differentiation, about 300 feet deep.

Q Is this a normal charge for a frac job in this area, $7,000?

A The net charge there is $7,122. We maybe fraced a little bit heavier because we had big open hole sections there, and we split our frac into two parts, which is not necessarily a common practice, and it cost us extra.

Q Drilling additional wells on this lease will reduce the cost of the tanks and separator somewhat, too, wouldn't it?

A Yes, sir. There is enough tankage there now to handle four wells, but although it does reduce the cost, by the same token, our footage price has gone up and I don't know that the net cost of the wells is going to be any less.

Q Do you have any indication yet whether this well will pay out or not?

A None whatsoever. We just have hopes.

MR. PORTER: Mr. Cooper, I know that you testified only as to cost of your particular well and not on any other aspects of this case, but I would like to ask you your opinion, from your observations and from the testimony previously presented here, in your opinion, will one well drain 80 acres efficiently?

A Of course, I have no evidence of my own. All I can do is form an opinion based on what I have heard. I don't think you

can definitely say, but I think there are indications that it will drain in excess of 80 acres.

MR. PORTER: Is your company a member of this engineering committee?

A We are a member as much as we can be. Since we have only three engineers and they are scattered pretty widely, we will cooperate in taking any well tests, over bottom hole pressure test, or any test in the field, but as for having a member in the committee, we will not have a member present at all meetings.

MR. PORTER: Thank you, sir.

MR. COOLEY: Mr. Cooper, my following remarks will be more in the nature of a statment directed to you and all other operators in this pool that have come to believe that there is a great deal of deviation trouble up there. I call your attention and all other operators in Verde-Gallup Oil Pool to Rule 111, which -- 111-A -- which states as follows: "When any well is drilled or deepened with rotary tools, tests to determine the deviation from the vertical shall be taken; when the deviation from the vertical in any 500 foot interval averages more than 5 degrees, a directional survey shall be filed with the Commission before any oil or gas from the well is sold so as to determine that the bottom of the hole is on the lease where the well is drilled."

MR. PORTER: Is there any further question of Mr. Cooper? The witness may be excused.

(Witness excused)

MR. PORTER: Do you have an exhibit?

MR. COOPER: Yes, if I could, I would like to introduce it.

MR. PORTER: Without objection this will be designated as Three States Exhibit No. 1 and will be admitted into the record. Anyone else have testimony to present in this case? Any statements? Mr. Buell.

MR. BUELL: I was simply going to say, Mr. Porter, that we will just let our testimony speak for our position, in the interest of saving time, and not make a statement.

MR. WEBB: May it please the Commission, I would like to reiterate just one or two points, and that is, that the testimony, I believe, has only been conclusive on very few matters that have been brought before this Commission. No. 1, that the topography of the area is extremely variable. No. 2, that the crooked hole and hole differentiation problems are extremely serious, and something that must be borne in mind in setting up any spacing pattern. I believe that all the testimony has shown that one well will, insofar as the information which is available at this time, drain 80-acres. The primary purpose of Pubco, and I believe the other applications in promulgating 80-acre spacing at this time, is the economic loss which might result should it be determined that less oil is in place than some of the operators who, I hope and believe and pray for, will be seriously affected, due to the extremely high cost of these wells. After wells are drilled, of course, the

fact speaks for itself that the wells cannot be undrilled until information is available to the operators and to the Commission which irrefutably points out that one well cannot drain more than 40-acres, in other words, that one well cannot drain as much as 40-acres. We earnestly solicit your indulgence for this one-year period so that the operators can assemble this data, which they are all earnestly trying to do, as has been indicated from the evidence given to this Commission of this Oil and Gas Engineering Committee. During that period, all of the operators have indicated, and I believe earnestly, that they will assemble data which will enable this Commission to enter a permanent order at the end of that time. It is not a moratorium on drilling or development or assembly of data, but only a moratorium on the drilling of unnecessary wells and the consequent economic waste that would result should it subsequently be found the fact that one well will drain and efficiently drain 80-acres. In this connection, we also would like to again reiterate our position that wells should be drilled on diagonal quarter-quarter sections within a governmental quarter section.

MR. SPANN: Mr. Porter, my name is Charles Spann, Albuquerque, New Mexico, Simms Building, representing El Paso Gas Products. El Paso has joined in the application of Pubco filed here, and we would like at this time to concur with the opinions given as to the advisability of the 80-acre spacing in this area and join in the recommendations that were made concerning that. In connection with the proposed Rules and Regulations, we feel that we cannot

agree with the Rules as submitted by Pubco except for Rule 3, and feel that in view of the topography of the area, Rule 3 should not be as restrictive as it is here posed, and in that connection, would recommend the Rule proposed by Aztec, as amended by Mr. Utz, in questions concerning the state-wide spacing Rules.

MR. DAVIS: Aztec Oil & Gas Company certainly concurs in the statements made by Mr. Spann on behalf of Pubco. The only thing we feel should be incorporated for this pool should be the flexibility factor we have been talking about. We do have a lot of concern about the topographical conditions and we feel that the 330 feet tolerance and the optional location wells will give us the flexibility.

MR. GRENIER: A. S. Grenier for Southern Union Gas Company. We have not presented any testimony at this time. We do, however, wish to go on record as supporting the recommendation for 80-acre spacing for a temporary one-year period, which the evidence in this case has already indicated is reasonably likely, in lieu of the committee and its activity under way to produce data, which by the end of that time can give us a firm grip or much firmer grip on the situation than we have now. We do strongly feel that, in the light of the terrain conditions existing here, that as much flexibility as possible should be given to the location of wells, but that, of course, in all instances possible, diagonal drilling within each quarter section is the most desirable pattern and one which we would expect to adhere either under the other lesser re-

commendations of Aztec or under the somewhat more stringent recommendations of Pubco. We would in any event, recommend tolerance of 330-acre feet instead of the 100 proposed by Pubco.

MR. KING: Lee King with Skelley Oil Company. We support the 80-acre temporary spacing as proposed by Pubco, and we also support the diagonal location of wells. We would urge this Commission to space wells on the center of 40-acres within 100 feet.

MR. PORTER: Anyone else have a statement? Anything further in this case?

MR. GREMIER: I would like to state that Southern Union is willing to participate actively and will participate in the gathering of data for the committee.

MR. COOPER: Three States, of course, requests the Commission to earnestly consider the 80-acre spacing, particularly in the view of the well costs, the uncertainty of reserve, and economic loss that can easily be sustained by the operator on 40-acres. As far as diagonal spacing or the flexible pattern is concerned, we have no objection to either or the 330 versus 100 feet we have no objection.

MR. PAYNE: Mr. Examiner, I have a statement here submitted by Standard Oil Company of Texas. The Standard Oil Company of Texas, an operator in the Verde-Gallup Pool, San Juan County, New Mexico concurs with the recommendations made by Pubco Petroleum Corporation to provide for 80-acre proration unit well spacing and Rules proposed in Case No. 1441, Signed R. H. Stewart, Standard

Oil Company of Texas.

MR. PORTER: Are those all the statements you have to read?

MR. PAYNE: Yes, sir.

MR. WEBB: May it please the Commission, I would like to add one thing that we, Pubco, and I believe I speak for all other operators, would like to thank the Commission for their kind indulgence when it accepted this case for hearing at this meeting. We stated that it would not take very long. However, it has taken a great deal longer than we had anticipated. On behalf of Pubco and all the other operators, we would like to thank you for your indulgence in time.

MR. PORTER: Thank you, sir. Nothing further. We will take it under advisement.

C E R T I F I C A T E

STATE OF NEW MEXICO)
)
COUNTY OF BERNALILLO)

I, J. A. TRUJILLO, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings, pages numbered 1 through 144 were reported by me in Stenotype at the time and place aforesaid; that the same was reduced to typewritten transcript by me and contains a true and correct record of said proceedings, to the best of my knowledge, skill and ability.

I FURTHER CERTIFY that I am not employed by or related to any attorney or party of interest in this matter; and, further, that I have no financial interest in the outcome thereof.

DATED this 9th day of June, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Joseph A. Trujillo
Notary Public

My Commission Expires:
October 5, 1960.