BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF: CASE NO. 1621

TRANSCRIPT OF HEARING

MARCH 25, 1959

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Case No. 1621 In the matter of the application of Humble Oil and Refining Company for an order reclassifying the Four Lakes-Devonian (Oil) Pool in Lea County, New Mexico, as a gas pool.

Mabry Hall
Santa Fe, New Mexico
March 25, 1959

BEFORE:

Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: The next case on the docket will be 1621.

MR. PAYNE: Case 1621, "In the matter of the application of Humble Oil & Refining Company for an order reclassifying the Four Lakes-Devonian (Oil) Pool in Lea County, New Mexico, as a gas pool."

MR. BRATTON: Mr. Examiner, my name is Howard Bratton, Hervey, Dow and Hinkle, Roswell New Mexico, appearing on behalf of the applicant, Humble Oil and Refining Company. This is an application to reclassify the Four Lakes-Devonian Pool in Lea County, New Mexico as a gas pool in accordance with Rule 5 of the Rules of the Oil Conservation Commission.

I would like to make a brief statement before presenting out witnesses and our evidence. This matter has been before the Commission once before, approximately eight months ago. At that time,

I N D E X

Humble presented evidence on a practical basis and without perhaps the conclusive laboratory work necessary to absolutely determine whether this pool is a gas pool or an oil pool. I would like to explain Humble's position in this matter and the approach which we take here today to explain to the Commission the evidence which we intend to introduce and which we believe conclusively establishes the nature of this pool.

We will present three witnesses, one witness from Humble to explain generally the history of the matter and the locale of the pool. We will present two witnesses from Core Laboratories who have made a study of fluid samples from this pool. We believe that the one determining factor and the ultimate factor to determine whether a pool is an oil pool or a gas pool or whether a well is an oil well or a gas well is the phase in which the material exists in the reservoir.

I would point the attention of the Commission to certain of its definitions as found in its Rules; specifically Definition No. 10 defining the casinghead gas, 15 defining condensate, 25 defining a gas well, 37 defining natural gas, 40 defining oil, crude oil or crude petroleum oil, 41 defining oil well and 46 defining pool. Now, specifically, I want to call to the attention of the Commission, and I will read two definitions, one of condensate and one of oil. Definition No. 15, condensate shall mean the liquid recovered at the surface that results from condensation due to reduced pressure or temperature of petroleum

hydrocarbons existing in a gaseous phase in the reservoir. Number 40 defines oil, crude oil or crude petroleum oil shall mean any petroleum hydrocarbon produced from a well in the liquid phase and which existed in a liquid phase in the reservoir. Number 41 defines oil well to mean: Oil well shall mean any well capable of producing oil and which is not a gas well as defined herein.

We believe that the ultimate test of whether a well is an oil well or a gas well or a pool an oil pool or a gas pool, is the nature in which the petroleum hydrocarbons exist in the reservoir. To that end, we intend to produce evidence directed solely to that point, the phase in which the petroleum hydrocarbons exist in the reservoir in the Four Lakes Pool. We do not, we will not present evidence as to a number of other matters which we recognize have been inquired into in other cases, such as gas-liquid ratios or gravity, matters of that nature, because we believe that while in some instances where the absolute proff which we propose to present here today is not available, those matters are indicia which the Commission relies upon. We believe that when the absolute proof is presented as to the phase in which the petroleum hydrocarbons exist in the reservoir, when that is presented, that, under the Rules of the Commission, is determinative of the issue.

As I say, we will present testimony directed solely to that point. If the Commission desires to inquire into other matters, naturally we will, our witness will respond as we have no desire in this or any other hearing to deny to the Commission or decline

to answer any question or present any information or material which the Commission desires; but I would like to record at this time an objection to any other information being considered as material to the determination of whether this pool is a gas pool or an oil pool. We will present three witnesses, Mr. Baze, Mr. Tefteller and Mr. Moses and I'll ask that they be sworn at this time.

(Witnesses sworn in.)

MR. UTZ: Are there other appearances to be made in this case?

ROY A. BAZE

called as a witness, being first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your name, please?

A Roy A. Baze.

Q By whom are you employed and in what capacity and where, Mr. Baze?

A I am employed by the Humble Oil and Refining Company at Midland, Texas. That's the Division Headquarters of our Western Division and embraces West Texas and New Mexico. My job at present is Assistant Division Petroleum Engineer in charge of reservoir engineering activities in general.

Q Have you previously appeared before this Commission as an expert witness?

A Yes sir, I have.

Q In your capacity, have you been familiar with the Four Lakes-Devonian Pool, Mr. Baze?

A Yes, I have, since it was first drilled and discovered.

(Thereupon, the document was marked as Humble's Exhibit No. 1 for identification.)

Q (By Mr. Bratton) Referring to what has been identified as Humble's Exhibit Number One, will you explain what that is and what it shows?

A Exhibit Number One is a plat of the area, of the Four Lakes-Devonian area. Shown in the red outline is the limit, or boundaries of the South Four Lakes unit in which Humble and Phillips are joint owners, Humble owning 63.6 per cent interest and Phillips 36.4 per cent. The horizontal pool limits of the Devonian Pool are outlined in yellow on the plat. Specifically, those limits embrace the northwest quarter of Section 1 and the northeast quarter of Section 2, Township 12 South, Range 34 East and also the southeast quarter of Section 35 in Township 11 South, Range 34 East. These limits were set out by the Commission in its Order R-928 and R-1129. The Devonian Pool contains three wells at present; on the plat here they are identified as Wells 2, 3 and 4 with a red circle. The discovery Devonian well was Number 2 in October of 1956. There are two other wells shown in the area, Number 1 and Number 5. These are Pan American completions of

different resrvoir and prorated, handled separately by the Commission. There is shown also in Section 2, a location for well Number 6. That is a drilling well presently drilling below 12,000 feet and it is destined for the Devonian Reservoir.

Q Mr. Baze, do you know if the royalty ownership is common in the South Four Lakes-unit?

A Yes, it is common ownership of royalty, it is common school land.

A Mr. Baze, are you familiar with the previous hearing before this Commission on the reclassification of this pool?

A Yes, I am; it was held in July 1958.

Q And will you explain briefly to the Commssion why Humble is now appearing before the Commission in this hearing?

A Yes, I'll be glad to. When we originally drilled the Devonian Resrvoir in late 1956, we very shortly thereafter in October or November of 1956 and continuing on until January 1957, sampled fluids from the reservoir and made analyses in our own laboratories in Houston. We did this work to learn some of the characteristics of the reservoir fluids and enable us to better operate it. Our investigations at that time were not as extensive as they could have been. We thought we had the answer to the nature of this fluid tied down reasonably well, so we came forward to the Commission in Case 1480 in 1958, requesting a reclassification of the reservoir from a gas pool-- an oil pool, which it had been so designated, and asked for a reclassification

to a gas pool, and at that time, we were not in a position in our laboratory work to say without reservations to the Commission that this fluid was gas. Rather, we presented the matter to the Commission from a practical standpoint, that it was a gas and should be handled and produced as a gas. Our laboratory work had not been as extensive, as I say, as it could have been, such that we could say definitely without qualifications what the state of the fluid was in the ground. And it was for that reason, I'd say, that we came forward and told the Commission that from a practical standpoint, we thought we knew it was gas and we would like to produce it as such. Following that hearing we of course, we continued to be prorated as an oil pool, but we decided to take a fresh approach to the matter, completely fresh and new approach. In that endeavor we employed the Core Laboratories to take samples from the reservoir and make such analyses in their laboratories as they felt were necessary to defineitely and decidedly classify the material as to whether it was gas or oil in the reservoir. I would just like to comment that the general instructions that Humble gave to the Core Laboratories was that the field procedures and the laboratory procedures, the equipment that was to be used and all techniques would be solely at the discretion of Core Laboratories, that was the general instruction to them. We did have some Humble people in the field when the samples were taken, we did have some Humble men in their laboratory in Dallas when some of the key observations were made,

but our Humble people in all of those endeavors were there solely in the capacity as observers. We endeavored to supply whatever information or equipment that Core Laboratories asked of us. And so today we have come forward with the results of this second approach to the determination of the nature of fluids in the reservoirer.

Q Mr. Baze, in your opinion, if this pool is reclassified an oil pool to a gas pool would that reclassification result in or tend to result in a waste or violation of correlative rights?

A No sir, I don't think it would. We certainly would continue just as we have done in the past, to make measurements of the performance of the field, to keep a good history of it, and certainly we intend to operate it in a prudent manner, to operate it efficiently.

Q To the end that liquid will not be left in the ground causing waste?

A That would be our intention in operating it in a very prudent manner.

MR. BRATTON: Now, if the examiner please, this will be predecessing the actual testimony which will be the foundation for Mr. Baze's observations, but I would like to ask Mr. Baze, with the consent of the Commission if you have examined the results of Core Laboratories studies and work and if you have drawn any conclusion from your examination of their studies?

A Yes, I have, I have been over their work very closely.

the work they did in the field and the testing program and the work they did in their laboratories. And I would like just to comment to the Commission that looking at reservoir material such as in the Devonian is nothing new in so far as I am personally concerned as I have seen samples like that on several other occasions in the last ten years with the Humble Company, and in going over the Core Laboratory results, in talking with experts within our own company and in talking with the Core Laboratory people, in my judgement the Devonian reservoir contains gas. I think that in my opinion it is definelty and distinctly and definitively gas. The liquid that's produced is condensate which existed originally as a gas in the ground and dropped out as a liquid as it was produced. I brought a little bottle here, it has hydrogensulfide in it, and it smells, so I suggest that we don't open it here. That's a sample of the liquid that's recovered at the surface. In the last ten years I have worked from a number of gas fields quite commonly, and that's the type of material that's produced in a liquid state. I have seen condensation in a range from water white down to an amber color. In my judgement, this is out and out condensate that's produced and the reservoir is definitely a gas reservoir that has characteristics common to many gas condensates--

MR. NUTTER: Mr. Baze, for the record will you identify the color of that particular sample?

A The condensate produced, Mr. Nutter, is a very light straw colored yellow material.

MR. BRATTON: Off the record.

(Discussion off the record.)

MR. BRATTON: Back on the record.

Q (By Mr. Bratton) Was Exhibit Number 1 prepared by you or under your supevision, Mr. Baze?

A Yes sir, it was prepared under my supervision.

Q Do you have any other comments that you would care to make to the Commission?

A I think not, sir.

MR. BRATTON: That's all the questions we have of Mr. Baze.

MR. UTZ: Any questions of the witness?

MR. PAYNE: Yes, sir.

CROSS EXAMINATION

BY MR. PAYNE:

Q Mr. Baze, in view of the fact that you testified that in your opinion it would not cause any waste or impair any correlative rights to reclassify this pool, I am going to ask you a couple of questions there. Is this an active water drive pool?

A We made some reservoir calculations on the pool last year. These were material balance type calculations and based on the pressure production history we had at that time, we feel like there is a fair degree of water drive associated with the pool.

Q If it is reclassified, the production of both gas and

oil would be considerably increased, would it not?

A We would produce it as a gas field, yes sir.

Q And in your opinion, is there any more danger of coning if this is reclassified as a gas pool?

A We would certainly not want to produce at a rate that would cone, sir, and that would be one of our intentions in operating in a prudent manner. We had one of our wells, Number 4, which made some water and we have worked it over to eliminate the water production.

Q Now, whether it is classified as an oil pool or a gas pool, in your opinion, will one well efficiently and economically drain 160 acres?

MR. BRATTON: Mr. Examiner, as I said, we will not deny the witness the--instruct him not to answer any other questions pertaining to matters other than the phase in which this material exists in the reservoir. I would again like to record our objections to questions going outside that field which we believe is a determinative field or determinative question under the rules of the Commission. I would further like to point out in addition to the expressed intention and desire of the Humble to operate this pool as to prevent waste, it is our belief that under the general power, statutory and regulatory, of the Commission, that regardless of the classification of the pool, the Commission can take such steps as are necessary to prevent waste when it is classified as a gas pool or an oil pool. The question of whether it is a gas

pool or an oil pool, we believe is the one present before the Commission here today and the one which we believe is covered by the definitions of the Commission. Again, I would like to point out for the benefit of the record that the witness has testified in his opinion it would not cause waste to reclassify this as a gas pool. I would also point out that the application does not seek to establish special rules and regulations if it is reclassified as a gas pool and that the statewide rule provides that gas pools are on 160 acres, it being presumed that one well, gas well, will efficiently and economically drain 160 acres. Therefore, in trying to find out if one gas well, assuming it is a gas well in this pool, will efficiently and economically drain 160 acres, that seems to be very far fetched from the standpoint of whether it would cause waste or not to reclassify it. Of course, I have no desire to enter into a legal debate with the Commissioner, the Commission's attorney, but we do believe that if the statewide rules, in the judgement of the Commission, are not satisfactory to prevent waste in any gas pool in the state, the Commission can, on its own motion, on an application or any part of it, call a hearing to establish special rules in that pool. That would be to either increase the statewide allowable or decrease it, for that matter. and as I say we certainly do not desire to and it is not our intention in this hearing at all, at any hearing in which we participate, to deny or decline to answer any questions of the Commission, but we do want our position made explicit that we feel so far as this hearing, the determinative issue ~~is~~

is whether this pool, this is a gas pool or an oil pool under the definitions of the Commission, and that is our sole purpose in trying to make our position clear, Mr. Payne.

MR. PAYNE: Very well, I don't care if the witness answers or not, I figure I know how he would answer.

MR. UTZ: You are not voicing a formal objection to the attorney's question, are you?

MR. PAYNE: I withdraw the question.

MR. BRATTON: I only object to the consideration of this by the Commission. We will not decline to answer any questions of this Commission at any time.

MR. NUTTER: Mr. Payne has withdrawn his question, I think.

MR. UTZ: Did you withdraw your question?

MR. PAYNE: Yes.

MR. UTZ: Are there other questions of the witness?

MR. NUTTER: Yes, sir.

CROSS EXAMINATION

BY MR. NUTTER: First I want to direct a question to Mr. Bratton. Mr. Bratton, this witness has testified that in his opinion these fluids that are produced from this pool exist in the reservoir as a gas.

MR. BRATTON: Yes.

MR. NUTTER: Now, his testimony seems to be predicated upon the anlysis that Core Laboratories made. We haven't had any actual testimony on the analysis, do we have anybody from

Core Laboratories here that will testify?

MR. BRATTON: Yes sir, we have. As I say, I asked the Commission's indulgence rather than putting Mr. Baze on now and then later. The witnesses from Core Laboratories are here and they will present evidence as to their tests and their conclusions, yes sir.

MR. NUTTER: You have testified as to conclusions that you made as a result of observations of the Core Laboratories analysis, is that correct, Mr. Baze?

A That's correct.

Q (By Mr. Nutter) Mr. Baze, assuming that the Core Laboratories analysis is correct and that the liquids in this reservoir do exist as gas, that the liquids that are produced from the reservoir do exist as a gas in the reservoir, that would be grounds for the classification of this pool as a gas pool, is that correct?

A In my judgement, it is, sir. The criteria is whether it exists as a gas in the original reservoir temperature and pressure and I think that this exists as a gas at those conditions.

Q Well, now, what would happen, Mr. Baze, in the event that the pressure in this reservoir would drop below the dew point, would this liquid that is presently in a gaseous phase in the reservoir become a liquid in the reservoir?

A Yes, that's a natural characteristic of a gas condensate reservoir. If you pull the pressure down below the dew point, the liquid does form in the reservoir and as the pressure continues

to drop, you get into retrograde condensate, it goes back to it's gaseous phase, and in my statement that we intend to operate the pool in a prudent manner means that we would not intend dropping the reservoir pressure to the dew point such that liquid would be formed in the reservoir and if our preliminary Core work is valid, and we have no reason in our mind to question it, that there is a water drive to some degree that exists, we do not think that the reservoir pressure would drop down to the dew point.

Q What is the dew point of the fluid in this gas?

A 3350 pounds.

Q What is the present pressure in the reservoir?

A Well pressure measurements in other wells, the well which was sampled was well Number 2, this pressure was 5061 pounds.

Q What was the initial pressure on this discovery--

A The initial pressure in well Number 2 in October, I believe it was 1956, it was 5113 pounds. We had a very, comparable pressure in our Number 4 well, in excess of 5000 pounds. We worked--

Q That was the initial pressure?

A No sir, that was in October of last year when I sampled the reservoir. We have since worked that well over to eliminate water production.

Q According to material balance calculations, does it

indicate that the drop in pressure of your initial 5113 to 5061, which I believe you stated was the last known pressure in Number 2 well, does it indicate in the material balance calculations that there is some medium in there causing the pressure in the reservoir to be maintained?

A Yes sir, it does.

Q Is that medium water?

A We feel it is a water drive, yes sir. We have measured somewhat lower pressure in the Number 3 well in the range of 4400 and 4500 pounds. That will, on conveyance, has a localized permeability condition with a slow build up characteristic.

Q What is the general shape of the structure?

A It is a tight little anticline with well Number 2 being located somewhat on the crest of the structure. On Well Number 5, to give you a little better definition of this I found the Devonian in the water.

Q And the Number 4 is probably completed close to the water, isn't it?

A Originally it was completed very close to the water and we experienced after a short while in the order of 80 per cent water production and we worked it over to eliminate the problem, the disposal problem of water, and we also wanted to conserve water in the reservoir.

Q I don't recall whether there were any structure maps introduced in the original case in this field or not.

A I think there were, I believe there were.

MR. NUTTER: Mr. Bratton, will the records in the original case be consolidated with the records of this case?

MR. BRATTON: No, sir.

MR. NUTTER: I was a little bit late getting here and I thought I might have missed that in the beginning.

MR. BRATTON: No.

MR. NUTTER: Will any structure maps be offered at this hearing?

MR. BRATTON: No, sir.

Q (By Mr. Nutter) Well, Mr. Baze, has Humble made any calculations to determine the efficient rate of production from the three presently existing wells in this pool so that the water encroachment would be such as to keep up with the withdrawal and not cause a decline in pressure?

A Yes, we have, Mr. Nutter.

Q Were you going to go into any recommended ways of withdrawals that would be--

A I didn't plan to, sir.

MR. BRATTON: Mr. Nutter, as I outlined in the beginning of the case, we come before the Commission at this time solely on the reclassification of this pool from an oil pool to a gas pool. To that end, we believe that the ultimate determinative factor in that decision is whether the material, the petroleum hydorcarbons exist in the reservoir in a liquid or gas phase. That is the

evidence which we had proposed to introduce to the Commission today, to determine that one issue. Now, as I stated previously, I assume that the Commission could, on its own motion, or any interested party could at a subsequent date, apply for a hearing as to special rules for the pool to go into the question of possible waste, but so far as this hearing is concerned, we come before the Commission with what we believe is conclusive proof that in this reservoir, petroleum hydrocarbons exist in a gaseous phase in the reservoir, which we believe is determinative of the one, the sole issue, before the Commission in this hearing. And as to these other matters, as I stated, we do not intend to go into them at this time. We certainly will not decline to answer any questions of the Commission as to any matters pertaining to this pool, but we do object to their being entered into the record for consideration of the basic question of whether this is a gas pool or an oil pool. In that light, Mr. Nutter, at the beginning I read briefly through certain definitions of the Commission which we believe establish the provision in the determination of whether it is a gas pool or an oil pool. The one determinative factor is the phase in which the petroleum hydrocarbons exist in the reservoir.

MR. UTZ: Do you have any further questions, Mr. Nutter?

MR. NUTTER: I take it the objection is sustained?

MR. UTZ: I take it that he did not enter a formal objection, he was just stating his position in the matter.

MR. PAYNE: I take it that you object to the evidence

being considered, but your witnesses will answer any questions that concerns this pool, is that right?

MR. BRATTON: Mr. Payne--

MR. PAYNE: I am not clear as to your position myself.

MR. BRATTON: Mr. Payne, I don't want to instruct the witness not to answer any questions by this Commission, but I do wish to make our position clear that we believe the one issue is as I have outlined it and any other information the Commission desires should not be considered for the determination, in the determination of whether this is a gas pool or an oil pool. I don't want to go to the extreme of instructing a witness not to answer a question of this Commission, I just won't do that.

MR. PAYNE: In view of Mr. Bratton's answer, do you have any further questions?

MR. NUTTER: I would like to ask a couple more questions.

Q (By Mr. Nutter) Mr. Baze, you stated that you would want to operate this reservoir if it was classified as a gas pool, in a prudent manner in which waste would not result. Would you go into the method of operation that you propose that would result in a prudent operation of the pool?

A We would rig up in the field somewhat differently with equipment, Mr. Nutter, for a gas pool than we would for an oil pool. Presently we have in the mill the purchase and installation of an effecient desurfacing equipment. We have a temporary rental unit on the ground which is, I think, not adequate, but for a long

time operation, we would certainly consider--as a matter of fact, we have written specifications now for a stabilization unit, which we would plan to install in the field as a gas operation and we would make continued pressure measurements in our well to guide us in watching the dew point. As I said, we would not be interested in accumulation of liquids of retrograde condensates in the reservoir, we certainly would make periodic tests of our wells. We are not interested in coning water into our wells. We would certainly insist with the gas company that we would like to take a rather stable rate of flow from the field to minimize any seasonal large variation in the take, which in itself might incur coning of water or say a rapid drop of pressure. We would want to take a fairly steady, sustained rate out and try to take advantage of water drive that is associated with the reservoir. Those are the points that occurred to me off hand. If that hasn't answered your question completely, I'll be glad to pursue it further.

Q Well, now you state that a prudent operation would require the observation of pressure at a constant rate and also observation to detect if there was any coning of water occurring or not. Now, will the rate of withdrawal be affected in the least if you should determine that the pressure were dropping or that coning of water was occurring?

A Yes, and I would make that answer to you, Mr. Nutter, whether it remains as an oil pool or a gas pool. We would not be interested in coning of water as an oil pool or a gas pool, we

would be interested in the rate of production whether it remains an oil pool or a gas pool.

Q You stated also that you would prefer to see the gas purchaser withdraw gas at a stable rate without seasonal highs and lows?

A Yes, sir.

Q This would be a stable rate at a recommended volume or--

A Yes, sir.

Q --Chosen volume?

A Yes, and I would not like to see it exceeded.

MR. UTZ: Would you care to state what that volume would be?

A In our judgment, we would not like to see a withdrawal from the reservoir on a daily rate of more that 5,000,000 cubic feet per day.

UR. UTZ: From the total reservoir?

A Yes, whether there would be one well, two wells or four wells, and we certainly anticipate four, we are drilling one now. They come quite expensive and we expect to make a well on Number 6 to give us four Devonian wells.

Q (By Mr. Nutter) In the event that a rate of withdrawal as such as you have mentioned there, should turn out to be too high in that the encroachment of the water into the reservoir wasn't keeping up with the withdrawal and you had a decline in pressure, would Humble, in it's desire to be a prudent operator in this

pool, consider the separation of the reservoir with gas?

A I can answer you, certainly we would consider it. In a gas condensate that type of operation more probably would take the form of cycle type of operation where material is brought out of the ground, run into some sort of processing plant and dry gas returned to the ground. I suppose it has been done before as withdrawals were made and inject water to supplement any natural water drive energy, and we would consider that also. Whether that form of operation was eventually decided upon, I think would depend upon the facts that develop and the economics associated with the particular operation. I might say that the operation of a gas reservoir such as this is basically, that is operating in a prudent manner, is basically I think no different than the operation of we'll say an oil pool which has some kind of gas type mechanism, it can be supplemented also.

Q I believe you stated that separation is part of a prudent operation?

A We have a stage separator in the field now and I think we would leave that.

Q What are the present gas-oil ratios on the three wells that you have completed?

A Cumulatively on our production up to the first of this month cumulatively, the gas-oil ratio has averaged 4150. Let me correct that, the gas condensate ratio has averaged 4150 cubic feet.

Q GCR?

A During the month of February, our production from the well averaged 4192 cubic feet. And I would like to comment here that whatever value this ratio is, is dependant almost completely on the surface facilities through which the reservoir material is processed. You can range this ratio from 4000 up to the order of 6000 simply by means of separation and temperatures on the surface.

Q You could have that separation in GCR with two stage separtion?

A I did not say with two stages.

Q I see.

A I say by various means of separation. If we ran a single stage separator and operated a very low pressure, the ratio could be in excess of 6000 with two stage. I think probably in February of 1957, during which time the ratio was 4192, that is the representative ratio operating two stage.

Q Now, this average ratio of 4192 in February is for the three wells that were producing during that month?

A Yes, sir.

Q What were the individual ratios?

A We took tests on these wells for the Commission. Number 2, in November 1958, at which time it had a ratio of 4282; Number 3, in January 1959, at which time it had 4389 cubic feet per barrel condensate, and Number 4, 4601.

Q What was the amount of that pressure?

A That pressure was taken in January 1957, sir.

Q Didn't you take a ratio on the Number 2 in January 1959?

A We did, sir. I don't have it recorded, I have just a production test that we made on that well in February and the ratio on that well at that time was 3926. You see, you can get a variation of 300 or 400 cubic feet, five hundred, really, by adjusting the separator pressure and the fluid by the time of the day.

Q You don't have any comparable ratios that were all taken more or less the same time for the three wells?

A Well, the ratios that I gave you on Numbers 3 and 4 were taken--on Number 3, January 31 of this year, and Number 4, on January 30. Those two are a day apart, and the ratio I gave you on number 2 in 1958 was November 15, and the other one was February 4 of 1959 on Number 2 Well, so that's--

Q That wasn't a monthly production ratio?

A Oh, no.

Q On the Number 2, that was the 4th day of February, you say?

A Yes sir, that was a production test, those were all production tests that I gave to you. The first one that I gave to you is accumulative ratio of 4150, represents all the production that was taken from the pool up to March 1st of this year, then I gave you another number of 4109 cubic feet which represented the

ratio of all three of the wells combined during the month of February.

Q That was the total production of liquid compared to the total production of gas during that month?

A During February, yes sir.

MR. NUTTER: I believe that's all, thank you.

MR. UTZ: Are there other questions of the witness?

MR. FISCHER: Yes, sir.

MR. UTZ: Mr. Fischer?

CROSS EXAMINATION

BY MR. FISCHER

Q Mr. Baze, these GCR's that you gave us, they are first stage?

A No, those are total gas.

Q Total?

A Yes, sir, which is produced.

Q And you say that at the present time you have some desurfacing rental equipment, is that right?

A Yes, sir.

Q Is that the equipment that is to the west of your present tank battery down there?

A Yes sir, it is that big--

Q Those big flumes standing up there?

A Yes, sir.

Q Well, all of that is desurfacing equipment, is that right?

A Yes sir, we have there the two stage separation devices, the desurfacing unit, and the dehydrator unit.

Q I think you said that in the efficient operation of this reservoir, that the thing would be to keep it operating above the dew point pressure, is that right?

A Yes sir, I think that would be the best way to operate it.

Q And after the method of obtaining the sample that you, or the samples that were examined by the Core Laboratories, you would rather let the Core Laboratories witnesses testify as to that?

A Mr. Fischer, they intended to testify in detail as to that. I think it would be better, I can answer your questions, but I feel like they are the people that acutally did it.

MR. FISCHER: That's why I asked you. Thank you very much, that's all.

CROSS EXAMINATION

BY MR. PAYNE:

Q Mr. Baze, as I understand it, all Humble is seeking here today is the reclassification of this pool from an oil pool to a gas pool, is that right?

A Yes, sir.

Q Now, you have made certain suggestions and comments

concerning the prudent operation of the pool if it is reclassified. I just wondered if you would be in a position to state whether or not Humble contemplates, should it be reclassified, whether Humble is contemplating asking for special rules and regulations governing the operation of the pool?

A Would you mind telling me, sir, just what you have in mind?

Q Well, you have come out with certain suggestions and recommendations as to how this pool should be operated. In fact, I believe you said it should be limited to 5,000,000 in gas--

A I did'nt--

Q I was just wondering whether you believe that that should be left to the opertor's discretion if the pool is reclassified or whether Humble intends to come in to ask for special rules and regulations for this pool and have it set up in an order as to how the pool would be operated.

A We have at this time no plans to ask any further orders of the Commission, sir, or it occurs to me that I don't know just how we will conduct an actual point on that flow. I haven't thought that all the way through, but we have no plans to come forward with other suggestions, or let me say requests of the Commission at this time, sir, and I certainly think that we are keenly interested in a proper performance of the reservoir and I did'nt mean to say to the Commission that I have laid out a complete plan of operation

of the field. You asked me for ways and means of operating prudently and I have answered you as I see it.

MR. PAYNE: Thank you, that's all.

MR. UTZ: Are there any other questions?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Baze, do you presently have a market for the gas in this pool?

A Yes, we were-- well, on February 1, 1958, the Devonian wells were closed involuntarily, remained closed until October 1, 1958. This was a gas conservation measure. During that time, we effected a contract with El Paso Natural Gas Company and we are presently selling our high pressure gas to El Paso and have been since it was in production in October.

Q And they are now connected to the wells that are now producing?

A Yes, sir. I don't want to mislead the Commission here. Until we know whether the final decision is an oil reservoir or an gas reservoir, we have, as I said, been selling to El Paso the gas from our primary separator, the second stage gas is being vented at this present time. We are looking into it and at this time our drawing specification for installing a compressor unit, and it is our plan at this time to pick up the second stage gas off the Devonian well, as well as the produced gas from the Pan American Well, and boost it up for sale. That is our current plan.

Q Regardless of the classification of the pool, you don't plan to flare any more gas out of this pool, do you?

A No sir, that is not our intention, sir. I want to be honest and straightforward with you, at the present time we do not have the compression facilities on the lease which are needed to boost the second stage gas up to and into the 650 or 700 pound El Paso line pressure.

Q Have you tested any of these wells with the four point method?

A No sir, we have not.

Q Could you test each well in that manner?

A Mr. Utz, I have fooled around a lot with open flow potential tests in the last ten years and I think it would be somewhat difficult to get with as much fluid as comes with this to get very much of a line. We have not tested and have not attempted it and I couldn't promise you that it could be done. I frankly don't know the answer to your question on that.

Q Do your minimum clauses in your contracts have any reference to open flows, or do you know?

A I really don't know, sir.

Q What is the gravity of the fluid produced from this field?

A Depending on the method that we separate. It has ranged from 54° up to 62°.

Q Mr. Baze, do you know of your own knowledge any gas

distillate pools, or well, I'll say gas pool ratios in the neighborhood of 4001?

A Yes, we have one in West Texas that falls in this approximate range, in the Ellenberger Pool. I have run across one or two others in the Humble Company that have been in the order of this and then I have known of some others that have been less than ten thousand cubic feet per barrel of condensate. I might also say that I have known some oil fields that had dissolved ratios of 30 and 40 cubic feet, which are in themselves not usual.

MR. UTZ: Are there other questions of the witness?

MR. NUTTER: Yes, sir.

MR. UTZ: Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q In the case of these other fields, Mr. Baze, where you have ratios in the neighborhood of 4000 up to 10,000, are they produced in such a manner that the gas is the primary objective of production and the liquids are produced as incidental fluids without restrictions as to the liquids?

A Some of these pools that I mentioned to you, Mr. Nutter, are in Louisiana, and I am just frankly not familiar with the regulations of the State of Louisiana, and in Texas, condensate is not regulated or prorated by the regulations on the gas, and depending upon the liquid that is there or there may be more economical

value in the gas in itself than in the liquids, then it can be again depending on the liquid content, there may be more value in the liquid than in the gas. And in the instance of the Four Lakes, I think there is an appreciable value in the liquid content. This is to me distinctly a gas condition in the reservoir and I think the criteria that describes whether it is an oil or a gas is the phase that exists at the original pressure and temperature, but you encounter some gas reservoirs that we will call them dry gas, you just don't get any liquid. Then we will run into the kind that is called gas condensate where the liquid content varies considerably and here I think we have a reservoir that you could describe as a rich gas condensate gas reservoir. It meets all the tests and requirements for recombining what constitutes a gas.

MR. NUTTER: Thank you.

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Baze, if you were producing 5,000,000 cubic feet a day from this field, how much liquid do you anticipate would be produced from that volume of gas?

A Let me rephrase my answer by saying to you that the gas ratio is a function of the surface separation facilities.

Q That can range anywhere from 4000 to 6000, I believe you said?

A As I mentioned to you, we are thinking in terms of

installing a stabilizer under a gas operation. I think probably with a stabilizer installed, that the overall produced ratio should be very close to 4000 per cubic feet per barrel of liquid, and at that ratio if we took out 5,000,000 cubic feet per day, it would be in the order of 265 barrels per day of liquid production, which would come from the reservoir. As I mentioned, this would be in terms of four wells.

Q And that would be produced from probably four or five wells?

A We have four, I think, that we can talk about now, Mr. Utz, and if we don't put a stabilizer in, I would think that the ratio should range very close to what it did in February, 4200 cubic feet, and that would be approximately 1200 barrels a day from the reservoir of liquids.

Q What was the depth of the top of the Devonian in your discovery well? That was the number 2 well, wasn't it?

A Yes. I am not certain that I can give you the top, but I can tell you pretty close. We perforated it from 12,809 to 12,859 feet, and if my memory serves me correctly, those perforations are about-- well, something like two or three hundred feet below the top of the Devonian. So roughly, as an approximation I would say to you about 12,500 feet in the discovery well, well depth.

MR. UTZ: Does anyone else have a question of Mr. Baze?

If not the witness may be excused.

(Witness excused)

MR. UTZ: Let's take a ten minute break, please.

(Short recess)

MR. UTZ: The hearing will come to order. Please continue.

FORREST TEFTELLER

a witness, being first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your name, please, by whom you are employed, and where, Mr. Tefteller?

A Forrest Tefteller, Midland, employed by the Dennis Owens Company.

MR. UTZ: Would you spell your last name, please?

A T-E-F-T-E-L-L-E-R.

Q (By Mr. Bratton) Have you previously qualified before this Commission as an expert witness, Mr. Tefteller?

A No, I haven't.

Q Will you state briefly to the Commission your educational background and professional experience?

A I received a B. S. in Petroleum Geology from Texas Tech in 1950, I was employed by a subsurface engineering company for two years, employed by the Western Company for one year, then employed by the Dennis Owens Company for the last six years.

Q Now, in what capacity have you been employed by the

Dennis Owens Company, what's been the nature of your work, Mr. Tefteller?

A Well, testing and in general, getting reservoir data.

Q And have you performed that work continuously for the past six years?

A Yes, I have.

Q And over what area of the country, Mr. Tefteller?

A Well, an area west of Abilene, Texas. We have offices in Farmington and Midland.

Q What is your position with the company?

A I am district manager of that area.

Q As such, have you performed testing work and sampling work continuously and supervised that type work for the past six years?

A Yes, I have.

MR. BRATTON: Are the witnesses qualifications acceptable?

MR. UTZ: Yes, they are.

MR. BRATTON: I might state to the Commission that this witness will testify solely as to the sampling procedure. He peformed that operation and he will testify as to that, and we will introduce another witness who will testify as to the laboratory examination end of the work.

(Mr. Bratton) Mr. Tefteller, you work for the Dennis Owens Company?

A That's right.

Q Does that company perform contract service for Core Laboratories?

A Yes, we do.

Q And in connection with the South Four Lakes Unit, the Four Lakes-Devonian Pool, did you perform certain contract work for the Core Laboratories?

A Yes, I did.

Q When did you work on the Four Lakes-Devonian Pool?

A I worked on that pool between the 8th of October 1957 and the 4th of November 1958.

Q From whom did you receive instructions as to the work you were to perform?

A From the Core Laboratories.

Q As to the information and materials you were to obtain and as to the methods you were to use in obtaining it?

A Yes, sir.

Q Will you describe to the Commission just what work you did perform in connection with this reservoir?

A Yes, I gathered all of the field data required for the recombination reservoir fluid study. That includes reservoir pressure, reservoir temperature, temperature and pressure influences on the products at the surface and volume measurement of the liquid and the gas. I also collected the samples of the liquid and the gas and shipped them to Core Laboratories in Dallas.

Q Now, did you obtain the reservoir pressure?

A Yes.

Q What well were you working on, Mr. Tefteller?

A I was working on the South Four Lakes Unit, Well Number 2.

Q And what pressure did you obtain from that well?

A I obtained a pressure at mid-point of perforation of 5061 pounds.

Q How long was the well shut in to obtain that pressure?

A It had been shut in ninety eight hours.

Q And did you obtain a reservoir temperature?

A Yes, I did.

Q And what was that reservoir temperature?

A It was 204° at the mid-point of perforations.

MR. UTZ: That was 200--

A 204° Fahrenheit.

Q (By Mr. Bratton) And what samples did you collect, Mr. Tefteller?

A I collected liquids and gas samples from the primary separator, two liquid and three gas containers.

Q And then you recorded the pressures and the temperatures at the separator and the tank, the information necessary for the recombination study?

A Yes, I did.

Q And in obtaining that information and obtaining the samples, was the time which you devoted to the work suffident, in your opinion for an accurate and representative study?

A Yes, we did'nt collect the samples until we were convinced of the stable volumes of the products.

Q And is the same true as to the other recorded data which you obtained?

A That's right.

Q Was the equipment which you utilized satisfactory for the obtaining of accurate and representative information and samples?

A Yes, sir.

Q In obtaining this information and these samples, did you use the standard procedures which you use in making this type of study?

A Yes, I did.

Q And is that the standard procedure which you utilized throughout the oil industry?

A Yes, it is our standard procedure.

Q Are you satisfied that the samples which you took were representative samples taken under satisfactory conditions?

A Yes, I am.

Q And adequate for a laboratory study?

A Yes, sir.

Q Are you satisfied that the information which you obtain-

ed and recorded and sent in was accurate and satisfactory for purposes of the laboratory studies which was to be made?

A Yes, it was.

Q Is there anything else you would like to tell this Commission in connection with the testing of the sampling procedures and data recording procedures which you used?

A Not that I know of.

(Thereupon, the document was marked Humble's Exhibit Number 2, for Identification.)

Q (By Mr. Bratton) Before we go further, just for purposes of clarity, will you refer to what has been marked as Humble's Exhibit Number 2, and I'll ask you, Mr. Tefteller, if that is a representation on the production equipment at the lease when you made the study which you made?

A Yes, sir, it is.

Q And purely for purposes of further clarification, will you show to the Commission where you obtained your samples?

A Yes, we obtained our gas samples from the meter run and our liquid samples from the side glass, in the primary separator.

Q So that all of the reservoir material was in the separator at the time you accumulated your samples?

A Yes, that's the only place that you can obtain one hundred per cent of the reservoir products.

MR. BRATTON: I don't believe I have any further questions.

MR. UTZ: Are there more questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Tefteller, did you take any bottom hole samples of the--

A We did take bottom hole samples as an experiment, purely as a precaution, I might say, in the event there was a doubt as to what the phase might be, and we feel that when the reservoir exists as a liquid, the bottom hole sample is a more desirable sample. When it exists in the gas phase we prefer the recombination method.

Q Were the samples which you took from the meterrun at the top of Exhibit 2 and the liquid samples which you took on the primary separator co-mingled prior to sending them to Core Laboratories for--

A They were in separate containers, three containers of gas and three containers of-- and two containers of liquid.

Q Did you also send a sample of the bottom hole --

A Yes.

Q-- Product to the --

A The bottom hole--

Q --To the Core Laboratories?

A Yes, sir.

MR. NUTTER: That's all, thank you.

MR. UTZ: Any other questions?

CROSS EXAMINATION

BY MR. FISCHER:

Q This bottomhole sample you attempted to take, was it stabilized?

A Yes, the well had been shut in for better than ninety eight hours.

Q Were you sucessful in obtaining the type of bottomhole sample that would be helpful? I mean, I know there is great difficulty a lot of times in obtaining bottomhole samples.

A Yes, there is. Now, this particular bottomhole sample, we took two and we tried to match them and they did match identically as to opening pressure and PV, but the PV was a long sweeping curve characteristic of gas and we found no bubble point indicated in the sample. We attempted two there in the field, but it actually was a long sweeping curve the PV pressure volume.

MR. BRATTON: Mr. Fischer, I might state, the bottomhole sample was not analyzed in the laboratory. The testimony of the laboratory man will be on the surface sample, so that's why we have not gone into the bottom hole sample .

Q (By Mr. Fischer) Mr. Tefteller, you said you tried to analyze them in the field?

A We do and in fact, all of the work is analyzed in the field to the extent that it is possible in the field and PV measurement in the field is a precaution that we take. When we

find that our bottom hole sampling effort is inadequate, why we don't continue with the recombination effort.

MR. FISCHER: Thank you, that's all.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Tefteller, in the determination whether a well is producting gas and liquid hydrocarbons, which may or may not be in gas or liquid state in the reservoir, isn't it more desirable to have a bottom hole sample than to have a sample of the product of the primary separator?

A Would you repeat that again, please?

Q In determining whether a well is producing gas and liquid hydrocarbons, which liquid hydrocarbons may or may not be in gaseous or liquid state in the reservoir, wouldn't it be more desirable if we had a bottom hole sample to make this determination rather than have the product of the primary separator?

A It if were possible to withdraw from a well the hydrocarbon system from the reservoir without it undergoing any changes whatsoever, I would say yes to that question, but in withdrawing your samples from the reservoir, you have a temperature influence which results in a pressure influence and then your sample is altered, in withdrawing it from the well to the surface, from the bottom of the hole to the surface and--

Q The product is enclosed in a sealed container when it is withdrawn?

A Yes.

Q And it is restored in the container in the original reservoir pressure and the same conditions?

A You have to return the container to the original reservoir pressure and temperature and that's impossible in the field.

Q Reservoir pressure is not maintained in the container when it is withdrawn to the surface?

A No, and as it is cooled the pressure will drop.

MR. NUTTER: No further questions.

MR. UTZ: Mr. Tefteller, wouldn't it be possible to analyze the bottomhole samples in the laboratory by bringing it back to the original pressure and temperature?

A I am not too familiar with laboratory procedures, and I think maybe the volume that we were able to collect at the bottom of the hole would probably be prohibited. We only collected six hundred CC's of sample, which is less than a quart, and when it is fluid, six hundred CC's of gas doesn't represent much volume.

MR. UTZ: But if it could be returned to the original pressure and temperature, wouldn't that be the surest way of knowing whether it was a liquid or a gas in the reservoir?

A I think probably so. Mr. Moses might be better qualified to answer that question.

MR. UTZ: All right, sir.

MR. NUTTER: In making an analysis of bottomhole fluid

samples, do you think that the sample which during flow or shortly after flow would be more representative of the conditions which have been encountered in the reservoir during production than taking a sample after ninety eight hours shutin?

A No, sir, I don't. In some cases, it would be all right but you don't know, you can't be sure of what happens to the reservoir fluid in establishing the pressure decline necessary to draw it from the reservoir into the well and we have conditioning procedures for bottomhole sampling when we attempt to draw fluid from the reservoir at the base of the well bore with a minimum of pressure drop and then shut the well in and allow the pressure to increase to reservoir pressure before we collect the sample. That tends to eliminate any possibility of analization or causing gas to break out and percolate out of the well and damage the sample.

MR. NUTTER: So it is a matter of whether you desire to get a sample that is representative to conditions in the reservoir a distance away from the wellbore or to get a bottomhole sample of flowing conditions at the bottom of the hole?

A That's right, and we like to have the reservoir fluid rather than the bottomhole sample.

MR. NUTTER: I see, that's all.

MR. UTZ: Are there other questions?

If not the witness may be excused.

(Witness excused)

PHIL MOSES

a witness having first been duly sworn was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your full name, please?

A Phil Moses.

Q By whom are you employed and where, Mr. Moses?

A I am employed by the Core Labortories, Incorporated, in Dallas.

Q And have you previously testified before this Commission as an expert witness?

A No, sir.

Q Will you state briefly to this Commission your educational and professional background?

A I received a Bachelor of Science Degree from Texas A & M College in 1949; subsequently, I went to work for Core Laboratories and have been employed continuously since then. The first year and a half of my employment, I performed core analyses and mud logging work, the remaining eight years I have been involved in reservoir fluid sampling and analyses.

Q And what is your position with the Company at this time, Mr. Moses?

A I am now the operations supervisor of the reservoir fluids division of Core Laboratories.

Q Over what area do you work, what areas have you had experience working with, Mr. Moses?

A We have made or make a large number of studies in most producing areas of the United States, Canada, and Mexico. We have done work in South America and other foreign countries.

Q Have you performed the type of work you performed in connection with the Four Lakes Pool in a wide area of the United Staes, over pools throughout the United States?

A Yes sir, we have.

Q And you personally have been doing this type of work for the past eight years?

A Yes, sir.

MR. BRATTON: Are the witnesses' qualifications acceptable, sir?

MR. UTZ: They are.

Q (By Mr. Bratton) Mr. Moses, when were you first contacted regarding the study of the Four Lakes Pool in Lea, County, New Mexico?

A In early October of 1958.

Q And by whom were you contacted?

A By Mr. Randall of the Humble Oil and Refining Company.

Q What was his request to you, and --

A Mr. Randall asked that we study the fluid in the South Four Lakes Field in any manner that we deemed necessary and by our own techniques to determine the phase of the reservoir fluid as it

exists in the resevoir.

Q Has Humble at any time had suggested or had any control over the operations, the studies, or the methods or material, or equipment that you have employed?

A No sir, we have had a complete free hand and have used the methods that Core Laboratories normally employs in studying this type of reservoir.

Q Did you arrange for the Dennis Owens Company to obtain the samples and the information which you desired?

A Yes, sir.

Q And you directed the material and the information and the samples which you required for this study?

A That's correct.

Q Will you advise the Commission as to what you did when you received the samples, what studies you made and what the results of the studies show?

A When we received the samples taken by Mr. Tefteller and also the data collected by Mr. Tefteller, I first closely examined the data to decide in my own mind that the test was representative, adequate and stable flow conditions had been obtained before obtaining samples. In my opinion, the test was very good. We then took the samples collected and recombined them in the same ratio in which they were produced. This recombined fluid was then placed in a visual cell at a pressure of 6000 PSIG, pressure well above the reservoir pressure. It was then heated to the

reservoir temperature of 204° Fahrenheit; we then slowly lowered the pressure on the system at 204° Fahrenheit and observed the resevoir fluid in the visual cell. At a pressure of 3350 PSIG, a dew point was measured. This is the pressure at which the first droplet of liquid was formed. At pressures above 3350 PSIG, the system existed as a gas, 100 per cent gas. The system was then studied at several other temperatures. At 214° Fahrenheit, the system exhibited a dew point of 3390 PSIG; at a temperature of 184° Fahrenheit, the dew point was measured to be 3390 PSIG; at 170° Fahrenheit, a dew point of 3250 PSIG was measured.

(Thereupon, the document was marked as Humble's Exhibit Number 3 for Identification.)

Q (BY MR. BRATTON) Referring to Humble's Exhibit Number 3, Mr. Moses, does this demonstrate graphically the result of your studies?

A Yes sir, it does. On the vertical scale, we have pressure and a PSIG and temperature on the horizontal scale in degrees of Fahrenheit. The dots, the black dots, here, here, here, and here, are the dew point which we measured at the various temperatures. Now, the area above this line drawn between the dew point, the system was 100 per cent gas and it is depicted by red. Now, the vertical blue line was the reservoir temperature, the horizontal blue line was the reservoir pressure at the point of sampling. Now, note that the intersection of these two lines was the condition

of the reservoir at the time of sampling and it is well into the gaseous region. We further examined the system at the reservoir temperature, at pressures below the dew point; we got a retrograde condensation; immediately below the dew point, the condensation was quite rapid and is not indicated here because of the fact that we weren't able to separate the dew point. At a pressure slightly below 3000 PSIG, we reached a maximum condensation point and began to get normal vaporization of the liquid. This is typical behavior of gas condensate reservoir fluids.

Q Mr. Moses, as shown on Exhibit Number 3, at what point, how low would the temperature be before you could possibly reach the credible point at which the material would exist as a liquid in the reservoir?

A We know from our studies that this reservoir fluid could not exist in the reservoir as a liquid, or to exist in the reservoir as a liquid the temperature of the reservoir must be less than 170°, that at pressure or temperatures above 170°, it existed in a gaseous phase.

(Thereupon the document was marked as Humble's Exhibit Number 4 for Identification.)

Q (By Mr. Bratton) Now, referring to Humble's Exhibit Number 4, Mr. Moses, does that Exhibit demonstrate the retrograde condensation you were referring to?

A Right, this is a plat of the retrograde data measured

on the vertical axis. We have a percentage of hydrocarbon flays; on the horizontal axis, we have a gain of pressure. Now, at the reservoir pressure 5061 PSIG, you will note we have a zero liquid. We lowered the pressure and had zero liquid until we reached a pressure of 3350 PSIG. We then got a rapod increase in liquid volume. These are the points measured, the black dots are actually measured points. At this point, approximately, or slightly below 3000 PSIG, we reached a maximum condensation and the volume of liquid decreased from that point on. Again I would like to say that this is typical behavoir of a gas condensate reservoir.

Q Could you get that type of curve from an oil reservoir, Mr. Moses?

A No sir, in an oil reservoir, if this had been an oil reservoir, this curve would have had to originate at the 100 per cent line, that is to say if the reservoir was 100 per cent liquid to start with, and that upon depletion, the curve would follow something like this, but the initial point would have had to been 100 per cent.

MR. NUTTER: Mr. Moses, for the--

A Yes?

MR. NUTTER: --sake of the record, would you take a pencil and indicate the approximate location fo the curve as it would exist in an oil reservoir?

A All right; this is purely speculation, of course, but it would--let-s assume the saturation pressure is about the same, it

would be perhaps like that.

MR. NUTTER: And label that oil reservoir, please.

A All right.

Q (By Mr. Bratton) Mr. Moses, from your studies, it is your conclusions that this material exists in the Four Lakes-Devonian Pool in the reservoir as a 100 per cent gas?

A That is correct. We exercised all due diligence in obtaining good data in the field and in the laboratory and it is my opinion that the reservoir presently exists as 100 per cent gas.

Q Is there any possiblity of an oil rim around this reservoir?

A No sir, for this reason; we measured a dew point considerably less than the reservoir pressure. Now, if this reservoir contained an oil rim, it would be necessary that the dew point be equal to the reservoir pressure. So that I say it is impossible that this pool could have an oil rim.

Q In this study, Mr. Moses, you utilized recombined surface samples?

A Yes, sir.

Q Why did you make that decision and is that method satisfactory in your opinion?

A Yes, it is accepted procedure in studying reservoirs where the phase is in doubt or where the phase is-- where the reservoir is definitely gas condensate, to use surface samples.

That is the accepted method throughout the industry of studying this type reservoir.

Q That would be your standard procedure in studying any reservoir where the phase is in doubt?

A That is correct.

Q And for that reason, you determined to use the recombined surface samples?

A That is correct.

Q You used data from one well. Is that data satisfactory and adequate in your opinion to determine the characteristics of an entire reservoir, of this entire reservoir?

A Yes, in reservoirs of this type, one sample is sufficient to study the fluid in the entire reservoir; the properties of the fluids produced from the other wells is similar. Only when you have a field of a large areal of extent or perhaps large structural differences, is it necessary to study fluids from more than one well.

Q And in your opinion, were the entire sampling and testing methods utilized standard procedures throughout the industry and recognized in the testing end of the industry?

A Yes, sir.

Q Is there any thing else you would like to say with regards to Exhibit Numbers 3 or 4?

A I think not.

Q If I may cite, Mr. Moses, I would like to read to you

two definitions from the rules of the Oil Conservation Commission. Definition Number 15, "Condensate shall mean the liquid recovered at the surface as results from condensation due to reduced pressure or temperature of petroleum hydrocarbons existing in a gaseous phase in the reservoir." In your opinion, were the liquids recovered at the surface here a condensate within that definition?

A Yes, sir.

Q I would like to read to you the definition of oil. "Oil, crude oil or crude petroleum oil shall mean any petroleum hydrocarbon produced from a well in the liquid phase and which existed in a liquid phase in the reservoir." In your opinion, were the petroleum hydrocarbons recovered at the surface here oil within that definition?

A No, sir.

Q I will read one further definition. "Oil wells shall mean any well capable of producing oil and which is not a gas well as defined herein." In your opinion, is the well which you studied an oil well within that definition?

A No, sir.

Q Are those definitions of condensates and oil, do they conform to the generally recognized definition and distinction between condensates and oil recognized throughout the industry?

A Yes, sir.

Q In your opinion, is the Four Lakes Devonian Pool, a gas pool or an oil pool?

A In my opinion, the South Four Lakes Field is an oil pool.

Q You are talking about the Four Lakes-Devonian Pool which you studied?

A The Four Lakes-Devonian Pool that we studied.

Q What did you say?

A It's a gas condensate pool.

Q I will repeat that question.

MR. UTZ: Do you wish to change your answer?

A I'll restate it, if you would like me to. In my opinion --

Q (By Mr. Bratton) If you would, please.

A In my opinion, the South Four Lakes-Devonian Pool which we studied is a gas condensate pool.

Q Were Exhibits Number 3 and 4 prepared by you or under your supervision?

A Yes, sir.

MR. BRATTON: I have no further questions of the witness.

MR. UTZ: Are there questions of the witness?

MR. FISCHER: Yes.

MR. UTZ: Mr. Fischer?

CROSS EXAMINATION

BY MR. FISCHER

Q Mr. Moses, in the initial case before this Commission the first time, Humble had a difference but I don't remember, and they submitted an Exhibit Number 5 which was a phase diagram.

At that time, the witness said that it was difficult for them to determine on which side, I believe, this went there, on which side of the critical line this reservoir fluid or system existed. In terms of the testimony today, it is that Humble's opinion at this time is that the reservoir system exists in the single phase gas zone. Could you give us an approximation, percentage wise or any way you can as to where this reservoir hydrocarbon system exists in relation to this critical line, is it fairly close to it?

A As the previous exhibit is part of the phase diagram, I think you recognize it as such, and I hadn't been in to it, but since you brought it up, we have prepared another exhibit if you would like to see it. The information in black--

(Thereupon the document was marked as Humble's Exhibit Number 5 for identification.)

Q (By Mr. Fischer) You are referring now to Humble's Exhibit Number 5?

A Right. Let me explain my scales again here. On the vertical scale, we have pressure in pounds per square inch; on the horizontal scale we have temperature in degrees of Fahrenheit. We have drawn a blue line again at the reservoir temperature of 204°. Fahrenheit. Now, as you will recall, these are the dew points which we measured.

MR. BRATTON: Would you refer to them by temperatures for the record?

A Right. Let me just get these values. At the reservoir temperature 204° Fahrenheit, we had a dew point of 3350 PSIG, and at 214° Fahrenheit, we had a dew point of 3390 PSIG, at 180° Fahrenheit, the dew point was 3290 PSIG, and the dew point was 3250 at 170°. Now, these are the measured data including the other dots. We drew up a hypothetical phase diagram, and it would be coincidence if this actually fitted the one we studied, but this is the one possible diagram. Now, in our estimation at 170°, we were close to the critcal. We might be ten or twenty degrees off or more, I don't know. I drew it close to the 170° mark. These lines are called quality lines.

MR. BRATTON: Those are the dotted lines you are referring to?

A The dash lines are normally called quality lines. They are drawn to pressures and temperatures saturation. I have drawn them to conform with the data that was measured on this pool.

MR. FISCHER: That's all, thank you.

A Does that answer your question?

MR. FISCHER: Yes, thank you very much.

MR. UTZ: Mr. Nutter, did you have a question?

MR. NUTTER: Yes.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Moses, if it were possible to obtain bottom hole samples or analyses such as you have ran in your laboratory, would

the data be more reassuring than the recombined samples of the separator?

A I think the answer to your question lies in the statement, if it were possible. The difficulty in obtaining bottom hole samples in any reservoir is to get a fluid in the bottom of the hole as representative of the fluid out into the reservoir and in getting that fluid to the surface without altering it in any manner. Now, it is our opinion that you cannot do that in a gas condensate well.

Q What prohibits it?

A First of all, the normal procedure in sampling a -- taking a bottom hole sample is to have a sample from a well that is static so that the pressure in the well is equal to the reservoir pressure. Now, in a rich gas condensate well, or virtually any gas condensate well where the well is static, some of this retrograde material is going to fall back into the bottom of the hole. It is obviously not representative of the reservoir fluid. Another objection, or the objection to sampling fluid samples of condensate well flowing is that the volumes of the liquid produced are relatively small and as the sample is brought to the surface, the pressure causes retrograde condensation. It may be possible to vaporize that liquid upon increase in pressure and temperature; however, the valve mechanisms in a sampler have small crevices and a small loss in that liquid could seriously alter the properties of what you are able to study.

Q What assurance do you have that a recombined sample is representative of reservoir fluid?

A Your assurance is that you take all due diligence in your field testing. It is imperative that the well be stabilized and that every precaution be taken to measure an accurate gas liquid ratio.

Q In other words, you measure the ratio of the liquid that is being produced by the separator and the gas that is being produced by it and take an average of it and then you repeat that again and if it is the same ratio, that determines your producing ratio?

A That's correct, that's the accepted method of studying this type of reservoir throughout the industry.

MR. NUTTER: I believe that's all, thank you.

MR. UTZ: Are there other questions?

MR. STAMETS: Yes, I have one question.

A All right.

MR. STAMETS: This would precipitate on the gas or liquids which could not be recombined?

A That could not be recombined.

MR. STAMETS: Recombined under reservoir conditions?

A No, sir.

MR. STAMETS: That's all.

MR. UTZ: Are there other questions?

MR. BRATTON: I would like to ask one-- excuse me, are there other questions from the bench?

MR. UTZ: I have one, go ahead.

MR. BRATTON: Go right ahead.

MR. UTZ: Mr. Moses, how many pools in your work with the Core Laboratories do you know of, or that you have checked that have ratios as low as 40 to 1 which are designated as a gas pool?

A I would have to just estimate, in the nieghborhood of ten to fifteen, I can't name you one right now, identical to the Devonian's ratio, I don't know the classification of the field. I can, too, name you one, the Carter-Knox field in Oklahoma, it's classified as a gas reservoir with a ratio of, I believe, that falls in that classification. It's a very rich gas condensate. I might add that we have studied reservoirs with surface ratios, total surface ratios, gas ratios as low as 3000 cubic feet per barrel which have exhibited dew points existing in the reservoir as a gas. That has been the approximate lower limit.

MR. UTZ: Mr. Moses, what first led you to believe that this was a gas condensate reservoir rather than an oil pool?

A We started this study with a completely open mind that we didn't know and in this respect, we took separator samples. I also recommended that subsurface samples be taken static just as another possible check. We decided that should this turn out to be an oil reservoir we would look at those samples also because they would probably be representative in that case. However, when we did examine the separator samples, it indicated that the reservoir was in a gaseous phase and the subsurface samples were no good, no work

was done on them, but my first indication was a dew point that we measured at the reservoir temperature.

MR. UTZ: Are there any other questions?

REDIRECT EXAMINATION

BY MR. BRATTON:

Q Mr. Moses, we have on Humble's Exhibit Number 5, and the critical points which you have marked on there, you have been able to determine from the studies that the critical point must exist below 170°?

A That's correct.

Q You do not know how far below that point it exists, but it's somewhere below that point?

A That's correct.

Q And without making the study as to temperature 204° down to 170° you would not have been able to tell how far below 204° that critical point exists?

A No, I would not have known.

Q By your studies which Core Laboratories have made, you can definitely state that the critcal point would have to be below 170°?

A That's correct.

MR. BRATTON: That's all.

MR. UTZ: Mr. Fischer?

MR. FISCHER: Mr. Moses, I am curious to find out your ideas as to where say in the well bore does this dew point occur for this

particular reservoir?

A At what point in the reservoir?

MR. FISCHER: Yes.

A Do you get a separation of--

MR. FISCHER: Yes, do you have any idea?

A I could just guess, you could get a combination of effects as you come up the well bore dropping pressure and temperature. I don't know, I would say probably within a few hundred feet of the surface.

MR. FISCHER: Well, what I want to do is get to this, it would occur say some point in the reservoir, to the well bore, it would not be down to the surface?

A Oh, definitely so. It entered the well bore as a single phase gas.

MR. FISCHER: That's all.

A We can make the statement that it will not separate until the pressure in the well bore falls to less than this, I believe this was 3290 PSIG.

MR. FISCHER: 3250?

A 3290, and that would get pretty close to the surface, I am sure.

MR. FISCHER: Thank you.

MR. UTZ: Mr. Moses, when the pressure and temperature drop below the point that you have indicated as the dew line, then it is my understanding that there would be a certain per cent of liquids

from the reservoir?

A Yes. sir, that's correct.

MR. UTZ: If the reservoir pressure and temperature should drop to this point, would you still consider this a gas condensate reservoir?

A Yes sir, that's typical behavior of a gas condensate and it is seldom you see a gas reservoir that doesn't happen.

MR. UTZ: Are there any other questions?

If not the witness may be excused.

(Witness excused)

MR. BRATTON: I would like to offer in evidence Humble's Exhibit Number 1 through 5.

MR. UTZ: Without objection, they will be received in evidence.

MR. BRATTON: We have no further witnesses; I would like to make a brief statement, if I could, Mr. Examiner.

MR. UTZ: Yes sir; are there any other statements to be made in this case? Would you like to make yours?

MR. BRATTON: Yes sir, and we would like to introduce a telegram from Phillips, who is the other owner in the pool. There are only two owners, Humble and Phillips, and we would like to offer a telegram from Phillips. Mr. Examiner, I realize that we are here on a somewhat unusual situation that is a little out of the ordinary. I realize fully that there are a number of indicia which indicate normally the nature of a pool as a gas pool or an oil pool in the

minds of the Commission and the minds of the industry. However, I believe that the Commission definitions themselves which are also the accepted standard set throughout the industry, that those define the ultimate tests to be whether the material exists as a gas or as a liquid in the reservoir. As I pointed out in the beginning, it is to that end that we have brought this case and presented our testimony, to show that within the Commission's definitions, this pool qualifies and is a gas pool. Now, that is our sole request, that it be reclassified as a gas pool. We have attempted to indicate to the Commission our desire to operate this pool in a prudent manner so that we will not in any manner cause waste. We believe that that is our desire and we will carry it out. We further believe that the Commission has the power in this pool or in any other gas condensate pool or oil pool or for that matter, in any pool to take such further steps or such further action as it may feel necessary or advisable in order to, in it's judgment, prevent waste. Now, we don't believe that those matters are properly before the Commission at this time. If at a later date we should so conduct ourselves that in the mind of the Commission we are not being a prudent operator, certainly the Commission can call a case on it's own motion to take such steps as it feels advisable to promote the greatest ultimate recovery in this pool. We believe that by our actions and by informal conferences in cooperation with the Commission, that we will operate this pool so that the Commission may not feel it is necessary to take such action, but certainly that is within

the prerogative and the power of the Commission. We recognize that this is an unusual pool and it is an unusual situation, but we do not believe that solely for that purpose, there should be any differentiation between it and any other pool which meets the ultimate tests as to whether it is a gas pool or an oil pool and that is how the material is in the reservoir. We believe that we have, we know that we have tried diligently to obtain the best independent study that we could obtain to determine this matter and to present this information to the Commission and we feel that we have proven within the Commission's definitions that this is a gas pool. Thank you for your kind attention.

MR. UTZ: Is there anything further in this case?

If not the case will be taken under advise, and the hearing will be adjourned until one thirty.

(Noon recess)

STATE OF NEW MEXICO)
)
COUNTY OF BERNALILLO)

I, JERRY MARTINEZ, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing were reported by me in Stenotype, and that the same was reduced to typewritten transcript by me and contains a true and correct roecord of said proceedings, to the best of my knowledge, skill and ability.

DATED this 7th Day of April, 1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Jerry Martinez
Notary Public

My Comission Expires:
January 24, 1962