BEFORE THE
OIL CONSERVATION COMMISSION
STATE OF NEW MEXICO

Santa Fe, New Mexico.

June 19, 1952.

IN THE MATTER OF:

Case 363: (NW Nomenclature) Consideration of Sub-section (c) of this case was postponed to June 19 upon request of Benson & Montin in order that additional data might be compiled regarding the West Kutz-Pictured Cliffs Pool.

Case ~~377~~ 377: Benson & Montin's application for an order establishing uniform 320-acre spacing of gas wells drilled to the Pictured Cliffs formation of the Gallegos Unit Area and adjacent lands in Twps. 28 and 29 N, Rge. 12 and 13 W, San Juan County, New Mexico.

Cases No. 363 & 377 Consolidated

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TRANSCRIPT OF HEARING

MR. SPURRIER: Cases 363 and 377.

MR. REED: If the Commission please, Seth and Montgomery, Mr. Oliver Seth and Mr. Justin Reed appearing on behalf of Benson and Montin, the Applicant in Case 377.

I wanted to make a brief statement of the case to the Commission, since it does involve some possibility of misconception. First, the applicant is here concerned only with the lands embraced within the Gallegos Canyon Unit Area and lands adjacent

to it on the Northwest, which have been included in the application. The applicant doesn't intend, by this hearing, to effect or be effected by any other spacing determination in any other pool. Although certain references may be made to the Fulcher-Kutz Pool, these will be only for purposes of illustration and comparison. There is no intention to draw any support from, or to detract from, any determination that has been made for these other pools.

We feel that our case is one that is sufficiently strong to stand on its own feet and support 320-acre spacing for this portion of the common source of supply of gas wells in the Picture Cliffs Formation. First of all, we expect to be able to show that the lands covered by the application, together with the present West Kutz Pool which has recently been established, embrace a common source of supply of gas in the Pictured Cliffs formation and that this source of supply is a separate pool from the Fulcher-Kutz Pool. This actually removes any conflict between Case 377 and Case 363 C. However, in order to avoid any difficulty and any misconception, we have protested 363 C up to this point, because we felt it would be wisest, from the Commissions standpoint, to consider the cases together.

Second, we expect to show that there are compelling reasons for having 320-acre spacing in the portion of this common source of supply covered by the application. First, because one well will effectively and economically drain 320 acres, and second,

because any denser drilling would be economically unfeasible and would result in waste. Third, we hope to show that although the Southern portion of this common source of supply, and that is the present West Kutz Pool, has been developed on 160-acre spacing that it is convenient and practical to break the spacing in this common source of supply along the Southern line of the Gallegos Canyon Unit, and to have 320-acre spacing in the Northwestern portion of the Pool. We will show that in order to insure uniform spacing and to protect correlative rights, that the well should be located on the Southwest and Northeast quarters of the governmental sections, with only such exemptions as are necessary for existing wells and future wells on good cause shown and whatever offsets may be necessary.

I would like to call Mr. Greer now as a witness.

ALBERT R. GREER,

having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. REED:

Q State your name, please.

A Albert R. Greer.

Q Mr. Greer, would you state briefly your qualifications as an expert in this case?

A I was graduated from New Mexico School of Mines in 1943.

MR. SPURRIER: Mr. Greer, weren't you qualified before this Commission before?

A I have testified before.

MR. SPURRIER: His qualifications are accepted.

Q Have you had considerable experience in making reservoir engineering studies?

A Yes, I have. Part of my experience was spent with Anderson Prichard Oil Corporation, a period of about three years, two years of which I did almost exclusively reservoir engineering work.

Q What is your present position?

A At present, I am employed by Benson and Montin as File Superintendent for their operations in the San Juan Basin.

Q Does Benson and Montin own acreage within the Gallegos Canyon Unit Area?

A Benson and Montin owns a substantial part of the acreage within the unit and a few thousand acres outside the unit.

Q That is covered by this application?

A Which is covered by this application.

Q They are the operators for the Gallegos Canyon Unit?

A Benson and Montin are the operators for the Gallegos Canyon unit.

Q Have you made a reservoir engineering study of this reservoir lying under the lands covered by the application?

A I have made a very careful and detailed study of this particular reservoir. In fact when we initially set up our program of exploration in this area, we went to great pains to

make it possible to obtain all reservoir information that was, that could practicably be obtained.

Q What was the purpose for doing that?

A Our initial purpose in wanting this unusually large amount of reservoir information was in order to support a pipe line into our area, which at that time we were quite concerned with, because the present demand for gas in the San Juan Basin did not exist and we were, or we felt that it would be necessary to support a rather large reserve in order to bring the pipe line into the unit.

Q Over what period of time has this study been made?

A The study itself commenced when we began drilling wells, in August of 1951.

Q Mr. Greer, have you prepared a paper showing the lands covered by the application and the present West Kutz Pool and the Fulcher Kutz Pool?

A I have.

(Exhibit No. 1 marked, for identification.)

Q I hand you Exhibit 1 in the Case and ask you if that is the map that you prepared?

A This is a map that I prepared covering the Gallegos Canyon Area and the adjoining fields.

Q Would you explain to the Commission what this map covers and what the colored designations are, Mr. Greer?

A I set out on this map the Kutz Canyon-Fulcher Basin Field approximately as defined by the Commissions present orders, also the West Kutz Field.

Q The Fulcher Kutz is colored in brown?

A The Fulcher Kutz is colored in brown. The West Kutz Field we have colored in green and is about as the Commissions orders now have it defined, plus two additional sections we have colored in to bring this area up to join the unit boundary. Then we have colored the Gallegos Canyon Unit Area in yellow and an area to the Northwest of the Gallegos Canyon Unit which is covered by this application is colored in blue.

Q The lands covered by the application are the lands designated in yellow and blue on the map?

A That is correct.

Q In your opinion, Mr. Greer, do the lands covered by this application embrace a common source of supply of gas in the Pictured Cliffs Formation with the lands in the West Kutz Field designated green?

A From my study of the area, I have determined that the area colored in green and in yellow and probably in blue cover one common source of supply.

Q In your opinion, is this common source of supply separate from that of the Fulcher Kutz Pool which is colored in brown?

A It is definitely a separate source of supply from the old original Kutz Canyon Basin Field.

Q What is the basis for that opinion?

A We have found, in the drilling of wells between the Gallegos Canyon Area and the Kutz Canyon-Fulcher Basin Area, that there exists a belt of low permeability sands which effectively separate these two pools. From core analysis and electric log information and productivity of the wells drilled within this belt, which we have cross hatched, we can definitely say that this zone contains sand that carries a high connate water content, a considerably lower permeability than in either Kutz Canyon or Fulcher Basin, and as such has effectively prevented the equalization of pressures between the two pools over these millions of years in which there has been adequate time for pressures to equalize.

Q If there had been communication, you mean?

A If the communication had been adequate it certainly, the two pools certainly would have had an equalized pressure when they were initially discovered.

Q There is no reason to expect that pressures will equalize in the next few years, then?

A We feel that if the pressure,- let me change that. We feel that if the communication has been so poor that pressures did not equalize within one hundred pounds over a period of millions of years, that the communication will still be so poor over the next 20 or 30 years that there will not be drainage between , or from, one pool to the other.

Q There are certain dry holes along the fringes of that low permeable sand?

A Yes, there are several dry holes that have been drilled which confirm our thinking in this respect. These wells are Potash No. 2 Pipkin in Section 35, 28 North, 11 West. Another well is Frontier No. 10 Bolack in Section 427 North, 11 West. Another is Benson-Montin No. 2 Gallegos Canyon Unit in Section 35, in 29 North, 12 West. Another is Birfros No. 1 Mattix in Section 24, 30 North and 13 West. Another is Western Natural No. 1 Bolack in Section 2 in 27 North and 11 West. Another is Wichinger No. 1 Crawford in Section 31 in 29 North and 11 West.

Each of these wells in which production was attempted by setting casing and ordinary completion methods, found very little, if any, gas, and if the wells were shot, they produced a substantial amount of water. The water, of course, being the high almost immobile interstitial water which we normally find in sands of extremely low permeability.

MR. REED: I would like to introduce Applicant's Exhibit No. 1 in evidence at this time.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 1 received in evidence.)

Q Did you have something further on that?

A Yes, I have a little more information. In regard to the pressure data to which I referred, which establishes definitely that we have two different sources of supply, the initial

pressure in the Kutz Canyon-Fulcher Basin Field was on the order of 575 to 580 pounds. That pressure existed over a distance of about 15 miles in which the pressures were equalized within just a few pounds. We have found the same situation in Gallegos Canyon-West Kutz Area, in which over approximately the same distance of about 15 miles, pressures have equalized within just a few pounds or 465 to 468 pounds. The only variation from this pressure, which we have found in each of the wells, is that as we approach these belts of low permeability there appears to exist a sort of transition in which the pressure commences its increase across the impermeable barrier from one source of supply to the other. We feel that the same will probably be found true in the Southeast part of Kutz Canyon Field.

Q So there has been pressure equalization in the two pools from Northwest to Southeast, but no pressure equalization between the two pools from Southeast to Northwest, which is the shorter distance than the overall length?

A A pressure equalization of a few pounds, say, over a distance of 15 miles and yet a difference in pressure of 100 pounds or closer to 120 pounds over a distance of only one or two miles across this impermeable barrier.

Q Mr. Greer, to your knowledge, has there ever been any testimony presented to the Commission in any other case relating to the spacing of gas wells in the Pictured Cliffs formation in the lands covered by the application, either the West Kutz or

Gallegos Canyon Area?

A To my knowledge there has been no evidence presented in support of any spacing pattern in this common source of supply for which our application covers part.

Q How many gas wells have been drilled to the Pictured Cliffs Sands in this area?

A We have drilled 7 wells within the Gallegos Canyon Unit. In the West Kutz Field there has been approximately --

Q (Interrupting) I am referring only to the land covered by the application. Have there been any other companies that have drilled wells in that area?

A Bay Petroleum Company, Corporation has drilled a well in Section 26 in 19 North and 13 West.

Q Are those wells located as indicated in the application, which we have filed a copy of, which I show you?

A Yes, and there is one other well, Lot No. 1 Graham, one mile North of the Bay well, which I believe has been completed this last week.

Q What is the status of these wells as to their production?

A Three of the wells within the Gallegos Canyon Unit are producing. Two of the wells completed in the Pictured Cliffs are shut in, waiting on pipeline. Bay's well is shut in, waiting on pipeline, and Lot No. 1 Graham is either abandoned or temporarily abandoned in the Pictured Cliffs, I believe they are attempting to complete it in the Fruitland.

Q Of these wells how many have been cored?

A Of the seven wells which Benson and Montin drilled, in the Gallegos Canyon unit to the Pictured Cliffs Sand, five of them were cored. We had excellent recoveries on the whole and as a result we have an unusually large amount of core information covering the Gallegos Canyon Unit.

Q Could you state to the Commission which of the wells listed in the application were the ones that were cored?

A Benson and Montin Number 2, Gallegos Canyon Unit, Number 3, Number 4, Number 5, and Number 7.

Q Do you have any information as to whether the Bay or the Locke's well have been cored?

A Bay's well was cored. Locke's well was not cored.

Q What type of core analysis was made on the Benson and Montin wells?

A We had two types of core analyses made, both by Core Laboratories of Dallas. The analyses were run in their Farmington Laboratory and in their Worland, Wyoming, Laberatory. In each well we took several samples and had what we commonly term, conventional core analyses prepared, and then from all the rest of the core we had special analyses run. I might explain the difference in the conventional analyses and special analyses.

Q Go ahead.

A In conventional analysis, a small sample is taken from the core and run, which small sample is on the order of two or

three inches, whereas, in special analysis the entire core section is analyzed, and of course, gives a better average figure for the characteristics of the core. We have found, and later confirmed with Core Laboratories, that in sands which have a high clay content, such as we have found in this area, that the conventional analyses tends to give an erroneously large porosity. In order to obtain an accurate figure for this porosity we have, therefore, had the special analyses run, which eliminates the error.

In our area the error approximates 4 to 5% of porosity difference. In other words, if the conventional analysis shows 25% porosity the true effective porosity is on the order of 20%.

(Marked Applicant's Exhibit No. 2, for identification.)

Q I hand you Applicant's Exhibit 2 and ask you to state to the Commission what that is?

A Exhibit 2 contains copies of all of the core analyses by the conventional and special analysis method, which were run by Core Laboratories, and which covers Gallegos Canyon Unit wells Nos. 2, 3, 4, 5 and 7.

MR. REED: I offer Exhibit 2 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 2 received in evidence.)

Q Has any other production research been run on the wells drilled by Benson and Montin?

A We had Core Laboratories make a special additional study covering characteristics of the Pictured Cliffs Sands, which information is in addition to the regular core analyses.

(Marked Applicant's Exhibit No. 3, for identification.)

Q I hand you Exhibit 3 and ask if that is the report of that additional production research?

A This is a copy of the production research tests made by Core Laboratories, for us, covering these particular wells.

Q What do those tests consist of?

A One of the tests which we were especially interested in was capillary pressure measurements. In order to give us a separate method of estimating the formation of water content in addition to the information shown by the cores, in the last few years work done with capillary pressure measurements of core samples have indicated that on the whole, excellent results can be obtained and that connate water content can be estimated rather closely from these capillary pressure tests.

In addition, we desired to have still another method of estimating the connate water content, so we had Core Laboratories run resistivities of the cores and analyses of the formation water. From the electrical resistivity of the core samples, the resistivity of the connate water and the characteristics shown by the electric logs, we have then a third method, whereby we can estimate the connate water content.

Core Laboratories determined these core resistivities and

water resistivities in order that we might make this calculation. In addition, they went into some detail to explain the conventional core analysis and special core analysis and the reasons why one method is more accurate than the other for the measurement of porosity, which is the special analysis, and also why the conventional analysis is more accurate for the measurement of permeability.

MR. REED: I offer Exhibit No. 3 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 3 received in evidence.)

Q Has any temperature and formation water analysis been made for any of the wells?

A For most of the wells we were able to obtain samples of formation water, which we had analyzed and also temperature surveys.

(Marked Applicant's Exhibit No. 4, for identification.)

Q I hand you Applicant's Exhibit 4 and ask you if that shows the results of those analyses?

A Exhibit 4 shows reservoir temperature in each of the wells and sodium chloride content of the formation water as determined by Core Laboratories, and also the chloride content of the formation water as determined by Core Laboratories.

MR. REED: I offer Applicant's Exhibit 4 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 4 received in evidence.)

Q Has any electrical log surveys been made on any of the wells?

A We ran electrical log surveys on four of the wells completed in the Pictured Cliffs Sands.

(Marked Applicant's Exhibit No. 5, for identification.)

Q I hand you Exhibit 5, and ask you if that is a copy of those logs?

A Exhibit 5 is a copy of electrical logs run through the Pictured Cliffs formation on Gallegos Canyon Unit Wells No. 3, 4, 5 and 7.

Q Would you explain to the Commission what the attached paper is on each of those logs?

A We have taken the information determined in the laboratory as to formation, resistivity of the core samples and the resistivity of the formation water and then from the electrical log we can determine the resistivity of the formation as measured in the well, and from these factors, we can estimate the connate water content.

This method of calculation was initially developed by Mr. Archie of the Shell Oil Company, and has received increasing acceptance over the last few years as an excellent method of estimating the connate water content where it is possible to obtain information as to the resistivity of the formation water

and resistivity of the formation itself. We have these figures from Core Laboratories analyses and, therefore, feel that we have reasonably accurate methods of estimating the connate water.

MR. REED: Offer Exhibit 5 -- Go ahead.

A (Interrupting) I would like to point out in particular Gallegos Canyon Unit No. 5, in which it is evidenced that there is a marked change in the resistivity characteristics between the upper and lower parts of the sand. In this particular well we found about 80 or 90 feet of Pictured Cliffs sand. All of this sand showed porosity and might have been interpreted to be productive. However, from this electrical log we can determine that the connate water contents in the upper part of the sand is only about 50%. We calculate 49.6%, whereas in the bottom of the sand the formation water content from our electrical log calculations would be approximately 81%, which is too high connate water content to allow commercial production. That section, if it produced anything, would probably produce just water, In the completion of this well, we plugged off this lower section, which is interpreted to be water production. A similar calculation was made for No. 7, showing the difference in connate water content of 34% in the upper part of the sand and 78.8 percent in the bottom part. Incidentally, on No. 7 it is quite apparent from this electrical log and the connate water content information that, although we had about 100 feet of Pictured Cliffs sand, only about 30 feet of it is gas productive.

I should point out one more thing, and that is, in running the electric logs we had micro-logs run which confirms the core analyses and confirms our other estimates of net pay thickness, as distinguished by the micro-log.

MR. REED: I would like to offer Exhibit 5 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 5 received in evidence.)

MR. SPURRIER: Let's take a five minute break.

(Recess)

MR. SPURRIER: You may proceed, Mr. Greer.

(Marked Applicant's Exhibit No. 6, for identification.)

Q I hand you Applicant's Exhibit 6. Would you state what that is, please?

A Exhibit No. 6 shows a comparison of electrical log data with a gas increase log of two wells which were drilled quite close together. This information gave us a method of confirming our calculations made by electrical log data.

Q How were these tests made?

A The well on the left hand side of the exhibit is Benson Montin No. 8, which was drilled through the Pictured Cliffs sand, and completed in the Dakato formation. We then drilled a well to the Pictured Cliffs Sand about 300 feet from No. 8. Those wells then are quite close together and we feel that the sand characteristics are probably nearly identical in one well as

compared to the other. We have shown by the green coloring the total thickness of the Pictured Cliffs Sand in this particular well, which is approximately 115 feet. The part of the sand that we calculated to be productive is colored in yellow. This we would determine from our electrical log analysis and just in general, I would like to point out that this well was drilled with clear water, and this water was on the Pictured Cliffs formation for several weeks, while the well was drilled all the way to the Dakato sand. For that reason, there has been some invasion of fresh water into the sand and has, therefore, influenced the exact amount of the resistivity of the formation. But in general the characteristics of the resistivity are quite different from the upper part of the sand, as compared with the lower part.

In confirming this calculation, when we drilled well No. 6, which is shown on the right hand side of this exhibit, we measured the increase in gas production as we drilled the sand. In order to do this we set pipe on top of the Pictured Cliffs sand, I say on top, it was about 5 feet into the sand, moved the rotary off and drilled a well in with cable tools. Every few feet we would shut down and measure the amount of gas. By the amount of increase as we penetrated the formation, we were able to tell how long we encountered productive sand. This distance is shown by the red coloring and it can be seen after about 30 feet of penetration below the pipe the gas quit increasing.

It happened at that particular point that one of the, because of difficulties with the rig, it was shut down for 40 hours. When we resumed drilling we made a bailing test to determine how much water had filled up in the hole at the end of the 40 hours, and we found the bailer perfectly dry. There was not a drop of water being produced when our total depth was about 1466. We drilled a few more feet and found no increase in gas production, and then, at about a depth of approximately 1475 to 80 we shut down for another 12 hour bailing test to be sure that we had not picked up any water, but at this point we found that the well had commenced to make water and we made a test at that time, in order to determine the amount, which as I recall was approximately 2 gallons an hour.

This we consider to be positive evidence that we had passed through the productive part of the sand. Just the fact that the gas failed to increase, of course, we might consider negative evidence, but the factthat we picked up water definitely confirms the fact that we had drilled through the gas pay and went into non-productive formation. Therefore, although there is 115 feet of Pictured Cliffs sand which is porous in this particular area, we are convinced that there is only about 40 feet of productive sand.

MR. REED: I offer Applicant's Exhibit No. 6 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 6 received in evidence.)

(Marked Applicant's Exhibit No. 7, for identification.)

Q I hand you Exhibit 7 and ask you to state what that is?

A Exhibit 7 is a similar type of gas increase log which was made for Well No. 1. We had initially proposed to core this well and have similar information on it, as our other wells as were cored, but the Farmington sand blew out at about 500 feet, and it was necessary to carry heavy mud, and because of that we gave up our plan to core the well and set pipe on top of the sand and drilled it in with cable tools, and in so doing, we were able to determine the rate of increase in gas production as we drilled this well.

Q What does that show in comparison to the other well that was drilled with cable tools?

A This shows that in this particulat well we had approximately 15 feet of productive sand below the casing and there was possibly four or five feet of sand above the shoe, which gives us about 20 feet of sand in this particular well. This was our first well in the area. It has been customary practice throughout both Kutz Canyon-Fulcher Basin and the West Kutz area, as it had been developed at that time to drill the entire section of Pictured Cliffs formation and shoot it in, completing the well. We followed this standard practice on this particular well, although we felt that the section which we could shoot, which would be from around ten feet below the pipe, would probably be the section that was not productive. We, therefore,

tested this well for two or three days after shot in order to see if the increase in gas production as a result of the shot would hold up. It did not. In our mind, in my mind this shows that the lower section, since it did not increase after the shot, is not gas productive. The only production that we can expect from this particular well must come from the upper 15 or 20 feet of sand, which was too close to the pipe to effectively shoot it.

MR. REED: I offer Exhibit No. 7 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 7 received in evidence.)

(Marked Applicant's Exhibit No. 8, for identification.)

Q I hand you Applicant's Exhibit 8 and ask you to state what that is?

A Exhibit 8 is a summary of our calculation of connate water content. As I indicated before, we estimated the connate water content from three separate and distinct methods. One of them was from a special core analysis, another was from electrical log data plus resistivity measurement of the sand and formation water, and the third method was by capillary pressure measurements.

We would like to point out that in estimating the connate water by special core analysis, that the total waters measured by Core Laboratories showed a content in excess of 60 percent. We felt that there was a possibility that in coring this particular

sand with its high shale content, that it might have picked up some filtrate from the drilling mud, which would give us a higher water content than actually existed in the formation. Core Laboratories has done a lot of work in estimating or in calculating the true formation water content from the total amount of water which they measure in their laboratories. This has been determined from quite a lot of experience, which they have had, with a number of sands in the past.

They have pointed out, however, that with shaley sands, that their method might not be as accurate as is ordinarily found for sands that are relatively clean. We have deviated a little from a conservative standpoint, which we think, engineers should be conservative in estimating the considerably lower connate water content than is indicated by the core analyses themselves.

We have estimated that by calculating how much the formation water in the cores was diluted as a result of the mud filtrate entering the core while the well was cored. As an example of how we calculated that, we know the formation water to have a chloride content on the order of 34,000 parts per million. This we determined by actually measuring some of the water produced from the wells. In analyzing the core, Core Laboratory ran chlorides for us throughout the section cored, from individual samples of the cores. The chloride content shown by their calculations was approximately 20,000 parts per

million on two of the wells, and around 28,000 parts per million on another of the wells. We, therefore, reduced the total water shown by the Core Lab. analysis by the ratio of 20,000 to 34,000 or, 28,000 to 34,000, whichever the case might be, in order to arrive at total water content within the core sample corrected for this filtration of water from our mud. We feel that gives a minimum water content that we can possibly estimate from the core analyses. The summary of that is about 50.3% as an average from four of the wells.

Our electric log data showed an average connate water content of 46.6%. The separate capillary pressure showed connate of 53.6. The average of these three is 50.1% connate water content. The overall averages all agree within a few percent. We feel that we have a very reasonable figure for connate water from these particular wells, as a result of this rather extensive research work we have done.

MR. REED: I offer Exhibit 8 in evidence.

MR. SPURRIER: Without objection it will be received.

MR. REED: Our next item is a general summary and conclusion of some of the reservoir characteristics. It would probably take sometime to present it completely. I wonder if it would be helpful to break now and meet earlier this afternoon.

MR. SPURRIER: We will recess until 1:30.

(NOON RECESS)

AFTERNOON SESSION

MR. SPURRIER: The meeting will come to order, please. Mr. Greer.

DIRECT EXAMINATION
(Continued)

By MR. REED:

Q You are the same Mr. Greer that testified this morning?

A Yes, sir.

Q Mr. Greer, as a result of the study that has been made in the data that has been compiled, concerning the reservoir under the lands involved in the application, what are your conclusions as to the porosity, permeability, connate water and thickness of the pay, and other reservoir characteristics?

A We have summarized most of the reservoir characteristics and have set them out on an Exhibit.

(Marked Applicant's Exhibit No. 9, for identification.)

Q I hand you Exhibit No. 9 and ask you to identify that, and just tell what it shows.

A Exhibit No. 9 shows certain reservoir characteristics which we found from our study of the pay thickness, the porosity, the permeability and the connate water content for the Pictured Cliffs formation in each of these wells that we cored.

Q What are your conclusions as to those characteristics?

A Four of the wells, on four of the wells we have what

we consider excellent information and from those four, we have drawn average values for the reservoir characteristics and those averages are, for net pay thickness-40½ feet, porosity - 18%, connate water - 50.1%. The average permeability was 5.9 millidarcys.

From this information we can determine the total volume of gas in place, per acre foot and also, the recoverable gas to an abandonment pressure we estimate to be 150 pounds. We have also estimated the reserves recoverable to an operating line pressure of 250 pounds. These figures are total gas in place, 137,000 cubic feet per acre foot. Recoverable to 150 pounds, 95.5000 cubic feet per acre foot, and recoverable to 250 pound line pressure, 65,000 cubic feet per acre foot.

Q What is the basis for your estimate of the abandonment pressure?

A We have two ways of making estimates of abandonment pressure. One is that as the reservoir pressure declines the wells productivity decline, and at some point, which we estimate to be around 150 pounds, the productivity of the wells will be so low as to be uneconomic to produce them.

The other factor determining abandonment pressure is that line pressure at which we can lift the water which accumulates in the bottom of the hole, through the tubing and so unload the well as to allow the gas to produce. Now, just what pressure it will take to lift the water through the tubing will vary a

little from one well to another. But it's going to be on an order of 50 to 100 pounds. Therefore, when we operate with a line pressure of, say, 50 pounds or 100 pounds, we may have to shut the well in, let the pressure build up before we can unload the water out of the well. When we reach a point as the pressure declines, that we can't lift the water out of the well, that will define our abandonment pressure.

Q Which you estimate now at 150 --

A (Interrupting) Which we estimate to be on the order of 150 pounds.

Q What is the basis for your figure of 250 pounds line pressure?

A That is approximately the line pressure at which the wells are now being operated. On our particular wells it has varied from around 225 pounds to about 250 pounds.

In the old Fulcher Basin Field, the area farther east from the compressor station, the line pressure has been on the order of 250 to 300 pounds for a period of approximately ten years. We presume at sometime the gas company will lower the line pressure, but we don't know when. In our area we also hope that the operating line pressure will be lowered in time, but we have no definite means of knowing when it will be lowered and, of course, the gas contracts that are written do not set out a definite time at which this pressure will be lowered. So, all that we can do is estimate our recoverable reserves at this time

on the basis of ten years, on the basis of 250 pounds operating line pressure. For that reason we consider 65,000 cubic feet per acre foot a reasonable figure at which to base the pay out of the well.

I would like to go a little further with our reserve figuring that the line pressure will eventually be lowered to 150 pounds. We will ultimately recover about 95½ MCF per acre foot, which for 40½ feet of pay is about 3,850,000 cubic feet per acre. That is a, we feel, a quite reliable figure. We have behind it all of our reservoir work, our net pay thickness, porosity and connate water and reservoir pressure, which we can measure quite accurately, and we feel that that figure is more accurate than can ordinarily be obtained in gas fields.

Now, the productivity of the wells that we have now completed indicate a capacity to produce into the line of about 550,000 cubic feet per day, which is on the order of 16,000,000 cubic feet per month. Now, with the reserve of 3,850,000 cubic feet per acre and a productivity into the line of 16,600,000 cubic feet per month, our wells will produce into the line at a rate which will deplete about 4 3/10 acres per month of ultimately recoverable reserves, or about 52 acres per year. That is a, that indicates a relatively high capacity to produce as compared to reserves. That is a figure that we think is important. 52 acres a year initial deliverability into the line, when we talk about 160-acre spacing is almost ridiculous.

Q As the area is drilled up that rate of production will, of course, drop off it, will it not?

A That is true. The closer the spacing, the faster the pressure will drop off, and the faster the rate of production will accordingly drop off.

MR. SPURRIER: Mr. Greer, do you mean 52 acres per well?

A Yes, 52 acres per well, per year.

MR. REED: I would like to offer into evidence at this time, Exhibit No. 9.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 9 received in evidence.)

Q From the study you have made, in your opinion, Mr. Greer, will one well on the acreage covered by the application efficiently and economically drain 320 acres of land over the gas supply in the Pictured Cliffs formation?

A From the work we have done in regard to drainage, we feel that one well will efficiently drain even more than 320 acres. We have work that evidences at least 640 acres efficient drainage per well.

Q Are there any examples in your production history that tend to support this conclusion?

A We have an example in regard to drainage which reflects a decline in pressure for a well drilled in an area after production had been started on offsetting wells.

(Marked Applicant's Exhibit No. 10, for identification.)

Q I hand you Exhibit 10 and ask you if that shows the well and the offset?

A Exhibit No. 10 is a plat of the area showing the unit in the West Kutz Field and colored in yellow on this exhibit is an area on which we have excellent reservoir pressure information, and in which four wells were drilled and completed last year and shut in pressure tests taken on those wells, and then they were tied into the line and commenced producing in January. Then in the month of May, the well indicated by the red circle, which is Hancock No. 11, Hancock in Section 3 and 27 North, 12 West was completed, this well shows a pressure which is approximately 20 pounds less than the initial pressures of the other wells, which were drilled before production was started in this area.

I would like to give you those exact figures. In Section 2, Danube No. 1, Harmon was completed in August of 1951 at initial shut in pressure of 466 pounds. Harmon No. 2 had an initial pressure of 461 pounds. Then in Section 3, Danube Thompson No. 3 had a shut in pressure of 463 pounds. Then in Section 34, in 28 North, 12 West, Benson and Montin No. 4, Gallegos Canyon Unit had initial pressure of 464 pounds. These four wells were drilled on three sides of the Hancock No. 11, and definitely established the initial reservoir pressure in that area.

They are all within one or two pounds of 465 pounds, with the exception of Harmon No. 2, which is off four pounds from that. Those shut in pressures were taken by representative of El Paso Natural Gas Company with a dead weight tester, were witnessed by a representative of the Conservation Commission and myself. The pressure on Hancock No. 11, I took it perscnally with a dead weight tester and, are as follows:

On May 26th, after shut in nine days, the well showed pressure of 444 pounds. This was a spring gauge 444 pounds.

On June 3rd, after shut in 17 days, it showed 443 pounds on my spring gauge. I assumed from that that the well had probably built up to a maximum and from that point on continued taking pressure tests with a dead weight tester.

On June 7th, after shut in 21 days, the pressure was 446½ pounds.

On June 8th, shut in 22 days, 446½ pounds.

June 11th, shut in 25 days, it was 446½ pounds.

That is a pressure decrease from virgin pressure of about 18 or 20 pounds. This definitely indicates that in the brief period of 4 or 5 months production from offset wells, that the gas under this particular tract had been efficiently drained, and in fact, something on the order of 6 or 7 percent of the reserves have already been produced out from under that tract before the well was completed. We feel that these are representative pressures for that particular well for two reasons. One is the well had a good initial productivity, over a million cubic

feet per day natural. After shot, shows a productivity on the order of 3,000,000 feet. A well with this capacity will ordinarily build up quite rapidly as long as there has not been a lot of production taken from the well. It was open only a short time after shot, approximately two or three days, and for a well of that capacity and under those conditions, we would anticipate a maximum pressure within four or five days. We feel this evidence is conclusive that the offsetting wells drained a distance, approximating, a half mile from each well, which is a total drainage area on the order of 600 acres per well.

MR. REED: We would like to offer Exhibit 10 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 10 received in evidence.)

(Marked Applicant's Exhibit No. 11, for identification.)

Q Mr. Greer, I hand you Exhibit 11 and ask you to identify that?

A Exhibit 11 shows the estimated future production rate and cumulative production expressed in terms of income, which we can anticipate from an average well drilled in the Gallegos Canyon Unit on 160-acre spacing. That calculation is based primarily on the information which we have developed in regard to reserves. The accuracy of that calculation will be directly proportional to the accuracy of our reserve estimates, and we feel that they are quite accurate.

Q What does the graph show?

A For one thing, it shows that with wells drilled so close together and with the capacity to produce, which is so high in comparison to the reserves, that the production rate will decline quite rapidly.

Q By so close together, you mean on 160-acre spacing?

A I mean on 160-acres. With an initial deliverability into the line of 5,060 cubic feet per day per well. We would anticipate that the production rate would be down to 3,000 cubic feet per day. At the end of five years it would be on the order of 50,000 cubic feet per day, approximately one-tenth the initial deliverability in the line. At the end of ten years the cumulative income for one well would be about 22 or 3 thousand. It costs approximately $17,000.00 per well to drill and complete wells in this area. We anticipate in operating cost a minimum of $25.00 per well per month, which is $300.00 a year or $3,000.00 in ten years. So, at the end of ten years we would have invested, in an average well, $17,000.00 building and development cost, $3,000.00 operating expenses, for a total of $20,000.00. This does not include the cost of the leases initially. It is quite definite that we cannot economically afford to drill wells under this type of spacing pattern.

I would like to point out that this calculation, that this type of calculation has been developed over a number of years subsequent to the initial back pressure testing, which was in-

augerated by the Bureau of Mines. It has become generally accepted by the industry as a method of projecting production histories of gas wells. We feel quite confident in our predicted production performance as set out on this graph.

I would like to add, that the total factors that we have used in constructing this graph are the reserves, which we have previously gone over, plus back pressure test information. Now, in taking back pressure tests on wells we have two experimental constants that have to be determined for the particular wells. One of them can be determined quite accurately by production into the line. The other constant has been determined over a number of years to be quite consistent for gas wells and varies from a factor of around five or six tenths, up to about one. The theoretical value for that factor would be very nearly one.

In our back pressure tests of wells in this area we have found that factor to be within approximately ten percent of one, and have used a factor of one in making our calculation. We anticipate that the production history will very closely parallel this rate as set out here. There is only one thing that could effect the shape of that production curve, and that would be, if the wells are drilled, say, in one end of the unit, only such that they could drain the entire unit for the distance of the mile or three or four miles, then this production curve would flatten out and the production rate would not drop off so fast. The reason being that the wells would be producing gas from

tracts outlying their own 160-acre units. That sort of thing has happened in the old Kutz-Canyon-Fulcher Basin thing in the past and has caused a great deal of misconception in the productivity of the Pictured Cliffs well.

MR. REED: I would like to offer Exhibit 11 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 11 received in evidence.)

Q Mr. Green, is there any production history in the Fulcher Kutz Basin that does not have these wells that draw from other areas and which might support such a production curve as a matter of experience?

A There is only one area in the entire Fulcher Basin-Kutz Canyon Field that we feel wells have produced gas only from their individual tracts and have not received drainage from outlying areas.

(Marked Applicant's Exhibit No. 12, for identification.)

Q I hand you Exhibit 12 and ask if that shows where the wells are located?

A Exhibit 12 is another plat of this area on which, colored in yellow, is a small area covering a group of wells which have produced gas from under this one particular area, and probably have not drained gas from any other part of the field.

The way we know that to be true is from the development of the field. Initial development in the Kutz-Canyon-Fulcher Basin Field is in the approximate center of the field as it is now

defined. The production was gradually extended to the Southeast from the old Kutz Canyon Field and a discovery well, I believe around 1938, was drilled in the Fulcher Basin Field. From those two points, production was moved out by approximately offset locations in both directions, Northeast and Southwest. In the course of this development, one operator stepped out about two or three miles from nearest production and drilled a well, BMNS No. 1 Waggoner, in this area colored in yellow. That area was immediately drilled up and the area Southeast of it was in field at a rapid drilling rate, such that there was no possibility for this area colored in yellow to drain gas from the old field to the Southeast. Likewise, the limits of the field were determined from the Northwest, which prevented migration into that yellow area.

Now, the average density of development in this particular area, colored in yellow, would approximate 120 or 130 acres per well. There were six wells drilled on one section, two wells drilled on another half section, and then all of these wells had probably been draining part of the section that lies to the Southwest. There is an area that the wells had to produce the gas that underlaid their tracts only, and that is all the gas they could produce. In such a condition we can predict the production performance of wells and would anticipate a curve somewhat similar to the one we have calculated for Gallegos Canyon Unit.

Q You are referring there to Exhibit 11?

A Yes, it would be similar to our Exhibit 11.

MR. REED: I offer Exhibit 12 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 12 received in evidence.)

(Marked Applicant's Exhibits Nos. 13 and 14, for identification.)

Q I hand you Exhibit 13 and ask you to state what it shows?

A Exhibit 13 shows the production history of a discovery well in this area colored in yellow, which we have just described. I don't believe I identified that by section. Let's put that into the record. This area colored in yellow covers Section 29, part of Section 30, part of Section 31 and the North half of Section 32 in Township 30 North, Range 12 West, all in the Northwest part of the Fulcher Basin Field.

Exhibit 13 shows the production history of the discovery well in that area. As can be seen from this curve, the scales being the same as our Exhibit No. 11, there is a close similarity in production performance of this discovery well in what we calculate to be the production performance on 160-acre spacing in Gallegos Canyon there.

MR. REED: I offer Exhibit 13 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 13 received in evidence.)

Q I hand you Exhibit 14 and ask you to state what that is, please?

A Exhibit 14 shows the average production history of the nine wells in this particular area. We prepared this production history to be certain that the discovery well which we choose as an example, was not an unusual well and that its performance was not comparable to average performance of all the wells. It is apparent, by comparing the two curves, that they are quite similar.

MR. REED: I offer Exhibit 14 in evidence.

MR. SPURRIER: Without objection it will be received.

Q Mr. Greer, did you prepare any projected production history plat for the Gallegos Canyon Unit Area based on 320-acre spacing?

A I have.

(Marked Applicant's Exhibit No. 15, for identification.)

Q I hand you Exhibit 15 and ask you if that is such a plat?

A Exhibit 15 is a production history calculated by me, for 320-acre spacing in the Gallegos Canyon unit.

Q What does it show in comparison with --

A (Interrupting) It shows on 320 acres the rate of production decline will be considerably less and that the cumulative income will be proportionately greater. In this case, at the end of ten years we can anticipate income per well approximating

$41,000.00 or $42,000.00. Slightly more than twice the cost of drilling a well and is, in our opinion, the minimum profit which we can economically drill wells under.

MR. REED: I offer Exhibit 15 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 15 received in evidence.)

Q Have you made any comparison between the recoverable gas in place under the sub-lands and that in the Fulcher Kutz Pool?

A I have made a comparison.

(Marked Applicant's Exhibit No. 16, for identification.)

Q I hand you Exhibit 16 and ask you to state what that is?

A Exhibit 16 shows the difference of the comparitive difference in reserves in the West Kutz Gallegos Canyon Area as compared to the Kutz Canyon-Fulcher Basin area, as effected by this difference in reservoir pressure, to which we have previously referred, assuming all the other factors to be the same.

Q What is that difference and the conclusion that you draw from it, Mr. Greer?

A The point that I would like to make here is, that with this difference of 100 pounds or 120 pounds in reservoir pressure that there is a somewhat proportionately less amount of gas in place in the Gallegos Canyon Area than in Kutz Canyon and Fulcher Basin Area. Since we can measure the pressures quite

accurately, we can determine also quite accurately what this comparison is. It is dependent upon simple fundamental engineering facts and is quite accurate.

This shows that the recoverable gas to operating line pressure of 250 pounds is only 61% as much in the Gallegos Canyon Area as in Kutz Canyon-Fulcher Basin, simply because we have a lower initial reservoir pressure. To a final abandonment pressure we have approximately 7% as much recoverable gas for Gallegos Canyon as compared to Kutz Canyon. Now, that is assuming all other factors to be the same.

We have evidence from a previous hearing that the connate water content in Kutz Canyon-Fulcher Basin was estimated to be 20%. We have a reasonably accurate figure of 50% in Gallegos Canyon. That gives us a still lower volume of gas in place in Gallegos Canyon than in the initial field. Now connate water contents are more difficult to determine exactly. We don't know that it was exactly 20% in the old Kutz Canyon-Fulcher Basin Field. We feel it is reasonably close to 50% in our area, but under any method of comparison we definitely have considerably less gas in Gallegos Canyon area than in Kutz Canyon. We anticipate that to be, assuming the same thickness, the same porosity there would be less than half as much gas in Gallegos Canyon as in Kutz Canyon.

Just a word in regard to the other factors which we assumed to be the same. At this previous hearing the porosity in the

Kutz Canyon Area was set out as 20%, whereas we know our porosity to be about 18%, so, if anything we have a lower porosity. The sand thickness was estimated at 40 feet, which is quite close to what we estimate for our Area. So, just in general, there are roughly twice as much recoverable reserves under the same area in Kutz Canyon as under Gallegos Canyon.

MR. REED: I offer Exhibit 16 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 16 received in evidence.)

(Marked Applicant's Exhibit No. 17, for identification.)

Q I hand you Exhibit 17 and ask you what that is?

A Before we go into Exhibit 17 I think we might just point out the significance of that difference.

Q What is the conclusion you draw from that?

A Since there is half as much gas in Gallegos Canyon as in Kutz Canyon-Fulcher Basin Field, in order for us to recover the same volume of gas per well as is anticipated in Kutz Canyon we need twice as much acreage assigned to each well.

Q Will you go ahead with Exhibit 17?

A Exhibit 17 shows a cross section made from electrical logs of wells in the Gallegos Canyon Area. These wells are: Gallegos Canyon Unit No. 4, No. 5, and Bay Petroleum No. 1 Federal in Section 27, 29 North, 13 West, which directly offsets the unit on the Northwest.

From our work with electric logs we can predict rather accurately, or we can determine rather accurately, the net pay thickness in each of these wells. It is apparent from this cross section, that the thickness of net pay drops off markedly from the Southeast portion of the Gallegos Canyon Unit to the Northwest part of the unit and into the area Northwest of the unit, which is covered by this application and which we have colored in blue on Exhibit No. 1. In our calculation of economics, we have used 40 feet of net pay as an average throughout the unit. Unless things change considerably from what conditions now appear to be, in the blue area Northwest of the unit there will be much less than 40 feet of net pay, in fact, there will be something on the order of 20 feet. This is indicated by Bay's No. 1 Federal and was also indicated by the gas increase log on our Gallegos Canyon Unit No. 1, which is also in the Northwest area.

It is apparent then, from this cross section, that if 320-acre spacing is necessary, which we feel it definitely is within the unit, that it also is quite necessary in the blue area Northwest of the unit.

MR. REED: I offer Exhibit 17 in evidence.

MR. SPURRIER: Without objection it will be received.

(Applicant's Exhibit No. 17 received in evidence.)

Q Mr. Greer, have you made any estimate as to the waste

that would result from development of this acreage on a spacing pattern denser than one well for each 320 acres?

A I have.

Q What is the result? What is that estimate?

A In the drilling and completion of wells in this area, it is the practice to complete the wells with cable tools. The wells are open to the air blowing gas which is wasted for periods varying from a few days to as much as two weeks, depending on the amount of difficulty in completing the well. Some of these wells will produce, during that time, a considerable volume of gas. Some of them an average of more than a million feet a day, to as high as three and maybe four million feet per day. It is quite possible that on an average, six to ten million cubic feet of gas is wasted in each well, in drilling and completion of it.

This volume of gas which is wasted is, of course, twice as much where you have two wells on 320 acres, than if you just had one well. Six million cubic feet of gas, out of ultimate recovery on the order of six hundred million cubic feet, is approximately 1%. It can be as high as 2% of the total reserves are wasted to the air in the completion of the well, which gas would be saved if we drill the wells on 320-acre spacing.

Q Have you made any estimate of the quantity of critical materials that would be saved as a result of spacing on 320 acres?

A Just in our area alone we are setting up a program to develop, what we are now defining as a participating area which

covers approximately 20,000 acres, and in which we will drill on the order of 75 to 100 wells, depending on how many offsets we have to meet on the 180-acre spacing. We can save the drilling of something like 75 wells in our unit which will result in the saving of over 1,000 tons of steel, which is quite critical at this time.

Q Total area will be approximately twice that?

A Before the entire area, should production continue to the entire limits of the area as covered by this application, it would be approximately twice that or on the order of 2,000 tons of steel saved.

Q Mr. Greer, on what spacing pattern is the Southeast portion of this pool being developed?

A It has been developed on 160-acre spacing.

Q Are there any wells drilled in the Northwest portion, that is the part covered by the application on 160-acre spacing?

A Bay Petroleum Corporation has drilled one well on part of their land in this blue area. I understand that they own the rest of the land in that particular section and can, of course, assign whatever Commission orders, 160 or 320 acres, to that particular well.

Q There is no situation in those lands where there are four wells on a section however?

A No, there are, in fact, there are no other completed producing Pictured Cliff wells in the blue area or capable of

production from the Picture Cliffs.

Q Where, in your opinion, Mr. Greer, is the most convenient and practical point to begin 320-acre spacing in the pool?

A We can very practically change the spacing from 160 acres to 320 acres at the Southeast boundary of the unit.

Q Why is that?

A We are setting up a participating area which covers most, which covers approximately half of the entire unit in this one participating area, will be operated as a single lease. We can, therefore, meet 160-acre offsets on the South boundary of the unit and change the spacing there to 320 acres, and there will be no cross drainage between properties within the unit. There will be no destruction of correlative rights throughout the entire area covered by this application.

Q The unit extends completely across the pool at that point?

A Yes.

Q Is there some acreage within the Gallegos Canyon unit that has not been committed to it?

A There are certain small tracts.

Q Where are the tracts along the Southeastern boundary?

A There are none of the tracts that have been committed along the Southeastern boundary. The unit has been, the unit area has been entirely unitized for three miles North of the Southeastern boundary.

Q Mr. Greer, in order to insure uniform spacing in the area covered by the application, and to protect correlative rights, where would you recommend that the wells be located in each section on 320-acre spacing?

A We have drilled our wells with initial pattern of locating the wells in the Northeast and Southwest parts of the section.

Q Are all the wells, presently located in the area, drilled on that basis?

A No. Bay Petroleum well is located in the Southeast part of the section. However, we would like to be definite in this one point, that we would prefer to see the wells drilled in the Northeast and Southwest parts of the section. However, as long as there are only two wells drilled to a section in the blue area, we would have absolutely no objection to where they were located.

MR. REED: I would like, at this time, to take up a point that has come up since the filing of the application. And that is the point that there has been an application for approval of location of wells in the area covered by the application. I think they are all in the blue area or nearly all in the blue area, and although the Commission may well feel that it wants to take the case under advisement on the merits, we would like to request that, at this time, some expression be made that these pending applications for well locations be postponed,

pending the final disposition of this case. The applications are on the basis of 160-acre spacing up there.

I understand that Bay Petroleum has a statement that they would like to make at this time.

MR. MORAN: Martin Moran, attorney for the Bay Petroleum, and we wish to state that we are in accord with the petition here and the spacing pattern for the Gallegos Unit, and the blue area included outside the unit. However, the point that was brought up at the last, on the pending application for the other wells in the blue area. If they are approved prior to the spacing pattern on the unit in the blue area, we would like to reconsider our approval on the 320-acre pattern.

We don't think though that 160-acre spacing is going to be in accordance with good oil field practice, and the best interest of the industry in this development here and, therefore, we are in accord with the Benson-Montin petition here for this spacing pattern.

MR. REED: Do I understand that they, the Commission postpone giving approval as to these well locations?

MR. MORAN: Yes, I do, until they have decided on whether they are going to grant your petition.

MR. REED: Does the Texas Company have a statement?

MR. RAY: C. J. Ray, representing the Texas Company. Texas Company is participant in the Gallegos Canyon unit and we wish to support the application as presented by Benson and

Montin and wish to concur in their recommendation for spacing and well locations within this unit.

MR. REED: Stanolind?

MR. HILTZ: I am R. G. Hiltz with Stanolind Oil and Gas Company. I think that Stanolind is the large interest hold near Canyon unit and we would like to concur with Benson-Montin in their request for 320-acre spacing and location of wells within the unit.

We believe that the testimony that they have presented is based on sound engineering principal, and that the data they have utilized is a result of laboratory practices that give representative data on the characteristics of the formation, both of which are acceptable widely throughout the industry. As they have demonstrated there would be no significant difference in the ultimate recovery from the area covered by the application, we feel that, as a result, an adoption of 320-acre spacing in the area covered by the applicant will preclude unnecessary expenditures of capital, will be in the best interest of conservation in that it will permit recovery of the maximum amount of gas and will in a sense, prevent some waste, and it will probably protect correlative rights. Therefore, we would like to concur in their application.

MR. REED: I believe that concludes our direct presentation.

MR. GRAHAM: Why did you include the blue area?

A Mainly to make our application effective. There are

a few scattered tracts in the Northwest part of the unit which have not been unitized. We, therefore, do not have complete control of spacing within the unit. If the wells in the blue area are drilled on 160-acres, they would then offset some of the land, as not unitized, inside the unit boundaries and then those tracts, would, of course, would then have one well on 160 acres, and that would spread throughout the unit to the point that our application would be entirely defeated. We would not in effect, have 320-acre spacing. Well, as I pointed out before, if anything, there is considerably less gas in place in the blue area than under the unit and although we don't have any acreage in the blue area, well, we feel that we are definitely helping the operators who do have.

MR. GRAHAM: You contemplate sometime to include the blue area in the unit if they sign up?

A The unit plan provides for enlarging the unit, if, of course, it is agreeable to the people who own the land outside the unit and to the people inside the unit. In other words, wells drilled in the blue area could be brought into the unit, providing the operators wanted to join the unit and the operators in the unit wanted them to come in. That has to have, also, the approval of the United States Geological Survey, the Conservation Commission, and the State Land Office.

MR. GRAHAM: On the 160-acre spacing, what do you estimate the life of the unit to be in years?

A I would like to refer to Exhibit 11 on that. You will note on that Exhibit, that at the end of 7 years, I have shown the production rate and the cumulative production by dash lines rather than solid lines. Now, at that point at the end of 7 years, producing against 250 pound line pressure, the average production is on the order of 25,000 cubic feet per well per day. These wells produce something like two or three barrels, up to five or ten barrels of water a day. And from that depth and line pressures that we operate under, it takes something like two to three thousand cubic feet per barrel to lift that water out of the hole.

Now, that is reasonable gas lifting efficiency, and we feel that our equipment is in order in that respect. Nevertheless, it requires some volume of gas, from 15 to 25 thousand cubic feet per day in some wells, just to lift that water from the hole. When we have reached a production rate on the order of 25 or 30 thousand cubic feet per day, we will have about enough gas to lift the water out of the hole and we will not be able to sell any gas into the pipe line. Somewhere in that length of time, around 7 or 8 years, it would be uneconomical for us to operate wells in the unit.

MR. GRAHAM: You estimate it would be about double the time on 320?

A To get to exactly the same point, it would take exactly, that is to drop to a production rate of around 30,000 cubic feet

per day, it would take exactly twice as long. 14 years instead of 7 years. Now, you will recall that this calculation is dependent on the fact that all the wells would be drilled up rapidly, which we propose to do. If it takes us a year to drill the wells, then this average would be extended one more year, say to eight years rather than seven. At that point then, we would have to either abandon the wells or shut them in until the pipeline company lowered the line pressures.

MR. GRAHAM: Still, the thing that confused me, the blue area outside, with reference to your development program that you have submitted?

A Our participating area comes up, it joins the blue area in one or two spots, I believe. Yes, our participating area goes as far Northwest. We have omitted the two Northwest sections, that is Section 13 and 29 North and 13 West; and Section 23 and 29 North and 13 West. Then, Section 26, within the unit in that same Township joins the blue area and is inside the participating area. The only other place that the participating area touches is on the corner between Sections 14 and 24, but, of course, the participating area can be extended as production is developed. It could go all the way to the unit boundary.

MR. GRAHAM: There is some possibility then of drainage on your theory --

A (Interrupting) No, sir, if we have - You mean offset drainage?

MR. GRAHAM: Yes.

A No, sir. If we developed on a pattern of 320 acres inside the unit and they are developed on a pattern of 320 acres outside the unit, then we anticipate no offset drainage. Of course, if the blue area had 160-acre spacing, and our participating area had 320 acres, there would be offset drainage to the blue area from our unit.

MR. GRAHAM: You insist on including the blue area in such an order?

A Yes, sir, we feel that our application could easily be defeated if the blue area were not included.

MR. MORAN: We would like to have it included too, from the mathematics of the picture and the recovery of the gas from the wells there. We don't believe that 160-acre spacing on the blue area will be commercial.

MR. GRAHAM: We intended to think of these units as the thing.

MR. MORAN: We looked at the blue area and thought they were throwing us in as a buffer. We looked at the figures and, saw they were correct in the petition for 320 acres. We believe this is a logical spacing pattern to follow through there. That is why we are in accord.

MR. GRAHAM: We tend to think of the unit as a unit agreement.

MR. MORAN: We are to, but we feel from the size of the

unit, it doesn't look practical to us, at this time, the undeveloped nature of our land, to commit it to the unit, although it is open and the question is open that we can change our mind and petition to join.

MR. GRAHAM: And just openly, it probably should be in the unit?

MR. MORAN: Yes, sir, we will say that.

MR. GRAHAM: You are not ready to join?

MR. MORAN: If you go along with the common development plan, same as the unit, we see no difference except we retain our operations instead of turning them over to someone else.

MR. SPURRIER: You have no objection to the unit if you can do your own development?

MR. MORAN: We couldn't do it in the unit.

MR. SPURRIER: Does anyone have a question of this witness? The direct examination is over. It is time for cross examination.

MR. TAYLOR: In the good old days of the country store they had two sets of scales. I think most oil men have two sets of scales. I want to know what this was prepared on, buying scales or selling scales? If it is selling scales, we had better give it back to the indians.

MR. GREER: Do you want me to answer that?

MR. SPURRIER: Anyone else have a question or observation?

MR. GRAHAM: May I ask another question? Who holds the

controlling interest in the blue area?

MR. MORAN: I have not seen a lease ownership. We own in the blue area, 1,560 acres there against the unit. That is in Section 27, 28 and 31.

MR. REED: Can you answer that, Mr. Greer?

A I don't have an ownership plat.

MR. MACEY: What sections did you say you have?

MR. MORAN: 600 in 27, all in 28, and 320 in 33, it is not 31.

MR. SPURRIER: Any further questions? Anyone that --

MR. TAYLOR: There is one question. If this proposed spacing was inaugerated and proration was inaugerated up there, how would it work against 320 and 160 spacing on pull from each well?

MR. SPURRIER: That is a good question. The Oil Commission has also set allowables based on acreage and, therefore, the well would get no allowable as such. Consequently, according to our previous theories, you would get as much production from 160 in one case as you would the other. You get twice as much from a well on 320 as you would from a well on 160.

MR. TAYLOR: In other words, on the South side of the unit the wells drilled on 160 acres, on the presently developed area, would only pull half the gas the 320's across the line would pull.

MR. GREER: Might I say something there? We propose to meet the 160 acre wells on the South with 160 acre wells in the unit,

so in that case, if you went along with your proration formula on an acreage basis, then offsetting wells would produce the same volume of gas because they would be on 160-acre spacing.

MR. GRAHAM: And under their own rules?

MR. GREER: Yes.

MR. SPURRIER: Actually the Commission has no formula for gas proration in talking about past history of oil proration. Gas proration is not that simple. Nevertheless --

MR. GRAHAM: (Interrupting) It is in the future isn't it?

MR. SPURRIER: Yes, in the future. Anymore questions? If not the witness may be excused.

(Witness excused.)

MR. SPURRIER: We have, incidentally, a lot of letters which have been sent to us in opposition of this application. We will not take the time to read them because they all substantially state that they are against the application, and there is no expert testimony presented.

MR. REED: We have examined the letters and we have no objection to their appearing in the record.

MR. SPURRIER: Without objection they will appear in the record.

MR. TAYLOR: I would like to make a statement, Mr. Spurrier. I am Lloyd Taylor, one of the blue babies referred to in that Exhibit.

MR. SPURRIER: Thank you.

MR. TAYLOR: My attorney, Mr. Howe, was due to appear here and was detained at Federal Court in Albuquerque, and I just got a wire during the meeting that he was unable to be here. I am not an engineer. I am just an operator and I want to make these statements for the record here.

I would like to present this as an Exhibit 1. That is a copy of an agreement we have signed by about 75 lessors in this blue area that is referred to here. In this agreement, it commits us to the drilling of some 15 wells in this blue area based on 160-acre spacing. That is the problem we are faced with, as operators, to meet our committment with these lessors. I have here the original of the agreement that is with the lessors names signed to the thing. I wouldn't like to leave this as an exhibit, as it is my original copy, but the Commission can see there are 75 lessors involved. That area is cut up in very small tracts, from one acre to ten acres. I think the highest tract is 320 acres. So that is the problem we are confronted with on the 320.

Another thing that we are confronted with, one of the areas that comes within the Gallegos Canyon Unit area referred to by Mr. Greer, we hold the lease and these people are parties to this agreement here, and it overlaps into the Galleges Canyon unit area. That area, described specifically, is the Northwest quarter and the South half of the South quarter of 23, 29, 13. In order to protect the lessors on that agreement that we had

signed, we have filed a notice of intention to drill, with the Aztec office, and Mr. Greer approved the locations in some of the blue area, but he withheld approval on the 160-acre spacing, or the 1 to 160 that was within the unit pending the action of the Commission on that application.

We would like that clarified some way before the Commission. We want the Benson-Montin operators and the Bay Petroleum operators to know that we have no fight with them or, we would like to get along with everyone, but at the same time we have this agreement to meet and we don't know how we are going to meet it with the 160-acre spacing. That is our problem.

MR. SPURRIER: In other words, in these escrow instructions you have agreed to drill on 160-acre spacing?

MR. TAYLOR: Yes.

MR. GRAHAM: Will Mr. Greer yeild to a question?

MR. GREER: Yes.

MR. GRAHAM: Could the same sort of situation be worked out in the Northwest, around the blue area, as contemplated down here in the green?

MR. GREER: No, sir. That is our problem. If we had 100% unitized land we couldn't. We could meet the 160-acre offsets up there the same as we propose in the South.

MR. GRAHAM: Are those agreements improbable to negotiate?

MR. GREER: We have tried very hard and we can't get all the land. For instance, there is part of it right there.

MR. MORAN: Isn't that agreement that you have subject to Federal and State rules and regulations considering development?

MR. TAYLOR: Yes.

MR. MORAN: If they set up 320 that would cancel the agreement as far as the 160 and throw it to 320 --

MR. TAYLOR: It probably would, but it wouldn't protect us with the guns over there. The way we feel on that, we made the agreement prior to any agreement on 320, we made it in good faith and they made it in good faith. In order for us to keep faith with the lessors we have to make an honest effort to fulfill our contract if the Commission rules against us.

MR. MORAN: I don't believe it would be a question of your good faith. The matter would be taken out of your hands by the State Regulatory Body.

MR. TAYLOR: We have Mr. Dustin.

MR. DUSTIN: The most of these fellows, I have 6 on the petition, leased this land to Benson and Montin or some of the other fellows with the agreement they were to drill on 160 acres. Now they are asking for 320. It started out here, not long ago, at 40-acre spacing. The State finally fixed it at 160, which looks like it was fair to everybody. As for 320, 640, we won't have much left. I would like to leave these petitions here with you fellows to look them over.

MR. TAYLOR: The position we take, we are caught between the devil and the sea. We are mixed up with the agreement with

the land owners and at the same time we want to have horse sense in the development of the area, at the same time, we want to not welch on our agreement.

MR. MORAN: You don't want to drill wells that aren't commercial, do you?

MR. TAYLOR: We just got through doing that.

MR. REED: Mr. Taylor, do you have any information that tends to go against the expert testimony that was presented today, or is your problem just one of the contract?

MR. TAYLOR: We have no geological information assembled whatsoever. Our information is taking into consideration the Northeast, Northwest, Southwest trend of that Fulcher Basin and Kutz Canyon, and I want to complement Mr. Greer on a very comprehensive report. We don't have anything, we don't attempt to repute any information that he gave us, but we are committed under that and we felt that we had to keep faith with those lessors. They are neighbors and we live right along with them.

MR. GRAHAM: Would Bay State object to, say, a unit of some sort covering the blue area?

MR. MORAN: We hadn't even considered that up to this time. We would like to take that under consideration and let you know by letter.

MR. GREER: I don't believe that would solve the problem. If you want 160-acres that is not going to satisfy --

MR. GRAHAM: (Interrupting) You are not afraid of the

correlative rights?

MR. GREER: The correlative rights --

MR. TAYLOR: (Interrupting) Here is another thing I would like to bring up in the blue area that we have there, it is very very difficult to get 320 without having some hold out similar to what you have got in your unit.

MR. GREER: If you think 320 is hard you should have tried 40,000.

MR. TAYLOR: In those small areas there is one fellow with a one acre.

MR. GREER: One fellow with a city lot. There interest in the thing is very small and they are just not interested.

MR. GRAHAM: Is the river bed involved in that?

MR. GREER: The river bed runs through that area.

MR. MORAN: You went on to 320-acre spacing instead of 160 in the blue area. Wouldn't the individual land owners ultimately recover more gas and more proceed from the sale of the gas than they would --

MR. GREER: (Interrupting) Yes, sir, they will receive more gas, just like we will, because the second bunch of wells would not be blowing gas to the air.

MR. GRAHAM: That is time considered?

MR. GREER: It would take a little longer to get it. We figure in the end of ten years we will have recovered only about 93% as much gas from one well on 320 acres as two wells on

320 acres, but that is so close to the same, it is inconsequential.

MR. TAYLOR: Another thing I would like to bring up is the proposed well locations in relation to the sections. I believe you gave the Southwest and Northeast corners of the section?

MR. GREER: Yes.

MR. TAYLOR: If that proposal were carried out in our instance it would prohibit us from drilling our only location that we have in Benson-Montin's unit out there.

MR. GREER: I can tell you how we can get together on that. If you have 320 we can pool it with you.

MR. TAYLOR: We have 240 acres in their unit. It is on the outside of the unit, sort of out on the corner there. It is sort of an orphan anyway.

MR. GRAHAM: Is it committed?

MR. TAYLOR: No.

MR. GRAHAM: What is your drilling obligation on that contract there? Suppose you get a dry hole?

MR. TAYLOR: We have to start another well on another location.

MR. GRAHAM: How often, every six months?

MR. TAYLOR: Every 30 days.

MR. GRAHAM: You are obligated to drill how many?

MR. TAYLOR: 15.

MR. GRAHAM: If the first 14 are dry you can go right ahead?

MR. TAYLOR: We can abandon our program after we drill

three wells, if the three wells are dry, why we are without any further obligation, but we are stuck for three wells. On the second well, the third well we want to drill is in the yellow area, we felt like we had a better chance in ultimate recovery from the three well committment that we had made there.

MR. GRAHAM: That is in the unit created?

MR. TAYLOR: It is in the unit, but not committed.

MR. REED: I might say, at this time, that in the application we only ask that the location of wells be established for Southwest and Northeast with such exemptions as are necessary for existing wells, and future wells on good cause shown and whatever offset wells are necessary.

MR. GRAHAM: Pending the proration of gas, a well in a unit now drilled by an uncommitted lessee, what position would you take?

MR. GREER: We could, the time that it takes to drill the well, we could go either way. We can join part of the unitized land in a single pooling agreement and drill one well. For instance, they have 240 acres. We could pool 80 acres with their 240 to make one spacing unit. That well would be operated separately from the rest of the unit area. Of course, we prefer to bring them into the unit. If they don't want to we are easy to get along with.

MR. GRAHAM: Would you have any reason to suggest something like that?

MR. TAYLOR: I don't think we have, would have a right to commit in the unit without the lessors consent.

MR. GREER: It would be a normal pooling agreement. You would pool the land into one pooling unit. We would let you operate the well in that case.

MR. TAYLOR: In the instance that you mentioned there, the way you have it outlined you would be running the half section North and South, rather than East and West. That would complicate your pattern.

MR. GREER: That depends on however that is set up. We can pool your 160 with 160, and your 80 with 240 of ours. That part is pretty easy to work out.

MR. DUSTIN: The driller is obligated to drill on 160 in that 240 and he has poolings in that --

MR. TAYLOR: (Interrupting) It so happens in this agreement, the 160 we are discussing is the only 160 that is in a single unit and doesn't have to be pooled. Everything else has to be pooled with someone else's land. All of them are pooled units, with that exception.

MR. SPURRIER: Anyone have any further comments?

MR. GRAHAM: What is your interpretation of Paragraph 5 of that agreement?

MR. TAYLOR: Do you care to read?

MR. GRAHAM: I can't see very good.

MR. TAYLOR: "It is understood and agreed by and between

said lessor that the wells herein above required to be - (Reads from contract) I would like to submit by mail the names of the lessors that are on the agreement, if I may?

MR. SPURRIER: Very well. We will include those in the record without objection. Without objection this will be included in the record, if we haven't already done so. This Exhibit No. 1 of Mr. Taylor.

MR. GREER: And Mr. Dustin's signed petition.

MR. TAYLOR: Do these concur with Mr. Greer, with reference to draining 320 acres with one well?

MR. WHITE: They are not in a position to answer that until they have studied the testimony.

MR. SPURRIER: If no further questions or comments, we will take --

MR. TAYLOR: (Interrupting) There is one more question I would like to ask. In relation to the question brought up about these applications that have been filed in the blue area, permission to drill, we are under obligation to get on at least one of those locations within the next few days.

MR. SPURRIER: We will give you an answer within the next few days.

MR. TAYLOR: So long as the locations fall within the position in the section that Mr. Greer has asked, there wouldn't be any objection to those?

MR. SPURRIER: That is right.

MR. TAYLOR: It is still on 160 acre basis because we don't have authority to ask for anything more.

MR. GREER: If they did go ahead and drill a well, then they could go ahead and assign the rest of their acreage to make it a 320 acre unit. There would not be another unorthidox location.

MR. TAYLOR: What would happen in regard to Mr. Dustin? He has a location that fails within the Southwest quarter of Section 14?

MR. GRAHAM: 29 and 13.

MR. GREER: Do you own anymore acreage in that section?

MR. TAYLOR: Yes, we've got one fellow that is balky and so far hasn't committed his acreage. We are not able to make a 320 committment on the acreage if the Commission ordered it at the present time.

(Discussion off the record)

MR. SPURRIER: If no further comment, the Case will be taken under advisement and we will get you an answer as soon as we can.

Next Case on the Docket is Case 378.

STATE OF NEW MEXICO)
: ss.
COUNTY OF BERNALILLO)

I HEREBY CERTIFY that the foregoing and attached transcript of proceedings before the Oil Conservation Commission in Cases No. 363 & 377, taken at Santa Fe, New Mexico, June 19, 1952, is a true and correct record to the best of my knowledge, skill and ability.

DATED at Albuquerque, New Mexico, this 27th day of June, 1952.

REPORTER

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